

‘Green Infrastructure Planning’

Towards mainstreaming the preservation of Urban Green Spaces and Ecosystem Services it Provides in Urban Planning Process

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As the world urbanizes rapidly, humans are increasingly exposed to the effects of urban development. Degradation of ecosystem services like clean air and recreational services caused by the reduction of urban green spaces or its network called the green infrastructure, leading to an eventual decline in human well-being is the main issue in urban areas like Thimphu today. Lack of a system that integrates green infrastructures planning in the mainstream development process, as well as the general perception of users and decision makers alike on the importance of ecosystem services to individuals’ and city’s well-being are the main causes thereof. At this backdrop, this study is an exposition of two interlinked approaches that serves to respond to the mentioned issues; firstly, how green infrastructure and the ecosystem services that it provides can be assessed for its economic value to exalt and validate its status from being a mere standalone space to a life and economy supporting infrastructure and ensure the prioritization of these spaces in decision making processes. Secondly, how green infrastructure planning as a tool can be used to mainstream the green spaces and its benefits in urban planning and development process for the sustainable future of the urban areas like Thimphu. Furthermore, the study also gives a due heed to the legal and institutional framework in the country to understand the possible areas for integration of the aforesaid approaches in the mainstream urban planning and development process.

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1. Introduction

Planet Earth has inherited an unique natural characteristic compared to its sister planets. These characteristics, or for that matter, natural environment has been for ages the basis for all forms of life (Daily, et al., 1997). The system wherein living organisms interact with each other and with the non-living components of its environment for energy and nutrients to survive and reproduce is called the ecosystem (United Nations, 1992). Whilst these living and non-living

components interact with each other through processes such as nutrient cycles and energy flows, humans receive multitude of benefits through these ecosystem processes, which are also called the ecosystem services (Daily, et al., 1997). At this instance, it is important to understand the status of the inverse relationship that these services share with development, viz., declining ecosystem services and increase in global development. Even more so, this trend is more pronounced in urban areas that are developing at an exponential rate. Unlike the wide range of natural components and its processes that can be found across the world, in urban areas, the sources of these ecosystem services are limited to urban green spaces network called the green infrastructure, which are decreasing by the day. Likewise, notwithstanding the national contribution and commitments that Bhutan upholds in terms of its rich natural environment, the issues of deteriorating green infrastructure and the ecosystem services that it provides are prevalent in Bhutanese urban landscapes. For instance, Bhutan has more than 70% of its land under forest cover, and as enshrined in the constitution, the forest cover will have to be more than 60% at any point of time in the future. However, the open spaces, riparian corridors that otherwise used to be interspersed with the urban built environment in the olden days are dwindling at a soaring rate. Similarly, albeit the fact that Bhutan has several initiatives, including the Principle of Gross National Happiness that advocate and support the preservation of its environment, the access to green open spaces, or the green infrastructure in its entirety, in the urban areas, are often limited to its peripheries. In fact, the green open space per capita ratio within major urban centers in Bhutan like Thimphu and Phuentsholing is below the global standard of 9 sqm per person recommended by the World Health Organization (World Health Organisation, 2009).

One of the reasons that underlie the said issue is the fact that urban areas such as Thimphu is confronted with several urban challenges, like rapid urban population growth leading to concomitant socio-economic and infrastructure development needs, which stand against the meagre developable urban land. In the context of the said urban challenges, the available green open spaces are often considered as the most appropriated site for such developmental needs and in the process, these spaces are replaced by the more environmentally recalcitrant gray infrastructure. Despite several attempts to abate the issue from the environmental and social fronts, these spaces often give way to a proposal that portrays highest economic benefits. Moreover, the green infrastructure within the city is forgone at the pretext of having the same elsewhere, usually outside the city limits. Therefore, in the light of the aforesaid issue, it is imperative to comprehend and unravel the question:

- *Research Question:* How are ecosystem services of urban green spaces measured and prioritized as an input to mainstreaming green infrastructure planning in the urban development processes for the well-being of the urban residents?
- *Aim and objective:* The study intends to disseminate awareness and broaden the perspective on urban green spaces as an important component of an urban area, especially due to the wide range of ecosystem services that they provide, as well as due to the huge economic implication affiliated to the loss thereof. The study also intends to expand Green infrastructure planning tool to mainstream the preservation of the green infrastructure and its ecosystem benefits in the planning and urban development processes.
- *Methodology:* Due to the novelty of the study in the country, the study will be mostly based on the secondary literature and cases pertaining to the subject elsewhere in the world. Nonetheless, an essential part of the study, that will bring to light the relevance of the study in the local context of Thimphu, is the study of existing status of its urban green spaces. Furthermore, in order to bolster the study, inferences from a residents' survey carried out in the neighborhoods in Thimphu shall also be expanded as a part of the study method.

2. Ecosystem Services and Green Infrastructure

The Millennium Ecosystem Assessment (MA), a global initiative, defines ecosystem services as: “the benefits that people obtain from ecosystem”. This includes goods, such as timber, and services such as air purification. The MA apportions these services into 4 different yet interlinked categories:

- Provisioning services: Goods provided by the ecosystem like timber, food, etc.
- Regulating services: Benefits received from the ecosystem regulation, such as water purification, air purification, flood control, regulation of climate (carbon sequestration).
- Cultural services: Benefits such as recreation, aesthetics, and mental/personal growth received from the ecosystem.
- Supporting services: Biological processes like soil formation and nutrient cycle necessary for the production of all the other services. (MA, 2005)

In an urban context, despite the fact that urban green spaces are attenuating, one can find different types of green spaces like parks, vacant lands, riparian or river corridors, etc. These urban green spaces are hotspots of various ecosystem services mainly regulating and cultural services. For example, walkways and playgrounds surrounded by green forests provides cultural

services like recreation and beautification, at the same time providing regulating services like air, temperature, and soil regulations. These types of recreational urban green spaces at a wider context of the city offers an opportunity to form a network that constitutes the said urban green spaces also called the hubs connected by corridors such as rivers, creeks, and tree lines and are termed as Green Infrastructure (Schäffler & Swilling, 2012). The presence of green infrastructure (GI) or the network of urban green spaces is vital for urban areas and their ecosystems, as it equips them with the ability to facilitate at all spatial scales the aforesaid ecosystem services that support healthy and secure urban environment for an enhanced well-being of their urban populace.

3. Problem Definition: The Need for a Comprehensive Approach to Green Infrastructure and Ecosystem Services in Urban Areas (Global to the Local case of Thimphu)

Global case: As the world urbanizes, green spaces in the urban areas have declined rapidly, which has instead led to the reduced ecosystem services. For instance, The United Nations Department of Economic and Social Affairs (UN DESA) has mentioned in its report ‘the World Urbanization Prospect: the 2014 revision’ that 54% of the world’s population resided in urban areas in 2014. This was a dramatic increase from 30% of urban population in the 1950s. Further, the report revealed that by 2050 urban population is projected to be 66% of the total global population (UNDESA, 2014). If the current trend of urbanization continues, the urban land cover areas are extrapolated to triple from occupying 0.51% of the total earth’s land area in 2010 to increase by nearly 1.2 million km² by 2030 (Seto, Güneralp, & Hutyra, 2012). Conversely, many of these cities today have less than 10% of its area designated as urban green spaces (World Cities Culture Forum, 2018). These development trends have meant that ecosystem services that green spaces produce especially in the urban areas are severely degraded. The MA report states that in the context of rapid population increase and growing need for food, fiber, fuel, shelter, and fresh water, the world has seen about 60% (16 out of 25) of its ecosystem services being degraded, some even degraded to the point of being irreversible. For instance; By the year 1980s, 30% of earth’s surface was converted into cropland from forest land; by 1960s, the withdrawal of water from rivers and other reservoirs doubled; and since 1750, the CO₂ concentration in the atmosphere increased by about 32% mainly due to increased use of fossil fuels. Similarly, there has been substantial increase in economic and public health cost associated with damaged ecosystem services, for example, the cost of recovering from damaged ecosystem services like air, and water due to unsustainable agriculture practices in the UK in 1996 was 2.6 billion dollars (MA, 2005).

Local Case of Thimphu: In Bhutan, albeit the increase in forest and green areas at the national level, urban areas like the capital city, Thimphu, is confronted with declining green spaces and deteriorating green infrastructure and ecosystem services within its city limits. As per the Population and Housing Census 2017; the urban population of Bhutan has risen from 196,111 persons (30.9%) in 2005 to 274,967 persons (37.8%) in 2017 with Thimphu thromde being the most populous urban area in country with 114551 persons (41.6% of the national urban population) in 2017 as compared to 79200 in 2005 (35.4 % rate of change) (National Statistics Bureau of Bhutan, 2018). With a land area of 21.6 sq.km (which includes the undevelopable/inaccessible areas such as forest, slopes, river buffer, etc.), Thimphu is the densest urban area (44 person per hectare) followed by Phuentsholing (13 person per hectare). In addition, since the preparation of the Thimphu Structure Plan in 2002 and its subsequent local area plans (LAPs), 8 out of 14 LAPs have been implemented with 6 undergoing implementations (Thromde, 2017). Subsequently, the proportion of gray infrastructure has significantly increased (close to 13000 structures in Thimphu Thromde as per the recent geodata survey carried out by the Ministry of Works and Human Settlement in October, 2020). Further, the population growth or the development trends have been observed to be sprawling in the extended areas of the thromde.

Conversely, the Strategic Environmental Assessment for Thimphu Structure Plan (TSP) carried out in 2017 states that there has been a major land use change pertaining to the green open space precincts. For example; the E-1 or Environment Conservation precinct (riparian corridors, environmental protection or sensitive area, etc.) decreased from 2.704 sq.km during the preparation of the TSP in 2002 to 1.076 sq.km in 2017, a net change of 60.2%; the E-2 or Forest Environment areas reduced from 4.359 sq.km in 2002 to 3.953 sq.km (9.3% loss) in 2017; E-3 Agricultural Environment precinct attenuated from 0.182 sq.km to 0.026 sq.km, which is a staggering loss of 85.7%; the G-1 (National Open Green Space) and the G-2 (Green Space System) precinct, which includes most of the recreational areas such as parks, botanical gardens, sports complex have reduced from 0.726 sq.km to 0.335 sq.km and 0.807 sq.km to 0.552 sq.km, a loss of 53.8% and 31.5% respectively from 2002-2017; and finally the neighborhood nodes which were proposed through the TSP as the center of the 16 urban villages that will provides the required social and environmental services at the neighborhood level have decreased from an area earmarked as 0.2 sq.km in 2002 to 0.081 sq.km in 2017, a decrease of 59.5%. All in all, the green infrastructure areas have decreased from 8.988 sq.km (34.4% of the total thromde area) to

a meagre 6.023 sq.km (23%) which is a reduction of 32.9% of all green open space areas in a span of 15 years. (Ministry of Works and Human Settlement, 2018).

The blight of green space reduction can be inferred to many urban issues caused through the reduction of ecosystem services thereof. For instance, due to the increase in the energy consumption coupled with the decrease in green spaces that sequester the CO₂ emitted, in 2015, the estimated emission across all the sectors was 2.41 million tons of CO₂. The CO₂ emission through burgeoning transport sector, which records major increase in vehicle importation and fossil fuel consumption is estimated to grow from 498 kilotons in 2019 to 964 kilotons carbon dioxide equivalent (tCO₂e) in 2030. There is an indirect loss to the government due to the rise in pollutants level. This loss can be due to premature deaths, rising health problems, loss of tourism etc. (Ministry of Information and Communications, 2020). Similarly, the soaring rates of non-communicable diseases (NCDs) now account for about 70% of the reported burden of disease. This rising trend is largely due to changes in lifestyle (physical inactivity), dietary habits, among others. NCDs cause the highest proportion of deaths for all age groups and account for 53% of all deaths. Among deaths caused by NCDs, cardiovascular diseases are responsible for the majority of cases (28%), followed by cancer (9%), respiratory diseases (6%) and diabetes (2%). Poor access to green open spaces for both passive and active recreation can be alluded as the main cause. In fact, the National Health Survey in Bhutan found that only 25.5% of the population aged 10-75 years do sports/fitness or recreational activities on the average of 3 days per week and 1.6 hours per day (World Health Organisation, 2015). A recent survey carried out by the Department of Human Settlement in the neighborhoods of the Thimphu Thromde to elicit residents' perception on neighborhood amenities illustrates that out of 1264 respondents, 565 (26%) and 415 (19%) thought that inadequate open spaces for recreation and lack of multi-

functional parks respectively as the main environment related issue in their neighborhood. By and large, the greens open spaces and its said ecosystem benefits, in most cases, have been delimited at the outskirts of the city making them less accessible and less affordable due the distance required to travel.

One of many reasons for the degraded ecosystem services and shrinking urban green spaces is the underrepresentation of environmental sector, particularly, the lack of promotion and preservation of urban green spaces in plans and policies as opposed to gray infrastructures. In other words, urban green spaces, more often than not, are being earmarked for the development of other uses like commercial and residential infrastructures. MA asserts that the degradation of the ecosystem services is a direct or indirect effect of changes made to meet growing demands for ecosystem services, in particular, the demand for food, fiber, shelter, and fuels. Mainly because most of resource management decisions are influenced by ecosystem services entering the markets compared to non-marketed benefits that support life. The effect of this short-term bargain is a long-term implication to the social, environmental and economic aspects of the city. For example, removal of urban green spaces like recreational urban parks leads to the reduction of ecosystem services like recreational services and air purification leading to aggravated health issues, as well as increased pollution level, which in turn leads to a huge

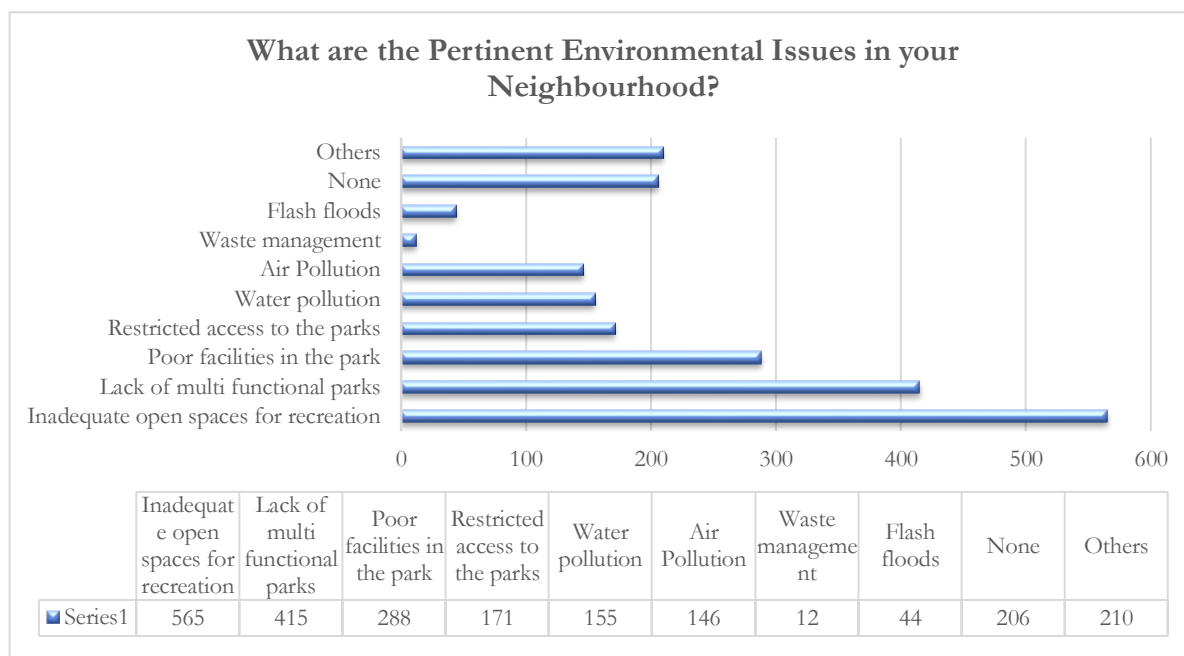


Figure 1. Residents’ response on the most pertinent environmental issues in their neighbourhood.

monetary, social and environmental implication in the long run (Austin, 2014).

Nevertheless, considering recent urbanization issues and the global phenomenon of climate change, urban green spaces have been given equal, if not a higher priority. For this

reason, it is a crucial step to understand these spaces as an important ecosystem service provider and adjudge it to be tantamount to gray infrastructure in an urban context. Countries like USA and UK have initiated several studies based on urban green spaces and the wider network of these spaces called the green infrastructure. That said, many cities and municipalities alike in these countries have incorporated green infrastructure in plans and policies. In fact, green infrastructure planning that caters to all the urban green spaces is an indispensable step in preparing the overall master plan of some of these cities. (Lennon, 2013). Green infrastructure planning, on the other hand, is not given its share of priority in the developing countries including Bhutan. Among others, the lack of awareness about its ecosystem service benefits and its value and the subsequent underrepresentation in development plans as stated earlier are main reasons thereof. Therefore, it is of paramount importance that a comprehensive approach that caters to protecting ecosystem services through the management of its sources such as green spaces in the urban areas need to be in place for a sustainable future of these cities. The ensuing part of the study highlights a combination of two approaches that attempts to respond to the afore-established issue.

4. Economic Valuation of Ecosystem Services in Decisions (Approach 1: Prioritization)

Apart from the provisioning services like food, fuel, timber, and fibers; ecosystem services that fall under the category of regulating, cultural, and supporting services are not traded in the market, hence, quantification of these services in monetary terms is very difficult. Around the world, due to the stated reason of not having a monetary value, these ecosystem services are not given importance by decision makers often leading to poor tradeoffs that ultimately favors services that have monetary values over those that don't. This is the main reason for degrading trend of ecosystem services around the world (GIZ, 2012). Therefore, it is important to derive a means to assess the economic value of these services. As per the Total Economic value (TEV) Framework, the economic valuation of ecosystem services is done by measuring the use and non-use values of these services. The use values are further broken down into direct, indirect use, and optional values, while the non-use values include the existence values and bequest values. The use values deal with the notion of these services being used and subsequent benefits being gained from the use of these services (food, fuel, etc.), whilst non-use values refer to the satisfaction that comes with the existence of the ecosystems and their services (valuing the existence of pandas without actually seeing one). The common factor in all these methods is the stated preference approach, which delves into understanding peoples' preferences for ecosystem services. One of the ways to generate stated preference is through eliciting peoples' perceived

values of these services using tools such as willingness to pay or contingent valuation method. Given the importance of economic valuation of ecosystem services, many studies show that countries, especially in the west, have used the aforesaid use and non-use valuation tools to ascertain their economic values.

Total Economic Value (TEV)					
TEV Categories	Use Value			Non-Use Value	
	Direct Use Value	Indirect Use Value	Option Value	Existence Value	Bequest Value
Commonly Used Valuation Methods	Market Based, revealed preference, cost-based and stated preference approaches	Change in productivity, cost-based and stated preference approaches	Change in productivity, cost-based and stated preference approaches	stated preference approaches	stated preference approaches

Some examples of economic values measured for ecosystem services are as follows; the economic value of cultural services like recreation is high in countries like UK. The cost of sedentary lifestyle is over 12 billion dollars annually. This is attributed to the health implication that results from an inactive life style such as obesity (Grant, 2010). Similarly, in the US, studies have shown the value of public recreational facilities to be around 452 million dollars per year (The Trust for Public Land, 2010). A study has shown that prices of houses increased by 8%, if it had the view of a park, and prices raised by 6% if the house is located adjacent to a park (European Commission, 2012). Globally, preventive measures for pest and diseases in agriculture accounts to 400 billion dollars. 30% of crop production that requires pollination has an economic value that is equivalent to 10% of the world agricultural output (Norris, 2010). The

Table 1. Economic Valuation Methods for Ecosystem Services.

wetlands in USA provided economic benefits of 5,200 dollars per acres pertaining to flood control (Kim, Cho, & Roberts, 2011). The total economic impact of global warming is estimated at 3 to 12 trillion dollars (Thornes, 2011). A mature tree of selected species can absorb as much as 0.5' of rainfall, a cluster of 100 trees can capture about 54900 gallons of rainwater, thereby preventing floods as well as providing fresh water for consumption (Mcpherson, Simpson, Peper, & Xiao, 2011). In Bhutan, the indirect economic loss from increased pollution level is estimated to be Nu 3,220,000/tons for PM emission and Nu 23,800/tons for NOx emission²⁴ (Ministry of Information and Communications, 2020). Similarly, the financial implication of referring and treating the patients with the NCDs, as implied in the earlier part due to poor

access to recreational open spaces, have increased significantly from 529 patients and a cost Nu 81 million in 2006-2007 to 1047 patients and Nu 180 million in 2012-2013 (World Health Organisation, 2015). The economic valuation of ecosystem services is an essential step to provide importance or priority to these services in decision making through the illustration of direct or indirect economic benefits received from ecosystem services, as well as economic losses suffered due to degradation of the same (Austin, 2014). GIZ, a German development agency, has stated benefits of generating economic values of these services and imputing them in decision making like:

- Evaluating the impacts of development policies and policy interventions that alter the condition of ecosystems and consequently effects human well-being.
- Comparing the real cost-effectiveness of an investment project; evaluating trade-offs between different ecosystem management options and choosing between competing uses and assessing liability for damage to the environment.
- Creating markets for ecosystem services in order to mobilize financial resources, e.g., global carbon market and payments for ecosystem services.
- Awareness building and communication to the public on the overall contribution of ecosystem services to social and economic well-being (GIZ, 2012).

5. Green Infrastructure Planning (Approach 2: Deliver ecosystem benefits to residents)

A step that follows the prioritization of the urban green open spaces through deriving its economic value is to plan and manage these spaces. Green infrastructure planning is a strategic planning approach that strives towards developing green space network, especially in the urban area that is designed and managed to deliver a wide range of ecosystem services at all spatial levels (Hansen, Rall, Chapman, Rolf, & Pauleit , 2017). Along with important features of green infrastructure like connectivity, integration, and multi-functionality, the attributes of green infrastructure planning that illustrates its applicability in various scales from a community to regional level and the emphasis on different ecosystem benefits form its main guiding principles (Hansen, Rall, Chapman, Rolf, & Pauleit , 2017). All in all, the core principles of green infrastructure planning can be summarized as:

- **Connectivity:** It is the strategic connection between the urban green spaces such as parks, riparian corridors, etc. that maintains the unrestrained distribution of the ecosystem services

- Multi-functionality: To combine the ecological, socio-cultural, and economic function of urban green spaces to provide multiple benefits concurrently
- Integration: Physical and functional coordination between urban green spaces and gray infrastructures that provides various benefits simultaneously. For example; trees planted as road buffers can firstly improve aesthetic values of roads, secondly reduce pollutants in the air.
- Social inclusion: It intends to provide an equitable access to urban green spaces and ecosystem services for all (Hansen, Rall, Chapman, Rolf, & Pauleit , 2017).

But, by and large, the most important aspect of green infrastructure planning approach as revealed earlier is the emphasis on the ecosystem service, and for that matter, making informed decisions that support the conservation of these services through management of green infrastructures to eventually promote human well-being. A timely information about the ecosystem service degradation and other findings pertaining to its assessment would provide valuable inputs and impetus to green infrastructure planning. For example; planning for critical green spaces before developing gray infrastructure; supports farm, forest, and landscapes for tourism; using green infrastructure to mitigate or making the communities disaster resilient are few out of many benefits of green infrastructure planning (Amundsen, Allen, & Hoellen, 2009).

There are many success stories on green infrastructure planning in the USA and UK. For instance, the storm water management success in many local governments in the US such as Chicago-Illinois, Portland-Oregon, among others, through a strategic Green infrastructure Planning process that entails mapping, public participation, incentivizing to expending regulations and policies, etc. is a commendable example leading unto socio-economic and environmental benefits. (United States Environmental Protection Agency, 2010). Similarly, the report published by the Green Building Council of the United Kingdom, illustrates 18 cases of GI Planning success in various places in the UK, where green infrastructure plans and its projects have led to environmental, economic and social benefits. One example of the case study is the ‘The Crown Estate London Ecology Masterplan’, which guides the installation of contextually valuable green infrastructure (GI) throughout The Crown Estate’s London portfolio. This will provide valuable habitats for wildlife on and around the buildings, and improve the experience for people who live, work and visit the area. (UK Green Building Council, 2015).

6. Green Infrastructure Planning Process

Green infrastructure planning has become an integral part of spatial planning in many cities across the world. There are several examples pertaining to green infrastructure planning process and the steps involved. But in general, these steps can be summarized into 6+ steps planning process as follows:

Step 1. Set goals: The green infrastructure planning should start with the formulation of goals that not only identifies the urban green spaces and ecosystem services physically and functionally active in the city but also ascertains the natural assets and functions that are valued by their communities.

Step 2. Review data: this step explores and reviews existing data pertaining to urban green spaces and ecosystem services in the city

Step 3. Prepare green Infrastructure maps: In this step, green infrastructure maps are made based on the goals establish and available data. The maps emphasize the conservation and enhancement of urban green spaces and ecosystem services that community values the most.

Step 4. Assess risks: assesses the risk (based on the maps in step 3) on urban green spaces and valuable ecosystem services that they provide. Assessment of the risks such as; which green spaces are affected or may get affected by current development patterns and processes; which biological corridors and green spaces are impaired, etc., are carried out under this step.

Step 5. Rank the assets and determine opportunities: The valued assets measured in earlier steps are now ranked according to their vulnerability or susceptibility to degradation. And accordingly, these assets are ranked to ascertain, which out of these natural assets and functions need immediate attention and improvement.

Step 6. Implement: Based on findings in earlier steps, policies, plans, and projects are implemented or the existing laws and zoning ordinances are reviewed to ensure the protection and enhancement of prioritized natural assets and functions. Change of land use planning steps; awareness programs and encouraging peoples' participation in plan preparation and other voluntary conservation actions; and data that need to be prepared to monitor urban green spaces in the city are some of the attributes that constitute the step (Firehock, 2015).

Step 6+. Integration of ecosystem service assessment: Ecosystem services assessment represents a holistic thrust for green infrastructure planning process. The six-step GI planning process as mentioned earlier mainly deals with the urban green spaces and the ecosystem services that are existing in the city and are valued by its populace. Despite the emphasis on ecosystem services, the process mainly revolves around green spaces and the study of ecosystem services is

limited to just the ones that are highly valued by its populace. As elucidated earlier, there are many services that people and community are not aware of, but plays a vital role in our daily lives and as a matter of fact, these services might need more immediate attention compared to those that are valued by people. In this respect, ecosystem service assessment that includes analysis of the condition of ecosystem services, level of public awareness on ecosystem services, and environmental and economic valuation should be integrated in the current green infrastructure planning process. This is to ensure that a holistic and a well-informed green infrastructure planning process is achieved so that the process is more encompassing and accommodate plans that cater to multitude of ecosystem services and eventually uplifts human well-being.

7. Legal Framework and Institutional Framework

In many countries, governments enact laws and provide frameworks for the formulation and implementation of policies, plans, and programs that are conducive to sustaining the natural environment and ecosystem services that they provide. Sometimes, these laws take shape in the form of international agreements, whilst mostly, they manifest in the form of national or sub-national laws that dictate ownership, taxation and use of natural resources (Ranganathan, et al., 2008). In Bhutan, under the rubrics of ‘Gross national Happiness’, there are many environmental laws such as the; Forest and Nature Conservation Act of Bhutan (1995); Land Act of Bhutan (2007); water Act (2011); National Environmental Protection Act of Bhutan (2007); Environmental Assessment Act (2000); and Biodiversity Act (2003) that regulates and safe guards the natural environment. On the other hand, notwithstanding the lack of robust urban planning laws, there are National Human Settlement Policy (2019); National Human Settlement Strategy (2017); and other rules and frameworks to be more precise, that offer avenues for the integration of environmental preservation or for that matter the green infrastructure processes mentioned in the earlier part of the study in the current urban planning and development processes. Nonetheless, while the existing laws as mentioned before could be a plausible startup-base for assessing the benefits of ecosystem services provided by urban green spaces in cities, together with collaborative efforts of responsible institutions, results of these studies would also rejuvenate the importance given to green spaces as vital ecosystem service provider, so that new laws and policies are formulated and existing policies are reviewed by decision makers to incorporate green infrastructure planning in city’s urban development plans and policies.

8. Conclusion

The study, not only recognizes urban green spaces as a sole provider of ecosystem services in the urban context but also its contribution to the development of the city and the

well-being of its populace. The conventional development processes that are degrading ecosystem services and urban green spaces are conspicuous throughout landscape of urban centers like Thimphu, and needs appropriate expedient to control or to quell these trends. The study results ascertain green infrastructure planning as a measure that can address the aforementioned issues. That said, it has been affirmed important that for green infrastructure planning to materialize and potentiate the development processes that conserve urban green spaces and its benefits, it needs to be incorporated firstly as an essential part of the urban planning and development process itself. For instance, creating corridors like center islands, tree lines, buffers, biological corridors, etc. to connect various green infrastructures; construction of roads and houses that integrates with green spaces; assigning multiple functions to urban green spaces by imputing facilities like recreation, nature trails, etc. to increase its functionality; investing and perpetrating awareness programs and activities for the locals and decision makers on ecosystem services, green infrastructure and their importance towards enhancing human well-being; and building city to city green infrastructure network through corridors such as bicycle trails, biological corridors, etc. are some of the practical aspects that represent the study and future green infrastructure planning implementation activities. Nonetheless, on a conclusive note, following are the recommendations from the study:

- Preparation of Green Infrastructure and Ecosystem Service Inventory: All the urban green space hubs and corridors in their entirety be checked and accounted for the kind of ecosystem services that they provide, as well as necessitate a process for a timely check on the condition of these services.
- Assessment of ecosystem services integrated into the development process: Based on the inventories recommended earlier, it is an essential step to assess ecosystem services provided by urban green spaces or green infrastructure in the city and accordingly, identify ecosystem services and urban green spaces that are at high-risk and needs immediate attention
- Integration of Economic Valuation of Ecosystem Service: Assessment of ecosystem services using economic valuation tools be integrated into the planning process to provide urban green spaces a comparable market value and thus importance in the conventional decision-making process.
- Mainstreaming Green Infrastructure Planning: Integrate green infrastructure planning principles, steps and processes in mainstream planning and development process.

- Awareness Programs and People's Participation: The enhancement of people's awareness on the important role of urban green spaces in providing multiple ecosystem services. Furthermore, people's participation in planning these spaces especially in identifying the needs and assessing the importance of urban green spaces and ecosystem services that they provide is recommended for a well-managed green infrastructure network that caters to societal needs.
- Incentives to Promote Green Infrastructure: The local government and other relevant agencies start incentivizing activities that support green infrastructure planning. Rebates to property taxes, development incentives and rights, for properties that have green spaces. Awards and recognition for those activities that supports and enhances urban green spaces and ecosystem services are some examples of incentive to promote green infrastructure.
- Unified GI Planning Plans, Policies, and Programs: A unified green infrastructure plan, policies and guidelines or an institutional framework as a whole that spearheads and supersedes any other policies or local edicts concerning the urban green spaces need to be formulated to encourage a well-coordinated, well-planned and well-managed green infrastructure in the city.
- GI Planning Research: there is a need to expand studies on green infrastructure planning and ecosystem services to provide impetus to mainstreaming green infrastructure planning in the city's context. Therefore, collaborating with academe such as the Royal University of Bhutan and other such institutions is an important recommendation from the study.

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