

IMPORTANCE OF VEGETATION SUCCESSION IN URBAN GRASSLANDS

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Abstract

Urban meadows have begun to become interesting for authorities in urban areas, including in our country, who are starting to support such landscaping solutions, not only for marginal areas but also for central areas of cities. Vegetation succession is an important phenomenon for restoring urban grassland vegetation as a functional habitat. Their importance consists in the setting of native species, the best adapted for the site conditions. Thus, succession is of great importance for obtaining sustainable and resilient urban grassland habitats able to provide environmental services for the human communities from their vicinity. Urban grasslands are exposed to the influence of natural and anthropogenic factors that are directing vegetation succession, having similarities with managed permanent grassland ecosystems. The anthropogenic factors implied in the appearance of the floristic composition of urban grasslands are usually mowing frequency, the addition of seeds, the removal of clipping, etc. Thus, the natural factors involved in the increase of the biodiversity in urban grassland canopy can be wind, birds, seed reserves in the soil etc.

Keywords: urban grassland, succession, functional landscape, resilient green space, urban natural habitat.

INTRODUCTION

The expansion of urban areas worldwide is associated with the increase of hard and paved areas with a serious impact on the natural fluxes. The most popular solution applied for the greening of urban areas is classical turf but with a high demand for energy and resources for maintenance (Ng *et al.*, 2015; Sărăţeanu *et al.*, 2023).

According to Klaus (2013), urban grasslands are able to provide numerous services for our society as environmental, recreational, social

and even financial. From the environmental services, the potential support of local biodiversity makes the urban grassland ecosystem proper for development and conservation.

Urban grassland parks are permanent green spaces, sometimes several decades old, that provide residents with recreational spaces. They are characterized by predominant grassy vegetation and scattered woody vegetation. The most important factor disturbing

them is heavy traffic and frequent mowing. For this reason, they have very disturbed soil. In these parks, the vegetation is usually mowed several times a year (Sărățeanu *et al.*, 2023).

As an example, the diminishing mowing frequency determines the increase of biodiversity in a lawn, directing its evolution to an urban grassland (Sehrt *et al.*, 2020) and being a driver for vegetation succession.

Periurban grasslands are habitats with a generally larger surface area compared to parks. They are located around built-up areas of cities, being old agricultural lands or abandoned industrial areas, in a medium successional stage. The age of the vegetation cover of these areas is characterized by spontaneous regeneration of vegetation. Such urban grasslands can be compared with semi-natural grasslands due to the role played in the preservation of biodiversity (Güler, 2020).

Fisher *et al.* (2012) have investigated the potential of wastelands and degraded soils with stones and brick content from urban areas in the development of low-maintenance urban grasslands rich in species. Thus, they have used regional seeds, adapted to the ecological conditions, with very good results. Their results proved the hypothesis, showing that rare grassland species can be persistent in such habitats, even in conditions with high rates of ruderal species.

Also, the obtained urban grasslands were able to provide ecological services; but also provided recreational areas appreciated by the residents with psychological and social benefits. Thus, restoration of urban grasslands in wastelands and highly degraded urban land improves the urban landscape and environment.

Thus, the research developed by Ng *et al.* (2015) on the CO₂ rates of respiration were higher in turf than in grassland. Also, they have hypothesised that urbanisation and, implicitly, the increase in the turf area will influence the urban atmospheric CO₂ rates.

According to Hejkal *et al.* (2017), the connectivity of the urban grassland patches is very important for the self-sustaining of the habitat networks from urban areas. This theory has explored the functional connectivity between public urban grassland patches considering the patch size and distance between patches. In the same context, different plant species groups were investigated from the perspective of dispersal distance, respectively 2m, 20m, 44m and 100m. Thus, it was confirmed that the graph theory is a proper tool for analysing habitat connectivity.

Urban grasslands with high biodiversity can be used to educate the public regarding the importance of nature conservation by experiencing it personally. The access of the inhabitants from big cities to natural habitats is often

limited. Thus, urban grasslands can be a great option for their experience with nature (Dresseno *et* Overbeck, 2013).

In Mediterranean countries could be difficult to implement the concept of urban grassland as an alternative to turf, but literature recommends lawn mixtures of grasses and legumes that shall be mown quite frequently and remove the clippings. The motivation is to reduce the risk of fire propagation (Monteiro, 2017).

The purpose of this work was to analyse the literature resources referring to the implications of the setting of resilient and functional urban grasslands from the perspective of the impact of the vegetation succession process.

Practically, this paper intends to present the data from the literature

that emphasize the role of the natural process of vegetation succession in obtaining cheaper and easier sustainable and resilient green spaces inside the anthropic environment of the cities suffocated by hard surfaces. There is a high demand for environmental services in the urban environment, the grassland being one of the more convenient solutions in many situations of landscape design. Thus, the need for responsible management of the resources fits with the use of urban grasslands as an alternative to the classical turf. Such designs demand knowledge in grassland science, so landscapers should collaborate with specialists from this field to obtain the best results in creating functional and resilient urban grasslands.

DISCUSSIONS

Literature referring to the succession process involved in the establishment and evolution of urban grassland ecosystems is very poor; there are only a few documents in this field that are approaching this topic.

Urban grasslands can be assimilated with managed permanent grasslands from the perspective of vegetation cover composition, dominated by native plant species. In the urban area, they are most often the result of vegetation succession from old fields. Management of urban grasslands by mowing prevents, in general, the

encroachment of shrubs and woody vegetation. The mechanical removal of shrubs and tumps can create patches of bare soil where occur annual weeds and even invasive species such as *Ambrosia artemisiifolia* (Greller *et al.*, 2000).

Rudolph *et al.* (2016) show that species richness is influenced by the maintenance intensity of urban grasslands, such as frequent mowing. However, the habitat conditions in most of the studied areas had proper abiotic conditions for the existence of a greater number of species that can be introduced in

different manners in the urban grassland habitat.

In research performed in Sweden, several methods of creating urban grasslands rich in meadow species were tested. The main conclusion was that long-term research is needed to look closer at the impact of natural factors and management on the urban grassland floristic composition (Mårtensson, 2017).

Research by Quintana *et al.* (2024) shows that urban habitats represent new opportunities to study natural processes such as vegetation succession. Thus, the research focused on the changes that occur during vegetation succession from the dominance of annual to perennial species in periurban green spaces in the Mediterranean area. The most important aspect highlighted was the fact that the soil had a significantly higher carbon content with the increase in the participation of perennial species in the vegetation cover. Thus, the research demonstrated that through the natural succession of the vegetation cover in green spaces, certain ecosystem services such as soil carbon storage, water regulation and nutrient cycling are improved.

A study developed over five years showed that seeding a mixture of species to cover well the soil surface can become rich in species and prevent the colonization of weeds due to the evolution of the floristic composition. The obtained prairie-like vegetation cover had a

better appearance during the cold season and a pleasant spring flowering appearance (Hitchmough *et al.*, 2017).

Research conducted in the Chicago metropolitan area demonstrated that green space areas in advanced successional stages, i.e. minimally maintained for at least 10 years, had a significantly higher soil organic carbon content compared to classically maintained green spaces (Yost *et al.*, 2016).

In addition to enriching the soil with organic matter, vegetation succession contributes significantly to increasing biodiversity in urban areas, as most green spaces are in early successional stages, characterized by the presence of large numbers of both annual and perennial species (Niemelä, 1999).

Research that analysed different types of urban grasslands in historic centres of 32 European cities, from those in early succession to mid succession, from the perspective of factors influencing floristic composition, showed that variation in species composition is mainly influenced by habitat type (Lososova *et al.*, 2012).

Deák *et al.* (2016) found that the mid-successional peri-urban grasslands have higher biodiversity compared to intensively managed urban grasslands from recreational sites. Thus, the vegetation from parks was dominated by early-successional species, while in peri-urban grasslands were dominant mid-successional species. Such

successional urban grasslands can be restored by using local seeds from species with high adaptability to the urban environment and by applying proper management. Also, can be a potential pool of biodiversity for the restoration of other urban grasslands.

Creating urban grasslands on wasteland from urban areas needs personalized approaches considering the grassland and ornamental species seeded and specific low maintenance intensity as autumn and early spring mowing to reduce the competition with early weeds. Setting a successful urban grassland requires time for the expression of the establishment of a resilient floristic composition (Köppler *et al.*, 2014).

Rojas-Botero *et al.* (2023) highlight the role of the ecological filters of the urban site and the year conditions on the species diversity setting in the road verges from urban areas. This means that a mixture of species seeded for the restoration of biodiversity will be under the pressure of these filters that will eliminate some species and will favour other species over time, having as a result of the modification of the vegetation community structure.

Other approaches of urban grassland development, described the speed-up of grassland vegetation restoration by introducing propagules of native grassland species from hay or seeding a commercial mixture. The species composition obtained during the three years of the research was

similar to a successional secondary grassland developed naturally for 30 years without any intervention (Kövendi-Jakó *et al.*, 2018).

According to the results obtained by Jiang *et al.* (2023), climate evolution, e.g. rainfall regime is influencing the urban grassland diversity and stability. In this way, the increase in the rainfall amount can accelerate the succession process by highlighting the competitor strategy of the ruderal species, thereby affecting the stability and sustainability of the species community. Also, it is suggested that it is necessary to pay more attention to the implication of the succession process in the evolution of urban grassland vegetation.

In an experiment on six sown urban grasslands, Norton *et al.* (2019) found that mowing intensity has an important role in the evolution of colonization of spontaneous species, with colonizer species having a lower participation in the plots rich in species mown with low frequency. Also, the mowing has an impact on the microbial diversity and invertebrate fauna, these being richer in the tall vegetation in comparison with short-mown urban grassland. A suggestion was to alternate in a designed model the alternation tall vegetation with short mown vegetation as mosaics, to provide conditions for more species of plants, soil microorganisms and invertebrates.

The minimal mowing works applied in urban grasslands shall keep them in a resilient condition so as to prevent the continuation of the succession process to shrubland and woody vegetation, as is in the case of

secondary agricultural grasslands, this kind of management proves to be the most effective for a rich biodiversity and a sustainable and functional vegetation community.

CONCLUSIONS

For the creation and management of urban grasslands, knowledge of vegetation succession is necessary because this natural phenomenon, together with the management of these areas, contributes to obtaining a stable and self-sustaining vegetation cover, similar to a natural habitat.

Some of the factors that accompany the processes of vegetation succession of urban grasslands, respectively their evolution, are represented by anthropogenic activities, but natural factors are also involved (wind, birds, seed reserves in the soil, etc.) as in the case of permanent grasslands.

The intensity of urban grassland management influences their appearance and functionality.

Urban grasslands act as permanent grasslands from the perspective of environmental services; but also, they are under the influence of the natural and anthropogenic factors that are directing the floristic composition, succession of the vegetation being one of those factors.

The strategies for establishing successful and functional urban grasslands shall have in view the use of seeding mixtures adapted to the local conditions and tolerant to the local environmental factors and low intensity mowing.

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