TECHNICAL TRANSACTIONS 5/2018
CZASOPISMO TECHNICZNE 5/2018
ARCHITECTURE AND URBAN PLANNING
DOI: 10.4467/2353737XCT.18.072.8554
SUBMISSION OF THE FINAL VERSION: 08/05/2018

Wojciech Bobek (w.bobek@pk.edu.pl)
Katarzyna Łakomy
Institute of Landscape Architecture, Faculty of Architecture, Cracow University of Technology

Contemporary processes in historical urban greenery areas and the selection of materials – introduction to research

Współczesne procesy zachodzące na terenach historycznej zieleni miejskiej a dobory materiałowe – wprowadzenie do badań

Abstract

The paper will discuss urgent and topical problems that affect historical areas of urban open space. Its main goal will be the identification of phenomena which take place within it, and which mainly affect its natural tissue. The article will also contain such aspects as: an analysis of modern trends in revalorisation and the effects of its impact, an analysis of possible preventive measures that can be taken, as well as an evaluation of the influence of environmental factors on the condition of individual types of greenery.

Keywords: historical urban greenery, revalorisation, greenery arrangement and maintenance

Streszczenie

Artykuł dotyczy pilnych i aktualnych problemów dotykających obszarów historycznej zieleni miejskiej. Głównym jego celem jest identyfikacja zjawisk zachodzących w jego obrębie, dotykających głównie tkanki przyrodniczej. W artykule zawarto także aspekty obejmujące analizę współczesnych kierunków rewaloryzacji i sutków ich oddziaływania, analizę możliwych do przeprowadzania działań prewencyjnych oraz ocenę wpływu czynników środowiskowych na stan poszczególnych typów zieleni.

Słowa kluczowe: historyczna zieleń miejska, rewaloryzacja, urządzanie i pielęgnacja zieleni

1. Introduction – goal, current state and scope of research

The problem of contemporary processes that take place in green areas located in the layouts of historical cities, towns and villages undertaken in the article constitutes a further development of research work that has been performed for many years at the Garden Design and Green Areas Division of the Institute of Landscape Architecture of the Faculty of Architecture of the Cracow University of Technology. The protection, revitalisation, regeneration and shaping of cultural and natural historical landscapes is a broad subject, in which the diagnosis of currently ongoing negative processes constitutes the basis of appropriately prepared guidelines and, afterwards, design work.

Research on the subject of the threats to historical gardens was initiated by Professor Longin Majdecki [4], as well as Professor Janusz Bogdanowski, Professor Anna Mitkowska [5], Professor Agata Zachariasz [8] and others. The year 2014 also saw the organisation of the International XXI scientific conference on garden design and historical dendrology called "Modern threats to historical gardens"[1] at the Cracow University of Technology, which was concluded by scientific publications [1, 2, 9].

The main objective of this article is analysing the changes that occur in material selections in areas of historical urban open spaces, against the background of the transformations of design tendencies, conservation ideas, environmental factors and civilisational needs. The article uses the research material of ZSOiTZ, expanded using analyses of the latest phenomena that threaten historical greenery, mainly from the areas of Krakow, Warsaw and Wroclaw.

The undertaking of this problem came as a result of observing the problem of contemporary trends in revalorisation and the effects of their impact on historical greenery. The revalorisation work that has been increasing in intensity in recent years, while fundamentally advisable and aimed mainly at the preservation and restoration of historical layouts and complexes, carries with it significant threats to the durability of these sites. Improper actions in this regard can be mentioned here, including:

- The revalorisation of large sites using a "one-off" system [6][2],
- The fragmentation of areas/staging, selective action aimed at solving an individual problem (surfaces, street furniture, water system) [9][3],

[1] Conference organiser: Garden Design and Green Areas Division, Institute of Landscape Architecture of the Cracow University of Technology, along with the Garden Design and Architecture Section of the Urban Design and Architecture Commission of the Krakow Branch of the Polish Academy of Sciences, the Władysław Szafer Botany Institute, Polish Academy of Sciences in Krakow.

[2] This exerts significant pressure on a site's living tissue, especially on tree stands, a known example of which is the revalorisation of the Park that surrounds the manor in Żelazowa Wola, which is the birthplace of Fryderyk Chopin. Although some years have passed, the condition of the tree stand still shows the mark that the change in surroundings has made on it, especially the planting of large amounts of infertile soil in its vicinity.

[3] A method based on the selective treatment of areas or the staging of work with a division into specialisations, and thus featuring the individual treatment of surfaces, street furniture, water systems and greenery. This can lead to completely unintended effects, as in the case of the Constitution of the 3rd of May Park in Suwałki, where a relatively properly performed replacement of the infrastructure and surfaces, without paying much attention to greenery, has caused a successive "falling out" of trees from the composition and their rather random infilling over a period of ten years.

- The excessive development of green areas[4],
- Making historical areas more contemporary – through inappropriate compositions, selection, furnishing elements[5].

The article will present the initial results of the author's research, which is meant to prepare detailed guidelines on how to proceed with historical greenery.

In the paper, the following have been listed:

- negative cultural phenomena that take place in historical green sites, as well as the strength of their impact,
- negative natural phenomena that occur in historical greenery with the strength of their impact,
- negative phenomena that hinder the maintenance of existing greenery and the introduction of new greenery into historical sites
- analysis of the actions that can be taken as well as their effectiveness in relation to endangered plant species and forms.

2. Negative phenomena and cultural processes that take place in historical green areas

The legal status of historical greenery sites has been in a state of legal dissonance between two essential legal acts for many years: the Act on the Protection of and Care for Historical Monuments [10] and the Protection of Nature Act [11]. This leads to various different problems of an administrative nature, associated with the division of competencies between institutions, the scope of the necessary documentation, the manner of its preparation and approval. In addition, when a site's legal status, owner, manager or administrator changes or when one historical site is administratively managed by several institutions, even the simplest of actions are made very difficult, and in extreme cases, even impossible. As research shows, a historical site can be under the protection of different forms and institutions, which are based on different legal acts, leading to conflicts of interest and competency between them, which can have differing goals for the same areas or elements. Additional problems can be caused by the manner of carrying out projects or work based on Public Procurement Law, which requires a high degree of precision in the description of items that are to be procured so that they can be sent to offering parties that are capable of their delivery, especially in terms of essential content.

One very dangerous, although not always observable problem, is the lack of sufficient knowledge or experience necessary to appropriately: manage, revalorise and maintain precious and at times transformed historical sites[6].

[4] The amount of new stimuli causes a pressure that is difficult to accept, especially for mature and senile tree stands.

[5] An erroneous or risky modernisation of historical areas through the selection of species, materials and furnishing elements that are improper in terms of a given composition, style and period leads to the erasure and even destruction of the historical value of an area and is often irreversible in its effects.

[6] Such works are not made any easier by various types of social groups which often act on the basis of emotions and sometimes prevent the implementation of even factually appropriate solutions. This can lead to the making of completely irrational decisions under the influence of growing "public pressure".

The scale of the impact of each phenomenon has been evaluated on a five-point scale, ranging from low to very high, although in the case of many sites and the very process of revalorisation, the possibility of reversing their effects or of the reinstatement or return to their original state is more important[7].

Fig. 1. Excessive tree crown rising of limes in 2007, which destroys „green wall" along the Błonia meadow

The data presented in the tables are the result of research conducted by the authors trough the years on the issues contained in the paper and they will be increased in the planned activities.

Table 1. Negative cultural phenomena that occur in historical greenery sites

No.	Phenomenon	Impact strength	Reversibility
1	2	3	4
		1 – Low 2 – Moderate, 3 – Medium, 4 – High, 5 – Very high	1 – Full 2 – Possible 3 – Conditional 4 – Difficult 5 – Impossible
1	Change of the legal environment	**3**	**2**
2	Changing legal status of sites	**3**	**3**
3	Existence of different forms of protection	**2**	**1**
4	Lack of a permanent administrator	**5**	**3**
5	Lack of protection	**5**	**4**
6	Administrative and economic problems	**4**	**3**
7	Employing the PPL to carry out projects and work	**4**	**2**
8	Influence of the division and assigning of funds	**4**	**2**

[7] Scale was based on expertise and author's method of valuating elements and objects.

1	2	**3**	**4**
9	Ownership problems	**4**	**4**
10	Secondary ownership/spatial divisions	**5**	**4**
11	Irrational management of a site	**4**	**3**
12	Social threats	**4**	**2**
13	Lack of knowledge	**4**	**1**
14	„Emotional" actions	**3**	**1**
15	Irrationality of solutions	**4**	**1**
16	Public pressure	**4**	1

3. Identification of negative natural phenomena in areas of historical greenery

Negative natural phenomena that take place in areas of historical greenery are not always properly identified and interpreted. This is a result of the fact of the complexity of these processes, which can mutually overlap and intensify their impact on natural tissue, which is also precious in compositional terms. One example that is easy to identify is the coupled effect of: climate change, which makes it possible for new species to appear and thrive, among them being pests and invasive species, which are additionally correlated with varying degrees of anthropic pressure. This can lead to the withering of individual species, such as: the horse-chestnut, the common ash or the Norway spruce. In many cases this leads to substantial changes in tree stands, which, at least in theory, are the most durable elements of the green layer of historical parks and gardens, and at the same times the most difficult to restore, especially due to their pace of growth and the time of reaching compositional maturity.

Table 2. Negative natural phenomena occurring in areas of historical greenery

No.	**Phenomenon**	**Impact strength**	**Reversibility**
1	2	3	4
		1 – Low, 2 – Moderate, 3 – Medium, 4 – High, 5 – Very high	1 – Full 2 – Possible 3 – Conditional 4 – Difficult 5 – Impossible
The problem of the „falling out" of stands (the withering of individual species)			
1	Pest gradation (secondary factor)	5	4
2	The chronic nature of diseases or the activity of pests	4	3
3	Syndromes	4	4
4	Anthropic pressure	3	2
The problem of species selection			
5	The dominance of summary action in the replacement of specimens – lack of strategy	4	1
6	Lack of selection verification in the case of replacing individual specimens	4	1

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1	2	3	4
7	Improper selection of species for specific places – avenue, row, street, road	4	1
8	Maintaining historical selection despite changes in: conditions, function, the environment	4	1
The problem of the erasure of composed layouts, arranged spaces			
9	Lack of control over succession processes	4	2
10	Change in species composition	3	2
11	Neglect in basic maintenance – periodic or long-term lack of maintenance	3	2
12	The effect of CO_2 on the increase of the growth dynamic of biomass	3	2
13	The activity of social groups blocking clearing work in valuable tree stands	4	4
The problem of the disappearance of valuable treeless sites, meadows and xerothermic lawns			
14	On the scale of the city (buildings)	5	5
15	On the scale of the city (overgrowth)	4	3
16	Fortress layouts – historical esplanades, slopes, embankments, moats	4	3
17	Parks – scenic points, meadows	4	3

Changes in the living conditions of plant layouts have been occurring increasingly quickly and on multiple planes in recent years. Originally planted avenues, rows and solitaires are experiencing increasing amounts of stresses. Functional and technical transformations, increasing requirements regarding the organisation of space and its adaptation to regulations and standards most often lead to limitations in the possibility of the development of trees, both existing and newly-planted ones[8].

Table 3. Negative phenomena that make the maintenance of existing and the introduction of new greenery to historical sites more difficult

No.	Phenomenon	Impact strength	Reversibility
1	2	3	4
		1 – Low, 2 – Moderate, 3 – Medium, 4 – High, 5 – Very high	1 – Full 2 – Possible 3 – Conditional 4 – Difficult 5 – Impossible
Problem of limiting space for trees			
1	Functional changes	4	4
2	Changes in the degree of use	4	4

[8] This impacts the shapes of the crowns and the modification of root systems. Legal regulations can cause deformations that disrupt the form of some trees. One example can be the Crimean linden, which traditionally develops a crown that reaches down to the ground, and which can be cut due to its vertical gauge.

1	2	3	4
3	Technical changes	4	4
4	Introduction of new infrastructure	5	4
5	Material changes (surfaces, furnishing)	3	3
6	Adaptation to regulations and standards	4	4
Changes in habitat conditions resulting from changes in surroundings			
7	Limiting space for tree crowns by structures (shading, collision)	4	4
8	Limiting space for tree crowns by trees (shading, collision)	3	3
9	Limiting the vertical and horizontal gauges	2	3
10	Changes in air circulation – the formation of funnels and turbulence	5	3
11	Limitations for root systems	4	4
12	Changes in the degree of surface curing (heating, water absorption, pollution)	5	4
13	The construction of underground structures	5	4
Problems of urban (micro-, meso-) climate change			
14	Expansion of the heat island effect	3	3
15	Intensification of sudden weather phenomena – hurricanes, windstorms, tornadoes	5	4
16	Rising number of changes in spatial distribution and frequency	5	3
17	Increase in temperature shifts (significant changes within the span of a week or month)	3	3
18	Decreasing number of days with full insolation	3	3
19	Change of the yearly distribution of precipitation	3	3
20	Increase in the frequency of high daily precipitation	4	3
21	Decreasing amount of snowfall	3	3
22	Changes in cross-ventilation	4	4

Changes in the built environment and land development can lead to new difficulties for trees in terms of wind, in the form of wind funnels and turbulences – which cause the occurrence of new forces and moments, especially torque, for which trees are not prepared and need to produce reactive wood. If this is combined with a change in insolation and the frequency of high rainfall, then it additionally affects changes in the soil, which make anchoring more difficult. This can also affect changes in cell turgor pressure, which is the deciding factor in wood durability. Many of these problems can be categorised as anthropic pressure, although human influence is in many cases being overestimated.

4. Examples of actions that can be taken and their effectiveness in relation to endangered plant species and forms

When analysing needs and actions that can be taken in order to preserve the most precious plant species and forms, two aspects that comprise this problem need to be considered, and that is time and spatial distribution. Actions and solutions that have significance over the short and long term cycle need to be considered. In many cases of ongoing or advanced degradation, it is not possible to perform work that covers entire areas – instead, a method of the spatial distribution and phase division of work [7].

Fig. 2. Wawel Hill, Royal Castle, an example of proper maintenance of all forms of greenery at historical space

The first and most basic – and from the perspective of time also the cheapest – solutions are all manners of ongoing maintenance work. The constantly performed maintenance of a site's current condition, adapted to the needs of said site or its elements, is of paramount importance to the continuity of precious elements of the landscape, as well as plant groupings, forms and species. Such actions are not directed at improving the value of sites or of a space, but they can de facto be, especially when the number of precious sites is decreasing on the national and regional scale, or that of a city. The simplest, although not always appreciated actions, include:

- the mowing of lawns and meadows, making it possible to preserve valuable monuments of culture like, for instance, Krakow's Błonia or the *hale* in the Tatra Mountains, which have been cultivated for centuries and will be a testament to a centuries-old tradition of organising space and of a manner of its maintenance. In many cases, simple mowing can significantly reduce costs that are spent on the renewal of such precious – although unstable from the point of view of natural succession – plant layouts;
- limiting the influence of winter-time maintenance of streets and roads, which affects circulation tree stands – including precious historical, composed avenues, often constituting a part of a larger layout – in a particularly destructive manner. The examples

of Krakow's Planty park illustrate that a change of approach in this field can save or extend the lifetime of such layouts by many years;

- the removal of leaves during autumn, which is particularly important in the case of trees with strong allelopathy mechanisms, causes significant changes in terms of lawns as well as diseases and leaf-born pests. In this second aspect, using the example of the horse-chestnut affected by the horse-chestnut leaf miner, the raking of leaves and keeping them in special containers – as Viennese experiences have shown – facilitates the development of the leaf miner's antagonists and thus regulates its population;
- surface runoff management based on the planned drainage and watering of plants and more demanding areas. These systems can be unmanned, automatic, semi-automatic or manually operated;
- the appropriate planting of young trees, which is a deciding factor in the effective generation replacement of specimens that form precious, historical composed layouts. Inadequacies in the process of planting cause a low percentage of adroitness among new trees and an insufficient degree of the replacement of old trees with new ones;
- maintenance and form cutting, which affects the preservation of the form, statics and vitality of plants, as well adaptation to a particular composition. Errors in this field are difficult to reverse and often result in the necessity to replace individual trees.

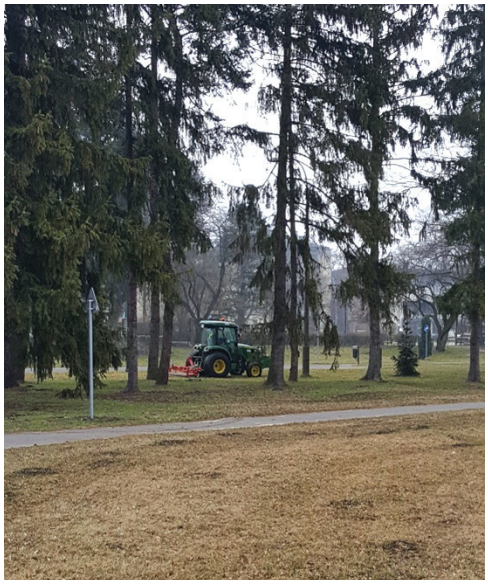

Fig. 3. An example of proper basic maintenance of all lawns after winter time at historical space in Krakow

The verification of plant selection and green area arrangement methods is particularly essential in the case of areas of distinct historical value. It exerts influence on numerous planes and we should not be content with thinking only in quantitative categories, as instead, we should focus more of our attention towards analysing efforts that are being made and the solutions that are being implemented. One problem that is difficult and that sometimes has its origin in neglected layouts of historical greenery is the occurrence and increasingly strong impact of invasive species on ecosystems and biotopes that are considered domestic for a given region or place. The search for and the implementation of methods, even the simplest and most maintenance-like ones, like those that have been mentioned above, can prevent phenomena that are difficult to reverse. Some domestic plant species can also constitute a problem if we take into account their expansiveness, which perhaps is not an ecological problem, but constitutes a significant local threat in terms of the disruption and erasure of plant compositions [3].

It also appears necessary to develop principles of tree replacement, not only in cases of individual specimens, but species as well. In significantly changing environmental and habitat conditions the search for successors that are better adapted is a necessity. It is quite difficult in the case of the purist willingness to preserve original species structures. Appropriate planting is also important, particularly in the planting of larger trees and can be the deciding factor in the proper growth of individual specimens. In the vicinity of buildings, inside valuable urban layouts or avenues, the modification of soil substrates in order to limit soil compression becomes a necessity in an increasingly greater number of cases.

5. Conclusion

In a period of technological development, we should pay attention to the selection and use of methods, techniques and materials dedicated to the well-being of plant life, the necessary layer of the majority of historical sites. In the context of research on material selection during the revalorisation of historical green areas, one phenomenon that is becoming a more and more dangerous threat is the aforementioned improperly understood comprehensiveness of action. It is interpreted by designers and contractors as a single-stage, holistic procedure, covering all layers of a structure at the same time. In many cases this leads to drastic spatial and structural changes, while for living tissue, especially mature tree stands, it can be a factor causing the degradation of habitat conditions, lowering vitality and causing difficulties in adaptation to ongoing changes, which, in consequence, can lead to the withering of species and even entire areas of tree stands which were in a state of dynamic balance beforehand. Proper staging can thus aid in minimising the results necessary to perform actions and should be included in design documentation. Insofar as a conceptual design should cover an entire site and provide guidelines, technical and detailed designs should take into account the necessary staging, both in spatial and temporal terms. This especially applies to the replacement of trees and tree stands, as well as maintenance work - which, as it has already been mentioned, does not solely provide a point-based effect, but also has one within the scope of the nearer and farther surroundings. The entirety of revalorisation work should be rational, preceded by compositional and historical studies and dedicated to the quality, value, the state of the preservation of a given historical area and the scale of the necessary actions and local socio-cultural and natural conditions.

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If you want to quote this article, its proper bibliographic entry is as follow: Bobek W., Łakomy K., *Contemporary processes in historical urban greenery areas and the selection of materials – introduction to research*, Technical Transactions, Vol. 5/2018, pp. 53–64.