

# PLANTING DESIGN FOR RESILIENT LANDSCAPES: THE ROLE OF CONIFERS, DECIDUOUS AND PERENIAL PLANT GROUPINGS IN ECOLOGICAL LANDSCAPE ARCHITECTURE

## COMPOZIȚII VEGETALE PENTRU PEISAJE REZILIENTE: ROLUL GRUPĂRILOR DE CONIFERE, ARBORI FOIOȘI ȘI PLANTE PERENE ÎN ARHITECTURA PEISAJULUI ECOLOGIC

**SANDU Tatiana<sup>1</sup>, VLADIMIR(ASIMINEI) Ina<sup>1\*</sup>,  
BERNARDIS Roberto-Renato<sup>1</sup>, BĂDEANU Marinela<sup>1</sup>**

\*Corresponding author e-mail: ina.asiminei@gmail.com

### **Abstract.**

*Resilient landscapes represent a hot topic in current research and rely on the integration and planning of plant groupings that provide not only beauty but also significant ecological value. Responding to the growing emphasis on resilient landscapes, the study assesses the contribution of conifers, deciduous trees, and perennial plants in harmonizing visual impact with the ecological benefits provided to the space. Based on design principles for different categories of spaces, several compositions were proposed and their impact on visual quality, as well as the ecological benefits generated, were evaluated. The study demonstrates that certain aesthetic and ecological effects arise only from specific groupings or species, and altering even a single element can compromise the outcome. This knowledge guides the proper mixing of plant groupings in both public and private designed spaces. Moreover, integrating this understanding into large-scale management strategies enables the creation of ecologically rich landscapes.*

**Key words:** resilient landscapes, planting design, ecological benefits

### **Rezumat.**

*Peisajele reziliente reprezintă un subiect de interes major în cercetările actuale și se bazează pe integrarea și planificarea grupărilor de plante care oferă nu doar frumusețe, ci și o valoare ecologică semnificativă. Ca răspuns la accentul tot mai mare pus pe peisajele reziliente, studiul evaluează contribuția coniferelor, arborilor foioși și plantelor perene în armonizarea impactului vizual cu beneficiile ecologice aduse spațiului. Pe baza principiilor de design pentru diferite categorii de spații, au fost propuse mai multe compoziții, iar impactul acestora asupra calității vizuale și beneficiile ecologice generate au fost evaluate. Studiul demonstrează că anumite efecte estetice și ecologice apar doar din*

---

<sup>1</sup> "Ion Ionescu de la Brad" Iasi University of Life Sciences, Romania

*grupări sau specii specifice, iar modificarea chiar și a unui singur element poate compromite rezultatul. Această cunoaștere ghidează mixarea corectă a grupărilor vegetale în spațiile amenajate publice și private. Mai mult, integrarea acestei înțelegeri în strategiile de management la scară largă permite crearea unor peisaje bogate ecologic.*  
**Cuvinte cheie:** peisaje reziliente, compoziții vegetale, beneficii ecologice

## INTRODUCTION

The term resilient landscape expresses the convergence of ecological performance and aesthetic experience. Landscape design is often analyzed from two antagonistic perspectives – aesthetic or scientific, rarely a synthesis of the two. Given the pressures of the present and climate issues, it is imperative that the landscape should be able to respond to both cultural and ecological needs without compromising the historical value of the plant heritage [Yang *et al.*, 2014; Cervetto *et al.*, 2025].

This paper aims to investigate the interaction between the aesthetic and ecological dimensions of a landscape. The study aims to introduce the concept of a functional framework [Tveit and Ode Sang, 2014] for the analysis of existing or planned plant compositions in a historical landscape site, demonstrating its applicability in a case study, namely the Copou Garden in Iași.

We argue that to enhance the resilience of a heritage landscape, is needed an interdisciplinary approach that combines ecological function, aesthetic character and social dynamics. Historic landscapes - although often perceived as a passive element of an environment - fulfill the role of an active system, contributing intensively to the sustainability, well-being and ensuring the continuity of an ecosystem [Swaffield and McWilliam, 2013]. But to maintain viability, a heritage site requires an integrated methodology that addresses the cultural perception of the population, the appropriate use of space and ecological resilience.

The three interdependent aspects underlie the recommendation of the six key elements of the proposed functional framework to be used as a practical tool in landscape resilience analysis.

## MATERIAL AND METHOD

The methodology of the study in question included three main stages: the study of bibliographic literature, historical photo-documentation and the realization of field observations. An investigation of the specialized sources that address the theme of the study was carried out, achieving an interdisciplinary synthesis of information from fields such as – urban ecology, landscape architecture, urbanism, vegetal design. This analysis allowed the identification of key elements, relevant for defining an analysis system, with the aim of correlating the aesthetic dimension with the ecological one.

In order to determine both aesthetically and ecologically efficient landscaping solutions, field investigations would be conducted, analyzing plant structures in parks, gardens or other urban spaces in Romania. The key elements pursued in the visual

documentation were: the way plants are grouped in compositions, the association of textures and seasonal rhythms, the user's interaction with the plant framework.

A functional framework is a carefully structured method for analyzing the ecological resilience and cultural correspondence of existing or proposed landscapes [Yang *et al.*, 2014]. The proposed six elements - Method, Application, Consequences, Association, Aesthetics, Necessity - offer a new perspective on landscape assessment and development.

For testing the respective matrix and conducting field observations, the Copou Garden in Iasi was selected.

## RESULTS AND DISCUSSIONS

Copou Garden is considered the oldest public park in the city of Iași, its first beginnings dating back to 1832, with the application of the Organic Regulation, which raised the issue of implementing spaces with a specific character, intended either for parade squares or public promenade gardens [Ciubotaru, 2015].

The location chosen for the garden presented a major advantage in its subsequent evolution, being located on Podul Verde Street, where the houses of the most prominent aristocratic families were located, walks in the garden becoming true festivities, and the park - an aristocratic sitting translated into nature [Ciflâncă, 2006]. In the context of the vegetation study, we cannot fail to mention the various plant palette proposed for planting in the period 1840-1860, namely: ash trees, poplars, sycamores, elms, hazels, chestnuts, rowan trees, honeysuckle, birches, blood oaks, hornbeams, lime trees [Ciubotaru, 2015].

Following bibliographic research, we can conclude that historic gardens embody a strong historical significance, being a true plant heritage, however, which faces current challenges related to resilience capacity. Among the consequences of this reality, we can observe the fragmentation of the spatial coherence of the site, the aging and degradation of secular vegetation and the lack of biodiversity (Figure 1).



**Fig.1.** The current state of the park

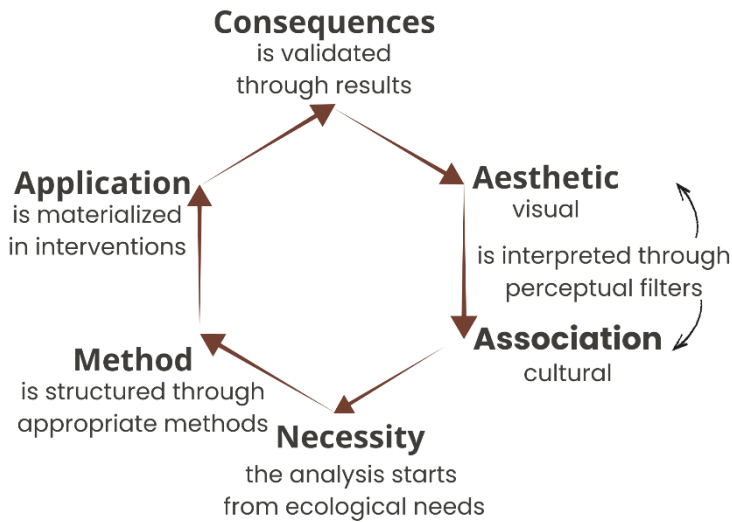
We affirm that in order to obtain both culturally and ecologically relevant landscapes it is imperative to use such analysis tools as the functional matrix (Figure 2). Starting from the Basic element, namely the Necessity - the analysis will start from the ecological need of the space, which will establish the basic

requirements that condition the viability and sustainability of the analyzed or proposed for the implementation landscape.

To determine this need, the analysis must be structured using appropriate methods depending on the role and characteristics of the analyzed landscape.

Application represents the transposition of the analysis results into concrete solutions.

Consequences reflect the effects generated by the intervention, serving as indicators for evaluating ecological and social performance, and their interpretation is carried out through perceptual (Aesthetic) and cultural (Association) filters.



**Fig.2.** The proposed methodological framework

Although the historical character of the park is largely preserved spatially, without significant changes, we observe that its ecological resistance remains insufficiently addressed, and unsuitable maintenance methods reduce the lifespan of the site.

Bibliographic studies demonstrate that a historical park requires not only static conservation, treating it as a monument - but as a dynamic organism, with spatial, ecological and social relationships [Lian *et al.*, 2024]. Thus, although we preserve the incipient spatial structuring of the park, its design and maintenance practices must target the most diversified plant structures, capable of supporting essential functions such as pollination, microclimate regulation and being, at the same time, adapted to urban stress [Fernandes *et al.*, 2025].

Essential aspects missing in Copou Park (Figure 3) concern the absence of a coherent green register, which would allow the inventory, assessment and monitoring of the state of existing vegetation, including changes regarding the appearance or disappearance of some species, as well as the condition of the root

system. This lack reduces the capacity for substantiated intervention and adaptive management of the space.

At the same time, there is an excessive use of annual plants, which requires frequent horticultural work and generates a constant disturbance of the soil structure. Their inadequate positioning leads not only to a plant composition lacking visual coherence and functional stratification, but also to the direct damage to mature trees, through plantings carried out in the immediate proximity of the trunks, which involves repeated digging and damage to the root system.

In addition, the expansion of lawn areas, recognized as a major consumer of water and maintenance resources, increases the pressure on the park's ecosystem, contrary to current principles of sustainability and ecological regeneration.



**Fig.3.** The inadequate plant choices and the expansion of lawn areas

Regarding the analysis method, it is recommended to carry out a spatial mapping of the site, using tools such as GIS, which would allow a detailed understanding of the way in which space is used and the distribution of vegetation over time. The ecological assessment would facilitate the observation of the evolution of relevant factors, such as tree vitality, the presence and dynamics of biodiversity, as well as pedological changes.

In addition, functional mapping would contribute to the identification of areas heavily frequented or avoided by users, sectors exposed to sun or shade and to the analysis of the distribution and functioning of the alley network.

The application of the necessary interventions, established following the methods used, will generate concrete design strategies and policies – specific for historical parks. Studies [Russo *et al.*, 2025; Hüttl *et al.*, 2019] demonstrate that the sustainability of heritage gardens is based on the integration of plant compositions formed by species adapted to current conditions, on the achievement of an appropriate zoning of the site and on soil regeneration methods. In particular, for the Copou Garden we propose the introduction of layered compositions (Figure 4) and the redefinition of the shrub layer, the integration of conifer species with cultural symbolism, the reduction of water consumption and the protection of historical trees.



**Fig.4.** Examples of layered compositions

In this way, the consequences of the resilient design integrated into the site will balance ecological aesthetics with cultural continuity. As the sources emphasize [Olivadese and Dindo, 2022], complementing biodiversity with a place-specific sensory palette, intended to be permanently imprinted in the memory of visitors, will generate an emblematic landscape, capable of combining cultural value, visual experience and ecological function, offering continuity to future generations. Although the space evokes important symbols, such as the Eminescu Linden Tree, the potential of the garden goes beyond this individual element, so it is important to ensure both aesthetic functionality and national spirit of the entire space, redefining the Copou Garden as a living heritage landscape.

## CONCLUSIONS

Historical parks should not be perceived as monuments unchanged over time, but as living ecosystems with interdependent structural, social and ecological relationships. To achieve this result, a change in conservation strategies is necessary, with an emphasis on ecological optimization and revitalization of the site's biodiversity.

It is imperative to move beyond the conventional categorisation of ecological and aesthetic aspects into two distinct categories. Instead, landscape resilience is about combining them in a context where beauty derives from the ecological coherence of the site, which in turn is supported by visual and cultural acceptance.

In the process of designing compositions with increased resilience, the careful integration of conifer, deciduous and perennial species represents a fundamental pillar in ecological landscape architecture.

The proposed methodological framework has the potential to be an applicable, practical and educational tool, useful for analyzing, creating and maintaining public green spaces as well as for study in specialized educational institutions.

REFERENCES

1. Cervetto M., Guti rrez O., Norbis W. et al., 2025 – *The role of aesthetic beauty of natural landscapes in supporting conservation efforts*. *Discovery Environment* 3, 92.
2. Ciof ncă I., 2006 – *Gr dinile publice din Iași  n a doua jum tate a secolului XIX*. Anuarul Institutului de Istorie »A.D. Xenopol« - Iași 43+44:215-222.
3. Ciubotaru M., 2015 – *Gr dinile publice din Iași  n secolul al XIX-lea*. *Lucr rile Simpozionului Național Monumentul*, XVI.
4. Fernandes B., Silva L., Costa D., 2025 – *Greening urban landscapes: A systematic review on urban forests and biodiversity*. *Urban Forestry & Urban Greening* 107.
5. H ttl R.F., David A., Schneider B.U., 2019 – *Historic gardens and climate change: Insights, desiderata and recommendations*. *Global Change and the World's Heritage* pp. 59–72. Springer.
6. Lian J., Nijhuis S., Bracken G., Wu X., Wu X., Chen D., 2024 – *Conservation and development of the historic garden in a landscape context: A systematic literature review*. *Landscape and Urban Planning*. 246.
7. Olivadese M., Dindo M.L., 2022 – *Historic and Contemporary Gardens: A Humanistic Approach to Evaluate Their Role in Enhancing Cultural, Natural and Social Heritage*. *Land*, 11(12), 2214.
8. Russo A., Esperon-Rodriguez M., St-Denis A., Tjoelker M.G., 2025 – *Native vs. Non-Native Plants: Public Preferences, Ecosystem Services, and Conservation Strategies for Climate-Resilient Urban Green Spaces*. *Land*, 14(5), 954.
9. Swaffield S.R., McWilliam W.J., 2013 – *Landscape aesthetic experience and ecosystem services*. *School of Landscape Architecture, Lincoln University*, (2.6), 349-362.
10. Tveit M.S., Sang A.O., 2014 – *Landscape assessment in metropolitan areas–developing a visual indicator-based approach*. *Spool*, 1(1), 301-316.
11. Yang J., Zhang Y., Wang X., 2014 – *Combining aesthetic with ecological values for landscape sustainability: A systematic assessment framework*. *PLOS ONE*, 9(7).