

SHORT COMMUNICATION

The Urban Tree Arboretum in Hørsholm, Denmark: A new tool towards an improved education of arborists and tree managers

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Abstract

The establishment and management of urban trees require expert knowledge and experience. The Urban Tree Arboretum (UTA) was established in Hørsholm, Denmark, to improve basic and advanced education for students and professionals working with tree establishment and management. The UTA presents 120 tree species and cultivars suitable for urban plantings. The trees were established in 2001 in replicates of three or six. Different pruning treatments allow for a comparison of their effect on the trees: formative pruning, shape pruning (topiary), pollarding and non-pruned. Tree dimensions are measured yearly and made available on the website www.bytraearboretet.dk. The website also offers photographic documentation of the trees and their tree features as well as a reference list open for entries by the public. The UTA is integrated part of several courses at the University of Copenhagen and has in 2007 and 2008 been visited by 570 external visitors on 27 guided tours.

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Introduction

Establishment and management of urban trees demands extensive experience and knowledge by urban forest authorities, not only in regard to technical efforts to improve tree life, but also concerning species selection and management of established trees (Sæbø et al., 2003). While the number of tree species able to cope with the demanding urban environment may be limited, it is still the ambition of many municipalities to increase diversity, in order to reduce the effects of calamitous pests and diseases.

However, recent investigations in the case of Copenhagen, Denmark, provide evidence that street tree composition is still dominated by rather few genera.

As shown by Bühler et al. (2007), of the 2164 trees established in Copenhagen between 1990 and 2000, 690 (32%) were *Platanus x acerifolia* and 632 (29%) belonged to the genus *Tilia*, including 437 *T. x vulgaris* 'Pallida' (i.e. 69% of all *Tilia* planted in the period). A survey by Pauleit et al. (2002) indicated that prevalence of very few genera (and particularly *Tilia* spp.) applies to other major Scandinavian cities as well.

In order to create a basis for more diverse urban plantings, it is essential to improve the general knowledge about suitable urban tree species. For the general education of present and future tree managers, a localized, concentrated collection of suitable urban tree species constitutes a powerful educational tool. Plant collections are traditionally part of university educational programs (Lewis and Affolter, 1999), supporting many different branches of plant sciences. However, arboreta mainly interesting to a rather narrow segment

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of professionals can be found as well, as described for utility line arboreta by Appleton (2006).

This paper provides a description and discussion of the design and management of the Urban Tree Arboretum (UTA) in Hørsholm, Denmark. The UTA was developed as an educational collection of urban trees with the – to our knowledge – unique feature of a systematic demonstration of the reactions of the trees to different pruning treatments.

Purpose and use of the Urban Tree Arboretum

The main reasons for the establishment of the UTA were nature educational. The UTA is designed to not only show students and professionals a variety of trees considered suitable for establishment in urban areas, but also demonstrate the effects of different, potentially inappropriate, pruning treatments. Thus, the UTA provides a unique possibility to learn how to “read” trees and tree responses to different pruning interventions. As a neutral guide, the UTA is also supposed to complement, illustrate and validate the information available in nursery catalogues and other plant literature.

In the larger context of existing worldwide botanical collections, the comparably small UTA is focusing strongly on the educational aspect, and targets a rather well defined group, namely professionals and students working with urban trees. As such, it is part of several educational programs at the University of Copenhagen, including landscape architecture and forest and landscape engineering.

As a learning tool, the UTA can offer two levels of education. For novices such as undergraduate students or gardener apprentices it is an obvious place to botanize, offering a diversity of trees otherwise only found in nurseries. For this purpose, the basic difference to other botanical collections is fundamental: unlike many collections, the UTA displays trees on cultivar level.

The second educational level relates to professionals with some degree of experience, not needing to learn to distinguish poplars from sycamores, but demanding knowledge about tree development on cultivar level, tree reaction to pruning operations, and options for increasing diversity of tree species in urban areas.

In addition to the educational role of the UTA, as much knowledge as possible is collected and stored, e.g. in regard to tree responses to pruning operations, growth rates of the various species and cultivars and ultimate dimensions. Phenological parameters are observed, too, as they are of immediate interest to tree professionals as aesthetic characteristic, but also, in a larger context, to document climate changes, following the example of Miller-Rushing et al. (2006) and Doi and Katano (2008).

Design

The UTA presents trees considered suitable for urban planting in Denmark and available on the European nursery market in a collection as complete as possible. The UTA was established on a formerly afforested area in the outskirts of the town of Hørsholm (55°52'N, 12°28'E). Mean annual precipitation in this area is 613 mm, and mean annual temperature 7.7 °C with on average 24 days/year with maximum temperature below 0 °C. The soil on the site is free draining and evolved from moraine clay with varying content of sand and organic matter. The planting site is approximately 1000 m long (north–south direction) and 20 m wide. To the west, the UTA is bordered by an afforested area, while the eastern boundary consists of varying terrain including buildings, meadows and woodland.

The UTA consists of 91 varieties of “large” trees (e.g. *Tilia* spp., *Fraxinus* spp. and *Acer* spp.) established with 3 or 6 replicates, and 29 varieties of “small” trees (e.g. *Crataegus* spp., *Malus* spp. and *Sorbus* spp.), where only one specimen per cultivar was established. The “large” and “small” classification refers not rigorously to tree size, but also to the importance as urban trees. Most trees were planted in spring 2001. The stem circumference was 10–12 cm. To date 416 trees have been planted (Table 1).

As it is the ambition of the UTA to reflect the nursery market, the collection is being augmented based on the recommendations of an advisory board, representing the management of the UTA, the Danish Nursery Owners Association and independent experts.

Pruning

For the species present with six trees, two specimens receive formative pruning according to the European Tree Pruning Guide, trying to provide the possibility of later removal of lower branches to achieve a clearance of 4.5 m and to develop a suitable crown structure for street trees (EAC, 2005). Of the remaining trees, one specimen is pollarded, one tree is shape-pruned, and two trees are not pruned, illustrating natural crown development.

For species with only three replicates, one receives formative pruning according to EAC (2005), one is not pruned, and the remaining one is either pollarded or shape-pruned according to the most likely treatment in real plantings (Table 1).

Shape-pruned trees are pruned to form a box of $1 \times 1 \times 1 \text{ m}^3$. This is done once a year by means of a pole hedge trimmer. In the case of pollarded trees, annual shoot growth is removed by manual pruning shear or a pruning saw. All pruning operations are carried out in late winter and are performed by professional nursery gardeners/arborists.

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