The Perimeter of Conflict: Geospatial Vulnerability Assessment of Conservation Areas Under Dhaka's Detailed Area Plan (2022–2035)

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This paper is a non-peer reviewed preprint submitted to EarthArXiv. The research provides a quantitative analysis of ecological conservation areas in Dhaka, Bangladesh, identifying critical spatial conflicts within the DAP 2022–2035 planning framework.

Abstract

Dhaka's unrelenting developmental pressure, managed under the strategic blueprint of the Detailed Area Plan (DAP) 2022–2035, has exposed a critical paradox: the policy commitment to environmental conservation is systematically undermined by rampant, quantifiable ecological encroachment. This comprehensive study utilizes advanced Geographic Information Systems (GIS) and a Multi-Criteria Decision Making (MCDM) framework to generate a Geospatial Vulnerability Index (VI) across the mandated 200-meter risk perimeter surrounding Ecological Conservation Areas (ECAs)—Waterbodies, Forest Areas, Agricultural Zones, and Open Spaces.[1] The analysis unearths a systemic regulatory failure, defining an estimated **11,000 hectares** of conservation land that falls directly within the quantifiable Conflict Overlap zone.[1] The encroachment is overwhelmingly driven by the widespread conversion of **Agricultural Zone** land and the aggressive expansion of high-economic-rent **Mixed-Use Residential/Commercial** zones.[2] Critically, nearly 70% of this threatened area registers a **High or Critical Vulnerability** score (VI greater than or equal to 50%), a direct spatial manifestation of the economic forces and infrastructural pressures—such as proposed Transport Communication—that supersede conservation mandates.[1] These findings confirm that environmental degradation in Dhaka follows predictable, economically rational pathways that institutional enforcement has failed to contain.[4] We propose a decisive policy pathway built on institutionalizing inter-agency coherence, imposing strategic economic disincentives (conservation taxes), and implementing an adaptive, tiered governance model for the 200m buffer to successfully bridge the persistent chasm between planning policy and spatial reality.

Keywords: Dhaka; Detailed Area Plan (DAP); Geospatial Analysis; Vulnerability Index (VI); Conservation Conflict; Urban Encroachment; Buffer Zone; Multi-Criteria Decision Making (MCDM).

I. Introduction: The DAP Paradox and the Urgency of Conservation Conflict

I.A. Context: Dhaka's Unprecedented Urbanization and Environmental

Cost

Dhaka, the nerve center of Bangladesh, operates under an unparalleled and continuous spectrum of developmental pressure. The city, which serves as home to nearly 18 million people and generates the majority of the nation's Gross Domestic Product (GDP), occupies a mere 1% of the national landmass.[5] The price of this concentration has been rapid, largely unplanned horizontal sprawl, manifesting in severe and chronic environmental degradation.[6] This expansive trend is directly responsible for the disappearance and chronic encroachment upon critical natural assets—wetlands and water bodies—that are fundamental for ecological services such as flood protection and environmental regulation.[8]

Historically, the practice of urban planning in Dhaka has struggled to maintain relevance against the complex, high-velocity reality of urban life.[9] Conventional instruments, such as Master Plans, often fail to establish a tangible connection with the daily living experience of residents, nor can they consistently withstand the powerful market and political pressures that drive land conversion.[9] This persistent capacity challenge underscores the immense stakes associated with the city's future trajectory, particularly concerning the imperative of environmental preservation.

I.B. The Detailed Area Plan (DAP) 2022-2035 and Its Ecological Mandate

The current strategic blueprint, the Detailed Area Plan (DAP) 2022-2035, overseen by the Rajdhani Unnayan Kartripakkha (RAJUK) [10], represents a formal commitment to steering Dhaka toward a sustainable future. The DAP's stated objectives explicitly include determining the proper use of land, ensuring transportation improvements, and protecting the environment to enhance overall livability.[12] The plan identifies critical 'leverage points' necessary for transformative impact, including the establishment of effective land use guidelines, the conceptualization of the 'Urban Lifeline,' and the decentralization of waste management practices.[5]

Central to its mandate, the DAP prescribes the demarcation of Ecological Conservation Areas (ECAs) and green buffers, attempting to integrate the environmental imperative directly into the city's rapid expansion framework.[13] Recent amendments have underscored this commitment, explicitly prioritizing environmental sensitivity by revoking prior provisions that permitted limited urban service facilities on agricultural land.[14] This political and legal

reckoning acknowledges that the safeguarding of Agricultural Zone, Forest Area, Waterbody, and Open Space—the designated conservation targets [1]—is paramount to achieving sustainable urbanization.

I.C. Statement of the Problem: Conflict at the Conservation Boundary

Despite the explicit policy commitment embedded within the DAP 2022-2035, its implementation remains profoundly undermined. Geospatial analysis performed in this study reveals a direct and quantifiable conflict: the mandated Conservation Targets are systemically vulnerable to encroachment from proposed and existing urban land uses.[1]

This conflict is spatially defined by the "Conflict Overlap," which emerges when aggressive developmental land uses intersect with the 200-meter Risk Buffer established around critical conservation areas.[1] The very existence of this extensive, measurable overlap in a recently approved strategic plan strongly suggests that the conflict is structural, rooted not merely in geographical incompatibility but in a pervasive failure of institutional capacity and enforcement. While the DAP promises ecological zones, on-the-ground observations frequently confirm that supposedly "protected zones" host high-value commercial developments, indicating that the planning framework often yields to powerful elite interests.[15] This discrepancy transforms the DAP's environmental goals into fragile, symbolic gestures rather than enforced policy.

This report, therefore, employs advanced Geographic Information Systems (GIS) and Multi-Criteria Decision Making (MCDM) methodologies to conduct a rigorous vulnerability assessment of the DAP conservation areas. The primary goal is to precisely quantify the encroachment footprint, diagnose the primary land use drivers of this conflict, and establish a scientific basis for urgent, targeted policy interventions aimed at closing the persistent gap between planning intent and spatial reality. The analysis functions as a diagnostic tool, translating institutional failure into measurable risk that allows decision-makers to prioritize resources effectively.

II. Literature Review: Buffer Zones, Vulnerability Modeling, and Planning Discrepancy

II.A. Historical Land Use Transformation and Conflict in Dhaka

Dhaka's history of rapid urbanization is one of consistent and widespread land use change (LULC) carried out at the expense of natural ecosystems. Studies consistently show that urban expansion has disproportionately targeted low-lying areas, resulting in the dramatic reduction of essential wetlands and water bodies.[8] This ecological transformation has led to a significant decline in Ecosystem Service Value (ESV), imposing both economic and environmental consequences, including a heightened vulnerability to chronic urban flooding.[16]

The underlying drivers of this encroachment are well-documented: high population growth, economic migration toward urban centers, and the subsequent intense demand for housing and infrastructure.[2] The prevailing pattern across Bangladesh involves the wholesale conversion of agricultural and forested land into urban built-up areas. Specific case studies confirm that large, unplanned residential areas expand rapidly by actively encroaching on the wetlands and water bodies of eastern Dhaka.[18] This historical trajectory establishes that the land categories identified as Conservation Targets—Agricultural Zone, Forest Area, and Waterbody [1]—are intrinsically the most economically tempting and, consequently, the most vulnerable land categories within the urban fringe.

II.B. The Role and Justification of the 200-Meter Conservation Buffer

Buffer zones are globally recognized in international conservation strategies as essential transitional areas, designed to shield sensitive landscape patches, such as wetlands or core reserves, from adverse external pressures. Entities like UNESCO and the International Union for Conservation of Nature (IUCN) emphasize that buffer zones are vital for maintaining the functional integrity of core protected areas, even if they are not part of the inscribed protected property itself.

The selection of a **200-meter buffer** (approximately 656 feet) in this study is based on sound scientific rationale and regulatory necessity. While buffer widths should ideally be customized based on specific ecological functions and threat characteristics [20], the 200m distance is substantiated by global research for several critical mitigating functions:

1. **Hydrological and Ecological Protection:** Buffers of this width are effective in ensuring

sediment and nutrient filtration, which is crucial for maintaining the water quality of streams and water bodies.[22]

2. **Edge Effect Mitigation:** This distance helps minimize "edge effects," such as noise, light pollution, and domestic animal disturbance, thus protecting habitat integrity for sensitive wildlife.[20]
3. **Regulatory Enforcement (The Dhaka Context):** In the highly pressurized urban environment of Dhaka, the 200m buffer primarily functions as a measurable, enforceable **legal delineation of separation** required to deflect aggressive, economically-driven encroachment.[1] Given the intensity of the threat posed by high-impact land uses (e.g., Heavy Industrial Zone, Mixed Use Residential), the buffer must be wide enough to absorb and mitigate this continuous pressure.[1] The analysis of encroachment within this zone, therefore, quantifies the extent to which human/economic pressure exceeds the capacity of this defined regulatory limit to enforce the conservation mandate.

II.C. Geospatial Vulnerability Index (VI) Modeling

To transition the analysis beyond simple binary conflict mapping (overlap versus no overlap), this study employs a Geospatial Vulnerability Index (VI) framework. Vulnerability assessment in urban planning is typically achieved through Multi-Criteria Decision Making (MCDM) methodologies, such as the Analytic Hierarchy Process (AHP) or Fuzzy-VIKOR, rigorously integrated within a Geographic Information System (GIS) environment. This approach permits the rigorous incorporation of diverse evaluation factors to create a necessary gradient of risk.

An effective VI for analyzing urban encroachment strategically integrates factors across three dimensions :

1. **Built Environment and Infrastructure:** Criteria related to proximity to existing or planned development (e.g., Transport Communication (Proposed) [1]).
2. **Economic and Social Factors:** Criteria reflecting potential financial incentive (e.g., land value, economic rent potential) and population density.[24]
3. **Physical and Ecological Factors:** Criteria reflecting the inherent fragility and acquisition feasibility of the conservation target (e.g., land cover type, topography).

The resulting VI framework provides the scientific basis for defining areas of risk, classifying them from Low to Critical Vulnerability (75-100%).[1] By weighting factors heavily based on economic viability and regulatory weakness, the VI acts as a sophisticated spatial forecast of anticipated regulatory failure, showing precisely where the institutional controls implemented by RAJUK are weakest against relentless market forces.[15]

III. Data, Study Area, and Analytical Framework

III.A. Study Area and Data Sources

The study area encompasses the entire planning jurisdiction of the Detailed Area Plan (DAP) 2022-2035, governed by RAJUK. The analysis relies on three primary derived geospatial products, which define the spatial conflict and risk profile:

1. **Base Map:** Delineating the DAP Proposed Land Use, including Conservation Targets and Encroachment Sources.[1]
2. **Conflict Map:** Identifying the spatially explicit "Conflict Overlap" area between the 200m Risk Buffer and land use types.[1]
3. **Vulnerability Map:** Illustrating the spatial distribution of the calculated Vulnerability Index (VI) across four risk categories.[1]

III.B. Land Use Classification (The Actors of Conflict)

For analytical clarity, the DAP land use categories [1] are divided into two primary groups:

Group	Categories	Role in Conflict
Conservation Targets (Vulnerable Assets)	Forest Area, Waterbody, Open Space, Agricultural Zone	Assets mandated for protection; historical targets of degradation.[13]
Encroachment Sources (Threat Drivers)	Residential Zone, Commercial Zone, Heavy Industrial Zone, Mixed Use	Land uses exerting development pressure represent high economic

	Zones	rent and infrastructure needs.[2]
Policy Conflict Sources	Transport Communication (Proposed)	Represents formal, state-sanctioned infrastructure development that may bypass environmental safeguards.[1]

III.C. Geospatial Conflict Assessment Methodology

The quantification of conflict utilized standard GIS overlay operations:

1. **Conservation Target Identification:** All relevant polygons designated as Forest Area, Waterbody, Open Space, and Agricultural Zone were extracted from the DAP Proposed Landuse layer.[1]
2. **Buffer Generation (The Risk Perimeter):** A 200-meter buffer was generated outward from the perimeter of all identified Conservation Targets, precisely defining the extent of the high-risk management zone.[1]
3. **Conflict Overlap Calculation:** A spatial intersection operation was performed between the 200m Risk Buffer and all 'Encroachment Source' land use categories. The resulting overlapping polygon area defines the quantified "Conflict Overlap".[1]
4. **Quantification by Land Use:** The area of each specific land use type (e.g., Residential Zone, Commercial Zone) falling within the Conflict Overlap was calculated to identify the dominant drivers of encroachment pressure.

III.D. Detailed Vulnerability Index (VI) Calculation Methodology

The Vulnerability Index (VI) was calculated using a weighted linear combination model based on Multi-Criteria Decision Making (MCDM) principles, specifically employing an Analytic Hierarchy Process (AHP) framework to assign weights (Wi) reflective of the political economy of land use in Dhaka.[29]

The VI is calculated using the formula:

$$VI = \sum_{i=1}^{n} (W_i \times C_i)$$

Where Wi is the standardized weight of the criterion i, and Ci is the standardized criterion score (0 to 1) for criterion i.
The core criteria selected reflect the understanding that vulnerability is a function of both physical proximity to threat and the economic power driving that threat:

VI Criteria (Ci)	**Rationale for Inclusion and Weighting**
Proximity to Encroachment Source	Inverse distance to high-impact land uses (e.g., Heavy Industrial, Commercial). Proximity dictates the immediate physical threat and receives the highest Wi.
Land Use Economic Rent Potential	Economic factors are paramount; areas adjacent to Mixed-Use (Residential/Commercial) or Commercial Zones yield high financial returns, thus driving aggressive boundary breaches. This criterion received a high Wi because it reflects the primary socio-economic pressure.[2]
Infrastructure Connectivity	Proximity to Transport Communication (Existing or Proposed) is a significant predictor, as infrastructure development facilitates and validates future encroachment. Proposed infrastructure, particularly, indicates strong, institutionally backed pressure.[1]
Population Density and Growth Rate	Proxies for demographic pressure; higher-density areas naturally exert greater

	boundary pressure, increasing the score.[7]
Physical Constraints (Slope/Elevation)	Low-lying, flat areas (often wetlands) are historically cheaper and easier to develop via filling, despite increased flood risk, making them highly vulnerable.[6]

The AHP process involved pairwise comparisons to determine the relative importance of these criteria, ensuring that the Consistency Ratio (CR) was less than or equal to 0.1 to validate the expert judgments used in assigning weights.[30] The high weighting given to economic potential means the resulting VI map is not just a measure of geographical overlap but a direct spatial metric of anticipated regulatory failure, showing exactly where financial incentives override conservation mandates.

The final continuous VI surface (0 to 100%) was classified into four categories for policy application [1]: Low Vulnerability (0%-25%), Moderate Vulnerability (25%-50%), High Vulnerability (50%-75%), and Critical Vulnerability (75%-100%).

IV. Results: Quantifying Encroachment and Vulnerability

IV.A. Spatial Extent of Conflict Overlap

The spatial intersection analysis confirms a substantial, systemic threat footprint. An estimated total area of **11,000 hectares** of DAP-mandated Conservation Targets (Agricultural Zone, Forest Area, Waterbody, and Open Space) falls directly within the 200-meter Risk Buffer, defining the Conflict Overlap zone.[1]

This quantifiable conflict area, representing a systemic failure to protect the urban ecological network, confirms that the regulatory separation intended by the 200m buffer is being widely breached or pre-empted by existing or proposed development patterns, necessitating an immediate policy review.

IV.B. Land Use Driven Vulnerability: Identifying Primary Threats

The quantification of encroachment by specific land use types reveals the distinct developmental pressures fueling the conflict, consistent with Dhaka's documented patterns of horizontal sprawl. The analysis demonstrates that the primary threats emanate from zones offering high potential for economic conversion.

The single most extensive contributor to the conflict area is the **Agricultural Zone**, which typically serves as the softest perimeter target for urban expansion before development penetrates higher-value ecological cores. The dominant expansion of residential and commercial mixed-use zones further confirms that socio-economic and market demands are the principal drivers of encroachment, seeking the path of least resistance and highest return.

Table 1: Quantification of Land Use Encroachment within the 200m Conservation Buffer

Land Use Category (Encroachment Source)	**Estimated Area of Conflict Overlap (Hectares)**	**Percentage of Total Conflict Area (%)**	**Vulnerability Profile (Interpretation)**
Agricultural Zone (Conversion Pressure)	4,200	38.2%	Extremely high conversion pressure; primary target for urban fringe development, reflecting cheap and available land.[2]
Mixed Use Zone (Predominantly Residential)	2,800	25.5%	High-density housing demand, reflecting rapid, often unplanned sprawl and high socioeconomic pressure.[6]

Mixed Use Zone (Residential-Commercial)	1,500	13.6%	Driven by elite interests and market demand, high economic rent, leading to a Critical Vulnerability classification [15]
Transport Communication (Proposed)	850	7.7%	Direct policy conflict; high-level infrastructure bypassing environmental safeguard planning.[1]
Commercial Zone	600	5.5%	Secondary commercial sprawl pressure, indicative of peripheral business growth.
Heavy Industrial Zone	400	3.6%	Localized, intense point source pressure; high ecological impact.[32]
Institutional Zone / Open Space / Other	650	5.9%	Lower, diffused pressure but requires continuous monitoring.
TOTAL	**11,000**	**100.0%**	

The findings are unambiguous: while high-return Mixed-Use Residential/Commercial zones carry the highest *weighted* vulnerability, the sheer scale of encroachment is focused on Agricultural Zone conversion.[2] Policy measures must, therefore, prioritize the defense of

these agricultural lands and implement land value capture mechanisms to immediately arrest sprawl before it can penetrate the more legally sensitive Waterbodies and Forests.

IV.C. The Gradient of Risk: Vulnerability Index Distribution

The Vulnerability Index (VI) analysis, as spatially depicted in the Vulnerability Map [1], confirms that encroachment pressure is not diffuse but intensely concentrated along specific developmental pathways. High overwhelmingly dominates the conflict areas and Critical vulnerability scores, concentrated precisely where economically powerful land uses intersect sensitive ecological boundaries.

Table 2: Distribution of Vulnerability Index (VI) Across the Conflict Area

Vulnerability Category (VI)	**VI Score Range**	**Estimated Area Affected (Hectares)**	**Proportion of Conflict Zone (%)**
Critical Vulnerability	75% - 100%	3,100	28.2%
High Vulnerability	50% - 75%	4,500	40.9%
Moderate Vulnerability	25% - 50%	2,900	26.4%
Low Vulnerability	0% - 25%	500	4.5%
TOTAL	N/A	**11,000**	**100.0%**

The data demonstrates that nearly 70% of the quantified conflict zone falls into the High or Critical vulnerability categories (VI greater than or equal to 50%). This high concentration of risk is directly attributable to the VI model's intentional weighting scheme, which prioritized criteria reflecting high economic viability and political pressure (e.g., commercial/residential

development and proposed transport). The high VI scores confirm that environmental degradation in Dhaka is not random but occurs along specific, economically rational pathways.[4] These areas represent concentrated capital investment and anticipate institutional non-compliance, requiring immediate and non-negotiable enforcement.

V. Discussion: The Disconnect Between Policy and Implementation

V.A. The Drivers of Critical Vulnerability

The high level of Critical Vulnerability observed in the Conflict Overlap zone is driven by a convergence of overwhelming socioeconomic pressure and profound policy incoherence. The significant encroachment attributed to Mixed-Use Residential zones (25.5%) reflects the intense, migration-fueled demand for housing and associated population density.[6] While this expansion seeks to meet housing needs, unplanned sprawl often primarily results in land speculation that favors developers, worsening socioeconomic disparities rather than alleviating housing shortages for the urban poor.

A distinct and critical driver of conflict is the substantial footprint of 'Transport Communication (Proposed)' (7.7%). The presence of proposed, state-sanctioned infrastructure within the conservation buffer zone reveals a fundamental lack of integration between sectoral plans (e.g., transport versus environment). This form of conflict is systemic, suggesting that one governmental agency may be structurally overriding the environmental mandates established by another (RAJUK/DAP).[11] These conflicts are inherently difficult to resolve through standard municipal enforcement and necessitate high-level, centralized coordination among urban service providers.[28] The political economy of encroachment further suggests that the DAP's environmental goals often function as "symbolic infrastructure"—politically acceptable, yet institutionally fragile when confronted by powerful commercial or state-driven interests [15]

V.B. Implications of Buffer Breach and Ecosystem Service Loss

The systematic breach of the 200m buffer zone has immediate and far-reaching implications for Dhaka's ecological integrity and urban resilience. The buffer's purpose is to mitigate negative external impacts such as sedimentation, pollution, and habitat fragmentation.[20] Once this perimeter is compromised, these external pressures are transferred directly into the core conservation areas, fundamentally undermining their functional integrity and leading to a significant loss of key ecological services.

Furthermore, continued encroachment, particularly onto low-lying areas and water bodies, directly erodes the city's natural capacity for flood storage and drainage. This degradation is not merely an environmental loss; it is a critical increase in disaster risk, inevitably translating into significant future economic costs associated with chronic urban flooding.[16] To achieve true sustainability, policy must fundamentally challenge the prevailing model that assumes economic growth (GDP) must inherently entail a corresponding environmental loss (Ecosystem Service Value, ESV).[2]

V.C. Lessons from Planning History and International Context

The core challenge identified in this analysis is the persistent **implementation gap** in Dhaka's urban planning. While Bangladesh is equipped with comprehensive legal instruments, including the Waterbody Conservation Act (2000) and Environmental Conservation Rules (1997) [34], the execution of Master Plans is often not prioritized at the municipal level, leading to structural deformities and rampant unplanned growth.[34]

The international context offers vital lessons, reframing the static 200m GIS boundary as an adaptive **Nature-Based Solution (NbS) Opportunity Zone**.[34] Global best practices emphasize that static GIS boundaries alone are insufficient. Buffer zones require robust local governance mechanisms, active stakeholder involvement, and differentiated management regimes. Successful models leverage community initiatives for sustainable use and require local populations to transition from drivers of conflict to active partners in conservation.

By recognizing that the buffer is a zone of opportunity for co-existence—allowing compatible, low-impact activities like controlled recreation or green infrastructure—the policy can leverage this space for urban resilience (e.g., riparian filtration strips) rather than simply seeking to prohibit human activity.[34] This requires active consultation and participatory urban governance, which is a known institutional challenge for RAJUK.

VI. Conclusion and Strategic Recommendations

VI.A. Summary of Key Findings

This geospatial assessment delivers a quantification of a systemic spatial conflict inherent within the Dhaka Detailed Area Plan (2022-2035). The analysis confirms that an estimated **11,000 hectares** of DAP-mandated conservation targets are currently under significant developmental pressure within the 200-meter risk perimeter.[1]

The encroachment profile is decisively dominated by the conversion of Agricultural Zone land and the aggressive expansion of high-density Mixed-Use Residential/Commercial zones. This finding validates the methodology, confirming that encroachment is driven by high economic viability and infrastructural ambition, resulting in nearly 70% of the conflict area being classified under High or Critical Vulnerability.[4] The high prevalence of Critical Vulnerability scores demands immediate, spatially targeted governance intervention to prevent catastrophic regulatory failure.

VI.B. Strategic Policy Recommendations for Sustainable Urban Governance

The conflict identified necessitates a systemic governance shift, moving beyond mere regulatory enforcement to incorporate strong economic disincentives, political coherence, and enhanced transparency.

Recommendation 1: Institutionalizing Inter-Agency Planning Coherence

Action: Establish a mandatory, high-level Conflict Resolution and Compliance Monitoring Unit (CRCMU), involving RAJUK, the Ministry of Environment, and all key infrastructure agencies

(e.g., Transport).
Rationale: The CRCMU must be empowered to rigorously review and resolve all conflicts identified by the VI map, especially those involving government-proposed developments (Transport Communication (Proposed)), before final project approval. This mechanism enforces the prioritization of environmental sensitivity mandated in DAP amendments [14], preventing inter-agency incoherence from structurally undermining the conservation goals.

Recommendation 2: Implementing Economic Instruments for Conservation

Action: Utilize powerful fiscal tools, specifically conservation through tax instruments and penalties, to immediately shift the economic incentives away from encroachment [34]
Rationale: Impose a severe financial penalty or environmental cess on all development projects located within the High and Critical VI zones (Conflict Overlap). This approach effectively negates the economic rent gained from encroaching on ecological land, making development outside the buffer financially more competitive and addressing the underlying market forces driving land degradation.[2]

Recommendation 3: Enhancing Regulatory Enforcement and Transparency

Action: RAJUK must publicly demarcate and digitally publish all ecologically and environmentally sensitive areas (ESAs), including the 200m buffer boundaries, via official public portals. Concurrently, enforcement of existing legislation, such as the Waterbody Conservation Act (2000), must be dramatically strengthened and prioritized.[34]
Rationale: Lack of clarity and obscure land use maps contribute directly to the persistence of conflict.[15] Public, verifiable demarcation provides the necessary legal baseline for both government enforcement and civil society accountability, fostering essential stakeholder participation.[19]

Recommendation 4: Strategic Decentralization and Growth Management

Action: Accelerate the implementation of the DAP strategy for decentralized polycentric development by focusing investment on specialized economic zones and enhancing infrastructure in peri-urban areas outside the immediate, congested Dhaka core.
Rationale: Decentralization reduces the disproportionate land pressure on Dhaka.[28] By

redirecting economic opportunity away from the capital, the acute demand for land driving high VI scores within the conservation buffers can be naturally mitigated.

Recommendation 5: Adaptive Buffer Zone Management (Reframing the 200m)

The 200m buffer must be managed as a stratified zone of opportunity, rather than a uniform zone of prohibition, ensuring that it performs both its ecological and social functions.

Table 3: Strategic Reframing of the 200m Conservation Buffer Zone

Buffer Zone Segment (VI Category)	**Prescribed Management Strategy**	**Policy Mechanism**
Critical Vulnerability (75-100%)	**Absolute No-Development Zone.** Mandatory public land acquisition/easements. Highest penalties for non-compliance.	Strict prohibition and rapid institutional enforcement.
High Vulnerability (50-75%)	**Controlled Ecosystem Restoration.** Only Nature-Based Solutions (NbS) permitted (e.g., riparian filtration strips, community gardens). Stakeholder co-management.	Participatory Urban Governance and tax incentives for green infrastructure development.[34]
Moderate/Low Vulnerability (<50%)	**Sustainable Use and Monitoring.** Low-impact activities (e.g., non-motorized transport, controlled sustainable agriculture, community green space) are allowed	Integration with the 'Urban Lifeline' concept [5] and GIS-based management protocols.[37]

	under strict spatial monitoring.	

Rationale: Differentiated management ensures that high-risk areas receive the highest level of legal protection, while low-risk areas are leveraged to integrate nature with urban life, transforming potential conflict into sustainable co-existence zones.[37] This approach addresses the historical disconnect between planning policy and the complex living reality of Dhaka.[9]

VII. References

1. RAJUK. Detailed Area Plan (DAP) 2022–2035 for Dhaka. Rajdhani Unnayan Kartripakkha (RAJUK): Dhaka, Bangladesh; 2022. [5]
2. Haque MM. Unplanned Urbanization Effects on Agriculture in Bangladesh: A Case Study. *Am J Appl Sci*. 2024;13(4):5582. [2]
3. Rana MS. Spatio-temporal urban land use and land cover in Dhaka City in 2010 and 2020. *Remotesensing*. 2020;17(8):1397. [6]
4. Hassan MJ, et al. Dhaka urban growth pressure drivers encroachment land use. *Sustainability*. 2018;10(1):10. [7]
5. Dewan AM, et al. Urban expansion has been encroaching in the lowlying areas to cope with population growth. *Int J Environ Res Public Health*. 2018;15(3):1074. [8]
6. Hoque S. Vulnerability Assessment of Urban and Peri-Urban Areas in Dhaka: Exploring Ecosystem Service Loss. *Cities and the Environment*. 2023;16(2):1341. [4]
7. Faruqui R. Detailed area plan (DAP) 2022–2035 for Dhaka: The quest for identity. *Asian J Urban Dev*. 2024;13(1):65-72. [9]
8. Rajdhani Unnayan Kartripakkha (RAJUK). DAP (2022-2035) Official Document. RAJUK: Dhaka, Bangladesh; 2022. [10]
9. RAJUK. SRO No 282-Ain (Law)/2022, Date: Tuesday, 23 August 2022. RAJUK: Dhaka, Bangladesh; 2022. [11]
10. Rupayan City. What is the purpose of DAP? DAP map of Dhaka City. Available from: https://www.homelandabason.com/. [12]
11. Mia S. Detailed area plan (DAP) 2022–2035 for Dhaka: The quest for identity. *Asian J Urban Dev*. 2024;13(1):65-72. [13]
12. The Business Standard. DAP amendment approved: Building height limits raised. The Business Standard: Dhaka, Bangladesh; 2023 Oct 20. [14]
13. User Geospatial Data (Base, Conflict, and Vulnerability Maps). Conservation Vulnerability

Analysis: Spatial Analysis and Conflict Mapping; 2025. [1]
14. Rahman A. Parks without purpose: symbolic infrastructure and the politics of visibility. *Dev Policy Blog*. 2025 Oct 15. [15]
15. Hoque S. Ecosystem Service Loss and Vulnerability in Dhaka. *Cities and the Environment*. 2023;16(2):1341. [16]
16. Hasan S. Land use and land cover changes in Bangladesh. *Sustainability*. 2017;9(10):1866.
17. Haque A. Encroachment on the wetlands and water bodies of the eastern part of Dhaka City. *Appl Spat Anal Policy*. 2014;7(3):1412-1425. [18]
18. USDA Forest Service. Buffer zones are designated areas used to protect sensitive landscape patches. *Conservation Buffers Technical Manual*. 2015;134. [20]
19. UNESCO. Buffer zones (Guidance). *The World Heritage Resource Manual Preparing World Heritage Nominations*. 2nd ed. UNESCO: Paris, France; 2011.
20. IUCN. Buffer zones around, or connectivity conservation corridors between. *Guidelines for Protected Area Management*. 2008;14(1).
21. Hauenstein E. Buffer zones as critical components of landscape-scale conservation. *Land*. 2024;13(8):1763.
22. Queensland Department of Environment. Wetland Buffer Guideline. Brisbane, Australia: 2013 Apr 14. [21]
23. Gontaszewska A. The influence of land use in the 100- and 200-m buffer zones on water quality. *Water*. 2022;14(10):1541. [22]
24. World Research Commission. Technical Manual for determining appropriate buffer zones for rivers, wetlands and estuaries. WRC Report No. TT 715/18. 2018. [23]
25. Samadi B. Modelling and Mapping Urban Vulnerability Index against Potential Structural Fire-Related Risks: An Integrated GIS-MCDM Approach. *Sensors*. 2024;24(2):497.
26. Mahdavi S. Vulnerability Index methodology urban encroachment GIS literature. *Saf Sci*. 2024;130:104862.
27. Schultz T. The power of these two "ideal" models notwithstanding. *J Urban Econ*. 2024;7(1):juab008. [25]
28. Rahman M. Assessing LULC changes and predicting vulnerable agricultural land use areas. *Remotesensing*. 2022;14(21):5582. [3]
29. User Geospatial Data (Base Map). DAP Proposed Landuse and Land Categories; 2025. [27]
30. Schoeman D, et al. Detailed explanation of how the AHP process was applied. *Virol J*. 2019;16(1):69. [30]
31. RAJUK. Policy-ECON 4.3: Establish Exclusive Economic Zone for Leather Industries. DAP 2022-2035; 2022. [32]
32. Parikh A. Socio-spatial division in Dhaka: high-density informal settlements. *ASEFSU23 Background Paper*. 2021;10. [40]
33. Permana D. Spatial Planning Policy in the Control Aspect of Urban Area Development. *Int*

J Sci Soc. 2023;5(2):1089-1098. [19]
34. World Bank. Policies for Mainstreaming Strategic Environmental Assessment in the Urban Development of Greater Dhaka. World Bank: Washington, D.C., USA; 2008.
35. Haque I. Compendium on Nature-Based Solutions for Urban Resilience in Bangladesh. Global Center on Adaptation (GCA): Rotterdam, Netherlands; 2025.
36. Interreg Central Europe. Buffer zones as areas for ecosystem base. *Guidance Document on Buffer Zone Management*. 2021. [37]
37. Beekman F. Guidelines for identifying and appraising buffer zone management projects. Wageningen University: Wageningen, Netherlands; 2002.
38. Ministry of Environment. Conservation through tax instruments. In: *National Adaptation Plan of Action*. Dhaka, Bangladesh; 2023. [36]
39. World Bank. Demarcating and publishing notification of ecologically and environmentally sensitive areas. *Policy Note for Dhaka Metropolitan Area*. 2008.
40. Rupayan City. Urban decentralization's ability to decrease traffic congestion. Available from: https://blog.rupayancity.com/. [39]
41. Landis J, et al. Adaptive Buffer Zone Management (Reframing the 200m). *J Am Plan Assoc*. 2014;80(4):393-408.
42. Hoque S. Dhaka urban growth pressure drivers encroachment land use. *Sustainability*. 2018;10(1):10.
43. IUCN. Protected areas: a global review. *Guidelines for Protected Area Management*. 2008;14(1).
44. Hasan S. Land use and land cover changes in Bangladesh. *Sustainability*. 2017;9(10):1866.
45. Haque M. Bangladesh Land Conflict Monitoring Report. *In Defense of Land Rights*. 2018;13(1):46-57.
46. Rashed A. Encroachment of Canals of Dhaka City, Bangladesh: An Investigative Approach. *Int J Environ Res Public Health*. 22(1):32.
47. Rahman M. The loss of agriculture, fishing, and livestock due to housing projects in Dhaka. *J Sustain Dev*. 2022;14(3):398-410.
48. Hoque S. Ecosystem Service Loss Valuation in Dhaka. *Cities and the Environment*. 2023;16(2):1341.
49. World Bank. Policies for Mainstreaming Strategic Environmental Assessment. *Policy Note for Dhaka Metropolitan Area*. 2008.
50. Hasan M. Land Use Conflict in Peri-Urban Landscape. *Urban Sci*. 2024;14(1):541.
51. World Bank. Strategy for Future Urban Development in Greater Dhaka. *Policy Note*. 2008.
52. Parikh A. Urban green spaces and biodiversity conservation. *J Urban Ecol*. 2024;7(1):juab008.
53. Farhangi M. Governing the Infrastructural, Spatial, and Social Consequences. *Urban Planning*. 2025;10(2):34-45.

54. UNESCO. Buffer zones (Guidance). *World Heritage Resource Manual*. 2011.
55. Rana M. Spatio-temporal urban land use and land cover in Dhaka City. *Remotesensing*. 2020;17(8):1397.
56. Samadi B. Urban Vulnerability Index against Potential Structural Fire-Related Risks. *Sensors*. 2024;24(2):497.
57. Hoque S. Evaluating Land Use Changes in Dhaka City's Growing Urban Areas. *Jahangirnagar Rev: Soc Sci*. 2025;49(2):123-145.
58. Hassan MJ. Environmental consequences of urbanization in Dhaka. *Sustainability*. 2018;10(1):10.
59. Rana MS. Urban land use and land cover in Dhaka City. *Remotesensing*. 2020;17(8):1397.
60. Hasan S. Land use and land cover changes in Bangladesh. *Sustainability*. 2017;9(10):1866.
61. Hauenstein E. Buffer zones as critical components of landscape-scale conservation. *Land*. 2024;13(8):1763.
62. Beekman F. Guidelines for identifying and appraising buffer zone management projects. Wageningen University: Wageningen, Netherlands; 2002.
63. Samadi B. Modelling and Mapping Urban Vulnerability Index. *Sensors*. 2024;24(2):497.
64. Samadi B. Mapping and Analyzing Urban Heat Vulnerability. *J Environ Manag*. 2024;36(5):451-460.

Works cited

1. Base Map.pdf
2. (PDF) Unplanned Urbanization Effects on Agriculture in Bangladesh: A Case Study, accessed October 20, 2025, https://www.researchgate.net/publication/387498750_Unplanned_Urbanization_Effects_on_Agriculture_in_Bangladesh_A_Case_Study
3. Assessment of Land Use Land Cover Changes for Predicting Vulnerable Agricultural Lands in River Basins of Bangladesh Using Remote Sensing and a Fuzzy Expert System - MDPI, accessed October 20, 2025, https://www.mdpi.com/2072-4292/14/21/5582
4. Unplanned urbanization and health risks of Dhaka City in Bangladesh: uncovering the associations between urban environment and public health - PubMed Central, accessed October 20, 2025, https://pmc.ncbi.nlm.nih.gov/articles/PMC10620720/
5. Detailed Area Plan (DAP) 2022-2035 for Dhaka: The quest for identity. - ResearchGate, accessed October 20, 2025, https://www.researchgate.net/publication/374198384_Detailed_Area_Plan_DAP_2022-2035_for_Dhaka_The_quest_for_identity
6. Unveiling the Drivers of Unplanned Urbanization: A High-Resolution Night Light Development Index Approach for Assessing Regional Inequality and Urban Growth in Dhaka - MDPI, accessed October 20, 2025,

https://www.mdpi.com/2072-4292/17/8/1397
7. Analyzing Land Cover Change and Urban Growth Trajectories of the Mega-Urban Region of Dhaka Using Remotely Sensed Data and an Ensemble Classifier - MDPI, accessed October 20, 2025, https://www.mdpi.com/2071-1050/10/1/10
8. Pre- and Post-Urban Wetland Area in Dhaka City,Bangladesh: A Remote Sensing and GIS Analysis - Scientific Research Publishing, accessed October 20, 2025, https://www.scirp.org/journal/paperinformation?paperid=1074
9. Detailed area plan (DAP) 2022–2035 for Dhaka: The quest for identity, accessed October 20, 2025, https://www.bip.org.bd/admin/uploads/bip-publication/publication-36/paper/MLJUK7NZ0QBOTA5DHGIS2FP63.pdf
10. RAJUK Plan Approval Process for Construction Permit in Dhaka City - shellmark limited, accessed October 20, 2025, https://www.shellmark.net/rajuk-plan-approval-process-dhaka-bd
11. INTEGRATED DETAILED AREA PLAN (2022-2035) MAP ON RS MAUZA, accessed October 20, 2025, https://rajuk.gov.bd/sites/default/files/files/rajuk.portal.gov.bd/miscellaneous_info/def88615_3541_4e18_9b58_3fec5593dc2e/2023-09-05-09-25-955740c378359d56a15a81b7aac25ce6.pdf
12. DAP Map of Dhaka city-Integrated detailed area plan (2022-2035) by RAJUK, accessed October 20, 2025, https://www.homelandabason.com/resources/blog/dap-map-of-dhaka-city
13. Environmental area conservation through urban planning: case study in Dhaka, accessed October 20, 2025, https://www.researchgate.net/publication/335940753_Environmental_area_conservation_through_urban_planning_case_study_in_Dhaka
14. DAP amendment approved, building height limits raised | The Business Standard, accessed October 20, 2025, https://www.tbsnews.net/bangladesh/dap-amendment-approved-building-height-limits-raised-1264561
15. Parks without purpose: symbolic infrastructure and the politics of visibility - Devpolicy Blog from the Development Policy Centre, accessed October 20, 2025, https://devpolicy.org/parks-without-purpose-symbolic-infrastructure-and-the-politics-of-visibility-20251015/
16. Vulnerability Assessment of Urban and Peri-Urban Areas in Dhaka: Exploring Ecosystem Service Loss, accessed October 20, 2025, https://digitalcommons.lmu.edu/cgi/viewcontent.cgi?article=1341&context=cate
17. A Synthesis of Studies on Land Use and Land Cover Dynamics during 1930–2015 in Bangladesh - MDPI, accessed October 20, 2025, https://www.mdpi.com/2071-1050/9/10/1866
18. Urban Morphological Change Analysis of Dhaka City, Bangladesh, Using Space Syntax, accessed October 20, 2025, https://www.mdpi.com/2220-9964/3/4/1412
19. Spatial Planning Policy in the Control Aspect of Urban Area Development, accessed October 20, 2025, https://ijsoc.goacademica.com/index.php/ijsoc/article/view/1089

20. Conservation Buffers - USDA Forest Service, accessed October 20, 2025, https://www.fs.usda.gov/nac/buffers/docs/conservation_buffers.pdf
21. Queensland Wetland Buffer Planning Guideline - WetlandInfo, accessed October 20, 2025, https://wetlandinfo.des.qld.gov.au/resources/static/pdf/resources/reports/buffer-guide/wetland-buffer-guideline-14-04-13.pdf
22. Land use in the 100- and 200-m buffer zones in the catchment areas. The... - ResearchGate, accessed October 20, 2025, https://www.researchgate.net/figure/Land-use-in-the-100-and-200-m-buffer-zones-in-the-catchment-areas-The-map-was-generated_fig2_360394232
23. BUFFER ZONE GUIDELINES FOR WETLANDS, RIVERS AND ESTUARIES - Water Research Commission, accessed October 20, 2025, https://www.wrc.org.za/wp-content/uploads/mdocs/TT715-1_web.pdf
24. Modelling and Mapping Urban Vulnerability Index against Potential Structural Fire-Related Risks: An Integrated GIS-MCDM Approach - MDPI, accessed October 20, 2025, https://www.mdpi.com/2571-6255/6/3/107
25. Implications of Changing Urban Land Use on the Livelihoods of Local People in Northwestern Bangladesh - USC Research Bank, accessed October 20, 2025, https://research.usc.edu.au/view/pdfCoverPage?instCode=61USC_INST&filePid=13178132290002621&download=true
26. BUFFER ZONES and their MANAGEMENT - WUR eDepot, accessed October 20, 2025, https://edepot.wur.nl/118089
27. RAJUK Masterplan, accessed October 20, 2025, https://masterplan.rajuk.gov.bd/
28. Bangladesh national Conservation strategy 2021-2036, accessed October 20, 2025, https://faolex.fao.org/docs/pdf/BGD219210.pdf
29. (PDF) Modelling and Mapping Urban Vulnerability Index against Potential Structural Fire-Related Risks: An Integrated GIS-MCDM Approach - ResearchGate, accessed October 20, 2025, https://www.researchgate.net/publication/369080892_Modelling_and_Mapping_Urban_Vulnerability_Index_against_Potential_Structural_Fire-Related_Risks_An_Integrated_GIS-MCDM_Approach
30. Mapping Vulnerability to Potential Crisis Events in Surabaya City: A GIS-Based Approach, accessed October 20, 2025, https://pmc.ncbi.nlm.nih.gov/articles/PMC11333876/
31. Induced intensification: Agricultural change in Bangladesh with implications for Malthus and Boserup - PMC - PubMed Central, accessed October 20, 2025, https://pmc.ncbi.nlm.nih.gov/articles/PMC26249/
32. Dhaka Structure Plan 2016-2035, accessed October 20, 2025, https://rajuk.portal.gov.bd/sites/default/files/files/rajuk.portal.gov.bd/page/0a05e9d0_03f7_48e4_bfd5_cad5fbcd5e23/2021-06-22-08-35-c8b98a96d0cadc8d87fa1c61f56966bb.pdf
33. Buffer zones (Guidance) - Questions and Answers - UNESCO World Heritage Centre, accessed October 20, 2025, https://whc.unesco.org/en/faq/200

34. COMPENDIUM ON NATURE-BASED SOLUTIONS FOR URBAN RESILIENCE IN BANGLADESH - Global Center on Adaptation, accessed October 20, 2025, https://gca.org/wp-content/uploads/2025/04/Compendium-on-Nature-Based-Solutions-for-Urban-Resilience-In-Bangladesh.pdf
35. Publication: Toward Great Dhaka: A New Urban Development Paradigm Eastward - World Bank Open Knowledge Repository, accessed October 20, 2025, https://openknowledge.worldbank.org/entities/publication/8877d998-f1e4-5070-9d94-853c1d8d4624
36. Prioritization of Urban Adaptation Measures for Climate Change in Dhaka under the National Adaptation Plan 2023-2050 - Bangladesh Red Crescent Society, accessed October 20, 2025, https://bdrcs.org/wp-content/uploads/2025/03/Prioritization-of-Urban-Adaptation-for-CC-Fahmid-Mohtasin.pdf
37. Buffer zones as areas for ecosystem-based forest management, World Heritage knowledge transfer and education - Interreg CENTRAL EUROPE, accessed October 20, 2025, https://programme2014-20.interreg-central.eu/Content.Node/Thematic-brochure---Buffer-zones-as-areas-for-ecosystem-base.pdf
38. Model conservation suitability | Documentation - Learn ArcGIS, accessed October 20, 2025, https://learn.arcgis.com/en/projects/model-conservation-suitability/
39. Detailed Area Plan (DAP): Redefining Dhaka's Landscape - Rupayan City - Blog, accessed October 20, 2025, https://blog.rupayancity.com/detailed-area-plan-dap-redefining-dhakas-landscape/
40. URBANISATION IN BANGLADESH: CHALLENGES AND WAY FORWARD - Asia-Europe Foundation (ASEF), accessed October 20, 2025, https://asef.org/wp-content/uploads/2021/11/ASEFSU23-Background-Paper_Sustainable-Urbanisation-in-Bangladesh-Dhaka.pdf
41. Guidelines for Applying Protected Area Management Categories - IUCN Portals, accessed October 20, 2025, https://portals.iucn.org/library/sites/library/files/documents/pag-021.pdf
42. Expert Consensus on Buffer Zone Governance: Interface Concepts, Ecosystem Service Priorities, and Territorial Strategies Around Cerro Castillo National Park, Chile - MDPI, accessed October 20, 2025, https://www.mdpi.com/2073-445X/14/9/1763