Editorial - Urban Food Forestry: Current state and future perspectives

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Nothing new under the sun: growing food in and around cities has gone hand in hand with the urban history itself. Since the very first foundation of a city, very likely Eridu in Mesopotamia, 7000 years ago, the question of how to produce food for the people living in urban areas was approached by periurban farming supported by a system of canals and water harvesting arrangements for irrigation (Clark II and Cooke, 2016).

The first evidence of systematic growing trees for food production in urban areas is with no doubts the fresco *Pond in the Garden* discovered in the tomb of the scribe Nebamum, Thebes (Middleton and Uprichard, 2008), which depicts the cultivation of fruit trees in Egyptian gardens 3500 years ago. Even in the ancient Greeks polis the role of urban farming was decisive. Gardens and food facilities then exploded in ancient Rome and in other pan Mediterranean and pan European urban cultures.

Discourses on growing food in cities belong to the wider theme of the so-called Edible landscapes (Fetouh, 2018; Çelik, 2017). *Edible Landscapes represent the integration of food plants within a landscape design.* There are many possible and definitions for this, but in general is possible to state that they are the result of the combination of fruit and nut trees, berry bushes, vegetables, herbs, edible flowers, and other ornamental plants into garden designs that may include a variable quantity of edible specimens.

Urban Food Forest represent a rather new, way of interpreting edible landscapes with deep roots in the past. The innovative elements are traceable in two key words: **forest** and **permanence**.

Forest refers to the assumption of emulating the successional functions and dynamics of natural and semi-natural forests through the combination of different species in a variety of layers to maximize the synergies among them and optimise the use of soil and light resources. More specifically, Clark and Nicholas (2013) defined Urban Food Forest as “the intentional and strategic use of woody perennial food producing species in urban edible landscapes to improve the sustainability and resilience of urban communities”.

Permanence relates to time and cultivation systems based on permaculture concepts. The Urban Food Forest aims to be permanent in time, not an annual or temporary way of farming, and permanent in the way of achieving socio-ecological sustainability (Krebs and Bach, 2018). In fact, permaculture is based on designing sustainable and resilient socio-ecological land use systems. Holmgren (2002), defines permaculture as *consciously designed landscapes, which mimic the patterns and relationships found in nature, while yielding an abundance of food, fibre, and energy for provision of local needs*.

Urban Food Forestry, i.e. the science and technique of designing and managing urban food forests, combines elements of Urban Agriculture, Urban Forestry, Agroforestry and Landscape Architecture to optimize the benefits these practices can provide. Urban food forests are multifunctional systems by definition, providing a wide range of ecosystem services to urban communities. As such, they contribute to increasing urban communities’ health and wellbeing while increasing opportunities for innovative community initiatives that engage a wide range of actors. Urban Food Forest could also play a crucial role in increasing urban resilience while counteracting some effects of climate changes, namely increasing soil perviousness, reducing erosion and helping flood control, removing atmospheric pollutants, saving water, providing habitats and mitigating local weather extremes. The integration of agroecological design practices (typical of Agroforestry systems), further contributes to the enhancement of ecosystem services for more inclusive local food production.

Having said this, there is still a need to develop a well-defined framework for Urban Food Forest theory and practice. To cast light on the different food-producing systems in urban sites, the review paper by H. **Park, M. Kramer, J.M. Rhemtulla and C.C. Konijnendijk** opens this special issue. After reviewing research conducted in Europe and North America on urban food systems from 1987 to 2018, authors point out that the lack of consistency in the use of terminology has been a major barrier to the up-scalability and replicability of research related to urban food forestry and advocate for a common terminology to be used among researchers and practitioners. They point out that the different functional attributes of “urban food forestry” (which according to the definition of Clark and Nicholas (2013), also includes individual food trees and shrubs), “food forestry” (i.e. a multi-storey, perennial, polycultural food system, Park et al., 2018), and “agroforestry” (the deliberate integration of trees with agricultural crops or livestock either simultaneously or sequentially on the same unit of land, Nair, 1993) must be taken into account when planning, designing and managing schemes for food production in urban sites, as well as when assessing ecosystem services provided by edible vegetation.

Urban food forests are multifunctional components of urban landscapes, and aim at integrating the provision of food with a wide range of co-benefits. Therefore, calculating the provision of ecosystem services is crucial for the development of urban food forest concept (Castro et al., 2018). Increasing food security (*sensu* FAO, 1996) is a primary goal of urban food forestry, but there is still little evidence on the number of people that can really access the food produced. Furthermore, the nutritional values of Urban Food Forest products in relation

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to the consumer's dietary needs are not yet well investigated (Clark and Nicholas, 2013). The paper **by Josefine Lærke Skrøder Nytofte and Christian Bugge Henriksen** aims to quantify the potential of a food forest to increase food security, both in terms of quantity and quality (i.e. nutritional value) of the food produced. Their research, conducted in a 26-year-old multi-layered food forest including 99 different species, revealed that one ha of food forest can yield about 8900 kg of food and 5 million Kcal annually. This amount may feed 5–6 people, but authors observed that their diet would be poor in proteins and fat unless beans, walnuts, chestnuts or other protein-rich species are integrated in the design.

Urban vegetation is expected to deliver regulating benefits, and there is uncertainty about whether the displacement of the "traditional" urban forest by edible vegetation may result in a trade-off between different ecosystem services (Almas and Conway, 2016). As an example, while the importance of urban vegetation to store carbon and ameliorate microclimate has been recognized by a number of studies (Nowak and Crane, 2002; Armson et al., 2012; Wilkes et al., 2018), as well as by UN Sustainable Development Goals, the studies on the potential of food forests to provide these benefits are still limited. To fill this gap, the papers by **Luke J. Schafer, Marin Lysák, and Christian B. Henriksen** and by **Lisa Mølgaard Lehmann, Marin Lysák, Luke Schafer, and Christian Bugge Henriksen** provide pioneering evidence about the carbon storage capacity of food forests. Analysing growth of a food forest in the UK, the authors found a potential carbon storage of about 40,000 kg C per hectare. Most of carbon is stored by the tree layer, while shrubs were shown to contribute by about 9% of total carbon stock. These values are comparable to those displayed by non-edible urban vegetation across the United States (Nowak and Crane, 2002).

The relevance for the community of urban food forests, namely focusing on social capital, place attachment and food, and environmental knowledge is explored by **Juliette Colinas, Paula Bush, and Kevin Manaugh**. Using semi-structured interviews, authors show that the open access to food producing trees can increase the sense of place.

Good planning, design, and management are key to enhance the wellbeing that the Urban Food Forest can deliver to society by maximizing accessibility and promoting fair harvesting. By analysing the urban forest management plans from 47 municipalities in Canada, however, **Kowalski and Conway** found that less than one third mentioned food forests. Authors indicate that higher interest for regulating than for provisioning ecosystem services, fear that food plants may produce mess, nuisance and attract undesired species, and high management requirements of fruit trees could explain why urban food forestry has just started to gain recognition in Canada. Citizens' education is crucial for the implementation of urban food forests, but creating and maintaining a volunteer pool is challenging for municipalities and decision makers. **Neda Tiraieyari, Robert M. Ricard, and Gary N. McLean** analyse the factors that affect the willingness to volunteer in urban agriculture in a University campus in Malaysia. One of key recommendations by authors is the need to build the image of edible landscapes during recruitments plans, by underlying their importance for the provisioning of ecosystem services which citizens may be unfamiliar with.

On the other hand, planners and municipalities should consider the potential negative consequences of urban food forests. There is a very limited body of literature published on disservices of food forests. For example, allergies are a well-known ecosystem disservice of green areas, but how the implementation of urban food forest will affect the pollen-food allergy syndrome in citizens is largely unknown (Katelaris, 2010). **Paloma Cariñanos, Manuel Delgado-Capela, Fernanda Maradiaga-Marína, and Guillermo Beníteza** reviewed the allergenic potential of 79 widely used species for urban food forestry under Mediterranean climate. Their research revealed that about 23% of species used for edible landscaping have allergenicity associated to the pollen grains while in the 30% of them the allergens are associated to the fruit. Interestingly, the paper explores the cross reactivity between allergens in the pollen and those in the fruits. For example, allergens in birch pollen were found to cross-react with homologous allergens contained in the fruits of almond, apple, apricot, cherry, hazelnut, kiwi, mango, peach, pear, and plum, increasing the occurrence of the pollen-food syndrome. This information is key to assist planners in the design of low-allergenic urban food forests. Another important concern on the implementation of edible landscapes is whether the food produced in a pollution hotspot such as the urban environment is safe for human consumption (Säumel et al., 2012). The topic is explored by **Antonella Gori, Francesco Ferrini and Alessio Fini**, who review the uptake and translocation mechanisms of soil- and air-born pollutants, with a particular focus on heavy metals. Authors found a lower translocation of heavy metals from the soil to the plant edible portion in trees, compared to horticultural and herbaceous crops. Nonetheless, authors describe the different strategies that species have evolved to growth in polluted soils (i.e. exclusion, passive accumulation, and "active accumulation"), which should be considered when planning food forests in heavy-metal contaminated soils. Fruit structure drives the uptake of air-borne heavy metals, but authors suggest foliar uptake and subsequent translocation to the fruit may also occur.

The special issue is closed by **Francesca Riolo**, who presents a case study on the first recorded food forest project in Italy, the Picasso food forest. The author highlights the main challenges faced during the implementation of the food forest, mainly related to legal frameworks, volunteering, and accessibility, and the main achievements, including effects on biodiversity, social inclusion, food security, and climate adaptation.

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