Szent István Egyetem

THE POTENTIAL OF POST-INDUSTRIAL SITES IN THE DEVELOPMENT OF THE GREEN INFRASTRUCTURE OF BUDAPEST

Theses of the Ph.D. dissertation

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The candidate fulfilled all the conditions prescribed in the Doctoral Regulations of Szent István University, the remarks and suggestions made in the preliminary disputation were taken into account during the revision of the dissertation, therefore the dissertation can be submitted for defense.

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Approval of the School Leader Approval of the supervisor

AIMS AND STRUCTURE OF THE THESIS

As an urban planner and landscape architect my interest turned to the liveable revitalization of the unused, brownfield areas of cities. These post-industrial areas were once productive and the economic strength of the cities while also polluting the environment. I am mainly concerned with the reuse and transformation in order to create a healthy and liveable urban environment with landscape architecture and urban planning tools within cities, by transforming underutilized areas, which is one of the current major challenges of our profession.

The most significant functional changes in the brownfield areas in Budapest can be observed in the Danube zone, and at the same time the Danube is of outstanding importance for the green space system. Therefore, in my doctoral research, these transforming areas along the Danube come into focus.

These areas are both located close to Budapest's centre as well as close to the waterfront, making them a major target for future real estate developments.
These two qualities also highlight these areas in terms of green infrastructure development and makes them of unique value.

My research compares eight not yet rejuvenated post-industrial plots along the Danube as the sample with a control group of three renewed areas, which already changed functions at least on the planning level.

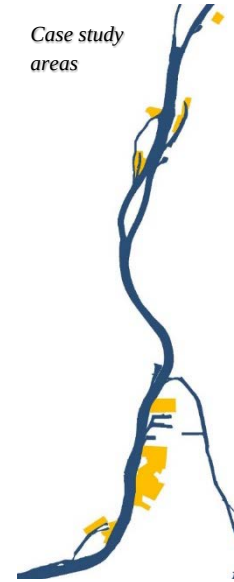
The main goals of the research were the following:

- first examines which areas will be transformed along the Danube in the near future, what role they can play in the development of green infrastructure, and whether the town planning tools adequately ensure this.
- then, formulates what trends can be identified, and what general and specific territorial proposals could improve the integration of brownfield sites along the Danube into the green infrastructure of the capital.

My hypothesis was that by developing the green network of the areas along the Danube and revitalizing the brownfield sites is an extremely valuable element of the green infrastructure that could be created along the north-south axis.

MATERIAL AND METHODS

Based on the objectives of the research, the following tasks and goals can be formulated:
• Determine the areas to be transformed in the capital's Danube area in the near future
• Assess the potential role of these areas in green infrastructure development
• Define the framework conditions for the planning and implementation of green infrastructure development.


Case study areas

To achieve the goals, the method and foundation of the research cover six major topics:

1. Identifying the research area
2. Industrial history and the development of green infrastructure in the capital's Danube area
3. Review and evaluate design background
4. Evaluation of control areas
5. Examination and evaluation of sample areas
6. Formulation of results

The three main types of results are:

• Answering research questions, rejecting or confirming hypotheses, establishing scientific theses,

• Formulation of general green infrastructure development proposals at the capital city level based on the scientific results of the research.

• Determining the green infrastructure potential, development, planning and implementation framework conditions in each of the examined brownfield areas.

SCIENTIFIC RESULTS

T1 The value-adding revitalization of former industrial areas can only be achieved with long-term and interdependent development based on a planning system.

The examined international case studies proved that long-term goals integrated into several levels of the plan hierarchy can be the key to regenerating brownfield sites.

In Budapest's case, the last decade has brought design changes which, if properly implemented, can facilitate successful renewal projects, but it is not yet clear from the examples observed whether the main conceptual ideas remain unchanged long enough for the planned renewals to be carried out.

T2 In the success of each project environmental rehabilitation has proven to be an important factor; based on case studies I itemized the required major environmental interventions.

The examples of Western Europe showed that during successful renewals improving the quality of the environment, value creation is an important cornerstone, without which the new life of the area cannot be realized. The following interventions are present in all revitalization projects: elimination of pollution, renewal of the existing building stock, renewal of natural endowments, complex planning concept for land renewal, planning the urban structural and ecological impact, creation of new recreational green spaces, interim utilization, strengthening green infrastructure services.

In the case of the Budapest, the above aspects do not appear with the same emphasis, and thus the examination of the environmental success of the projects shows that not all the renewals can be considered successful.

T3 The comprehensive settlement planning tools for Budapest's entire territory provide an appropriate basis for the development of the Danube area.

The planning system for the entire area of the capital contains multi-layered and interdisciplinary plans that build on each other, support each other and they are also good tools for the development of brownfield sites (settlement planning tools, urban development documents). The framework defined as a planning system and the design elements look at the problematic brownfields along the Danube area as a matter of priority, and assessed them as important development opportunities.

Based on the research, it can be concluded that the planning system of the capital and the conceptual objectives included in the plans appropriately manage the brownfield sites along the Danube, and if the objectives set out in them are achieved, the areas can be successfully revitalized, however, the green infrastructure aspects are not uniformly represented in the plans.

T4 I found that the "Danube area Regulatory Plan" (DÉSZ) due to its territorial delimitation, is not suitable for the management of the former industrial areas' complex problems.

In the capital plan hierarchy the comprehensive plans are followed by detailed regulations for sub-areas, priority areas. One of them is the Danube band, for which a capital-level regulatory plan was prepared, instead of many separate district-level regulatory plans.

Based on the research, I concluded that DÉSZ does not treat former industrial areas as a unit. 26% of the former industrial areas studied in the research are regulated by the plan, despite the fact that these areas are on the riverbank. The development of green infrastructure on the waterfront and the complex revitalization of former industrial areas require extended studies to areas enclosed by roads of structural significance and a minimum design area defined in a block.

T5 The development of green infrastructure in Budapest can achieve a significant structural improvement in the Danube area through the revitalization of brownfield sites. The linear green space system element on the riverside can only be created by revitalizing brownfields (former industrial and railway areas)

A significant part of the former industrial areas also have a valuable waterfront strip, water connection and near-natural waterfront vegetation. ZIFFA's development ideas and detailed regulatory plans indicate a walking and / or cycling route in the brownfield areas. Most of them do not yet exist or cannot be explored, and with the development of this green area strip, the accessibility and walkability of the Danube banks in Budapest can be significantly improved.

Studies have shown that 60% of the strips within the areas can be made available based on the ideas of DÉSZ / KÉSZ, which results in an additional 11,750 metres of Danube access.

T6 I I found that the green area ratio and planned width of the pedestrian and bicycle-paired routes along the Danube do not allow the development of a real green promenade in these areas. The green promenade can be created as a green area with the unification of the zoning classification, with green dominance.

In the case of the areas studied during the research, the width of the regulated coastal pedestrian and bicycle paths varies between 6 and 40 m, while the coastal aquifer or paved slope is 5–10 m wide. Thus, the green walk cannot be realized with this regulation in all areas with a uniform cross-section and the appropriate green area ratio. The minimum width of the green promenade is 10 m in plain terrain, in which a 5 m wide green road (pedestrian and bicycle paved surface, rest areas, etc.) and 50% green surface can be created.

T7 I found that due to the distance from the current residential areas the creation of green areas is not justified in the examined industrial areas, outside the already designated coastal zones, but they have great potential in case of future surrounding residential area developments.

The areas' distance from the residential area varies, but based on the research, it can be said that the former industrial areas cannot significantly improve the green area supply of the current residential areas.

T8 I found that the former industrial areas along the Danube may play a role in the chain of city parks in the future, thus contributing to a higher level of green space supply in the districts and in Budapest.

There are no significant green areas along the Danube in the transitional and outer zones of the northern part of Pest and the southern part of Buda. In addition to retaining recreational functions, the new green areas can expand the offer of Budapest's parks and balance the distribution of Danube riparian public parks in the area of the former Waterworks, the former Népsziget Crane Factory (and surrounding areas), the former Hunyadi Barracks on Háros Island and the Veneer Works.

With the designation of green areas, the supply of green areas to the population will improve, the area of green areas and urban public parks will increase by 23-40 hectares.

The chain of city parks along the Danube can work well together with the implementation of the green promenade along the Danube - a pedestrian-bicycle “green corridor”, therefore their development based on each other is important. With the realization of the linear and spatial elements, a real functional value and ecosystem service is created.

T9 Among the renovations of the brownfield areas along the Danube so far (control areas) there are some that can be said to be successful in terms of green infrastructure development.

Each of the examined projects carries development elements that are relevant for green infrastructure. Based on research the installation of Graphisoft park provides the environment that can be a good backdrop for recreational routes in the transition zone.

T10 I found that the former industrial areas have valuable vegetation that should be taken into account and preserved during the detailed regulation.

Based on the research, it can be concluded that in the former industrial areas, the vegetation consists primarily of non-dendrologically valuable individuals, although in some places these can also be found. Due to the large-scale cover and incorporations, these groups of plants and trees, which are of low value elsewhere, are extremely valuable either for reducing heat island or soil pollution or for maintaining habitats.

In former industrial areas, therefore, tree protection based on non- or not only dendrological value is important. Spontaneously formed stands, which consist essentially of non-invasive or allergenic vegetation, are suitable for maintaining the ecosystem service, therefore it is worth maintaining and further developing them when starting a new investment.

CONCLUSION AND RECOMMENDATIONS

My research investigated what role the capital's remaining post-industrial plots along the Danube can play in the future, especially from a urban ecological, environmental and urban green infrastructure perspective. My hypothesis was that the development of the urban green system of the plots along the Danube and the revitalisation of the post-industrial lands would create a valuable green infrastructure component along the North-South axis, which plays an important role in the conditioning and ventilation of the city, while preserving the plots' 'green' value.

The eight investigated sample fields are on the Pest and Buda side of the capital's transitional zones, as well as on the Csepel island, and are diverse in terms of their current state, the planned development and their legal/urban plan background. My research established that the developments' environmental success is also mixed, and as a result only one development, Graphisoft park may be considered for guidance in future investments. Budapest 2030 and ZIFFA, the two main conceptional visions both touch on the majority of the plots, and their overarching aim is to reduce the Danube's currently hard-to-reach stretches in order to create a pedestrian-cyclist green infrasturcture axis for recreation and ecosystem services.

The sample areas are varied in terms of future use and current state, but the defining trend is to increase the intensity of the vegetation and enhance the riverbank, which both will be definitive in the pedestrian-cyclist routes as well as providing an urban green promenade. Some of the main success factors are already present in the control areas, while some need to be

implemented, such as the interim utilisation and strengthening the green infrastructure service. Consistent regulations and implementation of the green infrastructure elements into the legislation, e.g. regulatory plans and brownfield management, which provide the foundation still remain inadequate.

Budapest is uniquely positioned along the river, which is worth capitalising on. It is therefore important not to leave these post-industrial plots out of the schematic developments due to the challenges and difficulties presented by their past. My research proposes the potential means of integration and discusses the plots' potential, and my suggestions aid the implementation of the value conserving revitalisation of the brownfield plots and a reachable and usable Danube bank with both recreational and ecological functions.

PUBLICATIONS CONNECTED TO THE RESEARCH TOPIC

Full papers

ADORJÁN, A. (2015a): Success and Applied Tools in Post-industrial Rehabilitations. In: *YBL Journal of Built Environment*, *3*(1–2) 5–15 pp.

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ADORJÁN, A., ANDREA, S., ZSUZSANNA, F. (2016.) Sustainable revitalization of brownfield lands - possibilities of interim utilization in the form of urban community gardens In: *Acta Universitatis Sapientiae. Agriculture and Environment*, 7. kötet, pp. 47-57. ISSN 2068-2964, DOI: 10.1515/ausae-2015-0004

ADORJÁN, A. (2016): A Valenciai "zöld folyam" jövője / Green network development in Valencia: A Turia park és a városi zöldinfrastruktúra fejlesztése / The Turia park and the urban green infrastructure. In: *4D TÁJÉPÍTÉSZETI ÉS KERTMŰVÉSZETI FOLYÓIRAT*, 18 pp.

Conference papers

ADORJÁN, A., PECZE, A., M. SZILÁGYI (2019): 'Brown' is the New 'Green': Post-industrial Sites as Potential in the Development of the Green Infrastructure on the Riverfront of Budapest, Hungary. In: *Adapting to Expanding and Contracting Cities : Book of Abstracts 6th Fábos Conference on Lanscape and Greenway Planning March 29-30, 2019 Amherst, MA*, 9 pp.

ADORJÁN, A., VARGA, P. (2006): "Greenscape" from brownfields: From

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