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VEGETATION INVENTORY BEFORE THE RECONSTRUCTION OF ROSNIČKA OUTDOOR SPORTS FIELDS (CITY BRNO, THE CZECH REPUBLIC)

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ABSTRACT

Outdoor sports fields are places for sports activities, but simultaneously, they also serve as living spaces for vegetation. Sports fields are primarily intended for human activities, yet they also serve as habitats for plants. The interaction between sports activities and vegetation is an understudied area, which is the focus of this paper. The aim of the study is to evaluate the biodiversity and ecosystem functions of the vegetation. The selected Rosnička sports field is used by the Sokol Physical Education Unit and is located in the cadastral territory of Brno-Žabovřesky, Czech Republic. A total of 99 plant taxa were found within the locality. As revealed by the canonical correspondence analysis (CCA), diverse parts of the sports field significantly differ in species composition from each other. The vegetation present in the outdoor sports field fulfils several ecosystem functions, such as creating a favourable microclimate, supporting biodiversity, serving an aesthetic function and providing a source of fruit. The quality of the sports turf is essential as it must withstand and facilitate sports activities. Sports facilities not only support the physical and mental health of residents, but also have the potential to synergistically support the biodiversity of urban ecosystems.

Keywords: synanthropic vegetation, urban ecosystem, human civilisation, anthropocene

INTRODUCTION

Parks, outdoor sports facilities and community sports fields are the predominant choices for various sports activities (Booth et al., 2000). Open outdoor spaces are preferred for sports and other physical activities (Brownson et al., 2000; Gilles-Corti & Donovan, 2002; Michael et al., 2010; Bauman et al., 2012; Kerr, Rosenberg & Frank, 2012). Sport affects residents' physical and psychological health and promotes social interactions in communities (Freeman, 2001; Cohen, Inagami & Finch, 2008; Thompson & Kent, 2014). Sport is a structural activity of today's society and plays an important role in a more sustainable future for human civilisation (United Nations [UN], 2015). The world's highest sports organisations (e.g. The International Olympic Committee – IOC) primarily recognise the educational function of sport, but also acknowledge its transformative capacity for its surroundings (International Olympic Committee [IOC], 2019; United Nations Framework Convention on Climate Change [UNFCCC], 2019). Currently, there is limited information on the relationship between sport and the environment (Mallen, Stevens & Adams, 2011; Mal-

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len, 2018; Trendafilova & McCullough, 2018). Nevertheless, a positive association between environmental attitudes and values of the sporting population has been demonstrated (Langenbach, Berger, Baumgartner & Knoch, 2020).

The representation of green infrastructure is a crucial component of outdoor sports complexes (Lachowycz, 2013). The basic function of green infrastructure in outdoor sports facilities is to improve residents' living environment and enhance the environment's aesthetics (Zhou et al., 2022). Green infrastructure is part of the urban ecosystem, which should be in ecological balance and provide several other functions (water protection, microclimate regulation, noise reduction, air filtration and biodiversity protection). By understanding the importance of ecosystem functions, green infrastructure will increase resilience to environmental risks and can contribute to effective solutions in eliminating climate change impacts (Bolund & Hunhamma, 1999; Middle et al., 2014; Knot et al., 2017; Qin, 2020; Francoeur, Dagenais, Paquette, Dupras & Messier, 2021). The biodiversity of green infrastructure in cities is a source of many ecosystem services. As part of urbanisation, many challenges arise in how to use these services. Preserving or revitalising biodiversity is key to achieving sustainability. Green infrastructure in cities plays a fundamental role in maximising positive and eliminating negative impacts on the city (Gómez-Baggethun & Barton, 2013; Sirakaya, Cliquet & Harris, 2018).

The availability of community-built environments such as parks and sports facilities positively affects residents' health (Takagi et al., 2022). In natural environments, the recreational pressure caused by sports activities and the organisation of various sports events is increasing. Currently, there is little information available on studies focused on environmental sustainability and the demand for sports. The behaviour of athletes, sports spectators and local residents is also important from the perspective of environmental impacts (Martins, Pereira, Rosado & Mascarenhas, 2021). Neighbourhood destinations, such as parks and green spaces, hiking trails and attractive scenery, are positively associated with physical activity, especially if they are located close to the residences of their visitors. Destinations further away from home are no longer used as much. Places with high biodiversity near cities are very attractive for sports activities (Keskinen, Rantakokko, Suomi, Rantanen & Portegijs, 2018; Takagi, Kondo, Tsuji & Kondo, 2022). Urban design guidelines, agents and policies supporting people's physical activities in an attractive environment and giving opportunities for inclusive and seasonal use of urban areas lead to multifunctional health of the city, streets and inhabitants (Hidalgo, 2021). The New Urban Agenda was adopted at the Third United Nations Conference on Housing and Sustainable Urban Development held in Quito, Ecuador in 2016. This policy document proposes a concrete action program for transforming and developing human settlements (UN, 2016).

The studied area has been used for sports for a long time. Only minimal care has been given to the green infrastructure. The aim of this study is: (i) to evaluate the biodiversity of vegetation in the conditions of the outdoor sports field; (ii) to evaluate the existing vegetation from the point of view of athletes and participants in sports events; (iii) to assess the ecosystem functions provided by the vegetation of the outdoor sports field that can directly affect athletes and can also contribute to ecological stability.

MATERIAL AND METHODS

Characteristics of the locality

The selected Rosnička outdoor sports fields are used by the Sokol Physical Education Unit. They are located in the cadastral territory of Brno-Žabovřesky (49.205262N; 16.573262E). The area is part of the forest park Wilson Forest (*Wilsonův les*), which was founded in 1882 and has a total area is 8,035 m^2. The altitude is 236 m above sea level. The average annual temperature in the area is 10.2°C and the average annual precipitation is 43.41 mm.

Work on the construction of the outdoor sports field in the forest park began in 1928. The completion of the work and the start of use of the sports arena took place in 1932. Although the sports field is situated at the foot of the northern side of the hill, its location is sufficiently accessible to sunlight both in winter and in summer. The sports complex has a grassy used for sports activities like hammer throw, javelin throw, high jump and ball games. There is a running track around this oval grassy field and a long jump track and landing pad at the verge of the grassy area. There used to be tribunes for spectators; however, they are not used anymore, and spontaneous vegetation grows over them. There are also remains of an orchard planting in the sports field.

Characteristics of stands in the sports fields

The sports field was divided into 5 areas, each with a different character of use. Their spatial arrangement is demonstrated in Figure 1.

Area A: It is the central location of the entire sports complex. There is a running truck with a long and high jump area, a javelin, hammer, cricket ball and discus throwing area. It is a flat area with an extensively managed sports pitch (grass) that is maintained by mowing to a height of 20–30 mm.

Area B: There is the former stand for the spectators of the athletic events. At the moment, the tribune is not in use. Benches and metal structures were removed. The sloping terrain remained modified in the form of terraces, reinforced with concrete lintels, and with stairs in the right, middle and left parts. Spontaneous vegetation, which is mowed twice a year, grows there.

Area C: Unused area left to be overgrown by spontaneous vegetation. In 2019, this area was cleared and fully grown trees and bushes were removed. The biomass of woody plants was taken away from the sports field. Since then, this part has not been maintained.

Area D: There are remains of an orchard planting and a reinforced footpath used for running. The terrain there is sloping and, on the northern and eastern sides, it is fortified with a stone wall to prevent landslides from the surrounding slopes. The vegetation is not maintained there.

Fig. 1. Location of the Rosnička sports fields and the delimitation of its 5 areas

Source: own work.

Area E: It is the area around the administrative building. There are mainly fully grown trees, which often disrupt the foundations of the building and walkways with their roots. It is a flat terrain. The vegetation is not maintained there.

Assessment of vegetation in the sports area

The determination of the biodiversity of the vegetation was carried out using a botanical inventory, and the intensity of occurrence of the identified plant taxa was also evaluated. At each site, the species that were found were recorded. Data collection was carried out on 30/05/2022, 12/06/2022 and 25/08/2022. Scientific names were used consistent with Kaplan et al. (2019).

The occurrence of individual plant species at the monitored locations was processed by multivariate analysis of ecological data. The choice of the best analysis was guided by the length of the gradient determined by the correspondence analysis (DCA) segment. Furthermore, canonical correspondence analysis (CCA) was used. Statistical significance was determined using a Monte Carlo test with 999 calculated permutations. The data was processed using the computer program Canoco 5 (Ter Braak & Šmilauer, 2012).

RESULTS AND DISCUSSION

A total of 99 plant taxa were found within the entire sports field. A breakdown of the number of taxa divided into biological groups in the monitored areas is shown in Figure 2. In Area B, 47 plant taxa were found, and in Area C, 46 plant taxa. A total of 25 plant taxa were found in Area D, 19 plant taxa in Area E and at least 16 plant taxa in Area A.

The CCA analysis defines the spatial arrangement of individual plant taxa and delimited areas. The results of the CCA analysis are significant at the significance level $\alpha = 0.01$. The results are, therefore, statistically highly significant. According to the ordination diagram (Fig. 3), the plant taxa can be divided into 4 groups.

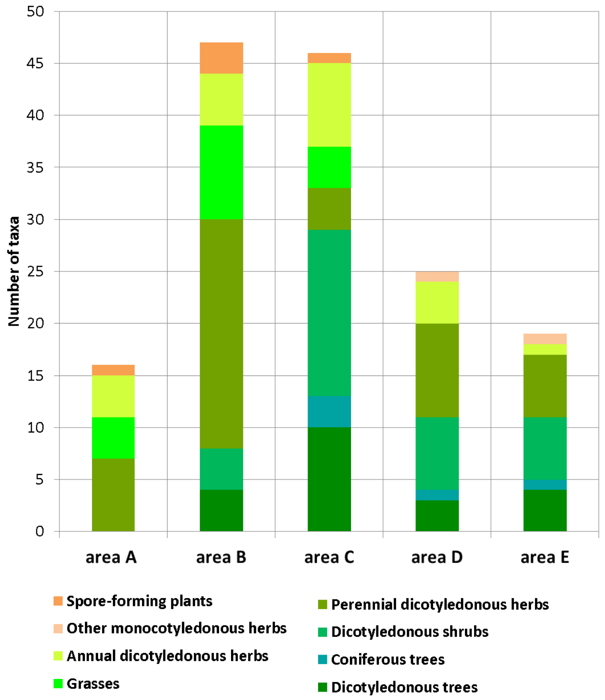

Fig. 2. Plant taxa and their groups found in the studied areas of the sports complex

Source: own work.

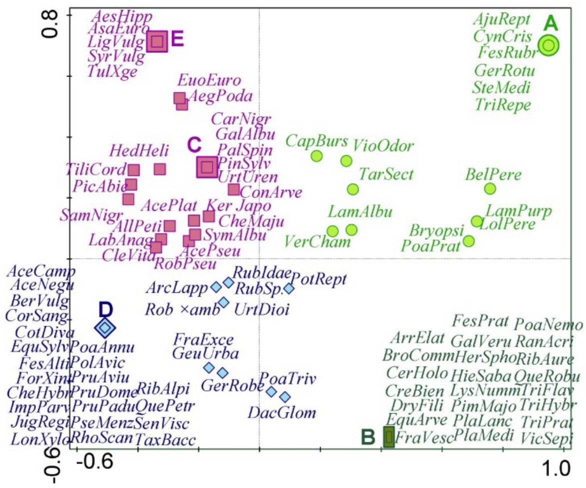

Fig. 3. Ordination diagram expressing the relationship of found plant taxa and monitored areas of the sports field (CCA analysis results; pseudo $F = 1.1$; $p = 0.01$)

Source: own work.

The first group of taxa was mainly found in Area A: *AjuRept – Ajuga reptans*, *BelPere – Bellis perennis*, *Bryopsis*, *CapBurs – Capsella bursa-pastoris*, *CynCris – Cynosurus cristatus*, *FestRubr – Festuca rubra*, *GerRotu – Geranium rotundifolium*, *LamAlbu – Lamium album*, *LamPur – Lamium purpureum*, *LolPere – Lolium perenne*, *PoaPrat – Poa pratensis*, *SteMedi – Stellaria media*, *TarSec – Taraxacum* sect. *Taraxacum*, *TriRepe – Trifolium repens*, *VerCham – Veronica chamaedrys*, *VioOdor – Viola odorata.*

The second group of taxa occurred mainly in Area B: *ArrElat – Arrhenatherum elatius*, *BroComm – Bromus commutatus*, *CerHolo – Cerastium holosteoides*, *CreBin – Crepis biennis*, *DryFili – Dryopteris filix-mas*, *EquAre – Equisetum arvense*, *FestPrat – Festuca pratensis*, *FraVesc – Fragaria vesca*, *GalVeru – Galium verum*, *HerSpho – Heracleum sphondylium*, *HieSaba – Hieracium sabaudum*, *LysNumm – Lysimachia nummularia*, *PimMajo – Pimpinella major*, *PlaLanc – Plantago lanceolata*, *PlaMedi – Plantago media*, *PoaNemo – Poa nemoralis*, *QeuRobu – Quercus robur*, *RanAcri – Ranunculus acris*, *RibAure – Ribes aureum*, *Triflav – Trisetum flavescens*, *Trihybr – Trifolium hybridum*, *Triprat – Trifolium pratense*, *VicSepi – Vicia sepium*.

The third group in Area C and Area E: *AcePlat – Acer platanoides*, *AcePse – Acer pseudoplatanus*, *AegPoda – Aegopodium podagraria*, *AesHipp – Aesculus hippocastanum*, *AllPeti – Alliaria petiolata*, *AsaEuro – Asarum europaeum*, *CarNigr – Carex nigra*, *CheMaju – Chelidonium majus*, *CleVita – Clematis vitalba*, *ConArve – Convolvulus arvensis*, *EuoEuro – Euonymus europaeus*, *GalAlbu – Galium album*, *HedHeli – Hedera helix*, *KerJapo – Kerria japonica*, *LabAnag – Laburnum anagyroides*, *LigVulg – Ligustrum vulgare*, *PalSpin – Paliurus spina-christi*, *PicAbie – Picea abies*, *PinSylv – Pinus sylvestris*, *RobPseu – Robinia pseudoacacia*, *SamNigr – Sambucus niger*, *SymAlbu – Symphoricarpos albus*, *SyrVulg – Syringa vulgaris*, *TiliCord – Tilia cordata*, *TulXge – Tulipa ×gesneriana*, *Urt Uren – Urtica urens*.

The fourth group occurred in Area D: *AceCamp – Acer campestre, AceNegu – Acer negundo*, *ArcLapp – Arctium lappa*, *BerVulg – Berberis vulgaris*, *CheHybr – Chenopodium hybridum*, *CorSang – Cornus sanguinea*, *CotDiva – Cotoneaster divaricatus*, *DacGlom – Dactilis glomerata*, *EquSylv – Equisetum sylvaticum*, *FesAlti – Festuca altissima*, *ForXint – Forsythia ×intermedia*, *FraExce – Fraxinus excelsior*, *GerRobe – Geranium robertianum*, *GeuUrba – Geum urbanum*, *ImpParv – Impatiens parviflora*, *JugRegi – Juglans regia*, *LonXylo – Lonicera xylosteum*, *PoaAnn – Poa annua*, *PoaTriv – Poa trivialis*, *PolAvic – Polygonum aviculare*, *PotRept – Potentilla reptans*, *PruAviu – Prunus avium*, *PruDome – Prunus domestica*, *PruPadu – Prunus padus*, *PseMenz – Pseudotsuga menziesii*, *QuePetr – Quercus petraea*, *RhoScan – Rhodotypos scandens*, *RibAlpi – Ribes alpinum*, *Rob×amb – Robinia ×ambigua*, *RubIdae – Rubus idaeus*, *Rubsp. – Rubus sp.*, *SenVisc – Senecio viscosus*, *TaxBacc – Taxus baccata*, *UrtDioi – Urtica dioica.*

The monitored areas of the sports field provide a living space for various life forms of plants – ranging from annual and perennial herbs, to shrubs and trees. It follows from the CCA analysis that differently used parts of the sports field differ significantly from each other in the species composition of the vegetation. Plant taxa are critical for biological relevance, defined as the number of other organisms dependent on a given plant taxon. Organisms use plants as a food source, a substrate, a shelter or a place for reproduction. Some plant taxa, particularly high-biomass and long-life trees, may be crucial to the survival of hundreds or thousands of other organisms, while some low-frequency, low-biomass species may be almost irrelevant (Tyler, Herbertsson, Olofsson & Olsson, 2021). The following woody plants: *Quercus petraea*, *Q. robur*, *Acer campestre*, *A. pseudoplatanus*, *Picea abies*, *Pinus sylvestris*, *Prunus avium*, *P. domestica*, *P. padus*, *Rubus idaeus*, *Tilia cordata*; and herbs: *Dactylis glomerata*, *Plantago lanceolata* and *Trifolium pratense* have high biological relevance from the taxa identified in the studied sports field.

Urbanisation leads to the fragmentation of natural habitats and strongly affects communities. The richness of plant species is taxonomically much higher in the city than out of it due to exotic plants that have been planted in places accidentally or intentionally for ornamental purposes. Cities can also be richer in native plant taxa (Bonthoux, Brun, Di Pietro, Greulich

& Bouché-Pillon, 2014). In recent years, attention has been paid to the loss of insect biodiversity – especially the decline of pollinators (Sorg, Schwan, Stenmans & Müller, 2013). Nectar and pollen production can be considered an indicator of the importance of plant taxa to pollinators. Naturally, plants also provide shelter and are a source of non-floral food for some insect larval stages (Baude et al., 2016). The biodiversity of vegetation is substantially influenced by how it is used and how vegetation is managed. An approach using the principles of urban agriculture can lead to the stabilisation of ecosystems in peri-urban areas (Nowysz, Mazur, Vaverková, Koda & Winkler, 2022). The species richness of the vegetation of the monitored sports field is a prerequisite for the creation of a rich ecosystem. The species composition of vegetation in urbanised areas is in the hands of people who directly decide which species composition of plant taxa will be sown or planted.

The most important location for the sports complex is Area A, which is used as the main place for sports activities. The taxa dominating there are grasses (*Festuca rubra*, *Lolium perenne*, *Poa pratensis*) and perennial dicotyledonous herbs typical of lawns (*Ajuga reptans*, *Bellis perennis*, *Bryopsis*, *Trifolium repens*). Lawns are a prominent element of outdoor sports fields and all public greenery, requiring high maintenance (Hedblom, Lindberg, Vogel, Wissman & Ahrné, 2017; Knot et al., 2017). The way of maintenance changes the ecosystem functions of lawns (Wheeler et al., 2017). Intensive lawns managed with herbicides, fertilisers, watering and frequent mowing have high aesthetic value (Norton et al., 2019; Yang, Ignatieva, Larsson, Zhang & Ni, 2019), but also negative characteristics such as intensive water use, nutrient runoff and low species diversity (Ramer & Nelson, 2020). Extensive grasslands, which are characterised by lower fertiliser use and less frequent mowing (Hugie & Watkins, 2016; Aronson et al., 2017), are often composed of spontaneous plant taxa that can be food sources for pollinators (Lerman & Milam, 2016; Norton et al., 2019).

The presence of extensively managed urban grasslands in urban areas has been constantly increasing due to the lower management costs and their high biodiversity (Watson, Carignan-Guillemette, Turcotte, Maire & Proulx, 2020; Lampinen et al., 2021). The turf at the monitored sports field must withstand sports activities and trampling (frequent stepping). Due to the limited financial resources of the operator, only extensive management is provided to the lawn. This is manifested in a higher representation of spontaneous plant taxa (dicotyledonous taxa). In the case of lawn restoration, the appropriate choice of species composition of lawns will be essential. Ornamental, recreational and sports fields are not considered semi-natural vegetation because they require a high level of human management such as fertilisation, irrigation, mowing, etc. (Ignatieva & Hedblom, 2018). The input level depends on selecting appropriate taxa and grass cultivars (Christians, Patton & Law, 2016). Grasslands requiring only low inputs must be tolerant to abiotic and biotic stresses, have low nutrient and water demands and be competitive to minimise weed occurrence (Hugie, Yue & Watkins, 2012). Dicotyledonous taxa such as *Achillea millefolium*, which tolerate frequent mowing, trampling, drought and extensive management, are also recommended for extensive grasslands (Pornaro, Fidanza & Macolino, 2023).

In the rest of the locations, a high proportion of taxa that can be considered as spontaneous vegetation. The importance of spontaneous vegetation in the green infrastructure of cities is highlighted by Xiao-Peng, Shu-Xin, Kühn, Dong and Pei-Yao (2019), namely the importance of biological diversity and a wide range of sociocultural factors. Incorporating spontaneous vegetation into green-space design-planning can help achieve greater sustainability in cities. The ubiquity of the garden style in green infrastructure is a common trend and leads to the selection of the same ornamental plant taxa, the same forms of planting designs, etc. This leads to the promotion and development of a market for non-native plant taxa that are very similar all over the world, which has caused a loss of ecological functions of landscape and leads to homogenisation (Quigley, 2011).

The green infrastructure of sports venues affects spectators at sporting events (Edwards, Knight, Handler, Abraham & Blowers, 2016; Pereira, Camara, Ribeiro & Filimonau, 2017). Urban vegetation is also very beneficial for the education of the younger generation (Jorgensen & Keenan, 2012). Vegetation provides both ecosystem and cultural functions. Spectators and athletes appreciate above all the aesthetic value of vegetation. From the aesthetic point of view, taxa that form conspicuous flowers are perceived positively, such as *Ajuga reptans*, *Bellis perennis*, *Cotoneaster divaricatus*, *Euonymus europaeus*, *Forsythia ×intermedia*, *Laburnum anagyroides*, *Lamium album*, *Ligustrum vulgare*, *Lonicera xylosteum*, *Lysimachia nummularia*, *Rhodotypos scandens*, *Syringa vulgaris*, *Trifolium hybridum*, *T. pratense*, *T. repens*, *Tulipa ×gesneriana*, *Veronica chamaedrys* and *Viola odorata*.

Urbanisation transforms natural landscapes into engineered structures (buildings, parking lots, streets, squares, etc.), leading to an increase in ambient temperature – commonly known as the urban heat island effect (Li & Wang, 2021). An essential function of vegetation and particularly trees is air cooling, especially in the summer months and the elimination of heat islands in urban areas (Gómez-Baggethun & Barton, 2013; Gillner, Vogt, Tharang, Dettmann & Roloff, 2015). This fact in humans is limited by heat stress and the discomfort associated with it (Paschalis, Chakraborty, Fatichi, Meili & Manoli, 2021). The creation of a favourable microclimate is an overlooked but irreplaceable function of vegetation on outdoor sports grounds. Another interesting group of plants are fruit trees; they produce fruit that can be consumed. On the other hand, their cultivation is associated with a higher demand for their maintenance. In the studied area there are remains of the original planting of fruit trees, such as *Juglans regia*, *Prunus avium*, *P. domestica*, *Ribes aureum*, *Rubus* sp. and *R. idaeus*. In the case of reconstruction of the sports field, there should be a space for planting fewer demanding types of fruit trees.

The management of the vegetation of sports facilities is linked with the production of waste biomass. Management of vegetation biomass and biological waste is not currently being handled within the area. According to Xin et al. (2020) unused plant biomass is processed mainly by landfilling and burning, which is costly and inefficient. A more environmentally friendly method is the processing of biological waste by composting (Wei et al., 2017; Yasmin et al., 2022). In the composting process, microorganisms convert biomass into stable organic fertiliser (Zhang et al., 2020; Rashid & Shahzad, 2021; Thomson, Price, Arnold, Dixon & Graham, 2021; Chorolque et al., 2022; Xu et al., 2022). Compost can be used to improve soil quality (Toledo, Siles, Gutiérrez & Martín, 2018; Longhurst et al., 2019) and it is possible to use it directly in the sports field. This method of handling local biological waste and its subsequent local use fits into the circular bioeconomy strategy (Marcello, Di Gennaro & Ferrini, 2021; Torrijos, Dopico & Soto, 2021; Zhou et al., 2022). Creating a local composting facility would bring several benefits. The amount of waste that must be transported from the sports field would be reduced, and at the same time, fertiliser that might find application in the revitalisation and maintenance of local vegetation would be produced. Unremoved vegetation biomass in combination with dry and warm weather can create a fire risk (Lazarus et al., 2020; Campos & Abrentes, 2021). The species composition of the vegetation and the condition of the vegetation are very important factors for the occurrence of fire (Piwnicki, Szczygieł, Ubysz & Kwiatkowski, 2006; Ubysz & Szczygieł, 2006; Marcisz et al., 2019). The development of monitoring systems using remote sensing, geographic information systems and multispectral imaging can be seen as an evidence of the importance of green infrastructure in cities. Awareness and knowledge about the state of vegetation provides information on the provision of ecosystem functions as well as about the risk of fires (Wang, Rich, Price & Kettle, 2004; Lotfata, 2021; Sikorska, Ciężkowski, Babańczyk, Chormański & Sikorski, 2021).

The design and construction of sports facilities should be focused on the needs of local urban residents and should lead to the improvement of the urban environment (Zhang et al., 2021). Planning and construction must include a green infrastructure rich in native plant taxa species. Globalisation and urbanisation are the main drivers of the homogenisation of urban landscapes around the world; therefore, the flora and fauna of cities is remarkably similar in different parts of the world despite geographical and climatic differences (McKinney, 2006). Sports facilities support the physical and mental health of residents, but on the other hand, they also have the potential to synergistically support the biodiversity of urban ecosystems.

CONCLUSIONS

The monitored areas of the sports field provide a living space for various life forms of plants – ranging from annual and perennial herbs, to shrubs and trees. A total of 99 plant taxa were found. The CCA analysis proved that differently used locations differ significantly from each other in species composition. The vegetation of the outdoor sports field fulfils several ecosystem functions, such as the creation of a favourable microclimate, the support of biodiversity, aesthetic functions and serves as a source of fruit. The quality of the sports fields is essential as it must endure and enable sports activities.

The ecosystem functions provided by plant taxa may differ in nature. The most important factor was the increase in the vegetation diversity. By selecting appropriate native species, urban planners can ensure the species stability of the vegetation or even increase its species diversity. Interestingly, the discovery of the taxon Rhodotypos scandens – a soil-cultivated ornamental plant, has already successfully penetrated urban ecosystems.

Less favourable ecosystem functions include the production of allergenic pollen by some taxa, which can affect the health and fitness of athletes. Of the plant taxa found, pollen is highly allergenic – *Arrhenatherum elatius*, *Dactylis glomerata*, *Festuca pratensis*, *F. rubra*, *Chenopodium hybridum*, *Juglans regia*, *Lolium perenne*, *Picea abies*, *Pinus sylvestris*, *Plantago lanceolata*, *P. media*, *Poa annua*, *Robinia pseudoacacia*, *Sambucus nigra*, *Taraxacum* sect. *Taraxacum*, *Tilia cordata* and *Urtica dioica*. Trees only produce pollen over a relatively short period, and it is impossible to regulate the production of allergenic pollen. Herbs, including grasses, usually flower repeatedly; however, pollen production can be regulated by mowing.

Vegetation maintenance is linked with the production of waste biomass. In the area, the produced waste is treated as ordinary municipal waste. It would be appropriate to use the biological waste generated during the maintenance of the vegetation for composting and to use the final compost as fertiliser for the existing vegetation of the sports field.

According to the results, the representation of non-native taxa is not dominant, and there is a risk that their proportion will increase. This increase may be due to climate change, causing a decline in native taxa and the deliberate seeding of non-native taxa. Urban planners and architects should be aware of the suitability and unsuitability of the plant taxa that they plan to incorporate into their designs.

Outdoor sports fields have the potential to support the physical and mental health of residents. The area of the outdoor sports field opens up new possibilities for vegetation due to its different uses. The combination of an outdoor sports field with the urban vegetation will have a synergistic potential that will support the residents' quality of life and can simultaneously increase the biodiversity of urban ecosystems.

Authors' contributions

Conceptualisation: J.W. and L.H.; methodology: J.W. and J.B.; validation: J.W. and P.M.B.; formal analysis: J.M. and Y.R.L.; investigation: P.M.B.; resources: J.W.; data curation: J.W.; writing – original draft preparation: J.B.; writing – review and editing: P.M.B. and Y.R.L.; visualisation: J.W.; supervision: J.W. and L.H.; project administration: J.W.; funding acquisition: J.W.

All authors have read and agreed to the published version of the manuscript.

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INWENTARYZACJA ROŚLINNOŚCI PRZED REKONSTRUKCJĄ TERENU SPORTOWEGO ROSNIČKA (MIASTO BRNO, REPUBLIKA CZESKA)

STRESZCZENIE

Obiekty sportowe są miejscami aktywności, ale również środowiskiem życia dla roślinności. Celem pracy jest ocena bioróżnorodności i funkcji ekosystemowych roślinności na tego typu obiektach. Wybrany teren sportowy Rosnička jest użytkowany przez Towarzystwo Gimnastyczne Sokół. Znajduje się w obrębie katastralnym Brno-Žabovřesky (Republika Czeska). Łącznie zidentyfikowano tam 99 taksonów roślin na całym obszarze. Kanoniczna analiza korespondencji (CCA) wskazuje, że różnie wykorzystywane siedliska znacząco różnią się pod względem składu gatunkowego występującej tam roślinności. Na terenie obiektu sportowego roślinność pełni wiele funkcji ekosystemowych (m.in. tworzenie korzystnego mikroklimatu, wspieranie bioróżnorodności) i funkcje estetyczne oraz stanowi źródło owoców. Kluczowym elementem są trawniki sportowe, które muszą umożliwić uprawianie sportu. Tereny sportowe przyczyniają się do wspierania zdrowia fizycznego i psychicznego mieszkańców, ale mają także potencjał do synergicznego kształtowania bioróżnorodności ekosystemów miejskich.

Słowa kluczowe: roślinność synantropijna, ekosystem miejski, cywilizacja ludzka, antropocen