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A REVIEW STUDY OF URBAN ECOLOGY OF VARANASI REGION

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Abstract: Domination of nature to better meet our wants has resulted from the emergence of human civilisation and its subsequent evolution into various societies.By 2050, 416 million additional people are predicted to live in cities in India alone, with seven megacities housing over 10 million people. The phenomena of urbanisation, which is a result of the growth of this intricate socioecological system, has changed the movement of materials and energy in the ecosystem globally and made cities the hubs of innovation and culture. Direct greenhouse gas emissions from cooking, power use, and car use are the responsibility of urban households. Multivariate analysis and a household survey were used to quantify this impact for Varanasi city.

Key words:*Urbanization,Human Activities,Globalization And Carbon Emission.*

Introduction: In order to better meet our wants, humans have dominated nature since the dawn of civilisation and the subsequent growth of many communities (Toynbee and Ikeda 1987). As a result, cities have become hubs of intense human activity in many parts of the world. "Wealth and rapidity are what the world admires, and what everyone strives to attain," according to Johann Wolfgang von Goethe (Goethe 1808).

In his masterpiece Faust, he explored the pathology of human civilisation by depicting the human tendencies that lead us to pursue the "magic mantle," the "quick dagger," and the "fast money," which are depleted to satisfy a series of desires but ultimately bring us to ruin. In addition to illustrating the negative effects of human activity on the environment, this comparison shows how the author integrates other facets of human progress, such as resource consumption and relocation, social justice and equity, and economic expansion. Cities and urbanisation are the current crystallisation of all these factors.

Numerous aspects of urbanisation can contribute to the solution of the world's problems, including resource consumption, waste generation, loss of ecosystem services, land use and cover change, and climate change. Some aspects of cities have been observed to appear more or less generally, despite any potential differences between the cities of today and the more than three-hundred-year-old parallel in Faust. First, as infrastructure is used more

intensively, the amount of space needed per person is decreasing. Second, socioeconomic activity picks up speed. Third, socioeconomic activities grow increasingly interconnected and diverse, resulting in intricate cultural and economic patterns.

Cities have become hubs of innovation and culture as a result of the growth of this intricate socioecological system, the phenomena of urbanisation, which has altered the movement of materials and energy in the environment globally (Verma et al. 2020). In 2018, over half of the world's population resided in cities; by the end of the 2021–2030 decade, that number is predicted to rise to over 60%, and by 2050, it will reach over 70%.

The number of megacities is also expected to rise 43 by 2030 from 33 at present, with more than 10 million inhabitants each (Fei and Zhao 2019). About 95% of the urban population growth expected to take place in developing countries and about 90% of the urban population growth is expected to take place in Asia and Africa, with China, India and Nigeria accounting for about 35% of the world population growth from 2018 to 2050. India alone is expected to add about 416 million urban residents by 2050, with seven mega-cities housing more than 10 million people (UN DESA 2017). The Sustainable Development Goals (SDGs) were developed to create a sustainable and inclusive society with the participation of different stakeholders at different hierarchical levels. Out of the 17 SDGs, the 11th goal aimed to focus on creating sustainable transport, adequate and affordable living spaces, inclusive and sustainable urban development, protection of cultural and natural heritage, protecting the lives of people, especially the most vulnerable sections, and reducing the economic loss caused by disaster-induced calamities and diseases, reduce the environmental impact of urban areas, provide universal and equitable access to green and public spaces, strengthen regional and national development taking into account the sustainability linkages between the rural, peri-urban and urban areas, increase the number of cities which have an integrated planning approach towards the environment, social inclusion, economic development and disaster risk reduction, and, to provide financial and technical assistance to the cities in the least developed countries to build sustainable and resilient buildings using locally obtained material (UN DESA 2017). Some of the major challenges which plague the urban areas are resource use and waste production, poverty alleviation and pollution. It has been estimated that the world’s cities occupy about 3% of the worlds surface area but contribute to more than 75% of carbon emissions and consume about 80% of energy. However, from an ecological perspective, understanding the dynamic relationship between the urban and the ecology is imperative to create a sustainable social-ecological system (SES). From the analogy mentioned earlier in this section, there is a need to develop an integrative approach and the cities in developing countries offer opportunities to create and test such an approach thereby bypassing the old planning strategies. The study of SESs requires an integration of the “complex, multivariate, nonlinear, cross-scale and changing systems” using a nested, multitier approach for organizing variables (Ostrom E 2007). Such integration can be used to understand the urban ecological phenomena. 1.1. Urban Ecology Ecology is the study of abundance and distribution of organisms (Andrewartha and Birch 1954), ecosystems and the processes influencing the distribution and abundance of organisms, the interaction between and among the organisms, and transformations of the flux of energy and materials (Carry Institute Ecosystem Studies). The ‘processes’ and ‘interaction’ give the study of ecology its characteristics qualities. Based on the above understanding, urban ecology can be defined as the

study of the distribution and abundance of living organisms, their relationship with the environment, the interaction between the organisms, and the transformation and flux of energy and matter in an urban area (Verma et al. 2020c). Urban ecology consists of cross-cutting themes which were traditionally dealt with independently. It includes the social, environmental, and economic dimensions of sustainable development, as well as the ecological relationships between them (Verma et al. 2020c). Advances in waste management, urban planning, green spaces and sustainable transport, water harvesting, urban agriculture, energy-efficient building, etc., have led to a transformation in urban ecology from a theoretical and empirical to an applied and transdisciplinary field. An urban area consists of biodiversity (parks, animals and trees), humans and their socioeconomic groups, built structures (roads, buildings), transport, essential services finance, health, waste disposal), energy flow (solar, electricity, coal, LPG, wood), food supplies, building material (bricks, mortar, steel, etc.), urban agriculture and biogeochemical cycles in urban areas. All these works together to give a city its appearance, form and structure. The form and structure include the dynamic relationships between these components. Cities have a one-way flow of energy and produce waste from the material consumed in the city. The resource base of a city may not be necessarily present within the boundaries of the urban area and similarly, the waste is also not always dumped within the urban boundary. However, the impact of such resource consumption and waste generation is evident across the globe. Due to the combination of multiple components with outside linkages, and the flow of matter and energy, the functions of urban ecosystems are better referred to as urban metabolism 4 (Perrotti 2020). The major issue with resource and energy mobilization due to urbanization is the scale at which it has happened due to anthropogenic subsidization (Bai 2016). Further, such resource consumption and output are not equitable within the urban areas or among them. For example, the green space availability in New Delhi was 5.5m2 /capita and the average per person emissions were 111 KgCO2 /cap, whereas in Varanasi the green space availability was 6.3 m2 /capita with 66 KgCO2 /cap (Kadian et al 2007). The reason has been attributed to the lifestyle and income disparities. Rural areas predominantly utilize traditionally solid fuels which might be responsible for higher carbon emission from cooking activities. This kind of disparities within urban ecosystems also exist in different processes and components which determine the scale and magnitude of the effect of urban phenomena on its environment. The recent advances in statistical modelling, causal analysis, remote sensing and Geographical Information Systems (GIS), development of indicators and sustainability frameworks, Sustainable Development Goals with 169 targets, and the recognition of the need for a transdisciplinary approach, have greatly benefitted research in urban ecology (Verma and Raghubanshi 2018). Remote sensing techniques are extensively used in land use land cover change and modelling, urban heat island, vegetation analysis, big data analysis, water quality and many other subjects (Chandan and Bharath 2018). From the perspective of urbanization, land use land cover change is the first step towards understanding the spatial and temporal impact of urban growth in physical terms (Patel et al. 2019). However, with the development of different satellite sensors, the number of classification algorithms also increased. There is a research gap in the selection of the classification algorithm. A similar discrepancy has also been reported for the use of Kappa based accuracy assessment indices (Pontius and Millones 2011). Further, indicators and targets are the backbones of sustainability frameworks, and from an ecological perspective, greenspaces are the connecting link of the anthropogenic to the

natural. Greenspaces harbour biodiversity and provide essential direct and indirect ecosystem services (Turkelboom et al. 2018). The biogeochemical cycles, like carbon, phosphorus, water, etc., also depend on the flora and fauna present in an urban area (Cordell et al. 2009). Urban green spaces form an essential ingredient of a liveable city, as the availability, accessibility, quality, and security of public green spaces is the key to a healthy environment in cities (Black 2012). Greenspaces also help in mitigating the global warming impact of GHG emissions. Urban areas are responsible for more than 65% of the global carbon emissions from fossil fuels and cement production, and three-quarters of the household emissions are attributed to mobility, housing, diets and leisure (Widenhofer et al. 2018). The residential sector accounts for about 20% of the GHG emission in American cities, whereas in India, it is about 24% (Goldstein et al. 2020). Historically, in developing countries, households have contributed the least towards global carbon energy emissions (Raupach et al. 2007). However, now a large population without access to clean energy coexists with the more affluent sections of the society having large carbon foot prints. This economic disparity in developing countries is augmented due to rapid social and demographic changes due to urbanization. The impact of social and economic factors on the urban environment determines the ecology of cities. Despite the recent developments, certain critical challenges remain in this field. From the perspective of urban sustainability indicators, we published a review identifying the challenges and opportunities in this field. Three major challenges were identified as lack of data at different administrative hierarchies, absence of thresholds or targets and a conceptual framework for urban sustainability. Due to the development of a large number of classification algorithm and satellite datasets, the selection of the classification algorithm is essential to get meaningful output from remote sensing analysis. Furthermore, factual data pertaining to the sustainability limitations or thresholds of various elements in an urban ecosystem must support the target selection process. An integrated approach is required because these elements function in a dynamic equilibrium with social and ecological influences. The biophysical and social elements must to be compiled in these integrative frameworks (Grove and Pickett, 2019).

Conclusion: The effects of human activity on urban ecology extend beyond the city limits. Nonetheless, urban resilience can be enhanced by utilising the ecological elements. The effects of urban households have not been examined from an ecological point of view. Climate change is one of the main effects of urbanisation. Direct greenhouse gas emissions from cooking, power use, and car use are the responsibility of urban households. Multivariate analysis and a household survey were used to quantify this impact for Varanasi city.

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