

## **Doctoral Study Programme Landscape and garden architecture – 2023/2024**

### **Planning and Design of Green and Open Spaces in Residential Areas and Zones in Urban Landscapes**

<b>Supervisor:</b>	doc. Ing. Attila Tóth, PhD.
<b>Workplace:</b>	Institute of Landscape Architecture
<b>Field of study:</b>	Agriculture and Landscape
<b>Study program:</b>	Landscape Architecture
<b>Form of study:</b>	daily/external

Theses: Green spaces of residential buildings in urban landscapes represent an important part of the urban green infrastructure and the living environment of urban inhabitants. The issue of planning and design of urban green spaces, including systems of residential greenery, is among the priority goals of current European policies (strategies and guidelines), e.g., the EU Strategy on Green Infrastructure, the EU Strategy for Biodiversity to 2030, the New European Bauhaus, the European Green Deal, and others. These policies imply the necessity for cities with a population of more than 20,000 to create and continuously develop smart urban greening plans, including housing estates and residential zones. To create a healthy and sustainable environment and a functional green infrastructure for urban residents, it is necessary to better know the principles and approaches to planning and designing residential green spaces, including best practices in Europe. Residential greenery belongs to the most accessible and inclusive elements of the urban landscapes, which significantly improve people's lives and living environment, e.g., in the form of short-term recreation, spending their free time, improving the microclimate of residential environments, etc. The aim of the dissertation will be the evaluation of long-term historical development and contemporary innovative approaches to planning and design of residential zones and objects in European urban landscapes.

**Rationale:** Residential green systems are key elements of urban green infrastructures. In Europe, there are many examples of best practices in planning and design of green systems, with a focus on residential green spaces. The current situation of residential spaces and the state of their knowledge in Slovakia is not sufficient. So far, no comprehensive research has been carried out, which would have evaluated the historical development and current innovative methods of planning and designing green spaces in residential areas in Slovakia, which is largely lacking in the profession of landscape architects. The condition and quality of open spaces of residential complexes in Slovakia currently lags the European standard. However, the above strategies, which are closely linked to the EU's investment and financial mechanisms, predict the support of this area. Hence, there is a need for methodical approaches that include proven as well as innovative solutions applied in European countries. The research results will have scientific as well as applied significance and benefit for landscape architecture and related disciplines. The dissertation will build upon ongoing research on green infrastructure in landscape architecture at the Institute of Landscape Architecture and will expand the current state of knowledge in the field of planning and design of healthy, sustainable, and resilient public and semi-public open spaces of residential zones and structures.

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## **Innovative and Sustainable Solutions of Green Roofs and Green Walls in Urban Landscapes**

<b>Supervisor:</b>	doc. Ing. Attila Tóth, PhD.
<b>Workplace:</b>	Institute of Landscape Architecture
<b>Field of study:</b>	Agriculture and Landscape
<b>Study program:</b>	Landscape Architecture
<b>Form of study:</b>	daily/external

Theses: Green roofs and green walls represent alternative forms of green spaces in urban landscapes, they serve as efficient and multifunctional nature-based solutions and enhance the urban green infrastructure. They have a positive effect on the local microclimate in the context of urban heat islands, support biodiversity and contribute significantly to stormwater management in urban areas. The planning and design of green roofs and green walls fall within the competences of landscape architects and require an interdisciplinary approach and cooperation with other professions, especially with architects and civil engineers, specialised in building structures and building statics. In the profile of knowledge, skills and competences of landscape architects, this area can be considered relatively new and insufficiently researched. Current technologies make it possible to implement and test a wide range of construction and material solutions, the application of different plant groups with diverse habitat conditions. The aim of the dissertation will be the investigation of current innovative approaches and sustainable solutions of green roofs and green walls, with the application of various structural, technological, and material solutions that will expand the state of knowledge based on own observations, evaluations, and experiments.

**Rationale:** The current state of knowledge and practice in landscape architecture needs to be expanded with the latest findings, innovative technologies, and sustainable solutions in the field of designing, projecting, establishing, and maintaining green roofs and green walls. The ReImaGine Living Lab of Green Innovations that is currently being established at the Institute of Landscape Architecture FHLE SUA Nitra, supported by Norwegian grants, will create suitable conditions for testing, monitoring, evaluation, and verification of various structural, material and technological solutions for green roofs and green walls. The identification, mapping, comparison and evaluation of current approaches to the creation of green roofs and walls in landscape architecture will bring new findings that will expand the current state of knowledge in the scientific research field, as well as in the field of practicing the profession of landscape architects, as there is a high assumption that the amount of assignments to establish green roofs and green walls will continuously increase, and landscape architects will need a relevant scientific and methodological support that this dissertation will generate.

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## **Implementation and Verification of Economic Principles and Methods in Landscape Architecture**

<b>Supervisor:</b>	doc. Ing. Attila Tóth, PhD.
<b>Workplace:</b>	Institute of Landscape Architecture
<b>Field of study:</b>	Agriculture and Landscape
<b>Study program:</b>	Landscape Architecture
<b>Specialist advisor:</b>	Mgr. JUDr. Zuzana Dobšínská, PhD.
<b>Workplace:</b>	Department of Forest Economics and Management FF TUZVO
<b>Form of study:</b>	daily/external

Theses: Macroeconomic and microeconomic indicators are significantly connected with landscape architecture in the current international context of research and practice. In addition to quantitative and qualitative indicators, ecosystem services are precisely evaluated through monetary and economic indicators. The application of green infrastructure and nature-based solutions is significantly supported worldwide by Payments for Ecosystem Services. Innovative green solutions need to be supported by clear economic measurable indicators, which will be reflected both in reports and budgets of landscape architecture works, as well as in model evaluations of economic sustainability and efficiency of green infrastructure elements and nature-based solutions. The aim of the dissertation will be to examine the mutual correlations between economy and landscape architecture and to evaluate the possibilities of applying quantitative economic models and indicators in landscape architecture.

**Rationale:** The current state of knowledge and application of economic models for evaluating ecosystem services, payments for ecosystem services and direct payment schemes in Slovakia is insufficient, which results in low or impossible implementation of internationally proven and applied models and schemes. Existing software tools designed and used for elaboration of reports and budgets do not reflect the needs of the practice and performance of the profession of landscape architects, and it is necessary to expand them and develop a functional model of quantitative economic evaluation of landscape-architectural works, buildings and construction objects, with a specific focus on the possibilities of applying green infrastructure and nature-based solutions. The dissertation research will support the implementation of the interdisciplinary project KR:EK:IN, which will explore the interdisciplinary field of landscape economics that has a high novelty in Slovakia.

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## **Study of the adaptability of young tree species to salinity stress in urban conditions**

**Supervisor:** prof. Ing. Viera Paganová, PhD.  
**Workplace:** Institute of Landscape Architecture  
**Field of study:** Agriculture and Landscaping  
**Study programme:** Landscape and Garden Architecture  
**Form of study:** full-time

### **Theses:**

Salinity causes direct damage to woody plants, inhibits growth, changes the morphology and anatomy of the organism. The negative impact of salinity stress is evident at the level of the entire plant and it is manifested in failure or reduced productivity of a tree. The tolerance of woody plants to salinity changes during ontogenesis. Germinating plants are relatively tolerant, seedlings react more sensitively, and with increasing age, they gradually become more resistant to salinity. The subject of the research are selected range of urban trees and their responses to the different levels of substrate salinity in the juvenile stage of growth and verification of the conditions for their effective regeneration. The aim of the research is identification of the traits and characteristics determining the tolerance of woody plants to salinity and knowledge of the strategies applied by tree species when coping with salt stress.

### **Rationale:**

The adoption and survival of woody plants in an urban areas is limited mainly by unfavorable soil conditions. The main problems are soil drought and increased content of salt ions in the soil substrate. According to the long-term studies, the average lifespan of new tree plantings in street greenery ranges from 8 to 13 years. The results of the proposed research will be beneficial for the development of knowledge in the field of woody plant ecophysiology, as well as in social practice in the optimization of habitat conditions within the proactive management of woody plants in settlements. The topic is related to the research activities of Slovak University of Agriculture in Nitra in the field of sustainable land use and the development of measures to mitigate the effects of climate change.

**Funding:** KEGA-015SPU-4/2023 Non-traditional urban tree species -presentation of possibilities, approaches and solutions from the FieldLAB

## **Quantification of the properties and ecosystem benefits of tree species using terrestrial laser scanning and drone photogrammetry**

<b>Supervisor:</b>	prof. Ing. Viera Paganová, PhD.
<b>Supervisor/consultant:</b>	doc. Ing. Ľuboš Moravčík, PhD.
<b>Workplace:</b>	Institute of Landscape Architecture
<b>Field of study:</b>	Agriculture and Landscaping
<b>Study programme:</b>	Landscape and Garden Architecture
<b>Form of study:</b>	full-time

### **Theses:**

Trees and their stands are important elements in landscape ecosystems. They provide ecosystem services such as air pollutant removal, carbon storage and sequestration, mitigation of the urban heat islands, reduction of the stormwater runoff and other socio-economic benefits, including benefits for human health. The stabilizing influence of trees and their stands on environmental conditions is a significant contribution within adaptation strategies for climate change, both in urban settlements and in the landscape. The fundamental question is the exact quantification of these positive impacts for further planning purposes. The research goal is development and verification of the fast and reliable method for quantification of the parameters and benefits of trees (and their stands) in ecosystem services.

### **Rationale:**

In the area of quantification of the ecosystem services, current outputs are mainly at the level of estimates and empirical data, which are not universal in nature and present a high degree of variability. The topic is oriented to the precise quantification of the parameters of woody plants and the compilation of allometric equations, which allow prediction of growth increment and changes in the crown projection of woody plants. They represent the starting point for quantification of the ecosystem services and environmental benefits of trees and stands, including carbon binding. The presented topic is related to the research activities of SPU in Nitra in the field of sustainable land use, effective sensing and forecasting of changes in the ecosystems, as well as in the field of developing measures to mitigate the effects of climate change.

### **Funding:**

KEGA-015SPU-4/2023 Non-traditional urban tree species -presentation of possibilities, approaches and solutions from the FieldLAB

## **Study of the growth dynamics and growth models of non-traditional alley tree species for urban conditions**

**Supervisor:** prof. Ing. Viera Paganová, PhD.  
**Workplace:** Institute of Landscape Architecture  
**Field of study:** Agriculture and Landscaping  
**Study programme:** Landscape and Garden Architecture  
**Form of study:** full-time

### **Theses:**

The development of biodiversity in urban settlements is an important tool for their adaptation to climate change. The biodiversity development is enhanced by restoration of the original habitats and by enrichment of the species structure. The use of taxa adapted to environmental changes with low invasive potential is supposed within qualified approach to the biodiversity development. An effective way is to use species of the autochthonous flora, which have not yet found wider utilization in the urban environment. The subject of the research are biological properties of non-traditional alley tree species, their phenotypic structure, dynamics and growth models, adaptive responses to pruning and changes of the environmental conditions. The research goal is the identification of suitable phenotypes of alley trees for planting on exposed stand and the proposal of a strategy for their sustainable management.

### **Rationale:**

Currently quite narrow assortment of trees and their varieties (or cultivars) is used for plantings in the settlements and cultural landscapes. The introduction of native species is limited by availability of the assortment for planting and the lack of information about their biology, growth dynamics and risks in long-term management, especially under conditions of urban environment. The obtained growth models of trees can be applied within prediction of the future growth and development of crown projection size of trees in urban areas. The topic is related to the development of biodiversity in the landscape through management measures.

### **Funding:**

KEGA-015SPU-4/2023 Non-traditional urban tree species -presentation of possibilities, approaches and solutions from the FieldLAB

## The benefits of green infrastructure in an agricultural landscape

**Supervisor:** Dipl. Eng. Jana Špulerová, PhD.  
**Workplace:** Institute of Landscape Ecology SAS  
**Field of study:** Agriculture and landscaping  
**Study program:** Landscape architecture  
**Form of study:** daily/external

**Thesis:** The topic of PhD thesis is focused on the mapping of green infrastructure elements in the agricultural landscape and their impact on the diversity and biodiversity of the agricultural landscape and the provision of selected regulatory ecosystem services in selected case study areas. The goal of the work is the development of new, innovative, progressive approaches and methods for the assessment of ecosystems, their condition and potential, as well as the demand for the provision of selected ecosystem services. Attention should be paid to the application of the new greening measures of the common agricultural policy and the rural development program, how they contribute to the enhancement of biodiversity conditions, the mitigation of climate change, as well as the provision of other regulatory measures or cultural ecosystem services.

**Rationale:** The European Union has placed greater emphasis through the Common Agricultural Policy (CAP) over the last twenty years on the greening of agriculture to enhance biodiversity and mitigate biodiversity loss (Cullotta and Barbera, 2011). Major agri-environmental targets by 2030 include, expanding the land share of organic farming to 25%; maintaining or restoring landscape features on at least 10% of farmland. These ambitious goals require improved environmental performance of European agriculture, with many implications for the CAP (Pe'er et al., 2022). The new Strategic plan of Slovak CAP include several strategic measures to support high diversity landscape features and to mitigate climate change, therefore this study focuses on evaluating the impact of these measures and the benefits they bring to society.

### References

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**Financial coverage:** project VEGA: Research of specific landscape elements of bio-cultural landscape in Slovakia

## **Assessing woody vegetation of traditional agroforestry landscapes in the context of 21st century green infrastructure.**

**Supervisor:** Dipl. Eng. Dagmar Štefunková, PhD.  
**Workplace:** Institute of Landscape Ecology SAS  
**Field of study:** Agriculture and landscaping  
**Study program:** Landscape architecture  
**Form of study:** daily/external

Thesis: Agroforestry can be thought of as the integration of woody vegetation, crops and/or livestock on the same area of land, where the woody plants may be within the land or on the boundaries (hedgerows) (<http://www.europeanagroforestry.eu/>). Traditional, centuries-old agroforestry and poly-cultural agrarian landscapes were widespread in Slovakia, especially until the first half of the 20th century. Subsequent trends of further extensification and abandonment of their traditional management in the conditions of collectivization and intensification of agriculture since the second half of the 20th century determined the formation of specific structures of woody vegetation with high biocultural value, providing a wide range of ecosystem services (J. Špulerová et al., 2017). The PhD student will focus on the development of methods for mapping and assessing social and environmental changes as well as legislative and institutional factors influencing the current state of woody vegetation structures in traditional agroforestry systems. The work should result in proposals for the measures and management needed to maintain their biocultural values into the future. This will make use of various sources of background data including Remote Sensing data and aerial photography methods, current and historical maps, archival sources, sociological surveys, etc.

Rationale: Despite efforts to reverse this, global agriculture is gradually moving towards intensified production systems. The area of agroforestry landscapes is shrinking and their disappearance is imminent (Santoro et al., 2020). The tree species structures linked to these socio-ecological systems provide a wide range of ecosystem services. Their knowledge, conservation and restoration are of interest for the development of global and national strategies for sustainable agriculture under climate change.

Financial coverage: project VEGA: Research of specific landscape elements of bio-cultural landscape in Slovakia