An Elementary Introduction to Urban Ecology and its Concepts

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ABSTRACT: ***The study of these consequences is the goal of 'Urban Ecology.' There are two ways to define the word "urban ecology." As a subfield of biology and ecology, urban ecology studies biological patterns and associated environmental processes in urban settings. In this sense, urban ecology studies the interactions between plant and animal populations and their communities, as well as their interactions with environmental variables such as human impacts. Finally, urban ecology is essential to urban policy since any improvement in living conditions in urban areas, as well as any endeavor to make cities more sustainable in terms of the natural environment, necessitates a societal and individual understanding of the problem. From this standpoint, anthropocentric judgments have no bearing on the research. The second, complimentary definition, on the other hand, indicates an anthropocentric viewpoint. Urban ecology is defined here as a multidisciplinary approach to improve living circumstances for people in cities, referring to the ecological functions of urban habitats or ecosystems for humans and thus includes parts of social sciences, particularly planning.***

KEYWORDS: ***Ecosystems, Environment, Planning, Urban Ecology.***

1. INTRODUCTION

The population of the Earth more than doubled in the second half of the twentieth century, rising from over 2.5 billion in 1950 to over 6 billion in 2016, and reaching over 6.6 billion at the time of writing in 2007. Another major demographic trend that is occurring concurrently with this exponential population rise is: According to the United Nations, the estimated population expansion of 2 billion people between 2016 and 2030 would be concentrated in metropolitan areas (UN 2004). The twenty-first century will be remembered as the century of urbanization. By 2030, urban settlements would account for more than 60% (4.9 billion) of the anticipated world population (8.1 billion), up from 29% in 1950. In the year 2007, the 50% threshold is projected to be attained. More than a dozen metropolitan agglomerations will have more than 20 million people in 2025, with several having more than 30 million. Rather than Europe or North America, 23 of the world's 25 largest urban agglomerations will be in Africa, Asia, or Latin America [1].

1.1. Urban Ecology Can Be Defined in A Variety of Ways:

Cities may also be thought of as emerging phenomena of local-scale, dynamic interactions between socio-economic and biophysical factors. Both are complex ecological organisms with their own internal laws for behavior, development, and evolution, as well as significant global ecological driving impacts. The study of ecosystems that involve humans living in cities and urbanizing landscapes is known as urban ecology. It looks at ecological services that are closely tied to urban development patterns [2]. Urban ecology is an interdisciplinary topic that aids communities in their efforts to become more environmentally friendly. Geography, sociology, urban planning, landscape architecture, engineering, economics, anthropology, climatology, public health, and ecology are just a few of the fields where it has strong roots. 'Urban ecology' has been used to define the study of humans in cities, nature in cities, and the linked connections of humans and nature because of its multidisciplinary nature and unique focus on humans and natural systems inside urbanized regions.

1.2. Research in Urban Ecology Has a Long and Illustrious Conceptual History:

There are several disciplinary origins in urban ecology. The notion of the 'Berlin School of Urban Ecology,' championed primarily by Herbert Sukopp since the 1970s, has been prominent in recent decades [3]. Different fields of natural sciences examined urban ecosystems and associated environmental processes at local and regional scales using this method. This encompasses patterns of biodiversity as well as features of urban soils and climate, as well as their change in time and place owing to shifting urban land uses. This also resulted in the first model of a city with idealized variations in temperature, soils, topography, vegetation, and wildlife

running from the heavily built-up city center to the periphery. Sukopp differentiates a core surrounded by three rings: the highly built-up central core region, a ring with more open space, and lastly the interior and outer border zones.

A transect around the concentric rings and its ramifications for temperature, soil and water, terrain, vegetation, and animal life in the various urban zones is perhaps the most widely reprinted figure in urban ecology. Sukopp's transect technique, which compares the particular ecological state of each zone with the others, and the entire city with its surrounding environment, is used in many urban ecology research[4]. In the summer, the urban heat island of highly built-up areas is a significant source of extra heat stress. High sun radiation, air temperatures, and humidity are linked to lower work efficiency, increased morbidity, and cardiovascular illnesses.

The ecological circumstances of each structure type (for example, industrial areas, central business districts, suburban areas with housing functions, and middle-class housing quarters) are examined, and their features may be compared. In urban ecology, this is another commonly utilized approach. Urban ecology, like geography, may be thought of as a spatial science. As a result, the scope of the research to be conducted is critical. Three different scales should be distinguished, especially in larger cities: the micro-scale of the local neighborhood with its unique built-up characteristics, the meso-scale of the district, which features a mix of different land use (built-up) types, and finally the macro-scale of the entire urban area, which is sometimes made up of different ad hoc groups.

The findings of the research may allow for some generalization across the three dimensions, with certain typical neighborhood's/districts/cities identified, leading to prototypes of a "virtual city". Urban ecology is concerned with spatial and temporal dynamics. Aside from the geographical component, current research has focused on four major change processes: changes in urban biodiversity, climate, human demography, and economy: The usage of urban land has a substantial impact on biodiversity patterns. Cities were once thought to being "biological deserts" until the 1960s, but they are now regarded as "hotspots" of botanic and animal variety. Species react to urbanization in a variety of ways, with native species declining and imported species increasing as a general tendency[5]. These alterations in urban biota are now thought to be important contributors to worldwide homogenization. Regional studies, on the other hand, have shown that urban regions have higher native and non-native species richness than surrounding areas, and that non-native species may also contribute to the dissimilarity of urban floras. Future research should focus on the role of cities in threatening or maintaining biodiversity. Cities have a significant role in climate change since they contribute around 75% of greenhouse gas emissions.

The impact of increasingly frequent and powerful heat waves superimposed on the urban heat island is extremely varied, but it includes an increased burden of illnesses, increased morbidity, and death. Floods, hurricanes, and droughts pose a special threat to coastal megacities[6]. Demographic shifts may have an impact on the anthroposphere. People in highly industrialized nations are living longer than ever before, but birth rates in countries like Germany are falling. The number of older persons is anticipated to rise, and the demographic pyramid's form is likely to alter. This, for example, leads to changes in behavior and the need for living space. However, it is clear that demographic changes have the potential to improve urban ecological conditions, not only because of the reduced number of people and thus demand for water, energy, transportation, and other resources, but also because of the reduced pressure on land use and the possibility of alternatives to traditional urban development. Building density, on the other hand, should not go below a particular threshold in order to provide cost-effective technological infrastructures.

One of the most significant elements affecting the operation and growth of urban agglomerations is economic change. The economic structure of a town affects its position in the interregional and transnational network of cities, and current economic activity also influences the urban landscape. Cities' economic structures have changed dramatically in recent decades, as they have been increasingly linked into global supply and demand networks, which are dependent on the globalization process[6]. Along with these changes, a significant driver for urban agglomerations in advanced economies is the shift from industrial to service-based economies; spatial aspects of this shift include the emergence of brownfields on former industrial land and rising demand for high-ranking service spaces. The four alterations described above are significant concerns that should be considered in future urban ecological research and planning procedures [7].

Urban ecology is an interdisciplinary study that takes into consideration natural realms as well as the anthroposphere and its socioeconomic components. As a result, for a more thorough knowledge of the current processes, integrated methods are required. In urban ecology, research clusters that look at a problem from many disciplinary viewpoints might be very beneficial. The abiotic spheres (atmosphere, hydrosphere, and pedosphere) and the biotic sphere (flora and fauna), which together create 'the natural system of a city,' or the anthroposphere (society and economy), which together form 'the socioeconomic system of a city,' may be included in clusters [8].

Various fields of knowledge related to urban ecology are integrated for this aim, ranging from remote sensing via field surveys for the sustainable development of neophyte or bird populations within the city to molecular techniques for monitoring environmental health. This is paired with a holistic perspective that considers the sociological and economic dynamics that shape city growth, as well as its implications for people' perceptions and well-being.

- *Cluster 1: Biodiversity and improving roadside ecological functions:*

In metropolitan areas, roadside habitats with high levels of physical stress and pollution are common. They may serve as habitats for plant and animal species, depending on their susceptibility to physical stress, pollution, and upkeep, as well as changes in soils and temperatures. The development of roadside vegetation may clash with public safety and tidiness concerns, yet it provides vital ecological services such as temperature reduction, hazardous substance sequestration, and habitat functions. Similarly, constructional modifications such as sheet pile walls, which, along with siltation and a sufficiently high pollution load, shift abundancies to more tolerant species, have a human impact on urban watercourses. Improved methods for developing and maintaining regions near urban roadsides and watercourses will be aided by a greater knowledge of biological mechanisms and functions, as well as public perceptions of various habitat types.

- *Cluster 2: Repurposing abandoned housing estates:*

De-industrialization is an issue that affects all highly industrialized countries, particularly in the heavy industry sectors. Large sections of Eastern Germany and the Ruhr Area in Western Germany, as well as parts of the British Midlands and the United States of America, such as Detroit and Pittsburgh in the Northeast, are examples. Large swaths of land that were once occupied by large enterprises are now unused. Many of these areas are also experiencing population declines as a result of migration and demographic shifts, as well as a reaction to employment losses. As a result, shrinkage does not occur just in ancient industrial estates, but also on areas utilized for technological infrastructure, services, and housing. Further urban development initiatives will face problems as a result of these developments. Using a combination of socioeconomic, environmental psychology, and ecological studies, risks and possibilities will be highlighted. An experimental method is used to assess strategies to promote biodiversity and the public's perception of them. The multidisciplinary approach aims to aid decision-makers' planning techniques.

- *Cluster 3: Temporarily utilized urban sites strategies:*

Many urban areas that no longer serve their original purpose (such as marshalling yards or old housing estates) can now be repurposed. These don't have to be long-term solutions. Urban sites that are only used for a short time function as adaptable planning and development tools. This planning technique is intended to avoid short-term problems caused by property circumstances.

Brownfields and other temporary urban sites are seen to be equally as essential for the urban ecology as permanent urban spaces such as parks or woods. The availability of temporary urban sites of various sizes, as well as their ecological consequences, are important considerations. Three variables influence its availability: (1) the urban land market, (2) political and planning laws, and (3) opinion formation and decision-making processes. These three socioeconomic, political, and planning categories are also the most significant variables in the urban agglomeration's land use system. In order to enhance their influence on the urban ecology, temporary urban sites are examined in the context of these categories.

- *Cluster 4: City inhabitants' psychological health and well-being:*

Urban ecosystems are prone to short-term changes that result in objective environmental changes. It's crucial to know if objective changes lead to changes in subjective perceptions and judgments in order to understand how

inhabitants react to these changes. These objective changes may then have an impact on city inhabitants' behavior decisions. Residents' sensitivities are triggered by both objective changes to the urban environment and changes in subjective perceptions. Changes in the quality of surface water and groundwater, as well as the shape of urban littoral zones, might pose health hazards. It is preferable to do research in two stages: To begin, objective quantifiable characteristics that are considered to be more detrimental in urban contexts, such as heat stress or water shortage, must be determined. Modeled scenarios based on observed data might be useful in illustrating potential urban environmental changes. Second, residents' perceptions and effective assessments must be investigated.

2. DISCUSSSION

Due to the unique properties of each subsystem and their densities, it has been shown that urban areas can be biologically rich. Nature and the city are no longer dichotomous in the sense that they are incompatible, but the lines between them have blurred significantly. The diversity of organisms seen in urban cities demonstrates this [9]–[11]. As a result, our perceptions of nature may change. The emergence of urban ecosystems marks a new phase in the transition from pristine, or natural, to culturally-shaped ecosystems, "four natures," which contrasts the urban-industrial nature as the "fourth nature" with the natural and cultural landscapes that came before it. Although it is commonly acknowledged that urbanization has a substantial impact on existing rural and natural landscapes, the public's opinion of urban-industrial ecosystems has remained mostly unfavorable. Whether or whether they are used on a regular basis, they may help to stabilize and improve natural living circumstances.

3. CONCLUSION

Urban ecology research has reintroduced the importance of urbanized regions as environmentally significant places. In this sense, the above-mentioned paradigm shift in environmental research is the conceptualization of urban space as an ecological entity. The examination of these and other American notions, with a special focus on the human dimension, yields an unique concept of urban ecology. On the one hand, there is a profound disconnect between nature and wilderness on the one hand, and the built-up environment of cities on the other: Cities are typically so large that city dwellers' contact with nature is difficult, and often the only easy access to nature outside the city is poor industrial agriculture or tree monoculture, whereas biodiversity inside the city is high and diverse – but often overlooked.

The ecological and economic benefits of the so-called "fourth nature," or "new urban wildness," are still underappreciated. City inhabitants spend the most of their time indoors, in settings that include artificially heated or cooled ambient air, piped drinking water, dirt in flower pots with decorative plants, and small pets. This ‘home nature,' a fifth form of nature, helps to replace the outside type of nature that city residents are cut off from. Human well-being, productivity, and health, on the other hand, are all dependent on natural components that are near to daily living in cities. The bright, spotted ‘harlequin pattern' (Sukopp) is not only seen in urban biotopes, but also in a wide range of temperatures and soil types. Human activity must be regarded an integral element of urban ecology, and geo-biosphere and anthroposphere methods must be integrated as soon as possible.

At ecological hotspots in cities, good practice examples of such integrated activities might be established. Given this more distinct picture of urbanized or industrialized regions from the standpoint of urban ecology, another fundamental concern about future urbanization processes arises. As previously said, the year 2007 is regarded as a watershed moment in human history, with the majority of people living in cities rather than rural regions for the first time. Increased land usage and deterioration as a result of development and settlement undoubtedly adds to the difficulties. However, it remains to be seen if dispersing a given metropolitan population across a much greater region will be more environmentally friendly.

Urbanization may be defined as a spatial concentration trend aided by agglomeration economics and the rich socio-cultural amenities that cities provide. One of the future objectives of urban studies in general, and urban ecology in particular, may be to answer this issue. The challenges for policy led by urban ecology are threefold: first, the city's ecological integrity must be restored, which means recreating a green matrix in them to bring plants and animals back to where the majority of people live; second, production and consumption systems must be redesigned to address the global problem of unsustainable "metabolism"; and third, urban citizes must be redesigned to address the global problem of unsustainable "metabolism."

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