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Stakeholder analysis matrix for buffer zone management in the peri-urban area of Chittagong, Bangladesh

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Abstract
Buffer zone (BZ) concept has emerged to minimize degradation of natural resources and enhance balanced land use planning for the areas where existing urban and peri-urban landscapes are threatened by rapid land use change. The primary aim of the study is to seek a better understanding of land use planning and governance in BZ surrounding the core zone of the Chittagong Metropolitan Area. Through questionnaires and interviews, the study also identified the key stakeholders' inclination and influence on land use decisions, i.e., preservation versus urbanization of the BZ. Then, the national and international policies of BZ management were reviewed to check the overall validity and credibility of the analytical results. The results revealed that the respondents in the responsible authorities have demonstrated a positive inclination to urbanization rather than preservation of BZ, whereas non-governmental organizations, practitioners, and academics have supported preservation rather than urbanization. In addition, the study also reported the conflict in interagency and multi-level coordination for urban development. In the national level, core zone development gains more support by containing 'strategic open space' and 'no development zone.' However, it contradicts the regional plan which allows the reduction of green coverage from 46.20 to 32.56%. Therefore, to achieve BZ management practices in a consistent and sustainable manner, overcoming knowledge and inclination gap, as well as effective coordination of land use governance, is critical.

Keywords Buffer zone management · Land use governance · Land use planning · Stakeholder analysis matrix · Stakeholders' inclination

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1 Introduction

The world is becoming urbanized increasingly involving synchronized transitions in landscape across several dimensions, including demographic, economic, and physical changes (IPCC 2014). Urban and peri-urban green spaces such as parks, community or private gardens, forest area, wetland, agricultural land, lake, and large open spaces perform a significant role for inhabitants of the city and nature (Barthel et al. 2005; Pérez-Campuzano et al. 2016; Vejre et al. 2010). However, various social and environmental problems are unexpectedly found in peri-urban areas (Ravetz et al. 2013), often being exploited of their immediate hinterland and valuable ecological sites (Simon et al. 2006; Singh and Asgher 2005). Moreover, this phenomenon is recurrent in developing countries (DAP 2009; Pérez-Campuzano et al. 2016). In order to enhance urban resilience, to raise global awareness of biological value and to reduce increasing pressure on natural resources, Douglas and Box (2000) and Ebreg and Greve (2001) proposed a concept of the protected and reserved areas to contain urban core, and it has been widely adopted around the world (De Leon and Kim 2017; MoEF 2009, 2012).

Buffer zones (BZs), including 'multiple uses area' or 'transitional zone,' are created to enhance the protection of the designed protected area as well as its peripheral urban area and can be located in different geographical settings (e.g., within urban core, in peri-urban settings or elsewhere) (Bentrup 2008; Ebregt and Greve 2001; Sun et al. 2006). Sometimes, resources use in the zone is legally or commonly limited, and often the zone has a little green area (Trzyna et al. 2014; UNEP-WCMC 2014). In 1971, UNESCO's Man and the Biosphere Programme addressed 'Buffer Zone' concept designed for concentric zones, with a core zone area bounded by a buffer zone (Douglas and Box 2000; Jongman and Troumbis 1995) or strictly located conservation area compiled with buffer zone and core zone (Ebregt and Greve 2001). To protect the core zone from adjacent settlement pressure and ensure its effectiveness, the BZ concept has been widely adopted for the crucial area for people and nature (Ebregt and Greve 2001). In order to achieve sustainable BZ functions, BZ concept has also addressed socioeconomic needs and wants of the locals engaged in natural resource-based livelihoods (Chowdhury et al. 2014). However, the economic potentiality of peri-urban resources tends to be prioritized in urban land use planning and management for both local and regional levels (Abramson 2016; Douglas 2006; Pérez-Campuzano et al. 2016; UNEP-WCMC 2014). With no clear visual demarcation of the BZ, there still is an uncertainty of how to practically measure the social and environmental value of BZ as a co-beneficial platform (Vejre et al. 2010).

Developing from the concept of 'promoting sustainable land-use planning and management,' landscape resources management shapes the frame of urban development versus environmental protection which focuses on the productive utilization of the existing natural resources as well as the enhancement of BZ management (UNCED 1992). Meanwhile, the failure of landscape resources management in BZ area can be caused by neglecting local people's needs and expectations, directly and indirectly (Chiesura 2004; IPAC 2012). Therefore, stakeholder involvement in land use is the key when it comes to protecting, conserving and managing peri-urban green space as a BZ. This paper reviews the existing BZ policy and associated strategies in order to clarify future direction on BZ functions and management. The study aims at expanding contribution to the regional governments for consistent and sustainable BZ management and land use governance. Particularly, the study has addressed the following questions: (1) What is the key stakeholders' perception of BZ preservation and management? (2) What are the conflicts in current land use

planning and implementation practices? And (3) what can be suggested for different levels of policy-making to enhance BZ functions? In this perspective, the study focuses on a peri-urban area covering different forms of natural landscape settings performing as a BZ territory in Chittagong Metropolitan Area (CMA) documented by regional- and national-level plans (CDA 2008; DAP 2009; MoEF 2009, 2012; UDMC 2014).

2 Literature review on buffer zone functions and management practices

The functions and the benefit of BZ planning are to protect critical or sensitive zones from other protected and non-protected areas (Douglas and Box 2000). It can often be found as a key element in conservation approaches, for instance, 'World Heritage sites' and 'Man and the Biosphere Reserves' (UNEP-WCMC 2014). Besides, these zones have been recommended not only as particular practices for preserving natural resources but also as a sustained opportunity for environmental, social, and economic benefits (Ansari 2008; De Leon and Kim 2017; Nilsson et al. 2013), and are increasingly significant in both urban and rural areas. From a social aspect, the benefits of BZ improvement include the enhancement of social life and physiological and psychological health, which enrich meaningful living life (Chiesura 2004; Trzyna et al. 2014). Moreover, it was found that BZ utilized as a productive agricultural land can benefit the broader scope of forest-based livelihood and agroecological farming activities-based practices and help minimize poverty and social disconnection (Bicalho and Peixoto 2016; BRAPAP 2011; Duguma et al. 2019; Muzzini and Aparicio 2013). From an environmental point of view, BZ can perform as an area for rainwater infiltration, biodiversity preservation, and obstruction zone to safeguard environmental vulnerability (Rudel et al. 2005; Schou et al. 2006; Trzyna et al. 2014). In terms of economic benefits, especially at the local and regional level, recreational and tourism activities can be expected to bring additional value by the utilization of existing assets and resources of the zone (Aguilar 2008; Kim 2012; Trzyna et al. 2014).

According to the Federal Environment Agency of Germany (FEA 2015), more than 100 million hectares of land is required globally for further urban settlement, airports, water reservoirs, dams, power stations, sewage treatment plants, and waste dumping sites developments until 2050, whereas more than 90% of that is demanded by developing countries (FAO 2011; FEA 2015). Political and administrative limitations over the control of land use changes also create vulnerabilities to geophysical risks in the peri-urban landscape (Douglas 2006; Pérez-Campuzano et al. 2016). There have been several studies conducted to analyze land use change scenarios in and around BZ area. However, there is limited literature addressing the land use governance and implication of policy instruments in BZ management. Therefore, the study examines stakeholders' perceptions and policy implications for BZ through stakeholder analysis and policy review.

3 Research methodology

3.1 Study area

The study area is designated as DPZ-07 (Fig. 1), one of the 12 Detailed Planning Zones (DPZs) contained in the Detailed Area Plan (DAP) 2009 of Chittagong Metropolitan Area.

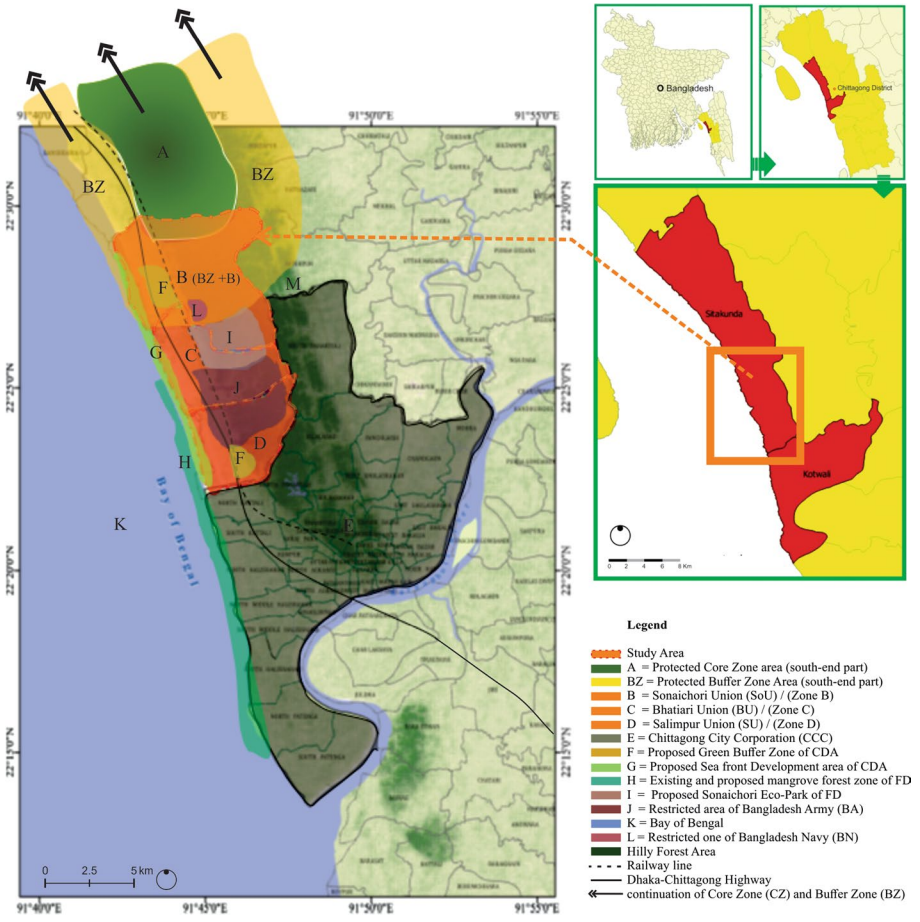

Fig. 1 Zoning map of the study area. *Sources*: CRPARP (2013), BRAPAP (2011), and DAP (2009)

It combines three unions of Sitakunda sub-district, Sonaichari Union (SoU), Bhatiari Union (BU), and Salimpur Union (SU), which are under the CMA in Chittagong District (Fig. 1). Geographically, the study area is on the northwestern edge of the CMA planning area consisting of flat plains meeting the Bay of Bengal on the west and the hilly region on the east on the periphery of Chittagong City Corporation (CCC). According to Muzzini and Aparicio (2013), the entire area is classified as a peri-urban zone based on its land use pattern and urbanization trends and is positioned between the edge of core zone (CZ, designated as reserved and protected areas) and the boundary of City Corporation. Most of the study area has experienced spatial growth due to housing, commerce, industries, and institutional and infrastructure services developments. From the land use survey of DAP (2009), it is observed that hilly area (including hilly forest and non-hilly forest), vacant land, sea beach, and water bodies (rivers, lakes, and ponds) have presented dominant land uses covering, respectively, 38.74%, 15.46%, 19.4%, and 12.43%. Another dominant use is industrial development, whereas less significance features are agriculture and fisheries. The total study area is 7211.5 hectares, and most of the land is privately owned (BIGD 2014).

In terms of administrative jurisdiction, the three unions have elected Union Councils controlled by Deputy Commissioner of Chittagong District, who is the Chairman of District Laws and Orders' Standing Committee. However, the Chittagong Development Authority (CDA) was established in 1959 by ordinance to undertake development in peri-urban areas. In addition, different autonomous bodies (e.g., Environment Department, Forest Department, local government, land division) work in their own capacity to implement particular agenda separately and sometimes regionally by their own rules and regulations.

Climatically, the environmental changes at regional levels are highly unpredictable. The Disaster Management Plan of Upazila Disaster Management Committee mentions that the area is vulnerable due to its terrestrial setting and highly prone to disaster such as flash flood, hilly flood, drought, excessive rain, snow rain, cyclone, tornado, tidal surge, intrusion of salinity, and arsenicosis (UDMC 2014).

Historically, the study area has performed as a BZ for Chittagong City to protect and prevent from natural disasters (DAP 2009; UDMC 2014). Despite the several vulnerabilities to safeguard for the urban core of Chittagong, this context is not acknowledged more attention to preserve and manage BZ concept. In 1999, the Government of Bangladesh (GoB) has taken measures to conserve existing ecosystem by 16 protected areas and several ecologically critical areas as well as to protect natural resources and promote necessary steps to manage BZ areas. In consequence, the study area has been fallen into additional consideration by GoB that is encompassed with different BZ preservation and expansion projects to fulfill different perspectives of national and international level, for instance, mitigating disaster and vulnerability, adapting livelihood practice, and developing carbon credit market (MoEF 2012). The GoB targeted to increase around 20% of state-owned land and conserve the remaining forest areas through the policy of National Forest Act 1994, and increase 10% reserve forest under the 'Forestation Program' of Forest Department (FD) by 2015 (Mustafa 2001). In 2004, FD has amended Social Forestry Rules to enhance green BZ practices through improvement of local livelihood (Mustafa 2001). In the Climate Change Strategy and Action Plan of 2009, afforestation and reforestation program has been introduced in order to support the existing and new coastal afforestation and reforestation program as well as wetland afforestation program with social forestry and local livelihood support (MoEF 2007, 2009; UDMC 2014).

Green BZ improvement and expansion by preserving existing hilly area through 'Restricted Hill Zone' under the policy of 'Strategic Open Space' have been introduced by the Detailed Area Plan of CMA (2009–2015). DAP has mentioned some programs to preserve the hilly landscape as natural resources, for instance, linear coastal afforestation program, a green walkway along lakes and river belts, and Coastal Mangrove Forests and Green Coastal Zones (DAP 2009). Under the Bangladesh Wildlife Preservation Act amended in 1974, the GoB has begun to address forest conservation and carbon financing opportunities through co-management with United States Agency for International Development (USAID), and launched Bangladesh Reducing Emission from Deforestation and Forest Degradation with Afforestation and Reforestation Program (REDD + ARR) for protected area for 2008–2017 (part of study area, mentioned as a zone BZ in Fig. 1). This project has reinforced BZ improvement and management activities through the Nishorgo Support Program (NSP) and its follow-up projects such as the Integrated Protected Areas Co-management Project (IPAC) for 2008–2013 and Climate Resilient Ecosystem and Livelihoods (CREL) for 2013–2017 (BRAPAP 2011). Significantly, Nishorgo Support Program supports to generate greater carbon intensities by reducing forest degradation and deforestation through reforestation and revegetation in core zone with additional 5-km zone as the reference region or landscape zone (part of the study area, mentioned as a zone B in

Fig. 1). Integrated Protected Areas Co-management Project is designed to support sustainable natural resource management through enhanced conservation of biodiversity and gender-based livelihood practices, and Climate Resilient Ecosystem and Livelihoods addresses environmental challenges by advocating the protection of forest and watershed areas through improved governance of natural resources and biodiversity, in particular strengthening community management organizations to encourage their financial integrity and self-governance (referred as area B in Fig. 1). In parallel, FD has introduced BZ expansion with NSP for poverty reduction and biodiversity protection in 2009 (in Fig. 1, mentioned as zone B + BZ and I). Also, Bangladesh Army has adopted the green infrastructure-oriented development strategies under the Ministry of Defense (in and around zone J). Moreover, Climate Resilient Participatory Afforestation and Reforestation Project (CRPARP) has been operated by FD with Arannayk Foundation since 2013 (mentioned as zone BZ, H in Fig. 1) to reduce forest degradation and upsurge forest vegetation and build long-term resilience (CRPARP 2013).

3.2 Data collection and analysis

The research primarily applied document review, field observation, questionnaire survey, and semi-structured interviews to collect data. A total of 63 questionnaire responses and 15 interview with the key stakeholders (e.g., town planners of DPZ-07 of Chittagong Development Authority, forest conservator of north Forest Division and coastal Forest Division, environmental planning department of Environmental Division (ED), city planner of Chittagong City Corporation, local government and non-government planners, architects, academics, core zone management bodies of REDD + ARR, local politicians, and local chairman and members of Union Councils) were collected to find out: (1) their perceptions and involvement in BZ management, and (2) policies and decision-making scenario of BZ planning and management. Besides interviews and questionnaires, field observation was conducted to supplement ground level perception on peri-urban landscape scenario (Fig. 2). All data collection was conducted during October–December, 2015.

In addition, in the process of stakeholder engagement, stakeholder analysis matrix (SAM) was conducted to identify key players in the study area. SAM is a method to identify the key stakeholders and to assess their level of knowledge, possible actions related to the policy and plan, their position to contribute, and find out the significance of their role. Moreover, it helps to know about the identified risk of stakeholders in making better strategies and decisions to greater acceptance (Schmeer 1999). The study used five indicators (Table 1) to find out the stakeholders' knowledge about BZ in the range of 1 (low) to 3 (high). Besides, Table 2 suggests each stakeholder's interest and involvement in BZ protection as well as shows their power affecting the overall policy processes by coding from 1 (low) to 3 (high) and willingness to initiate BZ preservation by 'Yes/No' answer. The role of Deputy Commissioner (DC) and Ministry of Defense (MoD) was analyzed based on their area of work, progress, and control capacity over DPZ and surrounding landscape that has affected BZ practices. For interpreting the results of the matrix, the study followed a color coding and scoring matrix with the negative and positive marking of inclinations as shown in Table 1. It used low to high scoring represented in color; for instance, red color means critical indication for BZ improvement where more attention is needed. Additionally, orange color represents a neutral inclination, and green color represents the positive inclination of stakeholders for promoting BZ management and preserving the existing area.


Hill cutting for informal settlement, salimpur union.


Informal settlement inside hill area, salimpur union.


Industrial waste dumping beside hilly forest, sonaichori union.


Brick field inside hilly forest area, salimpur union.


Illegal industry on hill, beside railway, sonaichori union.


Illegal tree cutting and selling shop, bhatiari union.


Ship-breaking industry along sea belt, sonaichori union.


Industrial waste deposal, beside coastal belt, salimpur union.


Small industry along highway, bhatiari union.


Industrial waste deposal, beside coastal belt, salimpur union.

Fig. 2 Photographs of the study area.

Table 1 Interpretation chart of stakeholder analysis data. *Source*: Adapted from Schmmer (1999)

Scoring	1 = low	2 = medium	3 = high
Area of interpretation indicators (e.g., B + C, D, E, F, G from Table 2)	Red color	Orange color	Green color
Level	(−) = negative inclination	(0) = neutral inclination	(+) = positive inclination

Due to the potential decision-making conflict over CMA planning and implementation among the key stakeholders, gap analysis framework tool was applied based on the following three aspects: (1) existing land use policies and planning institutions for BZ improvement, (2) contradiction between BZ preservation strategies, and (3) the role of planning and implementation institutions.

4 Results

4.1 Stakeholder analysis matrix analysis and interpretation results

From the stakeholder analysis matrix (Table 2), the study has identified key responsible stakeholders who have the ability to solve the problem in their ways and their importance in respective fields. Table 2 shows that DC, ED, and MoD are the legal authorities for controlling policies, but they do not have adequate knowledge or leadership attitude to the potential use of BZ. However, Union Councils are the local authorities under the local government that have no authority to influence the policy process. Due to the absence of leadership mindset affecting BZ preservation policies at the regional and national level, local people have little knowledge about BZ preservation initiatives and policies, despite their willingness to cooperate with authorities in such activities. Figure 3 shows that CDA and ED presented neutral inclination to protecting and managing BZ. However, FD, experts (practitioners and academics), and non-governmental organizations showed a positive inclination. On the other hand, DC, MoD/BA, and even local people indicated a negative inclination to preservation of BZ. The study also observed that UCs have failed to raise local people's demand as they are controlled by DC. Besides, Bangladesh Army under MoD has acquired forest land for developing and expanding defense boundary. Consequently, the BZ expansion project (zone I in Fig. 1) of FD has been canceled by GoB recently. Furthermore, CDA, FD, and ED are not only the key responsible authorities to protect urban and peri-urban landscape but also the crucial decision-makers in planning and management policies for creating and preserving BZ zones (DAP 2009; MoEF 2007). CDA, ED, and local people are more inclined toward urban amenities rather than preservation of BZ management practices. Moreover, the study did not find any involvement of Chittagong City Corporation in DPZ area during the study period.

4.2 Constraints in land use planning and institutional level for BZ preservation

The study identified two constraints in land use planning as follows: firstly, land use planning constraints in policy, program, and plan (PPP); and secondly, the institutional barrier at planning and implementation stages of BZ preservation.

Table 2 Stakeholder analysis matrix. *Source*: Interview, adapted from Schmeer (1999)

A	B	C	D	E	F	G
Key stakeholders/organizations	Knowledge on buffer zone values and management policies		Involvement and influence in land use change	Interest in buffer zone protection practices	Political power to affect the policy-making process	
	Level	Definition			Authority	Leadership
CDA—Chittagong Development Authority	2	Have buffer zone management policies in master plan Have no detailed strategy to execute those at regional and local levels	Often devise insensitive proposals focused in and around BZ area Lacks cooperation with stakeholders at regional level	Supposed to take initiatives to protect natural resources/landscape in upcoming master plan Develops land use/cover data	2	Yes
DC—Deputy Commissioner	1	Does not have initiatives to protect management-sensitive zone Works based on administrative jurisdiction	Controls Unclassified State Forest (USF) Allows illegal development in sensitive zone by tree felling Often has political bias	Does not have specific plan at regional and local levels	3	No
NFD—North Forest Division (Forest Department)	3	Runs forestry local livelihood improving projects Coordinate and work nationally and internationally for local level and regional level	Cannot control all forest land despite having USF Cannot take action to control illegal encroachment Lacks administrative coordination within the organization	Runs social forestry program and climate resilient afforestation projects Encourages local inhabitants to buildup awareness with NGO's help	2	Yes
CFD—Coastal Forest Division (Forest Department)	3	Runs coastal forestry projects for improving mangrove forest zone through local participation Aware of water quality and livelihood issues	Cannot acquire required coastal land due to administrative problems and political interruption	Promotes Social forestry program and climate resilient afforestation projects Tries to acquire coastal land from illegal shipbreaking industries	2	Yes
ED—Environmental Department	3	Mainly tasked with preserving and protecting hilly area including legal authorization for industrial settlement Assesses environmental assessment (EA),	Cannot monitor Union level More concerned with hilly environment at urban level Often prepares documentations without having on-site observation and monitoring	Highly exacting on environmental assessment (e.g., EIA, SEA)	3	No

Table 2 (continued)

A	B	C	D	E	F	G
Key stakeholders/organizations	Knowledge on buffer zone values and management policies		Involvement and influence in land use change	Interest in buffer zone protection practices	Political power to affect the policy-making process	
	Level	Definition			Authority	Leadership
Bangladesh Army (BA) under the Ministry of Defense (MoD)	2	Able to work under any hazardous condition Can plan and execute green zone development	Concerned within own boundaries Recently acquired land from FD for own development	Concerned only within their boundary	3	No
CCC—Chittagong City Corporation	1	Not concerned with outside of city boundary	Creates unexpected pressure by expanding CCC boundary	Going to have the study area annexed to their boundary next year	2	No
UC(s)—Union Councils	1	Not aware of natural resources/landscape conservation or management	Influence shipbreaking (noxious) and heavy industries in and around the sensitive zone Exert political domination for deforestation and hill cutting	Attend social and governmental programs without aim	1	No
NGOs—non-governmental organizations	3	Aware of current climate change impact and importance of landscape management Work with GoB and local bodies	Work in a limited area and specified projects by GoB Have limited funding	Increase social forestry Promote local livelihood Reduce dependency on forest resources use	2	Yes
Expert (architects, planner, professors)	3	Work in this sector to inform GoB and local people Arrange and participate in different seminars and programs	Focus on corruption and damages in and around sensitive areas	Build up awareness at both top and bottom levels Gather support of people and related agencies	2	Yes
Local people (all over the study area)	1	Have little idea of what is actually going on	Involved in deforestation, hill cutting Work mainly in shipbreaking industries	Seek alternative income sources Willing to cooperate with authorities to preserve and manage the landscape	1	No

Level (3 = a lot, 2 = some, 1 = none); authority (3 = high, 2 = medium, 1 = little), and leadership (willingness to initiate or lead an action—Yes/No)

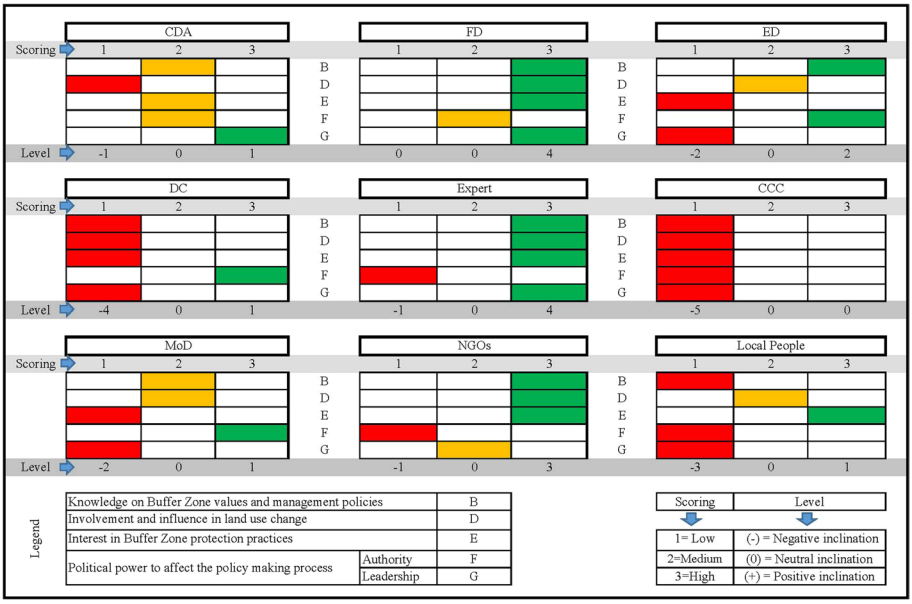

Fig. 3 Interpretation results of stakeholder analysis matrix *Source*: Interview, adapted from Schmeer (1999)

4.2.1 Contradiction in policy, program, and plan

Through the review of development plans of CDA such as Structure Plan, Urban Development Master Plan, Detailed Area Plan, and Bangladesh National Building Code, certain contradictions were identified. For instance, SP has identified Sitakunda Thana as one of the future industrial expansion areas concerning socioeconomic development issues. Alternatively, the plan has also mentioned the area as least suitable for urban development due to vulnerability to natural disasters (e.g., tidal cyclone surges, seasonal riverine flooding, hilly flood, tornado), and also less productive for agricultural activities caused by coastal salinity (UDMC 2014).

From the comparative analysis of Urban Development Master Plan with Structure Plan, it is clear that the policies encourage industrial development and city expansion to its urban periphery in the surrounding of Northern Hill region (Fig. 4b) that was dedicated as 'Strategic Open Space' to form a Regional Park and 'No Development Zone.' This aimed at preventing cyclone surges and floods through afforestation schemes and protecting the coastal area. Furthermore, the empirical study found shipbreaking activity (Fig. 4a) which has been spreading since the 1980s along the coastal area of zone B. Besides, Urban Development Master Plan also proposed a few roads construction and development projects (Fig. 4b) by demolishing natural recourses, for instance, hill cutting and felling mangrove and other forest areas.

The study found three different scenarios from DAP (2009): First and foremost, the land use survey by 2005–2006 documented that vegetation area accounted for 46.20% of the total land area of the region, whereas the new proposal by 2009 suggested 32.56% (including agricultural land development of less than 2%), despite the GoB's plan for protecting and enhancing the overall management of BZ. Moreover, the Detailed Area Plan (DAP) has proposed and initiated 11 types of landscape development program that would enhance

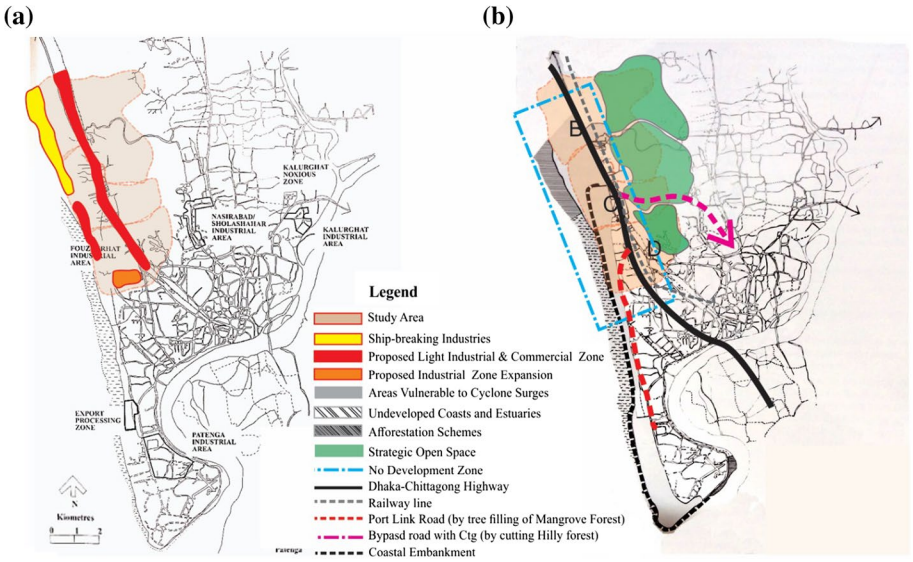

Fig. 4 Contradictory maps: **a** existing and proposed industrial development areas, **b** strategic open space, no development zone, and road development projects. *Source*: CDA (2008)

green BZ practices in the planning. Secondly, the proposed land use contains aggressive development plans for 25.51% of the coastal area, despite its declaration as a highly disaster-prone area by the Structure Plan and Ministry of Disaster Management and Relief (UDMC 2014). Lastly, the Detailed Area Plan has cited that industrial expansion should not settle within 300 m from the foothills and 'no development' will be allowed within 50 m by bylaws. Bangladesh National Building Code also imposed a similar restriction on such activities within 300 m. Despite those regulations, many industrial activities have been undertaken adjacent to the hilly landscape without taking legal permission and/or ensuring any sensitive environmental assessment. Surprisingly, CDA and other related authorities (Fig. 5) have permitted such developments.

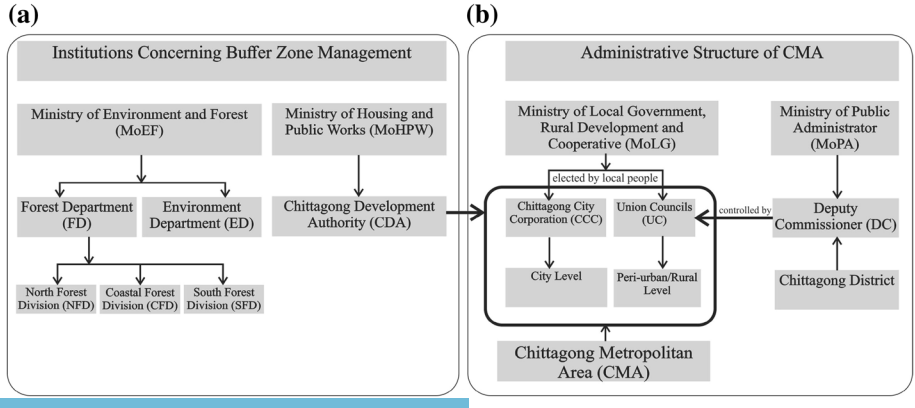

Fig. 5 **a** Institutions concerning buffer zone management, and **b** administrative structure of CMA *Source*: Building Construction Act 2008 (DAP 2009)

4.2.2 Institutional paradox in planning and implementation

The fundamental laws and regulations that concern BZ planning and development are controlled by three primary authorities (i.e., CDA, ED, and FD) at the regional level under two Ministries of Bangladesh (Fig. 5a). CDA is the key body to prepare CMA master plan (Fig. 5b) regarding urban and peri-urban development including landscape setting management where different authorities operate. FD focuses on forest area preservation through restricting surrounding constructions and encouraging reforestation, whereas ED is concerned with preserving hilly region and ecologically sensitive area.

The Ordinance of CDA was enacted in 1959 by entitling CDA to undertake development plan for CMA (e.g., including city and fringe areas). However, despite the separate Ministry of Deputy Commissioner and Union Council, UCs are controlled by DC who is the chair of district laws and orders and also sets the demarcation for Union Councils (at rural level) (Fig. 5b), whereas the city is controlled by Chittagong City Corporation. The mayor of City Corporation and Union Councils of Ministry of Local Government are elected by local people and represent expectations and demands of the locals.

At regional level, the study has identified two main operational approaches in the planning and implementation stages of CMA master plan 2008: (1) the Urban Development Committee (UDC) for developing policies and plans (Fig. 6a), and (2) Mega or Special Project Approval Committee (SPAC) to control adverse expansion and to execute environment-friendly development in and around sensitive areas (Fig. 6b). As stated by DAP (2009), if there are any projects in and around restricted or sensitive areas, they need specific approval for the development from SPAC before the UDC is approved. It is based on the Special Project Development Rules that apply to the following cases: (1) if the site is designed within 250 m from natural attraction/significance (e.g., hilly area, natural forest, national park, wetland, etc.), (2) from the coastal line, further development within 250 m, and (3) any kind of development beside highway. In the overall policy and planning level, all significant bodies of BZ preservation and management are included in the UDC structure. On the other hand, the evaluation by SPAC has no such expertise or related authorities to measure the vulnerability of such project execution (Fig. 6).

5 Discussion

Aiming at contributing to the assessment of land use planning and implementation policies of CMA from the perspectives of BZ preservation, development, and practices, the study has focused on the following key conflicts between the two views, i.e., pro-urbanization and BZ preservation in the case of DPZ-07.

First, it was confirmed by the interpretation of SAM that less priority is given to preserve and promote BZ improvement (e.g., buffer areas, forest area, hilly forest, wetlands, and open spaces) than to urban developments, as it is shown in (peri-)urban land use planning that planning for BZ and urban physical expansion as a practice are conflicting with each other. Despite the benefits of BZ functions and management, the top-level authorities have shown their preference for the development priorities through urbanization projects. Nevertheless, the BZ improvement practices have obtained positive feedback among all stakeholders by SAM. The Deputy Commissioner has shown the most negative inclination to BZ practices by illegally permitting for shipbreaking construction in the unclassified state forest of the mangrove areas. It has led to major impacts on land use governance

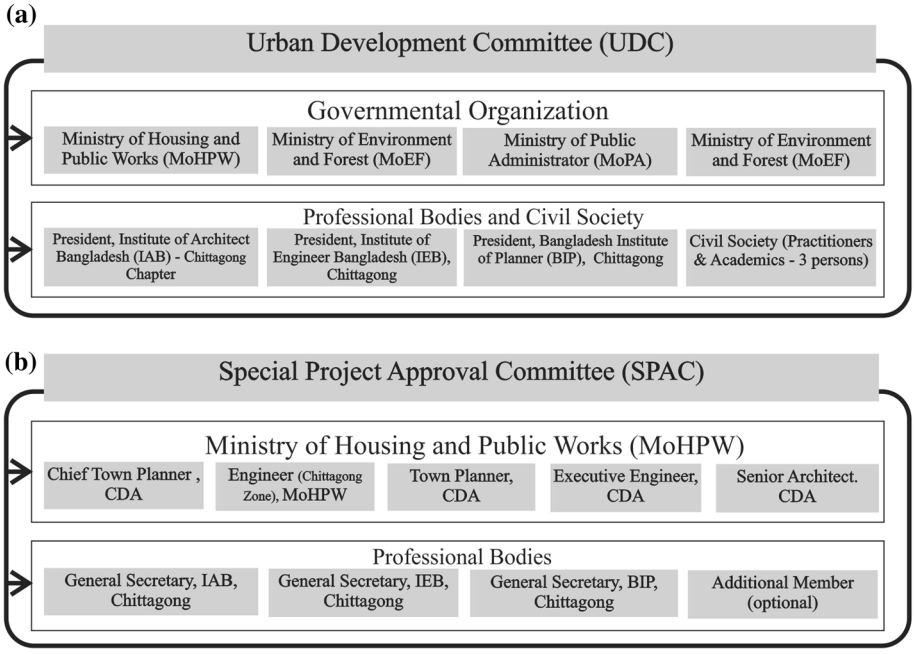

Fig. 6 Institutional structure of **a** urban development committee, and **b** special project approval committee of CMA. *Source*: DAP (2009)

in the region. Obviously, CDA, FD, and ED are institutionally concerned to preserve and conserve green spaces at policy and planning levels. BZ planning and management is not receiving adequate attention from CDA and ED. Surprisingly, CDA has shown maximum neutral inclination in SAM despite its recent CMA land use plan including several initiatives for green BZ growth and functions. On the other hand, FD, experts, and NGOs (e.g., Community Development Centre, Young Power in Social Action) are engaged to improve BZ areas through social forestry program by prioritizing women and youth, as well as the public awareness program such as organizing community participatory workshops and seminars, and media campaigns. However, the area is threatened by large-scale land transaction and conversion by the local builders and developers who are playing significant roles to purchase and capture the idle or abandoned agricultural lands on cheap rates for industrial and housing development. Local governments (e.g., UCs) have a lack of awareness and interest to control the intense land trade and prevent adverse land use change. Similarly, local Councilors are still encouraging shipbreaking yard spreading along coastal bay through the felling of mangrove forest in Zone C and D, which shows a lack of knowledge of potential benefit of BZ. However, these dispute initiatives in and around BZ and limited scope of agricultural productivities influenced locals to shift their livelihood. With this influence of industry-based development and job market, local people are not proactively participating in social forestry participatory program of FD to protect and conserve BZ. These underlying forces may explain how the public–private participatory programs and the awareness program on adverse environmental impacts through changing natural settings are running, and also how the local people could become the beneficiaries from BZ expansion and improvement practices. In sum, the BZ practices could not fulfill the local people's needs and did not establish a co-beneficial relationship between higher

authorities or between local and regional levels. It exposes a lack of interagency coordination and involvement in initiating constructive actions. Moreover, the absence of participatory activities, insufficient knowledge, and inconsistent decisions have also undermined the importance of BZ in the region.

The second conflict was in land use strategies and policy implementation of CMA. Since the formation of CDA, the UDC has played a fundamental role in policy-making, planning, implementation, and monitoring developments on a regular basis, and SPAC has taken responsibility of special or mega projects for controlling adverse growth before they are finally executed and implemented by the UDC. Without having appropriate experts and responsible authorities on BZ area protection and green conservation of greater CMA, how the SPAC approves special consideration projects in and around sensitive areas remains as a question. This limitation shows a conflict at the decision-making level for land use planning to enhance BZ functions. For instance, generally at the policy and planning level, the UDC provides a guideline for all relevant bodies of BZ preservation and management to protect buffer spaces (Fig. 6). However, when they implement, they focus on urbanization rather than preservation. Conversely, at the appraisal and implementation level of SPAC, there is no such expertise or related authorities with explicit knowledge and skills to synthesize and protect sensitive areas from uncontrolled urban development and illegal settlements. Moreover, the approved decisions of SPAC might be overlooked by the UDC due to the delay in the approval process, the latter's overload, and lack of diligence in checking documents. This is alarming for future urban development and landscape protection. Additionally, the UDC is the leading land use planning body for upcoming CMA master plan 2016–2021, where SPAC does not have any significant role. Lastly, policy implication conflicts manifest through knowledge gaps among the key stakeholders, especially at the top level. For instance, the absence of legal documentation for BZ management through peri-urban landscape planning can be attributed to the shortsighted strategies and schemes taken by higher authorities without identifying the core problem. The lack of credible and reliable data on landscape ecology, biogeography, and socioeconomic condition, segregated authorities, and people's perception are also crucial factors behind the degradation of natural settings and geography in the peri-urban area. This leads to adverse impact on BZ development to support environmental planning and management in the core zone.

6 Conclusion

The study has examined the present situation of CMA's urban fringe area with valuable landscape resources by addressing the concept of BZ, which has been functioning as a transitional space for the city environment and supporting core zone development. The study has found that insensitive urban land use plan and institutional conflicts are the main lacunae for promoting and protecting the BZ area. However, in the policy implementation stage, the crucial problem is the knowledge gap among decision-makers regarding BZ improvement for enhancing its functions. Hence, urban land use planning needs to integrate the regional land use planning and policy-making framework in the future master plan 2016–2021. However, Structure Plan, Urban Development Master Plan, and Detailed Area Plan of Chittagong Metropolitan Area, National Forest Master Plan (1995–2015) are currently outdated, and climate resilient ecosystem and livelihood project for BZ improvement has just been completed in 2017. In this regard, the study concludes with recommendations on potential institutional sustainability and related capacity development for the

policy-making and management bodies such as CDA, ED, FD, and Core Zone Management Committees. Firstly, at the policy-making and management stages, relevant authorities that are currently controlled by separate laws and regulations should coordinate with top administrative bodies to minimize conflicts on land use governance. Strategic environmental assessment (SEA) and social impact assessment (SIA) to evaluate the further impact on BZ area at the regional level should also be applied appropriately. Secondly, to conserve natural settings for promoting BZ functions, legal documentation of BZ preservation and management plan with urban land use planning is suggested. However, in order to set a proper boundary line to protect immediate impact, existing and possible extensive zoning of green space plan with the built-up area should be identified. Thirdly, to add socioeconomic value, community participatory activities such as proactive engaging in social forestry, reducing dependency on forest resources use, ensuring maximum beneficiaries in families, and introducing incentive strategies are also recommended. Finally, continuous urbanization and its peripheral expansion are additional stress on BZ land use. Therefore, a landscape-sensitive approach should be introduced to make effective and efficient land use plan and management policies. To this end, policymakers need to review more case studies and policy analysis. Future research may cover a wider duration of land use/land cover analysis, which would contribute to a more comprehensive approach to the changes in landscape ecology caused by urban development and peri-urbanization trends. In the developed countries in particular, urban landscape conservation such as ecological corridor and network has recently become a significant paradigm in order to promote recreational, transportation, and nature education opportunities for urban residents, and conservation and protection of the natural landscape. There is an urgent need for developing countries in Asia to identify and address the socioeconomic and ecological value of sensitive landscapes in the urban peripheries by integrating them into the urban planning agenda. In addition, wider attention should be given to a holistic approach to peri-urban and rural research, and development issues.

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