The Role of Individual Trees in the Protection of Urban Image

László Z. Nádasy[1], Gábor Sándor[1], Zsuzsanna Illyés[1]

Department of Landscape Protection and Reclamation, Szent István University, Budapest, Hungary[1]

Abstract

The protection of urban image and cityscape has become the target of professional attention in Hungary since the introduction of Urban Image Handbooks and urban image regulations. Trees are a major part of local image in Hungary. Using GIS methods we established that built-in areas are usually surrounded by sparsely wooded areas and groves, which are taller than the vast majority of buildings. Therefore, trees play a dominant role in shaping urban character. Effects of trees on urban living conditions, livability and the ecosystem services they provide, have been intensively researched in recent years. However, the role of individual trees in determining local image has been out of the focus of research. Although trees located on public property have been inventoried in past decades, information about their aesthetic properties and image value is scarce. In addition, there is an almost complete lack of knowledge regarding trees standing on private land, even though a large proportion of these are also visible from public areas, therefore having an impact on urban image. Tree protection regulations also fail to adequately address the topic. Identifying the individual trees with the most profound effect on the visual image of an urban area is a difficult task – not only due to of the lack of information, but also because there are no established methods for determining the aesthetic and image value of urban trees.

At the Szent István University, Department of Landscape Protection and Reclamation, we attempted to develop a methodology to evaluate the importance of individual trees from the standpoint of urban image and streetscape, with District XXII of Budapest as the study area. Using a three-step method based on the analysis of aerial photographs and fieldwork, we identified the top 1% of all individual trees with the most dominant impact on the surrounding urban landscape – 706 out of an estimated 70.000. We inventoried and analyzed several aspects of these trees and their environment (e.g. soil, condition, health). The results show that there is no direct connection between the urban image value of trees and their ecological, dendrological or nature conservation importance. Our research suggests that trees with the most profound impact on the cityscape are different from those with the highest ecological value. This makes it clear that efficient protection of urban image requires a new approach towards tree evaluation as well.

Introduction

The topic of urban trees and their various effects on urban living conditions has become the focus of worldwide professional attention in the fields of urbanism and landscape architecture. Some ecosystem services – stormwater drainage, shade and microclimate, oxygenation, etc. – have been extensively studied and often popularized by open access information systems or television programs. These effects are often included in environmental regulation and used in maintenance calculations. Other services, such as habitat value and soil protection, are well-known and often addressed in local and national regulatory measures. One of the most important roles of urban trees, however, is less tangible, and therefore much harder to include in regulatory tools: their visual impact on the surrounding cityscape and local identity. Recent

changes to the Hungarian regulatory toolkit have opened new possibilities and new talking points about urban trees.

Trees have a profound aesthetic effect on their built surroundings, which has been widely used by landscape architects and urban planners. In a heavily built-in, urban setting, groups of trees – groves, forests, gardens, alleys, tree lines – have become highly valued and in many cases, individually protected by municipal law. Individual urban trees, on the other hand, rarely become the center of attention, even though these are also very important in creating the identity of urban spaces. With a few exceptions, individual trees are only protected to the extent of general laws created to preserve woody plants in Hungary. Another problem for these trees is that while forests, parks, groves and alleys are generally situated on public property, many of the largest and most dominant trees are on private land, which makes listing, maintaining and protecting them a significant challenge for the municipalities. For financial and practical reasons, not all trees can be maintained with the same level of care, and therefore priorities have to be made. However, with the tree surveying and assessment methods currently known and used in Hungary, selecting such ”priority trees” is complicated.

At the request of the Municipality of District XXII of Budapest, a project was executed at Szent István University, Department of Landscape Protection and Reclamation to select the top 1% of all existing trees of the district, focusing on their impact on the surrounding cityscape. For this project, a new, three-step method had to be developed, which made it possible to evaluate the tree stock of the area without individually assessing all the estimated 70,000 trees.

Background and Literature Review

The topic of individual trees as defining elements of the urban landscape arose from the 2016 introduction of the Urban Image Handbook (in Hungarian: Településképi Arculati Kézikönyv) and the Urban Image Protection Regulation (Településképvédelmi Rendelet) to the municipal regulatory toolkit. The goal of these new documents is to facilitate the protection of local character by analyzing and defining different local urban character types and inventorying their differentiating elements. Urban Image Handbooks give recommendations for each urban character, including building dimensions, color use, plot placement, fencing type, shaping of roofs, doors, windows, facades and other elements. The law allows Handbooks to also include recommendations for the shaping of green surfaces and planting ideas. Urban Image Protection Regulation can be used to prescribe or forbid certain ways of building in certain areas, and also includes protection measures for both areas and individual urban landscape elements – buildings, facades, pieces of art, or even green elements (habitats, gardens, plants, works of landscape architecture). In general, the importance of these new tools lies in their approach towards urban landscape elements: instead of inventorying every single such element, it encourages the municipality to evaluate its assets and select the most significant of those. In the case of urban trees, they require a special approach based on the local value of each individual tree, as well as their role in creating an urban character.

In recent years, Green Infrastructure has emerged as a key subject for Hungarian end European strategies involving landscape architecture. The green infrastructure approach regards natural and semi-natural elements, including urban trees, as part of the Green Infrastructure Network. In highly built-in urban and industrial areas, trees are often the most prominent elements of this network. This makes the maintenance of urban trees an urban management priority. However, in reality, due to financial limitations and lack of manpower, not all urban trees can be maintained at the same level of intensity. Proper work organization

requires municipalities to evaluate their tree stock and identify priorities. However, currently there is no universally accepted or widely used approach or method for such prioritization in the country. International examples, like Heritage Trees (*Árboles Patrimoniales*) in Quito, Ecuador (Polo-Paredes 2014) and other South American cities, are only beginning to be adapted to the local administrative conditions.

Perception-based landscape evaluation methods have been gaining popularity and acceptance in recent decades. However, perceptional assessment and landscape preference is typically used at a much larger scale, on municipal, national or even international levels (Coeterier et al. 1996, Konkoly-Gyuró et al. 2017, Kollányi et al. 2017), or for assessing scenery and views, instead of unique objects (Du et al. 2016, Kalivoda et al. 2014). There are no such evaluation methods for individual trees that are currently in use in Hungary. Existing and widespread tree assessment methods in Hungary include the Radó-method (Radó 1997), the Párkányi-method (Jószainé Párkányi 2007) and the so-called MFE method (Szaller 2013). International methods are sometimes utilized as well, including the Helliwell-method (Helliwell 2008), the S. T. E. M. method (Flook 1996), the Burnley-method (Moore 1991), the CAVAT-method (Doick et al. 2018) and the CTLA Trunk Formula method (Guide for Plant Appraisal 2000; Cullen 2007). While these assessment systems are certainly useful for a wide variety of purposes, none of them is particularly useful for selecting the most significant specimens from a large number of trees. The logic of the aforementioned methods is to assign a – monetary or abstract – value to each tree specimen (Komen-Hodel 2015). This means that they are fundamentally unsuitable when assessing a large amount of trees and selecting the most valuable of them. Additionally, most municipalities have limited information about trees located on private property, even though these plants can also have a large impact on the surrounding urban landscape and constitute an integral part of the Green Infrastructure Network. This lack of information is especially problematic regarding trees with a large impact on urban image, as they are privately owned and maintained. Therefore, even though their appearance, health and survival impact the whole neighborhood, the general public and the municipality has very limited power to ensure their well-being.

In 2016, the Department of Landscape Protection and Reclamation at Szent István University, received a request to select, survey and analyze the individual trees with the most profound effect on their surroundings in District XXII of Budapest, located at the Southwestern part of the Hungarian capital. The preexisting Building Regulations of the District had already included a category for ”significant trees in terms of urban image” (hereinafter Significant Trees), but the category was empty – no such trees had been designated prior to our study. Regulations for the category included that no structure could be built under the canopy of a Significant Tree, with the exception of pavements (Budafok-Tétény 2018), which was groundbreaking in the Hungarian landscape protection scene.

Goals and Objectives

The study had two main objectives, the second being dependent on the completion of the first. The first objective of the study was to develop a method to select the 1% of trees located within District XXII. with the most impact on the surrounding urban landscape. The second objective was to utilize the new method to select the top 1% of all trees in eligible areas of District XXII. As the total tree stock of the area was estimated by the municipality to be approximately 70,000 individual trees, the goal was to compile a list of the 700 most valuable. The study included trees situated on both public and private property.

Afterwards, data about selected Significant Trees was analyzed to get a better picture about these valuable specimens.

Methods

The method developed as one of the objectives of the study needed to meet several requirements. From a practical standpoint, it needed to enable a rapid assessment of the large number of trees. As the fieldwork was planned to be carried out by several different groups of people, the evaluation criteria had to be as simple as possible, to rule out major differences between surveyors. The method includes several checks and points of re-evaluation. It was also important for the method to be as inclusive as possible, to avoid the exclusion of trees from the pool of possibilities based on criteria not directly related to their effect on local image. Therefore, we did not set any limits on the absolute size or age of trees. If they have a profound impact on local urban character, they are eligible. However, territorial or other exclusions can be agreed upon prior to the start of the selection process. In the sample project, for example, Protected Natural Areas were excluded, as the focus of the study was on urban image. Dead, dying or hazardous trees were also automatically deemed ineligible. In the case of District XXII. project, tree lines were not regarded as collective entities, trees within these linear elements treated as individuals.

The tree assessment method itself consists of three major phases. Each step is aimed at narrowing down the pool of possible Significant Trees. Steps 2 and 3 additionally serve a secondary purpose of providing feedback on previous steps as well, correcting mistakes made in earlier stages. The phases are the following:

Phase 1: Pre-selection. The primary selection of trees deemed suitable using available information. A high-resolution aerial photograph, preferably taken outside of the growing season – if available – is used. Based on the size and location of specimens, potential Significant Trees are marked in a georeferenced GIS workspace. The size threshold may vary depending on the properties of the study area; in our pilot project, we used 8 meters as the minimum canopy width for selection in this phase. Trees casting large shadows and suspected to be visible from a large area are targeted in this step of the method. Trees which are presumably fully or almost fully blocked from view from public areas – either by buildings or other trees – are excluded. During this phase, the principle of inclusiveness is very important, dubious cases – for example, trees partially blocked from view or slightly below the previously set size threshold – are to be included in the primary selection.

It is preferable to have several people work on the same area to make the results as objective as possible and eliminate errors. Marked individual trees are assigned a unique identifier for later phases. If aerial photographs are not available, open-access satellite pictures or any other recently taken georeferenced or georeferencable photographs can be used. If necessary, information can be obtained from online street-level interactive panorama services (Google Street View, Bing Streetside) as well. Using already existing municipal tree surveys or other similar databases is not advised, as it can possible introduce a bias into the assessment. In the case of District XXII., a recent high-definition aerial photograph was provided by the municipality. Information was also obtained from Google Street View. As a result, from the estimated 70,000 trees, a total of 1,600 trees were selected for further investigation in phases 2 and 3.

Phase 2: Field survey. The most time-consuming and arguably the most important part of the selection process. With the pre-selected pool of trees at their disposal, surveyors visit the complete study area.

During the fieldwork phase, surveyors assess each tree marked as potentially significant trees in Phase 1. The fieldwork phase is carried out in pairs, for both safety and professional reasons. For each tree on the pre-selected list, surveyors decide whether it is a dominant element of the surrounding urban landscape. The decision is based on the perception and professional opinion of the surveyors. The primary guideline for surveyors is that if a specimen's removal by itself would significantly alter the character of the area, the tree is eligible. Trees can be eliminated from the list prepared in Phase 1 for various reasons. These include the tree being blocked from view from public areas or being located within a mass of plants, without any characteristic feature that would make it stand out (Picture 1). Also, a number of canopies having been marked in Phase 1 can turn out to be several trees standing close to each other. If both surveyors agree that the specimen in question is worthy of inclusion in the list of Significant Trees, its unique identifier is confirmed and the tree is surveyed in detail. The specific set of data may vary, but the following are regarded as universally necessary: precise coordinates; taxon; height; trunk circumference/diameter; canopy diameter; health and general condition; threats and health issues. Pictures are also taken from several different viewpoints, which is crucial for Phase 3.

In addition to assessing pre-selected individuals, surveyors are also required to visit every part of the study area in search of trees which are prominent but had not been marked in Phase 1. If such trees are encountered, a unique identifier is assigned to them and the detailed survey process is carried out. New additions in Phase 2 are typically relatively small in size, but due to their appearance or location, they are still a dominant feature of the cityscape (Picture 2). As Phase 2 involves crucial decision-making, the preparation of surveyors is key. Each pair must be equipped with the same set of evaluation criteria to minimize differences between pairs. During phase 2 of the project in District XXII., 1.100 individual trees were marked as significant on-site.

Picture 1. A large white poplar being blocked from view by other trees, excluded in Step 2.

Picture 2. A small but striking cypress, a new inclusion in Step 2.

Phase 3: Post-selection. The final phase of assessment and the final step of standardization. During this phase, the field data is revisited and sorted by a small group of professionals in order to finalize the list of most valuable trees in the study area. The basis of re-evaluation is the photo documentation taken during Phase 2 and, if necessary, another field visit. The reason for this phase is twofold: its primary objective is to narrow down the pool of trees selected by surveyors on the field to the desired number. As it is expected in Phase 2 that the surveyors mark an excess of trees, this step of the process includes re-evaluating all entries and choosing the most significant of all trees. During this phase, the most important considerations are the representativeness and variety of the eventual list. Therefore, more of the less valuable trees in areas with a high density of marked specimens have to be excluded than in areas with fewer eligible trees. As a result, only the most remarkable trees of each neighborhood remain in the final list.

The second purpose of Phase 3 is to correct mistakes and discrepancies made by surveyors – incorrect identification, varying word usage etc. can be identified and corrected during this phase. In the case of District XXII., as the municipality expected the top 1% of its tree stock, a total of 706 trees were ultimately included in the list of Significant Trees.

Picture 3. Location of the 706 Significant Trees of District XXII.

Results

Both objectives of the study were successfully completed during the project. A method for selecting and evaluating the individual trees of a certain study area that have the most profound effect on its surroundings and define local character was created. Its successful utilization on the area of District XXII. proves that the method is usable. The second objective of the study, the project itself, yielded results that are both useful for practice and academia. Data on the 706 individual trees included in the eventual list of Significant Trees in District XXII. was analyzed for better understanding of trees of community importance.

Picture 3 shows the location of the 706 selected trees, which are relatively evenly distributed throughout the study area. The areas lacking any such trees are Protected Natural Areas (which were excluded from the study from the beginning), densely built-in downtown areas that are almost treeless and industrial zones with large closed-off areas.

A total of 79 different taxa are present in the final list and 17 of these were represented by more than 10 individuals. Figure 1 shows these taxa and the number of their occurrences.

It can be recognized that the species most commonly identified as significant include naturally occurring, indigenous taxa (*Populus alba, Populus nigra, Fraxinus excelsior*), traditional fruit-bearing trees (*Prunus dulcis, Juglans regia*) and popular urban ornamental trees, both indigenous and *exotic (Aesculus hippocastanum, Sophora japonica, Tilia cordata etc*.).

The height of each tree was recorded during the evaluation. Figure 2 shows the distribution of different heights. The data shows that most trees included in the final list are shorter than 12 meters (approximately the height of a 4-story building). This confirms that not purely the largest of specimens were selected, but other factors – uniqueness, shape, location, cultural and historic significance – were considered as well.

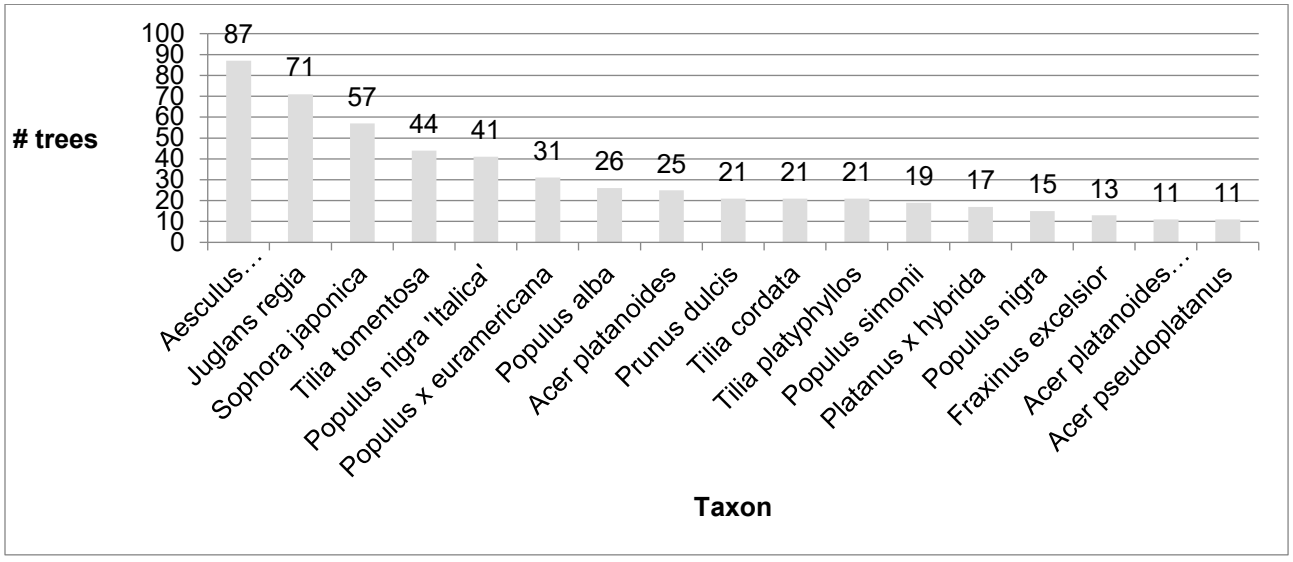

Figure 1. Most common taxa among Significant Trees and their number of occurrences.

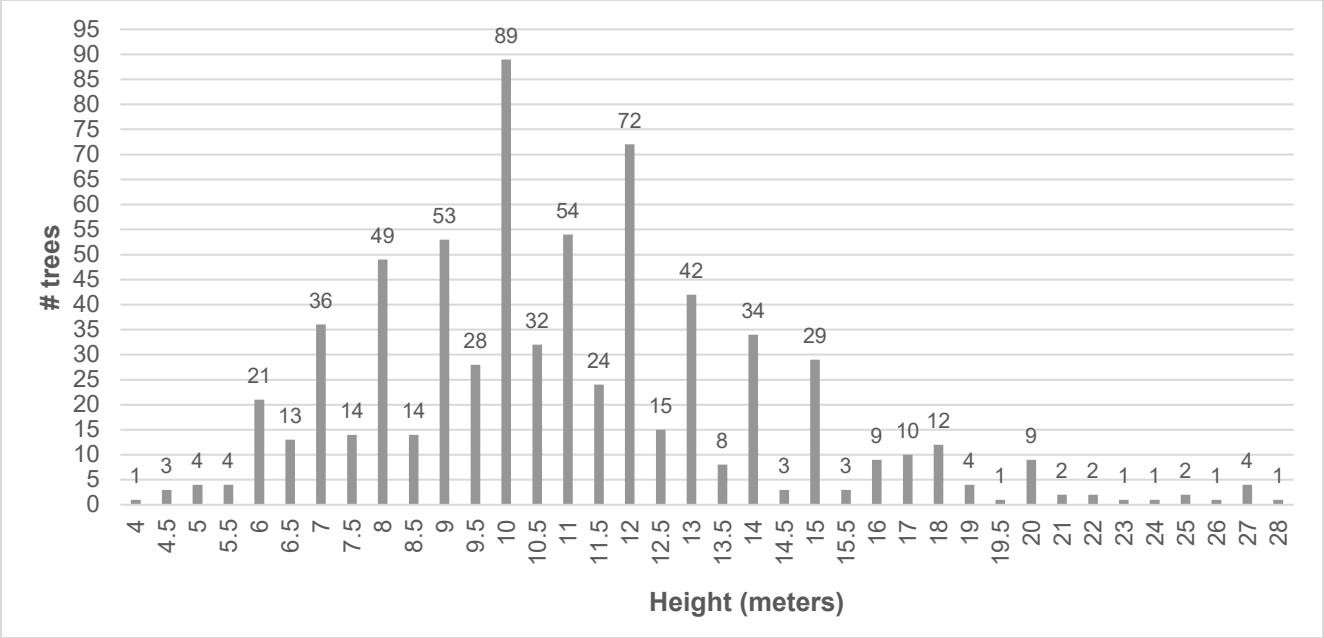

Figure 2. Distribution of Significant Trees by height

Discussion and Conclusion

The results of the research confirm that the impact of individual trees on urban image is a topic worthy of further study. The method developed as part of the research has been successfully used to select the most significant 1% of all trees in the study area in terms of impact on local urban character and cityscape. As a result of the research, the list of Significant Trees has been integrated into the local Urban Image Handbook (Budafok-Tétény 2017a) and Urban Image Protection Regulations (Budafok-Tétény 2017b). The results show that the height of trees do not directly correspond to their importance in local urban image, but other, less tangible factors are also present. It is also worth mentioning that species that are characteristically short, like *Prunus dulcis*, were also included, which further supports this view.

Trees can become dominant elements in the local image for several different reasons. Columnar trees (Picture 4.) are naturally shaped to attract attention. Other trees become defining elements of the surrounding cityscape due to their location and background – Picture 5 shows a tree situated on a high point, at the top of a flight of stairs. Solitary specimens easily stand out in an open area (Picture 6.), while Picture 7 illustrates how a tree can dominate the view in a narrow street.

Some trees become valuable because they evoke the spirit of the place. Old almond trees (Picture 8) in rapidly urbanizing neighbourhoods are characteristic examples of this peculiar category. Finally, large trees can dominate their surrounding due to their size. It is worth mentioning that trees do not need to be particularly large on an absolute scale to become characteristic landscape elements – relatively low-growing trees can also dominate the scene if their surroundings consist of low objects as well. For example, a walnut tree in a sparsely built-in neighbourhood with detached houses is a major focus point (Picture 9.), even though the same tree would be completely insignificant in a downtown area.

Picture 4. A columnar Lombardy poplar

Picture 5. Its elevated location makes this tree stand out more

Picture 6. Large solitary trees stand out in urban squares

Picture 7. A tree dominating a narrow street

Also, large size in itself is not sufficient to gain significance. The difference in the number of potentially significant trees in Phases 1 and 2 shows that a number of trees of outstanding size proved not to have a major effect on local image. Reasons include being hidden behind objects or other trees from public viewpoints and blending into their surroundings without dominating the scenery. As the research described above is prone to a certain level of subjectivity, further study is necessary to solidify findings and pinpoint key factors.

Our study shows that certain individual trees have a markedly increased effect on urban image and local landscape. Evaluating trees from this standpoint can give useful infomation for planning and prioritising management works for municipalities and public service providers. It can also raise awareness on the importance of trees located on private property, and with appropriate communication and regulatory tools, it may actively help preserve these specimens by increasing the sense of ownership and pride among owners of these remarkable trees.

Picture 8. An old almond tree, a relic of past land uses

Picture 9. Relatively small trees also can be significant in more rural areas

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