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New sustainable approach for historical garden restoration: the case study of Ludwig Winter's Gardens in Liguria Region

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Historical gardens are classified as living monuments which require special and specific rules and protection measures. Preserving and restoring historical gardens is particularly complex and some of them are not recognizable due to the lack of knowledge, management and phytopathological problems. Between 1868 and 1912 in Liguria Region, the gardener and nurseryman Ludwig Winter designed and realized several “acclimation gardens” characterized by a collection of exotic and rare plants. Different genera of palm (Brahea, Chamaedorea, Phoenix, Sabal,Syagrus and Washingtonia) were imported and widely cultivated by Winter. Nowadays, several major, lethal diseases have attacked palms in Liguria Region contributing to change landscape and gardens ‘structure. With the aim to propose guidelines for historical garden restoration, able to combine historical features with new needs, a research project was performed. Currently, two Winter’ gardens are object of restoration. Firstly, for identifying historical permanences (varieties and species cultivated, ornamental, compositional and architectural elements) a study was carried out. Documents relating to Winter’s projects including plans, notes and his correspondence were collected and studied. This project allowed to find and recognize many botanical species of exotic plants collected by Winter. Totally, 471 botanical genres of herbs, shrubs and trees were cultivated in his garden nursery, overall roses, palms and succulents. These elements, combined with the Winter’ compositional features and his design intentions defined the restoration process. The analysis gives information concerning various species today neglected, allowing to increase the biodiversity and the market. For ensuring a sustainable approach, creating a network between historical gardens and nurseries is considered an opportunity and a challenge. The results could be of interest both for methodological purposes and for the restoration of historical gardens planning and management.

Keywords:

botanical collection, sustainability, heritage, acclimation garden, palms

Composition of urban Tswana home gardens in Ga-Rankuwa, City of Tshwane, South Africa

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The urban poor are often encouraged to use urban open spaces, in particular those around their homesteads, for food production to alleviate poverty and improve their nutritional status. These people may attach importance to other types of plants or have other garden uses for open spaces. This article reports on a study which investigated the composition of urban home gardens of Tswana-speaking people living in a township in a large metropolitan area. Purposive sampling was used to uncover design elements found in home gardens and their purpose. Eight design elements were uncovered, namely medicinal, perennial food, annual food, security and privacy, ornamental, bare soil and veld, charm, and ancestral worship. A literature survey on traditional Tswana culture was conducted and the design elements found was compared to the findings of this survey, in order to find possible explanations for the presence of the design elements.

Keywords:

urban home garden, design element, Tswana, urban food production

Effect of gardening on nutritional knowledge, vegetable preferences and consumption among Grade 3 learners in Soshanguve

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The aim of this study was to assess the impact of gardening in combination with nutrition education on fruit and vegetable knowledge retention among primary school learners in an urban environment. The study was conducted in Soshanguve township extension 11 and 12 in Pretoria, South Africa. The two areas were selected due to the overall socio-economic status and household income levels. Three schools out of five were randomly selected from the same area (extension 11& 12). Selection of class participation was done through a random selection by the Grade 3 class teachers. A pre- and post-test experimental design was used to test the effect of 3 interventions: G (gardening treatment group), N (nutrition education treatment group) or NG (nutrition education and gardening treatment group). A total of 234 eligible leaners participated in the study. Data was collected using a “taste and rate” instrument, fruit and lunchroom observation to measure preferences and attitudes of the learners with regards to fruits and vegetables. Learners’ knowledge on the different food-groups,

nutrient-food and nutrient-function associations and learners' ability to identify fruits and vegetables was also measured. Analysis of the data was done using ANOVA and t-tests for knowledge related variables and chi-square for preferences, attitudes and consumption variables. Results indicated that there were significant differences between the treatments for learners' ability to identify fruits and vegetables and to match food types with nutrient-function for pre- and post-test scores overall. Nutrition education combined with gardening had the greatest improvement in fruit and vegetable identification scores than the nutrition education only and the gardening only interventions. Learners from the gardening treatment showed significant improvement in preference, attitude and consumption for a larger spectrum of fruits and vegetables than the nutrition education combined with gardening and nutrition education only treatments.

Keywords:

gardening, nutritional knowledge, vegetable preferences, vegetable consumption

Evolution Rule of Soil Fertility in Agricultural and Forest Field in Tipical Carst Region of Guangxi

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【Objective】To provide theoretical support for soil amendment and formular fertilization ,【Method】soil fertility status in paddy field, arid farmland, woodland of Huanjiang county, Hechi city, Guangxi were investigated. 【Result】Results showed that: (1) Soil integrate fertility was showed in the order of paddy field> arid farmland>woodland. Three commons with abundant total nitrogen, appropriate organic matter and deficient available potassium were found in three types of soil. (2) Arid farmland presented high total nitrogen, moderate available nitrogen, available phosphorus, organic matter and strong acidity, low available potassium. Paddy field showed very high available nitrogen, moderate total nitrogen, available phosphorus, organic matter, medium pH, low available potassium. And high total nitrogen, available nitrogen, medium organic matter, low available potassium and available phosphorus, strong acidity appeared in woodland. (3) The evolution rules of soil fertility were as follows: the percentage of soil sample with medium and high available phosphorus now was higher than that in the 80s. Other indexes including total nitrogen, available potassium, organic matter and pH, showed a downward tendency. Acidification existed generally especially in arid farmland which presented higher

Keywords:

Karst region ; Huanjiang county in Guangxi ; Soil fertility ; Estimate ; Evolution

Traditional Ecological Knowledge and demographic differences amongst cultural groups in an urban setting in South Africa

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There appears to be a global decline in TEK worldwide due to complex factors such as migration to urban areas. The loss of TEK could affect lives and health in communities not only in rural areas, but in urban areas as well. The lack of studies in the field of TEK in urban areas is evident in South Africa and other countries. This study was the first attempt in investigating the perceived lack of knowledge in an urban environment in South Africa. Data was collected by making use of a structured questionnaire from 3000 participants amongst three different cultural groups (Tsonga, Zulu and Pedi) in an urban area, Tembisa. Demographic information included age of participant, participant age when moved to Tembisa as well as the time the participant have resided in Tembisa. One other aspect that was investigated was the reasons why the participant moved to Tembisa if they moved. There was a clear differentiation amongst the three cultural groups in terms of participant age and the amount of knowledge that were still available in Tembisa. The younger generation of all three groups had much less knowledge than the older generation above the age of 39. Contrary to what was expected the number of years or the age when participant moved did not play a major role in knowledge of participants in any cultural group.

Keywords:

Traditional Ecological Knowledge, urban areas, cultural groups

Permaculture principles within the South African green industry: urban legend or reality?

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Promoting sustainable living practices in South Africa and in the world is becoming part of our daily lives. Various factors such as socio ecomic influences, climate change and urbanization are contributing to the mindshift of becoming more sustainable. As is the case with most African countries, urban sprawl and anthropogenic development is degrading the natural environmental at an unprecedented rate. The purpose of this investigation was to evaluate if permaculture practices and principles are being implemented within urban landscapes by the South African green industry role players as a potential method to reduce environmental damage and to promote sustainable

living. Structured questionnaires were submitted to 90 recognized green industry companies and it was clearly evident that the majority 66.67% either recognized permaculture practice but have not implemented it or simply do not understand the underlying principles of permaculture nor its potential benefit to the environment. It is therefore recommended that the South African government together with the necessary role players develop a strategic action plan to ensure permaculture principles to promote a more sustainable living environment in South Africa.

Keywords:

Permaculture, Urban sprawl, Sustainable practices

Influences of Family Culture and Garden Life on Landscape Development in Classical Gardens on Yangtze Delta ' A Case Study of Jichang Garden, Wuxi,China

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In the context of tradition and regional characters loss being prevalent in the contemporary landscape architecture, Chinese classical garden with a venerable history and a distinctive character is an extraordinary school of its own worldwide. Jiangnan classical gardens are the representative of Chinese classical gardens, of which most private gardens were the reflection of view of nature and traditional aesthetic spirits in the way of designed and constructed in person and lived in for generations. Therefore private gardens（mainly literati garden） become the outstanding style of

classic gardens on Yangtze Delta. Jichang Garden, established and managed by the Qin family from 1527A.D. to 1952A.D. is the representative literati garden since Ming Dynasty with high research value. This study focus on the influences of gardening aesthetics, residential life, daily activities and literati gathering of the Qin family on developments and variations of garden landscape from Ming to Qing Dynasty. Based on literature on plenty of documents including 293 poetries,5 history records, 4 local chronicles and a variety of landscape paintings, research has been done on the relationships between garden life（literature association, poetry-painting tradition and Kun opera culture） and the evolution of landscape elements, particularly the arrangement of architecture,rockery,water and plants, which would help us to understand the scholastic garden-making heritage and the narrative of “joy of rambling gardens every day”. The study traces back to the origin and chronological development of the regional characteristics of the unique design style of classical gardens on the Yangtze Delta, which would be valuable to the fierce problems of lacking regional characteristics in Chinese temporary landscape design.

Keywords:

literati garden; family tradition; regional culture; regional characteristic

Influence of contemporary trends on landscape design in South Africa

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Investigating contemporary trends in landscape design can aid in identifying current trends which can be valuable to professional suppliers and producers in the landscape and horticultural industries to produce plants and products that are in demand. The main objectives of this study were to determine factors that influence contemporary trends as well as current trends in landscape design in South Africa. This study was conducted in Gauteng, KwaZulu-Natal and the Western Cape and participants were members of industry related organizations such as the South African Nursery Association, South African Landscapers Institute, Institute for Landscape Architecture in South Africa, South African Council for the Landscape Architectural Profession and the Cape Green Forum. The Mixed-Methods research approach was employed for this study. Structured questionnaires were used to satisfy the quantitative part of the study and semi-structured interviews were conducted as the qualitative part of this study. Participants were selected through voluntary sampling. Indigenous trends were cited as the most significant influence on design styles in South Africa currently. A clear link emerged between the influences of climate change on design and the increased use of indigenous and endemic plants. Socio-economic factors and architecture also emerged as an influence on landscape design styles. The use of indigenous and endemic plants emerged as the most prominent trend in landscape design, closely followed by using water wise plants to suit the habitat

and sustainable environmental design for biodiversity. Taking the findings into consideration, it may be recommended that plant producers grow more indigenous and endemic plants while the landscape architect or designer may consider making greater use of endemic and indigenous plants to achieve an environmentally sustainable design.

Keywords:

Contemporary, landscape design, indigenous, endemic, water wise

Studies on historical development of 'the curved brook for drinking and poetry (曲水流觞)' in Chinese traditional garden art

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The curved brook for drinking and poetry is a typical scenic spot of Chinese traditional garden. The image derived from a spring ceremony for lucky in late spring in ancient China and began from a gathering of Wang Xizhi and his friends who were all famous scholars at Lan Pavilion in Kuaiji in the year of 353A.D. The paper explores the process of beginning, development and inheriting of the curved brook for drinking and poetry in Chinese traditional garden art, using the methods of historical documents research, ancient paintings analysis and landscape case studies. The paper contains three parts that are historical development research, typological analysis, and the inheriting and translation in modern time. The major results are as follow. Firstly, there are four stages in the history of the curved brook for drinking and poetry, which are conceiving stage, forming stage, developing stage and mature stage. Four features can be concluded - from folk custom to literati, from minority to mass, from large scale to small, and from diversity to singleness - based on the development. Secondly, according to the environments that traditional garden applying the image of curved brook for drinking and poetry, there are three models, which are natural environment, artificial environment and architectural environment. Thirdly, in the modern and contemporary landscape design practices, the applying of the image needs to be more deeply and wildly for the Chinese regionalism design.

Keywords:

Chinese traditional garden,History, Lan Pavilion, Wang Xizhi,Curved brook for drinking and poetry

The Influence of Different Plant Life Forms on Bird Communities in Urban Parks

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Urban park is the most important habitat site for birds in urban ecosystem. And the rational arrangement of plants plays an important role for the improving of ecological service function of wild animal's habitat. In this paper, to study the impact of plant habitat on bird community behavior in urban park, Beijing Olympic Forest Park was used as the research site, and the bird survey method of sample point combined with sample line was applied. The plant type was divided into tree layer, shrub layer, herb layer and aquatic plant layer. The bird in urban parkwas divided into 10 bird groups by using the principal component analysis method. Results showed that the behavior of inhabitation, movement and feeding of the bird group in the forest park mainly occurred in the tree layer, but the behavior distribution characteristics of bird groups in the shrub layer and the herb layer were not obviously. The utilization of different living plants is significantly different to bird groups, but the space cross effects of inhabitation, movement and feeding were existed. The results of the study have some reference and popularization value for the habitat construction of urban bird, which is of great significance to the construction of the characteristic habitat landscape and the maintenance of the bird diversity.

Keywords:

Plant Life form; Bird communities; Bird groups; Beijing Olympic Forest Park

The microclimate effects of tree-communities with different specie composition and canopy structure

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Aiming to investigate the microclimate effects of tree-communities with different specie composition and canopy structure, we took field measurements using mobile traverses in Beijing, China during summer, 2016. In this paper, the microclimatic characteristics at summer daily high temperature

time of 27 pure tree-communities in 9 different tree species were analyzed. The relationships between the microclimatic parameters and canopy structural characteristics were also explored. Results showed that the air temperature (AT) and relative humidity (RH) inside tree-communities were significantly different from that of the unsheltered asphalt control site (CK). Compared with CK, the tree-communities can decrease AT by 2.38-4.33°C and increase RH by 5.16-9.91%. There were significant differences in the levels of AT and RH among tree-communities in different species, indicating that the microclimate effects of pure tree-communities composed of different species are different. Correlation analysis between the microclimatic parameters and canopy structure indices of tree-community further showed that leaf area index (LAI) and canopy density (CD) had important regulating effect on the ambient microclimate under canopy. These findings may aid efforts to provide the guidance in urban green-space design, toward ameliorating the living environmental microclimate.

Keywords:

Tree-community; Air temperature; Relative humidity; Specie composition; Canopy structure

Study on application of Cerasus cerassoides in rocky desertification ecological restoration area

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Cerasus cerassoides is a kind of deciduous tree with excellent aesthetic value and ecological benefit. In this paper, we firstly discussed the geographical distribution, morphological characteristics ornamental characteristics and community characteristics of Cerasus cerassoides. The application of Cerasus cerassoides in rocky desertification ecological restoration area were further analyzed emphatically based on the field research in Hui Mountain of Jianshui County, Honghe Prefecture, Yunnan province, China. The results showed: (1) Semi-humid evergreen broad-leaved forest, monsoon evergreen broad-leaved forest and mid-mountain wet evergreen broad-leaved forest are the three main naturally distributed vegetation types of Cerasus cerassoides. Cerasus cerassoides community is full of main plant species among Semi-humid evergreen broad-leaved forest and monsoon evergreen broad-leaved forest. The strong sprout regeneration ability of residual part of its stem makes it more stable in the community population and will not decline in natural conditions. (2) Cerasus cerassoides is a positive vanguard specis which can grow in shallow limestone in rocky

desertification restoration environment well. The ecological restoration of artificial plant community in rocky desertification area needs to follow the five stages of rocky desertification, grass, shrub-thorn-bush, arbor-shrub and climax community. Cerasus cerassoides appears in the stage of arbor-shrub and climax community. In the special environment of rocky desertification, the Cerasus cerassoides community is composed by the species which having strong resistance, strong adapt ability and rapid growth like Pinus elliottii、Solanum deflexicarpum、Pistacia weinmannifolia. The application of Cerasus cerassoides has a variety of possibilities not only improving the soil and water conservation but also presenting a wonderful landscape.

Keywords:

Cerasus cerassoides、Rocky desertification、Ecological characteristics、 Community characteristics 、Landscape application

The impact of modern urban parks in the communities of Soweto, South Africa

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Background: Parks are now, as they have always been, a mirror of our societies in that they occupy a special place in the culture of the society and are a good record of the beliefs and customs of the time in which they were established. The City of Johannesburg (CoJ) municipality invests a large sum of public funds into the development of modern urban parks through the professionals in the green industry for the purpose of service delivery to the communities of Soweto. There is no evidence on the impact that the modern urban parks have on the communities. The study aims to determine the impact of the modern urban parks in the communities of Soweto and highlight the roles played by the municipality and the green industry in the development of the modern urban parks. Methodology: A mix method approach was used consisting out of a structured questionnaire for the communities and semi structured interviews for the municipal officials as well as the green industry professional. An observation survey was conducted to assess the use of the parks by the communities. Results: The study finds that the modern urban parks developed by CoJ municipality meet the needs of the communities in that they have improved the social and recreational value as well as the quality of life in Soweto. The parks however, are subjected to vandalism when communities express frustrations towards the government. The consequences of vandalism decrease the value of the park. Conclusion: From the results it can be concluded that the communities are generally happy with the modern urban parks developed in Soweto.

DIVERSITY AND COMPOSITION OF THE URBAN TREE OF THE JESUS NAZARÉ NEIGHBORHOOD - MACAPÁ - AP - BRAZIL

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The present work was developed with the objective of performing a qualitative and quantitative analysis of the tree species used in the vegetation cover of the Jesus de Nazaré neighborhood in Macapá-AP Municipality. The methodology used was the census, with visits in locus, to collect the necessary parameters for the analysis, such as: number of species, CAP, height, canopy size and state, interference in electric wiring and public walkway and the existence of herbs weeds, termites and ants. 409 individuals were inventoried, and the family with the greatest diversity was Fabaceae with 7 species (33.3%). Among the most frequent individuals were Mangiferaindica with 134 elements, totaling 32.8% of all vegetation cover in the neighborhood. Thus, studies of this nature can be configured as objects of support to the competent authorities in the elaboration and implementation of plans that envisage the use of species suitable for urbanization.

Keywords:

Urban planting; Environmental Quality; Mangifera indica

Analyses on accumulation and metastasis ability of Iris lactea var.chinensis to Cd stress

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Phytoremediation is an environment-friendly, in situ, cost-effective potential approach for cleaning up of soils contaminated with heavy metals. Selection of suitable plant species plays an essential role in the process of field phytoremediation. An experiment was conducted to evaluate the phytoextraction potential of 3 accessions of Iris lactea var.chinensis (ML019, ML011 and ML021) in response to different concentrations of cadmium (0, 50, 100, 200 and 300mg/kg). The results showed that accumulation, distribution and metastasis of cadmium differed in 3 materials. Cadmium contents in root and shoot were promoted with increased in cadmium concentration, while the accumulate factor of shoot and root was negatively correlated with cadmium concentration. Meanwhile, the cadmium contents in the root were higher than that of shoots, indicating that cadmium was mainly distributed in the root system of the plants. The performance of ML019 was much better than ML011 and ML021 in any treatments. Especially, when the treated cadmium concentration reached 300mg/kg, the shoot's cadmium content of ML019 was 2.92-flod and 3.62-flod higher than that of ML021 and ML011, and root's cadmium content of ML019 was 1.37 and 1.69 times higher than that of ML021 and ML011, respectively. Although the transfer coefficient of 3 accessions of Iris lactea var.chinensis did not have a significant correlation with cadmium concentration, the transfer ability of ML019 was significantly larger than that of the other two materials. Consequently, ML019 can be used as a superior plant resource for cadmium remediation.

Keywords:

Cd treatment · Iris lactea · cadmium content · accumulate factor · transfer factor

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Urban parks constitute critical biodiversity hotspots in crowded, concrete-dominated city environments. However, apart from landscaping aesthetics and recreational purpose, park designs which are based on their ecosystem services always received limited concerns in Hong Kong, one of the most densely populated city in the world. Our research assesses the biodiversity of trees of urban parks in Hong Kong. A total of 337 plots from 32 urban parks (> 1 ha) were surveyed across the city. The urban parks were categorized by land use type, park history and park size. Within a plot, all trees species were identified; species diversity, evenness and importance value were calculated and compared between different park categories. The preliminary results indicated that tree species diversity showed no significant difference by land use and park size. Park history had an impact on the size and number of trees. Old parks had fewer but larger trees compared to recently established parks. Further, we will use the data to perform in the i-Tree Eco model to quantify the ecosystem services in the urban parks. The model uses tree measurements and local environmental data to estimate several functional attributes (e.g. pollution reduction, carbon sequestration and energy effects). Our research could give suggestions and recommendations on greening plans for park designers to maximize the ecosystem services of urban parks to achieve a more environmentally sustainable city.

Keywords:

Urban park, landscape tree, species diversity, i-Tree, pollution reduction, carbon sequestration

Analysis quali-quantitative of urban arborization of three neighborhoods of the municipality of Santana, Amapá, Brazil

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The objective of this study was to analyze in a quantitative and qualitative way, the current situation of urban afforestation in three districts of the municipality of Santana-AP, seeking to contribute to the general diagnosis of afforestation of this place, providing future public management subsidies. A study was carried out in the municipality of Santana-AP, in the neighborhoods Nova Brasília, Provedor I and Nova União. A total of 191 individuals were identified, with 182 trees, 9 palm trees, distributed in 19 species, 19 genera and 9 botanical families in the three districts studied. The most representative families and species in Provedor I neighborhood were Anacardiaceae (Mangifera indica L. -52% of ind.) And Meliaceae (Azadirachta indica A. Juss. -13% ind.), Nova Brasília was Myrtaceae (Syzygium malaccense L.- 20% of ind.) And Anacardiaceae (Mangifera indica L.- 50% of ind.) And Nova União Anacardiaceae (Mangifera indica L. -80% of ind.). Among the species listed, 89% are exotic and 11% native. Mangifera indica L. (Anacardiaceae) represented 56% of the total species in the survey. The individuals are in the lower diametric classes. In the Provedor I neighborhood, 27% of individuals presented height between 4 and 6 m; Nova Brasilia was height over 11 m and Nova União presents with heights greater than 13 m. The phytosanity of the individuals did not meet with termites or weeds, but rather, injury caused by pruning performed drastically. It is recommended the creation and implementation of an Arborization Management and Monitoring Plan, with adequate measures, seeking to improve and increase the quantity and potential of the trees in the areas studied.

Keywords:

Afforestation, Inventory of afforestation, Urban landscaping

How to train a good landscape architect: experiences from the interdepartmental Master degree in 'Green areas and landscape design' (Genoa - Turin - Milan)

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Landscape architects are professionals able to integrate knowledge and skills in the field of landscape design and management at various scales, collaborating with other professional figures in the fields of architecture, engineering and natural and agronomic sciences. The International Federation of Landscape Architects (IFLA) defines the Landscape architect as who plans and designs urban and rural landscapes in space and time, based on natural features and historical values and cultural heritage of the area. To this end, it refers to aesthetic, functional, scientific and management methods and principles, with the proper use of natural and man-made techniques and materials. Since 2009, the Master Degree Course in 'Designing Green Areas and Landscape' is organized in Italy within the agreement of two Agricultural Departments (University of Turin and University of Milan) and two Architecture Departments (University of Genoa and Politecnico di Torino). These Academies are part of the UNISCAPE network for the implementation of the European Landscape Convention too. The training project aims to meet the demand for specific professionalism in the field of analysis and evaluation techniques, and landscape design activities. As part of the educational activity of the two years degree program, lessons and designing activities are mixed with numerous workshops and on-site visits (France, Germany, Italy). The aim of the paper is to show educational experiences focusing on the fundamental role of horticulture and urban ecology disciplines.

Keywords:

ornamentals, plant composition, education, horticulture, multidisciplinary, UNISCAPE

Flower-themed Tourism in China: Past, Present and Prospect

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With a vast territory and a varied climate, China is considered as the birthplace of many flower species in the world. Since ancient times, Chinese people have already formed habits of cultivating, using, admiring and eating flowers, and after thousands of years, this unique flower complex has become an important symbol in China's traditional culture, which defined as Chinese Flower

Civilization. Nowadays, as a particular type of tourism, flower-themed tourism has emerged as a blowout phenomenon in this decade, and Chinese scholars have a growing interest in this field, which attempts to incorporate insights from various perspectives such as geographical, economic, recreational and cultural studies. However, few studies have systematically analyzed the development process of this tourism industry at different stages. In this paper, firstly it briefly reviews the concept of flower-themed tourism, which includes flower tours, garden tours, flower festivals and other special events. To better explain why Chinese have great interest in viewing flowers, it explores the role of flowers in Chinese daily life through historical and comparative lenses. Then it examines the traits and characteristics of the current flower-themed tourism industry, which illuminated by several case studies in China. Furthermore, the study concludes with some suggested trends for the future development of the flower-themed tourism and underlines the urgent need to establish a systematic management model for this type of tourism.

Keywords:

flower-themed tourism, Chinese flower civilization, China

Exploring hydraulic redistribution for water management in gardens

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The understanding of water use by mixed stands, where trees and herbaceous share the same area, as in landscaping, requires at least the combined consideration of the role of water and radiation, as limiting factors for plant development and survival. Hydraulic redistribution (HR), a mechanism of transport of water between different root zones via roots, is of high interest in this context. Several studies in last decades, using bidirectional sap flow sensors in roots, and other tools, unlighted the role of this survival mechanism in potentially critical hydro-climatic conditions, i.e., when plants are subjected to severe water stress. Woody plants, can act as water transporters from underground deep layers to shallow soil layers, via their deep roots, and as a result of water potential gradients. Results from literature suggest that in doing so (HR) deep rooted plants not only ensure conditions for their own survival but also that, at certain stages, they increase the survival chances for other plants installed in nearby shallow layers. Our hypothesis is that synergies between species exploring different water from soil layers can be identified in a simple experiment, the results being of potential interest for garden planning. We show preliminary results obtained with olive trees in Mediterranean climatic conditions, and associated herbaceous plants, in a kind of split-root experiment. Water status of herbaceous plants in three different conditions was evaluated from leaf water potential and stomatal conductance. The results confirm our hypothesis in that herbaceous plants were significantly affected by water applied to part of the root system, even if not receiving irrigation directly. This mechanism should be taken into account when creating sustainable urban gardens, in respect to water management.

Keywords:

Keywords: water stress, irrigation, mixed stands, Mediterranean, landscaping.

Application and Disposition of Ground Cover Plants in Shenzhen Parks

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Acording to the investigation on the application status of ground cover plants in 21 representative city parks in Shenzhen, the species and application frequency of the ground cover plants were statistical analyzed. Moretheover, This study focuses on the application effects and disposition mode of the ground-cover plants, and the new excellent species applied in recent years. The results showed that 108 ground cover plant species were used in Shenzhen parks. Acanthaceae、Agavaceae、Liliaceae、Rubiaceae、Araceae plants took up more than 60% of all ground cover species applied in the parks, which have good adaptability to the local climate environment.The landscape characteristics of the ground cover plants were analyzed, and the application effects of the flowering plants and the colored foliage plants were summarized, which could provide reference and direction for the selection and disposition of ground cover plants in Shenzhen.

Keywords:

Ground cover plant; Application; Disposition

Ethnobotanical awareness and interest in biodiversity for environmental sustainability in suburban areas

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According to the UN Sustainable Development Goal 15, part of the 2030 agenda, biodiversity is an essential element of environmental sustainability. However, with husbandry of biodiverse systems increasingly lacking, recent increases in human migration to urban and periurban areas, and most practical needs provided for by modern industrial technology, a decrease of contact with nature has resulted in less reason to retain traditional knowledge associated with nature. Our study seeks to find the relationships between people’s current understanding of ethnobotanicals and edible plants and

how they perceive biodiversity in their neighborhoods. This study aims to find and understand this connection with a questionnaire given to all occupancies of a 746-unit housing complex in Matsudo City, a suburb of the Tokyo Metropolitan Area in Japan. Green spaces within a 200m radius of the complex center were analyzed for ethnobotanical plants, in particular Morus bomcycis. 112 responses regarding awareness of different plant and animal species in surroundings and ethnobotanical knowledge were analyzed. For specific ethnobotanical and ecological knowledge, we studied the respondents' perception and use, as well as collected background information regarding ecological niche species related to Morus bomcycis. Our findings show that ethnobotanical knowledge is related to interest in biodiversity. Although many organisms depend upon Morus bomcycis, few residents know associated traditional knowledge other than as silkworm food. There was a relationship between knowledge level and age; residents in their 60s and 70s knew more than others about the usages of the plant's berries for food, as well as other ethnobotanical plants'. Conclusions suggest that to foster biodiversity based upon native plant life, ethnobotanical plants should be thoughtfully landscaped and nurtured in the surrounding suburban environment. To increase human awareness, ethnobotanical and ecological education and signage is recommended to increase awareness and psychological identity with the human-plant connections available.

Keywords:

sustainability, ethnobotany, traditional knowledge, resilience, suburban, perception, landscape, biodiversity, Morus bomcycis, planning

Evaluation of the landscaping potential for rosette plants natives from Mexico

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Historically, the selection of species to be included in landscaping has used purely esthetic criteria. The methods used to recognize or propose potential ornamental species are varied, but most of them are completely subjective. The general objective of this research was to evaluate the landscape potential of rosette plants, native to the state of Querétaro, central Mexico, integrating ecological, handling and esthetic criteria. The methods included develop an updated list of native rosette species of the state of Querétaro with information from herbarium data, specialized literature and field collection. We developed a quantitative evaluation instrument like a way to reduce the subjectivity. The scores of handling criteria were established depending on the urban green area type. The scores of esthetic selection criteria were based on the characteristics of the rosette and leaves. Finally, each of species of floristic list was evaluated, obtaining a qualification per species, which indicated its landscape potential. As results, 55 species of rosette plants were recorded, for the Querétaro state, belonging to the family Agavaceae, Bromeliaceae, Crassulaceae and Ruscaceae. Of the 55 species, 35 are shrubs, 15 are perennial herbaceous plants and only five species are trees. Regarding the landscape potential of the species evaluated, that is to say, the score that average the esthetic and handling scores, the species that resulted with higher scores were: Echeveria bifida, Echeveria tolimanensis and Hechtia zamudioi with 0.83; Agave applanata, A. striata and Dasylirion acrotriche with 0.85; Yucca queretaroensis with a score of 0.87, Echeveria mucronata with 0.89, Dasylirion longissimum with 0.90 and A. filifera with 0.96. The evaluation of the landscape potential

of native species provides tools to landscape designers at the time of the selection of species to be introduced in urban green areas and also offers a perspective for horticulturist to propagate priority species.

Keywords:

plants species selection, design landscape, ecological criteria, handling criteria, esthetic criteria.

Diversity and impacts of ornamental plants of urban green areas of Querétaro, Mexico

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The urban green areas (UGA) have diverse economic, social and environmental impacts, which may depend directly on their floristic composition. Therefore, the objectives of the study were to document the floristic richness and to evaluate the positive and negative impacts of the most common ornamental plants in the green areas of Queretaro, central Mexico, a city with rapid urban growth in Mexico. The fieldwork was carried out in 20 green areas. In each site the species richness was recorded and the positive and negative impacts of the most common ornamental species were evaluated. 387 species belonging to 284 genera and 90 families were detected, of which Asteraceae, Cactaceae and Asparagaceae had the highest number of species. 62.1% (240) of the species are exotic, 37.9% (147) are native to Mexico and 8.7% (34) are native to the region (Queretaro), accordingly the UGA evaluated is an important space for the conservation of plant diversity. The main positive impacts of the species of the UGA sampled include their aesthetic and landscape value, medicinal use, soil cover and they are an important resource for pollinators, especially hummingbirds, butterflies and bees. The negative impacts generated by the plants were: damage to infrastructure such as wiring and sidewalks, allelopathy and soil acidification. In addition, the presence of seven highly invasive species such as Kalanchoe spp., Mesembryanthemum cordifolium and Spathodea campanulata was detected. Our results highlight the importance of UGA for the conservation of diversity of local plants because they harbor a part of the regional endemic flora, as well as the need to consider the impacts generated by plants on the urban landscape.

Keywords:

urban flora, urban landscape, urban planning, environmental impact, endemic flora

Evaluation of 'Self-watering' Green Roof Planting System on Establishment of Selected Ornamental Plants in Tropics

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Green roof is a new garden concept in Malaysia that has potential to be explored. There are several types of green roof planting system; one of it is the modular system. Modular system is more practical; it is easy to install, flexible and fully modular. However, the current planting systems that available in the market are mostly designed for temperate region and not compatible with Malaysia's climate which located in Tropical Zone. The plants to be planted on green roof in Malaysia have to survive and grow well in minimum substrate depth with extreme weather condition, and this is the main challenge to develop a green roof in Malaysia. Therefore, this research is to develop a modular green roof planting system and also to determine the potential of selected ornamental plants to be planted on green roof in tropics. The trial was done on green roof research plot in Horticulture Research Centre, MARDI located in Serdang, Selangor, Malaysia. Selected tropical plants were used in this study; Otacanthus caeruleus, Turnera ulmifolia , Vinca minor and Ruellia brittoniana. The treatments consist of two green roof planting systems; 'Conventional' system and 'Self-watering' system with 5 cm substrate depth. 'Conventional' system and 'Self-watering' system made from acrylic material (615 x 430 x 160 mm). Lightweight growing medium were used consisting peat moss, perlite and vermiculite with the ratio of 1:1:1. The 'Conventional' system is the system that was set up referred to the green roof planting system that available in the market. While for 'Self-watering' system is the planting system that we have innovated with a layer of reservoir. Watering for both treatments has done once a week and 8 liter of water for every planter box. From the observation, 'Self-watering' planting system promoted growth in majority of tested species. Moreover, most of the tested species performed very well with the high percentage of survival rate and have a good score in appearance scale in 'Self-watering' planting system. This research outcome shows the 'Self-watering' planting system can grow a better quality plants for green roof particularly for Tropical zone.

Keywords:

drought, rooftop garden, landscape plants, roof planting, tropical region

Does Street Trees Benefits to Our Brain? - An Environmental Brain Plasticity Study

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Brain function holds the greatest role on one's living and has been studied massively to improve human well-being. Living in stressful urban areas receives pressure from environment which could cause serious burden for brain function. Given working space and living space contribute a great portion to one's daily environment contact, moreover, transportation might cover more. Mounting evidences showed that street greenery can help to prevent the situation and improve health state in

a holistic aspect. Regards to this, choosing a healthier moving route in the city with street trees could be an applicable and important strategy. Nowadays, with the technique of Functional Magnetic Resonance imaging (fMRI) and artificial intelligence (AI) system there is a critical need to develop an AI system that can detect and feedback to our living environmental plan based on the street-view fMRI brain reactions.

The aim of this study includes three parts. The first is to recognize the features of street trees and to categorize the street prototypes within a city. Next, the effects of how street trees effect on human brain is identified by fMRI experiment. Input feature points like landscaping elements, color, green coverage, visual frequency, fragmentations, etc. Outputs of this process will be further developed into test materials for brain-reaction experiments. Finally, the design criteria of brain-beneficial street landscapes is suggested and applied to city greenery plans.

Keywords:

Urban, Street trees, Greenery, Brain, fMRI

Structural composition of vegetation in major urban green spaces of Nairobi City, Kenya

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Information on plant composition is important for planning and management of urban green infrastructure against the background of rapid change in the landscape of most tropical cities. Data on plant species occurrence and vertical distribution was collected through field surveys in randomly set quadrats along transects in each of three green space study areas that covered a combined area of 23 ha. City park is a more open green space but smaller and closer to the CBD than Karura and Ngong which are recreational urban forests. Analysis was done for plant species occurrence, species diversity and vertical structural distribution for trees, medium sized trees, shrubs and herbaceous plants. We recorded an overall total of 276 plant species with City park having the highest. A total of 1850 individual trees belonging to 84 tree species were observed in the three study areas of which 82% were indigenous species. A higher number of herbaceous and shrub plant species of 130, 81 and 128; and 49,79 and 90 plant species were observed in City park, Karura forest and Ngong forest, respectively than in the other taxa categories. City park recorded the highest number, 42%, of exotic plant species while Karura and Ngong recorded 37% and 36% respectively. Plants in the Poaceae, Asteraceae, Fabaceae and Euphorbaceae families were the most common. It was noted that high number of rare species occurred in all the study sites and some species were unique to given canopy levels. This information is useful for developing management strategies that guarantee sustenance of ecological, horticultural and recreational benefits of the urban green spaces.

Keywords:

Urban ecology, tropical city habitats, canopy layer, species richness, species occurrence, space management

Vegetable Quality and Safety in Urban Outdoor Production

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Production of vegetable is important for sustainable urban setting and food security to reduce transports hereby minimizing the carbon footprint of the food system. Regular consumption of vegetable is an important part of a healthy diet and reduced risks of disease. Especially leafy vegetables have short durability which is very difficult in a complex distribution chain. In urban area, air particle pollution is of particular interest due to potential adverse health effects associated with the continuous exposure of a high-density population. The objective of this study was to examine the effect of air quality on vegetable production, quality and safety. Swiss chard (Beta vulgaris subsp. cicla) was used as a model crop. The vegetable was cultured in three different urban areas in Southern Sweden. Air pollution as well as weather conditions were monitored. Leaves were collected two times during the growing season, with six replicates per time. Leaf area, plant fresh mass and dry mass were measured at harvest. Settlement of microbial and particulate components on the leaf surface were analyzed. The composition of leaf microbiota was mapped. Results are displayed in the presentation.

Keywords:

Urban outdoor production, vegetable, quality, safety, swiss chard, air quality

Using greenhouse to simulate urban conditions for plants experimentations

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The ecosystem services provided by urban plants strongly depend on the plant well-being. Indeed, environmental factors such as soil density, shading and irrigation can affect plant physiology, growth, and aspect. Plants in cities are often living in stress-inducing environments characterized by unfavorable and fluctuating aerial and subterranean conditions. Proposing plant species models fulfilling such conditions requires the understanding of plant development, depending on these abiotic environmental factors. However, experimentations in urban conditions are difficult as locations are constrained, plants and sensors are exposed to vandalism and the climatic conditions could not be controlled. In order to characterize the environment influences on plants, a southward greenhouse compartment was used to emulate urban environment. Roses (Rosa Hybridacv. Radrazz) were grown in stone-topsoil mixture representative of urban soil, drip irrigation was used to control water input, and shading screens were placed to mimic building shading due to sun path course. The experiment took place on twelve weeks between April and August 2017 in northwestern France with several modalities varying according to water input, plant shading, and soil density. Climatic measurements showed that the climate in the greenhouse compartment was close to the urban climate measured by ONEVU in Nantes during hot springs. Analysis of the plant morphology and physiology showed that hydric restriction was the primary factor impacting the plant growth, followed by shading, whereas the soil density had a limited influence. Moreover, a model depicting the plant transpiration and growth according to climate and soil conditions was formulated, as a tool to predict the plant development, mandatory for assessing the provided ecosystem services.

Keywords:

rosebush , water restriction, shading, plant morphology, urban climate

The Extension Master Gardener Program in the United States: A Brief History, the Impact, and Future Challenges

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The Extension Master Gardener (EMG) program started in the US in 1972. Volunteers are trained through Extension and are required to donate hours of service back to Extension on projects such as garden helplines, backyard garden demonstrations, community gardens and others.

Today, there are EMG programs in 50 states and the District of Columbia. The last national survey (2016) indicated that there were more than 88,000 active EMGs; approximately 14,500 volunteers are trained through Extension annually. EMGs contributed (2016) 5,718,738 hours of service to Extension programs which is equivalent to $138,050,335.00 worth of service. EMGs completed 999,111 hours of continuing education in order to remain active in 2016.

Volunteers are trained by Extension specialists, Educators, and other qualified staff. The information taught is university or research-based and they are required to use this information when serving in the capacity of an EMG.

The Extension Master Gardener National Committee (EMGNC) was formed in 2006 and facilitates national collaboration to avoid redundancy in development of educational training materials for EMGs as well as volunteer management training resources, and expedites collaboration with federal agencies, funders and professional organizations for input and funding for national issues and priorities. The most pressing issue for the EMG program is collecting data to show impact. There has not been a coordinated effort nationwide to collect impact data. In 2016, the EMGNC created a task force to address this issue. Moving forward, we must collect data nationally in order to address the following question, "What do we need to do to ensure that the EMG program remains relevant to our stakeholders?"

This presentation will be a brief introduction to EMG program as well as a discussion of the EMG National Committee efforts, the current challenges, and the future direction of the EMG program.

Keywords:

Extension, Extension Master Gardener, volunteer, impact

Citizen Science: The Value of Utilizing Extension Master Gardeners in University Plant Evaluations

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Citizen Science projects are those directly involving "citizens" who are not professional scientists, in the collection of data. Citizen science connects researchers and citizens to scientific research. Data collected by citizens or in this case Extension Master Gardeners (EMGS), is used to provide valuable information to seed companies, growers, brokers, the commercial industry as well as consumers. This citizen science project engages EMGs who have a passion for learning about plants, cultivars, and performance and involves EMGs collecting data in plant evaluation trials.

Prior to the start of the project, the citizen scientists (EMGs) are trained on conducting research in general. They are provided with the details about the entire project, from beginning to end in order to understand where their participation fits into the big picture. They learn the basic components of a research project and how to conduct valid research. EMGs are assigned the responsibility of gathering of data or evaluating the individual entries in the trials. Training is provided on the variables used to gather data and how to go about gathering and recording data. When conducting

plant evaluations, the rating scale needs to be defined clearly. During implementation of the project, the project director monitors EMG activity and continually reinforces correct research methodology. Additional training and guidance may be needed.

This session discusses the advantages and disadvantages as well as the benefits of using citizen scientists to conduct plant trials.

Keywords:

Plant evaluations, citizen science, field trials, Extension Master Gardener

Examining the potential use of a wildflower meadow in a vineyard to enhance the local rural landscape character

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Among the main benefits of using wildflower meadows is to enhance the local landscape character and increase biodiversity. Vineyards worldwide often constitute a dominant element of the landscape character. This study investigates the potential use of the local flora as a wildflower meadow in a vineyard cultivated with the variety ‘Sultanina’, at Pergiali, Corinth, Greece with an aim to enhance the local rural landscape character and increase biodiversity while sustaining a stable grape production. It is paramount in a vineyard that the meadow does not negatively affect both the quantity and quality of the produce. Three cultivation methods (treatments) were investigated based on three levels of harvest interventions on the local flora in the vineyard: none, periodic and constant (control). Throughout the duration of the experiment the composition of the local floral was identified (number, height and area of groundcover of the plants per species) as well as the insects found within the wildflower meadow and on the grape vine plants. At maturity, the main quantitative (yield/vine) and qualitative characteristics (soluble solids, pH and total titratable acidity) of the grapes were evaluated. Results showed that the overall composition of the local floral did not

differ between the without harvest and periodic harvest treatments, and that the quantitative and qualitative characteristics of the grape vines did not differ between all treatments. Furthermore the amount of pests found within the meadow was higher in the treatment without harvest compared to the periodic harvest treatment. On the other the hand the amount of pests found on the grape vine plants in both the without harvest and periodic harvest treatments were too small to consider. Further research is necessary to draw conclusive results on the effect of the local flora as a wildflower meadow on the qualitative and quantitative characters of the grapes.

Keywords:

landscape character, harvest, local flora, biodiversity, grape vines, qualitative and quantitative characters

Introduced hybrid tea roses in landscape design on South Coast of the Crimea

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At present Hybrid Tea rose group numbers more than 10 000 cultivars all over the world. Scientists of Nikita Botanical Gardens (NBG) have worked at the introduction of this group plants for about 70 years. During this period principal directions of Hybrid Tea roses use in landscape design on South Coast of the Crimea (SCC) were successfully found out: the creation of the group and solitary plantings in ornamental and health-improving rose gardens taking shrub and stem forms of cultivation. Four groups of cultivars, the most prospective for landscape design were marked out as a study result of introduced cultivars, their growth rate and development under conditions of South Coast of the Crimea, applying methods of botanical gardens. Plant ornamental peculiarities being evaluated due to approaches of cultivar study and rate of the state strain testing were considered as well. A group of early-blooming includes 11 cultivars such as 'Caribia', 'Pariser Charme' and others, which start their blooming period in the middle of May. In the group of roses with prolonged blooming, there are 38 cultivars such as 'Erotika' and ‘Traviata’, their total average blooming period makes 150 days. A rose group with strong flavoring consists of 32 cultivars such as 'Big Purple' and 'Yves Piaget', prospective for cultivation in aroma therapeutic rose gardens, rather current trend for the Crimean resort, considering that distinctive feature of this area is to use local parks for medical purposes applying methods of airphytotherapy. 20 cultivars such as 'Lady Rose', 'Mascotte' and others are supposed to be prospective for shrub and stem cultivation. Therefore as a result of researches 62 introduced cultivars are found as prospective for landscape design on SCC. The researches were granted by the Russian Science Foundation (№ 14-50-00079).

Keywords:

Nikita botanical gardens, early-blooming cultivars, aroma therapeutic rose gardens, stem cultivation, prolonged blooming.

Perceptions of hospital patients and staff, a tool to inform the design of healing gardens

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The benefits of hospital healing gardens are well-documented however require careful design to meet the full potential of their designed purpose. Three main groups of hospital users are identified; patients, staff and visitors. Patients and staff constitute the primary users of hospitals in both long-term and short stay medical cases. Each hospital needs to be addressed individually to identify the particular needs of its patients and staff. A questionnaire survey investigating the perceptions of a hospital's patients and staff on the design of its open space could be used as a tool to inform the design of a healing garden with an aim to address more holistic the particular needs of the hospital. In this study a questionnaire survey investigating the perceptions of both patients and staff of a private hospital in Thessaloniki, Greece was used as a tool to inform the design of a healing garden for the particular hospital. Results showed that the majority of the patients visit the hospital grounds during morning and noon hours (43.9% and 30.3% respectively) for 15-30' (42.4%), while the staff visit during noon and early evening hours (35.5% and 29.0% respectively) for maximum 15' (64.5%). The majority of the staff (68.0%) wanted a staff only seating area. The majority of the medical staff (98.0%) allow patients to participate in mild outdoor activities such as, walking, gardening and light exercise. Most patients (64.0%) wanted gardening if their medical condition allowed it, the presence of colour (36.2%) and pergolas or kiosks (35.0%) in the hospital grounds. With regards to the planting, patients showed a preference for the qualitative characteristics of plants such as scent while the staff showed a preference for plants that provided shade. Following a healing garden was proposed that addressed the particular needs of the hospital studied.

Keywords:

questionnaire survey, patient outdoor activities, plant characteristics, planting, holistic approach

The National Initiative for Consumer Horticulture in the United States: Presenting a Case for Research Funding

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The United Sates Department of Agriculture funds research and extension for ornamental crops such as trees, shrubs, and other plants primarily through the Specialty Crop Research Initiative (SCRI). Of the 162 projects funded by the SCRI from 2005 to 2015, none focused on Consumer Horticulture (CH). CH is the cultivation, use, and enjoyment of plants, gardens, landscapes, and related horticultural items to the benefit of individuals, communities, and the environment and ultimately drives the demand, consumption and sale of specialty crops. CH embraces public and private service industries, such as landscape design and maintenance, park maintenance, arboriculture, irrigation, public gardens, and other services. These services impact a broad array of ornamental/specialty crops and are integral to their use.

The march of urbanization has created sprawling suburban and peri-urban landscapes, yet the environmental impacts and sustainable design and management for such landscapes are largely undefined. We have yet to define the plants, products, and technologies appropriate to the diversity of landscapes and regional climates across the country. We need research that identifies, validates, and articulates the social, environmental, financial, health, and well-being benefits associated with gardening and landscaping. CH research will help sellers identify consumers and new markets. It will increase public awareness of the social, economic, and environmental benefits of landscapes and plants, and ultimately increase demand for specialty crops and associated services.

In order to seek funding for CH, the National Initiative for Consumer Horticulture (NICH) was developed to bring like-minded stakeholders together. NICH members are academicians, business leaders, non-profit representatives, and others who have joined together with the mission of growing a healthy world through plants, gardens and landscapes. In two years NICH has received funding and national recognition. We have also outlined a research agenda by gap analysis of the literature.

Keywords:

Consumer horticulture, NICH, specialty crops, landscapes

URBAN FOREST ASPECTS IN SQUARES OF SANTANA, AMAPÁ, AMAZON, BRASIL

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The urban tree generates environmental and social benefits and contributes to better the quality of life of the population from the urban centers. Due to the lack of a planning, tree planting in the square has caused problems to the inhabitants, such as the confrontation with urban equipments. The objective to predict the urban tree qualitative and quantitative of the 11 squares (Olímpica, Independência, Vila Amazonas, Paraiso, AERPA, Juventude, Fonte Nova, Fortaleza, Vilelão, Cidadania and Novo Horizonte) in the city of Santana, Amapá, Brazil. The collection of data was carried through with sheets that contained parameters of evaluation of the tree in the botanical aspects of individuals with ≥ 5 cm diameter at ground height. The methodology included the collection of plant materials that were later herborized and identified through identification keys, pertinent literature and by comparison with the HAMAB Herbarium's material. Tthe inventory was gathered 137 individuals belonging to 17 species, becoming seven exotic species (Ficus benjamina L., Syzygium cumini (L.) Skeels, Roystonea oleracea (Jack.), Mangifera indica L., Carica papaya L., Gmelina arborea Roxb. ex Sm and Acacia mangium Willd.) and ten native species (Cocos nucifera L., O.F. Cook., Psidium guajava L., Bixa ollerana L., Acrocomia aculeata (Jacq.) Lodd. ex Mart., Tapirira guianensis Aubl., Tabebuia serratifolia (Vahl) G. Nicholson., Sapium gladulatum (Vell.) Pax., Anacardium occidendale L., Andira inermis (W. Wright) Kunth ex DC. and Annona glabra L.), belonging to 11 botanical families. The families with the major number species were: Anacardiaceae (3) and Arecaceae (3). Over 41% of this species are exotic to the Brazilian flora and 59% native. Ficus benjamina L.represented for 63% of the showed trees. The diversity of Santana´s square greenery should be improved; the use of native trees should be encouraged, for the sustentability of this arborization, proportionate the ambient benefits.

Keywords:

biodiversity, native specie, exotic specie, urban tree

Production and commercialization of seeds and seedlings in Ferreira Gomes and Porto Grande, Amapá state, Brazil

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The demand for forest restoration projects grows increasingly in Amapa State. One of the difficulties that these projects are having is the lack of knowledge about the regional offer of seedlings of native species. This study aims to evaluate the nurseries and seedling production of amzonian species from Ferreira Gomes and Porto Grande, Amapa, Brazil. The field work consisted in visits to 7 nurseries, in which it was applied a questionnaire addressing various topics related to the nursery and the seedling production. It was requested a list of the species produced. In the diagnostic were included the nurseries producing seedlings of amazonian species. Regarding the administrative structure, Ferreira Gomes and Porto Grande nurseries are mostly small sized, administered by private agencies and many of them have lacks of infrastructure for seedling production. One of seven nurseries is registered to the RENASEM as required by the current legislation. The seedlings are produced with low diversity of species, predominance of plastic bags as recipients and little technical and managerial control over the production. It is necessary public policies aiming reinforce the existing nurseries, stimulate amazonian forest restoration and, consequently, the demand for native forest seedlings.

Keywords:

seed technology; nurseries; seedling production

Managing Urban Greening for Improving Well-being in European Cities

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The theme of ecosystem services has been of great interest in recent years and tends to occupy an increasingly important role in the design and management of urban green areas. Considering that

most people today live in cities, providing healthy conditions in the urban environment is necessary. Health and well-being are directly related to cultural ecosystem services provided by urban green areas. According to some authors, ecosystem health must comply with three fundamental conditions: vigor (measure of system's primary productivity), resilience (the capacity to recover from stress) and organization (number and type of interactions between the components of the system). Together with these conditions, it is imperative that citizens understand and appreciate the ecosystem in which they live, contributing actively and reasonably to its design, management and improvement. It is therefore important to study the relationship between the management regimes of urban green areas and the cultural ecosystem services that they provide. The study focused on the above-mentioned concepts comparing two European cities, Berlin (Germany) and Turin (Italy). The main indicators for urban green management were analyzed. Samples areas were deeply studied (vegetation types, management regimes) and citizens were involved in order to understand their expectations (questionnaires). Preliminary results of the research will be discussed.

Keywords:

green areas, cultural ecosystem services, health, urban planning

El Jardín de la Alameda in Murcia, Spain: origin and transformations of a public tree-lined boulevard

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The habit of strolling as a way to leave the dense housing grid that formed Spanish cities led to the emergence of certain places, distributed along the roads that entered the towns. Initially called "prados" ("meadows"), they gradually developed into tree-lined avenues known as "alamedas". The purpose of the present work is to study the origin and evolution of this garden, recently declared as the first historic garden in the city of Murcia. Originally, the tree species used were mainly poplar, black poplar, and elm, distributed in linear alignments to facilitate the stroll. Initially called Jardín de la Alameda, it was renamed as Jardín de Floridablanca in the mid-nineteenth century. Recently, the council of Murcia (southeast of Spain) have promoted its preservation becoming the first historic garden in the region in an urban context and after several interventions and changes.

Keywords:

historic garden, urban landscape, Elm trees, heritage

Assessment of Contamination in Crops Growing in Urban Horticulture (case study: Tehran, Iran)

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Vegetables are important part of alimentary diet and being exposed to polluted alimentary diet of trace elements via consumption of vegetables be carried to account a risk for human health. The contamination of agricultural crops with trace elements due to atmospheric contamination is a potential threat for their quality and their safety. The purpose of this study was to determine of Aluminum (Al), lead (Pb), Chromium (Cr), Manganese (Mn), Nickel (Ni), Copper (Co) and Molybdenum (Mo) trace elements concentration in bell pepper and eggplant and their health risk assessment in the vegetable that is grown in urban agriculture in Tehran. In this study samples of the vegetables were evaluated. Samples were digested in laboratory by using of acidic digestion. Trace elements concentration was read by using of ICP-MS device and data was analyzed by SPSS. Except Al and Cr in eggplant, which showed higher concentrations in the field-grown samples; most of the urban-grown samples were significantly higher at 5% level compared to the samples grown outside the city. In addition, the concentration of Cu in both of the vegetable grown in the field was more than those in the roof-grown. Aluminum concentration in the eggplant field was 52.4 times the yard and 52.3 times the roof and Cr in the eggplant field 1.6 times the yard and 1.1 times the roof. Copper concentration in field's eggplant and bell pepper was 1.22 and 1.24 times more than the roof. Except Pb, in some samples of eggplant, the roof-grown and the yard bell pepper, which were 0.18, 0.63 and 0.14 mg/kg dry matter (mg/kgDW) respectively and were significantly higher at the level of 5%; most of the samples had a concentration below the limit for Pb, Cd and PAHs, according to the European Union and the Iranian national standard and this difference was significant at 5%.

Keywords:

roof top garden (RTGs), air pollution, trace elements, urban horticulture.

An Approach for Plant Selection in Urban Landscapes (A Case Study: Tehran)

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Choosing appropriate plants for urban landscapes is vital to avoid potential financial and environmental losses that may occur if all selection parameters are not taken into account.

Determination of plant species assessment indices at urban green space did not have any special standard and many references just pointed to some of them. The aim of this study is making sustainable green space for under study region. Scientific reference of indices that have practical role at plant selection were determined after studying in this selection. Two essential elements were considered when outlining the selection criteria. The first was to identify the appropriate selection parameters for a specific region, and the second was to find the value or the importance coefficient factor of each parameter compared to other parameters. After plants grouping, selection parameters have been defined for each group. Plant species were comparatively graded for each parameter by a group of eight specialists. Analytical hierarchy process (AHP) technique and hierarchical cluster analysis have been utilized to find the most adaptable plant species for the area according to the main selection parameters of zone tolerance, urban conditions, esthetics, maintenance, growth characteristics, and specific features. The result showed that many of dominant green space plant were not proper species and there are new proper plant that received least attention.Several new plants were ranked high in the final tables suggesting that the urban landscape of Tehran has a great potential to become more attractive, less allergic, and less costly, as well as consuming less water. Before introducing new plants to the urban environment, they should be experimented on in small numbers for several years to confirm that they will not change the ecology of the whole region through invasion or posing a threat to any local plant species.

Keywords:

analytical hierarchy process (AHP), climate change, semi-arid cities, urban landscape.

REGIONAL GARDENS of ANATOLIA VINEYARD ' VEGETABLE GARDEN; SİİRT EXAMPLE

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Mesopotamia is the region where the agriculture that is an important milestone in the human history has been developed and the first settled societies were formed. The formed agricultural structure in the region was differentiated and developed according to the relationship between the region’s geographical specifications, life features of people who live that region and food sources. In this process, vineyards and vegetable gardens that are regional gardens were formed in the scope of agricultural structure. In the traditional life the vineyards are agricultural fields where the fruit need which is based on dry land farming is fulfilled, the vegetable gardens are agricultural fields where the vegetable production is mostly made and based on irrigated farming.

The city of Siirt where was built on the high parts of Mesopotamia is one of the oldest places of the world which the vineyard-vegetable garden cultivation. In this study; the vineyards and vegetable gardens in and around the city of Siirt were evaluated in terms of their general garden plan, its

elements and border plants by examining their general specifications. By this way, the regional garden culture's that has reached from the past to modern day introduction was aimed.

In the region the signs of these traditional gardens essential culture were detected. The vineyards and vegetable gardens kept their existence up to modern day as an important element of regional nutrition relations and economy by providing the daily fruit – vegetable need. However the local gardens that has come from history are gradually becoming narrow and changing its quality because of urbanization and intensive agriculture.

Keywords: (Last update 18 November 2017 19h06)

Mesopotamia, Garden Culture, Fruit - Vegetable, Urbanization, Anatolia.

Location-allocation model of urban agriculture from a justice lens

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In the context of a growing presence of urban agriculture as a tool towards environmental and social just cities, the objective of this research is to define a location-allocation model that integrates a spatial justice perspective to evaluate the optimal location of urban agriculture initiatives. Beyond allocating the demand to the absolute population, the proposed location-allocation model includes six single indicators covering multiple functions and benefits tied to urban agriculture: social inclusion, environmental justice, social justice, urban regeneration, food access and environmental education. Furthermore, accumulated and weighted indexes are proposed to integrate the results from the different approaches. The spatial efficiency of the entire community was employed to define the more just locations. The city of Bologna (Italy) was evaluated as case study to validate the model due to its importance in the development of urban agriculture in Italy. Spatial modelling resulted in a useful tool to assess the location of new urban agriculture projects. The San Donato – San Vitale neighbourhood was rated as the most preferred option for locating a new urban garden from a spatial justice perspective. Furthermore, the results were used to evaluate the proposal of the city council for implementing new municipal gardens. Notwithstanding that the available statistical data limited the scale of analysis and the employment of other indicators (e.g., air contamination levels), the model might be a useful tool for policy- and decision-makers in the planning and development of urban agriculture.

Keywords:

location-allocation model, urban agriculture, urban planning, spatial justice, spatial model

Societal evaluation of the ecosystem services of urban agriculture in Bologna

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Urban agriculture (UA) has expanded over European cities during the last decades as a tool towards more sustainable cities, being the provision of environmental and socio-cultural ecosystem services (ES) of these urban food landscapes an important driver. Some studies have quantified the ES provision tied to UA (e.g., the service of “food provision”) and quantified the perceived ES by surveying users and gardeners. Furthermore, the supply of ES has been employed as characterizing factors for community gardens. However, the evaluation of ES has been mostly limited to the perception of practitioners and experts, rather than including broader narratives. This study evaluates the ES of UA perceived by the society, focusing on how the level of involvement and knowledge affects these perceptions. ES were assessed by employing a survey with a non-monetary assessment via Likert scales of 14 environmental ES and 12 socio-cultural ES. The survey was compiled by three groups in Bologna (Italy): general public (n=280), students of the ERASMUS+ URBAN GREEN TRAIN project (n=29) and stakeholders of UA (n=16); which can be placed in a continuum from a low to a high level of involvement and knowledge of UA. Trends regarding the ES valuation and the level of involvement and knowledge were found in the results. In general, notwithstanding that socio-cultural ES were more valued than environmental ES for all three groups, stakeholders ranked better the environmental ES. With regard to the environmental ES, a higher involvement determines a lower valuation of the provision of resources beyond food (e.g., medicinal plants), the carbon sequestration and the conservation of genetic variability of UA, while a better valuation of the local climate regulation. A lower valuation of the socio-cultural ES resulting from a higher involvement in UA was found for all the ES under assessment.

Keywords:

ecosystem services, urban agriculture, local production, urban food systems

Urban Gardening: contribution to social inclusion and capacity building of political refugees' in Bologna, Italy

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The flows of migrant political refugees to Italy has constantly increased in the last decade and is not expected to decrease in coming years. In Bologna metropolitan area asylum seekers have passed from 321 to 816 in 2015. This trend requires a new systemic and structural answer that involves also the third sector and the civil society, in order to make integration happen effectively. To achieve this goal a major cultural change is required, and the constrains of a strategy limited to investments on building an efficient reception system are becoming evident. Reception centres must become new centralities, able to produce culture, solidarity, economic growth and, ultimately, social wellbeing. Refugees need to feel part of the hosting community where they can activate their own unique abilities, qualities and skills, to build their self-reliance and autonomy. The ResCUE-AB of Bologna University is collaborating with several reception centres in Bologna with the objective to contribute to answer to all foresaid challenges with an integrated approach, by using innovative tools for social innovation. More specifically, the collaboration aims to offer an educational and therapeutic gardening experiences, supporting the refugees in their autonomy process and fostering micro entrepreneurial development, and at the same time giving them the possibility to improve own skills, competences, and to become economic actors. Main activities include promotion of Urban Agriculture activities including microgarden technologies (both on soil and soilless), agroecology and urban biodiversity. Moreover, refugees and local citizen are together involved in the co-design and management of gardening, paying attention also to the introduction / diffusion of cropping systems tailored to refugees' native places and traditional knowledge, associated with low-input, water efficient, small-scale agriculture.

Keywords:

Urban agriculture, simplified soilless system, drip irrigation system, food security, integration

Ecological pest and pollinator management in rooftop agriculture

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Management of pests and pollinators, in a totally new environment to grow vegetables as rooftop is, should take in account physical, climatic, ecological, social and economic factors that strongly differ from other agricultural contexts. In this study an ecological pest and pollinator management (EPPM) approach constituted by an ecosystem-based strategy that focuses on long-term of both prevention from pest damages and pollinator protection is proposed. Within the study, the "rooftop garden ecosystem" is described: biotope (physical and climatic features), possible biocenosis (insect pests, plant diseases, beneficials and pollinators) and related ecological relationships, are discussed. Practices and techniques potentially pertinent to rooftop conditions are described and discussed. These include use of resistant cultivars, modification of cultural practices, pest exclusion and prevention, mechanical and physical control, biological control with beneficial arthropods, resistance inducers and elicitors, natural and botanical insecticides, habitat manipulation and use of functional biodiversity for pest control and honey bees, bumble bees and solitary bees, protection and improvement. Despite no consolidated data are available about sustainable pest management in rooftop gardening and vegetables production, an ecology-based approach and in particular the ecological similarity with greenhouses seems forerunner of important applications both in regard of pest control and pollinators management.

Keywords:

rooftop farming; vegetable crops; pest control; pollinators; Z-farming

Promoting education and training in urban agriculture building on international projects at the Research Centre on Urban Environment for Agriculture and Biodiversity

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The Research Centre in Urban Environment for Agriculture and Biodiversity (ResCUE-AB) is committed to promoting urban agriculture (UA) and biodiversity in Europe and in several countries of

the Global South. Education and training is one axis of ResCUE-AB activities and builds upon a range of international projects focused on the creation of innovative training tools. Lifelong learning instruments addressing the social and educational functions of UA were developed within the framework of LLP-Grundtvig sub-programme, such as the project “HORTIS” (Horticulture in Towns for Social Inclusion and Socialisation, www.hortis-europe.net). Specific training material and methodology on how to design and implement gardens in schools is the objective of the ongoing ERASMUS+ Strategic Partnership in School Education “GARDENS TO GROW” (Urban Horticulture for Innovative and Inclusive Early Childhood Education, web site under construction). The same funding scheme promoted the project “URBAN GREEN TRAIN” (URBAN GReen Education for ENTteRprising Agricultural Innovation, www.urbangreentrain.eu), with a cross sectorial focus on higher and adult education and the creation of pioneering business initiatives in UA. Within the project, a pilot training path on UA entrepreneurship was developed, tested and made available to different types of learners. Similarly, the ongoing ERASMUS+ Capacity building in the field of higher education project titled “BUGI” (Western Balkans Urban Agriculture Initiative) merges the most innovative business models in UA in Europe and supports their adaptation and diffusion in the Balkan context. The application of these educational tools is already being explored in the Urban Innovative Action “SALUS W SPACE” (Villa SALUS as a new Sustainable Accessible Livable Usable Social space for intercultural Wellbeing, Welfare and Welcoming in the Metropolitan City of Bologna, http://saluspace.eu), where UA is employed as a tool for revitalisation of abandoned urban spaces and promotion of social inclusion and capacity building among communities of political refugees and immigrants. Finally, the sustainability of different UA models is assessed and compared within the H2020 MSCA “SUSTURBANFOODS” (Integrated sustainability assessment of social and technological innovations towards urban food systems, https://susturbanfoods.com).

Keywords:

Urban Agriculture; Entrepreneurship; Education; training tools

Gaultheria procumbens essential oil as beneficial coccinellids attractive compound in laboratory and experimental urban garden studies

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Pest management is one of the most threatened ecosystem services in European cities. Increasing the presence of beneficial insects and in particular poliphagous predators as Coccinellidae is a key point. Previous experiments and bibliographical data suggest that it is possible to select a set of plants to manipulate the habitat in order to promote the presence and permanence of beneficial ladybugs in urban gardens. The attractiveness of the essential oil of Gaultheria procumbens (wintergreen) has been hereby addressed in order to verify its possible use as a lure for naturally

occurring coccinellids on the crops attacked by insect pests. Experiments have been carried out both in laboratory, through Y-tube olfactometer choice tests, and open air in the demonstrative and experimental garden of the agricultural science plexus of the University of Bologna, by monitoring sentinel plants infested with aphids. In both cases, essential oil was gradually emitted by means of a microencapsulation in a lipidic substrate. Results showed that Adalia bipunctata e Cryptolaemus montrouzieri were significantly attracted to the wintergreen essential oil in the laboratory olfattometric tests. Several coccinellids species naturally present in the experimental garden were found on the sentinel plants. In total, the number of beneficial ladybugs found on the sentinel plants with the essential oil were significantly more than those on the plants that were not treated with the attractive compound (control). The possible practical use of the wintergreen essential oil as an attractive for ladybugs is discussed.

Keywords:

Ladybird; urban horticulture; pest management; beneficial insects

Sustainable urban vegetable production: a SWOT analysis for Sub-Saharan Africa

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Africa is experiencing the world's most rapid rate of urbanization, with 56% of the population expected to be urban-based by 2050. In response, agricultural systems need to become more efficient with production concentrated in urban areas. Urban agriculture is complex, dynamic and has many dimensions. This study highlights a comprehensive strength-weakness-opportunity-threat (SWOT) analysis to guide sustainable vegetable production and consumption in urban areas across sub-Saharan Africa. Demand is rising among growing city populations for fresh, safe, affordable and nutrient-dense vegetables that promote consumer health. Growing vegetables generates income and employment; it is an engine for urban agri-business, especially for women, who can take advantage of the short value chains to supply nearby urban markets. Vegetable production is scale-neutral and characterized by short growing cycles; farmers can make a profit on relatively small urban land plots, especially with traditional vegetables, and can take advantage of the 'supermarket' revolution currently underway in the region. Because of the relative high value of vegetables, their production will continue to intensify in cities. However, unsustainable intensification, especially for vegetables, can lead to soil and water contamination, and compromise consumer health through excessive use of pesticides and fertilizers. A major barrier to vegetable production is access to a sufficient supply of clean water, which includes access to quality irrigation. Vegetables offer massive potential, yet successful cultivation depends on knowledge and quality inputs, including high quality seeds delivered through efficient seed systems. The increasingly complex global urban food system, with its focus on staples and only a few non-staple crops, diminishes the diversity of local vegetables available in urban markets across the region. This shift away from traditional vegetables is

detrimental to biodiversity and the nutritional quality of diets. Although agricultural research is currently in the forefront as an essential driver for development in sub-Saharan Africa, research on vegetables is treated as a secondary activity despite the numerous technological advances available from developed countries. Cities offer unrivaled availability of agricultural inputs such as labor, agro-chemicals, and agricultural machinery. Urban agriculture can be a stepping stone out of poverty, but suffers from weak investment, largely the result of inadequate access to finance. Inadequate urban policies, especially pertaining to land use, are a threat to urban farming, while climate change presents a further obstacle to productive and sustainable urban agricultural systems.

Keywords:

Africa, horticulture, SWOT analysis

Green spaces in Italy from subsistence agriculture to public parks: the city of Bologna from 13th to 19th century

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As other European cities, Bologna has wide green spaces inside the city walls; in the Middle Ages, the role of subsistence agriculture is above all important; during the Renaissance, this scenario changes partially; in the Modern Era, the role of gardens and public parks is increasingly important. The subsistence agriculture, protected by the city walls, is characterized mainly by these crops: cereals (rye, millet, spelled, panicgrass and wheat), vines (wine was one of the main items of trade), beans (mainly cowpeas), onions and leeks, herbs. During the Renaissance, new and more rational forms of agriculture (e.g. the “piantata Bolognese”) develop and new fruit and horticultural species partially change the kind of urban agriculture. Until the beginning of the 19th century, agriculture remains the fundamental component of the green spaces in Bologna – exept the Montagnola Park, existing from 1662, but renovated and improved at the end of 19th century. However, after the Italian unification (1861), the urban scenario gradually changes, and new parks and public gardens takes off in Bologna, especially from 1870 to 1896, while there are rectification of existing roads and new urbanization of some spaces inside the city centre. From the end of the 19th century a new urban phase begins in Bologna. A “dialectical” relationship between green spaces and built areas continue during the 20th century; in 1969-1970, the City Hall carries out policies to protect the old town and the green spaces, and in the early ’70s many new public parks are realized in the Bolognese outskirts.

Keywords:

Urban gardening; green infrastructure; urban landscape;

Edible Gardening: A Sustainable Food Security Approach

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With increasing population influx in cities, has increased demand for safe and fresh food in urban areas. It is estimated that in 2050, approximately 70-75% of world's population will shift to cities, and that will necessitate to produce more food. In Pakistan population is growing at 3%, and it is estimated that in 2025, it will be projected from 150 million (2010) to 208 million. In order to sustain this increasing pressure on resources, the idea of edible gardening seems to be a viable plan of supplementary production of horticultural food crops in urban and suburban areas. Edible landscape seems to contemporary component of Urban Horticulture (UH). UH is referred to "Horticulture activities within or around city according to the consumers' demand for food like, fruits, vegetables, and other uses like herbs, processed products, as well as ornamental plants for aesthetic gratification. The role of urban horticulture (UH) in response to the dietary requirement of urban dwellers, by using local resources and recognizing the importance that economic and resources used will not affect residents' health, food safety, and environmental conditions. Horticultural plants are best option that can be grown for food consumption (fresh or processed) and for aesthetic gratification in cities and surroundings. Many countries have already felt this peril and working to seek alternative growing areas to feed this increasing population. In developing countries like Pakistan, now the importance of growing food plants in urban and suburban surroundings is getting government attention. In Pakistan the idea of urban horticulture is getting popularize and many growers are involved in cultivation of vegetables in cities and its surroundings due to huge demand. A survey was conducted in Faisalabad and public perception was collected through a validated questionnaire to understand the public perception and opinion about acceptability of edible gardening.

Keywords:

Edible Gardening; sustainable: food security, Kitchen gardening, Urban Horticulture

Increasing Food Security through Extension Master Gardener Programming in Northeast Ohio

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While the rest of the world is experiencing rapid growth in urban centers, the cities in Northeast Ohio (Akron, Cleveland, and Youngstown) are experiencing the opposite. The region, which experienced tremendous growth during the height of industrialization, has experienced over 50% population loss over the last 50 years due to complicated socio-economic factors. Loss of population and tax base, coupled with raising poverty and chronic diseases has inspired government officials to consider land reuse strategies that will contribute to the well-being and overall health of communities. One of the strategies that cities are employing is the development of community gardens. However backyard food production and gardening presents challenges to a population several generations removed from actual food production.

To combat this challenge Extension Educators are enlisting the assistance of Extension Master Gardener Volunteers (EMGV)s. Extension Master Gardener Volunteers are trained in best practices and garden knowledge in order to assist Ohio State University Extension with research-based horticultural outreach. Based on growing demand the volunteers are providing programming for community gardeners in Northeast Ohio through formal mentor relationships, onsite technical support and partnerships with community based service agencies. As a result of these efforts, community gardeners have gained knowledge, confidence, and skills in the area of backyard food production and helped Extension provide programming to underserved, limited resource audiences. This presentation explores three different models of community engagement utilizing EMGVs, successes and challenges, and emerging opportunities EMGVs to continue to provide practical research based information to community gardeners.

Keywords:

Extension Master Gardener Volunteer, food security, community gardens

Vertical Farming: a possible solution for food security in the global metropolises

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Across the world, the cost of land and logistics costs tends to increase, agricultural production zones are increasingly distant from metropolises, natural resources are constantly threatened. One of the possible alternatives in long term is the implementation of vertical farms, where agricultural production is performed indoor by controlling temperature, photoperiod and plant cycle. The system

uses less land and 90% less water, also less losses during logistic process that could help food safety in higly populated cities far from green belts. In the short and medium term, solution would be use existing infrastructure with logistical optimization modeling, product and packaging standardization, clarity and accuracy of information (QR code traceability).

Were studied four interesting initiatives: a normal hydroponic (non indoor) company in Piracicaba city (Brazil); a sustainable initiative in the garage of a commercial building in São Paulo with artificial lighting to produce horticultural products in the biggest Brazillian city; the concept of a biological farm through a summer internship at the high technologic hydroponic farm Granpa (Hadano city, Japan); a visit at Keystone Technology (Yohohama, Japan). All initiatives shows positive aspects to implementation of Vertical Farming in big cities.

Keywords:

Vertical Farming, Sustainability, Efficiency.

Pruning practices differentially alter shoot allocation and leaf morphology of two landscape shrubs

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For three consecutive years, four pruning treatments were applied to two shrub taxa, Nerium oleander ‘Sister Agnus’ (oleander) and Leucophyllum frutescens var. green cloudTM (Texas sage), grown in a simulated residential landscape setting in Phoenix, Arizona, USA. All shrubs were drip-irrigated with similar volumes of water. The pruning treatments were sheared every six weeks, sheared every six months, severe renewal pruned yearly, or not pruned (control). Shoot fresh mass pruned as green waste was collected and weighed. The partitioning of shoot mass into stems and leaves, leaf morphology and leaf chlorophyll concentration were evaluated during the third year of pruning treatments. After three years, standing shoot mass of all pruned oleanders ranged from 44% to 54% less than those that were not pruned. Texas sage that were sheared every six months or not pruned had about 45% more standing mass than those that were sheared every six weeks or renewal pruned yearly. In contrast, standing mass density of both landscape taxa was highest for shrubs most frequently pruned. For both landscape taxa, pruning practices resulted in removal of 40% to 95% of all shoot growth as green waste. Both oleander and Texas sage shrubs that were renewal pruned yearly had a greater portion of standing biomass as foliage. Canopy leaf dry weights and specific leaf mass of both landscape taxa were lowest for shrubs most frequently pruned. In contrast, leaf chlorophyll concentrations were generally highest for oleander and Texas sage shrubs that were not pruned. In conclusion, for oleander, a Mediterranean evergreen shrub with persistent sclerophyllous leaves, shoot growth was related to the type of pruning and pruning frequency. For Texas sage, a North American Chihuahuan Desert native with a partial winter deciduous habit, pruning regardless of method or frequency stimulated growth.

Keywords:

Landscape management, landscape sustainability

Dynamics of Urban and Peri-Urban Agriculture for Food, Nutrition and Environmental Services

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Tomeet their needs for food, nutrition and eco-environment, urban and peri-urban Agriculture (UPA) and urban and peri-urban Horticulture (UPH) is emerging as one of the options, and many international organizations are working with national partners, which call for accelerated efforts. FAO has provided focus on UPA for improving livelihood of urban poor, by supporting projects in member country and creating awareness through workshops and conferences. Consultations have brought focus on greening cities, guided by UPH, and its integration in developmental strategies and programs, with multi-stakeholder participation. In India, many national consultation, conferences and workshops have been organized which has brought focus on urban and peri-urban horticulture. UPH has defined the activities of greening the cities, utilizing the waste, meeting the needs of food and nutrition, and servicing the environment by effective and sustainable use of natural resources through technological inputs, investment and policy. For supplementing the needs of food and nutrition peri-urban horticulture has emerged as an enterprise for production of vegetables, fruits, ornamentals and spices especially under protected environment in the country. There is a growing interest for rooftop gardening, vertical gardening, hydroponic and aeroponic system of cultivation. In this system city wastes are recycled for use which is providing employment besides meeting the needs. Well planned UPH could be a strategy to mitigate and adapt to the climate change. A key challenge, therefore, is to develop policy, strategies and technical support mechanisms for the sustainable management of urban and peri-urban horticulture (UPH), addressing production issues within a broader framework of environmental planning and management. The paper deals with dynamics of UPH in India with focus on greening the cities, supplementing the needs of food and nutrition and servicing the environment to address the challenges of climate change.

Keywords:

India, Peri urban horticulture, policy, dynamics of UPH, food and nutrition

Perception of improvement in people with disabilities who cultivate plants

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A number of studies have found that plants and related activities provide people with physical and mental disabilities, improved motor functions, stimulate concentration, motivation, relieve stress, and raise self-esteem and prevent disease. The outdoor activities stimulate, in addition to the physical musculature, brain activity, since it exposes the users to the sun, in a different environment, therefore, to new challenges. In view of the above, the objective of the work was to set up a kitchen garden at the Instituto de Ciências Agrárias of Universidade Federal dos Vales do Jequitinhonha e Mucuri with students from the Association of Parents and Friends of the Exceptional (APAE) in Unaí, MG, Brazil. For 1 year, 15 students, with moderate to severe mental impairment, visited at 7:30 to 8:30 a.m. daily, performing daily activities of kitchen garden. These activities have been shown to have a relevant role in the process of social insertion and rehabilitation of people with some mental disorder. It was reported by teachers of the APAE school, reports of parents and project members, through questioning regarding the behavior and cognitive development of students involved in the project, the evolution of 12 of the 15 students participating in the project. Some of the results obtained with the practitioners: evolution in the development of activities, resourcefulness, reduction of depressive crises, less introspection and more communication, increased vocabular, initiatives, improvement of interpersonal relationships. Thus, it is important to point out that the findings of this study indicate a positive result regarding the changes perceived by the practitioners from their insertion in the project, the activities demonstrated for people with disabilities their ability to perform tasks, social inclusion and living in society without prejudices.

Keywords:

kitchen garden, occupational therapy, exceptional people, cultivation

Usage Possibilities of Pistacia khinjuk Stocks in Landscape Architecture Studies

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The use of living materials in design and planning is one of the most important features that differentiate landscape architecture from other occupational principles. In this context, plants are indispensable elements for landscape architecture. Since plants play role with their aesthetic, functional, ecological and educational features in environmental regulation. Moreover, plants provide an identity for the cities where they are used in. Thereby they contribute to cities to be sustainable. Pistacia khinjuk Stocks is cultivated in Şanlıurfa conditions and commonly used as a rootstock in pistachio production. In this framework, the general characteristics of P. khinjuk were evaluated in terms of usability in urban landscape studies and providing 'Urban Identity' for Şanlıurfa in this study.

Keywords:

Pistacia khinjuk Stocks, Şanlıurfa, Landscape Architecture, Urban Identity

Assessment of the potential contamination of heavy metals in periurban hydroponic crops due to atmospheric pollution

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Urban agriculture has been spreading throughout cities in the last few years and is rising to the roofs of buildings. The potential food contamination is a key issue to be resolved to guarantee the health of consumers. Air pollutants has been seen to have a large influence on contamination and various studies have shown that the concentration of heavy metals in crops is inversely related to the distance from a road. Adopting soilless cultivation system the crop contamination from the soil can be overcome and, with good management practices, it can also avoid contamination from the fertirrigation system and pest treatments. This study focuses on the potential contamination of

heavy metals in hydroponic crops due to atmospheric pollution in urbans areas near high density roads.

The contents of heavy metal in the air and the lettuce leaves were measured in the same place and at the same time at 2 high-traffic sites in the Barcelona metropolitan area: an integrated-rooftop-greenhouse and an open-air rooftop, both in the Universitat Autònoma de Barcelona Campus. High-volume sensors were used to assess air contamination. Lettuce leaves were analysed to evaluate the heavy metal concentrations. This study has proven the feasibility of growing on the rooftops even if they are near a high-density road using soilless systems. The range of metal contents in crops is lower than the concentrations reported in previous studies where the major contamination risk in urban areas was related to soil pollution. Specifically, in all analysed crops the heavy metal concentrations in lettuce is below the EU-legislated limits. The preliminary results show that greenhouse infrastructure prevents the entry of the particles during the long anticyclonic seasons, but more research is needed in the future to study these differences with different rainfall patterns.

Keywords:

soilless system, contamination, cities, food security, food quality, toxicity, atmospheric particular, vertical farming

Intercropping, urban agriculture and circular economy. A first approach using Life Cycle Assessment

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Food supply to cities is a major concern nowadays, being a significant source of greenhouse gas (GHG) emissions. In this sense, urban agriculture (UA) has arisen as a field with a great variety of possibilities. Hence, during the last decades, different studies have assessed the feasibility of UA (with its wide variety of forms), comparing its environmental performance to conventional agriculture. From a broader perspective, understanding how integrated rooftop greenhouses (i-RTGs) (an innovative kind of UA that benefits from the synergies building-rooftop) can be environmentally enhanced through circular economy is an interesting research field. In this sense, a variety of strategies have been planned as further research to enhance i-RTGs performance. Some examples can be using inorganic and organic wastes as fertilizers, improving building-rooftop synergy to perform CO2 enrichment or decreasing year-round environmental impacts by performing “intercropping” practices. In this study we will focus on the latter.

Considering a main crop of tomato (January – July), we will study how we can diminish year-round impacts by growing different crops with less inputs and less requirements the remaining part of the year (August – December). Based on a life cycle assessment, the hypothesis is that most of the year-round impacts will come from the infrastructure (lifespan adjusted for 1 year). Furthermore, impacts of some items related to crop production (e.g. fertilizers or energy) will increase if we grow crops during the August – December period. Besides, as crop production is expected to increase, the year-round environmental impacts per functional unit (in mass terms) will decrease.

Keywords:

Rooftop greenhouse, soilless system, intercrop, LCA, impact assessment, ecoefficiency

Studies of Sustainable Design, Maintenance and Evaluation on its Benefits for Lawn Type Extensive Green Roof in Taiwan

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Lawn type extensive green roof have been promoted on many public buildings, their advantages include cheaper installation fees, good thermal insulation effects and lower loads to buildings. However in our previous survey targeting on 3 types of green roofs setup by schools, extensive green

roofs showed the poorest performance. This may result from inappropriate watering frequency and maintenance strategies, which cause poor plant growth and soil erosion. Poor aesthetic quality of extensive green roof consequently affect the will of re-installation. The aim of this project is to investigate factors including design of cross section, soil depth and maintenance strategies such as mowing and watering frequency. The experimental methods were employed to clarify how the variable above influenced grass growth, thermal insulation and biodiversity. The results shows that for setting up lawn extensive type green roof, the installation of cum reservoir were recommended since it could store rain water or extra irrigation water to provide the needs of grass growth. Consideration the load of floor slab, construction costs and maintenance fee, 20cm depth of medium were suggested. If the main installation purpose of a green roof is thermal insulation, less focus on visual aesthetic value, undertaking low maintenance strategies would benefit on accumulating more biomass. In the experiment, low maintenance operation was to mow lawn every two months and watering lawn at a 2 days interval, it resulted in the lawn grass grew higher than those in the high maintenance treatment, consequently, it showed better thermal insulation. Less frequent watering and mowing lawn also contributed to reduced carbon emission and higher biodiversity. The results of this study can provide a reference for the future organization, schools or residential buildings to install with a heat-insulated extensive green roof on the rooftop.

Keywords:

Biodiversity, Cooling effect, biomass, maintenance input

Toluene removal efficiency of botanical biofiltration is affected by duration of exposure and volume occupied by plants in a closed system

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Botanical purification of air pollutants is regarded as a low-cost and environment-friendly approach in improving indoor air quality, however, there are many factors affecting its efficiency. This study aimed to determine the best volume of potted plants in a closed chamber, determine the time it takes to reduce the amount of toluene in a closed chamber system, and initially understand the effect of toluene exposure duration on plant gene expression. Different indoor plants and number of

plants were tested for toluene removal in 1 m3 closed chambers for 15 h. Toluene concentrations at 3 h interval were detected by GC-MS analysis. RNA sequencing (Illumina HiSeq2500 sequencer) of Arabidopsis seedlings exposed to 60-75 ng of toluene for 30 min, 1 h, and 4 h and sequence data analysis were also done. Results reveal the most efficient volume that potted plants should occupy is 2-5% of the chamber. Greater volume of plants in the chamber reduced removal efficiency. Meanwhile, regression analysis of the reduction in toluene concentrations show that toluene concentration can be reduced to half by plants (T50) at 6 h exposure. Rapid reduction of toluene was observed from the beginning up to 6 h but slow reduction was observed thereafter. High throughput sequencing revealed differential expression of genes of Arabidopsis is affected by duration of toluene exposure. Greater number of highly expressed genes (1 - 1.5 fold expression) were found in samples exposed to toluene for 1 h than the other exposure durations. Understanding how exposure duration and volume occupied by plants affect pollutant removal efficiency and catching a glimpse of gene expression as affected by pollutant exposure may offer more insight into improving plant-based biofiltration of indoor air pollutants.

Keywords:

air purification, indoor air quality, air phytoremediation

Assessment of the potential of outdoor plants to reduce particulate matter under chamber conditions

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Particulate matter (PM) has become a serious environmental problem in Korea. This study evaluated the effectiveness of outdoor plants to reduce the concentration of particulate matter under chamber condition. Ten different types of outdoor plants were placed in 1 m3 glass. Particulate matter in the form of fine dust was introduced in the glass chambers and PM types that remain suspended in the air over time were monitored using an aerosol monitor for 4 h. Gravitational force alone (empty chamber) resulted in reduced PM concentration over time with the total suspended particles (TSP) and PM2.5 not significantly different from each other. After 4 h, particles larger than 2.5 µg have descended while the smaller particles remain suspended in the air. With plants in the chamber, the amount of PM2.5 in air was significantly lower than an empty chamber alone. Significant decline in PM concentration was observed with the use of the 10 plants with significant differences observed

among the plants' ability to reduce PM. Although the changes in PM concentration were not significantly affected by the volume of plants in the chamber, the amount of PM reduced was relatively high with 1-4.9% plant volume in the chamber. The reduction efficiency of PM in the chambers was higher with plants than in empty chambers after 2 h of PM introduction. Accordingly, within the first 2 h of PM introduction, most of the PM reduction from the air is due to gravitational force while after 2 h until the 4th h the reduction in PM is attributed to plant characteristics. From these results, using plants in outdoor environments can be potential means in lessening the dust problem in urban areas.

Keywords:

Ultrefine particle deposition, outdoor plants, chamber, urban greening

Effect of temperature and salinity on substrate moisture measurements made with dielectric soil sensors

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The influence of substrate temperature on the output readings of the EC5 and GS3 dielectric soil sensors was studied. For that, an experiment with pots filled with coconut fibre and no plants was carried out in a growth chamber. Five levels of pore water EC (ECp) (1.6, 5, 10, and 15 dS m-1) and four volumetric water content (VWC) (13, 27, 41 and 51%) were researched. The chamber was programmed to provide temperatures from 5ºC to 45ºC. The outputs of the EC5 (voltage) and the GS3 (temperature and bulk dielectric permittivity, εb) were recorded every 5 minutes. Significant linear relationships between temperature and voltage, and between temperature and εb, were determined. The voltage increased linearly with the temperature at low salinity (1.6 dS m-1) for the four VWC levels. It would cause overestimation of the VWC when comparing measurements made above 25ºC with respect to those made by below. However, temperature reduced linearly the εb, leading to the opposite effect to that described for the EC5. Under high moisture (51% VWC), the negative slope of the temperature-εb linear adjust changed to positive due to salinity, while the effect of the temperature on the voltage and εb was higher as the ECp increased. The latter would lead to bigger VWC calculation errors depending on the temperature, particularly under high salinity; to minimize the error, voltage and εb could be corrected to a temperature of 25ºC. Salinity increased both εb and voltage at any temperature. This effect was greater under high salinity, encouraging the overestimation of the VWC. So, water with an EC similar to the expected in our substrate will be needed to make an appropriate calibration equation.

Keywords:

pot plant, irrigation, salinity, soil probes, smart cities

Assessment of the water consumption of an indoor vertical garden by a low cost lysimeter

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Vertical gardens are an excellent solution to alleviate the negative effects of urban development and enhance urban sustainability. They are systems that allow to lodge vegetation in the envelope of the buildings, so much in the outside as the interior. In the interior, these systems present numerous environmental and human health benefits. Due to its particular design characteristics, the evaluation of irrigation is essential. The objective of this study was to evaluate the water consumption of a vertical indoor garden located in the office of the Telenatura spin-off of the UPCT by weighing lysimeter. The results showed the need to perform frequent and low flow irrigation. Also, the importance of using a recirculating system against an open one in irrigation management was observed, as well as the importance of automation and monitoring of water variables in the garden.

Keywords:

automatization, indoor plants, sustainability, irrigation, green buildings