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Urban Green Space Availability, Accessibility and Attractiveness, and the Delivery of Ecosystem Services

The main goal of this article is to analyze how different barriers which restrict urban green space (UGS) provision – notably their availability, accessibility and attractiveness – affect the delivery of ecosystem services (ESs). Our analysis involves three case studies in Lodz, Poland: the removal of trees in private properties following the liberalization of the Nature Conservation Act (availability); the replacement of allotment gardens with a city beach (accessibility); and the organization of entertainment events in the forest (attractiveness). The analyzed barriers include governmental failures, insufficient social support for the existence of certain UGSs, changes in spatial planning and activities discouraging other users. Our analysis shows that physical access to UGSs is not always equal to access to ESs, and that different ESs are affected differently at the three levels of UGS provision. Also, those who suffer from the loss of access to ESs are often not involved in making the relevant UGS provision decisions. All of these issues add new aspects to the current debates related to political ecology, environmental justice and ES trade-offs.

Keywords

Barriers; urban ecosystem services; institutions; residents' preferences; urban green space provision

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INTRODUCTION

Recent political, practical and academic discussions on urban green space (UGS) availability, accessibility and attractiveness (Comber et al. 2008; Kabisch et al. 2016; La Rosa 2014), need to be further extended to cover the context of ecosystem services (ES). This is because access to UGSs is not always equal to access to ESs, and – vice versa – the lack of physical access to UGSs does not have to mean exclusion from the delivery of (certain) ESs.

We refer to UGSs as all green spaces in urban areas, including forests, parks, private gardens, allotment gardens, cemeteries, brownfields, arable land, meadows and greenery along railway tracks, regardless of whether they are formally managed by the city, by their private owners or through any other arrangement. This broad definition allows us to capture all kinds of benefits associated with urban ecosystems and their services, without narrowing them to any specific management regime. Also, it allows us to perceive a broad spectrum of UGS availability, accessibility and attractiveness (collectively referred to as UGS provision), which we associate with the different levels of the possibility of inhabitants using UGSs. Note that a green space first has to be available to then consider its accessibility, and it has to be available and accessible for prospective users to consider its attractiveness (Biernacka and Kronenberg 2018) (Figure 1).

All three levels of UGS provision distinguished here – availability, accessibility and attractiveness – are related to institutions, and may be restricted by the different barriers connected with economic issues, spatial planning, legal rules, social norms, the inhabitants' preferences and the management of UGSs (Biernacka and Kronenberg 2018). Barriers preventing UGS provision may be very diverse, both in general and between the different levels, as indicated by the following examples. UGSs may not be *available* due to governmental and social failures, such as faulty decisions taken by officials or the lack of social support for UGS preservation. What is more, existing and nearby UGSs may still not be *accessible* because of numerous physical and psychological barriers, e.g., busy streets, railways (Van Herzele and Wiedemann 2003), fences, densely built-up areas, as well as social norms, entrance restrictions (La Rosa 2014; Park 2017) and discouraging surroundings (Biernacka and Kronenberg 2018). Eventually, even when they are available and accessible, the UGS may not be *attractive* enough for urban inhabitants because of problems such as a lack of equipment and park furniture, poor maintenance, congestion, noise and other nuisances (Dillen et al. 2012; Schipperijn et al. 2010; Grahn and Stigsdotter 2010) or at least they may be perceived as unattractive (Krajter Ostoić et al. 2017).

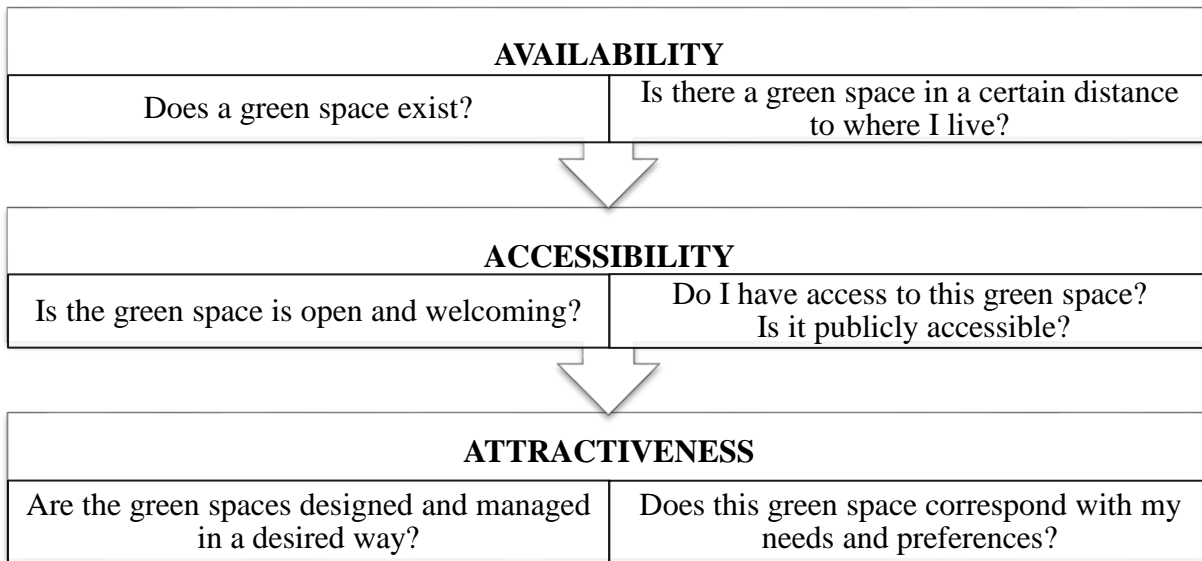


Figure 1. Three levels of urban green space provision (Biernacka and Kronenberg, 2018).

Following Haines-Young and Potschin (2018, page 3), we define ecosystem services as “as the contributions that ecosystems make to human well-being, and distinct from the goods and benefits that people subsequently derive from them.” The realization of ES benefits is strongly influenced by contextual factors, such as institutions or available technology, i.e., system components that do not provide ES themselves but which help realize and mediate benefits (Andersson et al. 2015). In line with this argument, we put emphasis on institutions, defined as formal and informal rules of the “social game” (Vatn 2005), and on the different actors who influence UGS provision based on their institutional mandates, such as individual users, formal and informal groups and city authorities.

All of these situations have important implications for the delivery of ESs. For the delivery of some ESs it is enough that a given UGS exists, while the delivery of other ESs may require that a given UGS is characterized by some level of physical or psychological accessibility, and in other cases, the delivery of ESs may be related to the perceived level of attractiveness of a relevant UGS. For example, urban inhabitants may not have access to fenced, private gardens and some of the related ESs (e.g. physical, intellectual and spiritual interactions with the natural environment), but still benefit from many other services which do not require physical access (e.g. the mediation of nuisances of anthropogenic origin, the regulation of temperature and humidity, pollination and seed dispersal) (Andersson et al. 2015; Camps-Calvet et al. 2016).

The main goal of this article is to analyze how different barriers restricting UGS provision affect the delivery of ESs. We focus on three levels of UGS provision: availability, accessibility and attractiveness, represented respectively by three case studies in Lodz (Łódź), Poland. Note that barriers preventing UGS provision, and ultimately also ES delivery, reflect the different, often conflicting interests of different stakeholders. As indicated above, our analysis is intended to broaden the discussion on UGS provision with additional consideration of its relationships with the delivery of ESs. Previous analyses of UGS provision can be associated with selected cultural

ESs only (recreational), but we argue that the broader context should be taken into account when planning urban green infrastructure (cf. Kabisch 2019).

All of the above links to differences in the various stakeholders' interests, preferences, expectations and opportunities to act regarding UGS management and use (Ernstson 2013; Goodness et al. 2016; Kimpton 2017; Rigolon 2017), which often results in misunderstandings and conflict situations (Castro et al. 2014; Zerah 2007). They are related to trade-offs in land use and the delivery of ESs. Indeed, UGS provision is not equal for all inhabitants, and some social groups (e.g., due to their income, race or ethnic variations) are less privileged than others (Rigolon et al. 2018a; Rigolon et al., 2018b; Walker 2012). Similar problems have also been observed in other geographical scales (Lattera et al. 2019). Moreover, some inhabitants may be less privileged because they live in relatively poor cities (Joassart-Marcelli 2010; Joassart-Marcelli et al. 2011) or they have good access, but only to small, fragmented and unattractive UGSs (dangerous neighborhood, lack of park infrastructure and leisure equipment) (Dahmann et al. 2010; Gobster 2002; Kabisch 2019; Perez-Verdin et al. 2004). Furthermore, the fact that the less privileged groups cannot benefit from many ESs provided by UGSs further weakens their general well-being and physical and mental health (Łaszkiewicz et al. 2018; Wolch et al. 2014). As a result, it is important to analyze the different stakeholders' stakes and roles, as well as the relevant institutional contexts.

This article is organized as follows. In the following section, we present our three case studies connected with UGS provision and ES delivery. We characterize our case studies by presenting the context and the involved groups of stakeholders. Then, we move to research methods, which are connected mostly with the analysis of secondary data (public discussions in the media, public consultations) and interviews. With the use of these methods, we determined which ESs have been limited for which groups of residents (and which have not) as a result of changes in UGS provision, along with the relevant institutional contexts. Finally, we synthesize our findings by highlighting that limiting UGS provision does not mean limiting the delivery of all ESs, and we point out that similar conflict situations are often not caused by people who are directly involved in them; rather, ES users tend to be confounded by top-down decisions and legal changes.

MATERIALS AND METHODS

Introduction to the case studies

We analyzed three case studies in Lodz (the third largest city in Poland with almost 700,000 inhabitants). The first case study reflects a problem relevant to all cities in the country, while the second and third ones concern specific locations in Lodz. However, all three case studies have universal implications. One can easily find parallels between the described situations and similar conflict situations regarding reduced UGS provision in other geographical contexts. Our focus on Lodz was motivated by the fact that UGS governance and management have already been well-studied in this city (Feltynowski et al. 2018; Kronenberg et al. 2017; Ratajczyk et al. 2017), which provided a good starting point for our analysis.

The first case study refers to the liberalization of the Polish Nature Conservation Act in 2017 (Articles 83, 85, 86 and 89), as a result of which landowners no longer needed to seek official permission from the municipality's office to cut trees on their property. This resulted in the massive removal of trees throughout the country. In previous years, records of tree felling were kept (tree removal had to be reported to the City Office), but since 2017, such a comparison is not possible based on official registers because the reporting obligation was also repealed, so the scale of the problem remains to be investigated. Polish cities lack specific data related to tree felling; there are practically no inventories of trees, neither on private or public properties (Feltynowski et al. 2018), which makes it even more difficult to trace the real effect of the massive tree removal of 2017. The 2017 removal of trees provides an extreme example of downplaying the importance of urban green spaces and urban trees, in particular, and illustrates the barriers (in particular governmental failures) to preserving urban ESs (Kronenberg 2015). In this case, the conflict of interest concerns the removal of trees (the stakes of its supporters and opponents), which is related to the liberalization of the law (in combination with property rights), as well as limiting the delivery of certain ESs.

The second case study features trade-offs related to the potential replacement of allotment gardens (over 100 plots in an area of 4.5 ha) with a public beach and park around a reservoir on the Jasien (Jasień) river in the center of Lodz (Figure 2). Allotment gardens are complexes of small plots (usually up to 500 square meters) allotted to individual leasees for the cultivation of plants or other recreational purposes (Bell et al. 2016; Drilling et al. 2016; Speak et al. 2015). For this area, the Municipal Planning Office is currently developing a local zoning plan (City Office of Lodz, 2017). This case study reflects broader controversies surrounding the existence of allotment gardens in Polish cities, in particular, in central areas, which are partly related to the fact that allotment gardens are only accessible to a restricted group of registered users (Drilling et al. 2016; Kosmala 2013). This case illustrates the broader disregard for allotment gardens in Poland, and the desire to replace them with other land uses, only some of which involve the preservation of the green character of these spaces (Haase et al. 2019). Indeed, challenges to the preservation of urban allotment gardens are common to many countries (Drilling et al. 2016; Spilková and Vágner 2016). In this case, the conflict of interest concerns the desire to use the allotment gardens' area in a different way (limiting access to ESs for allotment owners, but improving access to certain ESs for a wider group of residents) and the formal decisions which led to a public vote.

The third example represents a conflict between the different uses of the Lagiewniki (Łagiewniki) Forest in the north of Lodz (Figure 2). For most inhabitants of Lodz, the 1200-hectare Lagiewniki Forest is primarily an easily accessible place for recreation and relaxation, just a few kilometers from the city center (Jaskulski and Szmidt 2015). Since 2015, new types of entertainment activities have been organized in Arturowek (Arturówek), a leisure facility located in the southern part of the forest, with a public beach, ponds, playgrounds, a health path and mini outdoor gym. These activities have included loud music, beer and picnic festivals that attract large numbers of participants and disturb other users looking for peace and relaxation in the forest. In this case, the conflict of interest concerns the desire to use other cultural ESs and the different interests and preferences of different groups of forest users.

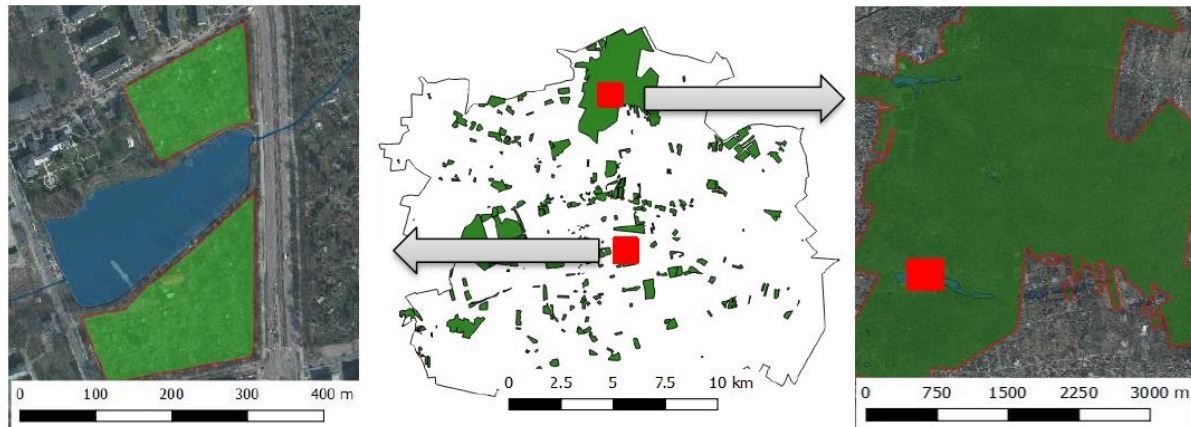


Figure 2. A map of Lodz with its main green spaces shows the location of allotment gardens near the reservoir on the Jasien river (left picture) and Lagiewniki Forest (right picture) with Arturowek (red square)

Research methods

To analyze the case study of tree felling in Lodz, we followed the heated public debate in Poland with opinions expressed in newspaper articles, on websites and in blogs, featuring official statements of various organizations and the personal statements of experts and interviewed members of the broader society. We selected and carefully read those newspaper articles, institutional statements and blog posts which directly referred to the benefits provided by trees to the broader society. Some of them acknowledged and others negated the importance of these benefits, and they prioritized the different interests differently. Of the several hundred articles and press notes which focused on tree felling, only some specifically addressed the above issues. We tried to capture the key arguments mentioned in the debate with regard to who benefitted and who lost out as a result of the removal of trees. Indeed, although there were numerous opponents of the revised law and especially of tree felling, there was also a comparable number of supporters and satisfied landowners. Both groups widely discussed the sense and relevance of protecting urban trees (vs. protecting the private interests of property owners). This material represents what emerged in the discussion as important standpoints regarding what society considers to be important results of the reduced availability of urban trees. Moreover, we analyzed the old and new versions of the Nature Conservation Act to capture specific changes in the law.

The potential replacement of allotment gardens by the Jasien river with a public beach and park was subject to broad discussion in Lodz, and it was voted through the municipal platform used by the City Office as a forum for public consultations – Vox Populi (City Office of Lodz, 2017). In this case, public consultations were organized following the strong opposition of allotment gardeners which emerged when the City Office announced its plan to liquidate allotment gardens and create a public beach and a park in their place. Apart from online voting, citizens could use hard copies of voting cards which they obtained from the City Office. Apart from the results and the special form of this vote, we analyzed Internet fora and media articles regarding the liquidation of allotment gardens by the Jasien river, official city plans related to the management of this area and additional materials from the Municipal Planning Office.

Our analysis of the conflicting uses of Lagiewniki Forest was based on interviews with forest users, supported by our own participant observation. To investigate opinions regarding the new entertainment events and how they affected the attractiveness of the forest, we interviewed 418 people from May to September 2017. The interviews were carried out in three places – in Arturowek (next to the site where the events took place), 1.5 km north of it (in the middle of the forest), and 2.3 km north of it (close to another major access point to the forest). The respondents were asked in a short survey (13 questions) whether they had participated in the music, beer and picnic festivals, and what they thought about them. The group of respondents was very diverse, reflecting the typical diversity of forest users, including different age groups, families with children, single people, as well as groups of friends; walkers along with those practicing sports (joggers, cyclists); they were also diversified in terms of socio-economic status. The interviews took place during the music, beer and picnic festivals throughout the whole season and each interview session lasted around two hours in each of the above three spots simultaneously. As soon as one interview was over, we approached the next passer-by. The results of our survey provide a general overview of the situation and indicate the different preferences and opinions of the residents.

Our approach to studying the barriers preventing the delivery of different types of ESs provided by UGSs follows the classification of barriers previously used in the context of UGS provision (Biernacka and Kronenberg 2018) and the most recent Common International Classification of Ecosystem Services (CICES) version 5.1 (Haines-Young and Potschin 2018). CICES was endorsed by the European Environment Agency and created in response to the need for a standardized, systematic classification of ecosystem services. This classification consists of sections, divisions, groups, classes and types of classes, with the three main sections divided into provisioning, regulation and maintenance, and cultural. CICES ‘Version 5’ was based on a review of the scientific literature, survey results and workshops, and it is commonly followed in Europe.

Each of the case studies concerns a different scale, types of green space, groups of stakeholders, as well as barriers that caused the occurrence of a given conflict situation. Due to this diversity, research methods and their results are not directly comparable. However, as already indicated earlier, the case studies are used to highlight the different problems and mechanisms, and not to serve as in-depth presentations of what happened in each of the described situations.

RESULTS

In the following subsections, we refer to our three case studies, indicating the key stakeholders involved in each case, along with their stakes, the institutional background, including the roles of the different stakeholders, and finally, the barriers which affect UGS provision and their impacts on the different ESs in each case study. We synthesize these results in Table 1 and finally provide a more general overview of how preventing UGS provision influences the delivery of ES.

Table 1. Synthesis of our case studies

Case study	Level of UGS provision	Types of barriers preventing UGS provision	Key stakeholders with conflicting interests, preferences and attitudes	Key ecosystem service groups restricted with reduced UGS provision
Removing trees on private properties	Availability	Liberalization of law, insufficient social support for the existence of certain UGS	Some property owners vs. Nearby residents, activists	Bio-remediation Filtration Hydrological cycle and water flow reduction Intellectual and representative interactions with the natural environment Pollination Seed dispersal Sequestration Smell and noise reduction Symbolic Visual screening
Elimination of allotment gardens by the Jasien river and the creation of a public beach and park	Accessibility	Changes in spatial planning, insufficient social support for the existence of certain UGS	Local authorities, potentially many inhabitants vs. Allotment gardeners	Bequest value Cultivated terrestrial plants Pollination Seed dispersal Physical and experiential interactions with the natural environment* Smell and noise reduction* Visual screening*
Organizing entertainment events in Lagiewniki Forest	Attractiveness	Loud and crowded outdoor events which discourage some users	People who enjoy popular entertainment vs. People who enjoy nature	Intellectual, representative, spiritual and symbolic interactions with the natural environment

* These services will remain available even when allotment gardens are replaced with a public beach and park, although some of them will be available to a different group of beneficiaries.

Preventing the availability of urban trees and the related ecosystem services

The massive removal of trees on private properties led to numerous objections and protests. These were motivated by the awareness of the positive external effects generated by trees in housing estates and private gardens. Indeed, while the benefits provided by trees represent public goods, the trees themselves are located on private land; hence, they are considered private property. Conversely, private property owners welcomed this change of law as a sanction of their right to manage their properties according to their own needs and preferences.

The change of law was related to the populist government's convictions, advocated most fiercely by the former minister of the environment, Jan Szyszko, reflecting his belief in sacrosanct private property. As a result, trees were often removed without a clear need, to seize the opportunity just in case the rules might change again (which indeed happened after six months).

When trees are removed, the nearby residents suffer the most; hence, those who cut trees also lost multiple benefits provided by the trees.

Legal failures, property rights and insufficient social support for the existence of urban trees represent the main barriers affecting the availability of urban trees, and consequently also the related ESs. When trees are removed from a city, services which are limited the most belong to the regulation and maintenance section (e.g., bio-remediation, filtration, carbon sequestration, smell and noise reduction, visual screening, hydrological cycle and water flow reduction, pollination, and seed dispersal) but also to the cultural section (e.g., aesthetic, symbolic, heritage).

Changes in the delivery of ecosystem services following the planned replacement of allotment gardens (restricted access) with a public city beach and park

In the online vote concerning the existence of allotment gardens by the Jasien River (N=8096), about 66% of respondents voted in favor of liquidating the allotment gardens, while about 26% voted to keep the gardens as they were (the remaining 8% voted for an intermediate solution, i.e., the partial liquidation of the allotment gardens) (City Office of Lodz, 2017). Meanwhile, in the paper vote in the City Office (N=447), most people opted to keep the allotment gardens – about 91%. It is worth noting that using the paper version requires a higher level of determination, and is usually used by those who have limited access to the internet, which might suggest that these were mostly allotment gardeners (elderly people).

The city of Lodz is the owner of the land where the allotment gardens are located, and it can execute its property rights by making the relevant land use decisions. Meanwhile, allotment gardeners are only land tenants, and the only way in which they can express their negative opinion is to protest or participate in a vote. If allotment gardens are replaced with a city beach and park, the UGS will remain available (will continue to exist), but its character will change, along with its accessibility for different user groups. This case study represents two different aspects of UGS accessibility: physical and psychological. Currently, the allotment gardens are fenced and only accessible to a restricted group of users, to whom a city beach and a park will most probably not only be unattractive but even psychologically inaccessible. This is because the character of this place will change and it will be taken over by a completely different group of users – the city plans to make it a fashionable place, the type of which usually attracts younger people who like to spend time in popular places where other similar people spend time.

The institutional context here reflects the insufficient social support for the existence of allotment gardens and the official decisions of the City Office favoring certain forms of UGS (and consequently the interests of the relevant social groups). Moreover, spatial planning failures and property rights (from the point of view of gardeners) are also barriers here, because due to the new local zoning plan, gardeners will lose the possibility of using leased plots. The City Office perceives a beach and a park as more appropriate for a modern city, compared to the allegedly outdated allotment gardens. This is partly related to the fact that allotment gardens deliver regulation and maintenance ESs similar to many other types of UGS, but their delivery of ESs representing the other two sections is restricted to registered users. This is mostly because of physical barriers (fences). A public beach and park could potentially offer a narrower range of regulation and maintenance ESs, with a restricted capacity to deliver services such as those related to lifecycle maintenance (reduced biodiversity, more people, and more infrastructure). Also, they

would not offer any provisioning services. Meanwhile, a public beach and park would open the opportunity to use ESs from the cultural section to a broader group of inhabitants.

Restricting the attractiveness of a municipal forest

Only slightly more than half of our respondents – forest users/visitors – had heard of the new entertainment events organized in the forest (227 out of 418 people) and this share was more or less equal in all three sites. Of those who knew these events and chose not to participate in them (157 people), 127 expressed negative opinions. In response to an optional request for additional comments, 50 people provided openly negative remarks – 9 people from Arturowek (4% of those interviewed in this site), 31 people from middle of the forest (23% of those interviewed in this site) and 10 people from the farthest place from the festivals (17% of those interviewed in this site); 18 had positive comments (10 of whom were interviewed in Arturowek). The former claimed that the forest should be an oasis of peace (especially those people interviewed in the middle of the forest, who care about silence and contact with nature; usually they were cyclists and runners), while the latter suggested that entertainment events constituted good fun for people in the open air.

The festivals are organized in the forest at the City Office's approval by the lessee. The City is the owner and manager of the land, and this particular site has been traditionally used for recreational purposes, with different activities coordinated by the Municipal Sports and Recreation Centre. Any opponents to activities taking place in the forest can either complain about them to the City Office, which requires additional effort, or avoid the area where the festivals are held (according to our survey results, about 41% of respondents who expressed negative opinions about these events changed the routes and locations visited in the forest to avoid nuisances). In practice, this means that, from the legal point of view, dissatisfied regular forest users are barely able to influence these events.

While the forest is still available and accessible, it becomes less attractive for regular users. The loud music, beer and picnic festivals involve many barriers associated with the third level of UGS provision – attractiveness – such as crowds, drunk people, noise, smoke from the barbecues, rubbish and improper behavior. In other words, the regular users' opportunity to benefit from cultural ES (e.g., scientific, educational, cultural, aesthetic and symbolic) is restricted by alternative uses of the forest as a site of entertainment events. In addition, we can assume that such festivals have a negative impact on the wild animals living in the forest.

Connecting barriers preventing the provision of urban green spaces with access to ecosystem services

In an attempt to generalize our findings, we considered a matrix of different ESs, the delivery of which is restricted by the different barriers preventing UGS provision at three levels (availability, accessibility and attractiveness) (Table 2). This matrix clearly indicates that not all barriers from a given level of UGS provision affect the delivery of different ESs to the same extent, and that cultural services are the most vulnerable to restricted UGS provision, while regulation and maintenance services are the least affected.

Table 2. Examples of the limitation of delivering different ecosystem services in the context of barriers preventing three levels of urban green space provision – availability, accessibility and attractiveness (for a broader overview of the barriers, along with their classification, see Biernacka and Kronenberg (2018))

Sections of ESs	Levels of UGS provision and types of barriers		
	Availability	Accessibility	Attractiveness
Provisioning	Barriers affecting this level (e.g., legal errors, new investments that cause the removal of trees) are directly related to the existence of UGS, and lack of UGS translates into the lack of any ES	Barriers affecting this level (e.g., fences, dangerous surroundings) affect physical access to UGS, which is essential to obtain physical products from ecosystems (e.g., through plant cultivation or animal husbandry)	Attractiveness is not typically associated with the provisioning ESs
Regulation and maintenance	Barriers affecting this level (e.g. legal errors, new investments that cause the removal of trees) are directly related to the existence of UGS, and the lack of UGS translates into the lack of any ES	Accessibility is not typically associated with the regulation and maintenance ESs	Attractiveness is barely associated with the regulation and maintenance ESs
Cultural	Barriers affecting this level (e.g. legal errors, new investments that cause the removal of trees) are directly related to the existence of UGS, and lack of UGS translates into the lack of any ES	Barriers from this level have an impact on those ESs from this section which require physical access, i.e., most of them (with exceptions such as intellectual and representative interactions with the natural environment – aesthetic experience, heritage)	Barriers affecting this level have an impact on the delivery of ESs from this section, because issues such as the visual aspects of UGS, the existence of park furniture, and the number of users or their behavior, directly translate into the willingness and frequency of using UGS and interactions with the environment

Barriers preventing UGS availability (e.g., new investments, legal, government and spatial failures, insufficient social support for the existence of certain UGSs) have the most important and clear implications for the delivery of ESs from all three sections: provisioning, regulation and maintenance, and culture. Clearly, without UGSs there are no ESs. At the second level of physical and psychological accessibility, restricted access to UGSs mainly affects the delivery of provisioning services (e.g., cultivated plants, reared animals) and, to a lesser extent, cultural services (those interactions with natural environment which require physical access). Barriers restricting UGS attractiveness affect only the cultural section of ESs as they translate into the users' willingness to visit the respective UGS.

DISCUSSION AND CONCLUSIONS

The aim of this study was to analyze how different barriers preventing UGS provision restrict access to ESs. We focused on three levels of UGS provision: availability, accessibility and attractiveness, and three situations where UGS provision was restricted. Our analysis shows that ES provision is not equal with UGS provision, at least not at all levels of UGS provision. This is a relevant extension of previous discussions on UGS provision. Only the most basic level of UGS availability is the most closely related with the delivery of the relevant ES, while at the level of UGS accessibility, the differences between ES delivery and UGS provision are the most significant.

Our case studies do confirm that ES delivery is closely related to the relevant institutional settings and failures. Our analysis shows that institutions act as filters or mediating factors (Andersson et al. 2015). The most relevant barriers in the light of our case studies are property rights, legal and spatial planning failures, insufficient social support for the existence or preservation of UGS, and loud entertainment events (especially because of noise and improper behavior). Property rights, in particular, are linked to trade-offs between the ESs offered by private land as externalities, and benefits from other land uses which could potentially be monetized by the owners. Our results indicate once again that ESs are co-produced by ecosystems and people – or, perhaps, rather the institutional settings within which they are delivered (Spangenberg et al. 2014). This is particularly evident in the case of accessibility and attractiveness, as even when they change, UGSs continue to exist, albeit in a different form and offering a different set of ES (Felipe-Lucia et al. 2015).

In each of the three case studies, decisions related to the existence and functions of particular areas affected the delivery of ESs to certain groups of city residents. At the first level of UGS provision – availability – the removal of trees results in the loss of all ESs. In the case of allotment gardens near the reservoir on the Jasien river and the second level of UGS provision – accessibility – some ESs are lost (especially from the point of view of allotment gardeners), other ESs appear (at least for a larger group of city inhabitants), and some ESs remain unchanged (of course, this depends on how this space will change, e.g., how many trees will remain, what share of impermeable surface and buildings will be achieved). As for the last level of UGS provision – attractiveness and the example of the municipal forest in Lodz – due to the organization of entertainment events, access to ESs is gained by those who otherwise would not use them (many of whom would probably not go to the forest had it not been for the entertainment events). Conversely, regular users lose access to some ESs (they change their routes because of loud festivals or refrain from going to this forest at all).

It is often assumed that stakeholder choices of ecosystem use are central in ES trade-off analysis (Turkelboom et al. 2018). However, as shown by our case studies, stakeholders who make decisions are not necessarily those who benefit from ESs or who are ultimately responsible for ES delivery and UGS provision (Ernstson 2013). Our case studies highlight the role of surprise and novelty (Faber, Manstetten and Proops 1992a; Faber, Manstetten and Proops 1992b) – often the inhabitants do not expect that something will happen, but when it happens, some of them gain and others lose (especially in the context of ES delivery). For example, in our first case study, we referred to a specific legal change which can represent broader, unexpected changes, which can dramatically affect the existence (availability) of UGSs. The change was so surprising and unpredictable that it could be classified as “political fiction” – before it was introduced, no one

thought that something like that could happen in real life. This may have dramatic and irreparable consequences as in the case of the removal of trees: property owners “benefited” from the liberalization of the law, while local residents lost many ESs provided by the trees, although none of these groups had expected such legal changes nor lobbied for them beforehand. However, due to loud protests and people’s objections, the government decided to toughen the law related to the removal of trees from private properties, which is an obvious manifestation that the liberalization indeed represented a governmental failure (Bojar-Fiałkowski 2017). The consideration of the different barriers to UGS provision should be part of every local planning process, not only with regard to UGS planning in general but also with regard to the distribution of specific benefits related to UGS availability, accessibility and attractiveness.

Our three case studies in one city in Poland illustrate some general phenomena and mechanisms responsible for limiting the delivery of ESs by imposing barriers limiting UGS provision. We indicated that access to UGSs is not always equal to the delivery of ESs. Moreover, institutional context and barriers (e.g., property rights, legal failures or insufficient social support for the existence of UGSs) are crucial in terms of delivering ESs. Our findings should be considered in future studies related to political ecology and environmental justice, especially with regard to conflicts surrounding access to UGSs and the relevant ESs. Further research should focus on a deeper analysis of delivering different ESs in connection with many other types of barriers limiting UGS provision. Such studies would benefit from the direct involvement of the different stakeholders and from their specific perception of what prevents access to the different UGSs and ESs.

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