

## Article

# Perception of the Vegetation Cover Pattern Promoting Biodiversity in Urban Parks by Future Greenery Managers

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**Abstract:** Urban greening should consider solutions that meet the needs of the EU Biodiversity Strategy for 2030, such as enhancing biodiversity. Urban parks can realize these needs. They often have a large area for designing greenery compositions with elements at the population, biocenosis, and landscape biodiversity levels. The research was carried out on plant diversity in parks with different gardening styles. The results were published. The analyses have shown which elements of greenery composition play the role in the conservation of plant biodiversity and which gardening practices they depend on. These results were used to develop a vegetation cover pattern to be applied by the managers of park greenery. The concept of this pattern has been characterized in detail. Its main principle is the coexistence of spontaneously occurring vascular flora and its patches with complexes of ornamental plants. The structure of the pattern is to be controlled by gardening practices varied in terms of the method and intensity of maintenance. A relatively high level of biodiversity should be provided by autogenous (tall tree-cluster, thicket, tall herb fringe community) and anthropogenic seminatural (flower meadow) elements. It was assumed that the applicability of the proposed pattern may depend on its perception by both green infrastructure managers and park users. To investigate this, a questionnaire study was conducted. The respondents were university students, i.e., future managers of greenery. They were also users of parks. The aims of this questionnaire were to investigate: (1) perception of greenery composition in relation to utility functions of urban parks; (2) perception of the proposed vegetation cover pattern; (3) perception of gardening practices to maintain the proposed vegetation cover pattern; and (4) applicability prognosis of the proposed vegetation cover pattern based on the results of research on perception. Most of the respondents accepted the proposed pattern and the gardening measures needed to maintain it. This was concluded as a chance to implement the pattern in parks, and at the same time to meet the needs of the EU Strategy 2030.

**Keywords:** biodiversity; green infrastructure; urban park; vegetation cover pattern



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## 1. Introduction

Urban greening in connection with the dynamic development of urbanism, encourages biophilia based on affinity with nature—biophilia [1] obliges urban planners and policy makers to seek sustainable forms of urban green spaces with strategic importance for the welfare of city residents [2,3], which, at the same time, would mitigate loss of biodiversity and biotic homogenization [4]. The effect of such searches is the idea of using spontaneous vegetation in urban ornamental planting design. Such vegetation is in balance with the ecological conditions of a given habitat and brings residents closer to nature. Self-forming plant communities do not require as much maintenance costs as typical garden compositions. In combination with ornamental plants, they can create a new plant society that is attractive to people [5]. The search for sustainable forms should consider the preferences of city residents towards ecosystem services provided by biodiversity, which result from the perception of biodiversity that characterizes different types of green spaces. For example,

Jim and Chen [6] examined the expectations of city residents towards landscape design of urban green space and perception of 25 ecosystem services. Visual landscape contributions with strong preference for naturalistic design were revealed. Some of the respondents surveyed by Buchel and Frantzeskaki [7] identified themselves as nature lovers. They visited the parks for their natural surroundings, allowing them to enjoy different species of flora and fauna. Both perception and preference can shape decision making in terms of mitigation of the biodiversity crisis [8]. Green spaces are commonly used by city residents and provide multifunctional ecosystem services, such as urban parks; especially those having a large spatial extent, a considerable capital of plant biodiversity, a vegetation cover pattern with dominance of spontaneous natural vegetation, and facilities for nature and sports recreation as well as social amenities [9]. European cities are implementing the EU Biodiversity Strategy for 2030 (<https://ec.europa.eu>, accessed on 17 December 2021) with goals such as protecting and restoring biodiversity and well-functioning ecosystems. To underpin biodiversity and provide ecosystem services in urban parks, we need ‘biodiversity-friendly’ planning approaches based on the results of specially programmed geobotanical research, where both the perception of biodiversity as well as the acceptance of green space management are involved in proposed solutions and decisions [10,11]. Perception is a complex system of psychological processes operating at the sensory–motor and meaningfully functional levels. It is the selective perception of stimuli and information depending on the individual’s experience, needs, expectations, and imagination. It is a procedure of subjective processing of signals that lead to the subjective recognition of the object of perception [12]. This definition clearly indicates the outstanding multifaceted nature of the study of perception, which depends on numerous factors. This has been pointed out by Qiu et al. [13] in a summary of their research findings.

A bibliography review on the perception and valuation of urban biodiversity done by Botzat et al. [14] showed that the studies were, mainly, focused on species richness and the diversity of urban forests and park ecosystems, but less frequently on other types of green sites. To a lesser extent, two other levels of biological diversity crucial for biodiversity conservation, namely, genetic, and biocenosis [15], were studied. Meanwhile, the EU Biodiversity Strategy for 2030 (<https://ec.europa.eu>, accessed on 17 December 2021) indicates a need to restore high-diversity landscape features. It highlights the importance of next-level perception of biological diversity, namely, in a landscape scale. This means that in the search for sustainable forms of urban green spaces, the perception of the structure and functions of the vegetation landscape should be taken into consideration.

In the questionnaire research on the perception of urban park biodiversity analyzed by Botzat et al. [14], authors did not define the term biological diversity. From the content of analyzed publications, it seems that this term was used more broadly than in the two key documents for biodiversity conservation, namely, in the Convention on Biological Diversity ([www.cbd.int](http://www.cbd.int), accessed on 17 December 2021) and EU Biodiversity Strategy for 2030. Not only indigenous species (naturally occurring in the analyzed physical–geographical unit) were included in biodiversity, but also introduced ornamental nonindigenous plants [16]. In terms of achieving the objectives listed in the EU Biodiversity Strategy for 2030, the results of the studies conducted among users of public green areas (including parks), which clearly demarcated the perception of indigenous species richness and diversity from the perception of planted aliens, are especially important. At the same time, the results of the studies on the perception of the anthropogenic factors shaping the biodiversity at different levels of the biosphere are also significant. This is because in urban parks the planted ornamental plants are always accompanied (at least during certain periods of green care) by spontaneous vascular flora and plant communities with a significant share of native species, which are important for species and phytocenosis conservation of biodiversity [17]. Positive perception and acceptance by park users of the plant cover that occurs spontaneously among the arranged greenery enables landscape architects to follow the principles of sustainable development in the design of park vegetation. Numerous studies from the last 20 years on the perception of park biodiversity aimed at finding a

vegetation design of public parks that considers park users' preferences. Few, however, addressed the perceptions toward spontaneous flora and vegetation [18]. Meanwhile, Kowarik [19] wrote that natural wildlife elements in urban cultural ecosystems provide numerous opportunities to connect biodiversity conservation with the public's experience of wildlife. Based on the review of studies from 2000–2012, Nielsen et al. [20] assessed the overall biodiversity of urban parks and their community attributes as well as drivers. They concluded that the diversity of plant species and habitat heterogeneity are largely rooted in design fashions and aesthetic considerations. However, most of their analyses were only concerned with species level. The species richness evaluation also included alien species, which influenced the evaluation of parks as particularly important biodiversity hotspots in the landscape. Neither architectural composition of greenery nor gardening care practices controlling such composition were analyzed for their impact on biodiversity. Jorgensen et al. [21] examined the relations of residents to spatial arrangement and physiognomy of the park vegetation in terms of their preference for safety in parks. The results suggest that it is possible to introduce more naturalistic vegetation patches, such as woodlots with edge vegetation into parks or other types of green spaces. Özgüner and Kendle [22] measured the influence of design styles on preferences in two types of parks: the botanical garden as a typical formal landscape and the public park representing a typical naturalistic landscape. It was found that the public prefers both types for different reasons. Qiu et al. [13] examined the perception of species richness of the different park habitats by both lay people and ecologists. The first group of respondents correctly rated differences in biodiversity across habitats. No positive relationship was found between preference and perception of biodiversity. For example, the lowest biodiversity value score was given to an intensively maintained ornamental park habitat being the subject of the highest preference. The ecologists, on the other hand, rated the natural structural elements of greenery and ecological processes higher than the lay people, which was considered a positive situation for the protection of certain aspects of biodiversity. Both groups of participants in the experiment allowed for changes in the intensity of maintenance, such as converting lawns to meadows. Shwartz et al. [23] examined people's reaction to changes that increase biodiversity after planting meadows with native plant species in public gardens. The respondents did not notice the changes made. Instead, they showed a strong preference for a rich diversity with the most species and related this diversity to their psychophysical well-being. Muratet et al. [24] analyzed the perception of plant richness by park users. The cultivated and spontaneous plants, native as well as alien species, were the main subject of the study. The knowledge of plant diversity was poor among park users. They recognized, mainly, those plants promoted by gardeners. The role of species richness and ecological plant functions was, for them, less important than the aesthetic value of plants. They preferred to consider spontaneous flora management in terms of cohabitation rather than removal. This was interpreted as an opportunity to create more naturalistic vegetation in parks. Eroglu and Ak [25] characterized the attitudes of the public towards visual potential of plants and their landscape composition in two types of park: those with more formal designs and those with naturalistic, spontaneous vegetation. The respondents also included spontaneous flora creating weeds among the intentionally planted individuals in their assessment. Park visitors surveyed by Jennings et al. [26] set priorities for tree management in parks that favored increasing tree species richness, planting trees in greater numbers and in dense clusters, as well as leaving trees to their natural physiognomy. They placed relatively more accent on native trees, emphasizing their characteristic importance to the sustainability of trees and ecosystem services. Palliwoda et al. [27] identified the interactions of park visitors with plant species. Visitors perceived, not only the ecosystem benefits (consumption, decoration, biodiversity experience, etc.) provided by cultivated plants, but also the spontaneously occurring plants. Li et al. [28] showed a positive attitude of urban residents towards leaving spontaneously occurring plants and including them in park vegetation arrangements. This attitude was especially represented by people with more exposure to nature, having professional degrees, and higher levels of education.

Shams and Barker [29] discussed user and manager preferences for urban green spaces, including parks, with different characteristics in terms of their application in policy and management practices.

The bibliography review concerning the perception of plant biodiversity in urban parks has shown that the residents have a positive opinion of green spaces with vegetation patterns combining patches of ornamental plants with plant communities that spontaneously develop. They see mainly aesthetic and recreational benefits in such a vegetation cover pattern. However, they are aware of the contribution of spontaneous plant elements to the protection of biodiversity and the provision of ecosystem services. They accept changes in the ways and intensity of horticultural practices aimed at enhancing biodiversity, even as treatments limit cultural services. These conclusions allow urban parks to be perceived as objects where it is possible to implement the needs of the EU Biodiversity Strategy for 2030 (<https://eur-lex.europa.eu/>, accessed on 17 December 2021), such as investing in the protection and restoration of biodiversity at all levels of the biosphere organization. Previous studies on the perception of biodiversity in urban parks usually concerned the biodiversity at the population level (plant species richness, life forms, floristic taxa richness). Much less often studied was the perception of biodiversity at the ecosystem level (diversity of ecosystems, plant communities, phytosociological units) and the sporadically landscape level approach (vegetation complex, land-cover type richness, spatial-dynamic units of vegetation). This implies the need to develop research into the perception of biodiversity especially at these two levels. Urban parks often have a large surface area. Therefore, there is a place in them for collections displaying the plant species richness and diversity of both alien and native ornamental plants, and at the same time for vegetation complexes with natural and seminatural plant communities contributing to the protection and restoration of urban biodiversity. Taking this into account, a vegetation cover pattern has been proposed for larger park facilities, to be used to obtain a relatively high level of biodiversity. It was assumed that its applicability may depend on the perception of the pattern concept by both green infrastructure managers and park users. To investigate this, a questionnaire study was conducted.

The aims of this questionnaire study were to investigate: (1) perception of greenery composition in relation to utility functions of urban parks; (2) perception of the proposed vegetation cover pattern; (3) perception of gardening practices to maintain the proposed vegetation cover pattern; and (4) applicability prognosis of the proposed vegetation cover pattern based on the results of research on perception.

## 2. Methodology

### 2.1. Concept of the Proposed Vegetation Cover Pattern

The vegetation cover pattern concept, which was subjected to research on its perception, was prepared on the basis of field studies on the spontaneous vascular flora of the urban parks of Poznań (Poland) and Salzburg (Austria). Parks representing two different gardening styles were analyzed—English landscape garden style (Salzburg) and conventional planting style (Poznań). Some of the collected material has already been analyzed [17], namely, the impact of greenery care management standards on biodiversity has been defined. The floristic composition of the vegetation patches depended on the general arrangement of greenery, as well as the type and intensity of gardening activities (mowing, leaf raking, mechanical weeding, soil digging, etc.). It has been proven that less intensive management in the Salzburg parks was more biodiversity-friendly than the much more intense gardening care practices applied in the Poznań parks. It was recommended to restrict those horticultural treatments that most strongly change habitat conditions and prevent the development of many native plant species. It has been found that the modification of the stylistic design of park greenery and greenery maintenance practices following these recommendations will meet the needs of sustainable management of the urban park biodiversity in line with the goals of the UE Biodiversity Strategy for 2030. The presented concept considers the conclusions of Borysiak et al. [17]. The next step was to prepare a

questionnaire to test the perceptions and attitudes towards the nature solutions proposed in the concept.

### The Proposed Vegetation Cover Pattern

The vegetation cover pattern for urban parks assumes the coexistence of spontaneously occurring vascular flora and its plant communities together with ornamental plant compositions, on the principle of a spatial-dynamic circle of substitute plant communities in the habitat of a specific potential natural vegetation (Figure 1). It was proposed to form clusters of tall trees with undergrowth and an unmowed herb layer, with a physiognomy reminiscent of natural forests with their ecotone vegetation. Such a patch would be surrounded by formations of seminatural anthropogenic vegetation. The whole formation would have the following sequence of plant communities (going from the center of the cluster): tall-tree cluster, thicket, tall-herb fringe community, flower meadow, lawn, and then a bed of ornamental plants. Autogenous vegetation (first three plant communities) that is self-sustaining in the existing local environmental conditions would form a complex composition together with usable patches of vegetation controlled by gardening practices, in the case of lawns, even to a very intensive degree (e.g., in order to create highly manicured ornamental carpet). The proposed model, which integrates vegetation patches of different stages of succession and is differentiated in terms of physiognomy, ecological functions, and management creates qualities of horticultural art that generate cultural ecosystem services. Moreover, autogenic vegetation, as well as moderately controlled seminatural flower meadows, will be hot spots for biodiversity and ecosystem services. These zoned greenery compositions (strictly ecological and utilitarian zones) should satisfy visitors who expect an aesthetic experience to be provided, among others, by intensively managed lawns or beds of exotic perennials from the park. At the same time, it enhances the ecological stability of an urban landscape.

### 2.2. Questionnaire

The questionnaire aimed to find out whether the proposed vegetation cover pattern meets the expectations of future managers (and park visitors at the same time) in the field of sustainable management of park greenery for urban biodiversity and, therefore, whether the proposed greenery model has a chance for acceptance and implementation. Strongly YES or definitely NO was requested when selecting the answer. Where deemed necessary for the interpretation of responses, justification of choice (WHY?) was requested. The last two questions were open-ended. The authors are aware that strongly YES or NO request gives more simple results than when offering more answer options. However, we believe that the obtained outcomes make it possible to significantly understand whether the proposed vegetation cover pattern can be accepted in the management of urban park greenery.

The research included face-to-face interviews with 142 respondents. The survey was conducted with the assurance of anonymity, confidentiality and informed consent. All participants had been fully informed why the research was being conducted, how their data will be used and if there were any risks associated. Data obtained from closed questions were analyzed by simple counts and percentages. In the case of questions in an open format, a qualitative analysis was performed; the open statements were used to learn about the motivations and views which determined respondents' responses to closed questions.

The questionnaire used is presented in Appendix A. Detailed survey results are included in Appendix B.





**Figure 1.** Elements of the proposed vegetation cover pattern of urban park restoring and enhancing the biodiversity. (A–C)—clusters of tall trees with: mowed herb layer (A), unmoved planted ground cover vegetation (B), a physiognomy reminiscent of natural forest (C); (F,I,L,O)—the sequence of vegetation formations: tall-tree cluster, thicket, tall-herb fringe community, flower meadow, lawn; (D–F)—shrub formations: clumps of ornamental shrubs with spontaneous weed vascular flora (D), shrubs spontaneously developed in clumps of ornamental trees (E), natural thicket and tall herb fringe community in the ecotone (F); (G–I)—tall herb fringe communities: spontaneously developed in the ornamental tall tree clusters’ ecotone in the active (G) and passive (H) recreation zones, natural tall-herb fringe community in the ecotone (I); (J–O)—grasslands: highly manicured lawn in the passive (J) and active (M) recreation zones, a piece of lawn that is mowed less frequently ((K), on the right), lawn converted into a hay seminatural flower meadow (L), floristic composition of lawn carpet from phot. (M,N), highly manicured ornamental carpet in the active recreational zone, care treatment similar to that in the agricultural landscape (O).

### 2.3. Respondents

All respondents were university students. We focused on people who, due to their field of study, took interest in the issues of plant biodiversity of urban green infrastructure. The respondents represented the fields of agricultural sciences (scientific disciplines such as agriculture and horticulture, forestry), social sciences (socioeconomic geography and spatial management) and natural sciences (biology, earth and environmental sciences). The questionnaire was completed by students from the Adam Mickiewicz University in Poznań and Poznań University of Life Sciences. The representativeness of students was adjusted to the classification of fields of science and scientific disciplines established in the Regulation of the Minister of Science and Higher Education [30].

The selection of respondents in respect of the field of their study was targeted as presented above; however, within the individual scientific fields, the respondents were selected randomly.

Of the 142 students, 54% were female and 46% male (Table 1). Respondents were 19–25 in age (79% of 20–24 range), which corresponds to the typical age of full-time students in Poland [31]. Regarding the level of study, 81% were bachelor's students at universities in their last year of studies and 19% were university master's students.

**Table 1.** Characteristics of the respondents participating in research.

Variable	Total ( <i>n</i> = 142)
Gender	
Male	66 (46%)
Female	76 (54%)
Scientific field/discipline of study	
Agricultural sciences	
Agriculture and horticulture	26 (18%)
Forestry	21 (15%)
Social sciences	
Socio-economic geography and spatial management	47 (33%)
Natural sciences	
Biological sciences	23 (16%)
Earth and related environmental sciences	25 (18%)
Education at universities	
Secondary (bachelor study)	116 (81%)
Tertiary (master study)	26 (19%)

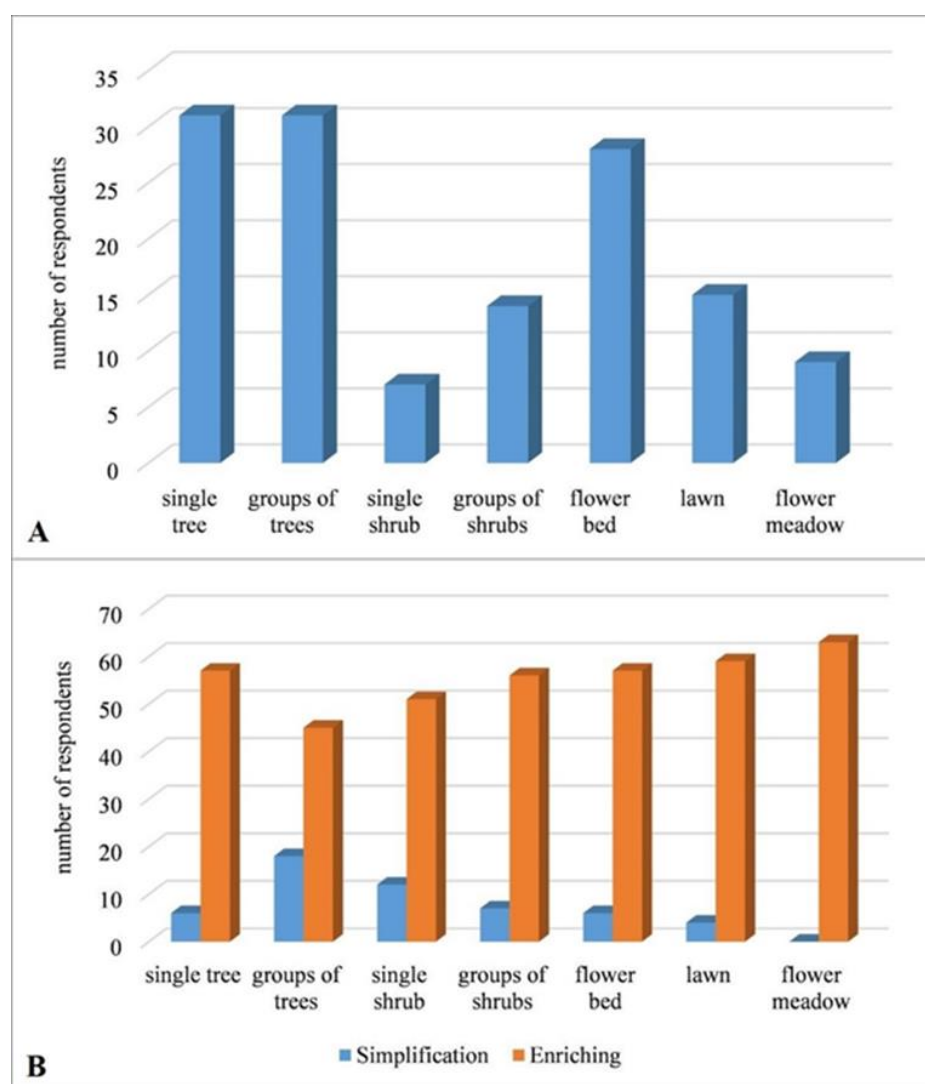
### 3. Results

#### 3.1. Perception of Greenery Composition in Relation to Utility Functions of Urban Parks

Each urban park has ecological and social functions that are often contradictory. It is difficult to implement them all at the same time in one facility. The respondents were asked (questions 1–5 in the questionnaire) about their preferences in relation to the utility functions of the park and about the vegetation cover that is to create a spatial framework for the implementation of expected functions. Many respondents believed that urban parks should be works of art with high aesthetic (53%) and/or architectural values (33%). Parks should be equipped primarily with benches (89%) and lighting (80%). The need for roads (65%), playgrounds and toilets (61%), fountains (56%), drinkable water supplies (51%), tables (50%), gyms (47%), pitches (44%), and barbecue areas (32%), were signaled. Parks were seen as natural (40%), historical (34%), and architectural (32%) heritage. It was believed that in every park, there should be a place intended only for passive recreation, separated by vegetation acting as an acoustic barrier isolating noise coming from the active recreation zone. Such places provide conditions for simultaneous contemplation (45%), observation (39%), and listening to the sounds of nature (37%). In the zone of passive recreation, a vegetation cover pattern diverse in physiognomy and color (70%) was expected, with a share of clusters of trees (32%), groups of shrubs (22%), lawns (29%), single shrubs (13%), as well as single trees, flower beds, and flower meadows—17% each. Vegetation is also supposed to provide stimuli perceived by sight (39%), hearing (30%), smell (27%), touch (16%), and skin (13%). As many as 83% of respondents thought that vegetation should be arranged to provide shade on hot days. For 69% of people, the way the park is managed should protect biological diversity. Only 20% of respondents were in favor of a simple structure of park vegetation cover pattern.

### 3.2. Perception of the Proposed Vegetation Cover Pattern

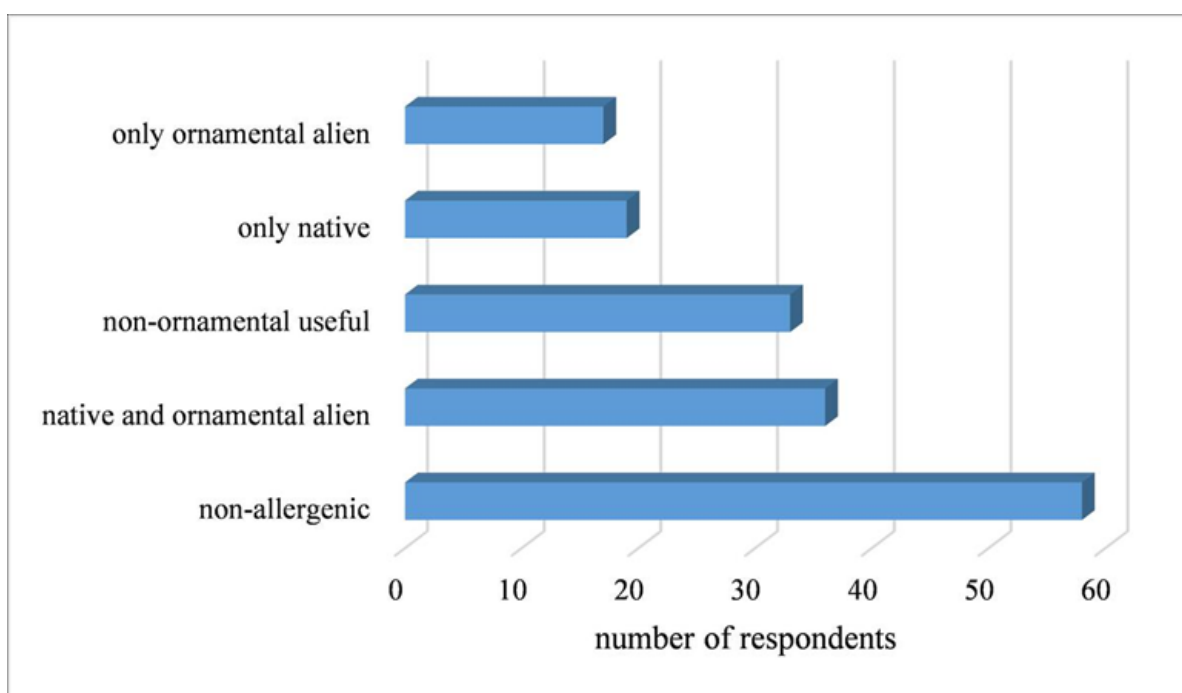
The answers provided show that many respondents were interested in the park vegetation cover pattern (questions 6–8 in the questionnaire). They also have ideas about changes in the vegetation structure enhancing biodiversity and utility values. During their visits to the park, almost half of the respondents (49%) spend time in a mentally active way analyzing the composition of vegetation. Few of them observed changes in the vegetation cover pattern (Figure 2A) made by park gardeners. The planting of trees (44%) and establishing flower beds (20%) were most noticed. The need (44%) for changes in vegetation cover pattern was expressed. Some respondents wanted to simplify the composition of greenery, while others wanted to enrich it in various forms (Figure 2B). Most of the respondents were in favor of the second option, and the choice was justified by enhancing the aesthetic value as well as increasing the diversity of animal habitats. Flower meadows (100%), lawns (94%), flower beds (93%), single trees (90%) and groups of trees (89%) were most expected. A comment was made on the species structure of flower beds. Namely, in parks, there should be more flower beds with early spring bulbous plants, long-flowering perennials attracting pollinating insects, and nectar plants. The supporters of simplifying the composition most often postulated the elimination of some groups of trees (29%) and individual shrubs to enlarge the open walking areas (19%).



**Figure 2.** Changes in the composition of greenery observed (A) and expected (B) by the respondents.



Generally, respondents were in favor of removing allergenic plants (92%, Figure 3). Almost half of the interviewees (57%) believed that the composition of greenery should be created from native and alien plant species. Aesthetic values of such arrangement were indicated, resulting from morphological and developmental features of plant species, revealed in different phenological seasons. Educational values resulting from the possibility of getting to know the flora richer in species were emphasized. Nearly half of the respondents (52%) were in favor of planting useful plants other than ornamentals, especially those used in herbal medicine. The role of useful plants in educating children was highlighted. Opponents of this group of respondents felt that private gardens were the place to grow and observe these types of plants.

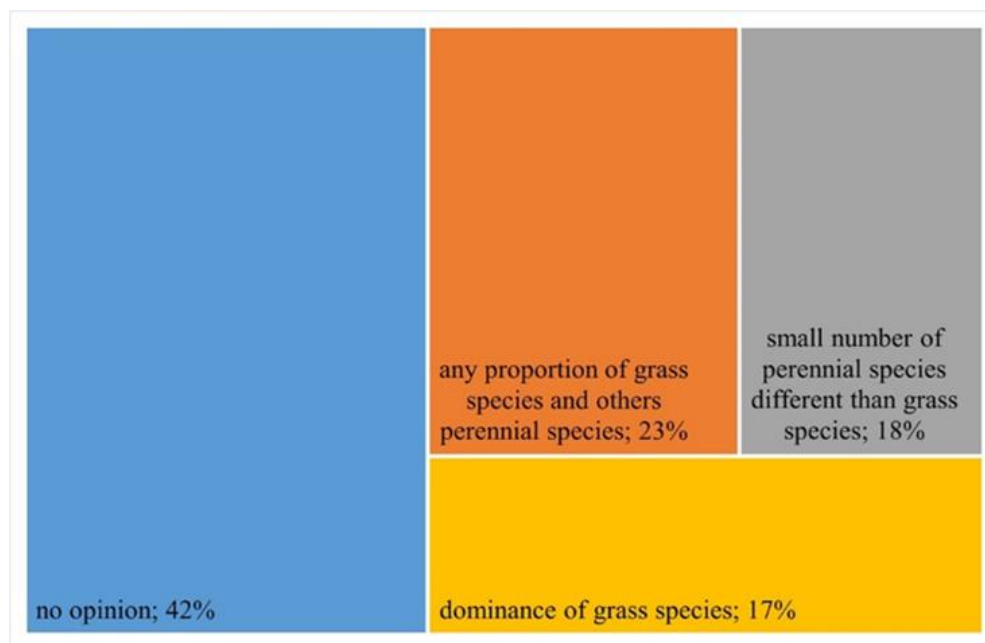


**Figure 3.** Respondents' preferences for plant species creating compositions of greenery.

### 3.3. Perception of Gardening Practices to Maintain the Proposed Vegetation Cover Pattern

The respondents defined their attitude to the gardening care practices needed to maintain the plant elements that make up the proposed vegetation cover pattern (questions 9–12 in the questionnaire). A sizable group of interviewees (43%) saw the need for changes in the way we care for greenery. Most respondents (85%) supported planting ground cover plants in groups of low trees and shrubs, instead of weeding to bare ground. According to them, this increases biological diversity, has a positive effect on the physical and chemical properties of the soil (including moisture and fertility), and improves aesthetic value. Most respondents (80%) were also against weeding, which involves removing spontaneous vascular flora that appears among planted ornamental plants. In their opinion, leaving this flora increases plant species richness as well as diversity, and at the same time improves the aesthetic image of the vegetation landscape of the park. They also believed that an important aspect of not weeding is that it reduces the labor and cost of greenery maintenance. Almost equally vociferously (83%), it was believed that fallen tree leaves should be raked, as the lingering litter spoils the aesthetic impression during the biomass decomposition phase. Several questions focused on lawn management. A significant number of people had no opinion on shaping the composition of species on the turf (Figure 4). The largest number (23%) indicated an arbitrary proportion of grass species and other perennials in the floral composition of lawns. The prevailing view (87%) was that lawns should be frequently low mowed, mainly for aesthetic reasons (53%). The

need to mow allergenic plants (32%), and sometimes for easier recreational accessibility, was also indicated. There was strong support (87%) for the proposal to turn some of the intensively managed lawns into flower meadows, due to improved park aesthetics (47%) and biodiversity (40%).



**Figure 4.** Composition of the lawn species expected by the respondents. The area assigned to each answer is proportional to the total number of responses.

Almost half of the respondents (59%) admitted that they did not know what the term biodiversity meant, the rest of them understood the term more or less correctly. A total of 20 definitions were given, most of which related to the population level of the biosphere. Only one definition was given strictly as written in the Convention on Biological Diversity. More than half of interviewees (63%) did not know why biodiversity is important to human well-being. Those who were knowledgeable about the relationship between biodiversity and human well-being (37%) listed some ecosystem services.

#### 4. Discussion—Applicability Prognosis of the Proposed Vegetation Cover Pattern

##### 4.1. Greenery Composition and Utility Functions of Urban Parks

The applicability of the proposed vegetation cover pattern was assessed on the results of research on perception (3.1.1–3.1.3) and their discussion based on the bibliography.

The results showed that the intensive park greenery management, promoting ornamental perfection (e.g., high-maintenance lawns) and aesthetic and recreational functions, has a chance of being replaced by the proposed vegetation cover pattern that is more biodiverse at the population, biocenosis, and landscape levels. By the pattern that assumes the spatial-dynamic coexistence of spontaneously occurring vascular flora and its plant communities patches together with ornamental plant compositions. That said, only 69% of respondents perceived the role of parks as facilities that should serve to protect biological diversity. It is, however, optimistic that they expect the park to be richly equipped with diverse technical recreational infrastructure. The research by Borysiak et al. [17] in urban parks of Central Europe has shown that spontaneous vascular flora, which contributes to urban plant species richness and diversity, can occur, at least periodically, within different types of recreational facilities (e.g., benches, lighting, playgrounds, roads). Such flora was characterized by a low anthropization effect (the proportion of archaeophytes and neophytes in the total flora), which was 30% in Poznań and 15% in Salzburg. Twice the value of this ratio in Poznań resulted from restrictive methods of greenery maintenance

adopted by the municipal green authority such as very frequent and low mowing (even during prolonged atmospheric drought), autumn raking fallen leaves several times, and mechanical weed control. Park greenery projects taking into account the expectations of respondents with regard to the technical equipment of the park, undoubtedly favor urban biodiversity.

A considerable number of students were in favor of simplifying the spatial structure of the greenery, but this was never justified by the need to increase safety through opening the field of view in a prospective manner. Jorgensen et al. [21] examined the perception of park vegetation density in terms of safety and preferences. They showed that mature tree patches with edge vegetation (of the natural forest edge type) prevented people from seeing inside the patch but do not necessarily worsen people's sense of security. Denser vegetation was preferred when viewed from a distance but was not preferred near paths. Such a study result may support the attitude of accepting the recommended enrichment of vegetation cover pattern in a sequence of tall-tree cluster, thicket, tall-herb fringe community. This should, however, be taken with caution as there are studies that show that natural environments with higher densities of vegetation may not always be restorative places for health [32,33]. Our participants were not asked what density of greenery the park should be enriched. This perceptual criterion may have been important because urban inhabitants asked by Bjerke et al. [34] about recreational preferences for urban park landscapes varying in vegetation density or in terms of security considerations gave the highest ratings to moderately dense scenes. Meanwhile, those surveyed by Harris et al. [35] had a high preference for dense vegetation, which was considered positive for wildlife while, at the same time, offering hope for designing landscapes that benefit both nature and people. An exceptionally extensive study on park user and management preferences for urban green space (considering types, characteristics, facility functions), was conducted by Shams and Barker [29]. Generally, the same characteristics were viewed positively and/or negatively by the interviewed participants, depending on the demand for a particular form of recreation or ecosystem benefit. The cited authors' multifaceted insights into the various perceptions deepened the understanding of how the useful and ecological functions of the proposed vegetation cover pattern can be combined in the management of green infrastructure facilities.

#### *4.2. Trees as Elements of Greenery Composition*

Among the students, almost all proponents of enriching the pattern of vegetation with natural structures mentioned single trees and groups of trees as desirable elements. This also applied to places exclusively for passive recreation, isolated from the active recreation zone. In both cases, one of the expected effects of this measure was the increase in biodiversity. A similar position was taken by park visitors who were interviewed by Jennings et al. [26] to prioritize tree management in parks. Respondents expressed their will to increase the species richness of trees (especially native ones), as well as the number of trees and their density. It is worth noting here that not only trees but also all plant biodiversity in green spaces can be highly preferred. Friendly assessments of the high species richness of plants in the urban park dominated among the respondents surveyed by Fischer et al. [36]. Kronenberg [37] highlighted institutional barriers associated with urban tree management in postsocialist countries. He included insufficient funds, unprofessional maintenance measures, poor supervision of contractors, regulations that downplay the ecosystem benefits provided by trees, and non-cooperation between experts in different fields and administrative units.

#### *4.3. Gardening Practices*

##### *4.3.1. Weed Control*

The positive attitude of future landscape professionals in the field of sustainable management of greenery to the spontaneous flora, which, according to standards of garden practices with a high level of maintenance, is destroyed should be welcomed. This allows

for an optimistic view of the applicability of the proposed vegetation cover pattern, which combines ornamental greenery with patches of spontaneously developed vegetation in one composition. Most respondents did not approve of weeding, which removes spontaneous flora from among the ornamental plants and, at the same time, in their opinion, increases the cost of greenery maintenance. This is not surprising, however, as there are increasingly frequent publications about the trend for naturalistic green arrangements, dictated by financial pressures. Green spaces adapting spontaneous vegetation to the composition of park vegetation are cheaper to create and maintain than intensively managed gardens [38].

Our respondents justified their negative attitude toward weed control also with the ecological role of spontaneous flora. They argued that this flora is part of biodiversity, provides aesthetics to the landscape, and contact with wildlife. The perception was not unique, e.g., it corresponded to Kowarik's [19] assumptions and the results of Chiesura [2], which showed concern for the combination of biodiversity conservation and wilderness experience in an urban environment. This also related to the results by Özgüner and Kendle [22] who examined the satisfaction of residents towards two types of urban green spaces: naturalistic landscapes and more formal designs. The majority expected a diverse and natural-looking landscape, and a significant proportion wanted a landscape with such qualities to simultaneously exude evidence of care. The positive attitude of our respondents to the wildness of vegetation in parks partially correlated with the results by Hofmann et al. [10]. These authors identified differences between the perception of parks and urban derelict land in designing green spaces, by residents and landscape planners. In general, the residents valued the use of wasteland as a recreational area, but with minimal maintenance and accessibility of such lands. They preferred formal parks to a greater extent. However, planners preferred natural areas with low accessibility and, similar to most of our respondents, high species richness. Mathey et al. [39] analyzed the expectations of residents regarding the use of urban brownfields covered with spontaneous vegetation representing in different stages of succession. Few were in favor of keeping such areas unchanged. Most residents preferred the reconstruction of the degraded area into some projected form of public green space (e.g., park). The results of the study suggested the possibility of using spontaneous vegetation in creating a landscape of a traditional city park. Developing garden arrangements, in connection with spontaneous vegetation, can be considered a variant of naturalistic landscape design having its roots in the main principles of English garden style. This gardening movement developed at the beginning of the 19th century and green areas for the urban populations were usually created in devastated areas [40]. The desire to obtain a more naturalistic landscape in parks using spontaneous plants was also expressed by park users surveyed by Muratet et al. [24], and Bergerot et al. [41].

#### 4.3.2. Lawn Maintenance

The proposal to replace some intensively managed lawns with flower meadows had a lot of support from respondents. Thus, such a practice has a chance to be implemented by future landscape designers. Obtaining such meadows is possible by reducing the frequency and height of mowing of high maintenance lawns to the intensity, which shapes the floristic structure of extensive farming meadows [42]. According to Ignatieva and Ahrné [43], shaping lawn species richness for biodiversity is a solution for the landscape design of sustainable green infrastructure. They are an alternative to the global homogenization of urban landscapes and loss of urban biodiversity. They are elements of a new landscape architectural style, known as biodiversinesque. The conversion of high manicured lawns into new species-rich meadows was identified by Klaus [44] as one of the most important challenges in restoring biodiversity. Jiang and Yuan [45] showed that it is possible. They examined the perception of herbaceous formations, including manicured lawns, urban meadows, and natural grassland. Students with a background in landscaping (future landscape designers, the same as our survey participants) and nonprofessionals were respondents. Natural grasslands received the highest scores among the participants for both groups. Urban meadows imitating a type of natural grassland, shaped by sowing a mixture of native and



exotic plants, received a high rating. Lower economic costs of maintaining such a formation than manicured lawns were emphasized. Additionally, Fischer et al. [46] proved that urban green spaces outside of conservation areas can contribute to the conservation of biodiversity of grassland through traditional meadow management. Thus, they can compensate for the disappearance of traditional mowed meadows in agricultural landscapes. Therefore, the proposed vegetation cover pattern (perceived positively, consisting, inter alia, of flower meadows, may be of great importance for the practice.

## 5. Conclusions

The respondents were students and, in the near future, will be managers in the field of sustainable management of green spaces, including urban parks. At the same time, as park users, they had their own expectations of the function of urban parks. The vast majority of them positively perceived the proposed vegetation cover pattern which increases plant biodiversity at the population, biocenosis, and landscape levels. The main assumption of this pattern was the coexistence of spontaneous flora and artificially formed compositions of ornamental plants, as well as the use of gardening care practices in a way that prevents biodiversity loss. The attitudes of future managers have shown that it is possible to maintain equilibrium between the ecological needs of the EU Biodiversity Strategy to 2030 and the park visitors' expectations toward the aesthetic values of parks. Parks can be sustainable forms of urban green space if both ecological and aesthetic preferences are taken into account when designing their greenery. The optimistic prognosis of the applicability of the proposed pattern can support the trends of naturalistic green design. The respondents formed a relatively homogeneous group of park users with similar specialist interests. Participation in the study was a valuable professional experience for them. This allowed for a deeper and more critical look at the drivers influencing biodiversity, such as the standards of green maintenance. It can therefore be concluded that they expanded their knowledge and professional competencies. Further critical research is needed on the perception of the proposed vegetation pattern among other social groups and users of other types of urban green spaces. This would provide stronger scientific evidence for the acceptance of the green composition model by landscape architects, city gardeners, and other stakeholders aimed at increasing urban biodiversity.

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## Appendix A

**Table A1.** Questionnaire for research on students' perception of the vegetation cover pattern in urban parks. Please answer strongly YES or definitely NO to the questions below. If your answer is YES, underline which statements you agree with. If your answer is NO, go to the next question.

No.	YES/NO		Question
1	Y	N	A park should be a work of art of high aesthetic/architectural values
2	Y	N	A park should be an area managed in such a way to protect the diversity of the plants/animals
3	Y	N	A park should be equipped with: paths/benches/tables/barbecue areas/playgrounds/pitch/gym/lighting/toilet/fountain/drinking water/others . . . . .
4	Y	N	In the composition of greenery, I perceive the elements of heritage: natural/historical/architectural/others . . . . . What elements? . . . . .
5.	Y	N	A park should be a place only for passive recreation, with the composition of vegetation that will be:
5.1	Y	N	An acoustic barrier isolating noise from the zone of active recreation and providing stimulation for: contemplation/nature observation/listening to the sounds of nature
5.2	Y	N	Provide shadow/air on hot days
5.3	Y	N	Consisting of various patches in terms of form/colour: single tree/single bush/group of trees/group of bushes/flowerbed/lawn/flowery meadow, others . . . . .
5.4	Y	N	A simple structure consisting of a small number of forms/colours/species of plants
5.5	Y	N	Providing stimuli received by sight/hearing/smell/touch/skin
6.	Y	N	I observed changes in the composition of greenery such as planting more single trees/single bushes/groups of trees/groups of bushes, creating new flowerbeds/lawns/flowery meadow Others . . . . .
7.	Y	N	The composition of greenery should be changed, the composition should be:
7.1	Y	N	Simplified by eliminating the part of/entire: single trees/single bushes/group of trees/groups of bushes/flowerbeds/lawns/others . . . . . Why . . . . .
7.2	Y	N	adding variety, increasing the number of: single trees/single bushes/groups of trees/groups of bushes/flowerbeds/lawns/flowery meadows/others . . . . . Why . . . . .
8	Y	N	The plant species in the greenery composition should be changed, the composition should be:
8.1	Y	N	Made only of native plants Why . . . . .
8.2	Y	N	Made only of exotic plants Why . . . . .
8.3	Y	N	made of native plants and ornamental exotic plants Why . . . . .
8.4	Y	N	Useful plants should be added
8.5	Y	N	Plants causing allergies should be removed
9	Y	N	I see the need to change the practices for maintaining the greenery composition
9.1	Y	N	Trees/bushes/flowerbeds do not have to be weeded to bare soil Why . . . . .
9.2	Y	N	The plants covering the soil should be planted in groups of low trees/bushes Why . . . . .
9.3	Y	N	Fallen leaves do not have to be raked under the trees, in the groups of trees/bushes Why . . . . .
10.	Y	N	Lawns should have sod with: dominance of grass species/small number of perennial species different than grass species/any proportion of grass species and others perennial species/low-mowed vegetation
11.	Y	N	Lawns should be frequently mowed low due to: aesthetic value/people having pollen allergy/others . . . . .
12.	Y	N	In some areas of the park, lawns should be transform into flowery meadow to improve aesthetics/biological diversity/others . . . . .
13.	Y	N	Do you know what the term 'biodiversity' means? Biodiversity definition . . . . .
14.	Y	N	Is biodiversity important for human well-being? Why . . . . .

Respondents' characteristics

Gender: female/male

Age: . . . . .

Education: secondary/tertiary education

Scientific discipline: agriculture and horticulture/forestry/biology/earth and environmental sciences/socio-economic geography and spatial management

## Appendix B

**Table A2.** The perception towards elements of the proposed vegetation cover pattern and gardening practices maintaining its structure.

	Observed Changes in the Greenery Composition	Simplification  The Greenery Composition	Enriching	Plant Species in the Greenery Composition	Gardening Practices for Maintaining the Greenery Composition	Lawn Management
	<i>n</i> = 142		<i>n</i> = 63			<i>n</i> = 142
	% of YES Answers					
single tree	22	10	90			
groups of trees	22	29	71			
single shrub	5	19	81			
groups of shrubs	10	11	89			
flower bed	20	10	90			
lawn	11	6	94			
flower meadow	6	0	100			
remove allergenic plants				92		
plant native and alien species				57		
plant non-ornamental useful plants				52		
plant only native species				30		
plant only ornamental alien species				27		
plant ground cover plants—in groups of low trees and groups of shrubs					85	
do not remove spontaneous vascular flora from ornamental vegetation					80	
rake fallen leaves—around trees, in groups of trees and groups of shrubs					17	
any proportion of grass species and others perennial species						23
small number of perennial species different than grass species						18
dominance of grass species						17
no opinion on the species composition of the turf						42
frequently moved low due to aesthetic value						53
frequently moved low due to people having pollen allergy						34
transform some of the lawns into flower meadows to improve the aesthetics						47
transform some of the lawns into flower meadows to improve biological diversity						40
do not transform lawns into flower meadows						13

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