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Strategies and Challenges for Urban Green Spaces: A Case Study of Butwal Sub-Metropolitan City

by

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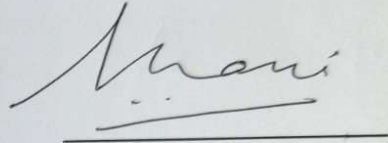
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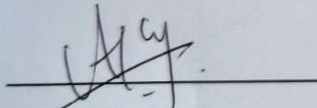**Asst. Prof. Dr. Inu Pradhan Salike**

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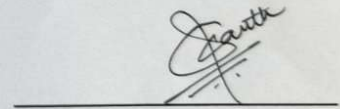Former Chairman

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I hereby declare that the thesis entitled **"Challenges and Strategies for Urban Green Spaces: A Case Study of Butwal"**, submitted to the Department of Architecture in partial fulfillment of the requirement for the degree of Master of Science in Urban Planning, is a record of an original work done under the guidance of Asst. Prof. Dr. Inu Pradhan Salike, Institute of Engineering, Pulchowk Campus. Except for the material consulted, which has been properly referenced and acknowledged, all the work in this thesis was done by me.

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ABSTRACT

Urban forms are changing and becoming more ad hoc. Urban green spaces are an integral element of a city's public open spaces and services, contributing to the health and well-being of city people. Therefore, it is essential to make sure that public green spaces are evenly distributed around the city and are easily accessible to all. Ensuring the effective preservation, establishment, and growth of green areas stands as a crucial factor in attaining sustainable urban development. The case of Butwal Sub-Metropolitan City is analyzed in this paper to examine the challenges and strategies involved in safeguarding and promotion of these essential green areas. A mixed methodological approach was considered for data collection, including interviews, observation, mapping, and analysis using various parameters and collection of required information from documents. The study reveals disparities in the distribution of green space around the city, particularly in highly populated regions, with an emphasis on accessibility, distribution, and the impact of local regulations. This study has made some important observations by carefully examining the urban environment of Butwal. First, it showed that there were differences in how green spaces were distributed throughout the city, with densely crowded wards frequently lacking sufficient access to these vital amenities. Second, it brought to light the difficulties encountered by local governments in the absence of clear typologies, standards, and enabling laws for the design and development of green spaces. The study also highlighted the difficulty in ensuring equal access to nature in urban settings due to the absence of defined legislation and minimum standards for green areas. By addressing the challenges and strategies explored in this case study, stakeholders can work towards creating more sustainable and livable urban environments, ensuring that nature remains an integral part of our urban landscapes, fostering well-being, community cohesion, and environmental resilience.

Keywords: Urban Green Spaces, Urbanization, Strategies, Challenges, Livable cites

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ACRONYMS

MoUD: Ministry of Urban Development

DUDBC: Department of Urban Development and Building Construction

UN: United Nations

WHO: World Health Organization

SDG: Sustainable Development Goal

KII: Key informant interview

NUDS: National Urban Development Strategy

KVDA: Kathmandu Valley Development Authority

UGS: Urban Green Spaces

LUP: Land Use Plan

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CHAPTER ONE: INTRODUCTION

1.1.   Background

At present, 55 percent of the world's population resides in urban regions, and by 2050 it is projected to rise to 68 percent resulting in expansion and densification of urban areas (United Nations, 2018). As a result of urbanization, more people live in cities. Living in cities restricts access to nature and might increase exposure to environmental threats such as air and noise pollution. Many urban areas are under greater stress because of growing populations, limited resources, and the escalating effects of climate change. These issues need to be resolved if cities are to offer sustainable and healthful living conditions. The primary cause of environmental problems on both the local and global scales is urban land use. Cities around the world are becoming more populated while the built environment and green spaces are diminishing. Green spaces make important benefits to the city, its citizens, and the ecosystem. However, due to rapid urbanization, these contributions could not be properly reflected in urban space. In the developing nations with high population growth rate and rural-urban migration, street planning is often limited by municipal interference when it does occur (M'Ikiugu et al., 2012). It rarely facilitates future green space, which is why the majority of newly developed metropolitan areas around the world are typically devoid of trees (Olembo & Rhan, 1987). The land that can be used for urban green spaces is always in risk because of how quickly populations in urban areas are expanding. Land is constantly being used for measures that provide the public and private investors with more direct economic benefits (M'Ikiugu et al., 2012).

Urban forms are evolving and getting more chaotic. It is combined with conflicting land uses and decreasing levels of amenities including parks, open spaces, and infrastructure services. The neighborhood's social and cultural climate has altered as a result (NUDS, 2017). Urban green space, as used in land-use planning, is the term used to describe open-space areas reserved for parks and other "green spaces," including flora, water features (sometimes called "blue spaces"), and other types of natural surroundings (World Health Organization, 2017). Green spaces are areas with vegetation (such as grass, bushes, or trees) that allow water to drain through the vegetation and soil, filtering some of the pollutants and silt before it reaches the groundwater underneath. In urban environments, green areas and porous surfaces are particularly essential because they absorb and seep

water, reducing runoff rates. While there are occasionally other types of urban open spaces, green spaces make up the majority of them. Urban green spaces, which are typically regarded as public areas, can occasionally be privately owned. Examples of these include corporate or institutional grounds, neighborhood/community parks, and campuses of higher education. Urban green spaces offer a wide range of positive impacts on the health of nearby communities and individuals. Urban Green Spaces (UGS) contribute on achieving SDG's: SDG-11 "Sustainable cities and communities"; SDG-13 "Climate action"; SDG-15 "Life on land" but this study mainly targets SDG 11 which targets to provide universal access to safe, inclusive, and accessible, green and public spaces. The main indicator for this target is; average share of the built-up area of cities that is open space for public use for all.

A strategy for urban green space confronts the present situation of green spaces (with all problems, conflicts, potentials and needs) and the future collective vision and goals. Strategic planning is especially important and suitable for the good and effective development of urban green spaces (Kasperidus et al., 2008). In the process of developing the strategy it is very important to recognize the spatial potentials and problems of urban green spaces in a city as well as the needs, values and priorities of the community. Analyzing the city's characteristics, such as demographics, cultural and environmental aspects, administrative organization, and financing sources, is important for developing the strategies for green spaces. Urban living poses challenges such as limited access to nature and increased exposure to environmental hazards like air and noise pollution. Growing populations, limited resources, and the impacts of climate change further add to the pressures faced by urban areas. which need to be addressed for healthy and sustainable living environments. Urban green space can be a setting that promotes health for all urban residents and is an essential part of public open spaces and shared services offered by a city. Green spaces can improve urban environments, build community resilience, and encourage sustainable lifestyles all of which are beneficial to the health and well-being of city people(World Health Organization, 2017). Therefore, it's essential to make sure that public green areas are distributed equitably around the city and are easy to access for everyone in the community. The presence of parks, playgrounds, or greenery in both public and private spaces are main elements of urban green space approaches and can help to guarantee that:

- Urban dwellers are provided with sufficient opportunities to connect with the natural environment.
- The conservation and protection of urban biodiversity are prioritized;
- Efforts are made to reduce environmental threats like air pollution and noise in urban areas.
- The effects of extreme weather, such as heat waves, heavy rain, or flooding, are mitigated;
- The overall quality of urban life is improved;
- Improved citizens' health and well-being. (World Health Organization, 2017)

1.2.   Need of the research

"The strategies should seek to promote the environment, social and economic sustainability of urban development. This means that urban development initiatives should be environmentally sustainable, i.e, should not have negative externalities and should not over-stretch the capacity of the environment to sustain itself."- National Urban Development Strategy (NUDS), 2017

The proportion of the world's population that lives in cities is rising, demanding more efforts to design and develop cities in a way that makes them livable and sustainable. According to data from the national census of 2021, 66.2 percent of Nepal's population lives in urban areas. Just 17.1% of the nation's population lived in urban areas in 2011, according to the national census. The level of air, land, and noise pollution; transportation issues in cities; excessive use of fossil fuels; land use incompatibility; encroachment into public areas and the expansion of squatter settlements; disrespect for cultural heritage and aesthetics; and environmental risk mitigation and disaster resilience are all factors that are contributing to the critical levels of urban environmental concerns (NUDS, 2017). The institutional capacity, suitable planning, and financial resources required by municipalities to manage the urban environment—which encompasses safety and security, disaster preparedness, and bolstering sociocultural components like open space preservation—are lacking. The quick decline in open space in urban areas is a major sign (NUDS, 2017).

Urban green space strategy offers a nature-based approach to enhance resilience, but there is limited research on its optimal design, implementation, and effectiveness in different urban contexts. Urban green spaces play a crucial role in providing recreational

opportunities, enhancing the quality of life, and mitigating the adverse impacts of urbanization. Urban green spaces offer multiple benefits in adapting to and mitigating the effects of climate change. They can act as natural buffers against floods, reduce the urban heat island effect, sequester carbon dioxide, improve air quality, and support biodiversity.

The research on urban green spaces provides evidence-based insights that can inform urban planning policies and practices. Understanding the potential of urban green spaces and the associated social, economic, and environmental benefits is crucial for urban planners, policymakers, and designers. It can help policymakers and urban planners make informed decisions regarding the location, size, design, and management of green spaces. Research can also contribute to the development of comprehensive green space strategies and integrate green infrastructure into urban planning frameworks.

1.3.   Importance of the research

The study of urban green spaces is critical in today's rapidly urbanizing world. Urban resilience is a critical issue for cities all around the world. Green spaces in cities help to create resilience by providing ecosystem services such as stormwater management, heat island reduction, and enhanced air quality. Understanding how to maximize the distribution and design of green infrastructure might help cities become more resilient to environmental threats.

It is necessary to do research to determine the exact aspects and characteristics of green spaces that improve physical and mental well-being among residents. Such understanding can help to inform urban planning and design, making cities healthier and more habitable. Furthermore, sustainable development is a major worldwide priority. By protecting biodiversity, sequestering carbon, and providing recreational spaces, urban green spaces help to achieve sustainable development goals.

1.4.   Problem statement

The integration of urban green spaces into urban planning faces significant challenges, impeding the realization of sustainable, healthy, and inclusive cities. Despite the well-known benefits of urban green spaces, such as improved public health, increased biodiversity, and higher quality of life, effective integration of these places into urban planning processes remains restricted. The existing policies and strategic documents face

notable challenges that hinder optimal clarity and effectiveness during implementation. The current policies don't indicate how green areas should be distributed; they just provide a percentage for them. The main issue this creates is how the green spaces are distributed within a settlement. This can exacerbate social inequities, with certain populations experiencing a disproportionate lack of access to the environmental and recreational benefits offered by green areas. The lack of comprehensive planning strategies and rules impedes the incorporation of green spaces into the larger urban fabric, resulting in poor distribution, insufficient connectedness, and limited accessibility for city dwellers. Many cities face inequitable allocation of urban green spaces, which disproportionately affects underprivileged neighborhoods. Low-income and marginalized communities frequently lack access to appropriate green areas, increasing existing social and health inequities. This uneven distribution not only damages social cohesion and communal well-being, but it also perpetuates environmental inequities within cities. Despite increased acknowledgement of the benefits of urban green areas, decision-makers, planners, and the public still lack awareness and comprehension. Inadequate understanding of the social, economic, and environmental significance of urban green spaces can lead to undervaluation, underinvestment, and missed chances for incorporating them into urban design. To successfully explain the relevance of urban green spaces and overcome existing hurdles, it is critical to bridge the gap between research findings and practical implementation.

1.5. Research objectives

The objectives of this research are:

- To analyze the existing urban green spaces.
- To identify the challenges faced by institutions during the planning process.
- To investigate the strategies adopted by institutions in planning urban green spaces.
- To develop strategies that will help to incorporate green spaces.

1.6. Research questions

This research mainly seeks the answer to the following question:

What are the strategies applied and challenges faced by the institutions while planning green spaces?

- How are green spaces located/planned in urban areas in the present context?
- What are the existing strategies, limitations, and gaps in these strategies?
- What are the urban green space challenges?

1.7.   Validity of the research

With the emerging concept of creating sustainable, healthy, and livable cities various efforts are being made at national as well as international levels. In the past, urban sprawl and expansion have caused urban areas to deteriorate. There is mounting evidence that global densification processes are reducing the amount of green space in cities. Planning and managing green spaces can be quite difficult, especially in areas with ongoing densification when fewer green spaces are expected to provide essential functions. Further information about variations in the amount of urban green space is required. Stronger laws and practices should be implemented in conjunction with increased attention and resources to address urban greening, a prevalent, if not universal, environmental concern. So, this research topic examines the availability of green spaces in a city and the planning efforts made to preserve and increase green areas. Hence, the research topic holds a lot of potential, and similar research has not been carried out in our context. That is why the research seems to be valid.

1.8.   Limitation of the research

The research is limited to public green spaces within the urban region and examines only physical (spatial) aspects. Urban green spaces (UGS) in this research refers to the green spaces providing recreational facilities to the public and have a direct impact on their quality of life. As there is a large amount of natural area present on the northern part acting as a regional green but very few public green spaces in the city that promote public interaction with nature. Due to the time constraints this study will be limited on green space provision and layout under spatial aspect, public participation and social equity under social aspect, and green space planning process, data availability and standards foe green spaces under institutional aspect.

CHAPTER TWO: LITERATURE REVIEW

The literature review section of the thesis serves the primary purpose of providing a comprehensive overview of prior research related to urban green spaces strategies and challenges. It aims to build information on challenges faced by green spaces in an urban area and strategies developed to overcome these challenges. This section looks at the database of existing knowledge in an effort to build a solid basis for the study and uncover gaps that the thesis tries to fill. The basic concepts and definitions of urban green spaces are examined, along with the various aspects that make up these spaces and guidelines on which the planning process is based on both globally and in the context of Nepal. By studying existing literature on urban green space challenges and strategies valuable insights can be obtained on identifying challenges for which the knowledge of existing situation of green spaces is essential. It offers insight into the city's present condition and provides basis for the necessary interventions to be taken into account.

2.1. Urbanization

The term "urbanization" describes the procedure of transforming the land cover based on density and/or sprawl (Şenik & Uzun, 2022). Here, the terms "density" and "sprawl" refer to the expansion of relatively less dense suburban communities that are linked to high-density communities in the urban core by a transportation network and take the shape of protrusions and scatters (Forman 2014;Şenik & Uzun, 2022). The future of the world's population is urban. Since 1950, the number of people living in cities has increased dramatically. In 1950, 30% of the world's population lived in cities; by 2014, that number had risen to 54%. It is expected that by 2050, approximately 70% of people would live in urban regions globally (UN, 2013). Urban areas will grow larger and/or become more densely populated as a result. One problem acknowledged is the elimination of green space during the densification process and the dearth of green space in metropolitan areas. Planning and managing green spaces may be quite difficult, particularly in areas that are under densification when there aren't enough of these spaces to provide essential servicesThis means that in an urban setting, appealing cities with high standards of living and resource-efficient systems must have both excellent and captivating urban design. It is crucial to protect the open green areas of strategic importance since the expanding metropolis effectively converts the nearby agricultural fields and forests in the urban edge into built environments (Xiao-jun 2001; Şenik & Uzun, 2022).

Living in an urban area restricts one's access to nature and can expose one to more environmental dangers, such as noise and air pollution. Rapidly growing cities put enormous pressure on green space through exploitation. Numerous urban regions are under increasing pressure from rising population, resource scarcity, and the escalating effects of climate change. Cities must overcome these obstacles if they are to provide sustainable and healthy living environments (World Health Organization, 2017). Therefore, objectives and strategies for each stage of urbanization could be included in the methodical planning procedure for open green space systems, like creating roof gardens in proportion to the density of the urban core, the use of vacant lots as parks, the use of agricultural areas and forests as "green belts" to control urban fringe growth, the prioritization of recreational uses for local residents, and the preservation of open green spaces that would support rural life.

2.2. Urban Environment

Urbanization has become a defining feature of today's world and has a profound impact on the urban environment. The urban environment plays a significant role in shaping our lives, work, and interactions. It encompasses not only the physical infrastructure of cities, but also the social and cultural aspects that define urban life. While some challenges of urbanization may be less obvious, they are just as important, if not more so, than the more apparent ones. Urbanization brings both opportunities and challenges, particularly in shaping the urban environment. The presence and availability of urban green spaces are closely intertwined with urbanization and the urban environment, as they contribute to the overall well-being and quality of life in cities. As cities continue to grow and face the challenges brought about by urbanization, it becomes imperative to integrate green spaces. Recognizing the environmental, social, and economic benefits of urban green spaces is essential for creating sustainable, inclusive, and resilient cities. The urban environment encompasses both natural and sociocultural elements, introducing concerns related to land use, environmental pollution, urban safety, culture, agriculture, and forests. One significant challenge posed by urbanization is the loss of natural habitats and green areas, leading to pollution, congestion, and environmental deterioration in urban contexts worldwide. As cities expand and become more densely populated, the need for green spaces becomes increasingly critical. Careful urban planning is paramount to ensure that the urban landscape remains livable, resilient, and sustainable. Incorporating well-designed urban green spaces is a key element in achieving this balance. However, rapid urbanization and

intensification, especially in developing cities, may compromise environmental planning. While each city faces unique challenges and restrictions in executing the greening imperative, the majority of physical and physiological barriers to vegetation development tend to be similar (Grey and Deneke, 1986; Bradshaw et al., 1995; Jim and Liu, 2001a; (Jim, 2004)). Unfortunately, as cities expand, green spaces are often sacrificed to accommodate housing, infrastructure, and commercial developments. This loss of green space can have detrimental effects on the urban environment and the well-being of its inhabitants. Urban green spaces, such as parks, gardens, and tree-lined streets, play a multifaceted role in mitigating the adverse effects of urbanization and creating a more sustainable and livable urban environment.

2.3.   Urban Green Spaces

Urban green space does not have a clear-cut definition that is widely accepted, and various academics appear to employ diverse definitions of the term. Therefore, the phrase "urban green space" refers to all areas of land that fall within this definition of "green space," whether they are publicly or privately held (Swanwick et al., 2003; Zou & Wang, 2021). Various research has distinct conceptual frameworks for green spaces. Several definitions and categorizations of green places resulted from this. This resulted in various categorizations and definitions of green places. For instance, some research used the phrases open space (Acharya and Bennett 2001; Alabi 2020) or green space (Jim 2004; Wolch et al. 2014) independently of other studies, which used the terms green open space (Cho et al. 2008; Mell 2020) or open green space (Singh et al. 2010; Mpofu 2013). Additionally, many definitions of the idea were used in investigations. For example, public places like parks, gardens, and waterways that are primarily used for recreation, nature conservation, and gatherings of urban inhabitants are considered open spaces, according to the Open Space Strategy (City of Melbourne Administration 2012) created for the city of Melbourne. Dunnet et al. (2002) define open spaces as places that blend urban and green environments, have public access, and enhance the visual urban landscape and quality of life as a component of the urban space. These criteria demonstrated that open spaces are areas that are both green and public. Li et al. (2017) similarly defined urban green space as an open area type that has water, grass, trees, flowers, and some necessary infrastructure components. But according to Tzoulas et al. (2007), the network of urban green spaces consists of both privately held and publicly owned spaces, such as golf courses and home

gardens, as well as public spaces like public parks, remnant natural reserves, and streetscapes (Berfin Şenik & Osman Uzun, 2022).

Any vegetation present in an urban setting, such as parks, open spaces, backyard gardens, or street trees, is referred to as urban green space (Kabisch and Haase, 2013, p. 113; (Haaland et al., 2015)).

The term "urban green spaces" describes the green areas found in parks and other urban natural areas. In cities that are becoming more urbanized, they are strategically crucial for maintaining a high standard of living (Chiesura, A. (2004) as cited in Tian et al., 2012).

Balram and Dragievi (2005) described urban green spaces as areas that are covered in vegetation, whether it is maintained or natural, public or private, in contrast to areas that are paved or have structures on them. Urban surroundings can contain green places, such woodlots, local parks, and wooded areas. While Grahn and Stigsdotter described urban open green spaces as all sorts of green outdoor habitats in the town or city (2003:6), Peschardt et al. (2012) defined these spaces as being bounded with at least some vegetation (Kimengsi & Fogwe, 2017).

All urban land covered in vegetation of any form is referred to as urban green space. This includes any type of vegetation, regardless of size or purpose, on both private and public property. It also includes small bodies of water, like lakes, ponds, or streams, also referred to as "blue spaces" (World Health Organization, 2017).

Urban green spaces, as defined in this thesis, refer to public spaces that are covered in vegetation, whether they are maintained or natural and may also include water bodies. The primary purpose of urban green spaces is to provide a means of engagement for the public, offering recreational activities and opportunities for interaction with nature and promoting social interaction among individuals.

Many UGS in the city region are unavailable to the public, therefore residents are unable to take advantage of its best advantages. In such circumstances, green space might not serve its purpose. Thus, it is crucial to comprehend the role that green spaces play in urban planning. 'Public open spaces' is another phrase that may be used to further build on the concept of a green space and to describe how functionally they might benefit a community's psychology. Urban Green Spaces include natural factors that are beneficial

to human wellness, such as green spaces, soil, water, and parks. With the advancements in sustainability studies, the term "green" is now used to describe environmentally friendly built environments as well as technologies. It no longer just refers to trees and other forms of flora. The plant cover of the spatial area is referred to as "greenspace" in urban planning. Urban greenspace serves as a place for numerous aesthetic, air purification, ecological, etc. purposes. Urban green spaces (UGSs) in cities are controlled parks and gardens that are natural or semi-natural, with sporadic vegetation pockets along roadways and haphazard green spaces (Barlow, 1997; Sangwan et al., 2022).

Public green spaces constitute a significant aspect of open areas and communal services offered by a city, functioning as a health-enhancing environment for all urban community members. It is crucial to guarantee convenient access to these public green spaces for all demographic segments and ensure fair distribution throughout the city (World Health Organization, 2017). The corresponding system of the natural environment is present in or supported by urban green space. In the urban ecology, it is the only spatial entity possessing both a regenerative mechanism and naturally occurring biological activity, and thanks to its ecological service role, it has a substantial impact on reducing the adverse impacts of the urban artificial environment. The successful creation, protection, and development of space is one of the key elements required to achieve sustainable urban development. Green and open space are without a doubt an essential component of sustainable urbanism. There are almost no cities or planning efforts that do not include parks and squares. How to cope with it, plan for it, and create it is the important question. Why then do cities still lack green space? We need to remove obstacles to greening cities, including poor science-to-policy-and-practice translation, cognitive bias, a lack of or ambiguity in evidence, incommensurability between disciplines and sectors, vested interests, and financial limits. To add additional green space, it is necessary to show leadership, skill, support, invest, and take certain risks. In order to overcome the challenges faced by various cities in various countries, including size and number of green spaces, land allocation, based on the population of urban dwellers, and accessible facilities for dwellers or tourists, local approach and integrative approaches should be focused.

Green areas play a crucial role in the daily lives of individuals, providing significant value whether one is actively engaging with them, strolling through their verdant landscapes, or simply admiring the scenery from a distance. Significantly, ninety-one percent of people

agree that public parks and open spaces improve people's quality of life in general (Horsham District Council, 2013). Green space is unquestionably an essential component of local government service delivery, even though it is classified as a discretionary service. It provides a wide range of amenities and possibilities to all its citizens and guests. Furthermore, because it's such a public service, consumers can respond strongly and passionately negatively to failures, but success is also quickly obvious. Given the variety of advantages that green places may provide, it is not unexpected that people feel this way about and value them. A substantial amount of research shows that there are numerous advantages to having well-managed green spaces that encourage a variety of uses and high ecological value (Horsham District Council, 2013).

Urban green spaces facilitate social cohesion by acting as organic hubs for community gatherings. In cities, they also foster a feeling of community and identity. The degree to which Urban Green Spaces lower air pollution depends on the amount of vegetation in the area. Urban greenery provides a friendly setting for socializing, exercising, and leisure activities in addition to providing a safe and healthful environment for jogging, running, and strolling. To fully benefit from city green spaces, the urban infrastructure—buildings, roads, and other infrastructure components—must not modify them. Green spaces need to be arranged as coexisting, environmentally beneficial spaces in order to satisfy human demands for leisure, relaxation, aesthetics, and environmental protection.

Cities' quality is impacted by the management, development, and maintenance of urban green spaces. Planning, design, management of urban green space, and the application of policies are all crucial topics of discussion for a sustainable environment and are fundamental to both local and global sustainable development. Regardless of their level of development, one of the biggest challenges facing many countries today is the appropriate development of sustainable cities. In this sense, urban green spaces can provide cultural, social, economic, and psychological services, especially for the benefit of visitors and urban dwellers alike. Urban green space development and sustainable city development are critical because almost half of the world's population now lives in urban areas, where pressure from international migration and the pace of rural-urban migration is still high, and most immigrants in developed countries reside in the nation's major cities. Furthermore, there is a critical need to raise the standard of living for those living in cities, with a focus on the ways in which human activity impacts the environment. Promoting the

sustainable use of natural resources, such as food, energy, and water, is one way to do this. Ultimately, the value of green spaces in our urban environments cannot be ignored by policy makers of today.

2.3.1. Types of Urban Green Spaces

Within the city or urban fabric, green spaces can take on a wide range of shapes, structures, and typologies. The greenspace typology aims to characterize and categorize the different kinds of greenspace that may be found in urban settings, some of which are widely accessible to the public in contrast to those that contribute to the ecology of metropolitan areas but are not intended for recreational purposes. Within a city, there is a hierarchy of green areas ranging from regional to local. In contrast to local level green areas, which have an impact on residents' quality of life, regional level green areas contribute to the ecology, biodiversity, and environment of the entire region. The typology of green spaces considered for this study is public green spaces which provide some kind of engagement.

Table 1: Public green spaces with their description and optimum size and distance (Greenspace Information for Greater London, 2022)

Type	Description	Size	Distances from homes
Regional Parks	Vast tracts, alleyways, or networks of open space, the most of which will be open to the public and offer a variety of amenities and features that provide advantages for green infrastructure, recreation, the environment, culture, and landscape. Provide a range of amenities and services, are easily reachable by public transportation, and are run in accordance with best practices for quality standards.	400 hectares	3.2 to 8 kilometres

Metropolitan Parks	Vast open spaces that offer a sub-regional range of amenities and benefits comparable to those of Regional Parks, are easily reachable by public transportation, and are maintained in accordance with best practice quality standards.	60 hectares	3.2 kilometres
District Parks	Large open spaces with a variety of natural characteristics that provide a landscape environment and allow for a wide range of activities, such as playing fields and outdoor sports facilities for kids of all ages, as well as casual leisure hobbies.	20 hectares	1.2 kilometres
Local Parks and Open Spaces	providing spaces for sitting outside, kids' play, court games, and nature preservation.	2 hectares	400 metres
Small Open Spaces	Some examples of specialized natural areas are gardens, outdoor seating areas, kid-friendly play areas, and nature conservation zones.	Under 2 hectares	Less than 400 metres
Pocket Parks	Small open spaces with natural surfaces, covered sections, with occasional seats and play equipment for unstructured play and leisure.	Under 0.4	Less than 400 metres
Linear Open Spaces	Paths; natural areas for protection; open spaces and towpaths beside rivers, canals, and other waterways; and other pathways that offer chances for unstructured recreation. Frequently defined by appealing		

	elements or sections that enhance the space's enjoyment but are not entirely open to the public.		

2.3.2. Benefits of Urban Green Spaces

Urban green spaces have a tripartite contribution that is regarded from an economic, social, and environmental standpoint, in keeping with the three main pillars of sustainable development (Kimengsi & Fogwe, 2017). By enhancing amenities and offering areas for both passive and active recreation, these spaces are commonly thought to improve communities. Green space seems to be especially beneficial for children, our future generation. For instance, one study found that children who attended schools with more green space had significantly better cognitive functioning than those who attended schools with less green space, and another found that Early exposure to green space is linked to a decreased chance of developing mental health problems as an adult (Mark J Nieuwenhuijsen, 2021).
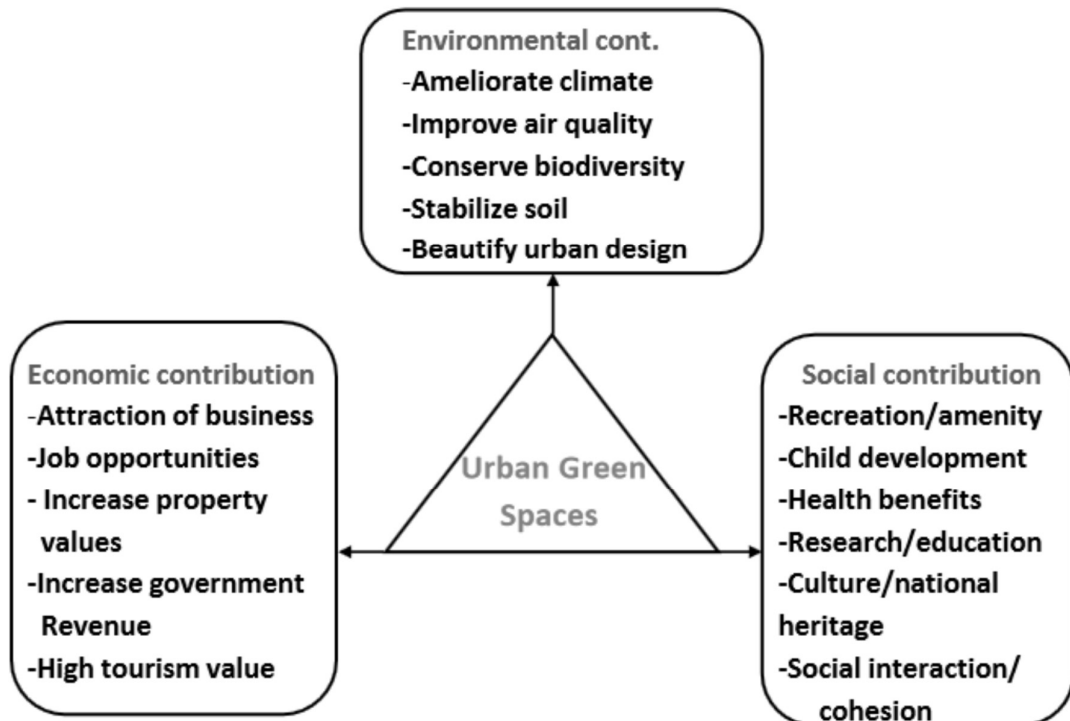
Figure 1: The Tripartite contributions of urban green space

Environmental benefits

Urban green spaces provide several positive environmental effects that support the ecosystem's general health and wellbeing. Some of them are:

- **Improved air quality:** The potential of green spaces to improve air quality is one of their most important environmental benefits. As natural filters, plants, trees, and other greenery capture pollutants such particulate matter, carbon dioxide, and nitrogen oxide.

- **Reduced urban heat island effect:** Because there is more concrete, asphalt, and other heat-absorbing material in urban regions, the temperatures in urban areas are frequently greater which is referred to as the urban heat island effect. By lowering surface temperatures, evaporative cooling, and offering shade, green spaces help to lessen this effect. An urban setting can be made more comfortable and attractive by adding trees and other greenery, which can lower local temperatures by several degrees. By reducing the consequences of abrupt shocks like heat waves and storms, urban green spaces also help cities be more resilient (Gill, Handley et al., 2007). Urban green spaces considerably contribute to cooling and can significantly lower temperature extremes. For instance, increasing the amount of tree canopy cover can help cities adapt to the heat of the city by providing more shade and cooling (Gill, Handley et al., 2007) and reduce the consequences of climate change by sequestering carbon (Dobbs, Kendal et al., 2014).

- **Water management:** Urban water runoff management greatly benefits from green places. In addition to reducing the strain on urban drainage systems and preventing flooding, vegetation aids in the absorption and retention of rainfall. Additionally, plant roots enhance soil penetration, enabling water to seep into the earth as opposed to generating runoff on the top. The impermeable surfaces of urban green space can also decrease stormwater flow during storm events, lowering floods and helping to mitigate and adapt to environmental change on a larger scale, such as increased urban heat and climate change.

- **Enhanced biodiversity:** A wide variety of plants and animals can find habitat in green areas. They serve as crucial steppingstones and passageways for species, facilitating gene flow and migration between disparate environments. Green spaces assist preserve biodiversity and ecological balance in urban settings by promoting

the protection of migratory and native species.

- **Carbon sequestration:** Urban vegetation, especially trees, are essential for removing and storing atmospheric carbon dioxide. Carbon sequestration is a process that lowers greenhouse gas emissions and their effect on global warming, therefore mitigating climate change. In urban green spaces, trees with larger and longer lifespans have more capacity to store carbon (Mitchell, 2023).

Social benefits

Urban green spaces are important for building stronger communities and promoting social relationships. A few benefits associated with green spaces for communities and society are:

- **Social cohesion:** Green spaces serve as social hubs where individuals of all ages and backgrounds can come together and interact. Recreational facilities, community gardens, and parks offer social interaction opportunities that strengthen social cohesiveness and a sense of belonging (Mitchell, 2023). Green areas provide an opportunity for involvement and interaction with the community. As well as uniting people and fostering chances for cooperation and collaboration.
- **Improved mental health:** There have been studies that have shown that having access to green spaces in urban settings improves mental health outcomes. Parks and other green spaces close by promote outdoor activities and sociability, which can lessen feelings of loneliness and isolation and enhance mental health.
- **Education and learning:** Green areas can be used as outdoor learning spaces and classrooms. Environmental awareness and education are promoted by community gardens, nature walks, and educational programs in parks that provide people—especially kids—the chance to learn about ecology, the environment, and sustainable practices.

Economic Benefits

Urban green spaces have several positive economic effects some of which are mentioned below:

- **Increased property values:** In cities, the value of real estate is positively impacted by being close to well-planned and managed green spaces. Studies have indicated

that properties close to green spaces, such as parks, are more valuable and draw in prospective tenants or buyers who appreciate having access to outdoor leisure areas and natural spaces.

- **Tourism and recreation:** Green areas have the ability to draw tourists and other visitors, boosting the regional economy. When managed up well, parks, gardens, and natural spaces can become well-liked tourist attractions because of their aesthetic appeal, peace, and leisure options. The increase in tourists has the potential to boost local businesses, including cafes, restaurants, and retail stores, so generating income and job opportunities.

- **Job creation and economic development:** Green space development and maintenance need labor, which creates employment opportunities for local residents. In the green sector, enterprises engaged in landscaping, horticulture, and park management, as well as charitable groups, play a significant role in creating jobs and promoting economic development.

Proper planning, design, and assessment can optimize the advantages of urban green spaces. There are too many benefits to be overlooked when it comes to ecology, the environment, climate change, human health, and well-being, so we must immediately green our cities and bring green space closer to people. Even while overcoming the obstacles to going green may not be simple, it should be doable with a team effort and the participation of many different stakeholders. Simply put, our green spaces are too valuable.

2.3.3. Importance of Urban Green Spaces

Recently, social factors including employment, education, and safety have received a lot of attention in the development of urban livability metrics. Environmental factors like clean air, peaceful neighborhoods, appealing street scenes, and green spaces within walking distance are also becoming more and more important. The importance of nature for human wellbeing has been highlighted in numerous international studies over the past ten years, but the reality of urban outflow highlights the urgent need for urban greening (Herzele & Wiedemann, 2003). More green space can enhance urban areas' natural beauty while also enhancing the health and wellbeing of its inhabitants. Additionally, boosting biodiversity in urban areas helps stop CO_2 emissions, hold onto precipitation, and lessen smog and air pollution. It is well established that urban green areas provide a wide range of aesthetic, social, economic and environmental benefits (e.g. NUFU, 2005; Tyrväinen,

et al., 2005). While the value of urban green spaces has long been understood, international research has focused particularly in the last ten to fifteen years on the relationship between urban livability and green spaces as part of overall urban green architecture (Caspersen et al., 2006).

Urban green spaces are vital because they give people a chance to interact with one another and the natural world (Horsham District Council, 2013). Green space is crucial for health, yet in many places, it is either insufficient or in the wrong location. We all like going for a stroll through a park, driving down a street lined with trees, or looking out our window at a forest, but those of us who live in cities might not get to experience these things as often as we should. Green space helps to mitigate climate issues by lowering the effects of urban heat islands, but because cities only occupy a small portion of the area and CO2 emissions are substantial, it has little impact on carbon sequestration. Cities with more green space can have better ecosystems and more biodiversity, especially if the city has well-planned green infrastructure. People frequently do not have access to green places close enough to their homes, depriving them of the health benefits. A considerable number of residents are at a disadvantage depending on the city or neighborhood they live in due to the unequal distribution and health impact of green space between cities as well as between different areas within cities. Particularly in poorer neighborhoods, there is typically less green space, and these areas do not benefit from it.

The United Nations 2030 Agenda for Sustainable Development recognizes the significance of green space in growing populations on a worldwide basis. The SDGs have a goal titled "Make cities inclusive, safe, resilient, and sustainable" that is particular to cities. By 2030, "provide universal access to safe, inclusive, and accessible, green and public spaces, in particular for women and children, older persons, and persons with disabilities" (United Nations, 2016) is one of the aims for this goal. The advantages of green spaces also indirectly support other SDGs, such as Goal 3: "Ensure healthy lives and promote well-being for all at all ages," Goal 13: "Take urgent action to combat climate change and its impacts," and Goal 15: "Sustainably manage forests, combat desertification, halt and reverse land degradation, stop biodiversity loss." The ability to achieve the Sustainable Development Goals will be significantly aided by the supply and management of green space. The New Urban Agenda, a global plan for the sustainable growth of cities recently adopted at HABITAT III in Quito, October 2016, emphasizes the importance of

green space for public health and wellness. Due to the world's rising urbanization, sustainable urban development is increasingly important (Haaland and van den Bosch 2015).

2.4. National plans, policies, and strategies

2.4.1. National Urban Development Strategy (NUDS), 2017

The National Urban Development Strategy of 2017 serves as a compelling and enlightening roadmap for the sustainable development of urban areas. This policy framework emphasizes environmentally responsible and progressive urban development, with a particular focus on maintaining a green, cool, and moist urban environment. The strategy places a strong emphasis on the protection and enhancement of green spaces, encompassing parks, open areas, urban forestry, and agriculture. Recognizing the pivotal role these green spaces play in enhancing overall quality of life, reducing carbon emissions, and improving air quality, the policy demonstrates a firm commitment to environmentally friendly practices, including low-carbon emissions, alternative energy sources, and countermeasures against urban heat islands. Acknowledging challenges arising from urban area fragmentation and encroachment on public land, the strategy advocates for comprehensive zoning laws covering building bulk, density, and land use. This approach aims to foster harmonious urban development that caters to the needs of a growing population without compromising the integrity of public open spaces. Despite these positive aspects, the strategy review highlights certain drawbacks, such as the lack of municipal-level data and undefined "open spaces," suggesting a need for a more systematic approach to accounting and monitoring.

Parks and open spaces

According to the National Urban Development Strategy of 2017, "open spaces" refer to neighborhood-scale parks and gardens serving both social and environmental functions. These undeveloped areas at the city and ward levels breathe life into urban landscapes. However, the debate on policy and urban development in Nepal often overlooks the challenges associated with open spaces in urban settings.

Existing policies outlined in the National Urban Development Strategy (NUDS), 2017, propose green space standards:

- 2.5% of the land in existing urban areas as publicly accessible, supervised green space at the ward level.
- In new urban areas, 5% of the land should be designated as publicly accessible, supervised green space at the ward level.

Current bylaws for community open space in planned residential zones also specify percentages based on total land area. However, the report identifies major issues:

- Lack of a clear national policy for urban parks and open spaces.
- Disjointed laws and rules regarding open spaces.
- Absence of tracking or inventorying of open spaces, leading to encroachment issues.
- The need for specified planning elements, including types and hierarchies of open spaces and temporal separation between residential zones.

The National Urban Development Strategy introduces guiding concepts interrelated to improve the urban environment. These concepts include:

- **Sustainability:** Urban development strategies should advance sustainability from environmental, social, and economic perspectives. Projects should be ecologically sustainable, devoid of unfavorable externalities, and not stress the environment unduly.
- **Green Practices:** The strategy prioritizes maintaining cities green, cool, and wet. Urban agriculture, forestry, green parks, and open areas are emphasized, along with preserving and promoting clean water resources like ponds, wells, rivers, and canals.

The National Urban Development Strategy of 2017 presents a comprehensive vision for sustainable urban development, addressing environmental challenges and emphasizing the importance of green spaces. For effective implementation, addressing the identified gaps, such as the lack of standardized definitions and municipal-level information, is crucial.

2.4.2. The Planning Norms and Standards

According to the DUDBC's (2013) Planning Norms and Standards, the minimum area of designated open space in Sub-metropolitan and Metropolitan cities should be 2.5% and 5% of the respective areas.

2.4.3. Environment-friendly Local Governance Framework, 2013

The Environment-Friendly Local Governance Framework of 2013 envisions the establishment of environmental governance and the creation of a sustainable, environment-friendly society at various levels, from households to districts. This framework outlines ambitious goals centered around accountability, collaboration, and local ownership, aiming to instill a culture of sustainable and environment-friendly development. This framework aims to achieve the following goals:

- Making everyone accountable, beginning at the most fundamental level, in order to promote sustainable development that is environment friendly.
- To promote collaboration and coordination between development and the environment; and
- To enhance local ownership through the localization of its various aspects for the sustainable management of the environment

The results expected from this framework are:

- Support with building environmentally responsible local governance structures at all levels, from the local to the federal
- A rise in environmental awareness at the grassroots level.
- The initiation of the multilateral environmental protection projects; and
- Advancements across the board in the areas of waste management, disaster management, climate change adaptation, and environmental protection.

Indicators for Municipal Environment-friendly Local Governance developed by Ministerial Council, Government of Nepal, in a document Environment-Friendly Local Governance Framework, 2013, mentions several indicators for green planning at different scales such as:

Municipal Level

Establishment of Park	- An established and well-maintained park or kids' garden at a location that is appropriate for both residents and children.

	• Play areas for kids or rest areas for senior citizens that are accessible to people with disabilities and inclusive of all genders.
Greenery promotion	• Tole/settlements mobilized to plant suited plant breeds in the road's left and right sidewalks.
	• Every year, trees are planted and safeguarded in at least 10% of all public fallow areas, streambeds, and riverbeds.
	• Adopting precautionary measures in areas susceptible to flooding, landslides, and soil erosion.
	• A park or children's garden that is created and kept up in a location that is accessible to the sixty thousand people living there.
	• Established within the city limits, such as a zoo or biodiversity park.
	• The establishment and protection of at least one urban forest inside the city limits.
	• A planned and executed program for mitigating and adapting to climate change.
	• An environmental protection awareness program was held inside the municipality.
	• Annual flowers placed along the road's border or main divider.

Source: (*Environment-Friendly Local Governance Framework*, 2013)

The Environment-Friendly Local Governance Framework of 2013 presents a comprehensive vision for creating environmentally responsible and sustainable communities. The outlined goals, expected results, and indicators for municipal-level governance provide a roadmap for integrating green planning practices into urban development, emphasizing local participation and environmental stewardship.

2.4.4. Land Pooling Reference Manual, 2072

Published by the Ministry of Urban Development (MoUD) and the Department of Urban Development and Building Construction (DUDBC), this document serves as a

comprehensive guideline for land pooling, aiming to enhance land development practices for more sustainable urban environments. The guidelines articulate the fundamental concept of land pooling, its necessity, and the recommended approach for effective implementation.

Key Aspects of the Guidelines:

a) **Concept of Land Pooling:**
   - The document introduces the basic concept of land pooling, elucidating why it is essential for optimized land development.
   - It highlights the need for a collaborative approach to land pooling to achieve better development outcomes.

b) **Services Provided During Land Development:**
   - Among various services provided during land development through pooling, the document emphasizes the allocation of land for open spaces and park development.
   - Open spaces play a crucial role in urban development, contributing to the overall well-being of the community.

c) **Challenges and Solutions:**
   - Recognizing that consolidating land for settlement development may impact landowners, the guidelines propose a solution.
   - A strategic approach involves excluding a total of 5 percent of the land for open space (park development) after combining public land and land donated by landowners.

d) **Specifications for Open Spaces:**
   - The document provides specifications for open spaces, recommending a minimum area of 300 sq.m. for the benefit of everyone.
   - The width of open spaces is suggested to be at least 12 meters, ensuring they are accessible and usable by the community.

e) **Community Engagement and Responsibility:**
   - Acknowledging the importance of preventing encroachment on open spaces, the guidelines stress the role of the neighborhood's members.
   - Community members are encouraged to actively preserve, safeguard, and ensure that the environment remains safe for everyday use.

This guideline for land pooling presented by MoUD and DUDBC underscore the significance of collaborative and sustainable land development. By allocating space for open areas and parks, the guidelines prioritize the well-being of communities and promote responsible urban development practices. The document serves as a valuable resource for planners, developers, and communities involved in land pooling initiatives, fostering a balanced and environmentally conscious approach to urban growth.

2.4.5. Kathmandu Valley Development Authority (KVDA)

KVDA has also planned to allocate 4% of total area in new developing towns for special zones for urban forests and parks as standard norms and public land will not be converted into built up spaces. The Ministry of Land Management, Cooperatives, and Poverty Alleviation prepared the land use policy under policy number two, which states that in accordance with the federal structure, land use plans (LUPs) at the federal, provincial, and local levels shall be developed and carried out. When developing LUP strategies, the following objectives shall be taken into consideration:

- To provide as many green spaces, open spaces, gardening plots, playgrounds, and entertainment venues as possible in both urban and rural residential settlement areas.
- To create green belts and open spaces alongside roads, canals, rivers, and other locations.
- To guarantee biodiversity preservation and promotion;
- To mitigate the effects of climate change.

2.5. International plans, policies, and strategies

2.5.1. The Singapore Green Plan 2030

Singapore stands out as one of the greenest cities globally. Over six decades of dedicated greening initiatives, the city has successfully cultivated a flourishing network of green spaces. In this meticulously crafted urban landscape, nature has been reintroduced, weaving seamlessly into the fabric of everyday life. it is evident that Singapore has evolved into a remarkably liveable, sustainable, and climate-resilient metropolis. The commitment to environmental well-being is palpable, with the ongoing Singapore Green Plan 2030 serving as a testament to the city's determination. The vision extends beyond mere greening; it aspires to metamorphose Singapore into a "City in Nature," fostering an even

deeper integration of natural elements within the urban framework (*The Singapore Green Plan 2030*, 2021).

The "City in Nature" aims to create a green, livable and sustainable home for Singaporeans. The challenges posed by climate change, characterized by heightened extreme weather patterns and escalating urbanization, are acknowledged in this plan. The imperative is articulated to construct a Singapore that affords its residents the opportunity to revel in a livable, sustainable, and climate-resilient environment. The transformation envisioned involves the evolution of Singapore into a "City in Nature." The strategy outlined is to not only build upon the accomplishments thus far but to embark on a journey to deepen the integration of nature into the urban milieu. In the pursuit of this vision, there is a commitment to further restore and embed natural elements within the fabric of the city.

The "City in Nature" targets are:

2026 targets:

- Develop over 130 ha of new parks and enhance around 170 ha of existing parks with more lush vegetation and natural landscapes.

2030 targets:

- Double our annual tree planting rate between 2020 and 2030, to plant 1 million more trees across Singapore.
- Increase nature parks' land area by over 50% from 2020 baseline.
- Every household will be within a 10-minute walk from a park.

2035 targets:

- Add 1000 ha of green spaces.

To achieve these targets the city has developed four key strategies:

1. Grow Nature Park Networks

Singapore's ecosystems find protection within its four nature reserves. Serving as crucial providers of ecosystem services, these reserves play a pivotal role in purifying the air and water while serving as habitats for native flora and fauna. In response to the challenges posed by urbanization, complementary nature parks have been strategically established around these reserves. Beyond mitigating the impact of urban development, these parks

also offer alternative spaces for recreational activities, providing opportunities for nature adventures that contribute to the revitalization of well-being.

The commitment to safeguarding Singapore's core biodiversity areas and nature reserves is emphasized. The establishment of Nature Park Networks by NParks is positioned as a key strategy to achieve this objective, aiming to protect and extend the city-state's natural capital. Looking forward, the narrative underlines a forward-looking vision: the ambition to grow the Nature Park Networks by adding 200 more hectares of new nature parks by the year 2030, ensuring that nature not only endures but thrives alongside the urban landscape.

2. Naturalise gardens and parks.

This strategy focuses on bringing nature into closer proximity to residents by enhancing its presence in both new and existing gardens and parks. This strategic initiative is aimed at providing immersive experiences in nature, thereby offering associated health and well-being benefits within easy reach. By the year 2026, the ambitious plan envisions the creation of over 300 hectares of gardens and parks, all undergoing a process of naturalization through diverse methods. Simultaneously, there is a dedicated effort to engage and cater to the younger generation through the creation of more nature playgardens. These innovative play areas, constructed with natural materials, seek to instill a sense of connection with nature in a manner that is both enjoyable and vibrant, specifically targeting the well-being of children. Moreover, it envisions the restoration of 80 hectares of forest, marine, and coastal habitats across Singapore. In an integrated approach, at least 50% of NParks' gardens and parks are set to feature restored ecological habitats.

3. Restore nature into urban areas.

The vision: cooling of surroundings, the enhancement of air quality, and the promotion of therapeutic effects linked to a greener living environment, involves the ambitious goal of establishing 200 hectares of skyrise greenery across the entire island by 2030. A noteworthy aspect of this plan is the deliberate enhancement of industrial estates through the integration of trees. This trend, observed over the years, is poised to continue, with a commitment to further intensify greenery. The specific target is to plant a minimum of 170,000 additional trees in industrial areas by 2030. This strategic move is positioned as a significant step towards creating more sustainable and nature-centric industrial landscapes.

4. Connect green spaces.

In assessing the ongoing efforts, the commitment to constructing an expansive network of ecological corridors stands out. These corridors strategically connect nature reserves and parks with heartland gardens and parks, culminating in the creation of an interconnected eco hub. The envisioned result is a harmonious convergence of plants, wildlife, and people within a cohesive natural framework.

Another notable facet of the plan is the aspiration to transform every road in Singapore into a Nature Way. By the year 2030, the goal is set at establishing 300 km of Nature Ways and 500 km of park connectors. This ambitious undertaking is designed to ensure that every household in Singapore is situated within a 10-minute walk from a park. The comprehensive strategy not only emphasizes the creation of accessible green spaces but also envisions an integrated urban ecosystem that seamlessly blends with the natural surroundings.

Nature Ways ›

Nature Ways planted along our roads are designed to replicate the natural structure of forests through multi-tiered planting. They keep our streets cool, and facilitate movement of animals between green spaces.

Nature Corridors ›

Nature Corridors are important ecological pathways that connect areas rich in biodiversity, such as nature reserves and nature parks, enabling animals to move safely between these core habitats.

Park Connector Network ›

The Park Connector Network is our island-wide network of trails stretching over 300 km. The trail links major parks and nature areas, offering easy access to recreational activities such as cycling and jogging.
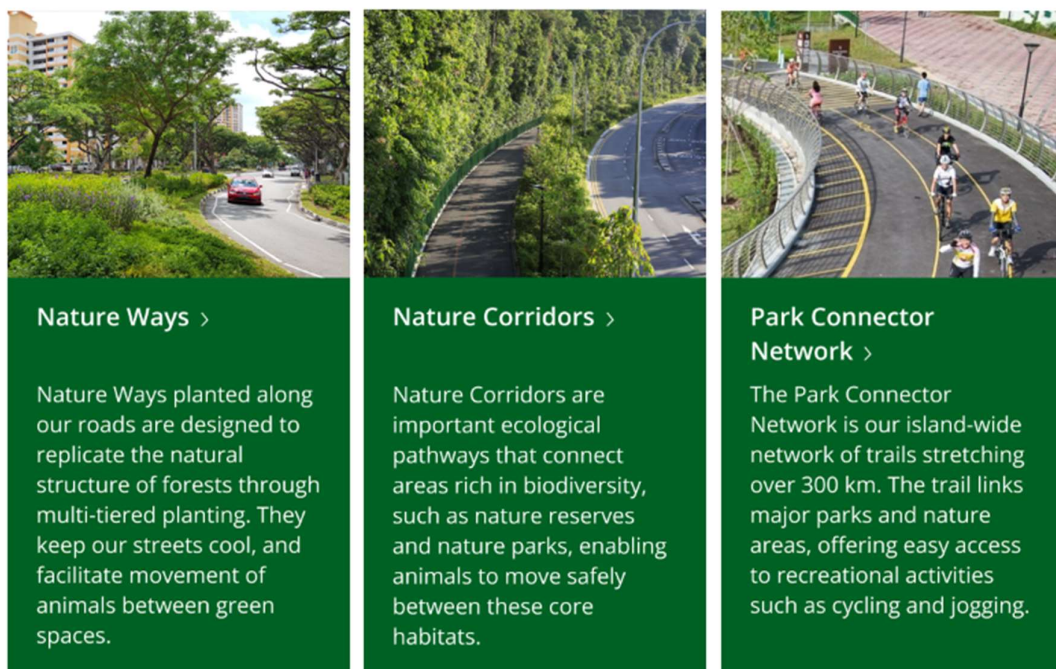
Figure 2: Nurturing stronger ties with nature

2.5.2. Delhi City Plan

The Delhi division of the Ministry of Urban Development published Master Plan for Delhi—With the Perspective for The Year 2021, outlining their vision for Delhi to become a world-class metropolis where all citizens live in sustainable environments, engage in productive work, and enjoy a higher standard of living. The Delhi Development Act of 1957 and the Master Plan of Delhi, which were both adopted in 1962, marked the beginning of the National Capital's planned development process (MPD-62). In the Master Plan, important sectors like land policy, redevelopment, shelter, the environment, mixed use, trade and commerce, the informal sector, heritage protection, and transportation are highlighted. The plan also outlines policy principles and vision for the perspective period up to 2021.

One of the main goals of the plan is to create a sustainable social and physical environment to improve quality of life. Delhi's urbanization has occurred at an almost unparalleled rate and scale, which has put tremendous strain on the physical environment and had a detrimental effect on pollution. The environment of the city can basically be understood in terms of two aspects of urban management: services management and the environment itself, sometimes known as the habitat. The former is concerned with natural resources and features, such as air and noise, water (bodies such as rivers, lakes, drains, ponds, and ground water), and land in terms of green spaces, open spaces, and other surface and below conditions. The latter is associated with the constructed environment and comprises the transportation system, solid waste disposal, sewage system, and water supply.

In relation to the background described above, it will be necessary to implement the following threefold approach and strategy:

- The management of natural resources and the infrastructure and services associated with the environment in a way that maximizes their utilization and minimizes or eliminates pollution.
- Development and maintenance of green spaces, open spaces, and landscape/recreational areas; and
- Conservation and Development of Natural Features with the Goal of Enhancing Their Environmental Value.

Green/Recreational Areas

Roughly 15% of Delhi's total urban land area is made up of green space. Furthermore, a large portion of green space is made available through Neighborhood Parks and Tot Lots in the gross residential use zones, as well as through plantations and green spaces on major campuses like President's Estate, JNU, IARI, and Delhi University, as well as roadway and drain-side plants. The DDA is currently developing two biodiversity parks in addition to the ones mentioned above.

With the exception of the Ridge/Regional Park, the new master plan calls for 15% of the Urban Extension's total acreage to be planted with green space. A portion of this will be developed as official parks for the community, while the remaining portion will be maintained as woodlands and incidental green spaces to maintain environmental balance. Along with the creation of specialist parks like Bio-Diversity Parks, there will also be plantations beside roads, sewers, riverbanks, etc. Moreover, sports complexes—which were categorized under the MPD-2001's green and recreational use category—will be viewed under a different sports category. The green spaces—which are designed for leisure—won't be disturbed by this.

Considering these objectives, planning norms and standards were developed.

Table 2: Planning Norms, Standards for Recreational Areas/ Parks at Neighborhood Level

S.N.	CATEGORY	Planning Norms & Standards	
		Population/Unit (Approx.)	Plot Area (Ha)
1.	Neighborhood Park	10000	1.0
2.	Housing Area Park	5000	0.5
3.	Tot lot at Housing Cluster Level	250	0.0125

Table 3: Planning Norms, Standards for Recreational Areas/ Parks at Sub-City Level

S.N.	CATEGORY	Planning Norms & Standards	
		Population/Unit (Approx.)	Plot Area (Ha)
1.	City Park	10 Lakh	100
2.	District Park	5 Lakh	25
3.	Community Park	1 Lakh	5

These planning norms and standards underscore the commitment to creating vibrant and accessible green spaces for the well-being and enjoyment of Delhi's residents. The Master Plan for Delhi is not just a blueprint for urban development but a visionary document that places sustainability, environmental preservation, and quality of life at its core.

2.5.3. Europe

The goal of the "GreenKeys - Urban Green as a Key for Sustainable Cities" initiative was to enhance urban environments through the use of green spaces, which are crucial for the development of sustainable urban areas. By encouraging the growth of urban green spaces as a crucial component of creating more livable cities, it aims to meet the increasing needs for supplying healthy living conditions in metropolitan areas. GreenKeys was carried out with 20 partners: 12 municipalities and 8 public and commercial research partners who supported the municipalities scientifically. From 2005 to 2008, the German Ministry of Transport, Building, and Urban Affairs and the European Union Commission co-financed the establishment of Greenkeys.

The availability of green space and the development of new green areas are typically strategic problems. Along with them, they have to do with concerns of social inclusion, community involvement, new partnership issues, productivity of financial resources, and quality improvement issues related to access and accessibility. Methodical information collection is one of the tasks involved in strategic planning. This in turn encourages a more comprehensive understanding of strategic concerns, such as:

- The availability and quality of green space.

- gaps and shortcomings.

- high-priority areas for action.

- a deeper comprehension of the internal and external legal and administrative environments.

- the identification of internal and external stakeholders.

The GreenKeys approach to an Urban Green Space Strategy development includes:

- Starting part (preliminary activities)

- Analytical part (information gathering and evaluation)

- Action part (formulation of strategy
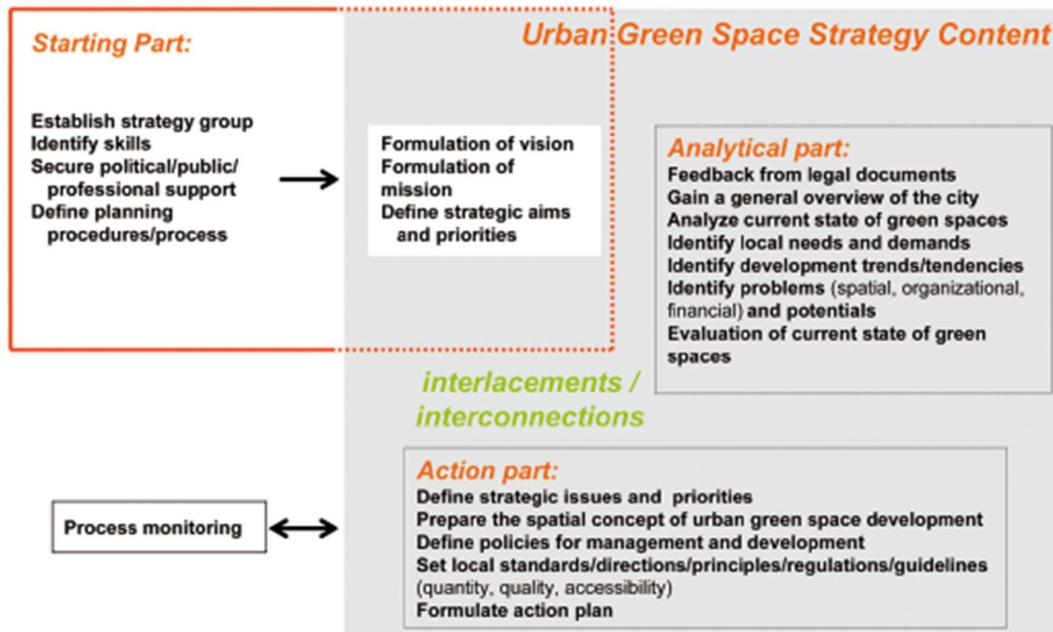
Figure 3: The GreenKeys approach to an Urban Green Space Strategy development

a. Starting part (preliminary activities)

The Starting section covers the critical activities meant to lay the groundwork for an effective strategy creation process. During this stage:

- it is necessary to form a responsible core strategy group.

- Identification of the necessary skills.

- a detailed working program.

- Arrangement of the required.

- It is important to identify and get in touch with the key spectators and stakeholders.
- A draft mission and vision need to be elaborated.

The core strategy committee is made up of representatives from the community, environmental services, planning officials, and sustainable urban development, among others. At this point, the strategy's goals, broad priorities, and mission and vision statements are developed.

b. Analytical part (information gathering and evaluation)

To advance the plan, a more thorough examination of the existing circumstances is needed. The creation of a thorough city profile is part of this stage of strategy development. It contains an overview of the city, including an examination of its demographics, geography, and current condition of its green spaces. determining the wants and needs in the community as well as the difficulties.

The foundation of the green space strategy must be a comprehensive knowledge of the primary attributes of the city. This comprises:

- the demographic characteristics (population size, social groups, age structure)
- its historic, cultural, geographical, urban, and environmental characteristics.
- the financial situation of the city.
- the administrative structure of the departments involved in the development of urban green spaces; and
- potential funding sources for the Green Space Strategy's execution.

General overview of the city

Based on a comprehensive analysis along with an understanding of the key elements, including demographics (population number, age distribution, social groupings, etc.), background information (geographical and other), and other city-specific qualities, the green space strategy must be implemented.

Analysis of current state of green spaces in the city

The assessment examines the green spaces as they are now, taking into account all of their potentials, issues, and visionary elements (needs, goals, and ideas), as well as how to best develop them going forward. The assessment map may be created in this section with a general (good/bad) or detailed (explain of all the criteria) description of the state of the

green areas. The analysis is predicated on the various facets and dimensions of the attributes of green spaces, such as their physical, structural, and functional elements (economic, ecological, and accessible aspects). The physical aspects mentioned here includes:

Aspects of Quantity

- distribution and supply of natural and landscape resources, such as woodlands, grasslands, and water regions.
- m2 of urban green space per person; and
- public green space as a fraction of the city area

Green spaces' morphological and structural traits, such as its corridors, green fingers, and relief features.

The use and accessibility of green spaces, as well as their appropriateness in terms of programming and provision, are all related to their functional features. Additionally, there is a connection between public green spaces and the surrounding area.

The outcomes can be shown using GIS in digital form or on printed maps. Highlighting issues or areas of particular relevance is a good idea. Map your green spaces, if at all possible, using GIS technologies to provide the spatial planning context of parks and green areas.

Once the typology of the existing green spaces has been established, various methods, such as community consultations, questionnaires, telephone interviews, or group consultations, are used to identify the needs and wants of the local community.

Standards for green spaces provision

Without a doubt, standards or criteria associated with the quantity, quality, and accessibility of green spaces are helpful and essential tools that enable local authorities to evaluate how well they serve the community and to benchmark their performance against others. To achieve a balance between carbon dioxide and oxygen and meet the ecological requirements for human well-being, experts from Germany, Japan, and other countries proposed a standard of 40 m² of high-quality urban green space or 140 m² of suburban forest area per capita in the 20th century (Wang, 2009). However, the current trend in developed countries is to adopt a general standard of 20 m² of park area per capita (Wang,

2009). According to the World Health Organization (WHO) and the UN Food and Agriculture Organization (FAO), each city dweller should have access to at least 9 square meters of green space, with a minimum of 0.5 hectares of green space being located within 300 meters of each home (Kuchelmeister, 1998). Currently, there are numerous regional standards for the amount of green space per person. The Public Health Bureau recommends a standard of 18 m2 per capita, the European Union recommends a standard of 26 m2 per capita, the United Nations suggests a standard of 30 m2 per capita, and the European Union recommends a standard of 26 m2 per capita (Wang, 2009). Regarding accessibility to open green spaces, the European Environment Agency suggests a maximum walking distance of approximately 1000 meters (15 minutes), while English Nature recommends a maximum distance of 300 meters (Khalil, 2014).

German example of standards for both green space and urban development; rules for open and green spaces; The implementation of this model requires quality, quantity, and accessibility standards for three types of urban open spaces. A residential area's or an urban district's open and green space quantity and accessibility standards:

Quantity: between 0.5 and 5 hectares; quantity: 6 to 7 m2 per resident.

Accessibility: Walking time of 10 to 20 minutes is required to cover the 300 to 750 m distance.

A map that shows the locations or points of conflict (fencing, broken connections) or other issues (unmaintained areas), among other things, can be used to visually represent spatial problems and be immediately utilized for additional assessment. Maintaining green spaces can become a major issue due to organizational issues. These issues are typically related to the city administration offices, which are in charge of the city's green areas but frequently lack sufficient internal communication or collaboration. One source of financial difficulties may be insufficient funds for the upkeep and development of urban green spaces.

There are several methods by which potentials and opportunities for the development of urban green spaces might be identified:

- Spatial (structural and morphological) such as creating a clear green space structure and network in the city.
- Functional (for different ways of uses, public accessibility); and

- Ecological (for enhancing the natural environment or climate condition), utilizing and integrating various findings from the analytical part.

They can be used as a basis for creating the map of the urban green space idea or green system, and they can be displayed on unique thematic maps. The analytical section can also be used to identify and summarize other factors, such as the possibility of using various funding sources and organizing changes in the management team.

c. Action part

The process of developing a strategy is centered on the Action section. The tasks completed in this section mostly rely on the analytical framework that has been established in earlier sections of the work. Specifically, it is necessary to examine and take into account the analytical part's results and conclusions in order to determine which concerns, based on their relevance and priority, are strategically important.

The action section compiles the results of the strategy process, and a draft strategy document is produced based on the results of previous actions. The "Action portion" includes:

- Determining the strategy's ultimate priorities;
- preparing the strategy map for urban green spaces; and
- Specifying how the priorities and objectives are to be carried out.

Defining strategic issues and priorities

Determining strategic concerns and priorities that arise from the analytical phase's conclusions—particularly from the assessment of green spaces and the identification of strategic problems—is part of the action section. These rely on the strategy's overall goals and vision. The development of ideas for strategic action later in the process and the execution of those ideas are influenced by key strategic issues. Priorities can be established for any kind of green space or they can come straight from the objectives, which include developing new green space and enhancing current green space. The strategic issues are usually related to:

- The provision and quantity of green spaces.
- The need to create new green spaces.
- Qualities of accessibility; and

- Qualities of connectivity.

Preparation of the Spatial Concept of Urban Green Space Development

One of the most important components of the plan for creating and enhancing the network of highly valuable and easily accessible green areas is the creation of the spatial concept. It situates the upcoming growth of urban green spaces in cities within the spatial framework of all urban land use, particularly the built environment. A spatial concept map can be used to show the spatial distribution of both newly constructed and existing green spaces, as well as the framework connecting them. It also outlines their worth or prospective value for the public and emphasizes how they relate to needs in the community.

Defining of local standards, regulations, principles, directions and guidelines

The definition and establishment of locally determined quantity criteria are made possible by the analytical part's assessment of community needs and the condition of green space provision at the time.

Green space provision is typically governed by local criteria that include accessibility, quality, and quantitative elements.

- The amount of green space required to make up for the shortcomings is specified by the quantitative component.
- The accessibility component defines the distance thresholds and travel prospects and costs to use the green spaces.

Initiating the establishment of local standards can be effectively achieved by referring to existing national standards and quality criteria put forth by governmental agencies, professional associations, or academic reports. It is recognized that, in numerous instances, adjustments to national standards are necessary to align with the specific conditions and opportunities at the local level. Therefore, it is advisable to examine instances where local authorities have formulated and effectively implemented unique local standards.

Setting quantity standards

Quantity standards for the provision of green spaces can be established to meet the needs for both recreational use and the maintenance of a desired level of species populations and

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wildlife habitat. A common definition of the quantity standard is the ratio of a spatial unit of a green space area to the population, such as one hectare of local nature reserve for every 1000 people or seven square meters of green space for each person. The population and amount of green space that are already available for examination provide an acceptable backdrop on which to base the establishment of appropriate local quantity guidelines. These must consider the requirements and expectations of the community in addition to details regarding the various degrees and kinds of use for various.

Setting accessibility standards

When combined with GIS, the distances threshold proves to be a practical and effortless technique for determining the accessibility of green areas. It indicates the number of individuals or households in a green space within a given distance value. The time it takes for people to go from their residences to a location—whether on foot, by bicycle, or by public transportation—is referred to as the distance value. For instance, according to certain standards, 450 meters is the walking distance covered in 10 minutes. The best and most efficient location for the addition of fresh green space can also be determined using the distance threshold.

2.6.   Strategies for Urban Green Space

A strategy generally refers to a plan for accomplishing multiple distinct goals. It involves the creation of a significant plan or technique to overcome specific challenges and accomplish predetermined goals. When formulating strategies for urban green spaces (UGS), it is imperative to consider policies related to social, economic, environmental, and ecological aspects, as well as sustainable development goals. These strategies play a pivotal role in resource allocation and decision-making in the face of urban development challenges. The goals of a green space strategy are multi-faceted, aiming at:

- Safeguarding the future of green spaces.
- Improving the quality of urban areas and the environment within.
- Making urban areas livable and more attractive.
- To enhance the well-being of local people. (Kasperidus et al., 2008)

Urban green space strategies, therefore, align with both the envisioned future and the current state of green spaces, encompassing existing problems, conflicts, opportunities, and needs. This strategic approach serves as a guiding vision for the improvement of green spaces, aiding in resource distribution and the development of action plans (Kasperidus et al., 2008). Strategic planning, a rational and reliable framework for decision-making, becomes an exciting and creative process when it integrates major users and stakeholders essential for meeting community needs. To ensure the success of green space strategies, understanding the attitudes and values of the community is critical. Preconceptions and personal experiences with green spaces, sometimes unfavorable, might not capture the true needs of locals. Therefore, strategy makers must possess a comprehensive understanding of the community's demographic composition, aligning with the declared aims and objectives of the "strategy area." This understanding allows for the incorporation of public opinion into the development process.

By 2030, Sustainable Development Goal 11 aims to provide universal access to green, public, and secure spaces, particularly for vulnerable groups (UN, 2021). The "3-30-300" rule, proposed by Cecil Konijnendijk, suggests that residents should see three reasonably sized trees from their homes, neighborhoods should have 30% tree canopy cover, and no one should live more than 300 meters from the closest park or green area (Mark J Nieuwenhuijsen, 2021).

Developing effective UGS strategies requires a keen recognition of spatial potential and challenges. It involves strategic actions, collaboration among decision-makers, and stakeholder participation to enhance UGS scenarios. These initiatives aim to ensure fair distribution and increased accessibility to urban green spaces. Specific strategies for UGS improvement include enhancing the planning process, strengthening spatial data, applying ecological principles, altering greening practices, and encouraging public participation.

In addressing the imperative goal of enhancing the availability of urban green spaces (UGS), comprehensive strategies have been devised, covering diverse facets from planning methodologies to overcoming physical, social, and institutional constraints:

2.6.1. Spatial aspect

- **Optimization of Green Space Layouts**

To enhance species diversity and optimize Urban Green Spaces (UGS) functionality in limited urban settings, recommended preferences for green space include larger consolidated patches, single patches instead of several smaller ones, clusters of small patches over linear arrangements, and interconnected patches through greenways or corridors. The spatial layout of green patches should be consolidated, with wider corridors favored to facilitate the movement of species, energy, and nutrients.
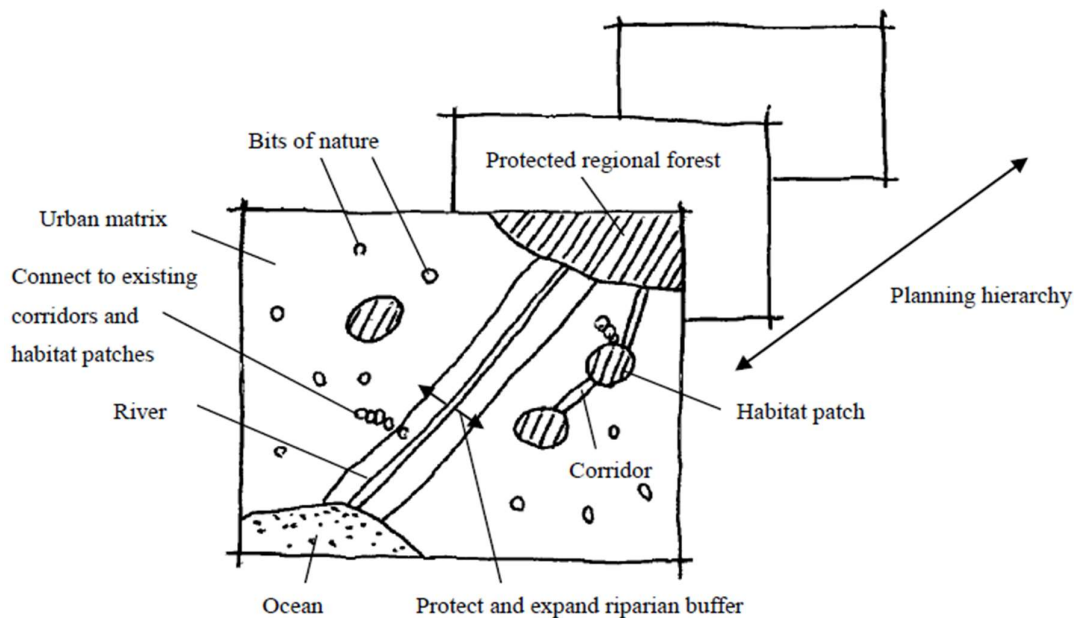
Figure 4: Graphic representation of green space layout
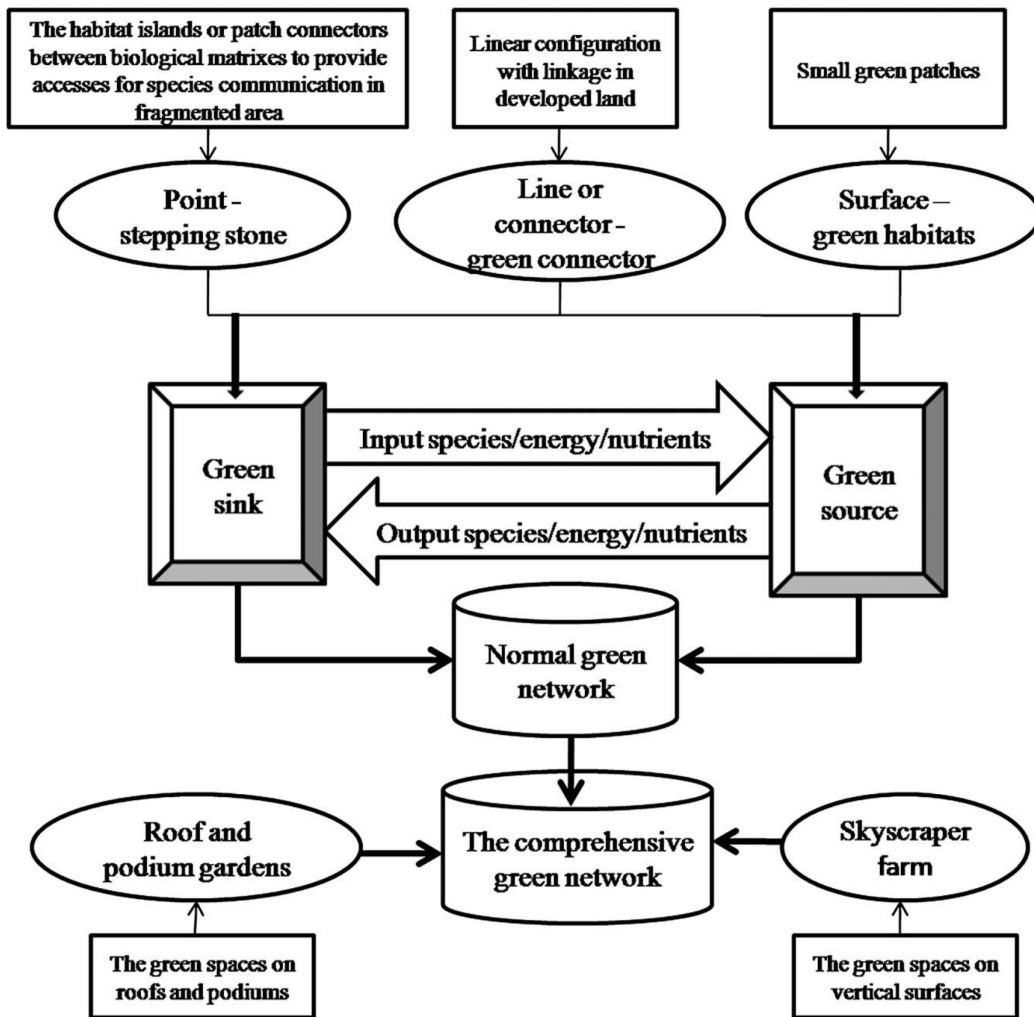
Figure 5: Green Network

- **Alter greening practices.**

To overcome land limitations in compact cities, altering greening practices becomes imperative. Strategies include the use of green walls and roofs, providing aesthetically pleasing landscapes while mitigating the urban heat island effect. Governmental initiatives, such as tax exemptions and incentives, are crucial to encourage widespread adoption. This innovative system introduces concepts like skyscraper farms and sky gardens, creating a comprehensive network that enhances landscape connectivity within the urban environment. These strategies aim to overcome spatial limitations, promoting sustainability and green infrastructure in compact city landscapes.

- **Applying ecological principles**

Applying ecological principles involves organizing city greens effectively, utilizing concepts like greenways, green fingers, and green belts. Greenways contribute to UGS management, often created linearly along highways, trains, rivers, and ridges. Green fingers, resembling human fingers, radiate from the city center to its edges, optimizing accessibility and diversity.

2.6.2. Institutional aspect

- **Improving UGS planning process**

The conventional method of green planning often applies a standards approach, determining the amount of green space based on predetermined criteria. However, a more flexible and multidisciplinary approach is essential, considering ecological, social, economic, planning, and legal components. This ensures that UGS is widely available, well-distributed, of acceptable quality, and in sufficient quantities. It requires collaboration and cooperation of different stakeholders, integration of various tools and technologies and prioritization.

- **Strengthening the spatial data**

Strengthening spatial data is crucial for efficient planning, utilizing tools such as Geographic Information Systems (GIS) to interpret geospatial data for priority analysis. By compiling vast amounts of spatial data, GIS aids in determining the feasibility of creating new green spaces.

- **Setting standards**

Setting green space standards is one way to guarantee that cities have enough green space (Haaland et al., 2015). The purpose of standards, or guidelines and rules, is to guarantee that every city dweller has access to high-quality green areas. Important guidelines in the plan ought to be included in the city's planning policy. The ideal state of green areas in terms of accessibility and quantity is very precisely described in standards, regulations, principles, instructions, and recommendations. It is possible for the standards (or rules and guidelines) governing green spaces in the city to be more general (descriptive instructions and directions) or more particular and detailed (for each form of green space and each land use) (Kasperidus et al., 2008).

2.6.3. Social aspect

- **Social equity**

Social equity in the distribution of green spaces refers to the fair and just allocation of these spaces across diverse communities, ensuring that all residents, regardless of socio-economic status, race, or other demographic factors, have equal access to the benefits of urban green spaces. Unfortunately, green space distribution is not always equitable, and disparities can exist, impacting the well-being and quality of life of different groups within a city. Fair allocation of green spaces across various social areas during land use planning and development will enhance their usability, accessibility, and availability (Das, 2022). Addressing social equity in green space distribution requires a holistic approach that involves community engagement, inclusive urban planning, and policy interventions. Strategies should aim to provide equal access to quality green spaces, empower communities in decision-making processes, and address historical disparities to create more equitable and resilient urban environments.

- **Residents' perspective**

Resident perspectives on urban green spaces can vary widely, influenced by individual preferences, needs, and the specific characteristics of the green spaces in question. Many residents appreciate urban green spaces as places to engage in recreational activities such as jogging, cycling, playing sports, or simply enjoying a leisurely walk. Residents generally prefer green spaces that are easily accessible from their homes. Proximity to green areas is seen as a convenience, allowing residents to integrate outdoor activities into their daily lives. Individual perspectives on green spaces will vary depending on a variety of factors, such as the resident's age, income, and cultural background. Residents' attitude to green space provision in different residential communities depends on the individual. Urban green in old core area quarters has an important function for socialising and is highly appreciated by residents. In newly developed areas at the periphery, green space cover is much larger, but less used and valued. By understanding the diverse perspectives of residents, urban planners and policymakers can create green spaces that are accessible, inclusive, and meet the needs of the community. It is important to consider residents perceive living in urban environments in regard to green space access and to acknowledge the needs of the residents in all planning stages (Haaland et al., 2015).

- **Public participation**

Public participation is integral to UGS planning, as city dwellers are the ultimate users. Carefully planned engagement programs, including workshops and seminars, ensure stakeholders are informed and decision-makers are receptive to diverse perspectives. Recognizing the demographic makeup of the area and adjusting UGS goals accordingly enhance the success of public engagement initiatives.

- **Social inclusion and integration**

This refers to the intentional planning and design of urban green spaces to foster a sense of belonging, participation, and cohesion among diverse community members. It involves creating environments where individuals from various demographic, cultural, and socio-economic backgrounds feel welcomed, represented, and engaged within the community. By prioritizing social inclusion and integration in the planning and design of urban green spaces, cities can create environments that promote community well-being, foster positive social interactions, and contribute to a more cohesive and resilient urban fabric.

2.7.   Challenges for Urban Green Space

Compact city structures are the result of urbanization, which has a significant influence on green spaces. The rise of the compact city concept has brought about a transformation of the urban landscape in an attempt at sustainable urban development, presenting both benefits and challenges. Urban green spaces (UGS) face many challenges to their vital role in improving the quality of urban life, including those related to distribution, quantity, quality, and availability.

The lack of available space is one of UGS's main problems, which is made worse by the rising demand for land for both residential and commercial uses. This problem is especially noticeable in small cities, where there is typically a shortage of green space in both developed and developing nations. The conflict between various urban land users serves as an example of the struggle for the fair allocation and accessibility of open green areas. Negligence by planning authorities and decision-makers affects UGS standards, leading to poorly managed existing green spaces. The lack of a common framework for definition, classification, and standardization exacerbates these issues. Preserving open green spaces with strategic significance is challenging, and the difficulty in developing new green space in already compact cities adds to the complexity.

Despite the widely acknowledged benefits of green spaces for cities, they often receive insufficient attention throughout the urban planning process, overshadowed by other land uses like residential, commercial, and industrial applications. Incompetence among decision-makers and planning authorities contributes to the uneven spatial distribution of green spaces, failing to meet both quantitative and qualitative standards. Concerns about the use of inaccessible green areas by city residents compound these challenges. The prospects for future recreation are hampered by new urban projects, and existing green spaces frequently suffer from inadequate management. These factors underscore the identified planning and management difficulties faced by UGS.

While the advantages of UGS for cities are well-documented, their creation, administration, and upkeep are still difficult tasks. This difficulty arises for a variety of reasons:

- Urban green spaces usually receive little funding and are not given high attention at the national or local levels in many countries.
- The concept of the high-density "compact city," which emphasizes the need for more intensive development in metropolitan areas, is becoming more and more prominent. This creates concerns about how and where to accommodate green spaces; and
- Due to the widespread dissatisfaction with the current situation, there is also a focus on the development of brownfield lands (Kabisch et al., 2016).

Urbanization, urban growth, and environmental concerns have all contributed to the recent development and densification of metropolitan areas, generally at the expense of urban green spaces (Haaland et al., 2015; Dawson et al., 2023). Meanwhile, growing urban populations have put further strain on already-existing urban green spaces, causing fragmentation and making it impossible to sustain its diverse social and ecological characteristics, endangering its user-attractiveness (Boverket, 2019; Grahn and Stigsdotter, 2010). Urban spatial planners face an increasingly challenging problem in maintaining urban green spaces and maximizing their potential benefits for a variety of urban populations (Haaland et al., 2015; Thomson and Newman, 2021). Making sure that people choose to visit UGS is a major difficulty (Haase et al., 2017; Hitchings, 2013). There are three types of environmental restrictions for urban green spaces development: social, institutional, and physical (Tian et al., 2012).

2.7.1. Physical (spatial) Constraints

The extremely limited space for building new green spaces in metropolitan areas as well as the relative area reduction of the existing green spaces due to urban encroachment are both results of fast urbanization. Infill development is another cause. Extremely limited green cover exists in built-up regions as a result of the highly limited availability of urban sites for greening, citizens' lack of knowledge about urban green spaces, and the adoption of an inadequate greenery system.

Physical constraints on urban greening in compact cities all share the following characteristics:

• Very limited ground-level area that can be reserved for vegetation.

• numerous pipes, cables, boulders, and large pieces of concrete in the topsoil as a result of subterranean infrastructure (Jim 1998).

• urban soil that is of poor quality, characterized as "stony" or "sandy," with a "poor structure," "heavy compaction," and a plenty of debris; and

increased pollution levels in the air, noise, and water due to growing urbanization (Hills 2002).

- **Green Space Provision**

In existing crowded urban situations, the provision of new green space is a general problem (Jim, 2004). Small cities sometimes have limited space, which can make planning for green areas more difficult. Even in less congested metropolitan areas, the production of new green space seems to be a serious problem. A neighborhood's overall living standards may be lowered by infill development if plans aren't made for additional public green space. Byrne et al. (2010) is one of the few studies that delves deeply into the challenges of designing for green space in cities that are densifying. They highlight the importance of accommodating different user groups, guaranteeing access to high-quality green space, and integrating existing green space into the newly constructed environment. They emphasize the significance of using open space standards. But even quantitative open space requirements are frequently not met (Haaland et al., 2015).

2.7.2. Social Constraints

The lack of attention from public institutions is the major social barrier to urban greening. Residents are unable to comprehend and appreciate the various functions of urban plants because of the lack of greenery (Lo and Jim, 2010). The working class's overriding need for financial security and upward mobility further erodes urban dwellers' knowledge of and enthusiasm for urban greening (Jim 2002).

- **Social inequity**

The uneven distribution of urban green space over cities has been acknowledged by several researchers e.g., (Milwaukee, USA: Heynen et al., 2006; five cities inthe U.K.: Dempsey et al., 2012; Delhi, India: Gupta et al., 2012; Johannesburg, South Africa: Schäffler and Swilling, 2013; Berlin,Germany: Kabisch and Haase, 2014; Santiago, Chile: Aquino andGainza, 2014) and urban areas with low green space cover have been related to residents with lower socio-economic status. This is viewed as a general challenge for future green space planning, as it is desirable for urban green space to be distributed more evenly and therefore be equally accessible (e.g., Dai, 2011; Cohen et al., 2012; Dempsey et al., 2012; Romero et al., 2012; Tian et al., 2012; Schäffler and Swilling, 2013; Senanayake et al., 2013). Geographical position can frequently be used to relate the distribution of green space, with areas closer to the perimeter typically having more green space than the most central regions (Tian et al., 2012; Aquino and Gainza, 2014). These geographic disparities and socioeconomic status frequently overlap. The distribution of green space is also influenced by time of development. The possibility that expanding green space area in neighborhoods could result in increased housing costs and a shift to inhabitants with higher incomes poses a challenge to balancing these inequities by greening disadvantaged regions (Wolch et al., 2014).

- **Public Participation**

Public participation in green spaces planning is crucial for ensuring that urban environments meet the diverse needs and preferences of the community. Many community members may be unaware of ongoing green space planning initiatives, limiting their engagement in the process. This leads to leads to a narrow range of perspectives being considered, potentially overlooking the needs and desires of a significant portion of the community.

2.7.3. Institutional Constraints

Enhancing urban greening is hampered by the current legal, administrative, and development and redevelopment systems. It has been established that the goals and requirements of the state play the primary or only role in the design of a landscape. However, lack of coordination and a hazy division of management duties for urban green spaces among many ministries render greening schemes unsuccessful (Jim 2001, 2002). The lack of a corresponding legislative guarantee, such as cooperation amongst the various departments, makes it difficult for the government and the citizens to prioritize the task of enhancing urban green spaces circumstances.

- **Urban green space planning**

The planning process for urban green spaces faces various challenges that can impact the effectiveness and sustainability of these spaces. The lack of comprehensive green space planning that takes a strategic, longer-term perspective on urban green spaces and their developments, is seen as a major problem (Byomkesh et al., 2012, Tian et al., 2012). Not implementing existing green space plans is another (Nor Akmar et al., 2011, Byomkesh et al., 2012). The lack of participation of stakeholders and the public is another challenge to successful green space planning (Nor Akmar et al., 2011).

- **Inappropriate policies and standards**

Policy frameworks in the context of urban planning are meant to direct relevant decision-makers in the industry toward reaching appropriate results for different city infrastructures. Urban green spaces provide several ecosystem services, and their existence and promotion necessitate governmental measures for the provision, preservation, and expansion of suitable green covers in cities. The World Health Organization's (WHO) recommendations, which call for each person to have access to at least 9 m2 of green space, defeat the general goal of appropriate green space provision policies because they take a "one size fits all" approach and ignore the differences in the physical and social conditions of cities around the world. The Ministry of Urban Development recommends suitable urban development standards and provides the Government of India with instructions for the creation and implementation of urban and regional development plans (URDPFI). UGS are classified as dwelling areas, neighborhoods, communities, districts, and subcity parks based on their spatial hierarchy. It recognizes UGS as a component of organized greens within the city's social infrastructure. These categories include the population to be supplied per unit and

the corresponding area requirements. While these criteria satisfy the quantitative requirements of UGS, they neglect to take into account the physical distribution and accessibility of the serving radius. Given the wide variations in geography among Indian cities, it is imperative to take into account their different local climate environment and cultural norms while formulating UGS criteria and policy measures. This is something that these standards often neglect to do.

- **Spatial Data**

The challenges for urban green spaces in terms of spatial data encompass various issues related to data acquisition, management, and utilization. Spatial data, which includes information tied to geographical locations, is crucial for understanding and planning urban green spaces. Inaccurate or outdated information may lead to flawed analyses and decision-making. In some regions or neighborhoods, there may be a lack of comprehensive spatial data, making it challenging to assess and plan for urban green spaces effectively.

CHAPTER THREE: RESEARCH METHODOLOGY

3.1.   Research Design

The overall strategy is chosen to integrate the different components of the study in a coherent and logical way, thereby ensuring effectiveness to address the research problem. It constitutes the blueprint for the collection, measurement, and analysis of data. The beginning of the research has been through the observation of problems. The realistic observance of the problem of green space reduction created a degrading urban environment and low living standards for urban dwellers in terms of physical and social activities. The observation of the problem was instantaneously followed by the topic selection of the research. This topic entitled" Strategies and Challenges for urban green spaces" would enlighten the relationship between urban environment and urban dwellers along with the role of urban planning for preservation and promotion of green spaces which affects the health and well-being of urbanities promote physical activities and social interaction. To study the urban green spaces and its accessibility to public, the challenges related to urban planning ad practice issues, a conceptual framework was prepared. This research has considered practical, ethical and scientific considerations for conducting qualitative research with observation and interview. The case study with detailed analysis of specific subjects, data is collected from using variety of sources and methods and has focused on gaining holistic understanding of the case.

3.2.   Research Paradigm

The research on strategies and challenges for urban green spaces addresses the existence of multiple realities, given the diverse perceptions associated with such spaces. The perception of users significantly differs from that of planners, emphasizing the importance of involving users in the planning process to enhance the creation of better urban green spaces. The study will analyze urban green spaces through surveys, observations, and case studies to answer research questions comprehensively. To establish a coherent understanding of the role of green spaces in urban areas and their significance for urban dwellers, the case study method is adopted as the primary source of information. This research is designed as exploratory and solution-seeking, commencing with a thorough understanding of urban green spaces and their relationship with urban planning. Recognizing the complexity of urban environments and the subjective nature of human experiences related to urban green spaces, the study aims to uncover the perceptions,

beliefs, and interactions of various stakeholders in urban planning and green space development. It acknowledges that different actors may hold diverse perspectives on the value and role of green spaces in urban contexts.

The research aligns with interpretivism, focusing on understanding the meanings and interpretations individuals assign to urban green spaces. This framework provides a solid foundation for exploring the subjective experiences and social meanings shaping urban green space planning. The study aims to explore the subjective realities of planners, policymakers, and community members regarding urban green spaces, recognizing that their experiences and perceptions are crucial for understanding the challenges and strategies in green space planning. In terms of epistemology, the research takes a nuanced approach, combining interpretivism and positivism. It recognizes multiple, subjective ways of understanding issues related to urban green spaces and seeks to generate context-specific knowledge relevant to Butwal Sub-Metropolitan City. This approach is valuable for providing insights and informing local planning practices.

3.3. Methodology

Methodology refers to the general principle which underlines how we investigate the social world and how we demonstrate that the knowledge generated is valid. The research methodology involves qualitative methods such as interviews and observations to gather rich and contextualized data on people's experiences and perceptions. Simultaneously, quantitative methods like mapping and analysis will be employed to collect data on variables based on distribution, accessibility and quantity such as the extent of urban green spaces. This dual-method approach ensures a comprehensive exploration of subjective understandings while providing a broader perspective and identifying trends in the research findings.

3.4. Research Methods

Research methods refer to the more practical issues of choosing an appropriate research design- perhaps an experiment or a survey- to answer a research question, and then designing instruments to generate data. To gain a comprehensive understanding of the research issue, the preliminary study is carried out meticulously. The preliminary review of the literature is a different term for this stage. The second phase is literature review, which involves reading extensively and thoroughly from a variety of data and information

sources, including textbooks and online sites. In the third phase, known as a case study, researchers examine and observe previously completed research on a specific subject to raise their understanding of it. The fourth phase is the data collection phase in which data is collected using various methods of data collection to get data for analysis and interpretation of the existing situation on research topics as directed by aims and objectives. Before visiting the field, various literatures were explored, and case studies were conducted. Qualitative study was conducted through various documents and key informant interviews conducted during filed visits and quantitative data was collected through study area analysis done in GIS mapping system.

Table 2: Research Method

Research objectives	Research Method
To analyze the existing urban green spaces.	- GIS Mapping - Land Use Data - Site Observation
To identify the challenges faced by institutions during the planning process.	Key Informant Interviews (Urban Development and infrastructure sector, Environment Sector)

In this research, mixed methods are used to collect the data and conduct this research. A formal interview technique is used to collect qualitative data which provides the perspective of the planning committee. The method used for this research includes:

- **Literature review:** Literature review is done to gain in-depth knowledge about the research topic. It helps to establish a solid theoretical foundation for understanding the present context of urban green spaces in case area.

- **Expert Consultation (KII):** Key informant interview of the major stakeholder's such as Mayor, head of urban infrastructure development, environment officers and other key personnels is done to gain the insight on city's vision towards green spaces and the issues related with such spaces.

- **Mapping green spaces:** It allows us to directly assess the physical aspects of the urban green spaces of a city and provides information on green spaces quantity, availability and accessibility.

- **Site Visits and Observations:** It allows us to understand the local context of the study area, providing tangible and firsthand insights that complement and enhance research findings.

3.5. Research framework

Framework for research topic involves identifying and organizing the key concepts, variables, and relationships that guide the study. The key concepts here are urban green spaces, the strategies for provision of green spaces in a city and the challenges identified in the process. Firstly, it is very necessary to know the existing situation of the green spaces in the study area. Based on this the challenges can be identified and the strategies to overcome these challenges are recommended.
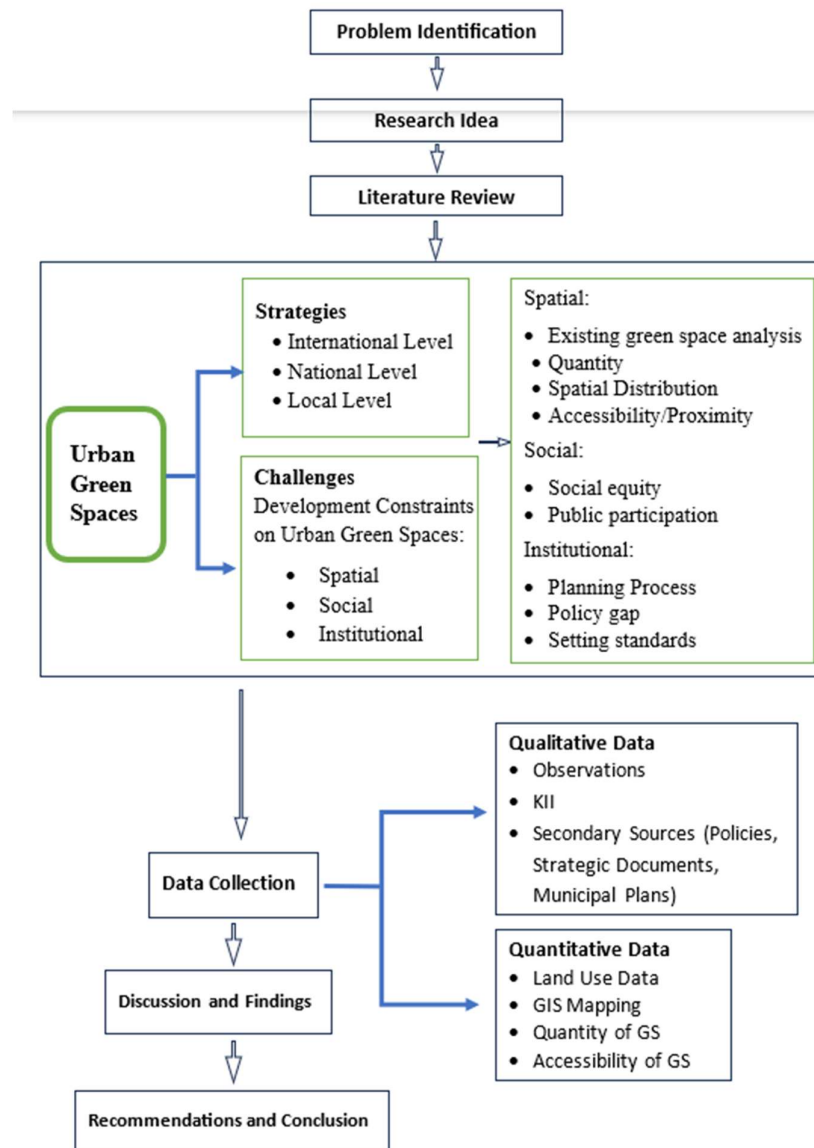

Figure 6: Methodological Flowchart

3.6.   Existing Green Space Analysis

3.6.1.   Mapping Green Spaces

The urban area comprises of different features in its built-up structure. Mapping green spaces in an urban area is a fundamental aspect of understanding the spatial distribution, characteristics, and overall health of these vital components within the urban fabric. To map green spaces, land use data and open street map is used, and the mapping is done is done in GIS. Land use data is collected from the department of survey and accessed through GIS. Open street map is used to confirm the available data and to add the missing data. Mapping allows for the quantification of the total green space coverage in a given urban area. Patterns of green space distribution become evident through mapping. GIS overlays can reveal clusters, gaps, or disparities in green space availability, helping planners address issues of accessibility and equity. Understanding the proximity of green spaces to various land uses, such as residential areas, commercial zones, or industrial sites, aids in identifying areas with a higher demand for green spaces.

3.6.2.   Analysis of Green Space

Analysis of the current green space situation in this thesis deals with the physical aspects of green spaces in the city, as the main subjects of the study. The important physical aspects of urban green spaces that should be checked and analysed are mostly quantity, spatial distribution and accessibility and proximity to green spaces. The quantity refers to the total area of GS in relation to population and urban context. Accessibility to GS relates to the spatial distribution of GS throughout the urban area, which is measured through a variety of GIS-based methodologies. The most widely used indicator to assess green spaces is their total area in respect to the total population (m2/inhabitant) (de la Barrera et al., 2016; Tayloret al., 2011; Van Herzele and Wiedemann, 2003; Caspersen et al.,2006; Kabisch and Haase, 2013; ISO, 2014).

Analysis of Quantity aspects like:

- the distribution and supply of public green spaces as a percentage of all the city area;
- the m2 of urban green space per inhabitant;
- Green Space per built-up area;

The entire amount of green space is divided by the population of each municipality to determine the indicator of green space per inhabitant (in m2). To determine the land cover per green space within the built-up municipal territory, the total quantity of green space is divided by the built-up area of each municipality.

Analysis of Accessibility aspects like:

- Proximity to Green Space
- Built-up area served

It is essential to consider not only the indicator of the total amount of green space but also its distribution within the municipal region. Theoretically, there are two extreme distributions:

- limiting all green space to a single community and
- distributing green space equally among all communities.

CHAPTER FOUR: STUDY AREA

4.1. Butwal Sub-Metropolitan City

The Butwal Sub-Metropolitan City is one of the tri-cities of the rapidly growing Butwal-Tilottama-Bhairahawa urban agglomeration primarily based on the Siddhartha Highway in West Nepal. It is one of the fastest-growing cities in Nepal for health, education, construction, communication, trade, and banking sectors. It has highway connections to the Indian border at Sunauli and to the hilly towns in Tansen and Pokhara valley. Geographically, Butwal is at the intersection of Nepal's two different National Highways, Mahendra Highway and Siddhartha Highway. It connects western Nepal with the capital Kathmandu through the highway and air links (via Gautam Buddha International Airport at Siddharthanagar). The city stands beside the bank of Tinau River, and at the northern edge of the Terai plain below the Siwalik Hills (Wikipedia contributors, 2023).

The vision of the Butwal Sub-Metro is "समानता, स्वाभिमान र अवसर-बस्नयोग्य बुटवल शहर" (Equitable, Dignified, and Capacitated-Livable Butwal) and is working accordingly.
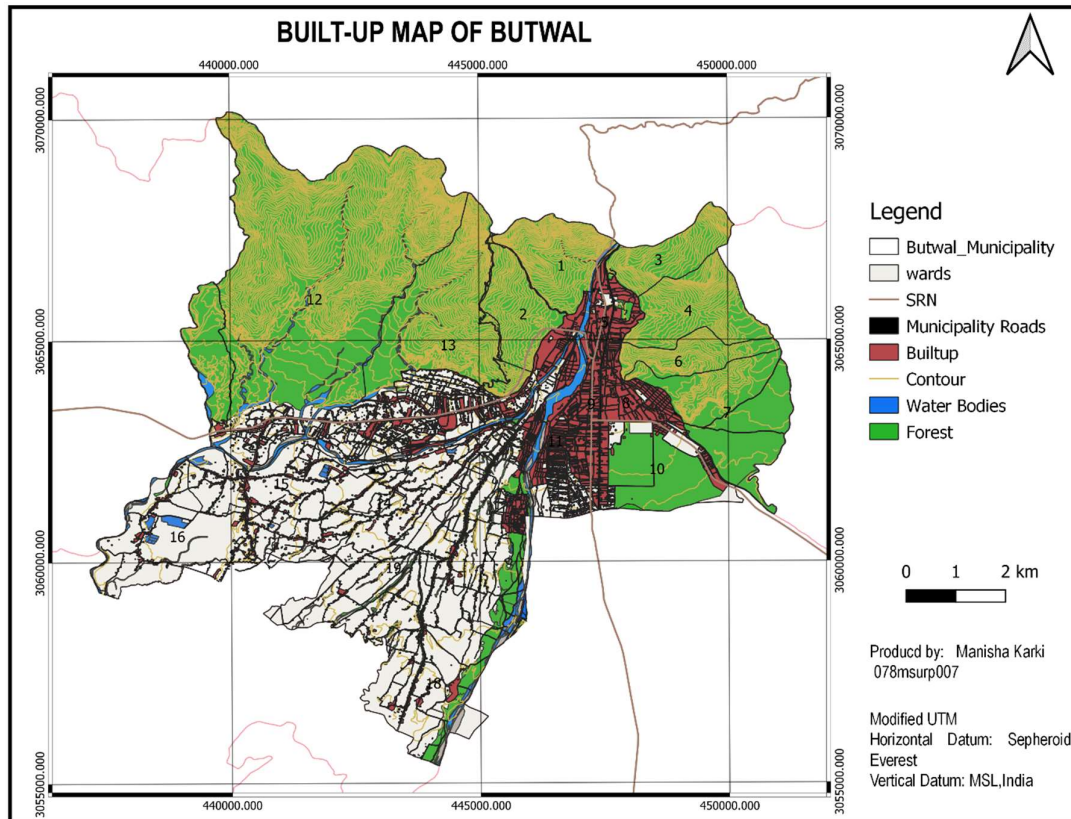
Map 1: Built-Up map of Butwal Sub-Metropolitan City

The total area of the city is 101.6 km2. The population size according to census data 2021 is 194335 which was 118462 during the 2011 Census. The municipality has 3.1 percent annual population growth from 2011 to 2021. The population density has increased from 1166/km2 (2011) to 1913/km2 (2021). While the total number of households during the census 2011 where 29662 it has increased to 50565 during 2021 census which is about double. It can be more clearly understood through the graph below:
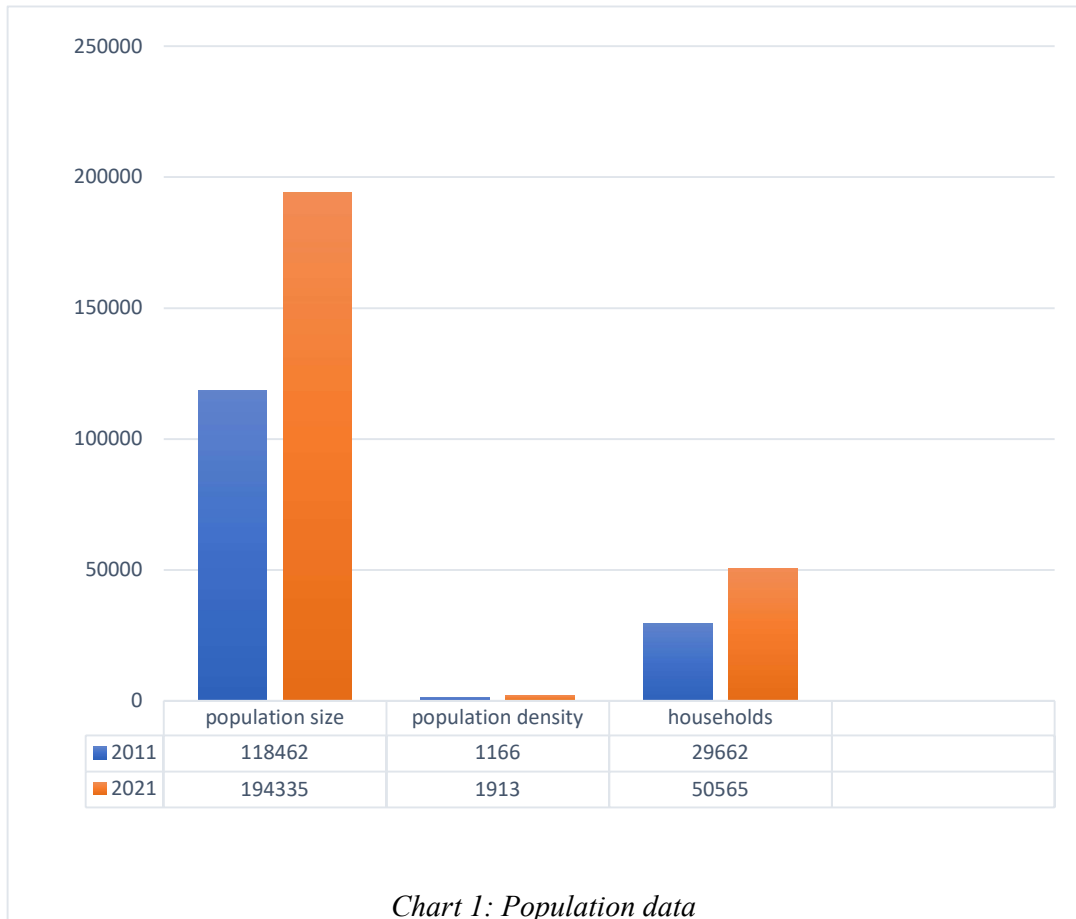
	population size	population density	households
■ 2011	118462	1166	29662
■ 2021	194335	1913	50565

Chart 1: Population data

Ward wise population distribution

The ward wise population distribution gives a clear vision of population distribution. As it can see in the chart below, ward 11 has the highest population as it lies in a city center where the attraction is comparatively high and ward 18 has the lowest population as it lies on the periphery of the city.
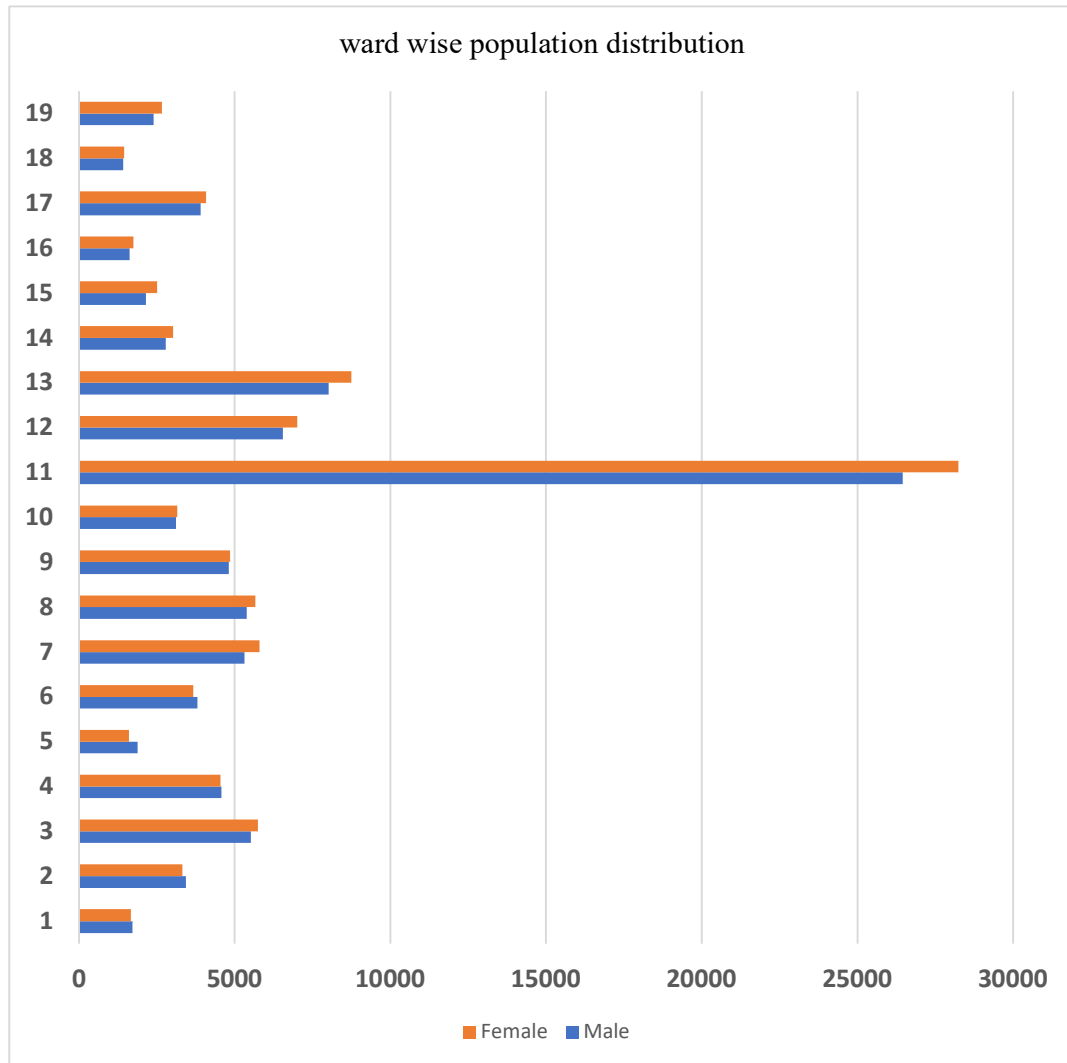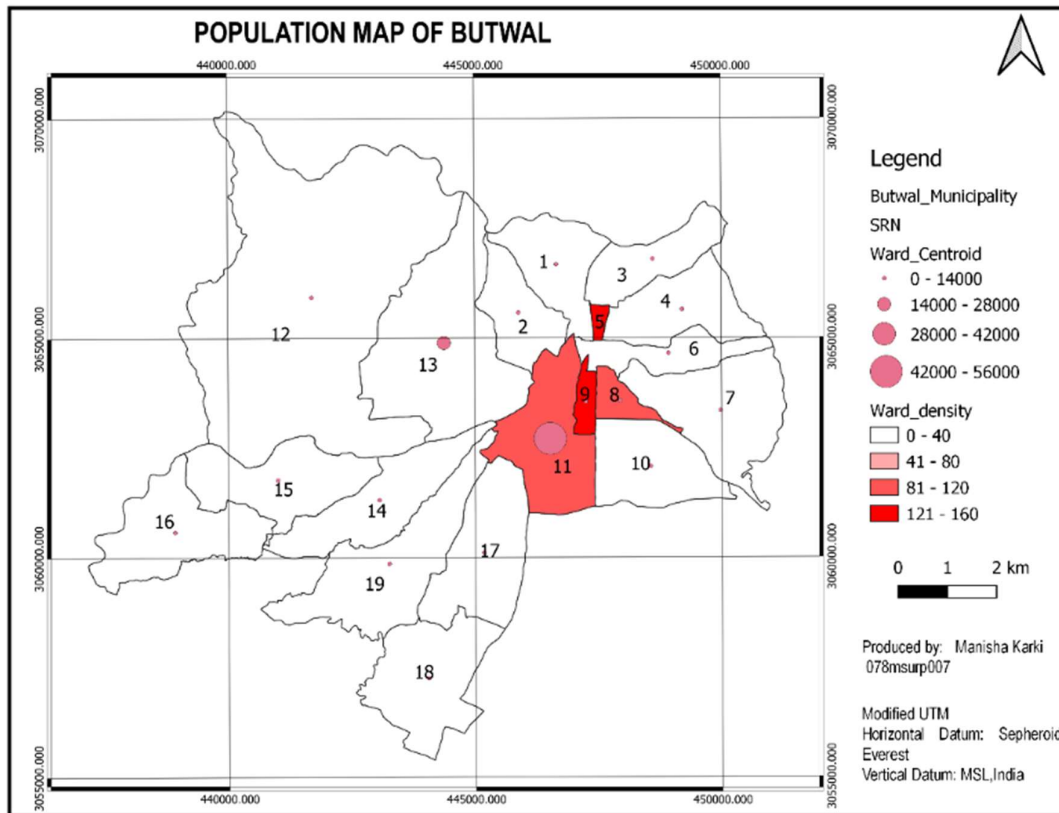

Chart 2: Ward wise population distribution

Map 2: Population Map of Butwal
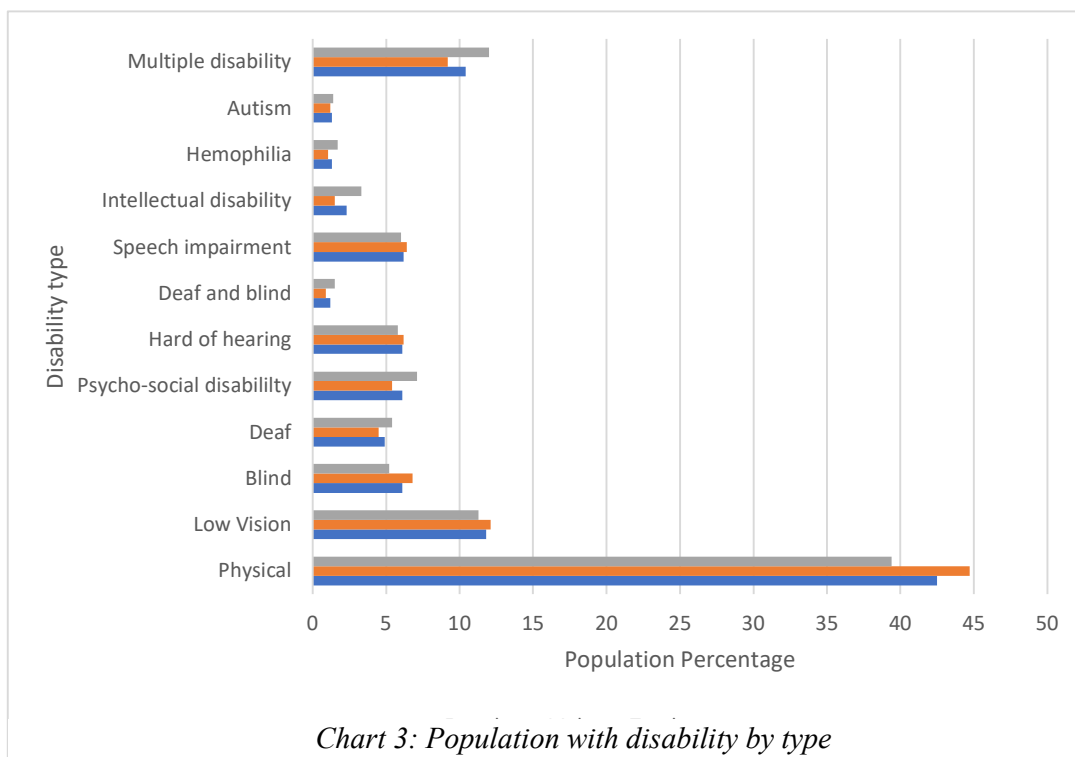
Population with disability by type

Chart 3: Population with disability by type

Physical disability is high with a total of 42.5 percent which is followed by low vision and multiple disability. This indicates the importance of inclusive planning in urban settings.

The city aims to:

- Prepare a record of information and facts related to the overall physical infrastructure, economic aspects, social aspects, natural heritage and disaster management of the sub-metropolitan city.
- Prepare various thematic base maps of sub-metropolitan cities.
- Explaining and analyzing the overall demographic, economic, social, physical, natural, historical, religious, cultural data.

4.2.   Local plans, policies, and strategies

Integrated Urban Development Plan (IUDP)

The Integrated Urban Development build (IUDP), which combines a multidisciplinary framework, participatory methodology, and cross-sectoral collaboration to build livable urban environments, appears to be the ideal solution. This document has been prepared with and objective to set out Long-term Vision and overall Goal, Objective and Strategies for BSMC (15 years) and prepare Land Use Plan, Physical development plan, Social, Cultural, Economic, Financial, and Institutional Development Plan; Environmental and Risk Sensitive Land Use Plan, Urban Transportation Plan, Multi-sectoral Investment Plan (MSIP).

Here the scope of IUDP is to provide full study of land use zone and recommend bye laws and regulations accordingly. Different land use zones are categorized for the documentation according to the existing scenarios among which urban green areas are mentioned under green zone.

It is clearly revealed that municipality has focused on environmental protection, inclusivity and good governance as the municipality's vision aims toward environmentally friendly city. Various plans and programs for the future are developed prioritizing urban environment protection and conservation. Some of these programs that focus on increasing green spaces useful to public are:

- A botanical park to be developed within the shivanagar community forest and siddhababa religious forest.

- Prioritizing environment protection activities and promoting public private partnership on park operation and management.
- Improvement of the municipality as a socially, economically, culturally, politically and environmentally equitable and inclusive city.
- Introducing sustainable city concepts such as green city, garden city.
- Developing supporting policies for the annual plans of municipality that promote green spaces and encourage public to include green roofs, green walls and urban farming whenever possible.

Annual Plans and Policies 2079/080

The plans, goals and programs promoting green provision in a city are incorporated into different sectors such as urban infrastructure development, forest and environmental management which includes:

- One ward one park
- One forest one park one pond
- Land deformed in Jyotinagar, laxminagar chure hills to be developed as parks and sports playground after land maintenance.
- A memorial park will be developed in memory of martyrs: B.P. Koirala, Puspalal Shrestha and Surya Prasad Pradhan in Devinagar, ward 11.
- A green trail along the Sukhaura river is to be developed along the ward 3, 4, 6, 7, and 8.
- Two tree per house
- Promoting tourism in parks and open spaces.

Annual Plans and Policies 2080/081

With a continuance to plans and programs of the year 2079/80 some new plans have been introduced on the current fiscal year policy and program documents. Some of the programs aligning with green development are:

- To establish the city as a green city, the necessary subsidy will be provided by adopting the policy of one house-three trees. Also, when designing a house plan, provision will be made to allocate necessary space to promote greenery.
- Beautification of road along Yogikuti to Chidiakhola, Ramnagar to Tamnagar, Belbas-Bethari road, Tamnagar-Suddhodhan Road as bright and green roads.

- Parking spaces and small parks will be constructed to improve the functionality and organization of Butwal's main road networks.

4.3.　　Existing Green spaces Analysis

Green spaces used by the public for various activities and spaces providing physical and social benefits for the people are included under green spaces. The analysis of existing spaces is done applying various parameters through GIS mapping and data is collected through municipal profiles and published documents. The list of such green spaces is mentioned in the table below.

- **Green Parks**

Urban and suburban parks and gardens are public resources that are progressively developing. Sub-metropolitan city ecosystems are especially protected in certain places. To promote green spaces, these locations must be protected. Recreation is essential for both mental renewal and personal hygiene after a daily routine job. many forms of entertainment. Rejoicing in a clean and natural environment and feasting in the forest are common and ancient practices among the measures. Parks and gardens are well equipped spaces that provide several recreational activities and promote biodiversity. The list of such spaces in Butwal city are:

Table 3: List of existing green spaces

S.N.	Name	Location	Ownership	Specialty	Estimated annual footfall
1.	Shikhar Deurali Park	Jalvinayak-1	Community	Tourism	3500
2.	Sahasradhara	Jalvinayak-1	Community	Tourism	
3.	Satyasai batika	Ward No. 7	Community	Tourism	
4.	Manimukunda park	Manimukunda tole-2	Community	All	500,000
5.	Laxmi Park	Laxminagar-4	Community	Tourism	40000

6.	Bhanu park	Between Siddharth Highway and Palace-4	Community		
7.	Hillpark	Ward No. 7	Community		
8.	Milanpark	Ward No. 12	Community	Tourism	100000
9.	Peacepark	Ward No. 12	Community	Tourism	500000
10.	Kaparkatti taal	Ward No. 12	Community	Historical	
11.	Water park	Ward No. 13		Tourism	50000
12.	Park and picnic spots	Ward No. 7	Community		
13.	Ramapithigus Park	Ward No. 3	Community	Tourism	
14.	JP park	Ward No. 8	Community		
15.	Jitgadi Fort	Ward No. 1		All	
16.	Buddha Park	Ward No. 12	Community		
17.	Padini park	Ward No. 13	Community		

Source: Butwal Sub-Metropolitan City Profile, 2019
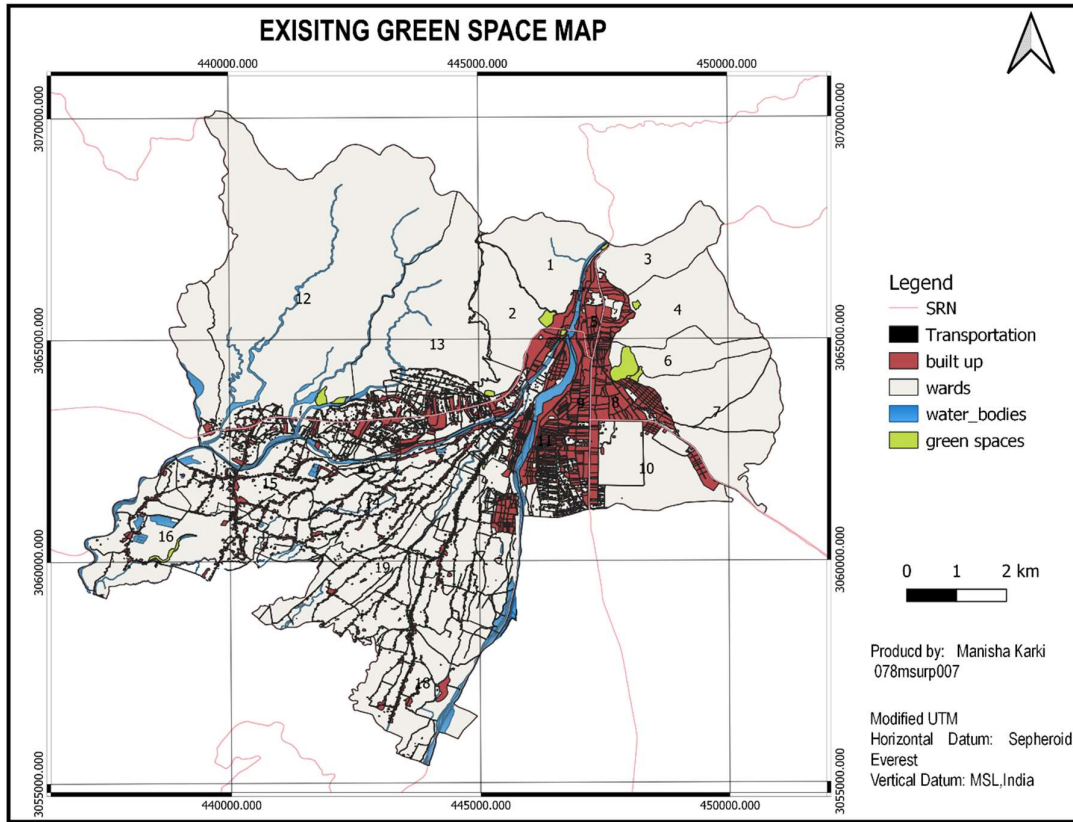
Map 3: Existing green space map

- **City wide analysis of existing green spaces**

The existing green spaces will be evaluated in terms of quantity and accessibility. The quantity will be examined based on the distribution and supply of public green spaces as a percentage of all the city area, the m2 of urban green space per inhabitant. Accessibility examines walkability. For the analysis various parameters are created as in table:

Table 4: Analysis of existing green spaces

	Metrics	Analyzed data	Description
Butwal SMC	Total area	101.6 km2	Total land area under metropolitan
	Total population	194335	Total population according to 2021 census
	Built-up area	13308576.96 m2	Tentative area as per GIS

Urban green area	Total green area	596849.1 m2	Tentative area as per GIS

Table 5: Analysis based on indicators of green spaces.

Quantity measures	Percentage of area	0.58%	public green spaces as a percentage of all the city area
	m2 per inhabitant	3.07 m2	the m2 of urban green space available to per inhabitant of a city
Spatial distribution and Accessibility	Easy access (450m buffer)	2976728.356 m2 (22.3 %)	Within 5-10 minutes walking distance
	Medium access (800m buffer)	5710377.660 m2 (42.9 %)	Walkable distance
	Built-up Area without walkable access to green spaces	7598199.3 m2 (57.0 %)	

- **Ward wise analysis of existing green spaces**

The ward wise analysis of green spaces is conducted to gain a comprehensive understanding of the distribution of green areas within each administrative division for a more informed understanding of the urban environment. The ward wise analysis helps to provide better understanding of existing condition and come up with the effective solutions. The green area percentage is calculated and shown in table 7 whereas green space per inhabitant and per built area is shown in table 8.

Table 6: Green area percentage of each ward

Ward	Total area (m2)	Green Area (m2)	Green Area %
Ward 1	3511696.99	11411.8	0.32%
Ward 2	2924965.45	78814	2.69%
Ward 3	2934926.39	11095.3	0.38%
Ward 4	3892471.41	21352.1	0.55%
Ward 5	226234.475	809.547	0.36%
Ward 6	2323980.63	131540	5.66%
Ward 7	5952273.52	159097	2.67%
Ward 8	950248.904	2844.08	0.30%
Ward 9	619197.092	-	-
Ward 10	4233041.04	-	-
Ward 11	5127063.44	1408.04	0.03%
Ward 12	27224785.1	94092.8	0.35%
Ward 13	10296008.4	22079	0.21%
Ward 14	4814807.44	-	-
Ward 15	4976311.05	-	-
Ward 16	5480779.99	58719.1	1.07%
Ward 17	5327733.28	3353.31	0.06%
Ward 18	5507620.87	-	-
Ward 19	6668986.46	-	-

Table 7: Green space per ward

Ward	Population	Built-up Area (m2)	Green Area (m2)	Green space per inhabitant	Green space per built area
Ward 1	3377	326949	11411.83	3.38	0.03
Ward 2	6760	405554	78813.968	11.66	0.19
Ward 3	11268	427959	11095.306	0.98	0.03
Ward 4	9115	343518	21352.068	2.34	0.06
Ward 5	3493	226088	809.547	0.23	0.00
Ward 6	7474	428509	131540.21	17.60	0.31
Ward 7	11113	495881	159097.34	14.32	0.32
Ward 8	11037	878187	2844.078	0.26	0.00
Ward 9	9665	590645	-	-	-
Ward 10	6266	685626	-	-	-
Ward 11	54699	2750937	1408.043	0.03	0.00
Ward 12	13567	1096857	94092.847	6.94	0.09
Ward 13	16762	1247355	22078.952	1.32	0.02
Ward 14	5804	706024	-	-	-
Ward 15	4652	668256	-	-	-
Ward 16	3371	388341	58719.054	17.42	0.15
Ward 17	7984	710270	3353.309	0.42	0.00
Ward 18	2861	383168	-	-	-
Ward 19	5067	472016	-	-	-

The ward wise analysis shows wards 8, 9, 10, 11, 14, 15, 17, 18 and 19 have no amount of green space available. Wards 8, 9, 10 and 11 are the city core and have higher built-up compared to other wards which makes it difficult to allocate space for green development. Other wards, although being the newly densifying wards without proper planning and plans it is challenging to secure land for such purposes. The graphical representation for the clear visualization for the comparison is shown below:
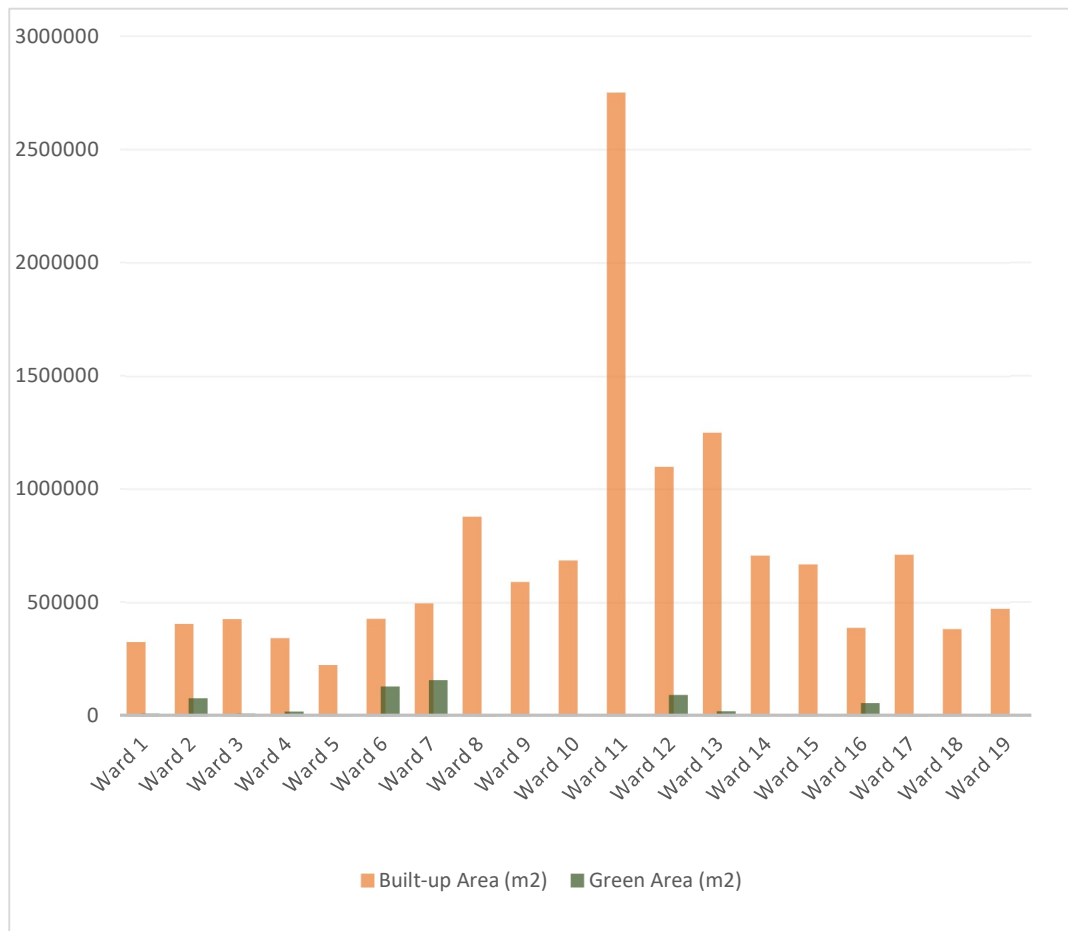

Chart 4: Ward-wise analysis of green spaces

The interaction between urbanization and nature is highlighted by the comprehensive analysis of the urban and green landscape, population distribution, and accessibility at Butwal. The analysis is done using GIS mapping system based on the data provided by the survey department and open street map. The existing situation analysis helps to understand the on-ground condition of green space provision in a municipality. This will also help to understand the constraints related to space allocation for green spaces. The analysis is also represented through maps. The city has a relatively small percentage of its area designated as public green spaces, and the accessibility analysis highlights areas within easy and

medium walking distances to green spaces which clearly shows most of the public do not have easy access to green spaces. The sustainable development goal 11 targets to provide universal access to safe, inclusive and accessible, green and public spaces. A methodological process is suggested for the analysis which includes spatial analysis to delimit the city/urban area, estimation of access to open public spaces within 400 meters walking distance, equal access to each space by all groups of people. Similarly, there are various accessibility approaches initiated by different cities as per their requirements. For such analysis an inventory should be the initial source of information. An attempt for such analysis is carried out and presented through maps below. These maps provide a visual representation of how accessible green spaces are within a city.
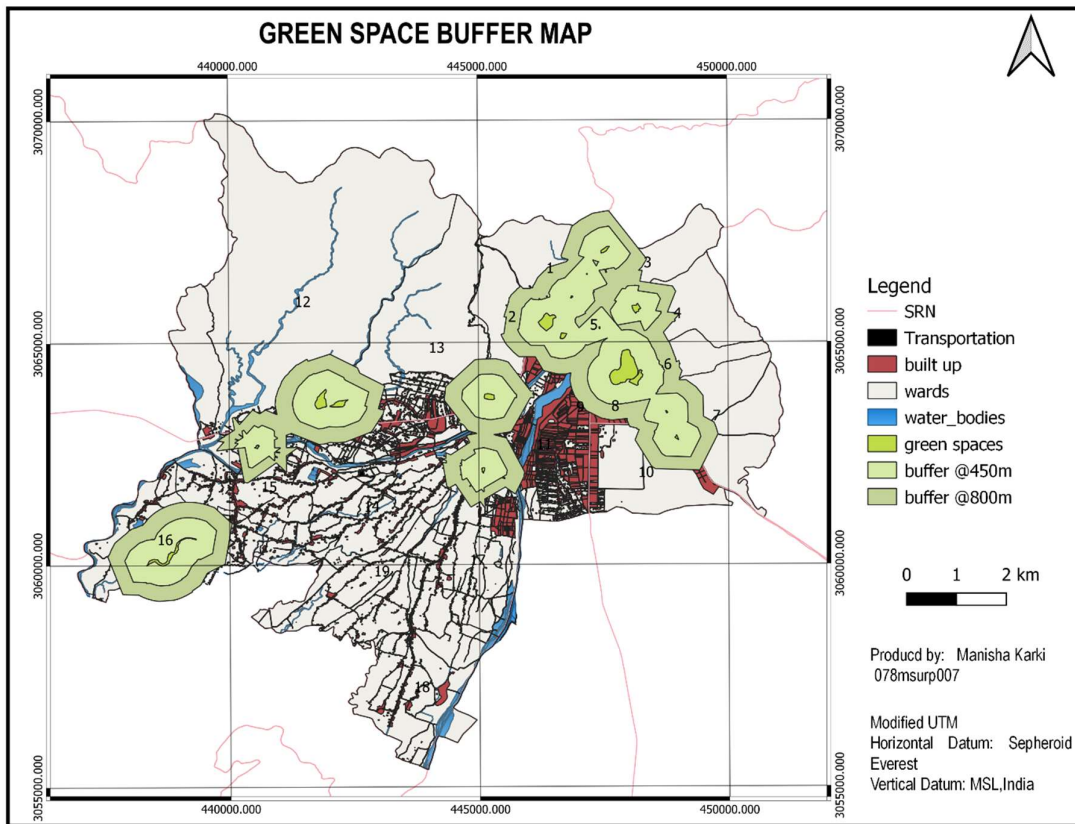
Map 4: Green Space Buffer Map
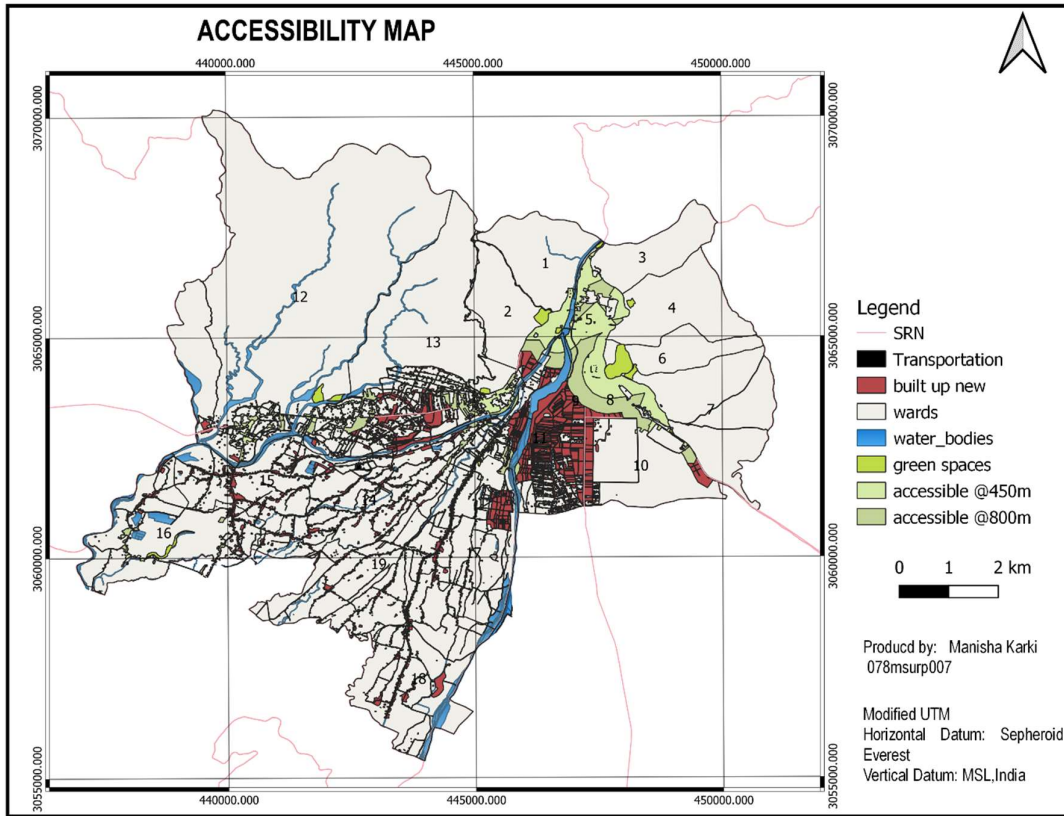
Map 5: Green space proximity map to built-up

The city's built-up area covers approximately 13,308,576.96 m², indicating a significant level of urban development. The ward-wise distribution showcases variations in land usage within the city. While some wards, like Ward 2, exhibit a substantial built-up area of 405,554.312 m² and a relatively large green space of 78,813.968 m², others, such as Ward 5, possess a comparatively smaller land area, hinting at potential differences in urban planning and land allocation strategies. Although the population density in ward 9 and ward 5 is highest and the wards are the city cores, there is none or very low green space. The most populated ward 11 also shows a very low amount of green space availability. Most of the green spaces are in the sub-urban areas near or within the forest area. Some major parks are developed within the forest area because of the lack of public land available within the city. The analysis of spatial distribution and accessibility underscores the importance of proximity to green spaces. The data reveals that a substantial portion of the city's population has easy access to green spaces within a 450-meter buffer, aligning with the concept of creating walkable and livable urban environments. Conversely, the sizable built-up area without convenient access to green spaces measuring 7,598,199.3 m² raises concerns about equitable access to nature and the potential impact on residents'

physical and mental well-being. The need for specialized urban planning solutions is highlighted by variation in ward characteristics. Wards like Ward 11, which have a sizable built-up area of 2,750,936.785 m2 and a modest amount of green space, may need interventions to increase green covering and establish a harmonious urban environment. On the other hand, wards like Ward 6 show the potential for successful integration of green spaces into the urban fabric thanks to their considerable green area of 131,540.214 m2 relative to their built-up area. The data also prompts questions about the equitable distribution of green spaces across the city's wards. Wards 9, 10, 14, 15, 18, and 19 show no recorded green area data, raising concerns about potential disparities in access to nature among different sections of the population. This raises the concern on environmental justice. Addressing this imbalance could be crucial for promoting social cohesion, health, and overall quality of life for all residents.

The city needs all types of green space but during analysis only local parks are found. The larger green spaces certainly have their benefits, but a city needs small pocket parks and tot lots that influence the daily life of city dwellers. The analysis clearly shows the lack of such spaces which are meaningful to public. The existing spaces are well equipped with most of the necessary elements in any public space such as resting shades, drinking water facilities, public toilets, waste bins, connection to nature, playgrounds. Such spaces provide recreational functions to the users. But most of the public will need commute service to visit green area as there are no natural spaces within the city core which are easily accessible. The main city area is deprived of natural elements which disconnect people from nature.

CHAPTER FIVE: DISCUSSION AND FINDINGS

Protecting green spaces in the context of urbanization poses significant challenges. In a city where both the quantity and accessibility of urban green spaces are lacking, the result is a concrete jungle susceptible to pollution, disasters, and characterized by low livability. Urban green spaces play a pivotal role in mitigating these negative aspects, serving as essential components of livable cities, wildlife refuges, and valuable recreational areas. The relentless push for rapid development and land allocation for various infrastructure projects underscores the urgency of implementing proactive and innovative conservation measures. These measures are crucial to ensuring that the vital green lungs of the city continue to flourish amid urban growth. Preserving green spaces in rapidly urbanizing cities highlights the importance of promoting environmental consciousness within communities. Educating people about the myriad ecological, recreational, and health benefits of green spaces can foster a sense of shared responsibility. This stewardship is further facilitated through collaborative efforts involving local governments, NGOs, and educational institutions. Educational programs, tree-planting campaigns, and neighborhood cleanup activities contribute to building a stronger connection between locals and their natural surroundings. These interactions not only enhance vigilance against intrusions but also strengthen advocacy for the preservation of these invaluable areas.

Spatial data plays a crucial role in enhancing our understanding of the distribution and dynamics of green spaces within urban environments. The available data on Butwal city's green spaces, as outlined in the 2019 city profile, is currently limited to a tabular presentation, lacking the valuable dimension of spatial mapping. The absence of spatial mapping during data collection poses challenges to comprehensive analysis and effective urban planning. Incorporating spatial information into data collection not only enhances the precision of analyses but also enables a more holistic understanding of the interplay between green spaces and urban development. Spatial data allows for the identification of clusters, gaps, or uneven distribution of green spaces, providing valuable insights for targeted interventions to improve accessibility and promote equitable green space distribution. Moreover, spatially mapped data aids in visualizing the connectivity and accessibility of green spaces, helping urban planners and policymakers design more efficient and inclusive urban landscapes. It can contribute to the development of strategies to optimize the placement of new green spaces, ensuring they cater to the needs of diverse communities. Incorporating spatial mapping into future data collection efforts will

significantly enhance the city's ability to monitor, plan, and create well-balanced green spaces that contribute to the overall health and quality of life for its residents.

To effectively protect green spaces amidst urbanization, a comprehensive strategy is necessary, encompassing community involvement, technological breakthroughs, and meticulous urban planning. Striking an equilibrium that enhances citizens' quality of life and environmental well-being requires a collective recognition of the inherent value of these areas. Seamless integration into the urban landscape becomes key to building a resilient and vibrant urban ecosystem, ultimately securing a sustainable future for cities.

5.1.   Strategies for urban green spaces in context of Butwal

The city's vision, as articulated by the Butwal Sub-Metropolitan City, emphasizes environmental protection, inclusivity, and good governance. The annual plans and policies highlight initiatives for green development, such as the establishment of a green city and the promotion of green roofs and walls.

5.1.1.   Spatial aspect

The local government has been initiating various green projects following the annual goals of the municipality. The plans such as one ward one park are great initiatives that will contribute to the issues of environmental injustice, but the size and placement should be considered accordingly. If possible, providing a single large patch in the ward at periphery with low population density should be considered but this will only be possible if there is enough land available. In this situation smaller green spaces like pocket parks and neighborhood green spaces can be provided which can be located significantly closer to the public. The annual plans consist of green projects which will increase the significant green coverage of the city. The plan of promoting urban green through a one house 3 tree program can be beneficial if implemented successfully. When a number of houses have tress along their either front yard or backyard, a series of green networks is created which acts as links between green patches. With a proper strategy and analysis such projects would contribute to a better urban environment.

- **Green space layout**

The plans such as one ward one park, one house two trees, green space along roadside are some of the strategies that contribute to improving green space layout. It supports the

creation of larger green spaces and connectedness. Roadside plantation, green ways create a network between different green spaces.

- **Alternative Green practices**

The practice of roof farming and roof gardening is one of the alternate approaches adopted by the local people. The roof of the buildings, mostly in residential areas comprises of various green elements such as vegetable farming and different aesthetic plants. The practice can be seen both in city core and periphery areas.

- **Ecological principles**

The municipality plans to apply ecological principles such as green ways and green belts to incorporate diversity. These approaches are important aspect as they provide better connection and network for various larger green spaces.

5.1.2.   Social aspect

- **Public Participation**

The current planning process includes demand collection from tole level to ward level to municipality. After deciding to carry out the project further planning process is started which includes the demand/necessity of components. This is a very good example of public participation. The process involves local people from the beginning of the project. Their needs are noted and analyzed and then are finalized. The locals were even involved during the planning process, they were consulted thoroughly during the planning period which develops a feeling of belonginess. This is a key factor for creating a better public space. There are various tole samiti's that are involved during the construction phase also, they even provide financial support and who cannot afford financing provide manual investment. This creates a great bond between local people and the place. Tole samitis are the prime stakeholders involved in the maintenance work too.

- **Social equity**

Through existing analysis, the social inequality in green space provision can be seen. Social equity ensures that green spaces are distributed equally in every community so that everyone gets to enjoy the benefits of nature. For these green spaces need to be placed near to people where they can be easily accessed. The city has developed an Integrated Urban Development Plan (IUDP), encompassing various plans such as land use, physical development, social, environmental, urban transportation, and multi-sectoral investment. The IUDP includes a focus on green zones, indicating a commitment to incorporating

green spaces into overall urban development. The city also has annual plans and policies that prioritize green development, environmental protection, and conservation. Specific programs include "One ward one park," "One forest one park one pond," and initiatives to develop small parks, and green trails. The program, developing park in each ward addresses the wards 8, 9, 10, 11, 14, 15, 17, 18, and 19 which have no recorded green spaces. Through this program these wards will be able to integrate green spaces and the small parks development will help integrating green spaces in each neighborhood. Prioritization should be given to neighborhood green spaces as these spaces play an important role in social cohesion and highly benefit the resident's well-being and quality of life. Plans also address the establishment of Butwal as a green city with subsidies for green initiatives like "one house-three trees."

5.1.3. Institutional aspect

Although there are plans and projects for green development, the municipality struggles with insufficient policies to guide and support these initiatives. The absence of clear guidelines hampers the effective implementation of green space projects, limiting their capacity to meet the growing demand for urban greenery. Strategic documents such as National Urban Development Strategy (NUDS), Planning Norms and Standards have become outdated and need revision. These documents need to be revised and enhanced as per today's need for the development of sustainable and livable cities. They only allocate a certain percentage for green space as a share of the total city area which raises a question, is it sufficient enough? With only the provided percentage for the green spaces major issue rises where how that percentage of the green should be distributed, is it fine if a city has a single green space that fulfills the percentage requirement or does the city needs strategically located multiple green space. The strategies for green space should be developed in such a way that it brings such places closer to people. While developing strategies, the demographic pattern and the zoning should be considered. This information can guide the development of targeted green space strategies that cater to the unique needs of each community. For instance, residential areas with a high concentration of families might benefit from larger parks with playgrounds and recreational facilities.

- **Green Space Standards**

The local plans and strategies lack the standard approach towards green space planning approach. The establishment of standards for green spaces serves as a cornerstone for

achieving social equity, environmental sustainability, and community well-being. The plans such as one ward one park can be effective if it can be guided by standards such as size, accessibility and proximity. The standards help to determine the area of green space and the walking distance. By integrating standards into urban planning frameworks, municipalities can create vibrant, accessible, and inclusive green spaces that contribute to the overall livability and resilience of cities. Therefore, the municipality should prioritize setting standards related to green space size and distribution, accessibility etc.

5.2.   Challenges for urban green spaces in context of Butwal

Upon analyzing the current urban landscape of Butwal, several issues pertaining to the provision of green spaces have become apparent. Butwal's rapid urbanization and development present constraints such as limited ground-level area and infrastructure complexities. Striking a balance between economic development and environmental preservation is crucial, requiring strategic planning to overcome these challenges. The key challenges identified include:

5.2.1.   Spatial constraints

Butwal faces challenges related to the availability of land for green spaces, exacerbated by issues such as land encroachment and the rapid transformation of land use from green spaces to built-up areas. The city's spatial constraints necessitate careful urban planning to accommodate both development and greenery.

- **Unequal Distribution of Green Spaces:**
Disparities exist in the distribution of green spaces across different wards, leading to unequal access and benefits for residents. Addressing this issue requires a strategic approach to ensure a more balanced and inclusive distribution of green areas throughout the city.

- **Conversion of Green Areas to Alternative Uses:**
The practice of renting out vacant plots designated for green spaces has resulted in a reduction of available green areas. This conversion of green spaces to alternative uses poses a threat to the overall green cover in the city.

- **Changes in Land Use Status:**

Public spaces undergoing a transition to private ownership pose a significant challenge. This shift in land use status can limit public access to recreational areas and green spaces, emphasizing the need for policies that safeguard public spaces from privatization.

- **Destruction of Green Spaces:**

Green spaces are under threat due to road expansion projects and social conflicts. While going through urbanization, the city has seen a significant reduction in green space quantity. A few of the green spaces located at the city core have been removed while expanding road networks or because of the change in land use. Balancing infrastructure development with the preservation of greenery is crucial to maintaining a sustainable and ecologically sound urban environment.

- **Limited Availability of Public Land:**

A significant challenge faced by the municipality is the scarcity of public land for green spaces. The dominance of privately owned or rented land, driven by economic interests, makes it challenging to allocate space for greenery. The existing land use planning, primarily categorizing land as residential, further limits opportunities for green development. The major challenge faced by the municipality is that most of the land is either privately owned or rented out, seeking economic benefits which makes it difficult to allocate land for greenery. The land use planning has been adopted but most of the land is categorized as residential areas which restricts the development of green areas. There is no space available for green development in the core area which warns local government to seek alternative greening measures.

- **Absence of Green Spaces in Proximity to the Public:**

The analysis reveals a lack of small pocket parks and tot lots within the city core, highlighting the absence of natural elements that could enhance the quality of life for city dwellers. Accessible green spaces contribute to residents' well-being and should be integrated into urban planning strategies.

5.2.2. Social constraints

- **Social Inequity:**

Ward-wise analysis reveals disparities in green space distribution, particularly in wards 8, 9, 10, 11, 14, 15, 17, 18, and 19. This social inequity raises concerns about environmental

justice, as residents in these wards may face disparities in access to recreational and environmental amenities, impacting overall quality of life.

- **Land Encroachment and Informal Settlements:**

Land encroachment, particularly along the river corridor in wards 11 and 12, poses a significant threat to potential green spaces. The presence of squatter settlements on public land limits opportunities for planned green development, emphasizing the need for measures to address and prevent land encroachment.

5.2.3. Institutional Constraints

- **Policy Gap**

The analysis identifies insufficient policies and standards as a challenge for urban green spaces. In Butwal, the Integrated Urban Development Plan (IUDP) and annual plans demonstrate a commitment to environmental protection and green development. However, the lack of specific quantitative criteria for green space provision and accessibility challenges the effectiveness of these policies. The "one size fits all" approach, as mentioned in the literature, may not account for Butwal's specific physical and social conditions. There is no defined typology or categorization of green spaces. The National Urban Development Strategy (NUDS) also highlights the need for proper definition of open spaces or green spaces. There is also an absence of categorization of green spaces. This is necessary as the city needs different types of green spaces. The municipality lacks effective systems for monitoring the status and condition of existing green spaces. Establishing regular monitoring and reporting mechanisms can help assess the health and functionality of green areas, informing future policy adjustments.

- **Urban green space planning process**

The planning process for green space in Butwal involves a systematic approach, starting from demand collection at the tole (neighborhood) level, progressing to ward level and municipal levels. Typically, the municipality takes the lead, either in response to identified needs or through proactive initiatives. Once a green space project is identified, it undergoes a realization phase, wherein it is either developed with the assistance of development partners or through a tendering process. In recent years, the presence of development partners has played a crucial role in supporting the planning process in Butwal, providing essential technical support. This collaborative effort includes consultation sessions with stakeholders, ranging from local representatives to municipal officers. While this process

is effective for individual green space development projects, there is a recognized need for a more comprehensive approach that addresses green space development citywide.

To initiate a citywide green plan, the first crucial step is to understand the current distribution of green spaces across the city. Creating a green map becomes imperative to visualize areas with deficiencies and plan interventions accordingly. Achieving this requires collaboration and cooperation among various stakeholders and departments. Urban planners, GIS specialists, the urban infrastructure department, and the environmental department must come together for an integrated approach. However, the implementation of such a comprehensive strategy faces challenges. One significant obstacle is the shortage of experts within the municipality, hindering the effective execution of these collaborative approaches. The lack of specialized personnel, such as urban planners and GIS specialists, limits the city's ability to undertake a thorough and integrated assessment of green space needs.

Another impediment to the citywide green plan is the scarcity of available land. As urban areas expand and face competing demands for space, finding suitable land for green spaces becomes increasingly challenging. This constraint poses a significant hurdle in the efforts to create a well-distributed network of green areas across the city. In addressing these challenges, it becomes essential for Butwal to invest in capacity building within the municipality, fostering the expertise needed for effective urban planning and GIS analysis. Collaborative efforts should also extend to exploring innovative solutions for maximizing the use of available land, such as repurposing underutilized areas or adopting vertical green space concepts.

- **Setting Standards**

While the Integrated Urban Development Plan (IUDP) and the annual plans indicate a commitment to green space initiatives, the absence of a standardized approach may impede the realization of broader goals related to social equity, environmental sustainability, and community well-being. The lack of the standards related to size, distribution, accessibility and other factors makes it difficult to guide the development of green spaces and affects the planning of these spaces which leads to the inconsistencies in planning process.

CHAPTER SIX: CONCLUSION AND RECOMMENDATIONS

6.1.   Conclusion

In the face of growing urbanization, this study emphasizes the crucial necessity of urban green spaces. Butwal's urban and green landscape analysis finds disparities in green area distribution, with densely populated wards frequently lacking adequate access to these essential resources. The city has experienced substantial population growth, contributing to a higher population density and built-up areas, demanding a delicate balance between development and the preservation of green spaces. This poses challenges for maintaining green spaces and requires strategic planning to balance development with environmental conservation. The ward-wise analysis indicates variations in both population and available green spaces, highlighting potential disparities in access to nature across different areas of the city. Efforts should be directed toward ensuring equitable access to green spaces for all residents, as it positively influences quality of life. With rising urbanization and environmental concerns, cities such as Butwal must emphasize the preservation and extension of natural spaces. As cities expand, officials must acknowledge the importance of green spaces and work toward comprehensive planning and laws that secure their availability for future generations. Finally, as cities continue to expand and grow, understanding the benefits of green areas in improving citizens' well-being, building community cohesiveness, and boosting environmental resilience is critical. Furthermore, local governments have considerable challenges due to the lack of defined typologies, norms, and supporting policies for green space planning and development. The lack of defined legislation and minimum criteria for green spaces makes ensuring fair access to nature within urban surroundings difficult. The difficulties of uneven distribution, poor accessibility, and the lack of clear planning guidelines highlight the need for comprehensive initiatives to protect and grow these vital resources. There should be strict laws and regulations to support and nature in cities. The national and local policies support nature in the city but fail to provide proper guidelines on incorporating nature within the city. There are inadequate framework or policies that enforce the minimum standards for green areas such as quantity and quality standard. Having such a standard is essential as such standard protects the nature in a city and also the planners are supposed to implement these standards which can sometime increase the green areas quality and also quantity. Providing natural spaces is much more difficult in core city areas as there is very little to non-open space left. The intensity of involvement of the city administration and the degree

of citizen participation are identified as crucial factors influencing UGS planning and management. Urban green spaces planning is indispensable as a basic task for sustainable city development.

There are several global cities that have been successful in incorporating green areas in city with various alternative measures and increase the green coverage. The lessons can be learnt from several case studies conducted during the study. The thorough study of urban green spaces conducted by these cities have assisted in recognizing and addressing issues related to urban green space planning and management and develop and implement policy frameworks that support the provision, maintenance, and expansion of green spaces. Such plans encourage the urban planners and policy makers to prioritize green spaces and provide a way forward. These plans not only provide nature in cities but also provide an interactive space for people and encourage physical activity which promote health and well-being of the public and elevates quality of life. Urban planners and designers collaborate with various stakeholders to come up with a strategic plan that not only focuses on quantity of green areas but also the quality and accessibility of such public green areas.

6.2. Recommendations

- Urban green space demand of the city, its quality and accessibility are one of the most important things to consider while planning green spaces.

- Reorganize departments and offices involved in urban green spaces, clarifying individual responsibilities to increase efficiency in creating and improving these spaces. Integrating expertise from various fields, including environmental science, urban planning, landscape architecture, and sociology, provides significant support to create a well-rounded planning approach.

- Review and revise existing policies to align them with current ecological and social needs. Ensure that policies are adaptive to changes in urban development and environmental conditions.

- Establishment of policies and flexible planning standards on national level that can adapt to changing urban landscapes is necessary. It is essential to consider variations in population density, topography, and cultural practices when setting standards.

- Conducting a thorough assessment of existing urban green spaces and mapping is necessary to be up to date on any kind of changes in green spaces. Implementation of a system for continuous monitoring and updating of spatial data to track changes in green space usage and effectiveness provides regular documentation. Utilize GIS and other technologies to map and track green spaces, allowing for better decision-making and resource allocation.

- Collective vision and goals for green development of a city should be developed and implemented effectively. Develop a green infrastructure plan that identifies key areas for green spaces, considering factors such as ecological significance, connectivity, and accessibility.

Recommendations for high density wards:

- Alternative ideas for green space development should be considered for the physical constraints. Such as green roofs, green walls, greenways, green corridors, vertical greening etc. Many of the residential buildings are seen adopting roof gardening and farming. With the encouragement of local government this can be promoted as one of the ways of bringing nature to the city. Policies that incentivize and streamline the process of implementing such green space alternatives should be formulated. This could involve tax incentives, grants, providing material at lower prices, or simplified regulations for property owners and developers who incorporate these eco-friendly practices into their buildings.

- Exploring the possibility of converting unused or underutilized spaces, such as vacant lots, parking spaces or disused industrial areas, into small, multi-functional green spaces. Even such areas can be developed as effective green spaces if properly planned. There are parking spaces at the city core which can be developed as a green parking space and many private vacant lots can also be promoted to well-maintained green spaces if collaborated with the private sector.

- Partner with schools and other public institutions to utilize their grounds as public green spaces outside of working hours. This can provide additional green space in neighborhoods and promote physical activity among children.

- Integrating green lanes within service roads and setback areas fosters a harmonious coexistence between urban infrastructure and nature, offering a seamless blend of functionality and environmental stewardship in community planning. Other urban infrastructures should combine green areas whenever possible. The city has a well-defined road network, integrating green ideas such as green ways where each side of roads is covered in lush greens is needed, it will also act as buffer between the different land use and reduce the sound pollution to the neighboring residents.

Recommendations for low density wards:

- Securing public land and existing green area preservation should be prioritized. The peripherical land is still developing which provides a chance to protect and secure public lands. The

- Review and update zoning regulations, byelaws to include provisions that mandate a minimum percentage and proper location of green space in new developments. Diversify land use plans to include dedicated green space zones.

- Development of the green corridor along the river with interactive green space rather than just linear tree canopies.

- Public-private partnerships: Collaborate with private developers to incorporate green spaces into new developments. The new development should be equipped with pocket parks and neighborhood parks as an essential part of the community. Developers can be incentivized through tax breaks, density bonuses, or other means.

Educating the community about the manifold benefits of green spaces is vital for instilling environmental consciousness and promoting proactive measures. In navigating these challenges, strategic planning, community collaboration, and the formulation of supportive policies are essential to ensure a sustainable and livable urban environment for the residents of Butwal. As the city anticipates a decrease in population growth in the coming years, there is an opportunity for proactive measures to balance development with environmental preservation with development of dedicated zones in land use plan for new communities if proper actions are taken timely. Development of diversified land use plan for new development that designates specific areas for green spaces, ensuring a balance between residential, commercial, and recreational zones.

6.3. Recommendation for Future Research

Due to time constraints, this study focused on planning perspective only. However, future researchers can expand the study to include more diverse study areas. The current research identified the challenges of green space planning and suggests strategies on how these can be overcome. Further research can be carried out on developing a detailed inventory of green spaces and identifying the potential areas for green development.

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Date: November 26, 2023

To Whom It May Concern:

This is to certify that the paper titled "*Strategies and Challenges for Urban Green Spaces: A Case Study of Butwal*" (Submission# 346) submitted by **Manisha Karki** as the first author has been accepted after the peer-review process for presentation in the 14th IOE Graduate Conference being held during Nov 29 to Dec 1, 2023. Kindly note that the publication of the conference proceedings is still underway and hence inclusion of the accepted manuscript in the conference proceedings is contingent upon the author's presence for presentation during the conference and timely response to further edits during the publication process.

Bhim Kumar Dahal, PhD
Convener,
14th IOE Graduate Conference

ANNEX 3: IOE GC ARTICLE

STRATEGIES AND CHALLENGES FOR URBAN GREEN SPACES: A CASE STUDY OF BUTWAL

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Abstract

Urban forms are changing and becoming more ad hoc. Urban green spaces are an important part of public open spaces and services provided by a city and serve as a health-promoting setting for urban dwellers. It is therefore necessary to ensure that public green spaces are easily accessible for all population groups and distributed equitably within the city. The successful protection, creation, and development of green space is one of the key elements required to achieve sustainable urban development. The case of Butwal Sub-Metropolitan City is analyzed in this paper to examine the challenges and strategies involved in safeguarding these essential green areas. A mixed methodological approach was considered for data collection, including interviews, observation, mapping, and analysis using various parameters and collection of required information from documents. The study reveals disparities in the distribution of green space around the city, particularly in highly populated regions, with an emphasis on accessibility, distribution, and the impact of local regulations. This study has made some important observations by carefully examining the urban environment of Butwal. First, it showed that there were differences in how green spaces were distributed throughout the city, with densely crowded wards frequently lacking sufficient access to these vital amenities. Second, it brought to light the difficulties encountered by local governments in the absence of clear typologies, standards, and enabling laws for the design and development of green spaces. The study also highlighted the difficulty in ensuring equal access to nature in urban settings due to the absence of defined legislation and minimum standards for green areas. By addressing the challenges and strategies explored in this case study, stakeholders can work towards creating more sustainable and livable urban environments, ensuring that nature remains an integral part of our urban landscapes, fostering well-being, community cohesion, and environmental resilience.

Keywords

Urban Green Spaces, Urbanization, Strategies, Challenges, Livable cites

1. Introduction

At present 55 percent of the world's population resides in urban regions, and by 2050, that number is projected to rise to 68 percent [1]. This will result in expansion and/or densification of urbanized areas. One issue identified is the lack of urban green space in densified urban areas and the removal of green space when densifying city areas. With an increasing percentage of the population living in urban areas, there is a growing need to ensure that cities are planned and developed in a sustainable and livable manner. Green spaces make important benefits to the city, its citizens, and the ecosystem. However, due to rapid urbanization, these contributions could not be properly reflected in urban space. Living in cities comes with certain drawbacks, including limited access to nature and increased exposure to environmental threats like air and noise pollution. The dilemma of how to become sustainable and provide more areas for public green spaces emerges when cities throughout the world experience a continuous increase in population and built environment.

While each city faces different challenges and restrictions in executing the greening imperative, most physical, and physiological barriers to vegetation development tend to be uniform [2]. Urban environments in the world are increasingly facing the triple effects of pollution, congestion, and environmental degradation. Urban green encourages social cohesion by acting as a natural gathering place for the community. They also foster a sense of identity and community

in urban areas. How successfully Urban Green Spaces mitigate air pollution depends on the amount of vegetation in a region. Urban greenery provides a safe and healthful atmosphere for jogging, running, and strolling as well as an inviting backdrop for social contact, exercise, and leisure activities. To fulfill human needs for relaxation, esthetics, leisure activities, and environmental preservation, green spaces must be organized as ecologically useful spaces that coexist. Effective planning, administration, and preservation of these spaces are essential topics in urban sustainability discussions. They provide a wide range of social, economic, cultural, and psychological benefits to urban residents and tourists, addressing the challenges posed by urbanization and migration. Prioritizing green spaces in urban contexts is vital for improving residents' quality of life and promoting sustainable use of natural resources, emphasizing the need for policymakers to recognize their significance. Understanding how to maximize the distribution and design of green infrastructure might help cities become more resilient to environmental threats.

The lack of comprehensive planning strategies and rules impedes the incorporation of green spaces into the larger urban fabric, resulting in poor distribution, insufficient connectedness, and limited accessibility for city dwellers. Many cities face inequitable allocation of urban green spaces, which disproportionately affects underprivileged neighborhoods. This uneven distribution not only damages social cohesion and communal well-being, but it also perpetuates environmental inequities within cities.

1.1 Research objectives

The main objective of this thesis is to study the challenges and strategies for green spaces planning. The research objectives for this thesis are:

• To analyze the existing urban green spaces.

• To identify the challenges faced by institutions during the planning process.

• To investigate the strategies adopted by institutions in planning urban green spaces.

• To develop strategies that will help to incorporate green spaces.

2. Literature review

2.1 Urban Green Spaces

The phrase "urban green space" refers to all areas of land that fall within this definition of "green space," whether they are publicly or privately held [3], [4]. While some research used the phrases open green space or green open space, several studies used different terms such open space or green space. Open spaces are areas that contribute to the visual urban landscape and quality of life as a part of the urban space, have public access, and combine urban and green spaces [5], [6]. Urban green space is defined as all urban land covered by vegetation of any kind. This covers vegetation on private and public grounds, irrespective of size and function, and can also include small water bodies such as ponds, lakes or streams ("blue spaces") [7]. Although designated as a discretionary service there is no doubt that green space forms a vital part of local authority service provision, offering a broad and varied range of facilities and opportunities to all its residents and visitors.

Green spaces exist in a great variety of shapes, structures and types within the city or urban fabric. Within a city, there is a hierarchy of green areas ranging from regional to local. In contrast to local level green areas, which have an impact on residents' quality of life, regional level green areas contribute to the ecology, biodiversity, and environment of the entire region. The typology of green spaces considered for this study is public green spaces which provide some kind of engagement.

Table 1: Public green spaces with their optimum size and distance [8].

Type	Size	Distances from homes
Regional Parks	400 ha	3.2 to 8 km
Metropolitan Parks	60 ha	3.2 km
District Parks	20 ha	1.2 km
Local Parks and Open Spaces	2 ha	Distances from homes 400 m
Small Open Spaces	Under 2 ha	Less than 400 m
Pocket Parks	Under 0.4	Less than 400 m
Linear Open Spaces		

2.2 Guiding Principles

Herzele and Wiedemann (2003) present several basic principles and presumptions to guide the construction of an indicator.

These principles make an effort to clarify these concepts and demonstrate how they relate to study.

The first principle is citizen based. Green spaces must be viewed in relation to the locations where people live and in a way that represents their perspective because they are meant to support urban populations' quality of life. Secondly, preconditions for use indicate that prior consideration should be given to the use-related prerequisites (proximity, accessibility, surface, safety, etc.). Green places won't draw people in if these conditions are not met. The third principle, variety of qualities indicate numerous characteristics provide a range of urban green related experiences and activities adjacent to residences and places of employment. And the last one, multiple use which means free and frequent use without regard for their original functions [9].

2.3 Indicators for green spaces in urban settings

The indicators developed to examine the physical characteristics of green spaces consider the two key dimensions of quantity and spatial distribution, and they are described in the following sections [10].

Table 2: Indicators of green spaces

Indicators	Name	Scale
Quantity of green space	Public Green Space per inhabitant Green Space per built-up area	Municipal
Spatial distribution and accessibility to green spaces	Proximity to Green Space	Municipal

Indicators associated with the quantity of green space: To calculate the indicator of green space per resident (in m2), the total area of green space is compared to the population of each municipality. The total amount of green space is divided by the built-up area of each municipality to get the land cover per green space of the built-up municipal territory.

Indicators associated with the spatial distribution of and the accessibility to green spaces: In addition to the indicator of the overall area of green space, it is crucial to consider how the green space is distributed within the municipal territory. The two extreme distributions, according to theory, are:

• limiting all green space to a single community and

• distributing green space equally among all communities.

2.4 Strategies for Urban Green Space

A strategy is in general a policy for achieving several specific objectives. In the case of green spaces, strategies are required to address a variety of (ecological) environmental, social, and economic policies and sustainable development objectives. They must also be able to effectively defend the objectives against other issues of urban development and planning in the political discourse of decision-making and resource allocation. An urban green space strategy addresses both the current state of green spaces (including all issues, conflicts, potentials, and needs) and

2

the collective vision and objectives for the future. It lays out a shared vision for enhanced green spaces that satisfies community requirements and serves as a benchmark for allocating resources and creating action plans. A strategic plan creates policies and initiatives to fix issues and seize opportunities. It offers a logical and trustworthy framework for making decisions that may be applied to various departmental/professional levels and working procedures.

2.5 Challenges for Urban Green Space

The identification of problems and obstacles can be gleaned from three aspects of the problems regarding green spaces: spatial problems, organizational problems and economic – financial problems. These problems are reflected in the planning, managing and maintaining of green spaces. Although there is a lot of information on UGSs' advantages for cities, their creation, administration, and upkeep are still difficult tasks. There is a growing emphasis on the need for more intensive development in urban areas, centered around the idea of the high-density "compact city," which raises questions about how and where to fit green spaces.

2.6 National plans, policies, and strategies

2.6.1 Nepal Urban Development Strategy (NUDS), 2017

The Nepal Urban Development Strategy 2017 offers a forward-thinking and environmentally conscious roadmap for sustainable urban evolution, emphasizing the preservation and promotion of green spaces, low-carbon emissions, and measures to combat urban heat islands. It addresses the challenges of fragmented metropolitan areas and encroachments on public land through comprehensive zoning regulations. However, it lacks standardized definitions for "open spaces" and municipal-level information, which should be improved for effective implementation. The strategy underscores the importance of integrating natural elements within urban areas and recognizes the role of parks and open spaces in enhancing quality of life. It advocates for equitable access to open spaces as a fundamental principle of urban planning, although this issue has historically been neglected in Nepal's urban development discourse and practice.

According to the open Space milestone of Nepal Urban Development Strategy (NUDS), 2017, green space standard of the following is to be initiated:

• 2.5 percent of land as public open green space at ward level (maintained, monitored) in existing urban area.

• 5 percent of land as public open green space at ward level (maintained, monitored) in new urban area.

2.6.2 Environment-friendly Local Governance Framework, 2013

The Environment-Friendly Local Governance Framework in Nepal aims to establish environmental governance and promote sustainable, eco-friendly practices at various levels, from households to districts. Its objectives include fostering responsibility for sustainable development at the grassroots level, promoting coordination between environment and development efforts, and enhancing local ownership of environmental management. The framework provides specific indicators for municipal-level green planning, including the establishment of parks, promotion of greenery, biodiversity conservation efforts, climate change programs, and awareness campaigns on environmental protection.

2.6.3 Land Pooling Reference Manual, 2072

The document, published jointly by MoUD and DUDBC, serves as a guideline for land pooling, emphasizing its importance for efficient land development. It outlines the concept and process of land pooling while acknowledging the need for open spaces and park development within consolidated areas. To strike a balance between development and landowner concerns, it recommends setting aside 5 percent of the land for open spaces, with specific criteria such as a minimum size of 300 sq.m. and a width of at least 12 m. These open spaces are intended to benefit the community, and their preservation and safeguarding by neighborhood members are essential to ensure a safe and sustainable environment for everyday use.

3. Methodology

The research studied the cases (urban green spaces) as it is and answer the research questions through survey, observations, questionnaire, and case studies findings hence follows pragmatic paradigm. The data is collected using both qualitative and quantitative methods. This research has been designed as exploratory as well as solution seeking which started from getting a thorough understanding of the urban green spaces and how urban planning affects the green spaces of a city. Quantitative Data will be collected based on distribution, accessibility, and quantity of urban green spaces. This can be done through surveys, GIS mapping, and data from government agencies and research institutions. Qualitative Data is gathered through interviews, focus group discussions, and observations, key informant interviews. To study urban green spaces and their accessibility to the public, the challenges related to urban planning and practice issues, a conceptual framework was prepared.
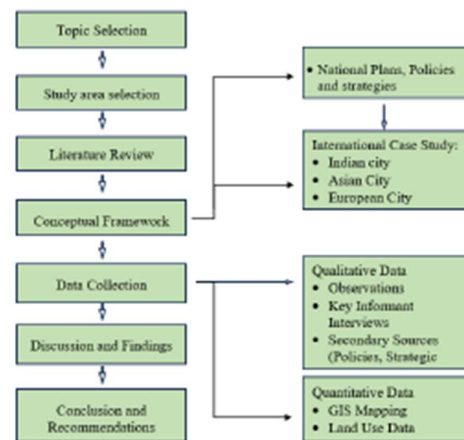

Figure 1: Methodological Flowchart

4. Study Area

4.0.1 Butwal Sub-Metropolitan City

The city is one of the tri-cities of the rapidly growing Butwal-Tilottama-Bhairahawa urban agglomeration primarily based on the Siddhartha Highway in West Nepal. It connects western Nepal with the capital Kathmandu through the highway and air links (via Gautam Buddha International Airport at Siddharthanagar). The city stands beside the bank of Tinau River, and at the northern edge of the Terai plain below the Siwalik Hills. The vision of the Butwal Sub-Metro is Equitable, Dignified, and Capacitated-Livable Butwal and is working accordingly.

The total area of the city is 101.6 km2. The population size according to census data 2021 is 194335 and the population density is 1913/km2. The municipality has 3.1 percent annual population growth from 2011 to 2021. The total number of households is 50565 during 2021 census.
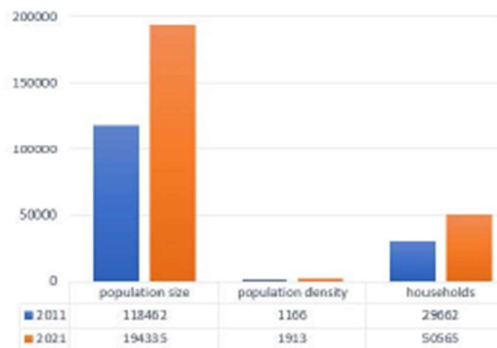

Figure 2: Population data

Ward wise population distribution The ward wise population distribution gives a clear vision of population distribution. As we can see in the chart below, ward 11 has the highest population as it lies in a city center where the attraction is comparatively high and ward 18 has the lowest population as it lies on the periphery of the city.
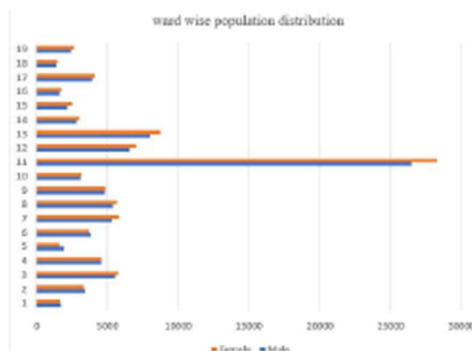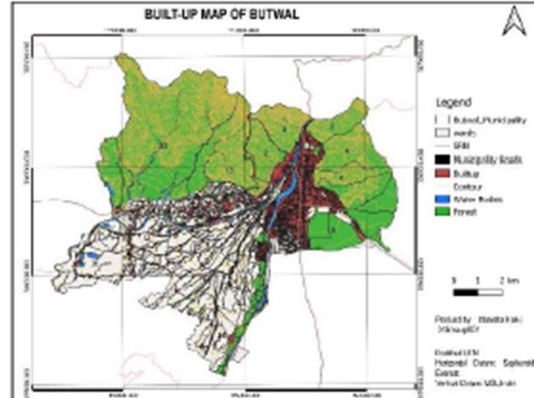

Figure 3: Wardwise population distribution

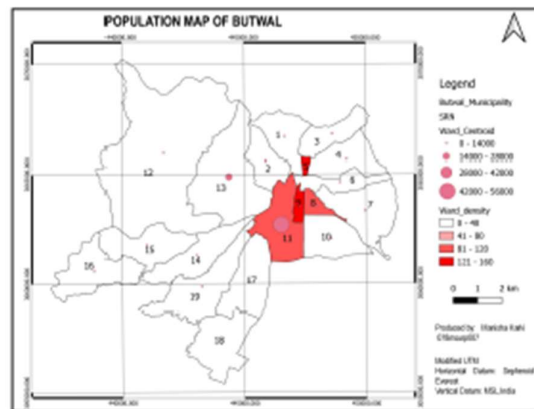**Figure 4:** Land-use map of Butwal (Source: Department of Survey)

Figure 5: Population Map of Butwal

4.0.2 Local plans, policies, and strategies

The Integrated Urban Development Plan (IUDP) represents an effective approach for the comprehensive and sustainable development of urban areas, emphasizing cross-sectoral cooperation, a multidisciplinary framework, and participatory involvement. The IUDP places significant emphasis on environmental protection, inclusivity, and good governance, aligning with the municipality's vision of creating an environmentally friendly city while prioritizing plans and programs geared towards urban environment protection and conservation. Some of these programs that focus on increasing green spaces useful to public are:

• A botanical park to be developed within the shivanagar community forest and siddhababa religious forest.

• Introducing sustainable city concepts such as green city, garden city.

• Developing supporting policies for the annual plans of municipality that promote green spaces and encourage public to include green roofs, green walls and urban farming whenever possible.

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The Annual Plans and Policies 2079/080 incorporates includes plans, goals and programs promoting green provision in a city such as:

•One ward one park •One forest one park one pond •Land deformed in Jyotinagar, laxminagar chure hills to be developed as parks and sports playground after land maintenance. •A memorial park will be developed in memory of martyrs: B.P. Koirala, Puspalal Shrestha and Surya Prasad Pradhan in Devinagar, ward 11. •A green trail along the Sukhaura river is to be developed along the ward 3, 4, 6, 7, and 8. •Promoting tourism in parks and open spaces.

4.0.3 Existing Green spaces Analysis

Green spaces used by the public for various activities and spaces providing physical and social benefits for the people are included under green spaces. In the map the size and location of green spaces can be seen. Green spaces of varying size and in scattered patterns. Most of the Green spaces are located downhill and are part of the community forest area.
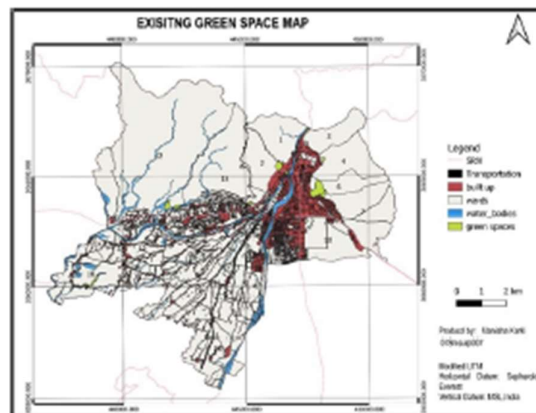

Figure 6: Existing green space map

The analysis of existing spaces is done applying various parameters through GIS mapping and data is collected through municipal profiles and published documents. The existing green spaces will be evaluated in terms of quantity and accessibility. The quantity will be examined based on the distribution and supply of public green spaces as a percentage of all the city area, the m2 of urban green space per inhabitant. Accessibility examines walkability. For the analysis various parameters are created as in table:

Table 4: Analysis of existing green spaces

Metrics	Analyzed data	Description
Total area	101.6 km2	Total land area under metropolitan
Total population	194335	Total population according to 2021 census
Built-up area	13308576.96 m2	Tentative area as per GIS
Total green area	596849.1 m2	Tentative area as per GIS

Ward-wise analysis of Green Spaces

Table 5a: Green area percentage of each ward

Ward	Total area (m2)	Green Area (m2)	Green Area %
1	3511696.99	11411.8	0.32%
2	2924965.45	78814	2.69%
3	2934926.39	11095.3	0.38%
4	3892471.41	21352.1	0.55%
5	226234.475	809.547	0.36%
6	2323980.63	131540	5.66%
7	5952273.52	159097	2.67%
8	950248.904	2844.08	0.30%
9	619197.092	-	-
10	4233041.04	-	-
11	5127063.44	1408.04	0.03%
12	27224785.1	94092.8	0.35%
13	10296008.4	22079	0.21%
14	4814807.44	-	-
15	4976311.05	-	-
16	5480779.99	58719.1	1.07%
17	5327733.28	3353.31	0.06%
18	5507620.87	-	-
19	6668986.46	-	-

Table 5b: Green space per ward

Ward	Population	Built-up Area (m2)	Green Area (m2)	Green space per inhabitant	Green space per built area
1	3377	326949	11411.83	3.38	0.03
2	6760	405554	78813.968	11.66	0.19
3	11268	427959	11095.306	0.98	0.03
4	9115	343518	21352.068	2.34	0.06
5	3493	226088	809.547	0.23	0.00
6	7474	428509	131540.21	17.60	0.31
7	11115	495881	159097.34	14.52	0.52
8	11037	878187	2844.078	0.26	0.00
9	9665	590645	-	-	-
10	6266	685626	-	-	-
11	54699	2750937	1408.043	0.03	0.00
12	13567	1098857	94092.847	6.94	0.09
13	16762	1247355	22078.952	1.32	0.02
14	5804	706024	-	-	-
15	4652	668256	-	-	-
16	3371	388341	58719.054	17.42	0.15
17	7984	710270	3353.309	0.42	0.00
18	2861	383168	-	-	-
19	5067	472016	-	-	-

The comprehensive analysis of Butwal's urban and green landscape, population distribution, and accessibility, utilizing GIS mapping and data from the survey department and open street map, highlights significant challenges in providing adequate green spaces within the city. Despite a substantial built-up area, the city's green space allocation is limited, with variations in land usage among different wards. The study reveals that densely populated wards like Ward 9 and Ward 5 have insufficient green space, primarily located in urban areas. The analysis underscores the importance of proximity to green spaces for creating a walkable and livable urban environment, but it also raises concerns about equitable access to nature, particularly for wards with no recorded green areas. The absence of even a small pocket park within the city core disconnects residents from nature, emphasizing the need for a more balanced approach to green space allocation and urban

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planning to promote social cohesion and improve overall quality of life.

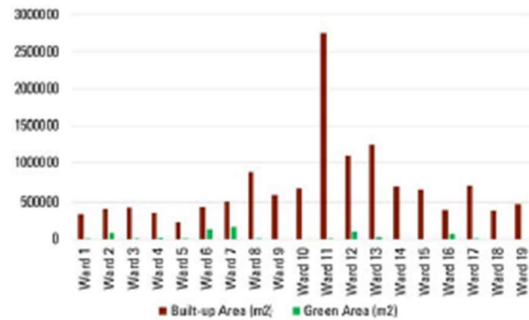The graphical representation for the clear visualization for the comparison is shown below:

Figure 7 : Ward-wise analysis of green spaces

Table 6: Analysis based on indicators of green spaces.

| Quantity measures	Percentage of area	0.58%	public green spaces as a percentage of all the city area
	m2 per inhabitant	3.07 m2	the m2 of urban green space available to per inhabitant of a city
Spatial distribution and Accessibility	Easy access (450m buffer)	2976728.356 m2	Within 5-10 minutes walking distance
	Medium access (800m buffer)	5710377.660 m2	Walkable distance
	Built-up Area without walkable access to green spaces	7598199.3 m2	
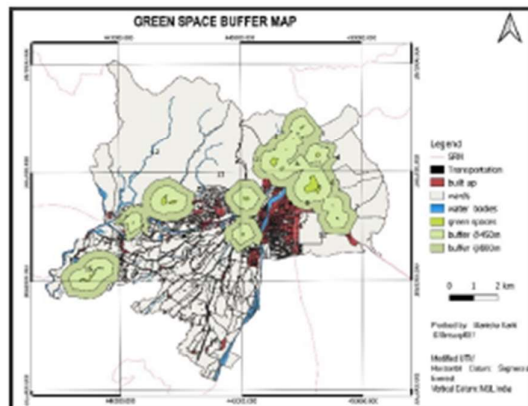
Figure 8: Green space buffer map

5. Findings and Discussion

The challenge of preserving green spaces in rapidly urbanizing cities is critical due to constant pressure for development and limited available land. Concerning its green spaces, the city
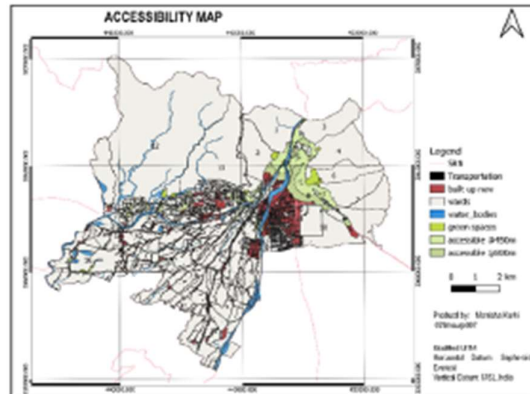

Figure 9: Green space proximity map to built-up

has spatial issues. There are few opportunities for recreation and green growth in the core region due to the noticeable lack of open or public places. On the other hand, the peripheral is primarily allocated for residential uses, which leaves little area for green efforts. The small remaining green spaces in the city have been converted to parking lots or are now used for a variety of other purposes, which only serves to exacerbate the problem. It is extremely difficult to guarantee that all city residents have equal access to green spaces given their uneven and scattered distribution throughout the metropolis. To protect these vital areas, it's essential to foster environmental consciousness among communities and promote a sense of shared responsibility. The city has major strategic shortcomings when it comes to managing its green spaces. First, the lack of a standardized typology or classification for green areas makes it challenging to plan and distribute resources effectively. Additionally, the lack of precise guidelines and standards for the provision of green space makes it challenging for the city to create and manage these crucial areas. It's significant because current regulations do not account for the varied levels of urbanization, the need-based provision of green spaces or the variation of topographical circumstances inside the city. It is crucial to close these policy gaps to make sure that green areas are properly dispersed, planned, and maintained to suit the shifting demands of the city and its inhabitants.

The local government has initiated green projects, such as the "one ward one park" initiative but faces challenges due to land availability and private ownership as mentioned by the key informant during KII. Land use planning is hindered by residential categorization, limiting green development. Alternative solutions include repurposing open spaces used for parking. Land encroachment along river corridors is a significant issue, prompting plans for memorial parks and gardens to protect land and increase green space.

Lack of supporting policies makes planning green spaces difficult. Public participation is encouraged through demand collection and consultation, fostering a sense of belonging among locals. According to the urban infrastructure development officer, in the coming years, population trends are expected to decline, and development has shifted southward, impacting agricultural land and urban environment quality.

Strict laws and regulations supporting green space development

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are lacking. National and local policies fail to provide clear guidelines for incorporating nature within cities, enforcing minimum standards for green areas. Access to nature in urban environments is crucial for well-being, community cohesion, and urban development. The absence of green spaces can lead to social disparities, health challenges, and urban degradation, emphasizing the importance of nature in cities.

6. Conclusion

In the face of growing urbanization, this study emphasizes the crucial necessity of urban green spaces. Butwal's urban and green landscape analysis finds disparities in green area distribution, with densely populated wards frequently lacking adequate access to these essential resources. Furthermore, local governments have considerable challenges due to the lack of defined typologies, norms, and supporting policies for green space planning and development. The lack of defined legislation and minimum criteria for green spaces makes ensuring fair access to nature within urban surroundings difficult. The difficulties of uneven distribution, poor accessibility, and the lack of clear planning guidelines highlight the need for comprehensive initiatives to protect and grow these vital resources. With rising urbanization and environmental concerns, cities such as Butwal must emphasize the preservation and extension of natural spaces. As cities expand, officials must acknowledge the importance of green spaces and work toward comprehensive planning and laws that secure their availability for future generations. Finally, as cities continue to expand and grow, understanding the benefits of green areas in improving citizens' well-being, building community cohesiveness, and boosting environmental resilience is critical.

Acknowledgments

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