1. PHD PROJECT DESCRIPTION (4000 characters max., including the aims and work plan)

Project title: Strategies of wild plant acclimation to urban environments

1.1. Project goals: The purpose of the project is to assess the strategies of wild plants acclimation to urban environments by studying physiological plant responses to urban conditions along the urban-rural continuum.

1.2. Outline

Due to the globally growing population living in cities and urban regions, urban environments became the areas of human, animal and plant coexistence. Due to dense buildings, deep excavation, common use of concrete, glass and asphalt, the urbanized areas are a challenging place for wild plant vegetation. Spontaneous plant communities are usually fragmented and pushed to the margins of urban environment, to the remnant or postindustrial areas, edges of pavements sidewalks, ruins and wall sides. There is progressive tendency to reevaluate the wild urban vegetation and to find the ways of incorporating it to the urban landscapes. It is emphasized that wild plants could contribute to creating of the sustainable green areas in urban environments. Wild plants, in a fragile and artificial ecosystem, such as the urban environment, may perform multiple ecological functions and provide numerous beneficial services. Urban vegetation may play a vital role in mitigating the urban heat island effect, supporting mental well-being among residents, and preserving biodiversity. However, some negative consequences may occur, especially if plants are badly managed or organized. In the scope of this project it will be assessed how wild plant communities adapt to the human-transformed urban environment. The mechanism of plant acclimation to the urban landscape will be studied by means of plant performance analyses, in terms of growth and photosynthetic activity, stress response, phenology, anatomy and morphology. Several species representing both herbaceous and wooden plants inhabiting selected locations, distributed along the urban-suburban-rural areas will be subjected for analysis. Plant physiological analyses will be accompanied by a comprehensive set of environmental analyses involving local climate and soil parameter analyses. Furthermore, the sociological study will be undertaken aimed on the perception of the presence of the wild flora in urbanized areas by suburban and urban inhabitants. The study will focus on the selected urban, suburban and rural settlements of Bydgoszcz-Torun Functional Area (urban region).

1.3. Work plan

First year: Survey of the target region for the areas of wild vegetation along the urban-rural continuum. Analysis of plant communities on the selected areas. Selection of the target plant species. Preparing the map of the areas selected for study. Delimitation of study key sites.

Second year: Performing plant physiological and environmental analysis during the first season. Assessing plant phenology phases during the first season. Collecting material for histoanatomical and biochemical analyses.

Third year: Performing plant physiological and environmental analysis during second season. Assessing plant phenology phases during second season. Collecting material for histoanatomical and biochemical analyses.

Fourth year: Sociological study. Writing publications and PhD thesis.

1.4. **Literature** *(max. 7 listed, as a suggestion for a PhD candidate preliminary study)*

Perpiña Castillo, C., van Heerden, S., Barranco, R., Jacobs-Crisioni, C., Kompil, M., Kučas, A., Aurambout, J. P., Batista e Silva, F., & Lavalle, C. (2023). Urban–rural continuum: an overview of their interactions and territorial disparities. Regional Science Policy & Practice, 15(4), 729–768.

Calfapietra C, Peñuelas J, Niinemets Ü. Urban plant physiology: adaptation-mitigation strategies under permanent stress. Trends Plant Sci. 2015 Feb;20(2):72-5.

Kisvarga, S.; Horotán, K.; Wani, M.A.; Orlóci, L. Plant Responses to Global Climate Change and Urbanization: Implications for Sustainable Urban Landscapes. Horticulturae 2023, 9, 1051.

Fineschi S and Loreto F (2020) A Survey of Multiple Interactions Between Plants and the Urban Environment. Front. For. Glob. Change 3:30.

Kennedy C (2022) Ruderal Resilience: Applying a Ruderal Lens to Advance Multispecies Urbanism and Social-Ecological Systems Theory. Front. Built Environ. 8:769357.

Kowarik, I. (2005). Wild Urban Woodlands: Towards a Conceptual Framework. In: Kowarik, I., Körner, S. (eds) Wild Urban Woodlands. Springer, Berlin, Heidelberg.

Del Tredici, Peter. (2014). The Flora of the Future. Places Journal. 10.22269/140417.

1.5. Required initial knowledge and skills of the PhD candidate

GIS, sediment and environmental data analyses, basics of social sciences and urban studies, principles of plant physiology

1.6. Expected development of the PhD candidate's knowledge and skills

Techniques in plant ecophysiology, plant stress physiology and biochemistry analysis