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## The use of Public Open Spaces for Disaster Resilient Urban Cities

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**Abstract:** There is an increasing recognition on the use of public open space as a strategy to make cities more sustainable. Accordingly, most of contemporary urban planners, designers, and landscape architects use the public open spaces as a strategy to increase the quality of life, to improve aesthetic beauty, to improve the environmental health, economic growth, to increase the walkability, liveability and vitality of a city, which leads towards the sustainability.

However, sustainable development should comprise the improvements of disaster resilience. Yet, lack of consideration has been given to use the public open spaces as a strategy for disaster resilience while accommodating the everyday use of the city. In other words, how to use the public open spaces to increase the ability of the city dwellers to resist, absorb, accommodate and recover from the effects of a natural hazard still remains largely uncovered.

Accordingly, this desk based research study, explores and emphasises the potential uses of public open spaces for disaster resilience as an agent of recovery, to provide essential life support, as a primary place to rescue and for shelters and potential for adaptive response through the analysis of literature discussions on previous disaster events along with current disaster management strategies and practices.

**Keywords:** Disaster Resilience, Public Open Spaces, Sustainable Development, Urban Cities

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### 1. Introduction

Urban built environment refers to the features in urban environment made by human, ranging from buildings, parks, playgrounds, streets, infrastructure etc. Public open space is merely one aspect of this complex urban environment, yet play an important role within the urban context. Urban parks and open spaces provide significant benefits for the quality of life of urban dwellers. It offers environmental importance such as air and water purification, wind and noise filtering and microclimate calming. Further, it provides psychological wellbeing, liveability to modern cities. Apart from that, Public open spaces promote social interaction and cohesion through encouraging the use of outdoor spaces. Furthermore, these functions and the values of urban public open spaces, directly and indirectly bring economic growth to the municipalities and cities. Consequently, it is confirmable that public open spaces help to create sustainable cities from all its three bottom lines; environmental, social and economic.

However, the sustainable development should comprise the improvements of disaster

resilience [1]. Conversely, within the context of city, the sustainable development should encompass the improvements of increasing the ability of the city dwellers to resist, absorb, accommodate and recover effectively from the effects of natural hazards. This emphasis is even more significant in urban cities, because rapid urbanization and population increase, challenge the resilience of the city through the issues such as settlements in hazard prone areas, more pressure on land and services, lack of capacities, inadequate resource management, uncoordinated emergency services, decline of eco systems and land scarcity.

Within this context, UNISDR [2] states that strategic planning and design of spatial elements and their influence on the natural and built environment are directives of city's capacity to absorb and recover from disasters. Further, public open spaces have become one of the key spatial elements which play an important role in urban cities. However, the use of public open spaces to make urban cities resilient to disasters, still remains largely unrehearsed. Confirming this fact, Hossain [3] claims that the role of public open space to enhance the city resilience, especially to encourage the adoptive response

following a disaster, has not been fully discovered yet.

Accordingly, this paper explore the potential uses of public open spaces for disaster resilience urban cities through the analysis of literature discussions on previous disaster events which provide evidences of use of public open spaces for disaster resilience. Finally, this study make set of recommendations that can encompass when using the public open spaces for disaster resilient urban cities while still accommodating the everyday life of the city.

## **2. Background: Disaster Resilient Urban Cities and Public Open Spaces**

### **2.1. Disaster Resilient Urban Cities**

A city can be identified as a spatial entity which contains significant amount of people, infrastructure, amenities, modern facilities etc. More specifically, city is a spatially integrated economic and social system at a given location, or metropolitan region [4]. Accordingly, apart from the tangibles in a city there are intangibles which wove people together, such as cultures, sub cultures, traditions, values, etc. Cities become urban cities with its' means of economic function, population density or size, or simply by administrative region [5]. Further, Pelling [6] describes, cities are the engines of economic growth; an integrated system linked with consumption and production, a source of livelihood, a stock of accumulated assets, and, a political and cultural arena. Therefore, any adverse effect to the city means, it is an adverse effect to these engines of economic growth, center of population, commerce, and culture of a country.

This consideration is even more important in the global urban context, because global urbanization trends demonstrate the increase of human migration towards the urban cities and therefore urban centres will contain an increasingly large proportion of the world's human population. In 2007, it was noted that more than half of the world's population was urban. Confirming this fact, the percentage was 54 percent in 2014 [7]. Further, the predictions show this will increase up to 72 percent by 2050, from 3.6 billion to 6.3 billion in 2050 [7].

This human migration and growing population towards urban cities, generate significant challenges to both natural and built environments in these cities. UNISDR [2] states, this rapid urbanisation brings more pressure on land and services and result lack of capacities and unclear mandates for DRR at local levels, inadequate resource management, settlements in hazard prone areas, uncoordinated emergency services and decline of ecosystems. Accordingly, it can be understood that unplanned cities and urbanisation can be one of the major challenges ahead to create a disaster resilience built environment in cities [8].

Hence, the consideration of the concept of 'disaster resilience' has become even more important in the context of urban city. The concept of 'disaster resilient city' emerged with the identification of this importance and now this term is widely used by many literature on disaster management and institutional policy documents. Further, most of the recent literature emphasize the need of urban planning and designing inputs when making urban cities resilient disasters. This emphasis instigated with the outcomes of World Conference on Disaster Reduction took place in Kobe, Hyogo, Japan in 2005, and with its attempt to 'promote a strategic and systematic approach to reduce vulnerabilities and risks to hazards' [9].

Further, the work of the United Nations International Strategy for Disaster Reduction (UNISDR) can be identified as one of the major inputs for the development of this concept; Disaster Resilient cities. UNISDR introduced a toolkit for local governments with Ten Essentials for Making Cities Resilient. This was developed under the Campaign of 'Making Cities Resilient – My City is Getting Ready', to accelerate implementation of the Sendai Framework for Disaster Risk Reduction (2015-2030) at local level. This toolkit endorses the actions identified under each essential which needs to be implemented as part of the overall disaster risk reduction planning process and also should influence the urban planning and design strategies [10]. Further, the fourth essential, proposes the action of maximizing the use of urban design solutions to make cities resilient [10]. In this way, when making urban cities resilient to disaster through planning and design interventions, the consideration need to be given on all the spatial elements such as streets, buildings, infrastructure, parks and playgrounds

etc. Further, this research study attempts to explore the use public open spaces as one of the key spatial elements which can play an important role in making urban cities resilient to disasters.

## 2.2. What is a Public Open Space?

The term 'Public Open space' came into practise in 19<sup>th</sup> century in United Kingdom and United States, with a view of allocating spaces to improve the health and quality of life of the working class people who lived in squalid and congested living environment [11]. However, Public open space still plays an important role in urban environment, with a range of meanings from 'green space' (e.g: parks, greenways) to all public spaces including streets and squares and private open spaces such as gardens, courtyards [12].

Public Open Space can be defined from different perspectives. Woolley [13] introduces two types of definitions. First definition is based on primary purpose of allocation derived from Policy guidance and the second one is from the user's point of view derived from academic approach. According to the definition derived from policy stance, Public open space stands between green and civic spaces including places such as, Parks and gardens, Natural and semi-natural green space, including urban woodland, green corridors, outdoor sports facilities, amenity green space, provision for children and young people, allotments, community gardens and urban farms, cemeteries, disused churchyards and other burial grounds. The second definition is from the user's point of view, as a place that allows different types of activities encompassing necessary, optional and social activities. The places such as, Parks, Playgrounds, Playing fields and sports grounds, School playgrounds, Streets, City farms, Incidental or 'natural' green spaces.

Carmona [14] divides the Public space into three categories based on the accessibility, ownership and use. Those three categories are as follows.

1. External Public Space – All spaces between the private landholdings including Public squares, streets, highways, parks, parking lots, stretches of coastline, forests, lakes and rivers etc.

2. Internal Public Space – Various public institutions (e.g. Libraries, museums, town hall) and Public transport facilities (e.g. Bus stations, Train stations)

3. External and internal Quasi Public Space – This means privately owned public spaces such as sports grounds, restaurants, cinemas and shopping malls. Places where legally private and nominally public.

Based on above discussions, it can be noted that there can be different interpretations for the concept of 'public open space'. Therefore, it is important to define the term 'public open space' for this particular study or in other words 'what is it meant by Public open spaces in this study?'

Important point from the Woolley's [13] definitions is, it can be any space between green and civic spaces but should be used by the public. However these spaces should be an outdoor spaces not covered by buildings. On the other hand, Carmona's [14] definition raised two important points for this study; accessibility and use. Since, this study focuses on identifying the use of the open space by the public to enhance the disaster resilience, particular consideration need to be given to the open spaces which are accessible to the public and also should be able to use by the public. Therefore, the meaning of public open space in this study can be outlined as any outdoor space accessible to the public and allocated for the public activities, e.g Public squares, Parks and gardens, Amenity green spaces.

## 3. Public Open Spaces for Disaster Resilience

It is well known that public open spaces are inevitably useful for the vitality of the city and to create sustainable cities. However, these Public open spaces have the potential to contribute at multi-scale within the entire city and can act as a proactive manner to solve the current and future issues through the planning and design interventions [15]. However, instead of harnessing this potential, less attempts have been made to identify the use of public open spaces to make cities resilient to disasters [3]. As an attempt to contribute this research need, following literature analysis, reveals the potential uses of public open spaces as a strategy for disaster resilience cities. Accordingly, this



desk based study shows that, most of the existing literature which discusses the use of public open space in disaster resilience, focuses towards three main areas of the disaster cycle; emergency response, recovery and mitigation.

### 3.1. Emergency Response and Recovery

In an event of earthquake or tsunami, people have limited time to gather to a safer place and for sheltering. Thus, the community's ability to make appropriate decision and response rapidly and effectively for an emergency is an important factor to consider. However, this community's ability will be mostly determined by the arrangement of the built environment. Confirming this fact, the studies of Allan and Bryant [16] on the earthquake event of San Francisco in 1906, reveal, after a major earthquake, open space network acts as the 'second city' providing simple to complex services such as gathering, shelter, distribution of goods and service, temporary inhabitation, commemoration. Further, they state that different typologies of open spaces contribute different functions from small squares to parks. Therefore, it is important to consider the connectivity among them through the street network.

Further, based on the studies of earthquake and tsunami in Chile 2010; Case study on San Pedro de La Paz, Fuentes and Tastes [17] emphasize the need of consideration on following factors when using the open spaces for disaster resilience,

- The consideration need to be given on the connection between open space, resilience and urban design as an integral way to plan and design resilient cities.
- Open space as a public good when planning and designing for reconstruction plans
- Design of open space network contributing to urban resilience
- Include open spaces as an urban asset for seismic events under the resilience framework.

Adding to this argument, León and March [18] claim that the ability of 'rapid resilience' need to be enhanced with the use of the urban morphology related to street network and assembly areas. This discussion raises the importance of public open space as a tool for the 'rapid resilience' in tsunami prone coastal urban

communities. Further, they emphasize, the need of Public open spaces with adequate location, accessibility, capacity, and terrain qualities as one of the key tsunami evacuation urban design approaches. Their recommendations further suggest, that urban design modifications need to be applied for identified tsunami rescue open spaces and streets with an objectives to provide safe assembly spaces, to provide the basic emergency services and utilities, such as first aids, fresh water, electricity, and communication and to become visually improved points with an improved way finders even in night time.

The studies of Taubenböck et al. [19], also recommend the use of open spaces as a strategy for the emergency evacuation in an event of tsunami. Their study on developing an interdisciplinary approach for tsunami early warning and an evacuation information system, eventually recommend setting of spatial planning strategies for tsunami mitigation. One of the main recommendations that they made is the identification of natural safe areas for emergency evacuation through the combination of land use maps with tsunami hazard maps using remotely sensed data. Here the natural safe areas are defined as open spaces accessible by the street network and larger enough to accommodate the people in a rescue situation.

Based on the above discussion, it can be noted that, the public open spaces have a great potential for emergency response and recovery in disaster events, especially for earthquake and tsunami prone cities. Apart from emergency management and recovery, public open spaces can be used as a potential tool to mitigate the impacts of natural hazards.

### 3.2. Disaster Mitigation

The concept of Public open spaces is currently in use under the flood risk management frameworks. White and Richards [20], also Burby and French [21] state, that the most common way to protect the flood prone areas from land encroachment and to control the future development, is keeping flood-prone areas for open space purposes.

However, as this paper focuses on urban cities, keeping flood prone areas, just for the purpose of conservation and preservation cannot be considered as the best practise for urban cities. Consequently, in order to make sure that these

open spaces will not be consumed by the rapid urbanization and to get the highest and best use of land, these open spaces have the potential to be converted as public open spaces promoting wildlife habitat and recreational activities [22].

Conversely, this concept can be used for the other types of hazard prone areas. Amarathunga et al. [23], emphasises the importance of using the land-use planning and regulation strategies to reduce the exposure of people and physical assets from the tsunami hazard. This guideline presents the necessity of setting up development setback line through the integration of tsunami inundation modelling into land use planning. Development setbacks are intended to direct new development or redevelopment out of identified hazard areas and to protect natural hazard mitigation features. Further, Ardekani and Hosseini [24] suggest that these preserved tsunami hazard areas through the development setbacks, can be potentially used for open-space uses and confine the uses to conservation, open-space, or scenic easement.

#### 4. Discussion

Accordingly, it can be summarised that current links between the public open spaces and disaster resilience mainly dwells in Emergency response, recovery and mitigation strategies.

To use public open spaces as a strategy for emergency evacuation, Fuentes and Tastes [17] and Allan and Bryant [16] point out the need of plan and design public open space network to urban cities contributing both urban resilience and disaster resilience. Furthermore, these network of places should comprise with different typologies of Public open spaces contributing different functions in emergency planning and recovery [16]. Adding to this argument, León and March [18] emphasize that the planning and designing Public open spaces for disaster resilience should encompasses the factors such as adequate location, accessibility, capacity and terrain qualities and these factors may depend on the type of the hazard. However, the connectivity among the streets and public open spaces can be considered as one of the most important factor among them.

Focusing on mitigation strategies, most of these discussions are based on ‘open space’ with Preservation and Conservation perspective, but not looking at the use of Public open space

which can potentially contribute for disaster resilience. Accordingly, as it was discussed in the previous section, first hazard prone areas need to be identified through the combination of land use maps with hazard maps. Then these identified hazard areas need to be converted to attractive public open spaces. The same method can be applied to the safe assembly areas under the emergency evacuation strategies.

However, most of the recovery planners identify the open spaces as an element of an emergency management plan but not as a part of the built environment of a city. Allan and Bryant [16] point out, planning open spaces for the only purpose of emergency planning or mitigation without any connection with everyday life of the city, will result to have unstructured open spaces which are not physically prepared and not identified by the public in an event emergency. León and March [18] further confirm this matter by highlighting the necessity to plan and design public open spaces to function well during both emergency and non-emergency times.

Apart from that, both strategies (mitigation strategies and emergency evacuation strategies) identify the use of open spaces discretely in two separate places, but not as an interconnected system that can significantly increase disaster resilience in an urban city. Apart from that, these potentials need to be effectively linked with the preparedness stage of the disaster cycle. Accordingly, this paper emphasize the need of using the public open spaces as an interconnected system as a significant spatial element which can increase the disaster resilience of urban cities.

#### 5. Conclusions

In conclusion, it can be noted that, the current focus on planning and designing public open spaces is given to increase the scenic beauty, improve the environmental health, economic growth, to increase the walkability, liveability and vitality of a city and to make sustainable cities. Yet, less attempts have been made to use these public open spaces to make cities resilient to disasters.

On the other hand, public open spaces have the potential of playing significant role in multi-scale within the city and to use as a strategy for current and future issues. At the same time, the

literature findings suggest that the public open spaces have the potential to act as an agent of recovery, to provide essential life support, as a primary place to rescue and for shelters for adaptive response and mode for mitigation.

Accordingly, it can be noted that there is significant potential to use the public open space for disaster resilience. However, in order to harness this potential, these public open spaces need to be planned and designed as an interconnected system which can significantly increase the disaster resilience. In summary, some of the important interventions that can be incorporated when using public open spaces for disaster resilience cities, are as follows.

- Create network of public open spaces contributing both urban resilience and disaster resilience.
- Different typologies of public open spaces contributing different functions with adequate capacity, location and connectivity.
- Necessity to plan and design public open spaces for disaster resilience, but also connected with everyday life of the city, to function well during both emergency and non-emergency times.
- Urban design modifications to visually improve the public open spaces to use as an identical points for emergency evacuation.
- Allocate Public Open space as an interconnected system within the city contributing to disaster resilience, but not as a separate set of spaces for mitigation, emergency recovery and everyday life.

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