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Attractiveness of urban parks for visitors versus their potential allergenic hazard: A case study in Rzeszów, Poland

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ABSTRACT

The political and social changes that have taken place in Central Europe after the collapse of the communist regimes in the 1990s, followed by the accession of some countries to the European Union, have initiated the intense development of cities. The development is manifested, among other features, in the renovation of old parks and establishment of new ones. These actions, however, require studies on the role of parks depending on their location in the city, the activities undertaken by park visitors, and the allergenic risks of park vegetation. Taking into account the above assumptions, comprehensive studies of this type were conducted in four urban parks in Rzeszów (Poland) in order to develop recommendations for the city authorities on their spatial management. Harmful impact of parks' vegetation was described by allergenicity index. Park visitors were counted during eight scans in each park. Types of visitors' activities were grouped into five main categories: resting, using playgrounds, cycling, other sports, others. Three categories of the parks land cover were studied: canopy, lawns and paths as well as location of the parks. We concluded that the type of activity undertaken in the park was primarily associated with the land cover structure of the park and its location within the city. A comparison with the use of statistical methods and an evaluation of the parks also showed that diversification of the character and functions of parks in the city is a desirable feature. We have identified three major types of parks using results of studies on the role of parks depending on their location in a city, the activities undertaken by park visitors, and the allergenic potential of their vegetation: downtown parks, open parks, and peripheral parks – requiring different spatial development recommendations to ensure their attractiveness for visitors while simultaneously mitigating their allergy hazard impact.

1. Introduction

Green infrastructure is one of the factors most strongly affecting the quality of human life in cities (Shackleton et al., 2017). It consists of many elements, but well-designed urban parks eagerly visited by city dwellers usually form its core. Due to the very high social acceptance of the establishment of new parks and the prevention of diseases of affluence through physical activity undertaken in parks (Orsega-Smith et al., 2000; Bedimo-Rung et al., 2005; Mowen et al., 2007) or to the benefits manifested in an increased value of properties located in green areas (Jim and Chen, 2010), but also on account of the important environmental functions of such parks (Sadeghian and Vandanyan, 2013), they are one of the most desired forms of urban land management consistent with the idea of sustainable development. It turns out, however, that in spite of the unquestionable benefits that parks bring for the entire urban system and the people themselves (Mowen et al., 2007; Adinolfi et al., 2014), by, for example, reducing the deposition of harmful pollutants (Escobedo and Nowak, 2009; Janhäll, 2015), they can pose real risks to human health due to their excessive production of plant allergens (Cariñanos et al., 2016). They emit also Biogenic Volatile Organic Compounds and pose a threat from the fallen branches, toxic or thorny plants side, as well as fear of wild animals or dogs running without a leash or fear of aggressive behaviour of other people (Cariñanos et al., 2017a). Therefore, the challenge of designing new parks and transforming already-existing parks in such a way as to minimize their negative effects, while at the same time not diminishing

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their attractiveness to the residents, becomes very important. The elaboration of recommendations for city authorities regarding low-allergenic plants in already-existing parks should be based not only on a detailed survey of the vegetation and an evaluation of its allergenicity level, but also on an analysis of the location of the parks within the urban structure, which may affect its ventilation as well as the dispersal of airborne plant pollen along the streets (Peel et al., 2014).

In order to apply these recommendations in the context of a particular city, it also becomes necessary to analyse the purposes of park visits because even the best-designed urban park will not fulfil its role if the residents are not willing to use it. Work on recommendations for urban park greenery shaping, which takes into account both vegetation impacts and the structure of park users' activities, has been successfully undertaken in southern Spain (Adinolfi et al., 2014). A shortage or lack of this type of analysis in Central and Eastern Europe is worth noting, but there have been attempts to estimate the allergenic impact of greenery in a housing estate area in Poland (Kuchcik et al., 2016). Meanwhile, parks in the cities of this region are often young structures, reconstructed after having been destroyed during World War II or established as new elements in the developing cities. When these parks were established, however, their allergenic hazard was not taken into consideration because scientific research in this area was not yet sufficiently developed and generally available in the bloc of socialist countries. Therefore, there is an urgent need to develop recommendations on spatial management in parks in this region, based on studies of the role of parks depending on their location in the city, the activities undertaken by park visitors, and the allergenic potential of their vegetation. Taking into account the above assumptions, a comprehensive study of this type was conducted in Rzeszów, which is located in southeastern Poland (Fig. 1). The main aim of our research was to compare and evaluate selected urban parks in the context of the following features: a) types of activity of park users and frequency of park visits; b) spatial arrangement of parks and the surrounding area; and c) allergenic potential of parks' vegetation. This study served in the pursuit of a practical goal, namely, the development of recommendations for the city authorities regarding land management in the parks located in the city. We believe that this study could provide a methodological model for developing recommendations on spatial management of parks in other cities in this part of Europe.

2. Methods

2.1. Study area

The study was conducted in Rzeszów (50°02′28″N; 21°59′56″E) in southeastern Poland (Fig. 1). It is a medium-sized city with an area of 120.4 sq. km. Its population is slightly more than 188,000. In the city, there are more than 1000 ha of green spaces, including 14 parks covering an area of 81.5 ha. Rzeszów is located in the warm temperate climate zone, and polar maritime air masses are the main climate driver. Over the period 1997–2016, the mean annual temperature was 8.9 °C and the mean annual total precipitation was 693 mm. The mean temperature and total precipitation in the warmest month, July, are 19.6 °C and 111.9 mm, respectively. The mean temperature of the coldest month, January, is -2.0 °C (TuTiempo, 2017). As in other parts of Poland, winds from the westerly sector dominate in Rzeszów, although because of the location of this city, close to the Carpathian Mountains, southerly foehn winds also make a large contribution here. They perform an important role in the process of ventilating the city, blowing away air pollutants along the Wisłok River valley.

We chose to analyse four parks differently located within the city. The criterion for selection was also a diversified land cover structure which allowed us to suppose that the purpose of park visiting will not be the same in each of them. All chosen parks accounted for 32% of all parks area and 2.6% of all green areas within the city.

2.2. Description of parks

The following parks were analysed (Fig. 1): Park Zdrowia (P1), Park Jedności Polonii z Macierzą (P2), Park Kultury i Wypoczynku (P3), and Park Inwalidów Wojennych (P4). They differ both in their size and management as well as in the density of buildings surrounding them (Table 1, Fig. 1). It was only after World War II that plantings were carried out and vegetation maintenance was undertaken, in particular in parks P1 and P4, which were designed as part of a newly developed urbanized area in the 1970s. Park P2 is situated closest to the city's old part and originates from the early post-war period. The largest park, P3, which is located in the floodplain of the Wisłok River, shows some distinctiveness. Some part of its vegetation overlaps here with the remnants of riparian alluvial forests. The vegetation of this park was predominantly planted by the city dwellers by the order of the socialist party, as was common in Soviet countries in those years. This park is part of vast recreationally developed riverine areas. Park P4, the smallest one included in this analysis, is the centre of a densely developed housing estate of high building density, with two public institutions immediately adjacent to it. All the parks have modern playgrounds for children, and as far as their land use structure is concerned, there are open lawn areas as well as shrub and tree areas. Concert shells used for outdoor events are located in two of these parks, P2 and P3.

2.3. Visitors' activities

We assumed that if people willingly come to parks, they are attractive to them. The number of visitors in the parks and the purpose of their visits to the parks' spaces were studied using a momentary time sampling technique known as the SOPARC (System for Observing Parks and Recreation in Communities) method (McKenzie et al., 2006). In this method, the analysis of park users' physical activity was the most important. In our study, all activities undertaken in the park were equally important, which is why we prepared our own visitors counting form, based on research conducted independently in Rzeszów for the riverside recreational areas (Ćwik, 2009) and on the visitors counting method used in Granada parks in Spain (Adinolfi et al., 2014). A reconnaissance conducted in Rzeszów for the riverside parks shows that city dwellers use these parks most intensively during sunny weather in the spring and autumn, outside the summer holiday period. Kasprzyk (2011) indicated that the time of pollination of different allergenic plants in Rzeszów begins in February and ends in the end of September. Therefore, this study was carried out during two seasons of the year (spring and autumn), while also making a distinction between working days and days off, as well as between before noon (10–11 am) and the afternoon (5–6 pm). In total, eight scans were carried out in each of the parks at the turn of September and October 2016, as well as at the turn of May and June 2017. Apart from the number of visitors at any given time, information was also collected concerning the activities undertaken by people visiting each park, with a more detailed division than that proposed by Adinolfi et al. (2014). During a 15-minute scan, the number of people performing the following activities were noted in a specially designed form: walking, walking dogs, sitting on a bench, using a playground, using an outdoor fitness station, using a picnic area and sunbathing, running, riding roller skates or kick scooters, playing ball, cycling, Nordic walking, observing nature, and 'other' – including municipal services. People playing a virtual game that consists in looking for Pokémon characters also had a special place on the form. These activities were grouped into four categories: resting, using playgrounds for children, actively performing sport-related activities, and being involved in other activities. It was also decided that the 'cyclists' group would be distinguished within the 'sport' category, since an assumption was made (later confirmed by the observations) that the presence of cyclists is strongly associated with the park's size, character, location, and infrastructure.