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Sustainable Cities and Forest Therapy: The Influence of Urban Parks in Developing Eco-Sustainable Living Environments for Future Cities

Cities are facing many essential challenges in terms of creating eco-sustainable living environments, developing sustainable urbanism and achieving sustainable urban form in future city development. One of these challenges is how to solve problems of unsustainable geographical expansion patterns and ineffective urban designing and planning methods that have increased the number of slums areas, unsuitable delivery of basic services inefficient resource use and poverty. The paper explores the influence of urban parks in developing future cities' eco-sustainable living environments. It argues achieving sustainable urban form today requires a reorientation of the search for new design strategies to respond to the variety of cities' urban forms and urban context challenges. It debates that managing the heavy dependence on ecosystem services is the main challenge for today's cities, which results in the depletion of natural resources and biodiversity and the efforts to mitigate and adapt to climate change while prioritising public health and quality of life. The research aims to investigate how to achieve sustainable urban form in future cities, as well as to address how to enhance eco-sustainable living environment issues in relation to design and planning. It develops an argument around the topics of city forest therapy, eco-sustainable living environments, sustainable urban form, and the role of urban parks in sustainable cities, and urban parks in Manchester City. The paper adopts mixed research methods to analyse and assess several urban parks around Manchester City. The outcomes of this research endeavoured to understand the impact of urban parks in promoting Manchester City's urban context eco-sustainable living environments. It also explores the influence of urban parks in developing cities' forest therapy and creating eco-sustainable living environments in the city's urban context.

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INTRODUCTION

The population growth in cities has increased in recent years to exceed the proportion of population growth in rural areas, around 70 % of the world's population is predicted to live in urban areas by 2050. Therefore, cities are experiencing massive urban transition the world has ever seen, accounting for 80% of global carbon dioxide emissions, consuming over two-thirds of the world's energy, and producing 1.3 billion tons of waste per year (Al-Saffar, 2019; Nations, 2013; UN-Habitat, 2016; United Nations, 2013, 2016). Thus, fast urbanisation often causes damage to the city's ecosystem, infrastructure services and impacts cities' natural environments (Hunter et al., 2019; Shen, Jorge Ochoa, Shah, & Zhang, 2011). This demographic change requires new methods and new sustainable design strategies as current tools are insufficient. These new approaches require innovative and intelligent strategies to address the rapid growth of cities effectively. In the next 50 years, we will need to build cities for 3 billion human beings, double what we have today. This confirms the necessity to implement urban sustainability principles and enhance forest therapy, which can be done by developing cities' urban parks to achieve eco-sustainable living environments. Therefore, attaining eco-sustainable living environments in Manchester City's requires employing smart methods and modern thinking to manage the city's future challenges, developing new systems of gaining (zero carbon, zero waste, green transportation, sustainable food, equity, happiness, health and culture), and implementing green sustainable infrastructure in terms of green space, parks, gardens, civic space, water, waste, transportation and energy (figure 1) (Lehmann, 2014; Reutersward, 2009).

Urban parks play an essential role in enhancing Manchester City's forest therapy to mitigate climate change and achieve sustainable eco-city development, as well as make cities competitive, eco, inclusive, resilient, sustainable and efficient in resource use. Eco-sustainable living environments can promote cities' urban parks, construct

sustainable urban ecosystems, and develop the city's renewable energy system management (Weiping, Zhengjia, Zili, & Liandong, 2022). Urban parks "provide a range of cultural ecosystem services including health benefits through recreational and tourism opportunities" (Misiune, Depellegrin, & Egarter Vigl, 2022, p. 113). Urban parks and green open spaces play an essential role in reducing vulnerability and improving people's mental health and well-being (Misiune et al., 2022, p. 285). Consequently, urban designers, architects, and urban planners need to adopt new principles for designing active cities, able to manage their land use, green infrastructure, urban parks, and living environments in productive ways. The paper develops an argument around the topics of cities forest therapy and how to develop eco-sustainable living environments in future city development. It concentrates specifically on sustainable urban form, sustainable urbanism and challenges, the role of urban parks in sustainable cities, urban sustainability, and the evolution of cities, along with a review of common challenges and barriers. It provides a review of the origins of these subjects, along with different definitions of each that are commonly cited in the literature. This research investigates and analyses Chorlton Water Park in Manchester as case study areas of this research.

MATERIALS AND METHODS (METHODOLOGY)

This research is based on a combination of theoretical and empirical data to ensure that research questions are answered by using appropriate methodologies. The research employs qualitative and quantitative methods to assess and survey Chorlton Water Park in Manchester City. A case study method is employed as a research tool to analyse Chorlton Water Park (Khalifehei, 2014). In all phases of the case study area, a wide variety of data from different sources, such as maps, photographs, and legislative texts, have been integrated and analysed. In this research, various assessment strategies are implemented, including a walking method, a serial vision method, and an

observation ethnographic approach—all of which assess the built environments situated within Manchester urban parks (Al-Saffar, 2024; Leech & Onwuegbuzie, 2009). Qualitative and quantitative approaches are ultimately two different methodological systems selected to accomplish the aim of the research study. The nature of this study can be defined as a multi-strategy approach, where each method integrates and builds on the strength of the other (Al-Saffar, 2020; Wilson, 2016).

A mixed methodology is applied, which combines quantitative and qualitative processes of analysis to assess Manchester City Chorlton Water Park current situation, problems, and challenges (Scholz & Tietje, 2002). The mixed research methods design has been synchronised with the information gathering. The paper utilises processes drawn from current embedded forms of gathering information, in which quantitative and qualitative


Fig. 1 - Green Sustainable Cities Infrastructure to measure eco-sustainable living environments in Manchester City's. Source: Author 2025 according to (Lehmann, 2014; Shen et al., 2011).

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information are collected simultaneously. This research employs various methods of gathering and analysing data within a single study paradigm. The results of this paper show how the use of two broad methodological approaches, qualitative and quantitative achieved the research aims and objectives. It shows the importance of mixed research methods to evaluate Manchester City urban parks and raise awareness of the significance of safeguarding the city's eco-sustainable living environments (Johnson & Onwuegbuzie, 2004; Leech & Onwuegbuzie, 2009; Scholz & Tietje, 2002; Wilson, 2016). Therefore, investigating Manchester's urban parks, specifically Chorlton Water Park, as a case study provides a comprehensive understanding of the eco-sustainable living environments' requirements in one of the significant historical cities.

SUSTAINABLE CITIES URBAN FORM AND URBAN SUSTAINABILITY

Sustainability has become an essential concept in national and international discussions, which have attempted to identify the role of cities in obtaining sustainable environments and facing urban growth challenges (World Commission on Environment and, Brundtland, Worcomenvdev, & Wced, 1987). Sustainability endeavours to enhance citizens' quality of life in cities through socio-economic and environmental development (figure 2) (Al-Saffar, 2016; Naguib, Afifi, & Wahba, 2016). Sustainability also strived to conserve the presence of the ecosystem and its infrastructure services that respond to human and natural environment requirements in cities. It tries to create a manifesto on how to protect cities' living environments sustainably (Yigitcanlar, Dur, & Dizdaroglu, 2015). Sustainable cities seek to develop long-term people's quality of life and enhance cities' natural environment by efficient use of natural resources and manageable urban growth (González, Berger, Sánchez, & Mahichi, 2023). Cities' urban forms have different degrees of sustainability, and due to that, there is no single model of sustainable urban form that is applicable in

Fig. 2 - Analysing the Three Dimensions of Sustainability from Global to Local Level. Source: Author 2025 according to (Naguib et al., 2016)
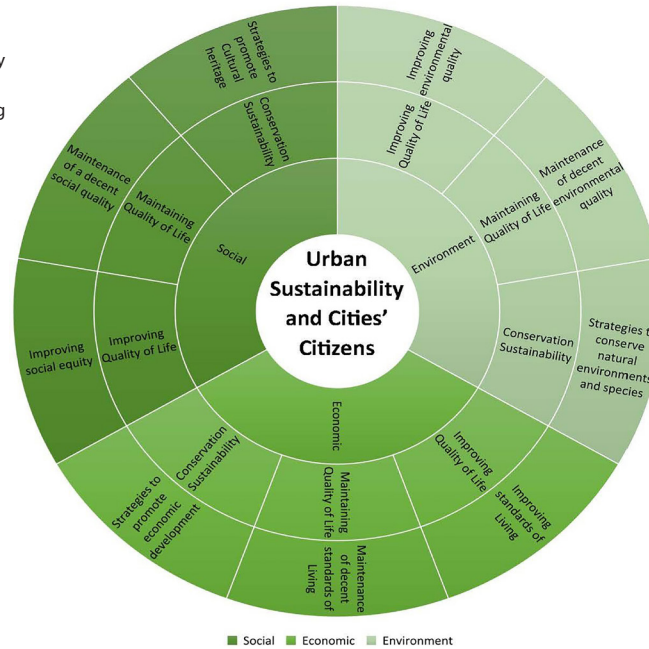
all cases. A sustainable urban form "is one that can adapt well to the requirements of growth and change without destroying natural resources and traditional culture in the process". (Romanos & Auffrey, 2002:253). Sustainable cities' urban forms have concentrated on increasing the urban development density, implementing mixed land uses and realising socioeconomic and environmental differences (Mike Jenks & Jones, 2010). Cities' future form strategies that should be adopted in a global economy and information age are still being debated (M. Jenks & Dempsey, 2005:24). The sustainable urban form concept to be achieved in Manchester City requires a high density and adequate diversity, compact with mixed land uses, and its design is based on sustainable transportation, greening, and passive solar energy. To achieve these aims, local governments, professionals, landscape architects, and urban designers should employ a variety of eco-sustainable

urban planning and design strategies and policies (Jabareen, 2006). We cannot consider urban forms 'sustainable' in their full meaning if they are not appropriate to people as places to live, work and interact. Thus, to achieve a sustainable urban form, develop eco-sustainable environments, and promote urban design policies, Manchester City should employ the compact city model, which consists of a city urban form with high density and mixed land use. It is also essential to understand the physical urban pattern and navigate it towards sustainable urban form development (Charehjoo & Siong, 2013).

Modern sustainable cities are places of economic production, social well-being, and environmental quality. These three elements have been highlighted as key components of sustainability in the 'Action Agenda for Sustainable Development' of the United Nations (Palacio, 2015). Therefore, Manchester City must consider sustainability di-

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mensions in future urban development (figure 3). The relationship between these three dimensions should be integrated as one cannot exist without the others. Developing Manchester City's urban living environments requires employing new sustainable urban design strategies that enhance cities' urban forms' sustainability. Thus, the fundamental thing to achieve sustainable cities is to produce new active generations able to participate in making decisions and changing the city's political structures. Furthermore, cities' sustainable urban form strategies should be adopted in a global economy. Consequently, a high quality of life for the whole society within a new socio-economic framework is the main objective to achieve urban sustainability and reduce the city's impacts on the local and global environment (M. Jenks & Dempsey, 2005:24,28). Many policies which seek to address the move towards eco-sustainable living environments in cities were growingly prioritised in governments' schemes during the post-COVID cities (Affolderbach & Schulz, 2017; Court, Kelly, & Hardman, 2022; L. M. Mitchell et al., 2021). The green city, urban sustainability and urban greening concepts have become essential to governance, policy-making and urban development in recent years. Cities around the world such as Vancouver, Freiburg (Germany), and Vaxjö have developed initiatives to become the greenest cities based on a sustainable strategies agenda (Affolderbach & Schulz, 2017; Court et al., 2022). Creating sustainable cities "is not just about improving the abiotic and biotic aspects of urban life, it is also about the social aspects of city life, that is—among others—about people's satisfaction, experiences and perceptions of the quality of their everyday environments" (Chiesura, 2004).

Urban sustainability concentrates "on human wellbeing which depends on, fundamentally, the flows of ecosystem services (provisioning, regulating, and cultural) derived from natural capital (biodiversity and ecosystems) locally and from afar" (Huang, Wu, & Yan, 2015). Urban sustainability and sustainable development have become increasingly prominent on political agendas and scientific research. Urban sustainability objectives
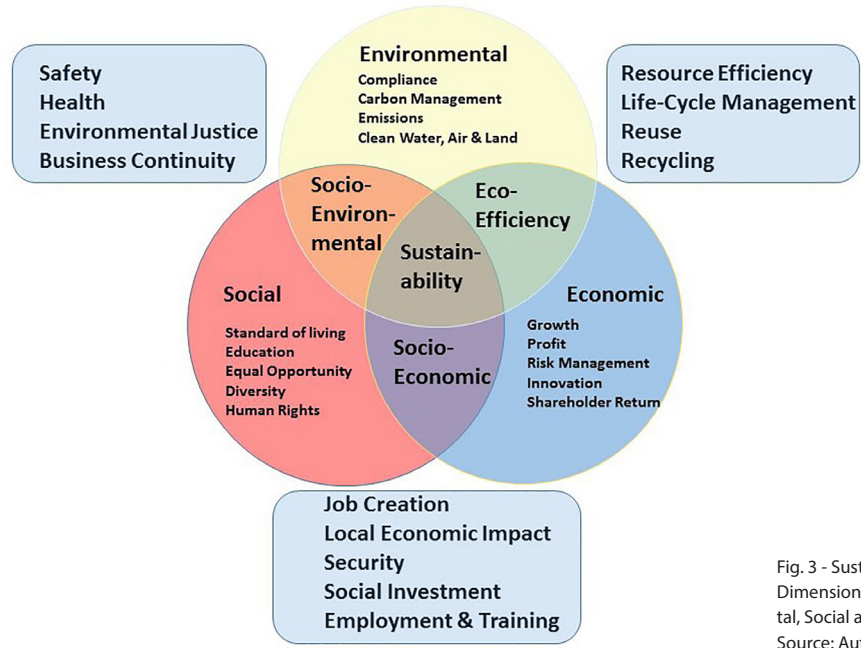

Fig. 3 - Sustainability Main Dimensions: Environmental, Social and Economic. Source: Author 2024

should aim to manage urban systems efficiently, maintain cultural and social diversity, minimise the consumption of open green space and natural resources, ensure equal access to city's services, and protect community health and well-being (Al-Saffar, 2018b; Huang et al., 2015). Consequently, urban sustainability could be achieved by considering urban systems as ecosystems, where humans by their behaviours can enhance cities' ecosystems. The challenge is how to counter human behaviours' negative effects and establish new sustainable activities that maintain equilibrium within the parameters of sustainability (Grierson, 2007). Urban sustainability is identified as "a desirable state or set of urban conditions that persists over time. It is often characterized by issues such as inter-generational equity, protection of the natural environment, minimal use of non-renewable resources, economic vitality and diversity, community self-reliance, individual well-being,

and satisfaction of basic human needs" (Adinyira, Oteng-Seifah, & Adjei-Kumi, 2007). Urban sustainability is "an adaptive process of facilitating and maintaining a virtual cycle between ecosystem services and human well-being through concerted ecological, economic, and social actions in response to changes within and beyond the urban landscape" (Huang et al., 2015). Consequently, we should understand the sustainable city concept, sustainable design strategies, what eco-sustainable living environments should look like in cities and how urban sustainability should function to achieve eco-sustainable living environments in cities.

DEVELOPING ECO-SUSTAINABLE LIVING ENVIRONMENTS IN FUTURE CITIES

During the COVID-19 pandemic, many issues become significant in the city's well-being context

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such as relaxation in the natural environment, mental health and the therapeutic use of direct social contacts. Long-term social isolation, online learning and working from home have revealed the need for urban parks, green open spaces, and eco-natural environments, which play a therapeutic and preventive role within the city's urban context and form (Sandra, Alina, & Anna, 2021). Achieving eco-sustainable living environments in Manchester City requires addressing urban environmental problems differently by considering the integration of ecology and community in the city's future development plan. Manchester City should consider health effects, ecology values, productivity and amenities as the main environmental planning indicators and evaluate the effects of urban environmental challenges based on these aspects. Moreover, Manchester City's ecological urban development requires implementing sustainability principles that save open space, create smart sustainable mobility systems, develop walkable communities, and enhance materials recycling. This promotes environmental justice, pollution prevention, and restoration of ecosystem aspects within the city urban context (figure 4) (Mersal, 2016).

Eco-sustainable living environments in cities are a complex issue to understand. It requires an understanding of the city's urban form and context, cultural background, regional and national differences, and socioeconomic and environmental features (Ibrahim, Omar, & Mohamad, 2015). Manchester City is a complex ecosystems, which present a diversity of urban environments, users, urban density, buildings, urban parks, open spaces, and land uses, that support each other mutually, both socially and economically (Al-Saffar, 2018; Palacio, 2015). Managing complex ecosystem services is the main challenge for today's cities, which results in the depletion of natural resources, city biodiversity, and the efforts to mitigate climate change while prioritising public health and quality of life. The sustainable city concept "can only be one for which the inflow of material and energy resources, and the disposal of wastes, do not exceed the capacity of the city's surrounding

environment. In other words, to achieve environmental sustainability urban consumption must match or be below what the natural environment — such as forests, soil and oceans — can provide, and the resulting pollutants must not overwhelm the environment's ability to provide resources to humans and other members of the ecosystem" (Science for Environment Policy, 2015). Designing eco-sustainable living environments in Manchester City requires a complex and multidisciplinary decision-making process, which involves managing a vast amount of data within the built and natural environment. The type of these data usually contains important information about population, economy, society and environment within the various fields at the local and national levels, and this data can be used in urban sustainability analysis. Sustainability and quality of life are the main elements to evaluate this information, which comes from different sources such as National Statistics, local councils, commercial survey companies and government departments (Cooper, Evans, & Boyko, 2009:243).

Designing eco-sustainable living environments in future cities requires integrating ecology as a main element in cities' urban parks development. Conserving nature, enhancing cities' eco-living environments, and aiming for a sustainable society can increase environmental awareness around the world, and produce ecologically friendly cities. One of the methodological challenges of developing Manchester City's forest therapy is how we determine appropriate methods to improve urban parks and preserve cities' ecological sustainability. Therefore, to achieve eco-sustainable living environments and sustain Manchester City's forest therapy we must consider and understand the impact factors of ecosystem services, restore landscape patterns, and establish an ecological civilisation that respects and conserves cities' natural built environments sustainability. (Yegang et al., 2020). Developing eco-efficient cities that reduce the need for natural resources, can have less impact on the built environment. Eco-cities that employ advanced technology systems in their infrastructures to manage air and water pollution
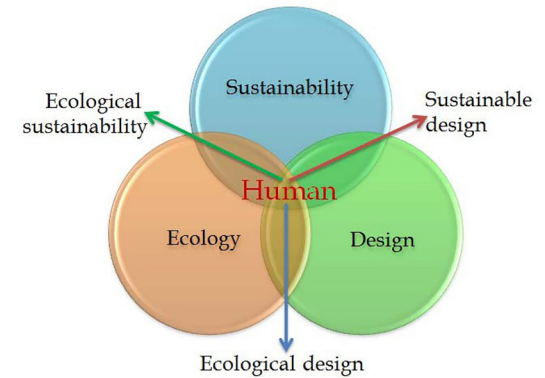

Fig. 4 - The relationship between Ecology, Sustainability and Design. Source: (Mersal, 2016).

and rising temperatures can promote people's quality of life and enhance cities' environment that has been affected by climate change (Saprykina & Saprykin, 2021). The goal of sustainable eco-city construction is to make cities inclusive, resilient, competitive, and efficient in resource use, as well as to mitigate and adapt to climate change for sustainable eco-city development. Sustainable construction of eco-cities includes sustainable construction of urban ecosystems and renewable energy management (Weiping et al., 2022).

How we think about the future has significant consequences on how we define Manchester City's future challenges and how we search for solutions. Traditional urban design strategies typically rely on predictions of probable futures extrapolated from past trends. Policymakers, architects, and urban designers need to rely on different knowledge of the past to build Manchester City's eco-sustainable future vision. Ecological sustainable development is "the integration of human activities into natural systems with ensuring the long-term sustainability of these systems. Human activities such as population growth, urbanization, transportation and industry cause pollution and depletion of natural systems. In this context, new planning approaches need to be developed in order to protect and enhance the environmental condition for the

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future" (Mersal, 2016). Designing eco-sustainable future living environments in Manchester City with energy-efficient, low-carbon, and smart energy systems requires creating a sustainable and ecologically healthy city. Such a city must function as a self-sustaining and resilient ecosystem, with a structure that supports long-term environmental balance. To achieve eco-sustainable future living environments in cities, urban designers should consider three main elements future technology, nature, and sustainability's design strategies. Future cities should focus on future technology, artificial intelligence (AI), the smart city concept, new materials, ICT, the Internet of Things (IoT), and smart transportation systems to create future cities for our society. Future eco-sustainable living environments need to understand natural laws and requirements, and how we mimic nature and live with nature. Designing eco-sustainable living environments requires mitigating climate change, preserving city nature, enhancing the city's forest therapy, and developing the city's urban parks (Yegang et al., 2020).

THE ROLE OF URBAN PARKS IN DEVELOPING CITIES' FOREST THERAPY

Manchester City urban growth has affected urban parks' natural ecosystems, community health and the city's quality of life. The new generation tends to live in new modern areas and city centre rather than suburbs and countryside areas, because of the availability of modern infrastructure, services, and job opportunities. Manchester City's communities are facing psycho-physiological health issues and a lack of urban parks and green open spaces. Consequently, developing Forest therapy in Manchester City has emerged as a significant element in creating eco-sustainable living environments and enhancing people's quality of life (Sandra et al., 2021; Zhiyong, Peng, Yue, & Bing, 2020). The city's forest therapy concept seeks to create an ecologically healthy city that enhances the people's quality of life and society through citizens' participation in urban planning and ecological systems management. The concept endeav-

ours to develop energy-efficient and low-carbon cities by employing self-sustaining, resilient, and ecological systems to return to nature (Yegang et al., 2020). Urban parks "inspire people with cultural, spiritual and historical values, reflected in strong emotional connections to these landscapes including through a range of cultural ecosystem services" (Misiune et al., 2022, p. 74). Urban parks and green open spaces can enhance urban residents' quality of life and help to mitigate climate change by reducing heat waves effect or slowing flood water. Urban parks are "widely recognised as multifunctional areas that can help address converging urban and global environmental change challenges" (Misiune et al., 2022, p. 208). Green open spaces and healthy ecosystems can promote biodiversity and provide different ecosystem services, which are significant for human health and quality of life, and for developing resilience and adaptation to climate change (Misiune et al., 2022, p. 235).

For centuries, the natural environment has been employed and documented to benefit human health and well-being. Developing natural open spaces, urban parks, and eco-sustainable living environments in Manchester City initially benefits people while also providing wider socio-economic and environmental benefits, including sustaining ecosystem infrastructure, relieving climate change, and ultimately promoting city quality of life. (L. M. Mitchell et al., 2021). 'Working with nature' is "increasingly seen as a promising way to address some important societal challenges, such as climate change and biodiversity loss, while also improving ecosystem resilience and providing multiple environmental benefits" (Misiune et al., 2022, p. 5). Conserving Manchester City's nature requires understanding climate change and nature's eco-sustainable urban parks. This can be achieved by employing smart sustainable approaches, future city design strategies, sustainable materials, ICT, the Internet of Things (IoT), and artificial intelligence (AI). These efforts can result in the creation of eco-sustainable living environments in future cities and enhancing the well-being of communities. (Yegang et al., 2020).

Urban parks are an essential element of the Manchester City's urban context that produces important ecosystem services and benefits the city's societies aesthetically, psychologically, environmentally, recreationally, and economically (Luis Loures, Raúl Santos, & Panagopoulos, 2007). Urban parks play an important role in developing cities' forest therapy, which enhances people's health and society's well-being, and is a main ingredient for city sustainability (Chiesura, 2004; González et al., 2023; Grant, 2012; Sandra et al., 2021; Warren, Ryan, Bushouse, Harper, & and Stinson, 2023). Urban parks "benefit the environment on multiple fronts by mitigating the impacts of urbanization on climate and ecosystems" (Misiune et al., 2022, p. 249). Urban parks are the main domain for achieving urban sustainability and enhancing citizens' quality of life through creating forest therapy, which promotes physical and mental health and mitigates environmental challenges. Urban parks are public open spaces that supply significant ecosystem services, create a microclimate, and enhance biodiversity protection (González et al., 2023). Urban parks, which include a diversity of grey, green, and brown infrastructure, are the main suppliers of ecosystem services within cities and contribute towards cities' forest therapy, urban resilience, sustainability, and eco-sustainable living environments. Integrating ecosystems into Manchester City urban design, planning, landscape, and architecture fields is a challenge because these domains do not fully combine human beings and the natural environment into urban ecosystem models. They also do not consider the city a sustainable ecosystem which formed of interaction of different systems such as social, economic, cultural, and built environment ecological systems. Consequently, to make a model relevant to urbanised regions we need to realise the built environment, economic services and culture, which are considered the main anthropocentric values in the city. Ultimately, Urban parks can contribute to the Manchester City's sustainability dimensions which are necessary for the preservation of the city's sustainable urban form (Ibes, 2016).

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MANCHESTER CITY'S URBAN PARKS - ECO-SUS-TAINABLE LIVING ENVIRONMENTS: CASE STUDY ANALYSIS

Greater Manchester covers an area of 1276 km2, is located in the northwest of England and contains ten metropolitan boroughs: Manchester City, Stockport, Oldham, Bolton, Tameside, Wigan, Rochdale, Bury, The Cities of Salford and Trafford (figure 5) (Lindley & Walsh, 2005; Radford & James, 2013). The city was formed by the integration of several cities and consisted of overlapping different urban realms and urban morphology patterns. Manchester City represents one of the biggest industrial cities in the Western world, which was developed in the two centuries after 1750. Despite the city's urban development, which impacts the built and natural environment, many moorlands, green open spaces, woodlands and natural urban parks still exist (Radford & James, 2013). The city's urban context is mostly flat in the south and west, with rising elevation in the northern and eastern parts, where the start of the Pennines Hills. The city build-up areas are approximately 42% of the conurbation (Lindley & Walsh, 2005; Radford & James, 2013). The city adequately represents the different levels of urbanisation, the variety of land use, neighbourhoods and diverse urban parks that promote the built environment sustainability (Gill et al., 2008; Radford & James, 2013; Rothwell et al., 2010).

In recent years, Manchester City's fast urbanisation and population growth have led to degradation and loss of substantial ecosystem functions and services. Urban designers, architects and policymakers seek to develop the city ecosystem services, which enhance people's quality of life, create a sustainable future and develop built environments. The urban growth process affects natural environments, which ultimately affects communities and wildlife populations. In Manchester, many urban contexts are suffering from a lack of green open spaces, sustainable infrastructure, and ecosystem services (Radford & James, 2013).

Greater Manchester identifies four urbanisation categories based on natural breaks, the first category is rural 0.00–5.25% impermeable landscape, which generally consists of green areas with little/no industrial areas, commercial and residential. Peri-urban is the second category 5.26–11.50% impermeable landscape, consists of green open spaces and is sparsely populated with industrial, commercial and residential areas. The third category is suburban 11.51–50.75% impermeable landscape, generally consisting of residential industrial, and commercial areas and little green open spaces. The last category is urban 50.76–100% impermeable landscape, which mainly consists of commercial residential and industrial areas with few/no green areas (figure 6). There is a growing trend of 'inner-city living' in Greater Manchester, particularly the City of Manchester, with numerous residential land uses located in the city centre and business districts. Despite the apparent lack of eco-sustainable environment and ecosystem services in these new modern areas, these new modern tours are associated with a high standard of living. In contrast, the city suburbs' natural environments are different and connected with diverse, ecosystem services, urban parks and green open spaces (Radford & James, 2013)

Manchester City has integrated biodiversity into its urban parks planning and management, which promotes the city's urban ecosystems' diversity and develops resilient eco-sustainable environments. Manchester City "was the first city in England to sign the Edinburgh Declaration – a global pledge registering our concern about biodiversity loss and signalling our commitment to tackling the twin challenges of the biodiversity and climate crises". In 2020, the city community confirmed the importance of connection with natural spaces on well-being and happiness. It also heightened awareness of the significance of green open space, wildlife, where we live, and where we work (figure 7) (The Wildlife Trust for Lancashire, Manchester and North Merseyside, Manchester City Council, & Group, 2022).

The main component of Manchester City Council's long-term plan is green and blue infrastructure for delivering a liveable, sustainable, green, and
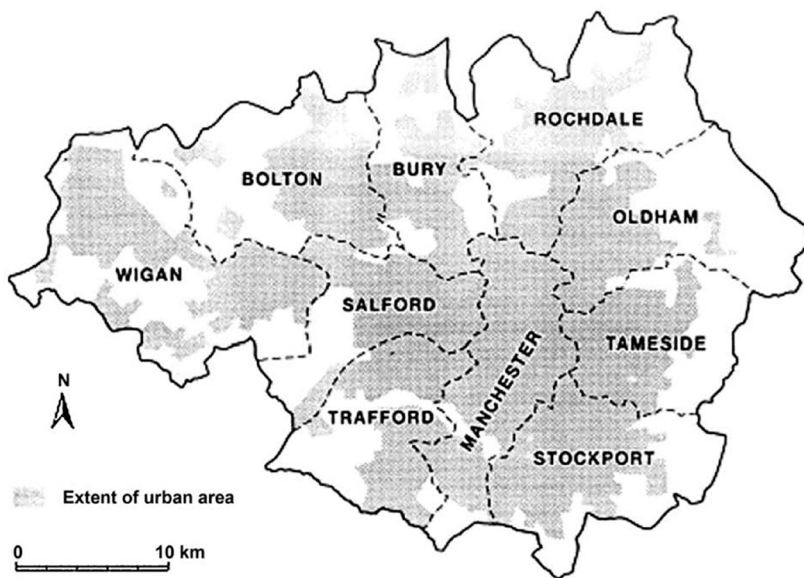

Fig. 5 - Greater Manchester with administrative boundaries Source: (Radford & James, 2013; G. Williams, 1999).

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Rural-Urban Gradient of Greater Manchester

Categories of Urbanisation

- Rural (0.00 - 5.25% impermeable land cover)
- Peri-urban (5.26 - 11.50% impermeable land cover)
- Suburban (11.51 - 50.75% impermeable land cover)
- Urban (50.76 - 100% impermeable land cover)
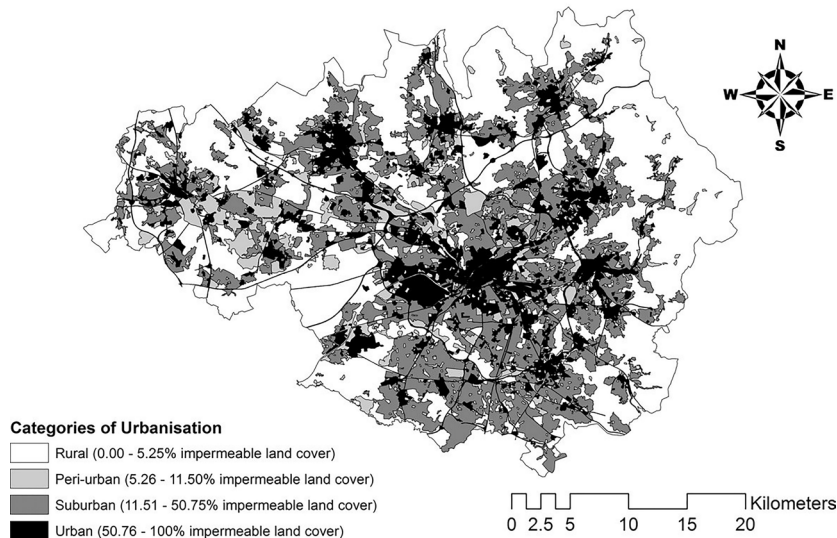
Kilometers
0 2.5 5   10   15   20

Fig. 7 - Whitworth Park in Manchester City. Source: Author 2024

Fig. 6 - Rural-urban gradient of Greater Manchester. Source: (Radford & James, 2013)

(a) Garden GI as a percentage of ward area
- 0%-5%: Low
- 6%-10%: Below average
- 11%-14%: Average
- 15%-16%: Above average
- 17%-27%: High

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(b) Total GI as a percentage of ward area
- 14%-39%: Low
- 40%-47%: Below average
- 48%-50%: Average
- 51%-56%: Above average
- 57%-73%: High

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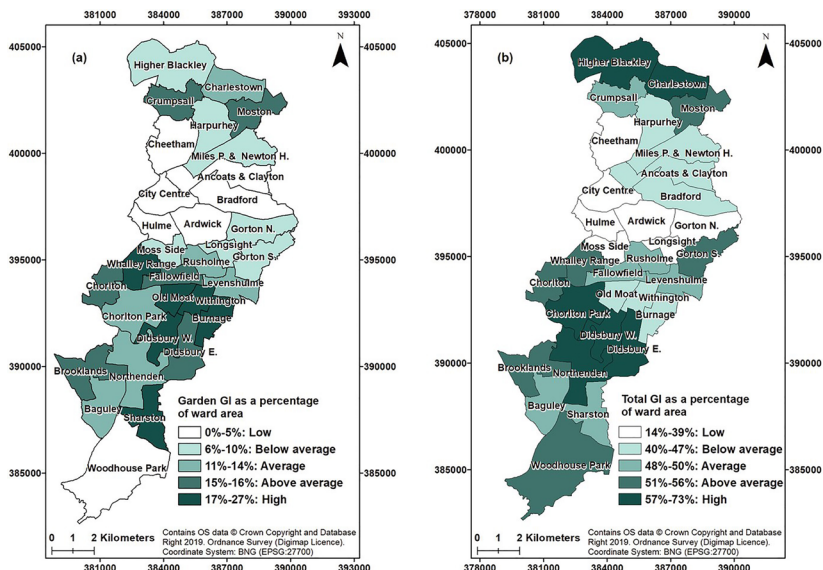
Fig. 8 - (a) Manchester City Garden Green Infrastructure GI as a percentage of ward area, (b) Manchester City total Green Infrastructure GI as a percentage of ward area. Source: (Ren et al., 2022).

healthy city throughout the twenty-first century. Manchester City "domestic gardens comprise over one-fifth (20.4%, 23.6 km2) of the total land area of the city. Gardens, however, are not comprised wholly of green space, and the proportion of Green Infrastructure (GI) in an average Manchester garden is 50.23%. At the city scale, this means that Manchester has a total of 49.0% GI—almost 10% less than previous estimations which assumed gardens were completely comprised of green space" (figure 8) (Ren et al., 2022).

CHORLTON WATER PARK IN MANCHESTER CITY

Chorlton Water Park is one of the important urban parks in Manchester City, which provides crucial wildlife habitats, promotes city urban biodiversity, and creates wildlife and ecological corridors. The park plays an essential role in saving numerous species, which struggle to survive in highly urbanised built environments. Furthermore, the park enhances biodiversity by providing a refuge for birds, insects, and aquatic life, fostering ecological balance in the city environment. Chorlton Water Park is an important infrastructure within Manchester's eco-sustainable living environments framework and has significantly contributed to integrating green open spaces into its urban context as part of its future eco-sustainable environments' goals.
The city's fast urbanisation growth raises concerns about the city's natural environment, air quality, climate change, biodiversity loss, and

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the urban areas' liveability. Chorlton Water Park can respond to these issues by providing multifunctional green open spaces, offering ecological benefits, fostering social well-being and reducing carbon footprint. Green open spaces contribute to reducing the urban heat island effect, mitigate air and noise pollution, and promote the city's local biodiversity (Haq Atiqul & Shah, 2011). The park's green open spaces helped the city to face extreme weather events such as floods, stormwater, and heat waves. The park is considered a natural flood defense by absorbing rainwater, reducing the pressure from the city's infrastructure drainage systems, which promotes city climate resilience (figure 9) (Douglas & Ian, 2023; Kabisch, Korn, Stadler, & Bonn, 2017).

Manchester City faces many challenges in adapting to the requirements of modern urban sustainability. During the COVID-19 pandemic, this park significantly enhanced the city's ecological, social, economic, and cultural elements. Natural eco-park also helped to improve societies' quality of life, health, and well-being, and achieve sustainable urban ecosystem services. Chorlton Water Park is a significant element in promoting the city's forest therapy, developing social sustainability, and enhancing community health and well-being by providing accessible green open spaces that reduce stress, encourage physical activity, and improve mental health. The park provides equal access to all residents regardless of their socioeconomic status and offers diverse leisure activities that enhance social coherence (R. Mitchell & Popham, 2008). The natural wetland habitat plays an essential role in Manchester City's eco-sustainable environment development by decreasing the impact of carbon dioxide and improving air quality. The park enhances the city's social aspect and park surrounding communities by encouraging eco-friendly practices and offering environmental education green spaces, where local communities can learn about eco-sustainable behaviours like recycling, conservation, and urban

gardening. The park's entertainment activities, such as walking, cycling, and boating, encourage residents to engage with nature, which ultimately develops their health, well-being and quality of life. This not only promotes environmental awareness but also helps consolidate a sustainable society and culture in the city's future eco-sustainable urban development.

The park's natural environment and green open spaces create excellent eco-sustainable environments for people's relaxation, socialising, and mental health and well-being, which are crucial components of future city sustainability. The park paths through the wooded shaded areas provide safe and exciting experiences when walking and cycling, which promote healthier lifestyles and re-
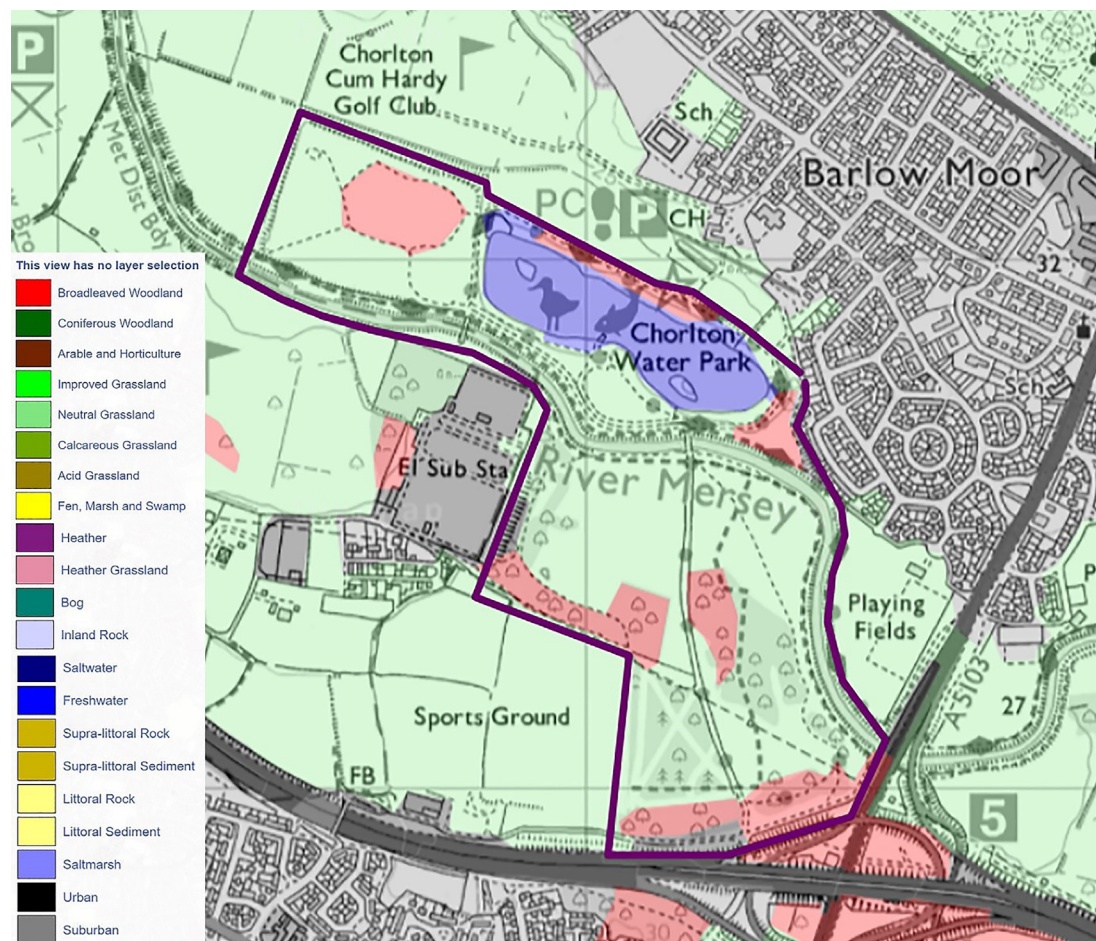

Fig. 9 - Chorlton Water Park in Manchester City. Source: Author 2024 according to Digi map.

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Fig. 10 - Chorlton Water Park in Manchester City. Source: Author 2024

duce environmental impact. These green spaces encourage surrounding communities to engage with nature and enhance the city's forest therapy (figure 10). Consequently, Chorlton Water Park is considered one of the significant city elements, which develop the city's socioeconomic and natural environment sustainability, creating a model for how urban parks can integrate natural ecosystems with the needs of integrating modern city infrastructures and ecosystem services.

RESULTS AND DISCUSSION: THE INFLUENCE OF URBAN PARKS IN DEVELOPING ECO-SUSTAINABLE LIVING ENVIRONMENTS IN FUTURE CITIES

The method of designing eco-sustainable living environments in cities is a complex and multidisciplinary decision-making process (Cooper et al., 2009, p. 243). Managing the heavy dependence on ecosystem services is the main challenge for today's cities, which results in the depletion of natural resources and biodiversity and the efforts to mitigate and adapt to climate change while prioritising public health and quality of life (Science for Environment Policy, 2015). Forests urban parks and green open spaces are reduced in cities as a result of urbanisation growth, which has led to changes in the city structure natural systems land use (Chiesura, 2004; Wu, 2010; Zhiyong et al., 2020). Therefore, to achieve eco-sustainable living environments in cities, we need new visions and strategies of multilayered understanding of what a city might become. We also need to depend on a wide-ranging selection of initiatives. Some of these initiatives should be top-down and demand powerful leadership and large-scale investment programs, other initiatives should be bottom-up and depend on shifts in actions. This can be supported by technology, a suitable design of the physical environment, information and feedback. The critical thing for cities to face their future challenges is to move towards a sustainable future over both the urban form design strategies and urban park physical infrastructure of the city

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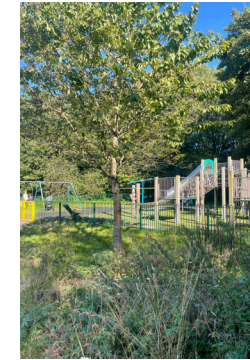
Fig. 11 - Nature Network Map. Source: (The Wildlife Trust for Lancashire et al., 2022).

(K. Williams, 2010). There is a strong relationship between community health, well-being and city nature and sustainability, which is influenced by the numerous drawbacks of urban growth. The eco-sustainable environment quality in cities decreased its value as a result of consuming natural urban parks, green open spaces and landscapes. Consequently, to tackle this issue, it is important to have an understanding of how eco-sustainable environment and ecosystem services are provided along the diversity in any changes in rural-urban gradient at local (physical/biological factors) and regional scale (policy). In the case of Greater Manchester, "where peri-urban sites exhibited a significantly higher value for biodiversity services. Suburban sites obtained lower values than both peri-urban and rural sites, possibly due to an increased proportion of Victorian terraced and semidetached housing (a typical house type for suburban areas in northern UK cities such as Manchester, typified by smaller gardens or yards and very little open space" (Radford & James, 2013).

To build an eco-sustainable environment in Manchester City, we need to develop habitat management systems, which improve the city's forest therapy and green space quality. We also need to increase the current wildlife areas' size and develop connections between green open space and natural sites, either by creating physical corridors, improving the wider environment, or developing new eco-sustainable green spaces, which ultimately, help to reduce the pressure on the city's natural wildlife. Conserving the current city's wildlife and providing natural solutions to reduce carbon and manage flood risk can develop wildlife populations and enhance people's quality of life in Manchester City. In this regard, a nature network map was developed in 2021 as part of the Lancashire Wildlife Trust's North Manchester Nature Network project, and funded by Cadent Foundation as an example of how a Nature Recovery Network can work at a local scale. The initiative aimed to develop a neighbourhood nature network which would enhance wild species numbers whilst connecting the local community to wild plants and animals (figure 11) (The Wildlife Trust for Lancashire et al., 2022). Ultimately, developing a resilient landscape, which mitigates climate change, and sustaining vital ecosystems such as improved soil, clean water and clean air can promote the city's eco-sustainable environment. Developing the natural and cultural diversity of Manchester City's urban parks and protecting its historic natural environment can benefit the city's sustainable future development and community health and well-being.

The research develops an Index Wheel designed for the case study area, informed by previous studies, a comprehensive literature review, and examples of smart eco-sustainable cities (figure 12). This Index Wheel considers eco-sustainable living environments' design strategies, which provide methods for stakeholders to develop Manchester City's urban parks' future vision. The Index Wheel address various aspects, mobility, healthcare, education, infrastructure, quality of life, energy, socio-economic and environmental aspects. The Index Wheel is divided into ten parts reflecting the city's eco-sustainable living environments' sustainable design strategies. The Index Wheel defines various tangible performance measurement indicators and systems. These indicators and systems are designed to evaluate the effectiveness of initiatives, concepts, urban parks, green open spaces, and the city's future infrastructures' design development, which aim at fostering eco-sustainable living environments in the case study area. This innovative Index Wheel combines key performance indicators for

eco-sustainable urbanism, offering a model that can be adapted to other cities seeking to enhance the sustainability of their urban parks and built environments. Furthermore, it provides valuable insights for policymakers, planners, urban designers, and architects, enabling them to prioritise objectives and allocate resources effectively to implement eco-sustainable living environment strategies. The indicators within the Index Wheel play an essential role in assessing current and future city urban parks' future developments. It helps to measure and assess the implementation of the cities' future eco-sustainable living environment strategies

CONCLUSION

The research explores how to achieve sustainable urban form in future cities by developing the city's eco-sustainable living environment. It asserted that cities' urban forms have different degrees of sustainability, and due to that, there is no single model of sustainable urban form that is applicable in all cases. The research argues that we should understand sustainable cities' design strategies, which help to achieve eco-sustainable living environments in future cities. It also investigates the influence of urban parks in developing cities' forest therapy and creating eco-sustainable living environments in the city's urban context. The research identifies the significance of forest therapy in developing sustainable city urban forms and enhancing people's quality of life. It presents new ideas on how to influence urban parks in developing eco-sustainable living environments in future cities. The research indicates that Future cities should embed eco-sustainable living environment strategies and biodiversity principles in their policies to help protect and enhance the city's nature. Cities should develop a partnership framework to respond to climate change and identify future challenges. The research asserted that designing eco-sustainable living environments in future cities requires integrating ecology as a main element in cities' urban parks development.
The research identifies the impact of urban parks

Fig. 12 - Future Cities Eco-Sustainable Living Environments strategies. Source: Author 2025
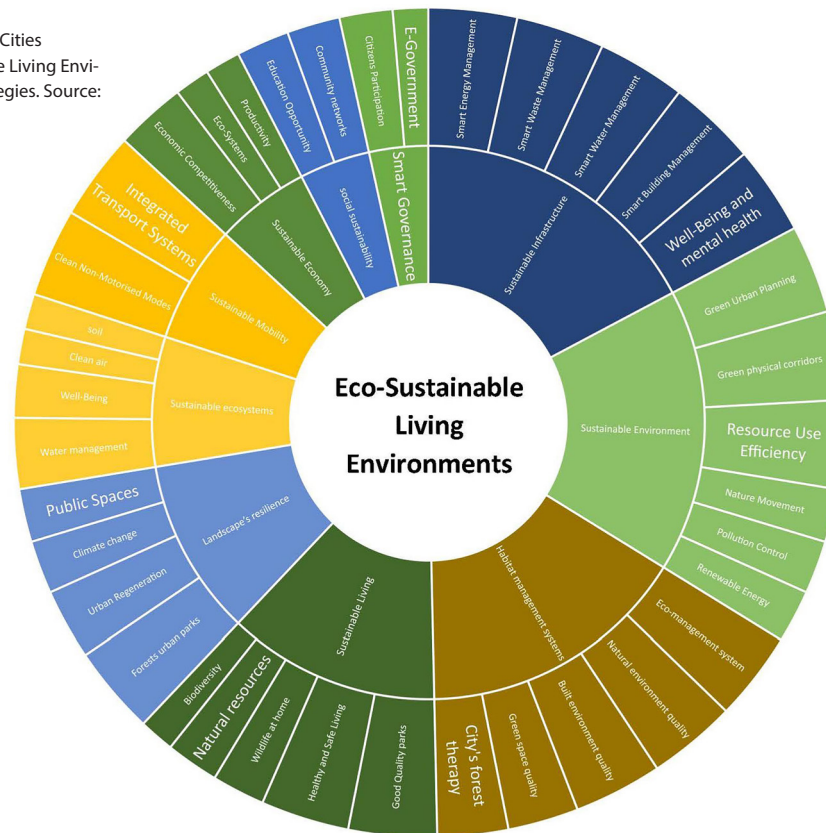
in promoting Manchester City's urban context eco-sustainable living environments. Manchester City's ecosystem services should create multifunctional, green open spaces, biodiverse, green infrastructure to complement the grey infrastructure and create eco-sustainable living environments. It assesses and surveys Chorlton Water Park in Manchester city as a case study area of this research which helped in producing a platform for promoting eco-sustainable living environments in cities. The research argues how the city's green infrastructure can provide a platform to integrate and connect people with wildlife and

make the city resilient efficient, pleasant and able to mitigate climate change.
Ultimately, the research analysis suggests an Index Wheel, which provides urban designers, architects, and policymakers with a variety of strategies and indicators to conserve and develop cities' natural eco-sustainable living environments and biodiversity, and to ensure the long-term sustainability of efforts to regenerate the city's urban parks, including continuous planning, finding economic anchors, incentives, and durable policies that can mitigate the longstanding impacts of multiple socio-economic challenges faced by the city.

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