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The Role of Biophilic Agents in Building a Green Resilient City; the Case of Birmingham, UK

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Abstract: The present research offers an exploration into the biophilic approach and the role of its agents in urban planning in questions of building a green, resilient urban environment. Biophilia, the innate need of humans to connect with nature, coined by Edgar O. Wilson in 1984, is a concept that has been used in urban governance through institutions, agents' behaviours, activities and systems to make the environment nature-inclusive. Therefore, it leads to green, resilient environments and to making cities more sustainable. Due to an increasing population, space within and around cities keeps on being urbanised, replacing natural land cover with concrete surfaces. These changes to land use influence and stress the environment, its components, and consequently impact the overall resilience of the space. To understand the interactions and address the adverse impacts these changes might have, it is necessary to identify and define the environment's components: the institutions, systems, and agents. This paper exemplifies the biophilic approach through a case study in the city of Birmingham, United Kingdom and its biophilic agents. Using the categorisation of agents, the data obtained through in-situ interviews with local professionals provided details on the agent fabric and their dynamics with the other two environments' components within the climate resilience framework. The qualitative analysis demonstrates the ways biophilic agents act upon and interact within the environment in the realm of urban planning and influence building a climate-resilient city. Their activities range from small-scale community projects for improving their neighbourhood to public administration programs focusing on regenerating and greening the city. From individuals advocating for and educating on biophilic approach, to private organisations challenging the business-as-usual regulations, it appeared that in Birmingham the biophilic approach has found its representatives in every agent category. Overall, the activities they perform in the environment define their role in building resilience. Nonetheless, the role of biophilic agents appears to be one of the major challengers to the urban design's status quo and the business-as-usual of urban governance. Researching the environment, focused on agents and their behaviour and activities based on nature as inspiration in addressing climate change on a city level, is an opposite approach to searching and addressing the negative impacts of human activity on the environment. This focus can provide visibility of the local human activities that enhance resilience, while these are becoming a valuable input to city governance and planning, with the potential of scaling it up to other cities and on to regional, national, and global levels.

Keywords: biophilic city; agents; building green resilience; governance; urban planning



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1. Introduction

Nature is the source of all true knowledge. She has her own logic, her own laws, she has no effect without cause nor invention without necessity. (Leonardo DaVinci)

Land use planning and urban planning are increasingly recognised by international bodies and their agencies such as UN-Habitat [1] and UN Office for Disaster Risk Reduction [2] as essential parts of sustainable development programs (such as UN SDG goal 13 for Climate Action, and goal 15 for Sustainable Cities and Communities) [3] and disaster

risk reduction programs all over the world [4]. Wamsler et al. concluded in their research that “the goal [of the cities] is, in fact, to work towards disaster resilience and sustainability, by expanding the focus from trying to prevent, control, or resist extreme weather events to a broader systems resilience framing in which we learn how to live with an ever-changing, sometimes risky environment” ([5] p. 71).

There are several recent advances on the rural landscape’s frontiers, such as including multifunctionality in practices and formulation of policies on the matter of urban resilience [6,7]. However, only minor efforts in the planning for urban resilience have been carried out thus far [7]. Moreover, urban adaptation through local planning has been limited in practice [8]. In academia, the past and present research in urban planning has mostly focused on the technological and physical design of how to make cities more sustainable and resilient [9–12] rather than on societal interactions. Regarding the frontiers of governance in urban planning, the research on resilience is not yet pervasive either [13], focusing more on governance itself and its effects on climate resilience [14] (elaborated in Section 1.1).

In recent years, the biophilic approach, the concept of bringing back nature in the city, has emerged as a holistic approach to nature in urban environments through design and governance. Biophilia, a term coined by Harvard professor E.O. Wilson in 1984, describes the innate human relation to nature and the pursuit of nature-full environments. Biophilic Cities, a network of partner cities based on this premise, was introduced by Timothy Beatley in 2013 [15]. The partners in this network are not only concerned with the physical characteristics of urban systems, but also incorporate the aspect of behaviour, knowledge and attitudes of urbanities towards nature [16]. In such cities, humans care more for their environment [17] and thus have a greater understanding of and connectivity to their surroundings. According to Beatley and Newman [17], this behaviour ultimately nurtures a growing resilience in cities. Nevertheless, the environment as a whole is as resilient as its ability to withstand and absorb stresses [14,18,19], as well as its ability to change and learn [8].

A biophilic approach in city planning through design and governance is a practical means of making these urban areas more resilient [17]. Furthermore, the interactions and relations of the physical environment (urban design and layout) and the social component (urban governance) affect the degree to which then the environment in its entirety is resilient [8]. For biophilic cities, Beatley and Newman [17] stressed that the biophilic quality is not only about the physical urban design but also about how “biophilic” are the practices and behaviours of the humans (agents) within the environment. While biophilic cities were addressed by Beatley and Newman [17] as sustainable and also resilient cities, there is still a need for further research to identify which elements of biophilic cities make them resilient.

This paper focuses on biophilic agents, one of the three elements of a biophilic city (agents, systems, institutions) that have been defined and identified in this research. For this a combination of frameworks has been used: Godschalk’s [20] urban resilience characteristics, Beatley and Newman’s [17] biophilic resilient cities definition, Tyler and Moench’s [8] urban elements categorisation, and Corfee-Morlot’s [21] agent categorisation. The result is a biophilic city resilience framework defined by three distinguished elements: biophilic agents, biophilic systems, and biophilic institutions. This definition of an urban environment was the starting point for identification and exploration of the element of biophilic agents in the scope of resilience building in cities. Our research aims to bring the complexity of concepts of resilience and urban governance to a simplified structure, and to understand the influence of local elements on tackling a global issue. Therefore, the aim of this paper is to explore and describe the role of biophilic agents in building urban climate resilience as actors within urban planning processes.

1.1. Resilience and Cities

Resilience is a term used in different disciplines such as ecology, economy, disaster studies, sociology [8,19], which already conveys how complex and interconnected the world and the different elements within it are. The Intergovernmental Panel on Climate Change (IPCC) defined resilience as “the ability of a system and its component parts to anticipate, absorb, accommodate, or recover from the effects of a hazardous event in a timely and efficient manner, including through ensuring the preservation, restoration, or improvement of its essential basic structures and functions” ([22] p. 563).

Resilience is a critical characteristic of cities and urban areas to adapt to changing climate, physical environment, and society [8,20,23]. Additionally, with the social and natural environment being at risk from hazards due to climatological changes, vulnerability of the urban areas increases. For an environment to be sustainable, it must be able to withstand and adapt to stresses and changes, in other words, to be resilient. According to Godschalk [20], systems that are disaster-resilient are redundant, diverse, efficient, autonomous, strong, interdependent, adaptable and collaborative (see Figure 1). These characteristics apply to all elements of the urban environment. By redundancy and diversity of the elements, the environment has backups in case of stress or risk to which it is exposed to or is affected by. An interdependent and collaborative environment can rely on the connectedness and participation of its elements. Furthermore, a resilient environment is one of which the elements are capable of operating without requiring other elements to exist or function in it, thus being autonomous. Additionally, it has the capacity to withstand external forces, learn from changes, and balance the energy needed, making the environment stronger, adaptable, and efficient.

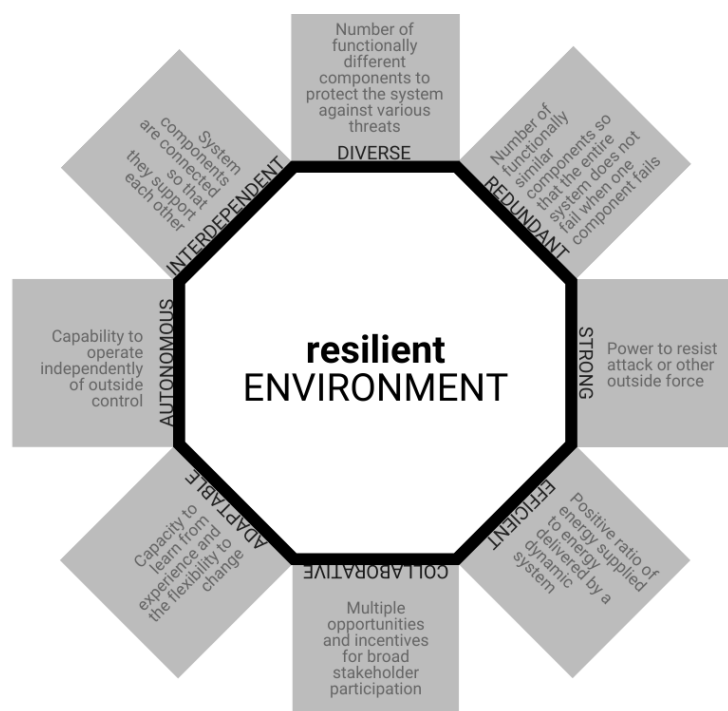


Figure 1. Visual representation of characteristics of a resilient environment (own elaboration, inspired by Godschalk [20]).

With the growth of urban areas, changes in their design and governance are unavoidable and the subsequent issues are becoming more complex. Hence, urban planning faces a growing need to embrace flexibility and maximise certainty in decision making, in planning, in a legal and regulatory framework, so that it can adapt to the changing needs and its environment [24,25]. Urban planning faces challenges of addressing environmental, economic, and social issues and transforming them into strategies and plans that focus

on both content and process, thus enabling sustainable urban growth. For planning to fulfil the social role and aim of sustainable development, Janin Rivolin [26] stated that a performance-based planning model is more suitable as it is more inclusive and flexible, as opposed to conforming planning characterised by hierarchy and rigidity. Given that adaptation to climate change is a developmental process, planning for it needs to be multidimensional, multiscale, and it should integrate the knowledge of local stakeholders to evolve and efficiently address the changes resulting from the adaptation process [27]. On the European scale, only the UK planning is overtly performance-based due to a long history in pragmatist British law [26,28]. In the UK, the “legislation demands the inclusion of climate change issues in general local planning documents addressing both mitigation and adaptation, applying to local planning authorities of all sizes” ([29] p. 213), granting partial autonomy in governance of climate change to local agents who can so plan according to their needs [30]. Thus, while climate change is a global issue, the measures to mitigate or adapt to it are taken and applied on the local scale, the city scale.

1.2. Biophilic Approach and Cities

The effects of climate change are severe and particularly worrying in urban areas, due to their increased population concentration [31–34]. Results of increased episodes of natural disasters as a consequence of changing climate have influenced the way cities operate but are only slowly changing how people think about the cities within the greater socioecological system. Cities do not exist siloed from nature. Their functioning and the resilience of the human, biotic, and abiotic elements in the face of climate change depend on the space they share and the relations they have. Beatley and Newman [17] added that cities that give nature space in the urban environment intrinsically invite its population to interact with nature, improve their relationships, and increase resilience. From large-scale spatial ideologies of Ebenezer Howard’s Garden cities [35] and Le Corbusier’s Radiant city [36], where urban areas are planned with nature as a counterpart to the social construct of a city [9], in recent years, a new concept of bringing back nature in the city has emerged as a holistic approach to nature in urban environments, described as the biophilic approach. In essence, it brings attention to the interaction of the social and ecological systems [17]. Nonetheless, a biophilic approach has yet to advance from the exploratory nature it currently has [37,38] in order to provide frameworks and applicable conclusions.

Biophilic Cities, a global partner network building on the premise of existing socioecological relations, recognises cities that stand out for being places where nature is an element of inspiration in design and governance. While design representing the physical environment can bring back nature and nature-like features to urban areas, the extent to which cities may demonstrate biophilic qualities also depends on how social aspects are included. In other words, biophilic cities embrace nature within their urban design, as well as in their governance.

The overall lack of urban planning for climate resilience [6] and the diverse definitions of what resilience in urban matters is, can make these collaborations as well as resilience objectives difficult to achieve. The urban climate resilience framework by Tyler and Moench [8] was developed to aid planners and urban practitioners to identify and describe the different elements acting in an urban area and their vulnerability towards climate change by focusing integrally on social, ecological, and infrastructural urban elements. While the Biophilic Cities Network framework distinguishes between physical design and governance factors, its lack of identifying and defining the components of an environment was addressed in this study using the categorisation of Tyler and Moench [8]. The key elements of this framework are agents, institutions, and systems whose degree of interaction defines their individual degree of resilience and ultimately as a whole.

Systems are the physical elements of the environment, the design and layout of urban space, and are influenced by urban governance. Biophilic design elements, or *biophilic systems*, in urban areas are based on the inclusion of nature and nature-like elements in the built-up area. Because these are physical characteristics of a city, these are easily identified

and categorised, ranging from local greening, through creating connected natural systems, to making use of biomimicry in architecture and surfaces [17]. Not only are they the visual ‘green’ in the city, but these elements can extend to infrastructure that enhances biophilic governance and behaviour of the agents. These include features like permeability of the road surfaces, cycling infrastructure, flood plains, public transport network, and ecosystem infrastructure.

Agents represent a city’s social factor, and their behaviour plays an essential role in adaptability to change. *Biophilic agents* represent the human component in this framework, such as individuals and households, neighbourhood and community groups, private and public organisations dedicated to nature or nature-like activities. They are the ‘users and suppliers’ of the biophilic system and co-create the biophilic city. Among such organisations, which can be formal or self-organised, are nature clubs, outdoor activity organisations, tactical urbanism clubs, cycling groups, community activities focused on nature, businesses dedicated to nature or nature-like services and products, and governmental bodies focused on nature.

Biophilic institutions are the formal and informal practices, inspired by or focused on nature, that shape the landscape which influences the behaviour of the agents and interactions between them. These can be regulations on land use and buildings, water and energy management, urban development plans, nature awareness educational programs and activities, and all the ‘rules’ that promote and endorse interaction with nature, with agents and with systems. Biophilic agents, together with biophilic institutions, form part of the biophilic governance (Figure 2), the environment’s social dimension.

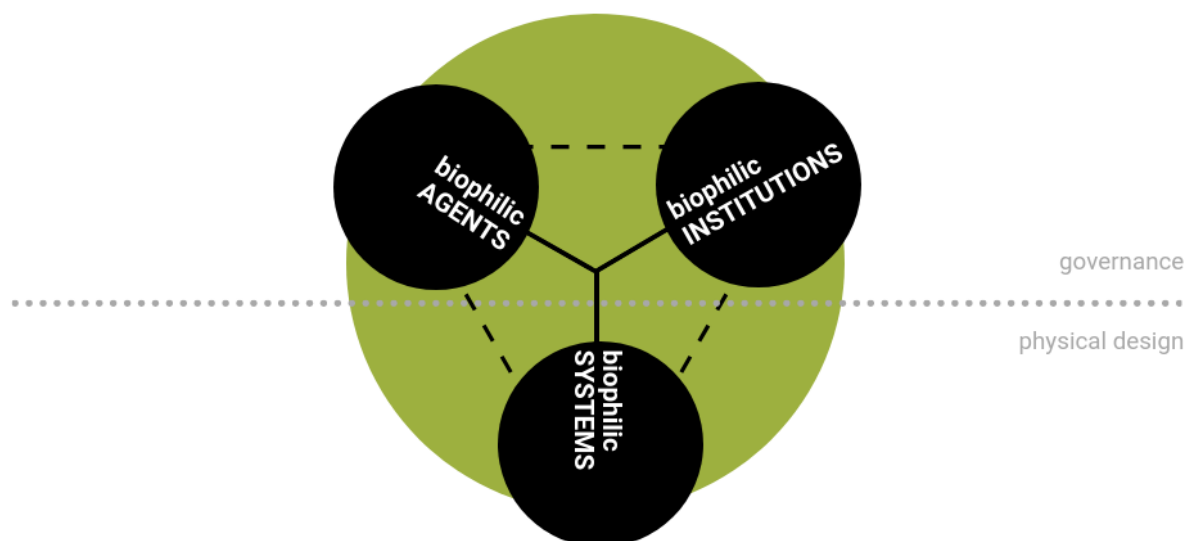


Figure 2. Visual representation of and connection between the elements of a biophilic city and the climate resilience framework (own elaboration, inspired by Tyler and Moench [8]).

Overall, for a city to be biophilic, this position cannot be attained by having only one of the three elements, agents, institutions, and systems, in place. The biophilic physical design element might be the one that is easiest to visually distinguish in a city, yet it alone is insufficient. The socioecological relations, regulations, behaviours, attitudes, actions with and within the urban space enhance the biophilic quality of cities. Institutions promoting and endorsing biophilic behaviour and nature-linked development in urban areas, and agents identified through behaviour related to nature, are the other two elements playing an important role in developing practices and lifestyles which endorse biophilic spaces. Directly or indirectly, they serve as pathways to create more resilient cities in the long run [17]. Indeed, Godschalk [20] highlighted the importance of professionals on urban matters (architects, planners, engineers, and others) working together towards urban resilience. Jabareen [19] also noted that a “more resilient city is one with inclusive decision-making

processes in the realm of planning [...] and collaboration” (p. 223). Furthermore, “integrating the many different stakeholders and agents into the planning process is essential for achieving climate change objectives” ([19] p. 224). Overall, the interaction between urban design and governance plays an important role in urban planning and can determine the future of urban development, as well as its resilience.

1.3. Resilience Framework for a Biophilic City

Corfee-Morlot et al. [21] developed a typology of agents by putting them on a geopolitical scale (from local to international agents), thus allowing to identify the key players in an environment by the reach of their influence. International, national, and regional agents play a role when it comes to the interconnectedness of the cities within a region or country, and the broader frame for environmental governance. Despite climate change being a global issue, the urban areas are affected by local actions of (urban) society and (urban) land use. Therefore, the locality of environmental issues requires the existence of local or city-scale agents in the governance of the city, operating on the city scale.

In order to identify the biophilic agents in building the city’s resilience, a new framework was developed combining the different concepts applicable to this case study—climate resilience, biophilic approach, and typology of agents. The Climate Resilience framework for climate-resilient city planning, together with the typology of agents adapted from Corfee-Morlot et al. [21], is confronted with characteristics of the biophilic city, where components of the climate resilience framework are identified in the biophilic approach framework. These defined components are placed at the centre of the framework since the environment is to be assessed by Godschalk’s [20] eight characteristics of a resilient urban environment (as shown in Figure 1). The visual representation of this framework then shows a biophilic city circumferenced with the resilience characteristics creating so a continuous abstract layer of resilience over the environment and its elements (Figure 3).

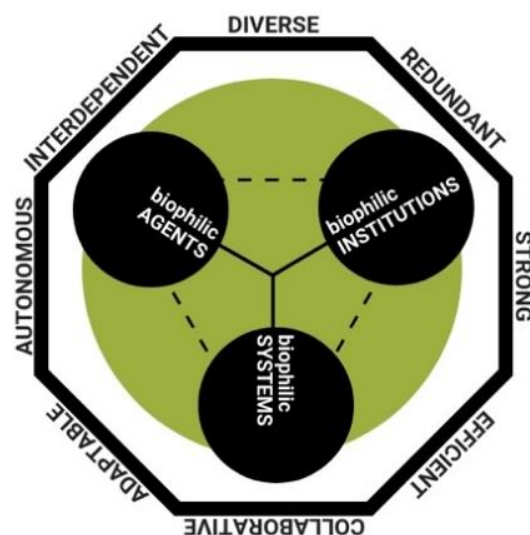


Figure 3. Biophilic city resilience framework (own elaboration).

This framework is developed for and applicable to a city that is officially recognised by the Biophilic Cities Network of partner cities, thus including the agents, institutions, and systems that support and enhance the biophilic conditions in the urban system. Each component of a biophilic city (agent, institution, system) plays an important role in the quality of the environment. The interdependence of agents, institutions, and systems affects the degree to which as a whole they influence the resilience of the city. Hence, the existence and role of each determine the other.

2. Methodology

At the time of the research (August 2018), a total of 16 partner cities located all over the world were officially recognised as biophilic, forming part of a city partner network called Biophilic Cities [39]. According to the network's webpage, the membership is application-based, and therefore, the number of partner cities in the network fluctuates and the list is updated correspondingly. From Asia to Central America, these cities have different economic, social, cultural, and climatological backgrounds, which makes the partner cities interesting to study through different theoretical lenses and scientific perspectives.

To match the requirements, after an initial pre-screening desk research of all biophilic cities in the partner network, the city of Birmingham in the United Kingdom was chosen as a case study.

The qualitative research presented here is based on data obtained via literature review, (prior, during, and after the fieldwork) and via interviews. Over 20 agents identified through the desk research were contacted for an interview before the fieldwork. However, due to having few responses, a snowballing technique was used with the agents who agreed to be interviewed. In total, 10 interviews were conducted in 2018 on-site in the city of Birmingham with local specialists and professionals of urban planning, academia, city governance, NGOs, and businesses that conduct activities within a biophilic approach, and (or) climate resilience in the context of urban planning.

Due to the qualitative exploratory nature of the investigation, the inquiry for data was made using semi-structured interviews to allow for a range of answers to a topic that has not been addressed before. Questions for the semi-structured interviews contained issues on urban planning and governance (such as: Which agents are involved in the urban planning? Are there opportunities and incentives for broad agent participation?), on the biophilic approach (such as: Who is involved in the biophilic approach of the city? What roles do citizens play in this approach?), on climate resilience in urban planning (such as: Which agents are involved in climate change issues? Who participates in decision-making and planning regarding environmental and uncertainty issues? (related to Jabareen [19])), and last but not least, on governance in biophilic approach to climate resilience in urban planning (such as: Do you identify the interaction between climate resilience and biophilic approach in urban planning? Do you identify the biophilic agents that influence climate-change-related urban planning?) (the interview guide can be found in the Supplementary Materials). Interview outcomes were coded using Atlas.ti 7 software for the obtained data to be qualitatively categorised. In the analysis, more than 60 agents were identified, who were then assessed through the characteristics of a biophilic resilience framework established in the literature review process. The methodology of the analysis is visually represented in Figure 4 following 4 levels of analysis.

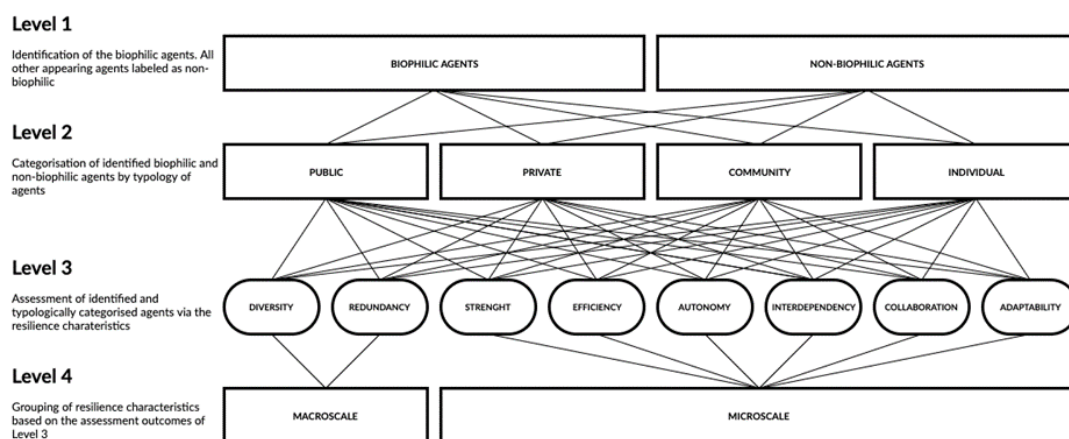


Figure 4. The methodology of agent analysis (own elaboration). Visual representation of how agents mentioned in the interviews were identified and categorised according to the research framework of biophilic resilience.

While the main focus was to identify biophilic agents, the interviews revealed that these co-exist and are connected to several other, non-biophilic, agents in the environment of Birmingham (Figure 4, level 1). Therefore, these were also included in the analysis. The distinction between biophilic agents and non-biophilic agents was made based on their official activities in the environment. Biophilic agents' existence and their main or primary activities are oriented towards creating and supporting physical nature in the urban areas and encouraging environmentally friendly behaviour. Non-biophilic agents with biophilic activities, or their cooperation with biophilic agents, were not considered for categorisation as a biophilic agent (e.g., a bank providing funds for biophilic projects).

Consequently, the identified agents, after being categorised as biophilic or non-biophilic, were further classified by the designed framework's agent typology—public, private, community, individual (see Figure 4, level 2). Additionally, non-biophilic agents, due to their existence and interwovenness with the identified biophilic agents, were further labelled by their focus of supportive connection to the biophilic agents, such as governance enabling, planning, education, funding, among others.

Next, in level 3 of the Figure 4, the identified agents were analysed by the framework's specified resilience characteristics. The research focused on the agents where each characteristic analysis was based on an agent's existence in the environment, with their activities having only a supportive informational value. Additionally, resilience characteristics were applied to agents and their actions only by criteria established in the theoretical framework. Whether an agent was efficient or not was solely established by its actions and not how efficiently the environment's system or institution works. The same applies for interdependence, autonomy, strength, and adaptability. The collaboration was coded only as an act between agents.

The last step in the analysis (Figure 4, level 4) drew a distinction between a macroscale and a microscale in view of the environment's agents. In the macroscale analysis, the resilience characteristics diversity and redundancy of agents describe identified agents in the environment in a manner that shows the number of agents in each agent category and how they cover and represent specific functions in the environment. At the microscale, the analysis focused on the interaction amongst the agents and with the two other climate resilience framework components: institutions and systems. Furthermore, it was analysed how this behaviour of agents stimulates the six other resilience characteristics—efficiency, adaptability, strength, autonomy, interdependence, and collaboration. These characteristics describe the activities mentioned in the interviews (Figure 4).

Interviewees were coded as IP1 to IP10, and agents identified from these interviews were coded *BA* for biophilic agents, *NBA* for non-biophilic agents. The typology of agents provided a categorisation label of *BA* or *NBA* in the following manner: *Pr* for Private agent, *Pu* for Public agent, *Co* for Community, and *In* for Individual.

Case Study—Birmingham

Birmingham, UK's second-biggest city, is a former industrial city ruled by factories, manufacturing facilities and workshops. The city is dealing with urban expansion and population growth rate well above the national rate [40,41]. The city's industrial past, together with current economic growth, has shaped the urban design and land use, leaving only a few pockets of nature and water bodies within the city. The further from the city centre, the greener and more nature-full the neighbourhood (Figure 5) [42].

Many buildings and areas of the past manufacture boom have become sites of abandonment and gentrification, inducing more urban sprawl [43]. Numerous brownfield sites and derelict industrial buildings in the city [43,44] have been for a long time sitting idle without the city reusing these urban lands, especially housing, which the city is in need of for accommodating its growth [45]. Because the development is taken there, the surrounding natural environment comes under stress [46]. Birmingham's urbanisation is happening inwards (densification), as well as outwards, causing its Green Belt to shrink by 3810 ha between 2013 to 2018, thus making it the most affected of all in the UK [47]. The Green

Belt policy was introduced in the 1950s by the national government (Ministry of Housing, Communities and Local Government) to limit the sprawl and prevent neighbouring cities from merging [47]; in the case of Birmingham, from merging with the closely neighbouring urban areas of the populous West Midlands region. Nowadays, the Green Belt policy is part of the UK's National Planning Policy Framework, which provides local governments with guidance on sustainable development [48].

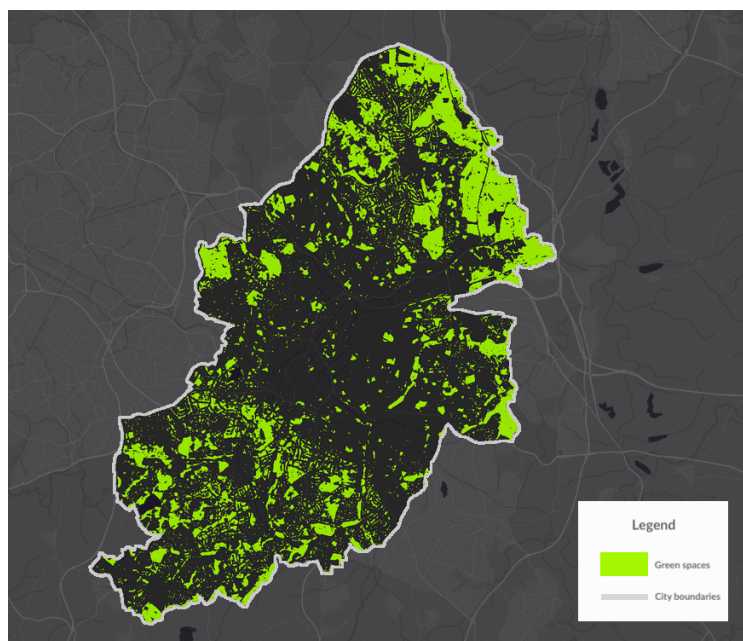


Figure 5. A 2016 map of green spaces (coloured green) in the city of Birmingham, UK (modified map based on ESRI UK—Landsat 8 NDVI data [42]). The city centre lays in the middle part of the map where the smallest number of spaces with vegetation can be observed (darkest colour).

Over the past few years, Birmingham has become an example of a city transforming from an industrial to a more natural one [16,49] through a shift in urban development governance towards a more sustainable and environmental approach. However, the changes in climate and an increased number of different weather extremes recorded (heatwaves, unexpected snowfalls, flooding) [50,51] affecting the urban area put pressure on the city's urban future and pose a challenge for resilient, sustainable development. The recently published Birmingham Development Plan 2031, approved by the national government, and adopted by the local city council in 2017, acknowledges these issues and sets out to address them through plans, with environment and sustainability being an important pillar of the city's urban planning and development [45].

3. Results

Issues of urbanisation, population growth, nature preservation within and around the city, as well as of resilience to climatological hazards show the struggle Birmingham is confronted with in developing sustainably in the future. Nevertheless, being part of the Biophilic Cities Network demonstrates the actions and existence of stakeholders interested in improving and working towards such urban development.

3.1. Categorisation of Agents

Overall, from the 10 interviews conducted during the fieldwork, 64 different agents in total were identified, then categorised into public, private, community, and individuals, using the agent typology from Corfee-Morlot et al. [21] (see Methodology, Figure 5). Out of those, in total, 36 are biophilic agents. The other 28 agents were characterised as non-biophilic agents (see Figure 6).

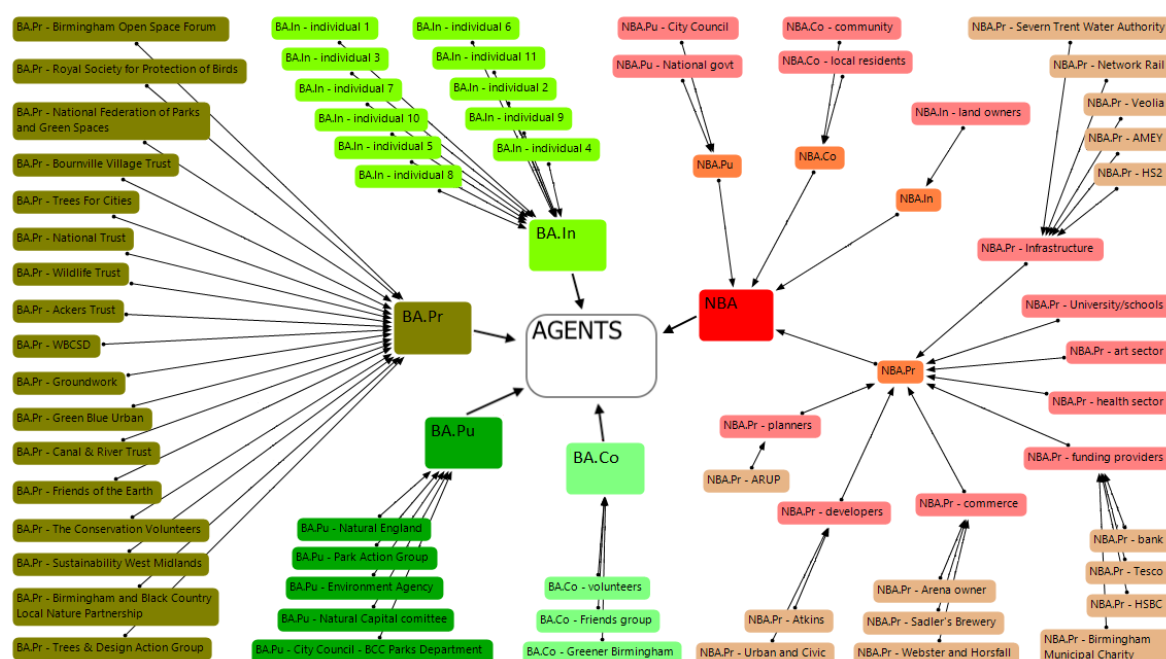


Figure 6. Agents in Birmingham identified from interviews (own elaboration), with their agent category and biophilic characteristic. Biophilic agents (BA), located on the left side of the diagram, coloured in shades of green and clustering the categories of agents—public (BA.Pu), private (BA.Pr), community (BA.Co), and individuals (BA.In). Non-biophilic agents (NBA) are displayed on the right side of the diagram, coloured in shades of red), first grouped by the four main agent categories (private—NBA.Pr, public—NBA.Pu, community—NBA.Co, individuals—NBA.In), then by their activities through which they connect to the biophilic agents (level of governance, landowners, infrastructure, academia, health sector, funding, planning, development, commerce).

3.2. Macroscale—Diversity and Redundancy of Agents

3.2.1. Diversity of Agents

In Birmingham, the agents who were frequently identified as acting with the biophilic approach, were privately organised groups (see Figure 6), such as Birmingham Open Space Forum, Wildlife Trust for Birmingham and the Black Country, Canals and River Trust, most notably. Public biophilic agents, represented by the national, regional, or local government dedicated to planning topics, are much less represented in Birmingham's urban area. The functional capacity of these biophilic agents in the urban environment of Birmingham includes area development, conservation works, regulation, public awareness, and public engagement. Biophilic agents identified through the interviews are mostly focused on the groundwork, actual activities developed to conserve, maintain, and improve nature in the city.

We put a lot of work with schools and younger people. And then other community groups,..., refugee groups, arts, vulnerable groups, and lots of mental health work. We also have big events. It ranges from activities that we do, take care, cut the trees, doing the actual management work that people can volunteer and come along, and depending on skills they can join on surveys as well. (IP4)

Most of the identified biophilic agents fall under the category of private agents that organise as groups of self-motivated individuals, sometimes forming networks on a specific topic. The functions they cover in the urban environment are mostly over a specific aim of a biophilic character such as maintenance of their neighbourhood's green area, setup of urban gardens, urban nature protection through activism, or knowledge exchange:

In the Trees and Design Action Group, these are all people who want to make our urban areas greener. Some are very small consultancies, for example, this one called Green Blue Urban. Their job is to sell devices for planting trees in the cities. [...] Then there

are bigger consultancies like Atkins and ARUP who have the green infrastructure and climate adaptation is part of their agenda. They may send a colleague. People come for different reasons. We have a presentation every time in Birmingham. Sometimes they would come to listen to the presenter, sometimes people come to network, to try and find somebody to work with. The local authorities come. In the Midlands, there are about four hundred people on the [action group's] spreadsheet. (IP6)

The presence and activity of biophilic agents often require other agents that cover supplementary functions for the biophilic agents to be able to fulfil their purpose. One of these functions is to provide funds, which in the case of Birmingham is covered mostly by non-biophilic private agents.

Trees for Cities tack into the corporate social responsibility streams of major companies. [. . .] You have money that they want to be using for the good of the environment. They give this money to Trees for Cities. (IP6)

We [Wildlife Trust for Birmingham and the Black Country] are funded through, so for example, my role itself is funded, quite a mixture of Children in Need, Postcode Lottery, National Express and things like that. It is different funding parts that allow us to do different projects, like Nature Improvement Area, the NIA project. (IP4)

Furthermore, activities of the biophilic agents are also subject to regulations. This function is covered by public agents, both biophilic and non-biophilic. In case of urban planning and development of the urban environment, these are rather related to non-biophilic private agents. However, there has been a shift to include biophilic agents in the process, as well as in the execution of the plans. Ultimately, research, as one of the activities of agents, figures as an important process in which biophilic and non-biophilic agents connect and act together towards applications of a biophilic approach in the city.

Urban Living Birmingham was a collaboration of four universities, [namely] Aston, Birmingham University, Warwick University, and BCU, and the city council and a network of stakeholders. The project was to look at the tricky interdisciplinary issues across Birmingham that were underpinning the challenges Birmingham faced [. . .], including the team around the environment and the resilience of the city. (IP7)

3.2.2. Redundancy of Agents

Redundancy of agents is defined as having two or more functionally similar agents so that the system does not fail when one agent fails. This goes from the smallest organisational scale to the national scale, all having an impact on the local environment. In the case of Birmingham, the different types of biophilic agents, private, public, community, and individual, are unevenly but numerous represented, yet requiring the presence of and interaction with non-biophilic agents to functionally cover the activities necessary to maintain and enhance the biophilic quality.

Redundancy is an interesting characteristic because it enhances the efficiency and strength of the environment and implies its degree of adaptability. The data analysis showed that the institutional setting can play an important role in redundancy. If processes and regulations are stiff and strict, redundancy of agents has importance when it comes to maintaining the performance of the environment:

It can kind of lead to quite a lot of project delays because they [planning officers of the Birmingham City Council] are supposed to have them set up in time for their approval work. But they [planning department of the Birmingham City Council] cannot because they just do not have enough people or people with the right skills. So, it does affect us [BA.Pr], it does sometimes make our jobs more difficult. (IP8)

In cases where flexible institutional structures are in place, redundancy allows for stepping in of other agents than those public ones to help maintain the environment's functioning:

We [Birmingham Open Spaces Forum] are looking at working with the council on how to do a risk assessment, on how to put this into practice. Again, if there is not a [park] ranger to do it, they [community groups] can do it themselves. We are enabling the groups to be able to do more on their side and to take more of a lead than they ever did before. And the council's Park department is more open for that happening now than they were ever before. Before it was, "no sorry, no, cannot do that", and now it is "OK, let's look at how we can do that". That is a definite change of things being done. (IP9)

3.3. Microscale—Collaboration, Interdependence, Strength, Autonomy, Adaptability, and Efficiency of Agents

The microscale analysis of the situation of the biophilic environment in Birmingham gave also an insight into the other six resilience characteristics: collaboration, interdependence, strength, autonomy, adaptability, and efficiency. These describe, through their specific actions, behaviours, and interactions, the agents active in the environment and the effect of their doings on the mentioned resilience characteristics. Additionally, their actions and behaviours reflect the existence or nonexistence of the other two components of an environment—systems and institutions.

3.3.1. Collaboration of Agents

Results of the data analysis showed that agents do collaborate in the biophilic approach to build climate resilience and that they use different means to do so. Collaboration, as a resilience characteristic, has been defined for this research as the interaction between agents voluntarily resulting in cooperation. In Birmingham, examples of such relations are mostly institution-based, through academia, plans, or programs, or system-based through area development.

The biophilic idea in the planning is a really good idea, but the danger is that it is a theoretical idea. So, what we are trying to do is to find mechanisms to make it practical, so that the people delivering it on the ground do not need to know it necessarily, but the system you create delivers the outcome that you want. That is what we are trying to do. (IP1)

Collaborations between agents in the urban environment of Birmingham are economically, legally, and knowledge- and skill-motivated. Some of them result in cooperation between biophilic agents to support each other (IP3–4, IP6, IP9).

That is how nature works; you've got to work with the neighbours. Along the canal, Canal and River Trust look after it and do most work on it, but we (The Wildlife Trust for Birmingham and the Black Country) work quite a lot with them, because my reserve is connected to the canal. And so, we go out together, do surveys, put a lot of black boxes, do the tree planting. So, we team up quite a lot. Recently we started a project with Canal and River Trust, National Trust, and Ranger Service, again, using the canal as trying to get people using the canals. (IP4)

Some biophilic agents seek collaboration with non-biophilic agents. The motivation behind these relations is based on the exchange of resources mostly through an institutional approach, such as programs and projects they develop for their benefit to the environment (IP2–4).

In the realm of urban planning, the interviews showed that biophilic agents cooperate through the institutions (regulations, plans, acts) established by the local authority, such as the Big City plan, the Green Living Spaces plan, but also following the national government's Green Belt development, and National Ecosystem Assessment.

It became a national debate as to Birmingham changing at the moment. What happened in relation to that is that the same methodology, around mapping these multiple layers of ecosystem services, we said, ok it works for a millennium, for the globe, it works for national scale, we have now done it for the city scale, let's take it to the site. Then we can have a continuous chain of using the same methodology. We created a partnership with

external developers and funded it through research. And we created a planning tool that uses that same decision-making matrix. You get to the point where the idea would be, after a 25-year term the land that we build on actually returned more to the environment than it did when you arrived there, even if it was Green Belt. So, the deal was, and is, that we are using this tool on the Green Belt. (IP1)

Overall, in terms of collaboration, the work and activities of biophilic agents in Birmingham is influenced by cooperation with non-biophilic agents due to the advantages it brings to each of the categories of agents involved (public, private, community, individual) and ultimately to the environment.

3.3.2. Interdependence of Agents

As in collaboration, the analysis of the interdependence of agents in Birmingham has shown that it is institution-based or system-based. That means that either the agents are using networks and collaborations and they rely on them to establish a connection, or the need of working together arises from developing a physical space in the city. Both ways of working have a legal (IP1, IP3, IP6, IP8–10) or economic foundation (IP1, IP3–4, IP7, IP9–10) and turn collaboration into interdependence. The difference between interdependence and collaboration in this research is that even though these relations represent the dependence of agents, in interdependence, the relation of agents is required and mutual, whereas in collaboration, the interaction between agents is voluntary.

It relies on having a good local connection with the reserve [the natural area], with the local community around it, because then they protect it for you. (IP4)

In Birmingham, one of the main issues is the growth of the city. In urban planning and development, the interdependence exists naturally through institutions (formal relations) that regulate urban development. Agents, both biophilic and non-biophilic, are subject to planning laws and land policies that are set by public agents, some biophilic and others non-biophilic. Moreover, the interaction of the agents in the realm of building climate resilience through a biophilic approach in urban planning is more driven legally, then economically (IP1, IP6, IP8). Policies and acts make the agents interdependent and while the public agents that are responsible for setting the framework and rules are not necessarily biophilic, the institutions are and require all agents within the environment to comply.

3.3.3. Strength of Agents

Strength of agents for this research has been framed as the ability to persevere and carry out actions even if the legal, economic, or environmental conditions change and affect the functioning of the agent and their work.

Analysed data indicate that in Birmingham the political discourse and the financial situation of most public agents hinder their activities in the environment and create threats for activities of other agents in the biophilic approach (IP1–10).

At some point, political discourse is one thing but actually being active on the ground and being there is other. They [Wildlife Trust for Birmingham and the Black Country and Birmingham Open Spaces Forum] know that the show must go on and the work has to be done. These people are with all that they have at hand trying to do their best. (IP10)

Agents do not exist siloed from institutions and systems in an environment; thus, their strength is observed through their actions and behaviour towards these and the changes occurring.

Biophilic agents, private, community, and individuals, being focused on nature, have nature as the priority of their activities when negotiating about the physical environment and possess strength through their specialisation. From small-scale actions and behaviour (IP6, IP9) to creating groups for plan development as specialists in the biophilic approach (IP1, IP10), the presence of community and individuals shows that even smaller actors can steer the situation. Contrarily, the non-biophilic public agent responsible for the whole city governance has the strength to decide in favour or against the biophilic approach advocate.

3.3.4. Autonomy of Agents

The analysis of autonomy of agents in Birmingham indicates that it is subject to systems and institutions in place. The agents' activities and behaviours are defined in relation to these two components. For an agent to be autonomous within the biophilic approach and climate resilience building in a complex environment such as a city, the collected data suggest that it is either based on their biophilic beliefs, motivations, or on the possession of power. In Birmingham, biophilic agents, despite their reliance on non-biophilic agents, have demonstrated within the existing systems and institutions that they possess the ability to autonomously carry out actions for improving the situation of the environment through different approaches in autonomy.

Belief-based autonomy of agents shows how agents, despite the difficulties they face through institutions or systems to develop their activities, find ways to include biophilic approaches in conversations about climate resilience. In line with such autonomous behaviour is the organising by themselves into networks (IP9–10), engaging with public (IP3–4), document elaboration (IP3–6, IP10), even plans and proposals, suggesting improvement (IP3–4, IP7–8), as well as organising art projects with a biophilic approach (IP1–2). Furthermore, the behaviour of agents that pursue a biophilic approach as a response to power based on autonomy includes activism and petitioning (IP1, IP9–10).

3.3.5. Adaptability of Agents

Adaptability refers to the capacity of the component to adjust to a change occurring in the environment and vice versa. Change is inevitable, and so adaptation happens all the time. The analysis has shown that there is institutional adaptability and systemic adaptability. Both require the agent's behaviour to change and adapt to the new reality. In Birmingham, the need for adaptation is sometimes caused by the shift in responsibilities of existing agents (IP1, IP6, IP8–10). There are also cases when finance plays an important role in influencing the performance of the agents and their adaptability to continue their activities (IP4, IP7–9).

We know what needs to happen, but changing behaviour, both of developers and the public, is quite difficult. (IP1)

In fact, the interviews revealed that the financial issues are one of the biggest issues that influence the work of the biophilic agents in Birmingham. The city's governmental body, categorised as a public non-biophilic agent, holds the principal role in the overall governance of the city, making this agent the most dominant and influential one in decision making, even in the case of the city's environmental issues. Therefore, with local government experiencing financial difficulties, the operations of other agents in the environment of Birmingham, both biophilic and non-biophilic, have been influenced and they are demonstrating their adaptability to the given situation (IP1, IP7, IP9). In terms of biophilic activities, private biophilic agents, such as charities and NGOs, have taken on roles of supplementary bodies in maintaining certain natural areas of the city (IP1, IP4, IP6, IP8–10). These ceased to be cared for by the local government as a consequence of the diminished city budget and resources allocated to nature-related administration.

3.3.6. Efficiency of Agents

From the data collected, biophilic agents in Birmingham have shown through different approaches in existing systems and institutions of the environment that their activities and behaviour are efficient when it comes to a biophilic approach and building climate resilience, even if there is yet space for further actions. However, this research did not measure efficiency as a degree of change between two time periods, but rather described the final outcome as assessed by the agents themselves and their involvement.

Efficiency in changing the behaviour of the public to be more biophilic is observed to be difficult in the case of Birmingham (IP1, IP4, IP9–10). Nevertheless, biophilic agents working on smaller scales (spatially and by the overall impact on the city) have been reaching out to non-biophilic private agents and managed to collaborate with them (IP3–4).

Efficiency in urban planning has been influenced by the skillset an agent has (IP1, IP8) to perform the necessary work. It is a particular feature, but its weight is important in relations that the agents sustain with other agents or are dependent on in the process of planning and developing an area in the urban environment of Birmingham. The interview data suggest that skills, specialisation, and overall resourcefulness of agents also improve the efficiency of their work and outcomes (IP4, IP7–8).

Thus, the efficiency of agents can be measured through their ability to connect institutions and systems of the environment so the whole can be capable of and benefit from a biophilic approach in resilience building:

The city as a system has to work as well. Green infrastructures, lots of green infrastructures, small parks and so forth, [. . .] there is this connectivity principle; that characteristic is really crucial. Unless those get together and connect that across the city as part of the system of the city, both in spatial terms and also governance terms, then you will never realise the benefits. There is a big role for the strategic bodies, whether that is national body like Environment Agency looking at catchments of rivers or the local authority [Birmingham City Council] in terms of its role managing the public realm, highways, so on. (IP7)

3.3.7. Additional Insights

Additionally, the research on biophilic agents and their role in building resilience in an urban environment further revealed some hidden and equally important issues that influence the role of agents and their work in an environment. These are the embeddedness and importance of existing systems and institutions, both biophilic and non-biophilic, in the environment, the participation of non-biophilic agents in the environment and the resilience-building process, the economic capacity of the environment and its agents, and, last but not least, the overall understanding of a biophilic, nature-inspired, and nature-based concept. These topics were not further analysed, yet they show how complex the issue of governance in building resilience is.

4. Discussion and Conclusions

To research agents, and more specifically, biophilic agents in urban planning, who are building resilience towards increasing changes in climate, provide a focus on the social factor in sustainability of urban development. Biophilic agents' actions and behaviour are, together with green systems and institutions, an essential part of building cities that can cope with and adapt to changes. By focusing in this research on the agents' role in a city environment, information was provided on how their work is intertwined with the existing formal and informal institutional agreements and regulations as well as with the existing, planned, and future systems in the physical design of the urban environment. Cities are more than their buildings, infrastructure, set of rules and laws. Cities also reflect the actions and behaviour of their inhabitants. They co-create the city within the given physical and social norms by reactively or proactively acting on situations, provoked by the changes that affect their lives and well-being. One of the most pressing changes affecting humans in urban environments are the climatological effects such as heat waves, floods, more extreme winters, to name a few. Furthermore, the environment that humans live in is increasingly becoming urbanised. These changes to land use come together with changes in climate, posing a variety of challenges around how to plan sustainably and develop our space as fit for the future. While technological advances provide solutions to specific issues, governance is required for these solutions to be put into use. Urban planning, as one of the tools of governance of cities and their populations, deals with the physical part (the different systems) and the social part (institutions and agents) to address the urban challenges to build a city's climate resilience. Different approaches in urban planning have been based on systemic nature inclusiveness in the urban environments to lower the impacts of flooding, heat waves, and air pollution, as a result of climate change. Biophilia, a holistic approach

to nature, offers a framework that focuses on nature and human governance, highlighting the socioenvironmental interwovenness within an ecosystem.

The biophilic approach is a relatively new approach and therefore this research required a new framework to be created in order to guide the research. Therefore, a combination of frameworks has been used, in which the biophilic approach was enhanced by the agent categorisation and position within the resilience framework. In this way, it was possible to have enough detail about all the existing types of elements that make up a city.

The biophilic approach in an urban environment creates an opportunity to identify more than the natural, biophilic systems, such as green urban infrastructure, trees, and eco-corridors. It allows to identify the biophilic institutions, formal and informal relations defining the interactions regarding nature between the environment's systems and agents, such as climate acts or sustainable development plans, and the biophilic agents, humans acting on nature in their urban area. By identifying the different components, they become visible on the map of urban resilience building plans, which can be analysed and addressed in the wider city governance and urban planning.

Understanding the role of biophilic agents in the scope of climate resilience starts with understanding which agents are present in the urban environment. In Birmingham, the agents active in biophilic issues of the city are numerous and are not limited only to biophilic agents' activities, as observed from Figure 6. Non-biophilic agents have an important position when it comes to developing these activities. A symbiosis and interconnection of both groups benefits the environment. The research focused on biophilic agents. However, non-biophilic agents were identified as a result of different relations they hold with the biophilic ones. Biophilic agents, being dedicated to nature and nature-related issues, have the advantage of being focused on one issue, hence, they are proficient and specialised in the matter. Biophilic public agents present in Birmingham are mostly representations of national governmental bodies dedicated to nature-related topics. Biophilic private agents are represented mostly by local organisations including charities and trusts. The nature of their presence and their history was not part of this research. However, some interviewees provided details on why these were established. Importantly, this shines a light on what influences the existence of biophilic agents when it comes to the urban environment. The changes in the biophilic systems and biophilic institutions in the city affect the quality and quantity of the biophilic agents in Birmingham (private, community, and individuals). Changes, deterioration, but also funding options and political discourse have affected the city governance and with it, urban planning and development.

Birmingham was recognised as a biophilic city by joining the Biophilic City partner network, yet its economic growth has changed the surface and design of the urban area, thus challenging its biophilic status. The private sector has partially taken over certain activities of the public agents when public administration has to deal with cuts in resources. Additionally, the biophilic agents, individuals, and community, become the leading force in shaping the city and its urban green, by servicing the city's green, in protecting it, and contesting the urban development plans with the biophilic approach.

Together with biophilic institutions and biophilic systems, agents become tools and means of an urban area that through their interconnectedness and interaction have the power to shape and influence the degree to which an environment is biophilic.

Biophilic agents in Birmingham have shown an understanding of their environment through the diversity of actions they take to acknowledge nature and its place in the city. However, climate change and climate resilience are not the main reason that influence their existence, nor their day-to-day activities. Their motivation is mostly rudimentary, which is their present right, need, and state or (well-)being connected to the environment's nature-fullness. Nevertheless, biophilic public agents, as well as some non-biophilic public and private agents, are also concerned with climate change and its effect on their activities. Even though it is not the primary motivation, it is their ultimate goal. In the case of these agents, the motivation is mainly rooted in the length of their presence in and connectedness

with the spatial environment in the past, as well as their desire for a future in the same (urban) environment.

Furthermore, as the interviews have revealed, biophilic agents in Birmingham are accompanied by non-biophilic ones. The role of these agents in the biophilic approach to building the city's resilience cannot be omitted, for they fulfil functions that the environment lacks or is unable to provide sufficiently. Hence, non-biophilic agents in relation to biophilic agents act as partners providing resources, financial and human. Their interaction shows how interconnected the biophilic and non-biophilic agents are in developing activities that enhance the biophilic state of an environment. While this can be linked to the redundancy and diversity of biophilic agents, or the lack thereof, the components in an environment do not exist siloed. The efficiency of this collaboration and interaction then affects the development of the biophilic systems, which in an urban environment affects all the agents involved. Additionally, the involvement of non-biophilic agents in governance that strives for resilience is a positive sign as it indicates learning and adapting of agents, which are the abilities of a resilient environment as defined by Tyler and Moench [8].

Resilience building is, therefore, an ongoing task, that needs to be flexible enough in response, which can differ over time. This, however, requires the involved (biophilic) agents to have holistic knowledge about climate change, the urban environment, and areas in its proximity, to understand the uncertainties that the environment and its elements face. In this way, they can act proactively, nurture collaborations and interactions, and effectively manage the challenges of the environment stemming from changes the climate poses. Ultimately, the redundancy and diversity of biophilic agents and of all the elements in the environment in building resilience provide the management of urban areas to cover all the functionalities to work towards sustainable and resilient development.

The biophilic city resilience framework created and used in this study helped to look at agents through a lens of resilience, rather than seeing specific, individual actions and behaviours that are only nature-full without placing it in a bigger context. Using a framework that specifies characteristics of a resilient environment has allowed the data collected to be placed within a scope. Yet, the framework made for this study when met with data has shown flaws which could not be accounted for before, such as an in-depth specification and definition of each resilience characteristic for the agent component, in order to enhance codification of data.

This study presents the current situation regarding biophilic agents and their role in building climate resilience in Birmingham through actions in urban planning. It is a qualitative exploration of the role the biophilic agents have in an urban environment through their expertise, behaviour, and activities. These range from small-scale community projects for improving their neighbourhood to public administration programs for regeneration and greening of the city. From individuals advocating for and educating on the biophilic approach to private organisations challenging the business-as-usual regulations. The activities they perform in the environment define their role in building resilience. Nonetheless, most of the time, the biophilic agents' role appears to be to challenge the status quo of the urban design and to challenge the business-as-usual methods of urban planning and governance.

However, few limitations to this study did influence the methods, analysis, and final outcome. First and foremost, there has been no similar investigation undertaken yet where biophilic agents are operationalised and at the same time reviewed through a resilience framework. Therefore, the approach to obtaining data and carrying out the analysis has been a major challenge. The framework created for this study is limited to and only applies to specific cities, the partner cities of the Biophilic Cities Network and their agents. The research on biophilic agents themselves, or the lack thereof, provides a wide range of interpretation on what a biophilic agent is. Here, they are presented with a definition that is biased towards the research framework and their interpretation by the researcher. As a result, the study has been framed as an exploratory and in-depth case study.

Secondly, the qualitative design of the research, while defined and laid out, introduced another limitation for the data acquisition, handling, and review. The in-depth, semi-structured interviews provided an unexpected amount of data including details going beyond the scope of this study, yet these were complementary to the topic. However, the sample size of 10 interviewees made it difficult to generalise and operationalise the roles of biophilic agents, thus constraining this research to an exploratory study of current environment related to the work of biophilic agents regarding urban planning towards climate resilience building in the city of Birmingham.

Lastly, the study was significantly influenced by a restricted availability of time and limited financial resources (lack of funding). This played a crucial role in two main processes: the selection of the city for the case study, which was based on the limited number of biophilic partner network cities, close geographical proximity to the researcher's home institution (the Netherlands), and the linguistic capability of the researcher (English-speaking). The other process affected by the restricted investigation resources was the overall study design, which includes the extent to which the data were collected, coded, and analysed for the qualitative research.

Being fully aware of the limitations of this exploratory study, this research lay nonetheless a foundation for further investigations on the topic of biophilic approach and its agents, in terms of planning and building green resilient cities. These could be aimed at a further detailed analysis of the hidden issues encountered in this research, such as the participation of non-biophilic agents of an environment in the resilience-building process, the economic capacity of the environment and its agents, and the overall understanding of a biophilic, nature-inspired, and nature-based concept by agents. Furthermore, probable investigations could include, among other topics, an analysis of the role of agents compared to the other environment's components (systems and institutions), interactions between agents, and the influence on biophilic approach in resilience building, identifications, and an analysis of interactions between the three biophilic components (agents, systems, institutions) on urban resilience building, as well as the overall influence of the biophilic approach (design and governance) in climate resilience building.

Supplementary Materials: The interview guide and questions are available online at <https://www.mdpi.com/article/10.3390/su13095033/s1>.

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