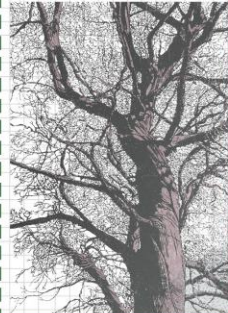
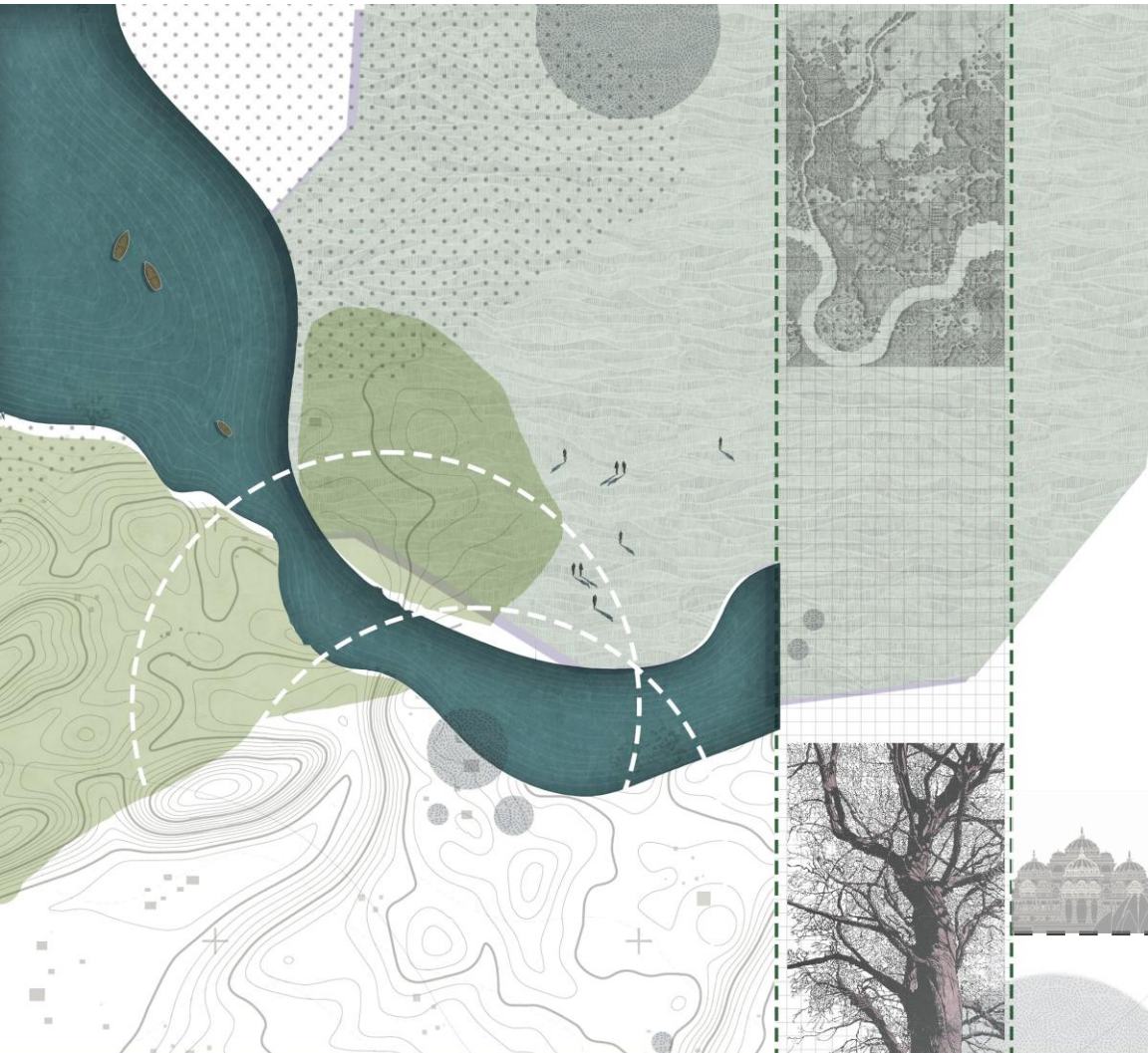


Reviving Mehrauli: Integrating Landscape Design for Ecological Restoration and Heritage Renewal



By Udisha Sarkar & Adarsh Kumar

STUDY AREA:

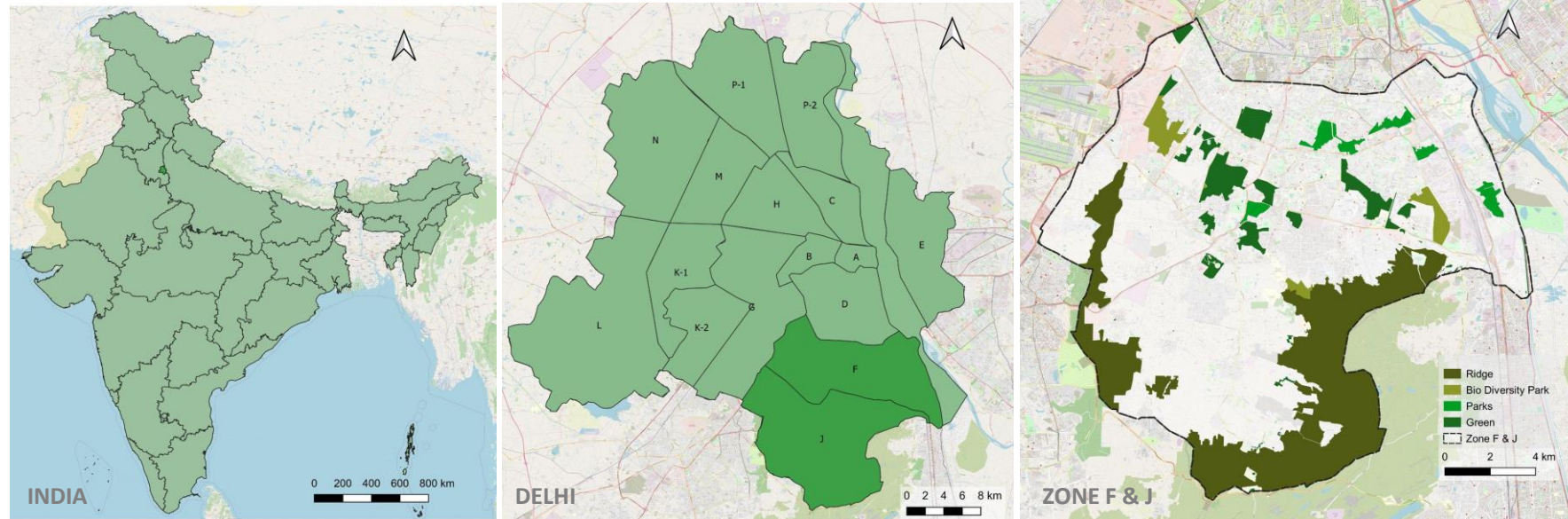


Figure1: Locational Setting for Mehrauli in Zone F of Delhi; Source : Author, 2025

- Mehrauli is a prominent neighbourhood in **South Delhi, India**, situated in the **southern part of the national capital**.
- Coordinates: ~ **28.5205° N latitude, 77.1855° E longitude**.
- Strategically located near **Gurugram** (Haryana), Mehrauli benefits from strong **regional connectivity** within the **National Capital Region**.
- One of the **7 medieval cities of Delhi**, Mehrauli holds immense **historical and cultural importance**. It is among the oldest continuously inhabited areas of Delhi.
- Lies along the **Delhi Ridge (Northern Aravalli Range)**, making it one of the **greenest historical precincts in Delhi**.



Figure 2: Detail Policy area – Wetlands around Hauz shamshi, Mehrauli

RESERVE FOREST

- A. South-Central Ridge Forest
- B. Southern Ridge Forest

WILDLIFE SANCTUARY

- C. Asola Bhati Wildlife Sanctuary

PROTECTED FOREST

- 01. Hauz Khas Dist. Park
- 02. Jahanpanah City Forest
- 03. Basant Naar, Moradabad
- 04. Vasant Vihar Dist. Park

CITY FOREST - 7 in Zone J

BIO-DIVERSITY PARK

- 05 Aravalli Biodiversity Park
- 06 Neela Hauz Biodiversity Park
- 07 Tilpath Valley Biodiversity Park
- 08 Tughlaqabad Biodiversity Park
- 09 Deer Park, Dhaula Kuan
- 10 JNU Greens (Institutional)
- 11 Sanjay Van
- 12 Qutab Golf Course
- 13 Mehrauli Archaeological Park
- 14 Mittal Farms
- 15 Machli Park, Forest Area
- 16 Hauz Khas Forest
- 17 Aastha Kunj Dist. Park
- 18 Okhla Central Park
- 19 Sarita Vihar Dist. Park

MAPPING THE GREEN IN ZONE F & J



METHODOLOGY:

The research methodology follows a **systematic approach** for conducting **locational context analysis**. Literature review was done to establish **theoretical foundation**, followed by area identification to **define the study boundaries and scope**. A dual approach combining **primary surveys with secondary data collection** was followed. The methodology incorporates 3 parallel analytical streams: **Historical Analysis, Spatial Analysis and Policy Framework Analysis**. Based on Analysis practical recommendations were provided.

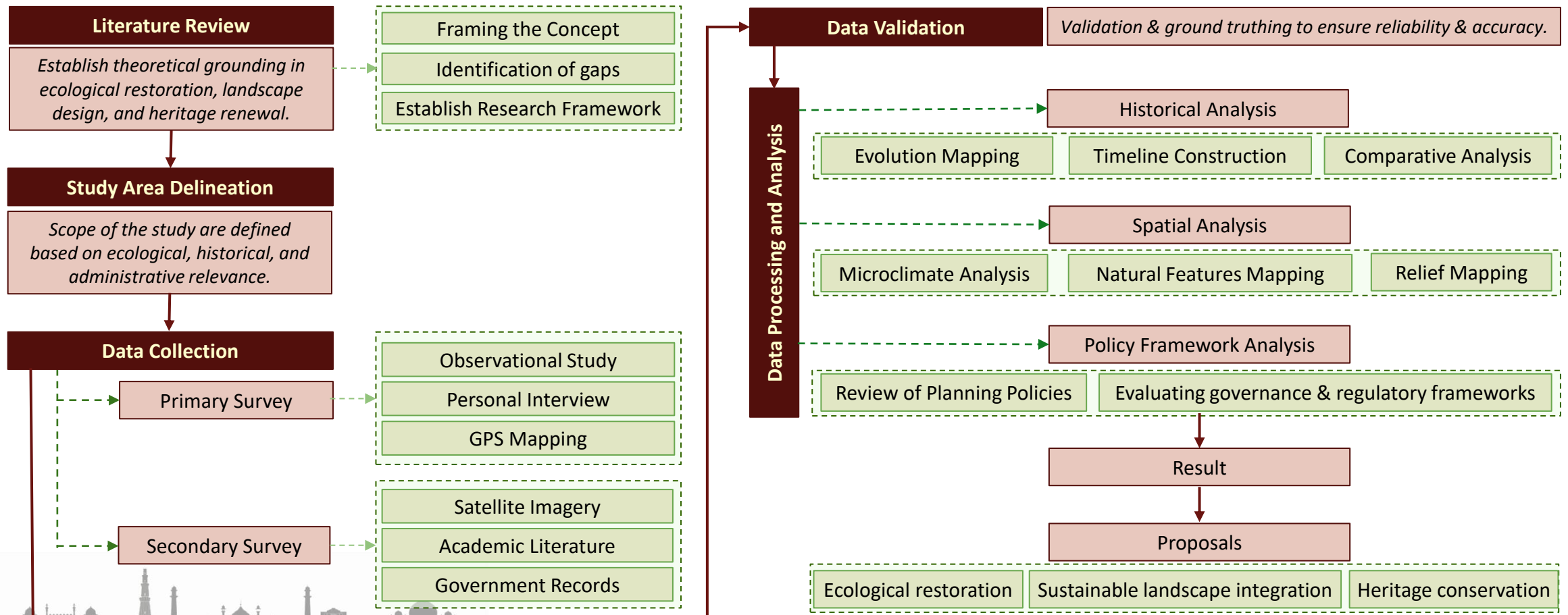
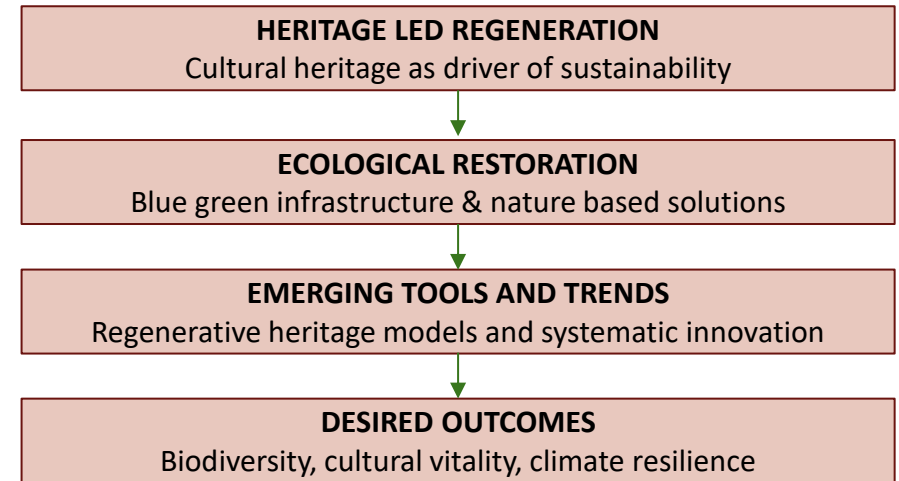


Table 1 : Methodology Flowchart ;Source: Author, 2025

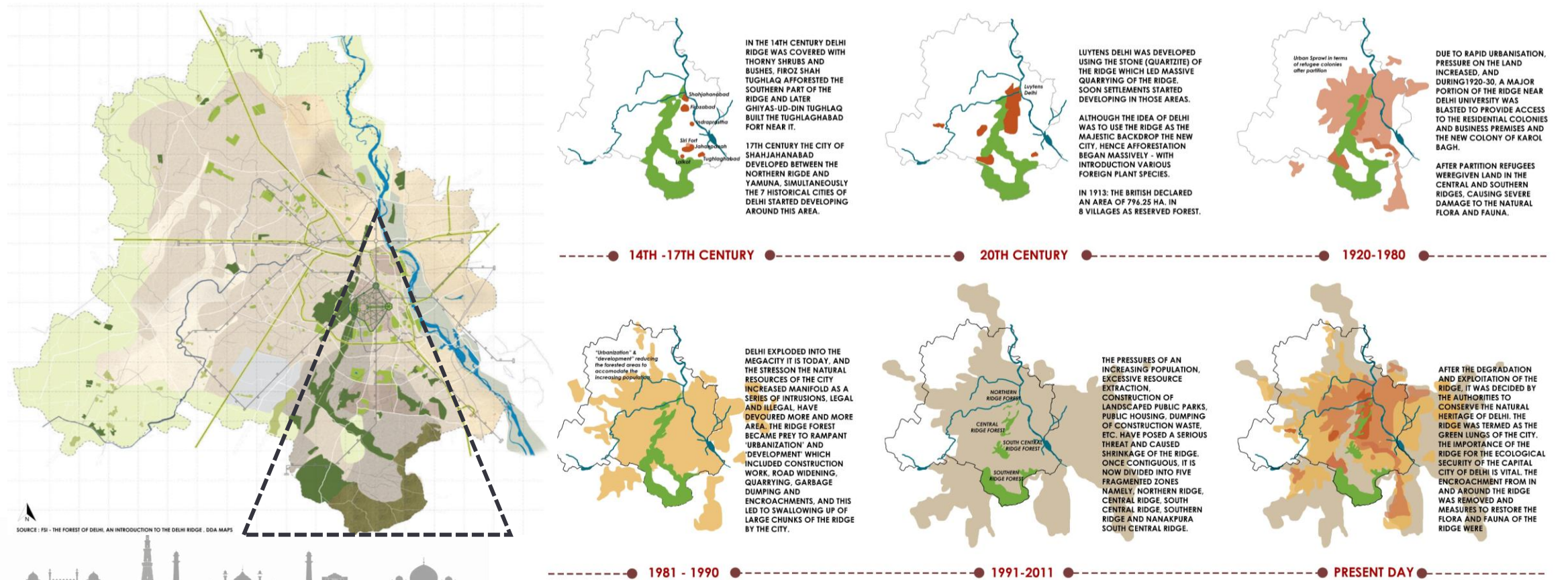
LITERATURE REVIEW:

- The foundation of integrating landscape design for ecological restoration and heritage renewal begins with strong conceptual frameworks. The concept of **novel ecosystems** as a bridge between cultural landscape conservation and ecological restoration was introduced. *Macdonald and King (2018)*
- A **regenerative landscape design framework** that integrates ecological processes with cultural values was proposed, promoting adaptive and community-driven approaches. *Smithwick et al. (2023)*
- **The UNESCO Historic Urban Landscape (HUL) Recommendation (2011)** further provides a global policy foundation, advocating for a landscape-scale, participatory approach to managing historic areas in line with contemporary ecological needs.
- The challenges and opportunities in scaling ecological restoration within historic settings is important. *(Toma et al., 2022)*
- The use of blue-green infrastructure to enhance ecological and social co-benefits is emphasized. *Interdisciplinary BGI Review, 2024.*
- Regenerative urban heritage models are proposed *(Hassan et al., 2022)* , systemic innovation strategies for heritage-led regeneration are identified *(Egusquiza et al., 2021)*, and advanced green infrastructure planning as a mechanism for territorial resilience. *(Mazaherylaghab et al., 2025)*



BACKGROUND STUDY:

The historical centrality of Delhi is intricately bound to its geomorphological positioning within the “Delhi Triangle,” delineated by the Yamuna River to the east and the Aravalli Ridge to the west and south. This spatial configuration, characterized by the juxtaposition of fertile alluvial floodplains and resistant quartzite uplands, engendered a dual advantage: hydro-ecological resilience through enhanced groundwater recharge and climatic moderation, alongside strategic defensibility against external incursions. Consequently, this unique confluence of environmental and topographical determinants rendered Delhi a favorable locus for the successive establishment of imperial capitals and facilitated its consolidation as a persistent urban center (Nagendra et al., 2020; Kumar, 2023).



SOURCE : FSI - THE FOREST OF DELHI: AN INTRODUCTION TO THE DELHI RIDGE. DDA MAPS

BACKGROUND STUDY:



Image : Southern Catchment of Delhi, TU Delft

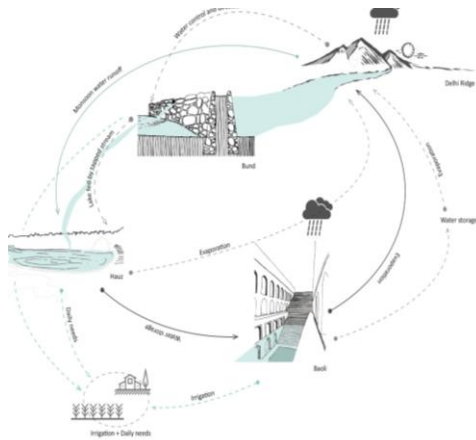


Image : Historical Waterworks Functioning of Delhi

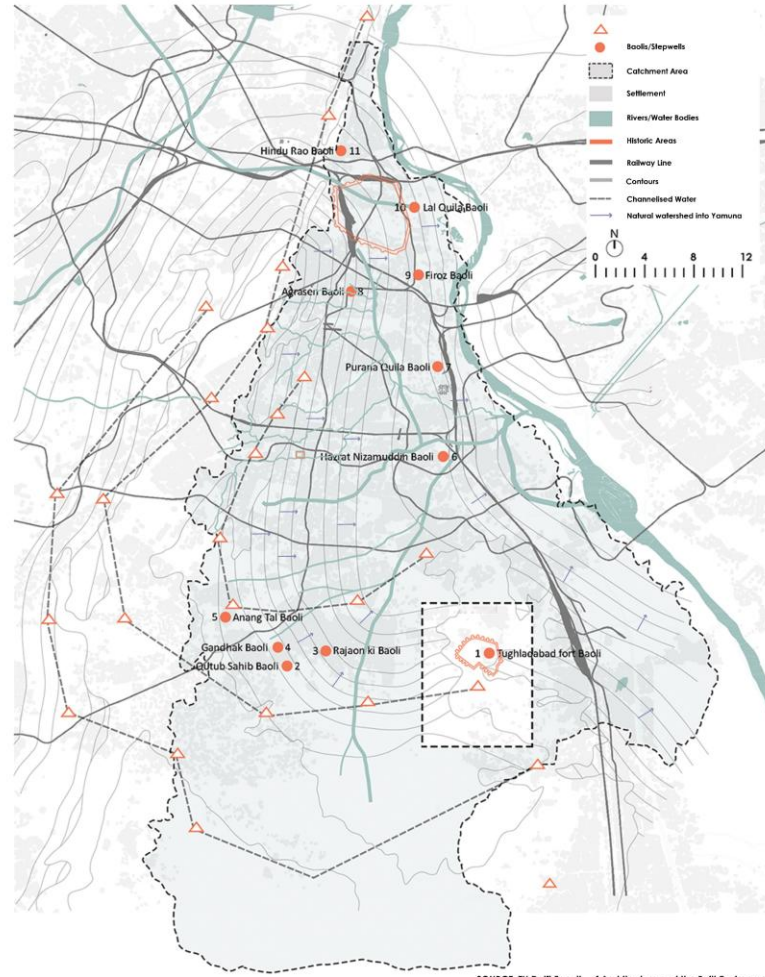


Image : Heritage water Network, in zone J & F

- Within the **geomorphic configuration of the Delhi Triangle**, the alluvial plains are sustained by numerous seasonal and perennial *nallahs* descending from the Aravalli Ridge through eroded gullies into the Yamuna River.
- Historically, these east-flowing streams were harnessed to create extensive water reservoirs, including Anangtal, Hauz-i-Shamsi, Hauz-i-Rani, and Hauz Khas, which provisioned settlements such as Anangpur, Mehrauli, Jahanpanah, and Siri.
- Despite the presence of the Yamuna, much of Delhi's population relied primarily on groundwater and stored surface water until the introduction of piped supply in the late nineteenth century.
- Furthermore, the infiltration facilitated by *nallahs* enabled the recharge of aquifers, which supported the construction of multiple *baolis* (stepwells) functioning as decentralized, multi-level water storage systems.



ANALYSIS:

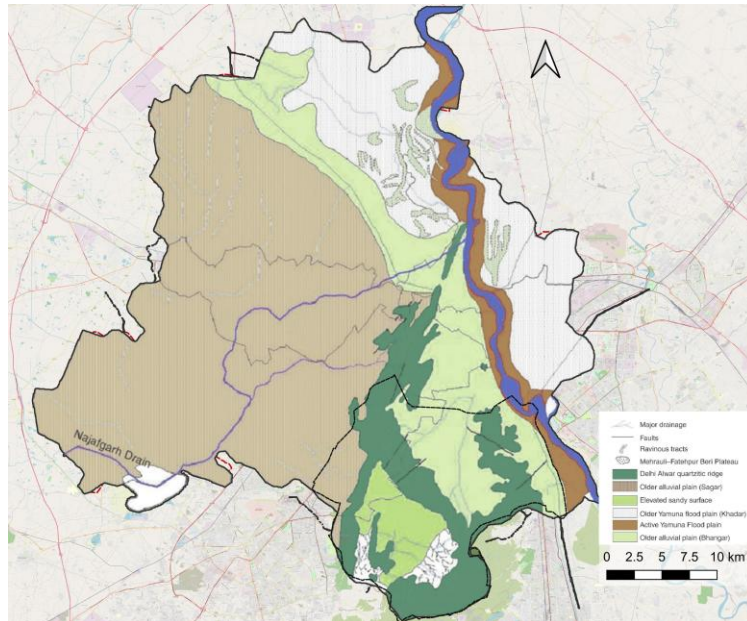


Image 2 : Soil map
Source: Author, 2025

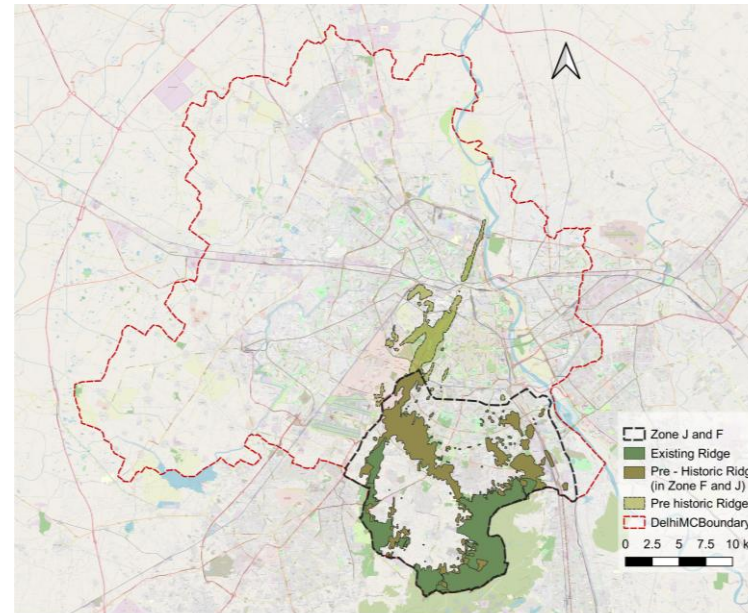


Image 2 : Morphological & Forested Ridge
Source: Author, 2025

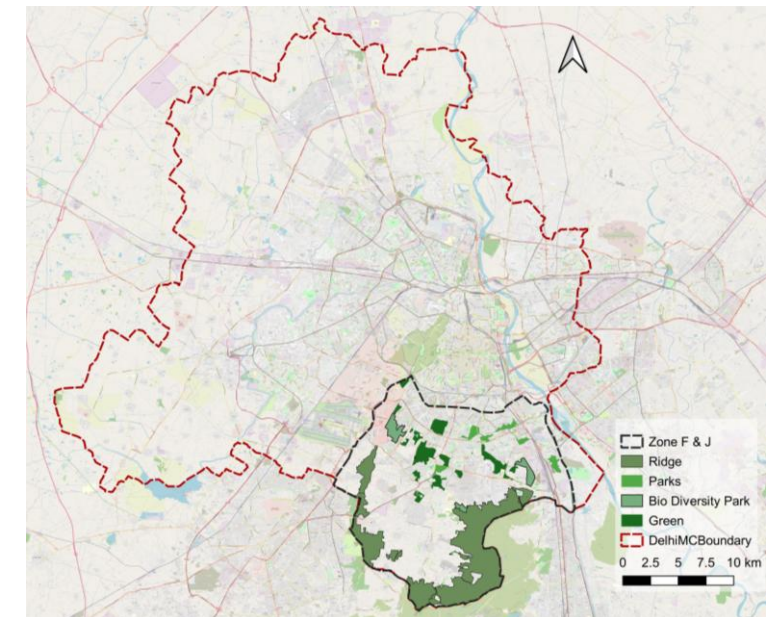


Image 2 : Green Categorisation
Source: Author, 2025

Soil Characteristics: Delhi's soils are predominantly alluvial in the floodplains, with sandy to loamy textures, while the ridge zones exhibit skeletal and gravelly soils influencing vegetation patterns and recharge potential.

Ridge Morphology: The Delhi Ridge, an extension of the Aravalli system, serves as a critical geomorphological feature regulating microclimate, groundwater recharge, and acting as a natural barrier against desertification.

Forests and Green Cover: The ridge forests, along with city greens and plantations, constitute Delhi's primary ecological assets, mitigating air pollution, supporting biodiversity, and offering resilience against urban heat island effects.



ANALYSIS:

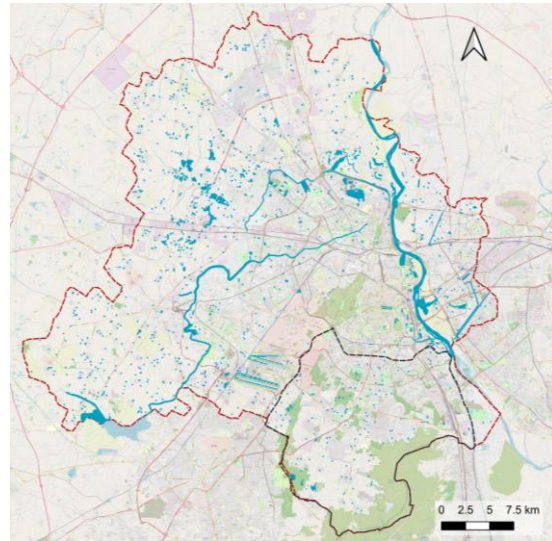


Image 2 : Waterbodies & Drains
Source: Author, 2025

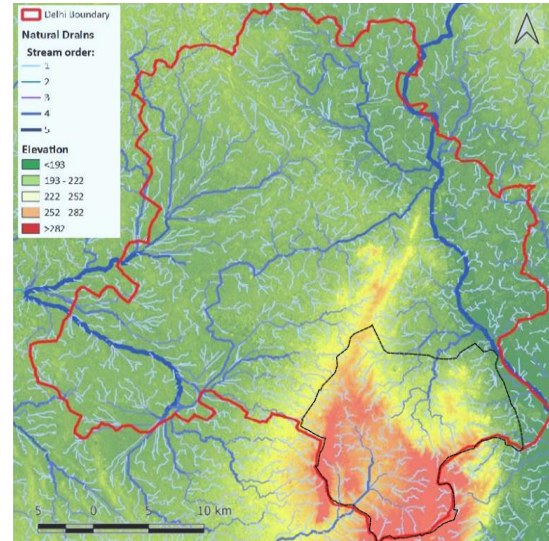


Image 2 : Natural Drainage & elevation map
Source: Author, 2025

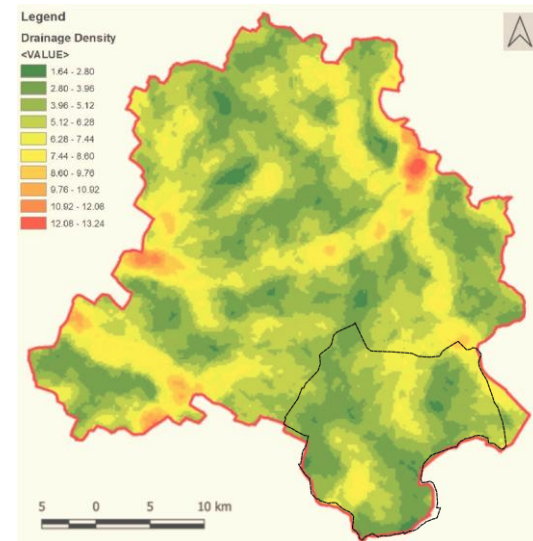


Image 3 : Drainage Density map
Source: Author, 2025

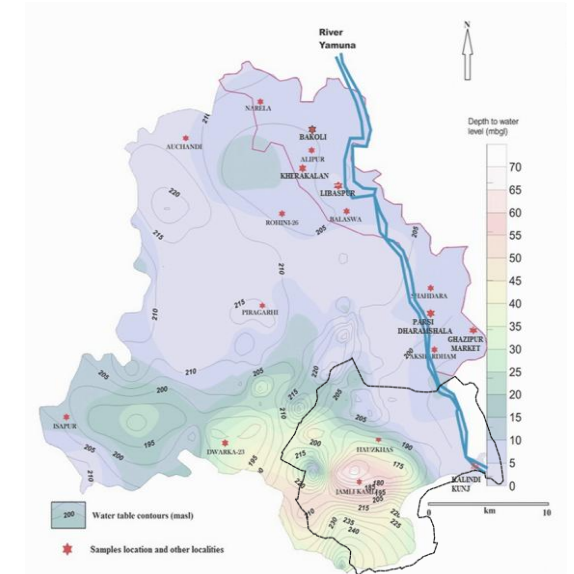


Image 4 : Groundwater Table map
Source: Author, 2025

Hydrology: Delhi's hydrology is governed by the Yamuna and seasonal streams; Zones J and F rely primarily on local drains and aquifers.

Natural Drainage : In Zones J and F, ridge-controlled topography directs water flow towards the Yamuna, simultaneously generating numerous localized watersheds across the region.

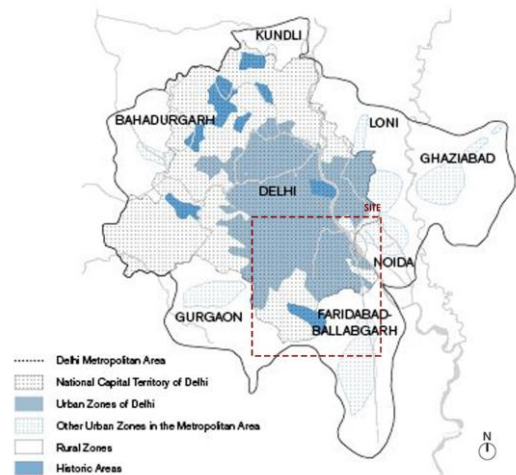
Recharge Potential: Impervious surfaces limit recharge in Zone F, whereas residual open land in Zone J offers limited but shrinking recharge capacity

Groundwater Table: Both zones record declining groundwater; depletion in Zone J stems from peri-urban extraction, while Zone F reflects stress from urbanization



ANALYSIS:

Human activity has a major influence on how urban patches are arranged spatially at any given time. Existing patches get more intense over time as a result of ongoing building, while new patches appear in various places, reflecting trends in sprawl and compactness. Through supervised and unsupervised categorization of satellite data, differences in the distribution of urban areas among Delhi's districts are evident, with the South and South-West districts having the biggest extent of built-up territory.

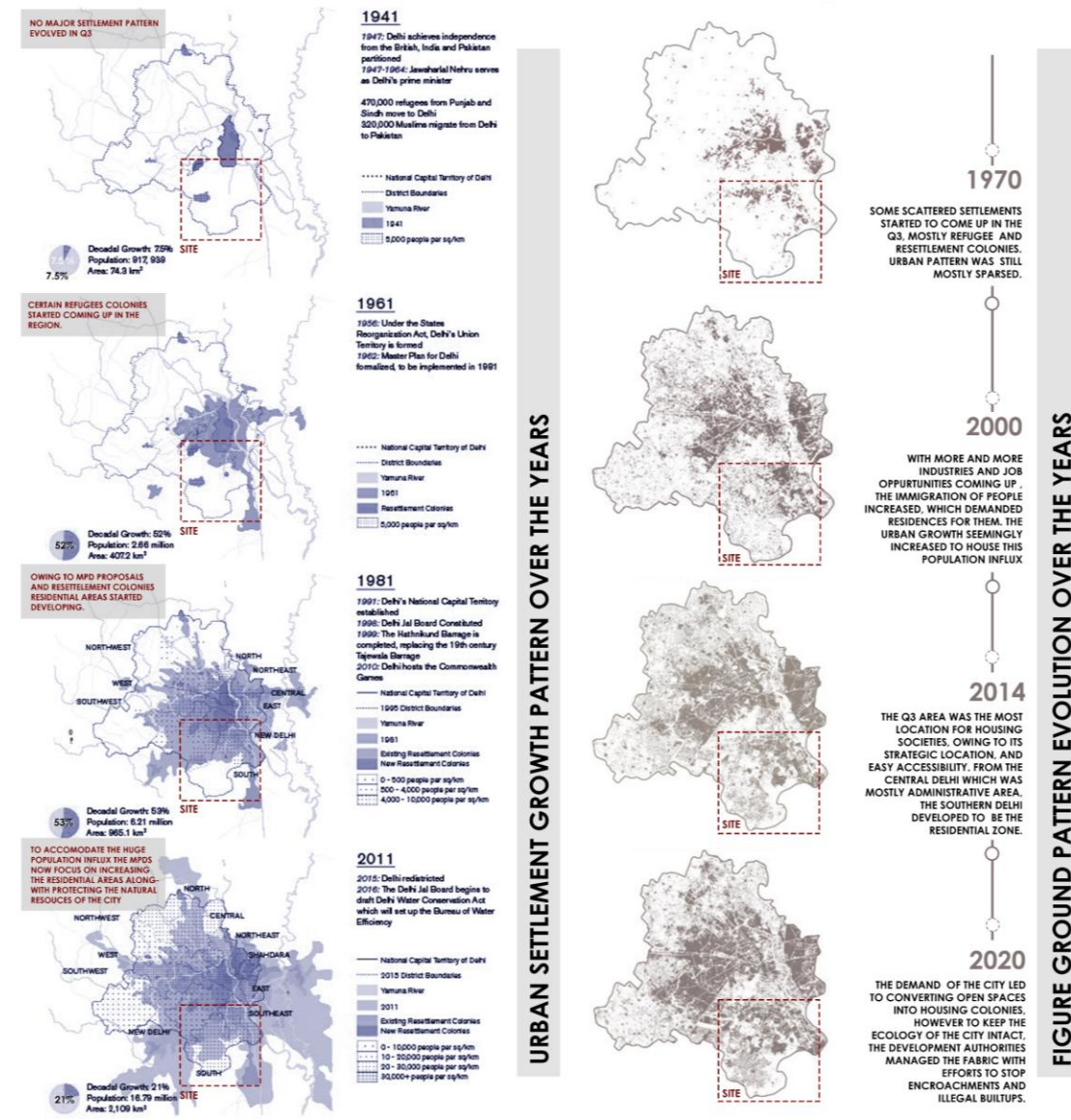


Urban sprawl, driven by migration, rehabilitation, and industrialization, led to forest encroachment, informal settlements, and inadequate housing, thereby intensifying urban heat islands and flooding as population growth outpaced infrastructural capacity.

Image 1 : Urban zones of Delhi; Urban Evolution
Data Source : Urban Development Delhi Govt. 2019 Report

Year	Urban Area (sq.km)	% of Total Area	Urban Population (Lakhs)	% of Population
1961	326.54	22%	23.59	88.72%
1981	591.90	40%	—	92.78%
1991	700.23	47%	84.71	89.94%
2001	924.68	62%	129.50	93.18%

Table 1 : Urban Area & Population Growth
Data Source : Urban Development Delhi Govt. 2019 Report



ANALYSIS:

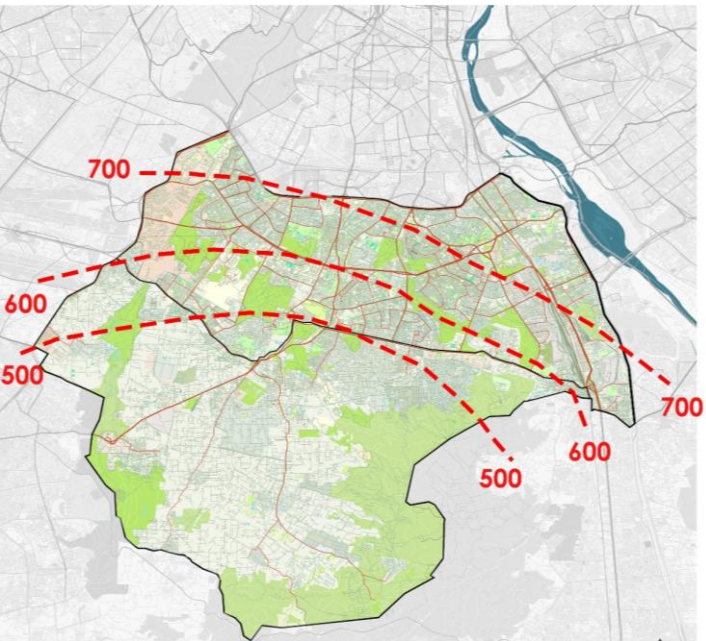


Image 2 : Isohyetal map
Source: Author, 2025

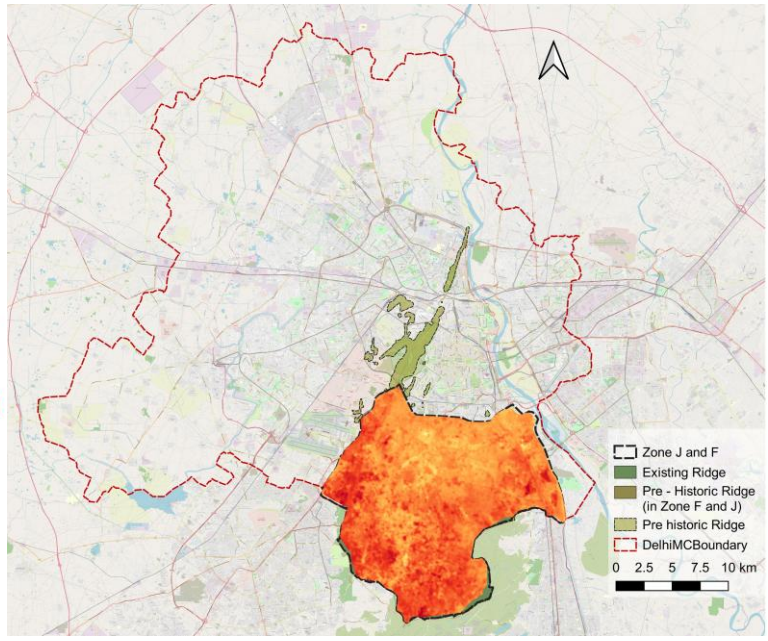


Image 2 : Land Surface data map
Source: Author, 2025

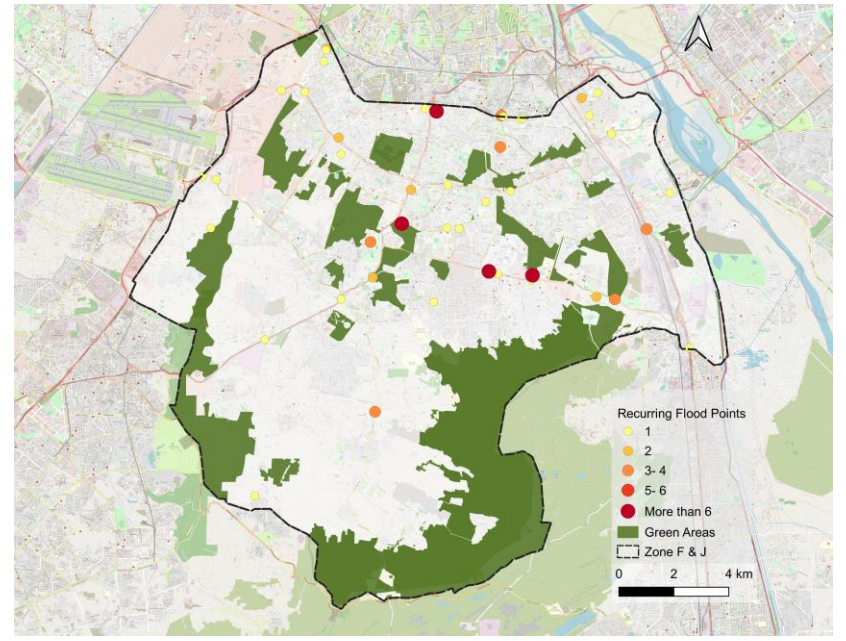


Image 2 : Flood points
Source: Author, 2025

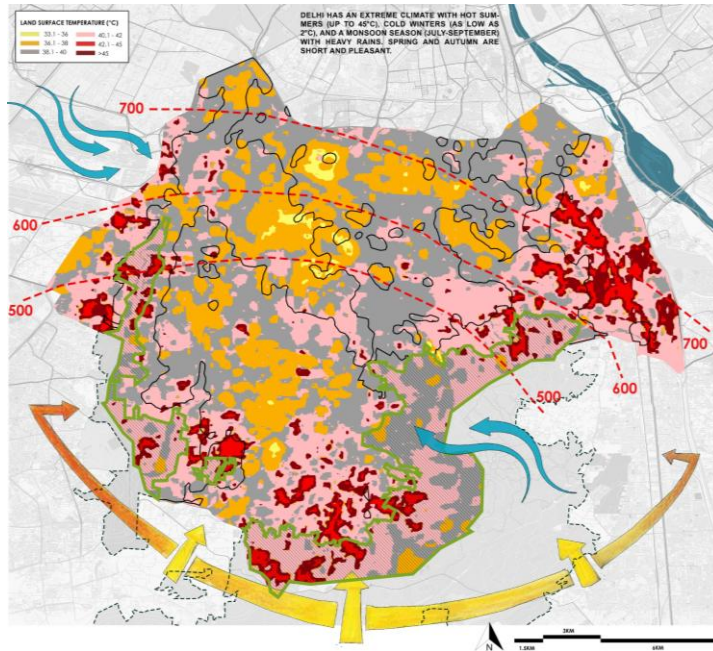
Isohyetal patterns: in Zones J and F reveal rainfall variability, with peripheral agricultural tracts in Zone J offering higher recharge potential, while dense urbanization in Zone F increases surface runoff and localized flooding.

Land surface morphology: shows Zone J contains residual ridge outcrops and undulating terrain that influence drainage flow, whereas Zone F, being largely low-lying and built-up, exhibits reduced natural drainage efficiency.

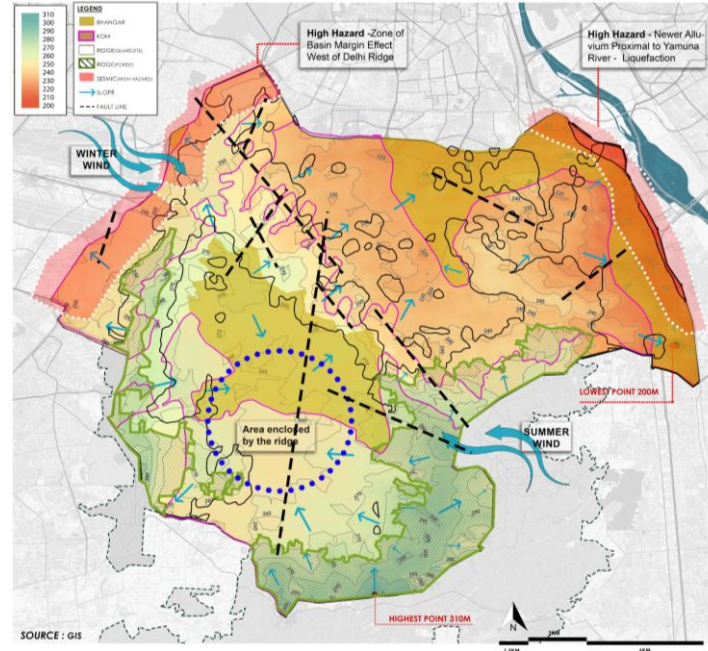
Flood points: are concentrated in low-lying stretches of both zones: Zone J faces seasonal waterlogging along peri-urban roads with weak stormwater networks, while Zone F experiences frequent flooding near the Yamuna floodplain and congested transport intersections.



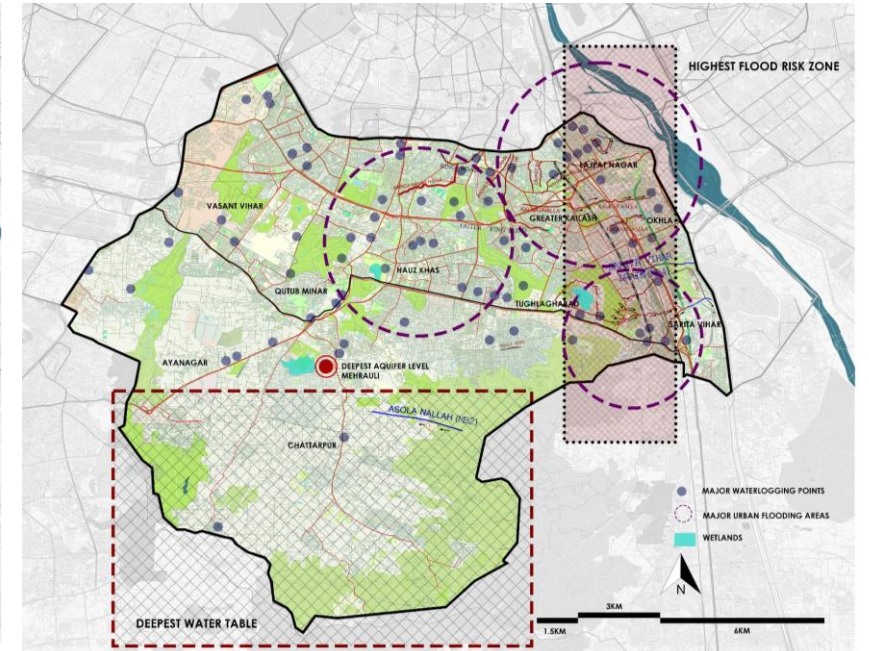
RESULTS:



Microclimate Study
Source: Author, 2025



Natural Processes Study
Source: Author, 2025



Hydrological Study
Source: Author, 2025

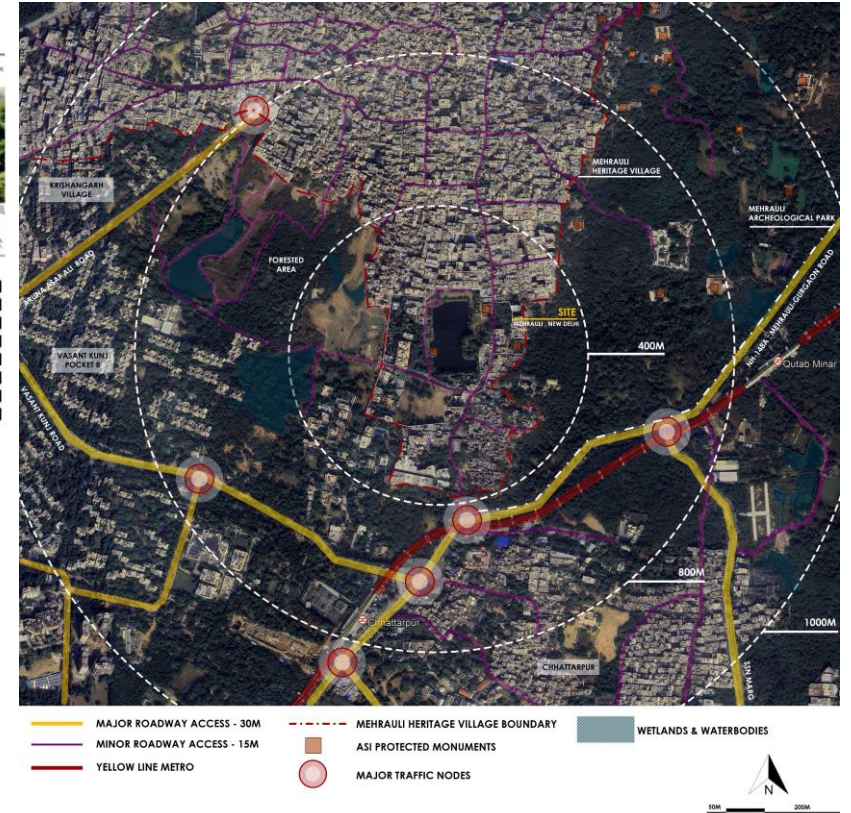
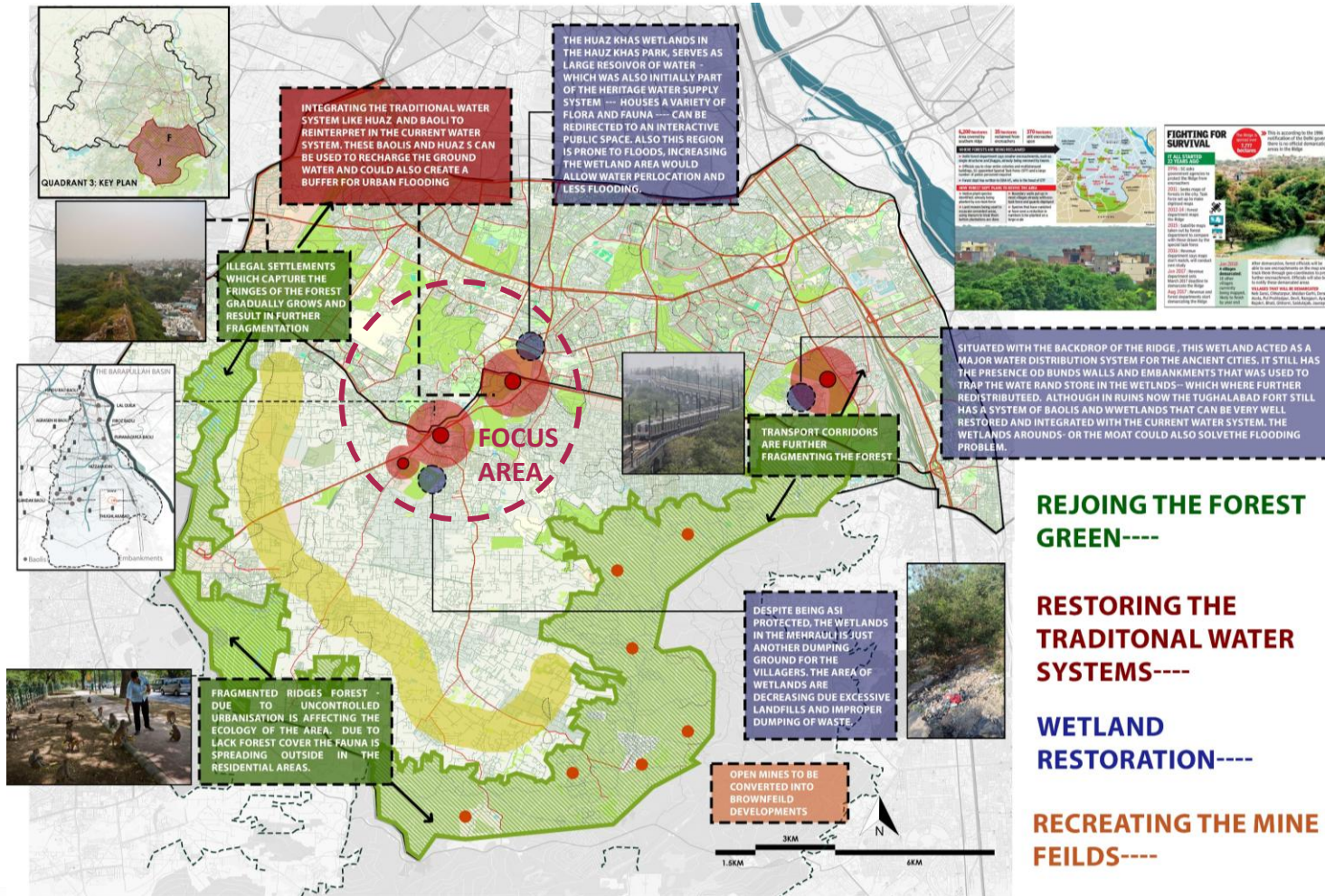
The microclimate analysis reveals that the Ridge areas with Kohi soils have lower water-holding capacity, higher runoff & erosion. Temperature variation is strongly influenced by the urban heat island, where built-up areas register higher temperatures compared to vegetated areas.

The topographical analysis highlights a distinct soil-geology-vegetation relationship, with higher water retention in Bangar soils of South Delhi and reduced capacity in the Kohi soil. The region exhibits zones of high seismic hazard, especially along the basin margins and near the Yamuna.

The hydrological assessment indicates that water availability in the region. Groundwater levels vary greatly, with deeper aquifers located in the south and southeast, while the Yamuna basin area is prone to flooding and urban waterlogging. Delhi Police has identified 96 flood-prone points in Zone J & F and recorded 250+ flooding incidents in the last five years.



PROPOSALS:



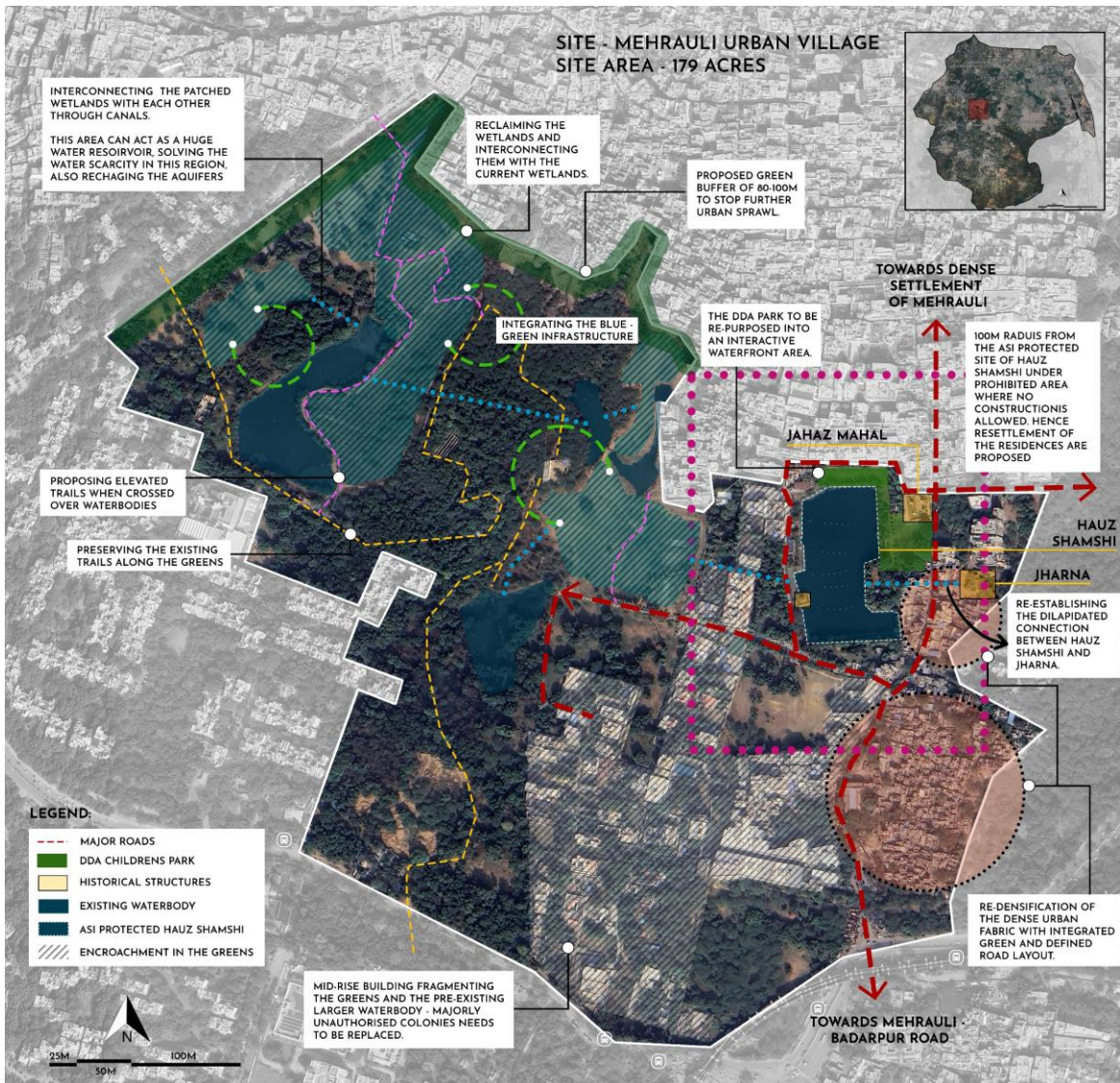
REJOINING THE FOREST GREEN----

RESTORING THE TRADITIONAL WATER SYSTEMS----

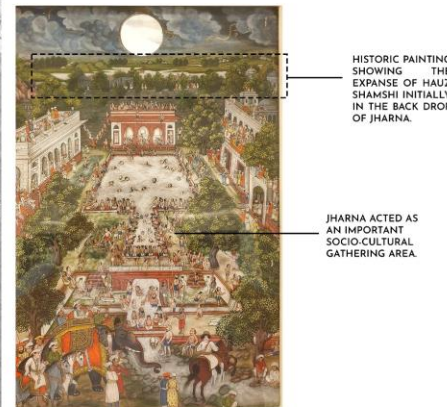
WETLAND RESTORATION----

RECREATING THE MINE FEILDS----





REINTEGRATING THE WETLANDS OF MEHRAULI WITH THE URBAN FABRIC - AN URBAN PLACEMAKING



SOURCE: Wilton Dierple - 1815 Islamic Museum of Art

Type of wetland	Intervention	Ecosystem services likely to be enhanced	Ecosystem services likely to be diminished
Lagoon	Fraun aquaculture by creating enclosures within the lagoon area	<ul style="list-style-type: none"> Food provision Livelihoods for wetlands dependent communities 	<ul style="list-style-type: none"> Water regime moderation Flood buffering
Lake	Impounding water by regulating outflows	Increased water availability for human use	Ability to moderate floods
Marsh	Construction of road connecting settlements located on the periphery	Transport	<ul style="list-style-type: none"> Hydrological regime moderation Flood buffering Aesthetics
Urban lake	Concentration of shoreline for beautification	<ul style="list-style-type: none"> Aesthetic value Tourism and recreational benefits 	<ul style="list-style-type: none"> Ability to accommodate monsoon flows Habitat values

SOURCE: Ministry of Environment, Forest and Climate Change Government of India

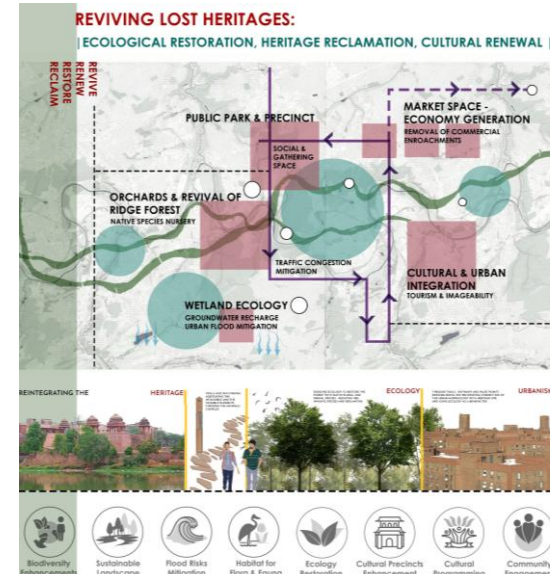
RE-DENSIFICATION OF THE DENSE URBAN FABRIC

RECLAIMING THE LOST URBAN WATERS WITH PROPOSED WETLANDS AND WATER CHANNELS

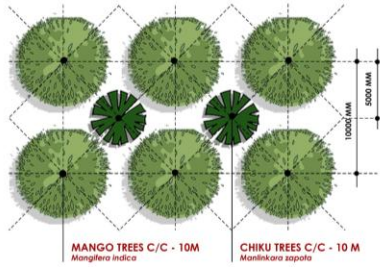
PROPOSING GREEN BUFFER TO MITIGATE THE URBAN SPRAWL, PRESERVING THE EXISTING TRAILS THROUGH THE GREEN AND WETLANDS (ELEVATED)



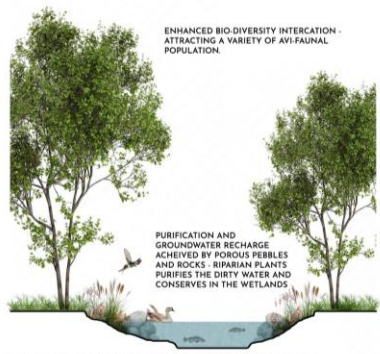
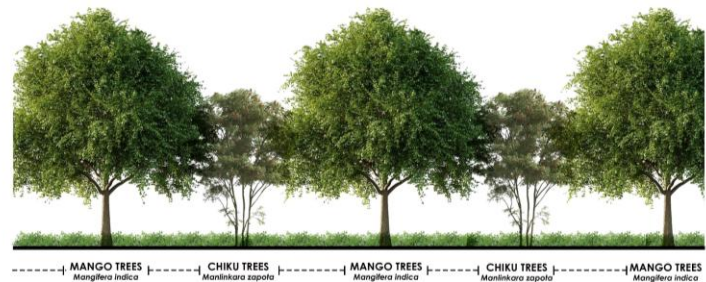
CULTURAL LANDSCAPES - INTEGRATING THE GREENS, THE BLUE, THE HERITAGE AND THE SETTLEMENTS



FRUIT ORCHARD:



QUINCUNX ORCHARD:
THE QUINCUNX SYSTEM, ALSO KNOWN AS THE DIAGONAL OR FILLER SYSTEM, IS AN ORCHARD LAYOUT WHERE PLANTS ARE ARRANGED IN A SQUARE PATTERN WITH AN ADDITIONAL PLANT IN THE CENTER OF EACH SQUARE.



HYDROPHYTES AND WATER-RESISTANT PLANTING AROUND WETLANDS

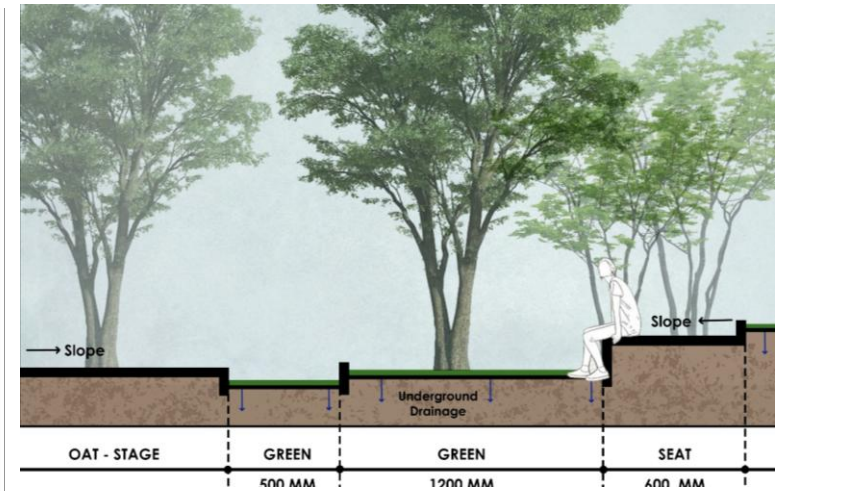
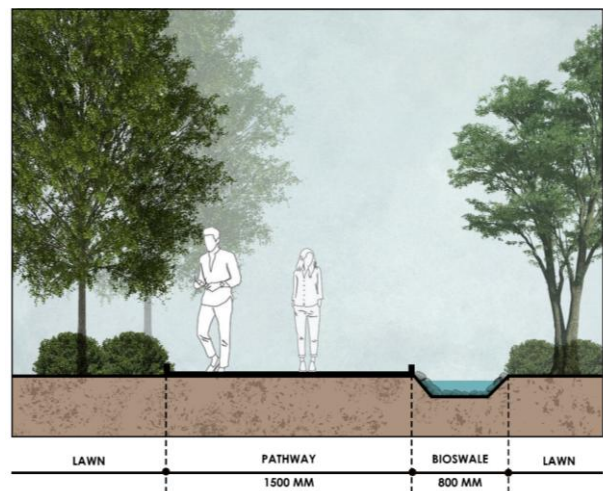
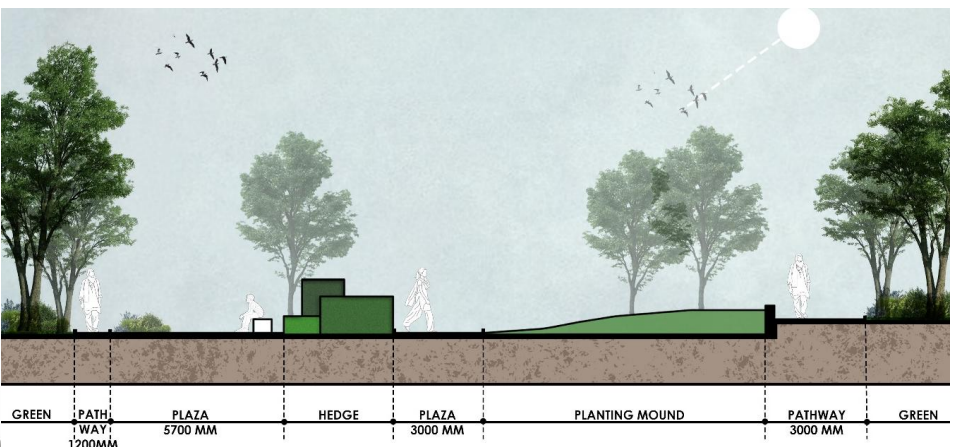
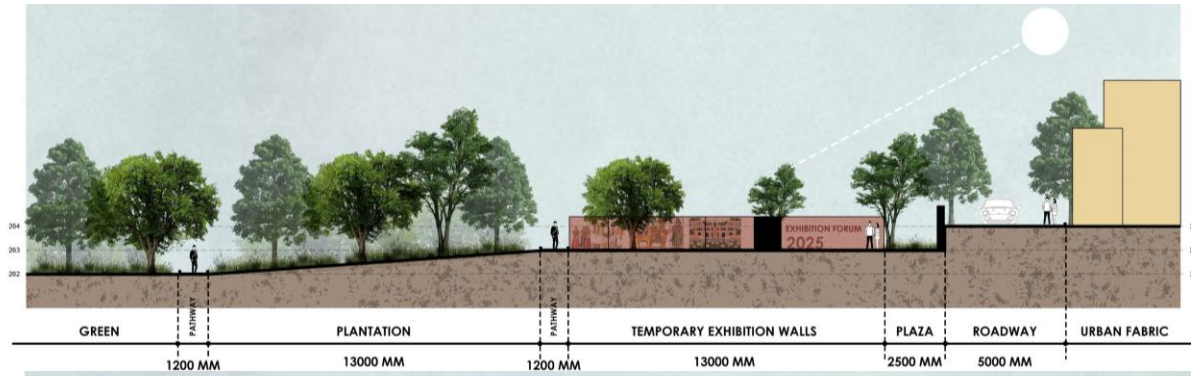
RIPARIAN VEGETATION

SOURCE: AUTHOR



CHANGING THE VEGETATION INTO A LUSH -GREEN FORESTRY INCLUDING THE NATIVE SPECIES

SOURCE: AUTH



FEASIBILITY & SCALING

WORKABILITY OF INTERVENTIONS

Compatibility with Existing Urban Fabric

The interventions are **retrofit-based**, not greenfield developments. This allows implementation within:

1. Existing forest lands (Delhi Ridge, protected forests),
2. Archaeological parks (ASI-controlled zones),
3. Public lands under DDA, MCD, and GNCTD.

Such low-displacement, nature-based interventions are already practiced in Delhi at sites like Neela Hauz and Aravalli Biodiversity Park, proving field viability.

Climatic and Ecological Suitability

The proposal responds directly to Delhi's:

1. High runoff and waterlogging during monsoons,
2. Declining groundwater levels,
3. Heat island effects in dense urban zones.

Native vegetation, soil-sensitive landscape grading, and decentralized water retention structures ensure **low maintenance and high survival rates**.

Institutional Workability

Phased implementation & distributed across agencies:

1. DDA: Ridge, biodiversity parks, and landscape zones
2. ASI: Heritage buffer areas and adaptive reuse
3. MCD / DJB: Stormwater drains, wetlands, and public realm upgrades

This avoids reliance on a single implementing authority, increasing execution feasibility

PHASING AND COSTING

PHASE 1 : 20.6 Cr

PILOT AND ECOLOGICAL STABILISATION

TIME FRAME : 2 Years

Component	Unit Cost	Quantity	Cost (₹ Cr)
Wetland restoration (desilting, bunds, planting)	₹30 lakh / ha	15 ha	4.5
Bio-swales & rain gardens	₹12,000 / rm	8,000 rm	9.6
Ridge plantation & soil treatment	₹12 lakh / ha	20 ha	2.4
Drain re-naturalisation (soft engineering)	₹1.2 Cr / km	3 km	3.6
Baseline surveys & monitoring			0.5

PHASE 2 : 25.65 cr

LANDSCAPE & HERITAGE INTEGRATION

TIME FRAME : 2 Years

Component	Unit Cost	Quantity	Cost (₹ Cr)
Heritage landscape treatment	₹3,500 / sq.m	1,50,000 sq.m	5.25
Restoration of historic water structures	₹1.5 Cr / structure	4	6.0
Green corridor development	₹2.0 Cr / km	4 km	8.0
Trails, signage & street furniture	₹1.8 Cr / km	3 km	5.4
Community interfaces & buffers			1.0

PHASE 3 : 11.8 cr

COMMUNITY USE, LIVELIHOODS & RESILIENCE

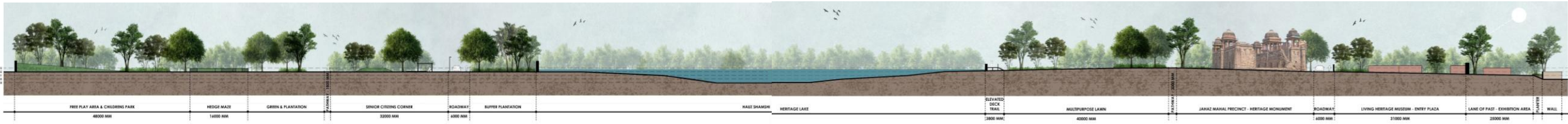
TIME FRAME : 3 Years

Component	Unit Cost	Quantity	Cost (₹ Cr)
Eco-tourism facilities & nodes	₹2.5 Cr / node	3	7.5
Community landscape stewardship	₹25 lakh / cluster	6	1.5
Climate-resilient amenities, Training, institutional support	Lump sum		2.8

PHASE 4 : 18.5 cr

SCALING & CITY-LEVEL REPLICATION

TIME FRAME : 2 Years



CONCLUSION:

Landscape design operates as a multidisciplinary framework that unites ecological restoration with heritage renewal, addressing both environmental degradation and cultural continuity. Ecological restoration seeks to rehabilitate biodiversity, soil health, and ecosystem services disrupted by anthropogenic or natural pressures, while heritage renewal revitalizes historic landscapes, monuments, and cultural precincts, ensuring their relevance in contemporary urban contexts. When integrated, these domains transform landscape design into a regenerative instrument, enhancing ecological resilience through water retention and biodiversity corridors, while simultaneously conserving and interpreting cultural assets. This holistic approach fosters multifunctional landscapes that sustain cultural memory, ecological sustainability, and community engagement.

WHY DOES THIS MATTER?

- Integrating landscape design for ecological restoration and heritage renewal is central to shaping sustainable urban and peri-urban environments.
- It addresses biodiversity loss, urban sprawl, and climate impacts by restoring ecological networks, improving connectivity, and mitigating heat island effects.
- Simultaneously, it strengthens cultural identity, promotes tourism, and fosters community engagement through the preservation of historic landscapes and inclusive public spaces.
- This integration creates multifunctional landscapes that combine ecological corridors, cultural assets, and climate-responsive environments, ensuring resilience and socio-cultural vitality.

