

THE IMPORTANCE OF COMPOSED TREE FORMS IN RURAL AND URBAN ENVIRONMENTS

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Abstract

Vegetation, present in both urban and rural environments, constitutes a critical component that significantly enhances environmental conditions and ecological balance. High vegetation exerts a substantial influence on local climate and environmental quality and shapes the physiognomy of landscape sequences. When arranged in diverse spatial configurations, vegetation fulfills a wide range of functions, including biological, technical, aesthetic, and social roles. The effectiveness of composed tree stands is determined by the careful selection of species and the design of planting structures, encompassing both spatial composition and the internal structure of individual forms.

Key words: composed forms of trees, urban greenery, rural areas, mid-field woodlots, ecological balance of the landscape

Introduction

Vegetation in both urban and rural settings is a fundamental component that improves environmental conditions and supports ecological balance. Tall vegetation has a significant impact on climate regulation, environmental quality, and the visual character of landscape sequences. In urban areas, greenery softens architectural rigidity, reduces visual monotony, and enhances residents' well-being. In agricultural landscapes, which are often extensively modified and lack substantial forest complexes, integrated tree systems - such as those in fields, along roads, and near watercourses - provide environmental and economic stability, including positive effects on crop production [Fortuna-Antoszkiewicz 2019].

Greenery organized in diverse spatial configurations fulfills a range of documented biological, technical, aesthetic, and social functions [e.g. Hejmanowski et al. 1964; Niemirski 1973; Karg, Karlik 1993; Łuczyńska-Bruzda 1995; Karg 2003; Bell, Treshow 2004]. The effectiveness of composed tree stands for specific objectives relies on the careful selection of species and the design of planting structures, including spatial composition and internal structure [e.g. Milewski, Hejmanowski 1965]. Continuous observation and analysis of natural and anthropogenic landscape processes provide increasingly detailed insights. Long-term evaluation of design solutions and their outcomes expands the cognitive spectrum [e.g. Fortuna-Antoszkiewicz, Łukaszkiwicz 2018; Fortuna-Antoszkiewicz et al. 2018].

Material and methods

From 2015 to 2025 (ongoing), comprehensive research has been conducted on various forms of composite woodlots in both urban and rural contexts. Observations have focused on trees of different types and sizes, examining their functional roles, distribution patterns (as independent elements or within larger systems), and spatial structures, including complexity and species composition. Analyses have also considered habitat conditions, spatial context (such as surrounding development and available space for tree growth), and the condition of selected woodlots (including estimated age and tree health). This research has enabled evaluation of the effectiveness of different composite woodlot forms, with findings continuously validated or updated, and has been supported by a systematic review of relevant literature.

Results

To fulfill their intended functions, composed tree stands require appropriate **structural arrangement** at both the object and landscape (area) scales:

1/ Object scale:

- spatial forms: single trees, groups, rows, strips, patches;
- internal structure of individual forms: varied width, density, vertical arrangement – ensuring better tree exposure and favorable conditions for tree and shrub growth (less competition for nutrients);

2/ Landscape scale (area scale):

- spatial rigor within a given area: wooded areas with a specific structure, appropriately positioned relative to each other and the surrounding areas.

In agricultural areas, the following tree forms can be distinguished (following the basic classification by Hejmanowski et al. 1964):

- *a individual form* – individual trees or shrubs (solitary trees), loosely distributed among fields, meadows, and pastures;
- *group form* – trees and shrubs in small clusters of any shape; occupying an area of up to 10 ares; composed of several to a dozen or so trees or trees and shrubs (Fig. 1);
- *a surface form* – groupings of trees and shrubs on an area exceeding 10 ares; located near cities, they can over time be incorporated into urban greenery resources and, after appropriate adaptation and reconstruction, transformed into so-called landscaped greenery (Fig. 3);
- *a row form* – a single row of trees or trees and shrubs; may occur as a single-sided or double-sided form, e.g., in the case of roadside or waterside trees; it is derived from natural linear arrangements (e.g., along watercourses), but in composed arrangements, it usually takes the form of a regular form (Fig. 5);
- *a belt form* – linear groupings of trees and shrubs in an irregular arrangement or in multi-row arrangements; The width of the strip in composed shelterbelt structures does not exceed 10 m.

Row and strip forms can also be built exclusively with shrubby plants → *hedges*: low hedges up to 1.0 m high; medium hedges 1.0-3.0 m high; tall hedges exceeding 3.0 m high (example: southern England – hedges, systematically and precisely connected in large areas, constitute the characteristic, traditional landscape of the local countryside).

The forms of shelterbelts located in rural areas find their counterparts in urban spaces (Fig. 1-6), where they have been given a slightly more refined and precise form, derived from classical elements and spatial arrangements used, for example, in 18th- and 19th-century parks and gardens [Fortuna-Antoszkiewicz 2019]:

- *a solitary tree* - it is a single tree or large shrub growing in a specific space within a landscaped interior. They occur in gardens, open landscapes, and urban areas. They are planted to create a specific effect (image, mood), and in such cases, they are valuable specimens from a dendrological and aesthetic perspective. They can also appear as spontaneous, accepted self-seeds that enrich the spatial composition (complementary elements with a spatial subdominant character, a form of opposition, and a type of visual information) (Fig. 2);
- *a group* – it is several or a dozen trees or shrubs that form a cohesive composition (a distinct volume) within a specific space within a landscaped interior. It can take various forms, taking into account formal and structural considerations (free or regular, loose or compact arrangement) (Fig. 4);
- *an avenue* – it is a pedestrian or vehicular path lined with regular rows of trees. It is one of the fundamental components of sophisticated garden compositions and urban designs, and can stand alone as a spatial structure with a rigorous composition (e.g., a street alley) (Fig. 6).
- *an espalier* – it is a regular, usually single-row arrangement of trees. In a garden, it typically takes the form of a compact wall exceeding 220 cm in height, and in an urban setting, it may serve as a single-sided border for a street or square. *Hedges*, or single- or multi-row, dense plantings of trees or shrubs up to 220 cm in height, are derived from espaliers. They can be shaped (trimmed) or unshaped, and can be single- or multi-species.

Woodlots vary in their **spatial construction** (vertical and horizontal) and **species selection**, which significantly influences their form [e.g. Hejmanowski et al. 1964, Fortuna-Antoszkiewicz 2019]. The spatial construction is determined by **the vertical structure** (story structure) and **the horizontal structure** (the arrangement of plants and the mixing of individual species). **The vertical structure** includes:

- single-story woodlots – where the trees exhibit little height variation, and the tree crowns are set at a similar level;
- two-story woodlots – where the trees form two distinct layers (story) of different heights, with the treetops of the lower story only slightly penetrating the upper story;
- multi-story woodlots – where the tree crowns interpenetrate.



Fig. 1: A single tree - *individual form* in a rural area, southern England / *Quercus robur* L. (photo: B. Fortuna-Antoszkiewicz)



Fig. 2: A *solitary tree* in an urban space, Warsaw / *Phellodendron amurense* Rupr. (photo: B. Fortuna-Antoszkiewicz)



Fig. 3: A loose group of trees - *surface form* in a rural area, southern England (photo: J. Łukaszkiwicz)



Fig. 4: A *group of trees* in an urban space, London (photo: B. Fortuna-Antoszkiewicz)



Fig. 5: An *avenue - row form of trees* in a rural area, central Poland (photo: B. Fortuna-Antoszkiewicz)



Fig. 6: An *avenue* in an urban space, Warsaw (photo: B. Fortuna-Antoszkiewicz)

When planning multi-story tree stands, it is necessary to consider the intended form and primary function, as well as to select tree and shrub species according to their biological characteristics (such as attainable size, growth rate, and root system type) and habitat requirements (including soil, water, and sunlight). Multi-story systems facilitate landscape integration due to their similarity to natural plantings and enhance environmental stability by providing greater system resilience and improved soil shading. These systems can be applied to all types and forms of tree stands; even the simplest single-row planting can incorporate multi-species, multi-story arrangements.

The horizontal arrangement is the spacing of individual plants (trees and shrubs) within a shelterbelt. This spacing depends on various factors – soil fertility, the species of trees and shrubs used, and the form and internal structure of the shelterbelt.

In terms of a **species composition**, single-species (monoculture) or multi-species (a composition of at least two different tree and shrub species, with various species mixes) are common. An effective species arrangement in a so-called tiered shelterbelt consists of trees and shrubs and typically contains about 90% primary species and about 10% admixed species. The species composition of shelterbelts depends primarily on specific spatial and habitat conditions (water, soil, climatic conditions, topography). For a long time, native species characteristic of a given area have been primarily used. The more species-diverse the woodlots (trees and shrubs), the richer the biological life of other organisms (increasing biodiversity [EU Biodiversity Strategy 2030: Bringing nature back to our lives [COM(2020)0380], 2020]) and the greater the environmental stability. The appropriate selection of tree and shrub species determines not only the effectiveness of various types of woodlots, but also their durability and impact on the landscape's physiognomy, both in cities and rural areas [The European Landscape Convention, 2006].

The species composition of tree stands, combined with appropriate spatial structure (compactness), provides measurable social and ecological benefits. For example, **luminous stands** in urban parks enhance resident comfort by increasing safety and ensuring optimal lighting, thermal conditions, ventilation, and atmospheric air composition [e.g. Łukaszkiwicz 2019; Łukaszkiwicz et al. 2018; Bamwesigye et al. 2021]. In agricultural areas, more open, fully lit stands promote increased honey yields in certain tree species, as their crowns are more developed and bloom more abundantly than in compact stands [e.g. Fortuna-Antoszkiewicz, Łukaszkiwicz 2012, 2017]. This, in turn, supports the protection of bees and other pollinators, which is particularly important in the context of global concerns.

Conclusions

In both urban and agricultural areas, distinct spatial plant elements are formally and structurally analogous. This is evident in observations of various tree planting forms, such as those in the consistently maintained English landscape, where agricultural areas feature spatial forms similar to garden structures derived from classical landscape park compositions [Fortuna-Antoszkiewicz, Łukaszkiwicz 2016]. In these contexts, the agricultural landscape merges with garden spaces, contributing to a broader landscape composition aligned with the 18th-century concept of the "park landscape" in wooded agricultural regions. For composed trees used for specific purposes, regardless of their urban or rural location, effectiveness in aesthetic-spatial, functional-technical, and ecological-landscape terms is determined by the appropriate selection of species and planting structure, taking into account both spatial composition and the internal structure of individual forms.

References

- Bamwesigye D., Fialová J., Kupec P., Łukaszkiwicz J., Fortuna-Antoszkiewicz B. (2021). *Forest Recreational Services in the Face of COVID-19 Pandemic Stress*. *Land*, 2021, 10(12): 1347
- Bell J. N. B., Treshow M. (2004). *Air pollution and plant life*. Ed. Wydawnictwo Naukowo-Techniczne, Warsaw
- EU Biodiversity Strategy 2030: Bringing nature back to our lives [COM(2020)0380], of May 20, 2020
- Fortuna-Antoszkiewicz B. 2019. *Vegetation in spatial composition - values and preservation of heritage*. Ed. SGGW Publishing House, Warsaw
- Fortuna-Antoszkiewicz B., Łukaszkiwicz J. (2012). *Fruit trees plantings along roads in Poland – tradition and present (19th / 20th century)*. *Czasopismo Techniczne*, Issue 30, Year 109: 127-136
- Fortuna-Antoszkiewicz B., Łukaszkiwicz J. (2016). *Genesis and characteristics of woodlot forms in the landscape of southern England*. *Nauka Przyroda Technologie* 2016, Vol. 10, Issue 4, #50: 1-18
- Fortuna-Antoszkiewicz B., Łukaszkiwicz J. (2017). *Fruit alleys – the way of historical rural landscape creation in Poland*. *Miškininkystė Ir Kraštotvarka, Forestry And Landscape Management* 2017 1 (12): 15-24
- Fortuna-Antoszkiewicz B., Łukaszkiwicz J. (2018). *The historic alley complex in Radziejowice - the cultural heritage of Mazovia. Evaluation of the state of preservation and value of the object*. *MAZOWSZE Studia Regionalne*, No 24: 63-83
- Fortuna-Antoszkiewicz B., Łukaszkiwicz J., Wiśniewski P. (2018). *Preservation status and landscape values of poplar plantations of the Żerański Canal - a methodological case study*. *MAZOWSZE Studia Regionalne*, No 2018/27: 81-102
- Hejmanowski, S., Milewski, J., Terpiński, Z. (1964). *The tree-grower's guide*. Ed. PWRiL, Warsaw
- Karg J., Karlik B. 1993. *Afforestation in rural areas*. Ed. Zakład Badań Środowiska Rolniczego i Leśnego PAN, Poznań
- Karg J. (2003). *Mid-field plantings, buffer zones and field margins. Agri-environmental programme*. Ed. The Ministry of Agriculture and Rural Development, Warsaw

Łukaszkiwicz J. (2019). *Tree plantings in the city landscape: selected aspects of shaping the structure and functions*. SGGW Publishing House, Warsaw

Łukaszkiwicz J, Fortuna-Antoszkiewicz B, Rosłon-Szeryńska E, Wiśniewski P. (2018). *Shaping of tree stands in large parks in Europe for the needs of optimal recreational bioclimate, biodiversity and ecological sustainability*. Global Journal of Engineering Science and Researches. 2018, 5(12):63-86

Łuczyńska-Bruzda M. (1995). *Afforestations in an open landscape. Ecological and cultural reasons for afforestation in an agricultural landscape in the light of the literature on the subject*. Ed. Ośrodek Ochrony Zabytkowego Krajobrazu Narodowa Instytucja Kultury, Warsaw

Milewski J., Hejmanowski S. (1965.) *Trees and shrubs used in woodlots*. Ed. PWRiL, Warsaw

Niemirski W. (ed.). 1973. *Shaping green areas*. Ed. Arkady, Warsaw

The European Landscape Convention, Journal of Laws of 2006 No. 14, item 98

Souhrn

Vegetace, která se vyskytuje jak v městském, tak ve venkovském prostředí, představuje klíčovou složku, která významně zlepšuje podmínky životního prostředí a ekologickou rovnováhu. Vysoká vegetace má podstatný vliv na místní klima a kvalitu životního prostředí a utváří fyziognomii krajinných sekvencí. Je-li uspořádána do rozmanitých prostorových konfigurací, plní vegetace širokou škálu funkcí, včetně biologických, technických, estetických a sociálních rolí. Účinnost komponovaných stromových porostů je dána pečlivým výběrem druhů a návrhem výsadbových struktur, zahrnujícím jak prostorovou kompozici, tak vnitřní strukturu jednotlivých forem.

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