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THE ROLE OF URBAN GARDENING IN BUILDING CITY RESILIENCE TO CLIMATE CHANGE

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ABSTRACT: This article has two purposes. The first is to illustrate the role that urban gardening can play in building city resilience to various negative impacts caused by changes in the economic and social spheres, as well as their connection to global warming. The second goal is to investigate whether Polish cities use urban gardening to strengthen the resilience of socio-economic systems to climate change. Based on literature studies, experiences and contemporary trends in urban gardening in different countries were presented as a key factor for improving the resilience of cities. Some initiatives and projects were described based on dedicated websites. To formulate recommendations for Polish cities, the results of the "Let's Feel the Climate" project, under which 44 urban adaptation plans were developed, were subjected to critical analysis. Worldwide, the usage of urban gardening to strengthen cities' resilience to climate change is becoming more and more common. Polish cities have yet to join this positive trend.

KEYWORDS: urban gardening, climate change, urban resilience, adaptation to climate change

Introduction

Since there is no universal definition of an urbanised area, estimates of the size of the urban population vary depending on the source. However, all researchers agree that the percentage of the urban population in the total population is constantly growing. According to UN data in 1960, there were twice as many people living in rural settings (2 billion) than in urban areas (1 billion). The latest published estimations show therefore, that 55% of people in the world lived in urban areas in 2018 (World Urbanization Prospects). According to the Statista (https://www.statista.com/statistics/270860/urbanization-by-continent/), in 2020, North America was the most urbanised continent worldwide, with 82 percent of the population living in cities followed by Latin America and the Caribbean, and Europe with 79 and 75 percent of the urban population, respectively. It is projected that the global share of people living in urban areas will increase to 70 percent in 2050, compared to 56 percent in 2020. Urbanisation is a global issue that concerns several scientific and political interest fields – society, economy, innovation, infrastructure, services, environment and resources, governance, and diplomacy. Today it is commonly agreed that cities, despite their attractiveness due to easy access to services and labour market, are places where the cumulation of various social and economic problems is very high (Bauman, 2001, Therborn, 2013).

Global warming is an additional threat that affects the urban population differently, particularly through extreme weather phenomena (Robin, 2007, Dell et al., 2014, Graczyk et al., 2019). Climate warming in urban areas means an increase in heat stress for residents, especially during more frequent and long-lasting heat waves, increased risk of flash floods due to rains falling on a hardened and impermeable surface, flooding because of significant loads on the sewage network with rainwater during storms and torrential rains (Della-Marta, 2007). In turn, periods of drought result in deterioration of the microclimate and the condition of vegetation, as well as a reduction in air quality (Gomez-Baggethun, Barton, 2013; Wang et al., 2014, Kabisch et al., 2015). Urban heat islands, limited access to green spaces and fresh, locally produced food, high level of social isolation undermine the vitality of expanding metropolises. Increasing the resilience of local socio-economic and natural systems to various types of stress became a challenge for city authorities.

This article has two purposes. The first is to show the role that urban gardening can play in building city resilience to various negative impacts resulting from changes in the economic and social spheres and connection with global warming. The second goal is to investigate whether Polish cities use urban gardening to strengthen the resilience of socio-economic systems

to climate change. Resilience is understood as the capacity of a city to respond to a perturbation or disturbance by resisting damage and recovering quickly. It concerns both social and technical infrastructure, including blue and green infrastructure.

Research methods

Various methods were used to collect data for the research. Based on literature studies, experiences and contemporary trends in urban gardening in different countries were presented as a key factor for improving the resilience of cities. Some initiatives and projects were described based on dedicated websites. To formulate recommendations for Polish cities, the results of the "Let's Feel the Climate" project, under which 44 urban adaptation plans were developed, were subjected to critical analysis. The project was implemented under the auspices of the Ministry of Environment (http://44mpa.pl/miejskie-plany-adaptacji/). In the study, data from Statistics Poland were also used.

A new approach to an urban horticulture

Urban gardening is as old as cities. The ancient Romans used the term *rus in urbe* to describe the presence of fields and gardens in cities, providing food, shade, and relaxation. The concept of *rus in urbe*, which means 'a country within a city', has penetrated the development of cities until today (Melvin, 2018). The potential of urban horticulture was demonstrated both during the industrial revolution, when it was a remedy for the disastrous living and working conditions of millions of factory workers, and during both world wars in the twentieth century, when produce was grown in private gardens and public parks in Victory Gardens (e.g., in the United Kingdom, the United States, Canada, Australia, and Germany) to supplement food rations during the rationing period and to increase the morale of societies. Although Victory Gardens were portrayed as a patriotic duty, 54% of Americans polled said they gardened for economic reasons, while only 20% mentioned patriotism (Bentley, 1998).

Today, urban gardening is experiencing a genuine revival. It is evident in the number of people involved in this type of activity and the innovative approach to the very organisation of work, location, and technology used (Guitart et al., 2012). Urban food gardens can be divided into individual and collective gardens. The former include family gardens and allotment gardens,

community gardens, educational and school gardens, and therapeutic gardens. Squatter gardens are a special category and can fall into both groups. Gardens' sizes vary from crops in balcony pots, through small plots of land squeezed between houses, to large gardens set up on former wastelands and the roofs of parking lots and other buildings. Food production in the city can be a kind of hobby, a way to save on purchases, but it can also fulfil other significant social, economic, and ecological functions, also connected with the transition to a low-carbon future (Walker, Salt, 2006; Aiken, 2012, Goldstein, 2016). The research has shown a positive impact on food production (both for self-consumption and sale) in neglected residential districts characterised by high unemployment and crime rates. In addition, collective gardening in specially designated public places turned out to be a factor facilitating establishing contacts, strengthening social ties, improving the safety of residents, and gaining new knowledge and skills. Such effects have been reported in a long-term project in Philadelphia (Branas et al., 2018).

In turn, the *Unit* of *Community Action* (*Unités d'Action Communautaire*) in Geneva initiated a garden plots project within the public sphere for the use of local residents. The area occupied, initially 310 m^2, was enlarged in 2010 to 4,290 m^2. The Beaulieu collective, a group formed by the neighbours' association and the ecology foundation, manages the garden. The collective reclaimed the abandoned greenhouses and the flower beds of the city's green space management service. Community activities related to food production and ecology education have increased each year, including seed conservation, beekeeping, and organic agriculture promotion. The greenhouse produces ancient horticulture species and provides them to a conservation group, distributing rare seedlings to other community gardens and organic shops. The project is located within a public park helping to gain new followers and to promote the project. The findings provided by Food Urbanism Initiative (supported by the Swiss National Science Foundation under the National Research Programme NRP 65 "New Urban Quality") puts forth urban strategies that summarise the lessons learned through the project's research. The developed recommendations create social opportunities, guarantee ecological benefits, extend urban economies, and make the city fertile (https://www.foodurbanism.org/urban-strategies/).

Singapore, a sovereign island city-state is another good example of the drive for large-scale green and climate-friendly solutions. Green buildings play a key role in climate change mitigation strategy. They are energy-saving, water-saving, and pretty to visually appealing. Since the launch of the BCA Green Mark scheme in 2005, the number of green buildings in Singapore has increased from 17 in 2005 to over 3,000 by 2021. The task is to green 80% of all buildings in Singapore by 2030. Food production is also increasing in

accordance with undertaken by the Singapore Food Agency (SFA) action to achieve the '30 to 30' goal to meet 30% of food needs locally by 2030. The SFA launched the tender for sites on the rooftops of Housing & Development Board (HDB) multi-story car parks for urban farming. The sites will be used to farm vegetables and other food crops, as well as for other related purposes, such as the packing/storage of produce. It is a part of a broader concept known as HDB's Green Towns Programme dedicated to intensifying greening in HDB estates. It is also important to encourage Singaporeans to grow their own edibles and experience the benefits of health and well-being that come from gardening. This idea is realised by NParks launching such an initiative as 'Gardening with Edibles' (https://www.nparks.gov.sg/gardening/gardening-with-edibles). To support the interest in edible gardening, by 2030, NParks aims to increase the number of community gardens islandwide to 3,000 and the number of allotment plots in parks to 3,000 under its flagship gardening program, Community in Bloom (CIB). The program was launched in May 2005 and was first carried out at Mayfair Park Estate. The CIB nationwide gardening movement aims to foster a community spirit and bring together all residents to make Singapore the City in Nature. Today, the CIB has over 1,600 community gardens across Singapore that have engaged more than 40,000 gardening enthusiasts (https://www.nparks.gov.sg/gardening/community-in-bloom-initiative). Allotment gardens situated in public parks and gardens are another initiative. They are not fenced to allow the public to visit and appreciate them. Each allotment garden plot consists of a raised planter bed (2.5m x 1m) and comes equipped with soil in the planter box and a mini-storage area for tools. The lease period for these plots will be typically up to 3 years at a charge of 57 Singapore dollars per year (excluding tax) but may vary depending on the location (https://www.nparks.gov.sg/gardening/allotment-gardens).

Public gardens are also meeting places for people. It is especially important for seniors, the number of which is growing rapidly, particularly in highly developed countries. During heat waves, weakened and sick, they often die alone in their apartments, and this fact is sometimes discovered after many weeks or months. In Japan, known as a country with a huge population of people 85+ living in one-person households, the number of unaccompanied and undetected deaths has risen significantly. In Japanese, there is even a special word to name lonely death (*kodokushi*). It is 'bad death' that affects the apartment in which it took place. They are called *jiko bukken* – 'black property', or the 'psychologically harmful property', and are much cheaper than others. This *signum temporis* results from broader societal challenges such as social isolation, poverty, or social exclusion. Nowadays *kodokushi* is at the centre of public attention. It became a stimulus to develop efficient local

welfare networks. To reduce the number of lonely deaths and develop more resilient social structures special initiatives are undertaken. They include raising the residents' awareness of the issue and re-activating neighbourhood life in green areas and community gardens (https://savvytokyo.com/heres-how-to-join-a-community-garden-in-tokyo/; https://www.dezeen.com/2013/09/12/pasona-urban-farm-by-kono-designs/).

The growing awareness of the dependence of the quality and safety of life of city dwellers on the condition of the natural and man-made ecosystems is visible in a dynamic development of interest in blue and green infrastructure (Wagner et al., 2013) and in ecosystem services provided by city greenery, lakes, rivers. Ecosystem services are defined as benefits that humans obtain from ecosystem functions (de Groot et al., 2002; Millennium Ecosystem Assessment, 2003) or as direct and indirect contributions from ecosystems to human well-being (TEEB, 2010, 2011). Thus, building the resilience of cities to the effects of climate change has become a particular challenge.

Table 1. Benefits of urban gardening

Area of recognised benefits	Kind of benefit
Economic	Access to fresh, inexpensive food Shortening the path "from field to plate" Lowering the cost of living of households Increasing household savings Business development opportunities Generating income Employment and qualification opportunities Increasing the value of the real estate Reducing city's maintenance costs
Social	Community meeting place Building social capital Revealing social activism Improving food security and variety in the diet Strengthening food justice Expression of cultural heritage (access to food of cultural importance) Outdoor physical and mental recreation Education in horticulture / agriculture and a healthy diet
Ecological	Increasing urban green spaces Mitigation of urban heat islands Improving air quality Increasing biodiversity Increasing the capture and infiltration of rainwater Protection against floods Reducing food waste through composting Reintegrating city dwellers into the natural environment Reducing the carbon footprint of cities

Source: author's work.

Gardens and parks in cities mitigate urban heat islands, improve air quality, increase biodiversity, increase the capture and infiltration of rainwater, protect against flash floods, and reduce the carbon footprint of cities (Robine et al., 2007, Dymitryszyn, Urban, 2015, Graczyk et al., 2019). Reduction of the carbon footprint of cities can be achieved in cooperation with residents, using their willingness to be active in gardening. This can be done by increasing food production in cities and shortening the way from 'field to plate' and thus reducing the number of 'foodmiles'. In addition, cultivation sites provide physical activity, stimulate social interaction, encourage healthy nutrition, and reinforce dwellers' connection to the earth. In turn, using the retention capacity of gardens acts as a buffer in case of flash floods and flooding. This avoids many losses in the property of various entities and lowers the city's maintenance costs. Results of literature studies are summarised in table 1.

The project "Let's Feel the Climate" and urban gardening – the case study of Poland

A project "Let's Feel the Climate" ("Wczujmy się w klimat") involving the development of adaptation plans to climate change in cities with more than 100,000 inhabitants covered 44 of the largest Polish cities. It was initiated by the Ministry of the Environment and implemented from January 12, 2017, to January 12, 2019, by the consortium in cooperation with city authorities, residents and experts. The scale of the project was significant because, together with Warsaw implementing the "Adaptcity" project, it covered 30% of the Polish population. As a result, the Urban Adaptation Plans written according to an identical pattern were developed. According to the adopted assumptions, the implementation of urban adaptation plans is to have a real impact on the lives of city residents. Modernised flood protection systems, effective water resource management schemes and the development of information and warning systems against threats are to make the inhabitants feel safer and benefit from the improvement of the aesthetics of cities. Green areas, important for the inhabitants' quality of life and reducing the nuisance resulting from urban heat islands, are to play an important role. When implementing the project, it was necessary to consider the specificity of individual cities resulting from their geographical location, historical heritage, and the diversity of contemporary development determinants. One of the project's objectives was to identify the main climate risk factors and the vulnerability of the socio-economic systems of individual cities to their impact.

In the study of 44 Urban Adaptation Plans, we turned our attention to chapters entitled *Adaptation Actions*. In general, adaptation plans included

organisational, educational, and information activities as well as technical activities aimed at increasing the resistance of cities:

- to higher maximum temperatures and heatwaves, magnified by the urban heat island phenomenon,
- to the occurrence of torrential rains and flash / urban floods,
- to the occurrence of periods without precipitation with high temperature,
- to strong and very strong winds and storms, including hailstorms.

All Urban Adaptation Plans were analysed in terms of urban gardening as an element strengthening the resilience of Polish cities to climate change. We were curious to what extent the city authorities and entities involved in the project are open to using urban gardening to strengthen cities' resilience to climate change. It turned out that this aspect of building city resilience has been completely ignored. If any, the references to allotment and home gardens only concerned the inventory of green areas (Białystok, Gdynia, Legnica, Lublin, Olsztyn, Poznań, Włocławek, Zabrze). The importance of ecosystem services provided by urban gardening has been entirely omitted. Likewise, no attention was paid to the potential of economic benefits for city budgets from reducing the costs of building and maintaining rainstorm infrastructure, reducing the nuisance of urban heat islands, which in turn may reduce the number of hospitalisations and deaths during heatwaves.

In Poland, the family allotment garden is a public utility by providing common access to the area of the family allotment garden and a plot facilitating gardening for one's own use as an improvement of the environmental standards of the environment. It satisfies the leisure, recreational and other needs of social members of local communities (https://stat.gov.pl/en/metainformation/glossary/terms-used-in-official-statistics/1376,term.html). As a green area, it is subject to the protection provided in regulations on the protection of rural and forest areas and provisions of the law on nature protection and environment protection. The history of the allotment gardeners movement in Poland dates back to the end of the 19th century. From 1900 to 1990, thousands of allotment gardens were established in Polish cities, where urban and suburban wastelands were successfully adapted for gardening. After World War II, the authorities came up with a slogan: "An allotment garden for every worker's family". The activists of the allotment gardeners movement managed to realise this postulate and transform such gardens into a public utility. State-owned enterprises granted plots as a kind of reward for 'good conduct'. After the transition to a market economy in 1990, the recreational function of allotments gradually began to displace gardening.

Moreover, plots in attractive locations have become the subject of interest of developers willing to build apartments, office buildings, and shopping

centres. Until 2005, the allotment gardens under the law were treated as agricultural land. After this year, the new act classified them as "green areas within the meaning of other acts" and this provision is in force today. In recent years, in Poland, especially in large cities, allotment gardens have become a topic of conflict. As a result, decisions regarding their future development are avoided in the spatial policy (Biegański, 2015).

It is a paradox that 12 out of 44 cities involved in the "Let's Feel the Climate" project are the cities from the Silesian Voivodeship, where the tradition of allotment gardens is old and strong (Bielsko Biała, Bytom, Chorzów, Czeladź, Częstochowa, Gliwice, Jaworzno, Katowice Mysłowice, Ruda Śląska, Sosnowiec and Zabrze). In 2019, out of 4,614 allotment gardens in Poland, as many as 657 were located in this voivodeship. They covered an area of 3490.6 ha, which accounted for almost 11% of allotment gardens in Poland (GUS, 2019). However, even in the Silesian Voivodeship, which has the highest rate of urbanisation in Poland (77.6%), and numerous ecological problems, including poor air quality, the potential of urban gardening in strengthening cities' resilience to climate change was not noticed or appreciated. It proves a stereotypical approach to adapting cities to climate change when the authorities prefer to spend money on grey infrastructure, educate and inform residents, but do not invite them to active cooperation.

Conclusions

Thanks to the results of many years of research, the awareness of urban gardening impact on human welfare and well-being is growing. This applies to various aspects of human life that can be assigned to the social, health, psychological, educational, and economic spheres from the individual's point of view. When looking at urban horticulture from the perspective of local authorities, there are also aspects related to adaptation to climate change, improving the population's living conditions, safety, and reducing the city's maintenance costs. Nowadays, we see a growing appreciation of nature-based solutions in city management. In many cities around the world, the potential of local communities to adapt to climate change and strengthen resilience through gardening activities is also appreciated. Both the inhabitants and the maintenance of cities benefit from gardening activities. Numerous examples of actions taken all over the world demonstrate this. Community gardens and micro plots strengthen residents' social bonds and relationships.

They can be used to enhance social dynamics by acting as a form of basic public infrastructure. Making vacant land available for gardening in cities can

develop local food production centres. By encouraging local production, several goals can be achieved at the same time: strengthening social ties and cities' resilience to the effects of climate change, creating production communities conducive to economic development, and reducing the carbon footprint of cities. It is worth referring to the inspiring experiences of cities which saw significant potential in adaptation to climate change in urban horticulture. This is supported not only by social and ecological but also by economic arguments. Strengthening the resilience of cities to climate change does not have to rely only on the development of infrastructure by local authorities but on the careful use of what the city gardens offer, so enthusiastically cultivated by the inhabitants. Urban gardening has the advantage of activating residents to take measures that are a source of external benefits in all its forms. Through their work and the money spent on establishing and maintaining gardens, city dwellers engage in adaptation to climate change. Gardens absorb and retain water and improve the microclimate and provide food and protect biodiversity. Unfortunately, cities in Poland have yet to recognise the benefits of urban gardening in increasing resilience to climate change. Local authorities have yet to learn this lesson.

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