Urban tree diversity for sustainable cities - policy brief

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URBAN TREE DIVERSITY FOR SUSTAINABLE CITIES

Policy brief summarizing the benefits of diverse tree populations and the actions required to achieve high urban tree diversity

Policy brief

URBAN TREE DIVERSITY FOR SUSTAINABLE CITIES

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THE CHALLENGE

The world is urbanising at an unprecedented rate – over half the world's population live in cities. This proportion is even higher in Europe, where nearly three quarters of people live in cities. Globally, the urbanised population is projected to increase to 66% by 2050, with 95% of urban expansion expected to occur in the developing world.

Urban trees provide a range of ecosystem services, thus they form a vital component of liveable cities. But urban forests are threatened by land use conflicts, climate change, intensive human use and abuse, as well as pests and disease – and as a consequence, the social, economic and environmental benefits relied upon by citizens are threatened. Fortunately, species diversity, diversity within species, age and structural diversity can support urban forest health, and thus ensure optimal and long-term provision of ecosystem services in the face of such threats.

A CONTEXT FOR URBAN TREE DIVERSITY

Urban tree diversity is promulgated in city strategic documents, often by way of species diversity targets, age and size diversity targets and spatial distribution targets (e.g. in Copenhagen, Denmark). This local focus on urban tree diversity sits within a framework of regional and global documents pertaining to diversity, sustainable development, and green infrastructure. These include:

- The United Nations' Convention on Biological Diversity (CBD) which states that "biodiversity is first and foremost a local issue" and that "it is through our daily activities that we impact biodiversity and it is through local actions that the situation can be addressed efficiently." The Aichi Biodiversity Targets set in CBD's 2011 – 2020 strategic plan "are as applicable to cities & subnational governments as they are to national governments" and "some can be achieved only through the collective efforts of cities and subnational governments".
- The United Nations' Sustainable Development Goals, specifically Goal 11, which aims to make cities inclusive, safe, resilient and sustainable.
- The European Commission's 7th Environment Action Programme (EAP), specifically Objective 8, which recognises that "cities often share a common set of problems such as poor air quality, high levels of noise, greenhouse gas emissions, water scarcity, and waste." As such, the EAP aims to "help cities become more sustainable", "promote and expand initiatives that support innovation and best practice sharing in cities", and "ensure that by 2020, most cities in the EU are implementing policies for sustainable urban planning and design, and are using the EU funding available for this purpose."
- The European Commission's Green Infrastructure Strategy aims "to promote the deployment of green infrastructure in the EU in urban and rural areas." This comes from the recognition that green infrastructure is a relatively quick and comparably inexpensive strategy for cities to adapt to climate change, and "is contributing to all other targets of the EU Biodiversity strategy."

WHAT DO WE KNOW ABOUT URBAN TREE DIVERSITY?

It is important to appreciate that ecosystem services are reliant upon urban tree diversity, and also that diversity provides urban forests with the ability to adapt to existing and future pressures and threats.

Ecosystem Services Rely on Urban Tree Diversity

The ecosystem services provided by urban trees include regulating services (e.g. air pollution reduction, storm water management), cultural services (offering settings for recreation and tourism, physical and mental health benefits), supporting services (e.g. providing wildlife habitat), and provisioning services (e.g. food and fuel production).

Most provisioning and regulating services are related to size and structure of trees, whereby older, larger, and healthier trees contribute greater services. Other services are related to species-specific morphological or physiological characteristics.

Some species are better than others at providing any single ecosystem service, due to intrinsic (i.e. morphological and physiological) and temporal (diurnal or seasonal effects) characteristics. For example, the traditional Japanese custom of Hanami (a cultural service) is dependent upon the flowering of the cherry tree (Prunus spp.). So in order to optimise multiple ecosystem services, it is essential to promote species diversity, age and size diversity.

To optimise one ecosystem service, diversity is unnecessary. But in order to optimise multiple ecosystem services, high urban tree diversity is essential.

Diverse Urban Forests are Resistant and Resilient to Disturbance

Species diversity, diversity within a species, age and size diversity are also necessary for urban ecosystem adaptability – an adaptable ecosystem is resistant and resilient to disturbance. Such adaptability allows urban forests to provide long-term ecosystem services in the face of biotic and abiotic change. Recent pest outbreaks and the environmental changes resulting from climate change highlight the need for species diversity and within-species genetic diversity to achieve a resistant and resilient urban forest.

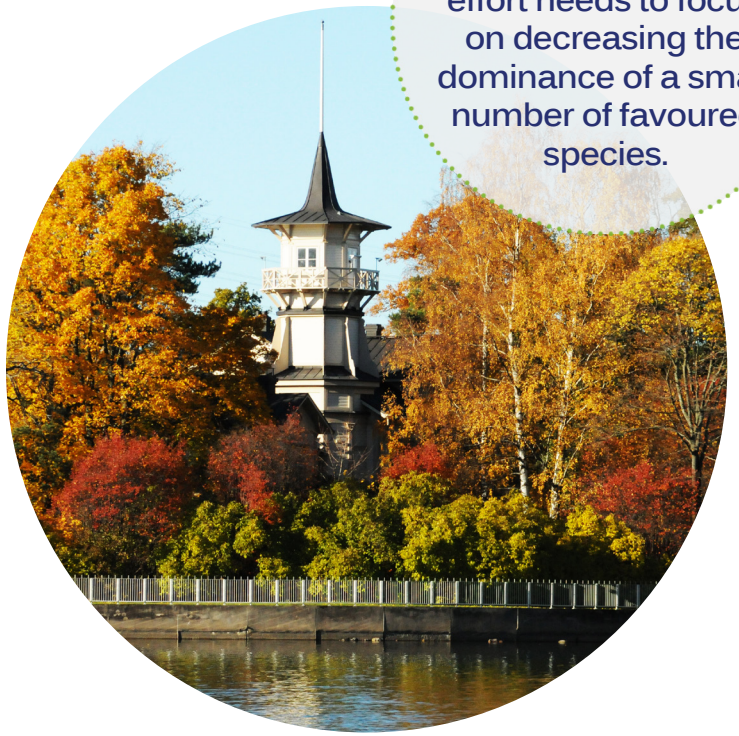
Urban forest diversity provides resistance and resilience to disturbances including climate change and pests and/or disease.

Cities and Urban Tree Diversity

Given that long-term ecosystem service provision by urban trees is dependent upon diversity, it is encouraging to know that cities can support urban tree diversity. In fact, cities usually have greater species richness (count of the total number of species) compared with their rural surroundings. This is due to: (i) the high incidence of introduced species, (ii) socio-economic factors, (iii) land use and land cover heterogeneity, and (iv) diversity of environmental factors like soil and climate diversity.

Despite high species richness, normally a few species dominate the urban tree population. For example, species diversity of 108 cities worldwide found 20% of trees in urban forests were of the same species, 26% were of the same genus, and 32% were of the same family. At the local scale, single species can even be more dominant. Tilia x europaea comprises over 44% of Helsinki's street and park trees. The dominance of a small number of species is particularly problematic along streets and other paved sites.

Cities support high species diversity, but further effort needs to focus on decreasing the dominance of a small number of favoured species.



Urban tree diversity is part of the cultural history of urban parks and green spaces, Helsinki, Finland. Photo: Anders Busse Nielsen

5 KEY ACTIONS FOR URBAN TREE DIVERSITY

There is a need to promote tree diversity in urban forestry strategic decision-making, design and management. To achieve this, we recommend the following actions:

1 Understand your urban tree diversity

Tree inventories provide baseline data for understanding current urban tree diversity. Planning for tree diversity needs to be based on the current state and composition of the urban forest. Tree inventories should be regularly updated to track progress towards diversity goals, inclusive of species diversity, as well as age and size diversity. Diversity should be monitored at the scale of the city or city district, as local diversity may be misleading. For example, an allée may comprise only a single even-aged species for visual effect, but it is not representative of the diversity within the whole urban forest.

2 Establish locally-relevant species diversity goals

Local authorities must establish their own species diversity goals, ideally as abundance thresholds or diversity indices. Abundance thresholds are popular with urban forest managers and policy makers; they specify a maximum proportion of the total tree population that any single species, genus, and/or family should comprise. Diversity indices are popular with ecologists and measure the abundance and evenness of species, genera, or families in an urban forest. Abundance thresholds and diversity indices should be developed based on local conditions. Urban tree diversity in Reykjavík, Iceland and Lisbon, Portugal will differ and the diversity goals must reflect this.

3 Determine which species and cultivars are best suited to the local urban environment

Cities are filled with 'safe bet' tree species that nurseries have traditionally found easy to propagate, grow, and sell. This conservative approach restricts urban tree diversity. To break this cycle, urban foresters and landscape planners require the knowledge and confidence to experiment with underused species. New species or cultivars should be monitored to see whether they are appropriate for the local climate and environment, but also to see whether they have invasive potential.

4 Include local actors in urban forest diversity action

With diversifying populations, the range of tree preferences can be expected to increase. This can be catered for by engaging local actors in urban forest diversity actions. This may include professionals (e.g. municipal 'tree' officers, urban foresters, urban planners, landscape architects), but also local citizens from varied cultural and demographic backgrounds.

5 Develop a locally-relevant species prescription

A prescription includes a list of species to be planted and also their abundances. At a minimum, a prescription should also include a structural description (i.e. size and form); known environmental limitations (e.g. soil moisture, compaction, salt); and potential for invasive behaviour. It may also include each species' suitability for specific planting environments (e.g. street, park, parking lot, residential) and the ecosystem services/disservices associated with the species.

Copenhagen, Denmark has recently included diversity targets in their urban tree strategy.
Photo: Stock Photography, Dreamstime.com

The policy brief content is based on the following publications:

Alvey AA (2006) Promoting and preserving biodiversity in the urban forest Urban Forestry & Urban Greening 5:195-201

Costanza R et al. (1997) The value of the world's ecosystem services and natural capital Nature 387:253-260

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Forestry in the Nordic and Baltic countries is increasingly influenced by urban values, norms and demands. For this reason, Nordic Forest Research (SNS) supports collaboration and knowledge exchange among leading researchers in a Nordic and Baltic Centre of Advanced Research on Forestry Serving Urban Societies, 'CARe-FOR-US'.

Front page: La Rambla, Barcelona. Urban forests provide ecosystem services for rapidly urbanising European cities. Photo: Stock Photography, Dreamstime.com

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