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Reduction of Green Spaces in Urban India: An Analysis

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Abstract: *The Urban Space is increasingly becoming environmentally fragile, politically & economically strategic and socially significant domain for all. At the same time, urban centres are providing new opportunities and comfortable life style. Urbanization is as essential as economic development but is creating urban stress and puts pressure on existing greenery. Urban centres are acting as a centripetal force by providing better facilities and opportunities for people, so they are attract towards the main centre of a city and have started moving towards main hub and living in proximity. When people start settling around the urban center, it gradually loses its greenery due to increasing population and after a certain period of time it expands beyond its carrying capacity. When population crosses its threshold level at the centre then people start living in its fringes and start deteriorating its greenery. To serve a large urban population, more land is required for housing, infrastructure. Construction on those lands, however, often results at the cost of existing greenery. Reduced greenery means reduced capacity to absorb harmful gases, noise and adverse impacts from human made & natural calamities. It's time for urban sustainability and policy makers should work on green infrastructure beyond the idea of economical or financial infrastructure.*

Key Words: *Green spaces, urbanization, carrying capacity, artificial environment, urban sprawl and urban heat islands effect (UHIs).*

1. INTRODUCTION:

Urbanization has changed its spread from urban centers to urban sprawl and is considered as a challenge for providing land to existing as well as growing population, though the land use pattern has changed significantly from past decades to the present scenario. Urbanization is as essential as economic development but is creating urban stress and puts pressure on existing greenery. 'Green Spaces' is the term which is generally used in the context of urbanization i.e., a green or open spaces must be provided while a city is planned. As suggested by the World Health Organization (WHO) providing 9 sqm. unpaved open space for every inhabitant of the city is essential which is most of the times not followed by densely populated cities due to space crunch. Thus, providing green space for every individual household is not possible that's why city centers may have spread in its fringes in search of better living conditions.

According to UN-Habitat studies, more than half of the world's population resides in cities and projected that urban population will grow to two-thirds by 2050. The growing, large-scale concentration of human settlement in the world's cities poses significant difficulties for innovation, as well as countless potential to improve human habitats. The majority of this population expansion will occur in developing countries, which are predicted to add 1.3 billion people by 2030, compared to 100 million in developed world cities over the same period (UN Habitat: For A Better Urban Future).[1]

UN World Urbanization Prospect in 2018 represents data about urban population growth at global level; earlier world's urban population was 55% and expected to rise to 68% by 2050. World's urban population is expected to be highly concentrated in just few countries like India, China and Nigeria. These three countries together will account for 35% of the projected growth of the world's urban population between 2018 and 2050. These growing trends are likely to be more significant particularly in developing countries, where it is projected that 90% of additional 2.5 billion urban dwellers will be accommodated by the growth of secondary and tertiary cities by 2050 (UNDESA, 2018).[2]

The paradox inherent in the mass migration towards urban centres is that on one hand if people desire better living conditions, then they have to move towards urban centres. However the same mass migration when settles down in urban centres and subsequently result is urban sprawls and over a period of time dense congestion in the living spaces and declining urban green spaces, the process of urbanization comes under heavy criticism.

2. URBAN GREEN SPACES (UGS)

Green Spaces (land that is partly or completely covered with grass, trees, shrubs, or other vegetation). UGS includes parks, community gardens. Green areas are normally classified as Recreational Areas in Master Plan. (Urban Greening Guidelines, 2014).[3] According to the UN Habitat, 2015 urban green spaces are a component of 'green infrastructure'. It is an important part of public open spaces and common services provided by a city and can serve as health promoting setting for all members of the urban community. It is, therefore, necessary to ensure that urban green spaces are easily accessible for all population groups and distributed equitably within the city (UN Habitat, 2015).[4]

Urban centers may be considered as the main hub for new opportunities and technological innovations or providing better living standards in today's scenario. However, for developing urban centers, existing greenery will be compromised and in place, it will be providing an artificial environment which includes fragmented green spaces and/or modified habitat for beautification purpose, which sometimes cannot hold the pressure of existing population.

Land use pattern in cities with their various components and diverse use from its buildings, transport systems, and parks and need for food and other services has the palpable and fundamental impact on ecological processes and on biological biodiversity. This profound impact is likely to continue in future so; urbanization should be supported by food production. The urban pattern has an effect on species richness and biodiversity and to mitigate consequence of the effect of urbanization, urban landscape should be integrated with green areas as patches and is called as landscape mosaic pattern; these patches are connected by corridors which facilitate movement of species and the functioning of ecosystems within the urban fabric, and thus protect biodiversity (UN Habitat: For A Better Urban Future).[4]

Millennium Ecosystem Assessment 2005, based on the 1992 Convention on Biological Diversity, defines the diversity of life on Earth, constitute many components from species, genes, populations and ecosystems to number of geographical scales from local to global level (UN Habitat: For A Better Urban Future).

As indicator says, according to the Sustainable Development Goal 11- Sustainable Cities and Communities, Target 7: States: By 2030, provide universal access to safe, inclusive, accessible, green and public spaces, in particular for women and children, older persons and persons with disabilities. For all people living in cities, open and natural places provide opportunity to improve their well-being and sense of personal fulfilment. Some of the benefits include improving our physical and emotional well-being, strengthening our networks, and making our cities and neighborhoods more appealing places to live and work. SDG 3- Good Health and Well-Being will be aided by Target 11.7. Green spaces can also help to achieve SDG 7-Affordable and Clean Energy-by lowering city temperatures and making cities more energy efficient (Ghani and Tan, 2020).[5]

In the past two centuries, it is evident that a remarkable shift has taken place from primarily rural to urban population. This could have happened due to industrialization process as the earlier population was based on agriculture & farm activities and thus so lived in rural areas. Earlier in the eighteenth century, before industrial revolution, not more than 5% of the global population inhabited the cities. In modern history the process of change from an agrarian and handicraft economy to one dominated by industry and machine manufacturing started in Britain during 18th century and from there spread to other parts of the world. (PRB, 2015)[6]

3. THEORETICAL FRAME WORK:

3.1 UNSUSTAINABLE CITY CENTERS

Governments of the world have created innovative and strategic approaches for smart city transformation to improve operational efficiencies, maximize environmental sustainability efforts, and create new citizen services. To tackle these critical challenges in a well-planned manner is essential for cities inspired to shift toward more sustainable measures among all stakeholders: citizens, businesses, and governments (PwC, 2015)[7]. Most of the cities in the world have already expended beyond their carrying capacity limit. Thus cities have become unsustainable and are forced to find other options for relocating their main urban center which appears to be difficult as following examples reflect:

Recently in May 2019, Indonesia was in news for relocating its capital city from Jakarta to initially proposed Central Kalimantan and Palangkaraya due to traffic congestion, groundwater scarcity due to drilling and its skyscraper buildings. Another example is Egypt, where in 2015 the government announced that it would attempt to replace their historic capital city of Cairo with a new smart city in an undeveloped area out in the desert some 40 km east of Cairo. Myanmar's decision for relocating its capital city from Yangon to Naypyidaw back in 2005 was not fit to required objectives and was criticized by many and the idea of capital relocation has gone wrong. Other examples are Malaysia that has moved its capital from Kuala Lumpur to Putrajaya which was a planned city in 1999. Brazil also moved from Rio de Janeiro to Brasilia near the Amazon, including South Korea and Kazakhstan. All these countries have relocated their capital city because they expanded beyond their carrying capacity and became unsustainable and inhabitable.

The above examples of shifting city centers indicates that these cities have crossed their threshold level of

'sustainable living space' because concentration of many people in dense areas and sharing limited space increases their carbon footprint and the availability of average built-up area is less for every household. These patterns are making cities less pleasant and environmentally fragile to live-in. It also threatens the earth's carrying capacity and is most vulnerable to climate change.

3.2 ALARMING BELL FOR INDIA

India is holding second largest population of the world and it's difficult for states to provide each a proper livable space. India is experiencing process of urbanization; especially from 1950s by stimulus of industrial process and once a place start becoming industrialized; people are moving towards cities in search of greater opportunities for their better life style. When the cities became hubs of trade & business, more people start moving to gain access to some of better social and financial benefits (Ravi, et. al., 2016). [8]

Census 2011 shows that 31.16% of the India's population resided in urban areas and is expected to grow to around 40% by 2026. It is also projected that the number of towns and cities which was 7933 is likely to cross the 10,000 mark in next decade (Census 2011)[9]. It can be argued that most of the urbanization is self-motivated in search of better facilities available for education, jobs and better infrastructure. This type of one-sided migratory process has caused rapid and haphazard urbanization. Due to this, severe social, economic, physical and technical problems have emerged such as traffic congestions, scarcity of resources, growth of slums, urban sprawl, housing shortages, air, water, and sound pollution, inefficient waste management, human health concerns, deteriorating infrastructures, social segregation, and exclusion (UN Habitat, 2015).[10]

4. RESEARCH METHOD:

The **first objective of this study is investigating reasons behind the degradation of UGS** for which different types of secondary sources of information including reports, journals, databases, books and research papers from published in scholarly and academic journals have been used. **Second objective aims to explore how trends of urbanization affects urban greenery** and thus making an inference that how increasing urban population taking over green spaces in and around cities. For analyzing this inference qualitative (secondary) nature of the research is adopted which allows for the in-depth exploration of the phenomena with greater impact for making interpretation about the reduction in urban green cover and centrifugal spread of urban population. A substantial portion of research articles pertaining to *urban green spaces* have been looked into.

5. DISCUSSION:

5.1 URBANIZATION TRENDS IN INDIA

Century ago in 1901, Kolkata was the only metropolitan city in the country but in the coming decades the number of metropolitan cities has grown exponentially and has increased from 5 in 1951, to 12 in 1981, 23 in 1991, 35 in 2001 and 53 in 2011. These 53 metropolitan cities have accounted for a population of about 158 million and are expected to grow about 100 plus in next decades. By the year 2051, India would have 1.70 billion people as population and per capita land availability would be 0.19 Ha. At this pace of increasing population urban settlement will be boosted up and accounted for 48% of the total population i.e. 820 million people living in urban area (Ministry of Urban Development, 2014).[11]

Table 1: Urbanization Trends in India

Census Year	Urban Population (in millions)	Share of Urban Population to total Population (%)	Annual Exponential urban growth rate
1961	78.94	17.97	Nil
1971	109.11	19.91	3.23
1981	159.46	23.34	3.79
1991	217.18	25.72	3.09
2001	286.12	27.86	2.75
2011	377.1	31.16	2.76

Source: Bhagat, 2011[12]

Table 1 shows, an increase in the urban population from 78 million in 1961 to 377 million in 2011, by a 13.19% increase over five decades. This exponential growth in the urban population is a matter of serious concern.

5.2 INCREASING POPULATION OVER GREEN SPACES

With regards to India, surveys have estimated that over 40 crore people would be added to its urban population. For the first time since India's Independence, the absolute increase in population was more in urban areas than in rural areas, as per the 2011 census. The urban population increased from 27.81% in 2001 to 31.16% in 2011 with an absolute increase of 9.1 crores during the decade. As a result of the urbanization process, a substantial amount of prime agricultural land will be transformed to urban development, especially on the outskirts of major centers. Due to development activities, 14% of green spaces have been transformed and according to MoUD, 2014 existing open space per capita in cities for listed Master Plans is 17.43 sq.m. Such data shows that increasing urban population creates a serious threat to existing urban greenery.

Table 2: Major cities of India with per capita green spaces

City	Population in Millions	Population Density per km^2	Geographical area (km^2)	Green Cover % (in km^2; 2017)	Per Capita Green Space (m^2; 2018)
Delhi	28.5	12,591	1484	20.00 (296.80)	**10.41**
Mumbai	23.5	20,482	603	36.48 (220.00)	**9.36**
Kolkata	15.2	24,400	1380	7.30 (100.74)	6.61
Bangalore	13.9	4381	2196	2.09 (46.03)	3.31
Hyderabad	11.57	18,480	650	1.66 (10.79)	0.93
Chennai	9.88	14,350	1189	15.00 (178.35)	**18.05**
Ahmedabad	8.41	9900	464	17.00 (78.88)	**9.38**
Surat	6.55	1376	326.5	11.84 (38.66)	5.9
Gandhinagar	6.33	660	649	54.00 (188.46)	**29.77**
Jaipur	3.71	598	467	5.43 (24.75)	6.67
Nagpur	2.94	11,000	285.9	18.00 (51.42)	**17.49**
Mysore	1.7	6911	128.4	20.19 (25.92)	**15.25**
Chandigarh	1.05	9252	114	35.00 (39.90)	**38**

Source: Ramaiah and Avtar, 2019[13]

Table 2 shows the population in the 13 most crowded cities as of the 2018 Estimated Census which was obtained from Ramaiah and Avtar, 2019 (India Environment and Population Portal). This table also gives information about the geographical area, forest & tree cover, and per capita space in these cities. Figures in bold above indicate the optimal of 9 m^2 per capita green cover.

Despite the fact that metropolitan regions provide better prospects and higher living conditions, urbanization causes a number of issues. Encroachment and resource constraints put stress on basic needs. Due to the various pressing challenges that plague on urban green spaces, the unplanned urbanization problem is ecologically unsustainable and to serve new immigrants to cities, more land is required for housing, infrastructure. Construction on those lands, however, often results at the cost of existing greenery. Fragmented greenery means reduced capacity to absorb harmful gases and other pollutions which also invites adverse consequences of climate change like flash floods.

5.3 PRODUCTIVE OPEN SPACES

Many progressive practices over the world made urban spaces productive either it is vertical gardening, roof planting, and terrace gardening and many more. There are many examples available making open spaces productive and providing opportunities to urban dwellers a chance to earn their income. Kongjian Yu writes, universities in China have traditionally been landscaped with ornamental lawns and flowers, but the Shenyang Architectural University Campus was designed to be productive. Storm water was directed to a pond, which acted as a reservoir to water rice paddies (UN Habitat: For A Better Urban Future).

Case of Berlin, Germany, the *"StEPKlima"* demonstrated the significance of existing urban green spaces and parks for the improvement of climatic conditions, for centrally placed leisure opportunities, for protection of water resources and for the maintenance of habitat for animals and plants. The ecological benefits that derive from the largest park in the city, the *Tiergarten*, are a model for future planning and argue for the safeguarding of green spaces. These

areas play a key role in adapting to the negative effects of climate change and to the improvement of living conditions in the city (UN Habitat: For A Better Urban Future).

Case of Dar es Salaam, Tanzania, urban agriculture has been developed and promoted as an income earner and a food source at the subsistence or household level. Food security was highlighted by droughts in the 1970s and 1980s and the government supported urban agriculture in a bid to encourage households to be self-sufficient. The challenge has been to regulate the largely informal urban agricultural activities so that natural systems, such as river valleys and wetlands, are not compromised (UN Habitat: For A Better Urban Future).[14]

5.4 RECOMMENDATION FOR OPEN SPACES BY W.H.O.

Currently, developed countries have tried to adopt a general standard of green space of 20 sqm. per capita. The WHO has also given suggestions for designing green area networks so that all residents live within a 15-minute walk to open space. In India, the prevailing condition for open space per capita varies from 0.81 sqm. in Chennai to 278 sqm. in Greater Noida which indicates the wide variation within it. Jaipur, Prayagraj, Chandigarh, Bhopal and Noida cities of India have more than the WHO prescribed norm of 9 sqm. while the cities like Ludhiana, Amritsar and Bengaluru have less than the norm ranging from 1% to 5%. It is mentioned in the Greater Noida Master Plan that ample space for urban green should be provided with most of the residential sector designate large area of land under the green area (MoUD, 2014).

6. CHALLENGES AND MITIGATION:

6.1 EXISTING CHALLENGES TO URBAN GREEN SPACES

Urban areas serve as dynamic and complex entities that harbor heterogeneous mixture of artificial environment, natural, semi-natural and modified habitats. Major concerns related not only to physical and mental health of people which got affected with loss of urban greenery but also to rise in urban temperatures and heat stress-induced mortality and health problems due to growing population. It is a well-known fact that trees have potential to mitigate the effects of climate change and pollution as well. Generation of urban heat islands effect (UHIs) due to rapid urbanization and haphazard urban sprawl have depleted green cover and increased urban vulnerability to climate change.(Chaudhry, *et al 2011*) [15] Unplanned urban development can increase the risk of human-made hazards such as flash flooding and drought among others. Implementing master plans with areas dedicated to green space is one of the issues of unplanned urbanization. Despite the benefits already explained in various literatures, UGS are under stress in developing countries due to over use, and they are threatened in fast urbanizing conditions, with greater susceptibility in the face of global environmental change. Regardless of multiple regulations and conservation bylaws, the planning, monitoring, and management of UGS in India's developing cities are a major concern. So, how can an urbanize world could lower carbon footprint & increases green footprint and at what extent.

6.2 PROBLEMS OF URBAN GREEN SPACES: MITIGATION STRATEGIES

It is the known fact that urban vegetation or urban green areas can mitigate prevailing climatic conditions as well as adverse effects on human health and well-being. In the context of UGS for sustainable development, the environmental benefits of green spaces include mitigating climate change by sequestering carbon emissions and reducing air pollution. To address problem of urban green spaces, it is essential to sketch out urban green cover which could help in providing information on available urban green spaces; this would ultimately help to ensure that community, individual and policymakers could make the best use of existing green space. Another way of mitigating adverse effects of climate fluctuation to some extent is open spaces should be free from impervious urban surfaces so natural percolation of water (rain water or surface run-off) could happen and helps in maintaining green cover in urban areas. A critical step that planning authorities must take is to design interventions that support landscape planning with a greater grasp of future spatial configurations of urban landscapes. Maximizing, measuring and monetizing environmental benefits of urban green areas: these can presently produce huge ecological benefits that are currently being undervalued and could make a more significant contribution in mitigation against climate change which is presently underdeveloped.

7. RESULT:

Migration due to education, job and other probable conditions to cities for better living standards and its spread towards urban fringes have been creating stress on available land and existing greenery is the biggest problem. Projections made on the basis of trends in urbanization process, the global population will rise rapidly to 9 billion people by 2030 with large scale migration from rural to urban regions occurring particularly in developing countries. Such

expansion and migration create a slew of issues in terms of urban planning and management. Furthermore, the prioritization of planned development goals such as green infrastructure, water, sanitation, electricity, and roads is fraught with difficulty.

Migration can be minimized by providing better opportunities at local level like better education, job (formal & informal), and agriculture facilities as well as decentralization of schemes and policies for sustainable development of rural areas. Rural areas should have better road connectivity for ease of doing business and commute.

8. RECOMMENDATION:

Government of India has suggested some recommendations for maintaining and increasing urban green spaces. As per the UDPFI Guidelines, 1996 of Ministry of Urban Development, the proportion of recreation areas to the total developed area should be between:

Table 3: Percentage of recreation areas

Type of Town	Percentage of recreation area
Small Towns	12-14%
Medium Towns and Large Cities	18-20%
Metropolitan Cities	20-25%

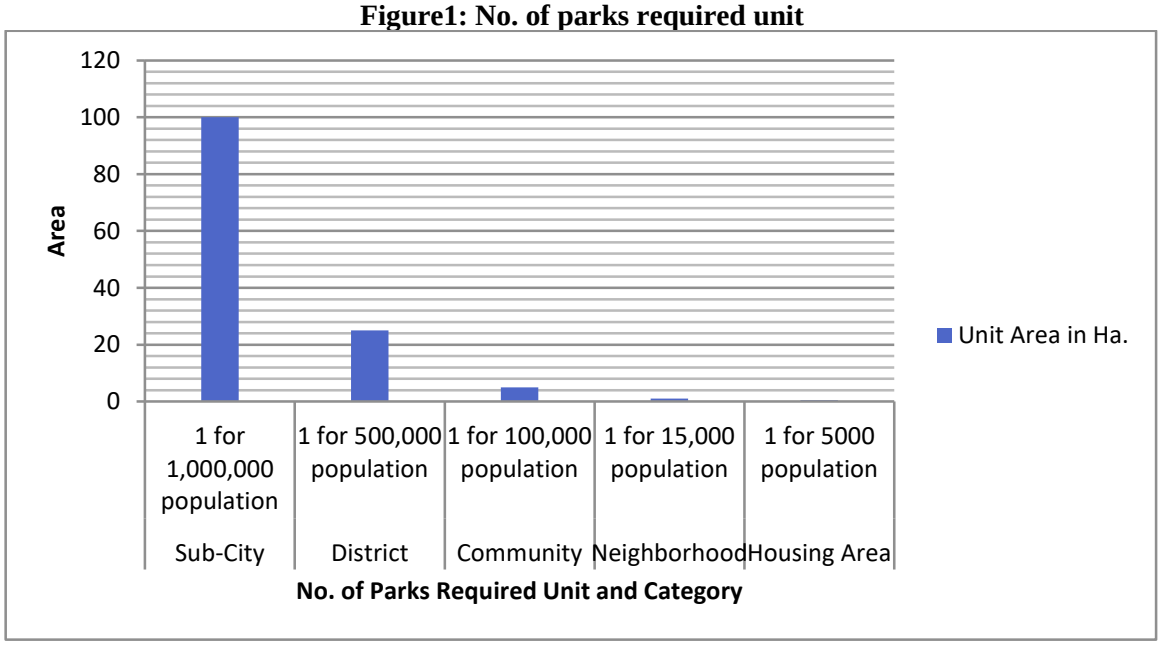
Source: MoUD, 2014

Other suggestion for increasing urban greenery is promoting UGS stewardship for maintaining greenery in fragmented and degraded land. Unavailability of records or data of exact and current situation on UGS creates problem in monitoring and evaluation. Sometimes local authorities are unaware of the linked trade of land distribution and its repercussions on a city's urban environment and using old designed maps for planning, management and monitoring of UGS. One of the greatest bottlenecks in the decision-making process is a lack of base data in understanding the diverse and dynamic landscapes that exists in cities. As a result, more detailed maps (spatial data) with geographic heterogeneity are required to facilitate a more comprehensive understanding of UGS which helps in planning and management. Use of GIS or drone-based mapping is very helpful in creating exact data set for proper monitoring and evaluation.

Richard Forman has given the idea of mosaic landscape: (coarse-grain: have large patches that support specialization and fine-grained landscape: has many small land uses) by his research that examines the spatial patterns and relationship between human and nature to survive and thrive (UN Habitat: For A Better Urban Future).

There are some other recommendations to maintain or increase urban greenery is by planting techniques. There are different types of planting techniques: Avenue Planting, Group Planting, Mixed Planting, and Informal Planting. (Sen and Guchhait, 2021). [16]

Figure1: No. of parks required unit



Source: Shruti et. al., 2019[17]

Figure 1 shows required units of parks for different categories of urban settings over unit area (Ha.) for proper development of planned city.

9. CONCLUSION:

The above discussion underlines that rapid destruction of green spaces has been induced by a variety of anthropogenic activities. Main reasons for decreasing urban green spaces are low priority to green spaces, unawareness among the general public, poor maintenance and lack of coordination among the policy makers on green spaces. Adding to these factors, increasing population density is adding more pressure on green spaces.

Climate change is remarkably a challenge and green spaces will play a role in climate change adaptation and mitigation. Parks can help in reducing air pollution and temperature regulation (creating micro-climatic conditions) at some extent, generally for larger parks. There is a need for reconfiguration of existing infrastructures to provide green spaces and other amenities to reduce heat. Parks can play crucial functions with regards to health and climate regulations and thus providing a way better future for the coming generation in an urban set up.

Considering the current situation of COVID-19 Pandemic, people are forced to move towards their native places (mostly belong to rural areas) because urban economy has got stuck due to lockdown and spread of the COVID virus. Pattern of pandemic spread occurred mostly in urban areas in comparison to rural areas. Is it justifiable to move towards process of urbanization or living a life sustainably in rural fit?

Urbanization also raises questions regarding food security as most of the urbanization took over on agricultural land, which cannot be compromised for the sake of urbanization. If there is no land for agriculture then how government could process & manage food distribution system for India's growing population.

While considering decline in global climatic conditions, metropolitan areas must be addressed soon. Furthermore, air pollution which affects a large number of urban residents internationally is a big concern due to excessive carbon emissions from automobiles in cities. Aside from increased pollution, urban growth, and groundwater depletion due to overuse, there are other issues to consider that proper allocation of resources to stop migration and sustainable management of urban sprawl. A strong step should be taken by planning authorities to design interventions that support landscape planning with a greater grasp of future spatial configurations of urban landscapes. We are at a stage that things have to be managed in sustainable manner and the idea of urban sustainability must be considered and is seen as a vision of ecologically, socially and economically responsible urban planning, a holistic vision that enables sustainable urban development through the reconciliation of the implicit interests in a city.

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