

DELHI HILLS, FORESTS AND A RIVER

ALSO AVAILABLE IN HINDI

NATURE
IN THE
CITY
SERIES

LANDSCAPE
FOUNDATION
INDIA

2017

In a fast growing city, the place of nature is very challenging. On one hand, it forms the core framework based on which the city develops while on the other hand, it faces serious challenges in the realm of urban development. The research document attempts to construct a perspective to recognize the role and value of nature in making our cities more livable. On the way, the educational work delves on the natural history, relationship of nature with culture and lists and maps ecologically significant areas (both natural and manmade) in the city. The knowledge of the natural context will enable citizens to observe and analyze present day development opportunities and concerns in a much more sensitive and balanced manner in which conservation of city's natural resources holds equal value.

JOURNEY SO FAR

The narrative surveys the changing relationship of different cultures with nature over twelve centuries. In a fast-growing metropolis it is helpful to know the natural context while we analyze the opportunities for the conservation of natural resources.

MAPPING NATURE

The map lists ecologically significant areas, both natural and manmade - forests, river, parks, lakes and water bodies in the city. The historic character of the city comes through in the many well-conserved heritage precincts.

This is a living project. No knowledge is exhaustive. We would appreciate readers' contributions about these themes and environmental concerns of the city. We encourage them to write to info@landscapefoundation.in. We would be happy to include suggestions in future editions of the research.



Decorative carving in local stone at Qutb

THE REGION

Spurs of Aravalli (known as Ridge in Delhi)—the oldest fold mountains in India—and river Yamuna—a tributary of river Ganga—are two natural features which frame the triangular alluvial region. While there was a scattering of settlements in the region, the urban settlements of Delhi developed, more profoundly, around the eleventh century on the Aravalli Ridge to the south of the alluvial plain.

A spur of the Aravalli hills enter the Delhi region from present-day Gurugram in the south, and continue northwards, descending gradually towards the north east side, ending in Wazirabad near the river. The vegetation of Ridge comprises dry and deciduous trees which have adapted to the shallow soil and limited water. Some parts of the Ridge on the southern side have deep alluvial basins where there is a change in vegetation. The land flanking the river has sandy and coarse soils with shallow ground water table while the south western side is low lying. The composite climate of the region is characterized by a dry and hot summer (March to June) and a dry cold winter (October to February) interspersed by a brief monsoon period.

CHANGING COURSE OF RIVER YAMUNA

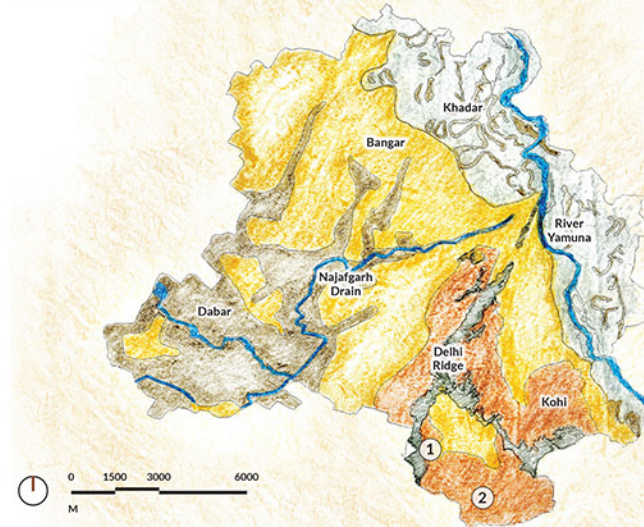
Leaving the hills and the plains, the river abandoned its original course and urban development in the 19th and 20th century gradually pushed it eastwards to the lowest elevation leaving behind six old courses in the region.



River Yamuna near Indraprastha Power Station

DELHI WITH ITS GEOGRAPHICAL DIVISIONS

Based on the geology and the geomorphology, the region of the city of Delhi can be broadly divided into four parts - Koli (hills) which comprises the hills of Aravalli, Bangar (main land), Khadar (sandy alluvium) along the river Yamuna and Dabar (low lying area/ flood plains).



1 Sanjay Van (Southern Ridge)



2 Asola (Southern Ridge - Stone quarry)

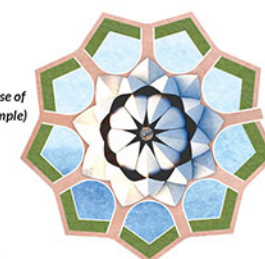
DELHI MASTER PLAN 1962

The first ever Master plan for an Indian city after independence envisioned the city with a green infrastructure of hierarchical open spaces which were multi functional - Regional parks, Protected greens, Heritage greens, and District parks and Neighborhood parks. It also included the settlement of East Delhi in its purview. Moreover the plan also suggested various conservation measures and buffer zones for the protection of river Yamuna, its flood plains and Ridge forest.



0 2500 5000 10000
M

Plan of Baha'i House of Worship (Lotus Temple)

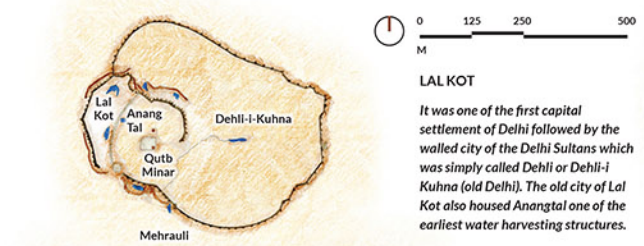


JOURNEY SO FAR

1 NESTLED IN THE HILLS

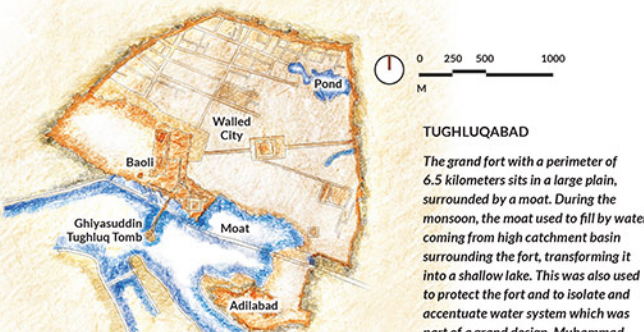
Securely nestled in the Ridge, most of the earlier settlements - Lal Kot, Delhi-i Kuhna (Old Delhi), Siri, Jahanpanah and Tughluqabad - were in the south.

The Ridge had forests, groves, orchards and grazing grounds. Level areas were cultivated into agricultural fields with the help of irrigation. There were natural streams, channels and ponds, many of which drained into the Yamuna on the east. Water-harvesting in this arid region was given due value in imperial building projects such as tanks (Anangtal, Surajkund, Hauz-i Rani, Hauz Khaz, Hauz-i Shamsi), baolis (a few - like Ugarsen ki Baoli and Gandhak ki Baoli, survive, but many others have since been covered over), moats around forts as in Tughlaqabad and Adilabad and barrages and bridges (Athpula, Satpula, Barapulla). In times of prosperity there was a self-sufficient public system of water management. Till the 16th century, the Yamuna riverbank was not envisioned as a potential site for imperial capitals.



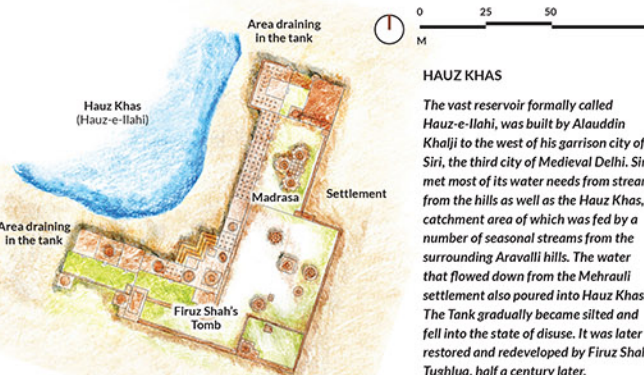
LAL KOT

It was one of the first capital settlement of Delhi followed by the walled city of the Delhi Sultans which was simply called Delhi or Delhi-i Kuhna (old Delhi). The old city of Lal Kot also housed Anangtal one of the earliest water harvesting structures.



TUGHLUQABAD

The grand fort with a perimeter of 6.5 kilometers sits in a large plain, surrounded by a moat. During the monsoon, the moat used to fill by water coming from high catchment basin surrounding the fort, transforming it into a shallow lake. This was also used to protect the fort and to isolate and accentuate water system which was part of a grand design. Muhammad Shah Tughluq built his fort of Adilabad on the opposite hill, to the south of the lake. A path above the barrage connected the two forts and sluice gates built into the barrage regulated the overflow of the lake into the river Yamuna. The water was used for irrigation by the peasants living to the east of the two forts and the lake. The city had built many reservoirs, kunds and baolis inside its fortification. It had an elaborate network of dams and sluice gates that was integral to the whole defensive scheme.

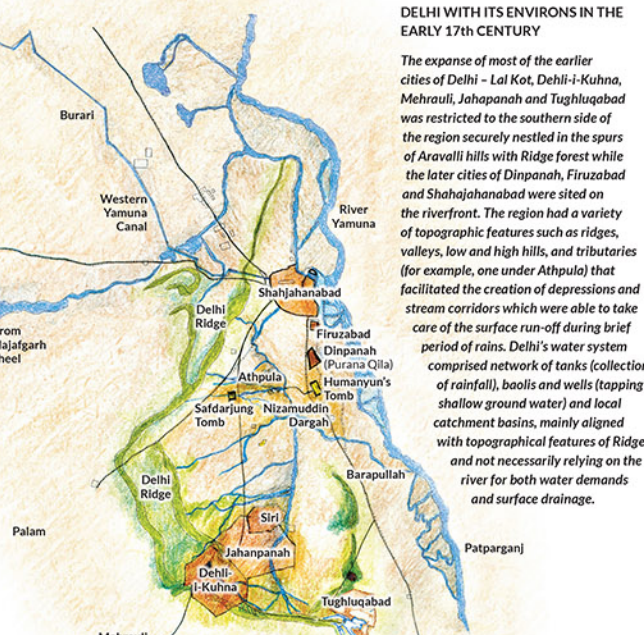


HAUZ KHAS

The vast reservoir formally called Hauz-e-Ilahi, was built by Alauddin Khilji to the west of his garrison city of Siri, the third city of Medieval Delhi. Siri met most of its water needs from streams from the hills as well as the Hauz Khas, catchment area of which was fed by a number of seasonal streams from the surrounding Aravalli hills. The water that flowed down from the Mehrauli settlement also poured into Hauz Khas. The Tank gradually became silted and fell into the state of disuse. It was later restored and redeveloped by Firuz Shah Tughluq, half a century later.

2 ON RIVERFRONT

The eastern bank of the Yamuna river played only a peripheral role in urban development until the 14th century. There was a sudden change in this relationship when Firuz Shah Tughlaq, the third ruler of the Tughlaq dynasty, laid out a vast system of canals, reservoirs, sluice and wells for the agricultural needs of his empire. His city of Firuzabad was cited on the bank of the Yamuna.



DELHI WITH ITS ENVIRONS IN THE EARLY 17th CENTURY

The expanse of most of the earlier cities of Delhi - Lal Kot, Delhi-i-Kuhna, Mehrauli, Jahanpanah and Tughluqabad was restricted to the southern side of the region securely nestled in the spurs of Aravalli hills with Ridge forest while the later cities of Dinpanah, Firuzabad and Shahjahanabad were sited on the riverfront. The region had a variety of topographic features such as ridges, valleys, low and high hills, and tributaries (for example, one under Athpula) that facilitated the creation of depressions and stream corridors which were able to take care of the surface run-off during brief period of rains. Delhi's water system comprised network of tanks (collection of rainfall), baolis and wells (tapping shallow ground water) and local catchment basins, mainly aligned with topographical features of Ridge and not necessarily relying on the river for both water demands and surface drainage.

The Western Yamuna Canal (250 km) was built to bring water from rivers Yamuna and Sutlej, from the northern side to the agricultural fields of the region. Other water structures such as a masonry dam and a nine-span bridge at Wazirabad gave a new meaning to water management. The imperial capital city of Firuzabad was sited to the west of the Yamuna instead of within the secure boundaries of the Ridge in the south. It had its own sources of water that included wells, step wells and tanks. This was followed by Purana Qila/Dinpanah citadel (believed to be located on the site of the early medieval settlements described as Inderpat/Indraprastha in Sanskrit inscriptions) and the grand tomb of Mughal emperor, Humayun. The spiritual centre of Delhi, the shrine of Nizamuddin Auliya, the most revered Sufi saint (d. 1325), added another dimension to areas near the riverfront. After nearly seven decades, in the mid-17th century, Shahjahanabad, the capital city of the Mughal emperor Shahjahan, embraced the Yamuna. Although the main source of water remained wells, baolis and ponds and not the river, the establishment of the capital city along the riverside was a symbolic gesture - controlling the river, by restricting public access which regarded as a sovereign prerogative. With few small settlements now located across the river (Shahdara), the river was used for transporting supplies to the walled city.

Hence, over time, two prominent features of the city - the Yamuna and Ridge - exchanged places in the siting of settlement and imperial spaces and the social and economic culture of the city.



3 CHANGING ROLES OF NATURE

The role of the Ridge forest till late 19th century was ecological, productive and recreational. Parts of it were cleared to make way for agricultural fields in the southern side. It also housed many hunting grounds and series - near Malcha and Palam. Firuz Shah Tughluq's engineering feat in the north also changed its character with people settling in that direction.

As imperial cities moved towards the banks of the Yamuna, the southern Ridge suffered neglect and deforestation. It, however, was a groundwater source. In 19th century when the British came, there was a drastic change in the character of the relationship that the authorities shared with the Ridge and the river.

The British Civil and military 'Lines' were situated in the northern Ridge. The Ridge itself was the site of the battle to control the city. It was declared a Reserved Forest under the provisions of the Indian Forest Act, 1878. The main objectives were the need to ensure steady supplies of timber for public works and stability of regional climatic conditions, water supply and soil fertility. Later, in the early twentieth century, while designing a new capital, the Ridge became a majestic backdrop to the new city. It was afforested by planting various exotic species including Prosopis juliflora, a Mexican tree now known in India as vilayati (foreign) kikar, which created extensive monocultures. People living there were displaced and locals who depended on the Ridge for fuel and fodder were kept out by fences and guards. In 1920-30, a major portion of the Ridge near Delhi University was blasted to provide access to residential neighborhoods and business premises.



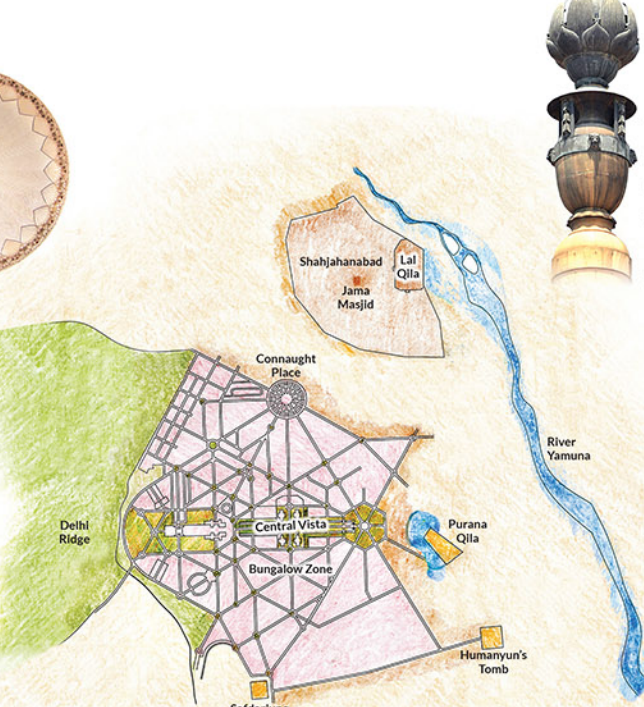
DELHI ENVIRONS POST 1857

Shahjahanabad, a walled city with the fort, occupied a flat piece of land between two hillocks, northern Ridge and another on which Jama Masjid was constructed. The entire eastern wall of the city with its fort, Lal Qila, overlooked the Yamuna riverfront. In the city, the water supply system was still through Western Yamuna Canal (from Hissar), wells, baolis and tanks while moats running along the fort wall and along the city periphery were fed by rivers. There was plenty of water inside the fort in the ornamental channels (Hayat Baksh, Nishat) waterfalls and fountains irrigating its gardens. In the city, a system of channels (Chandni Chowk) flowing through the canals that criss-crossed the streets, gardens and havelis formed the water supply infrastructure of the city. The river was isolated and hence didn't feature in the imagination of the daily lives of the residents except for few business trips of wheat grain merchants from their locality - Shahdara - which was across the river by Yamuna pushtha.

There were drastic changes in the form of the water supply and surface drainage systems. The traditional water harvesting system comprising wells, baolis and tanks fell into neglect. It got totally disrupted over the years, and became defunct. Open nallahs turned into open sewers. Large water bodies such as the Najafgarh Jheel, the Hauz Khas Jheel and many others, gradually dried up. The decline of the water system that had survived for more than one millennium, had already started, never to recover again.

In 1863, a Municipality was constituted, with one of its responsibilities being to develop a water supply system for the city and the Civil Lines with the Yamuna as the main source. Water was delivered through a centralized system of distribution controlled by the Municipality. The new water supply and drainage systems further negated the role of baolis, step-wells, tanks and springs. The 'control' of the river took the form of embankments to prevent the meandering and the constant eastward shift of the river. Efforts were made to ensure that there was no pollution of the river near the source of water supply, with regulation of activities like bathing, washing and worship. For the first time in the history of Delhi, water, passing through an elaborate system of filtration, was introduced to the city through pipes from Chandrawal, the northern site along the Yamuna, followed by Wazirabad in later decades.

Later, during the construction of New Delhi, as a capital in the 1920s, water sewage system was introduced for the first time in the city. The river started performing multiple roles - feeding agriculture, facilitating transport and supplying water and sewage catchment. The idea of the British to develop the eastern side of the Yamuna, a low lying area, was never abandoned in the new city planning. After the making of the Yamuna pushtha embankment following the flood of 1955-56, east Delhi came to be settled in a major way.



LAYOUT PLAN OF NEW DELHI (1912)

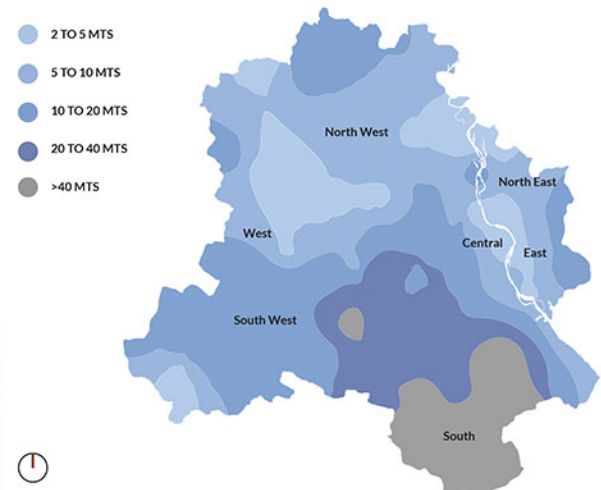
The British capital city connected river Yamuna and Delhi Ridge with the ceremonial axis. Landscape features were important in the siting and planning of the city. The main vista was laid out on the sloping land between the Ridge and river Yamuna that facilitated easy drainage. It was flanked by the symmetrical vistas of King's Way (Rajpath) with the Viceregal Lodge (Rashtrapati Bhawan) on the western side, while symbolically linking the important vistas with the city of Shahjahanabad on the north and extending the composition upto the axis linking the Safdarjung tomb and Humayun's tomb. Based on the Garden Design pattern, the main city comprised of a formal pattern of tree lined avenues with crossings and landscaped roundabouts intercepted by Bungalow plots.

4 NATURE IN A GROWING METROPOLIS

After India's Independence in 1947, Delhi became a refugee city with many colonies coming up to house those displaced by Pakistan during Partition. It exploded into a megacity with severe stress on its natural resources. The Ridge became prey to rampant urbanization and gradually became fragmented. Its ecology got disrupted with indiscriminate and unscientific denudation of forests.

Over the last few decades, except for areas like Delhi Cantonment, patches of Ridge Protected Forest, and parts of New Delhi, the city, now increasingly denser, saw large developments in housing, commercial, institutional, healthcare and infrastructure. With these benefits, came the pitfalls of conservation of natural resources. The network of drainage channels has become an ecologically defunct element of the city's landscape. There is a decline in the level of ground water. Conversion of parts of the natural forest to parks, and unregulated mining of mineralized quartzite in the south Ridge of the Aravalli (now banned by Supreme Court) are important issues concerning these natural resources.

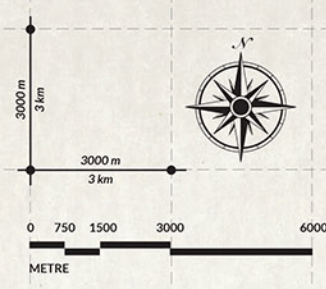
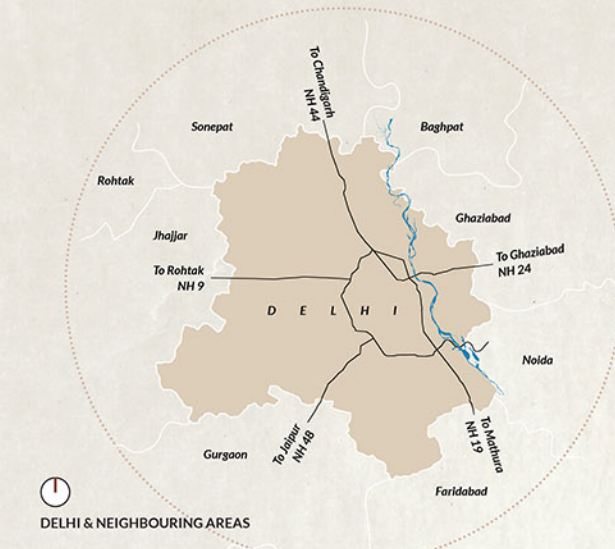
Agricultural and pastoral land has drastically reduced. The other developments that have affected the natural resources include resettlement colonies in parts of the Ridge; development of East Delhi across the Yamuna, construction on the flood plains and low-lying areas; floods of '70s and '80s (in river Yamuna and Najafgarh drain); the alignment of highways; Delhi Metro Railway Line through the Yamuna, Barapullah and Ridge; Akshardham Temple complex and the 2012 Commonwealth Games Village on the flood plains. Being one of the prime sources of water to the city, the Yamuna has been put under a lot of pressure.



DEPTH OF WATER TABLE ACROSS DELHI
Source: Central Ground Water Board Bulletin, 2017

More than 75,000 industrial units in Delhi in residential and non-conforming areas have resulted in air pollution. Besides its planned development, the city has a large volume of unplanned colonies that lack basic sanitary conditions. The pressure of an ever-increasing population has adversely affected the character of existing open spaces in the city.

Despite rules and regulations, the exploitative relation that the city gradually established with the river and the Ridge has persisted. There is an urgent need to rediscover the natural assets of the city, taking strong measures to save them for posterity while creating an ecologically sensitive, living environments.



MAPPING NATURE

ECOLOGICALLY SENSITIVE AREAS

- FORESTS**
 - Northern Ridge
 - Central Ridge
 - South Central Ridge
 - Southern Ridge

In addition to these, there are few patches of protected forests in the city Rajokri, Mitraon, Mukhmelpur, Chumehera and Bawana. Many of the forested areas in the suburbs have been converted into agricultural fields.

- GREENS AROUND MONUMENTS**
 - Coronation Park
 - Hauz Khas Monuments
 - Humayun's Tomb
 - Lal Qila
 - Lodi Gardens
 - Mehrauli Archaeological Park
 - Purana Qila
 - Qutb Minar
 - Roshanara Garden
 - Safdarjung Tomb
 - Shalimar Bagh
 - Siri Greens
 - Sultan Garhi Archaeological Park
 - Sunder Nursery
- GREEN STRETCHES ALONG RAILWAYS**
- LAKES, BIODIVERSITY PARKS, MARSHY LAND & MAIN DRAINS**
 - Aravalli Biodiversity Park
 - Asola Wildlife Sanctuary
 - Barapullah Drain
 - Bhalswa Lake
 - Burari Drain
 - Hari Nagar Lake
 - Hauz Khas Lake
 - Najafgarh Drain
 - Okhla Bird Sanctuary
 - Paschim Vihar Lake
 - Purana Qila Lake
 - Sanjay Lake
 - Shamsi Talab
 - Tughluqabad Biodiversity Park
 - Yamuna Biodiversity Park

- PUBLIC PARKS, REGIONAL GREENS**
 - Astha Kunj
 - Buddha Jayanti Park
 - Garden of Five Senses
 - India Gate Greens
 - Jahapanah Forest
 - Lotus Temple
 - Memorial Greens
 - Millennium Park
 - Mughal Gardens
 - National Zoological Park
 - Nehru Park
 - Rajiv Gandhi Smriti Van
 - Swaran Jayanti Park
- AGRICULTURE LAND**
- SOILS**
 - Bangar
 - Dabar
 - Khadar
 - Kohi

The listing comprises of significant areas under each category.

Levels mentioned in the map are heights (in meters) above Indian mean sea level as per Survey of India Map Series, 4th Edition 2016. The difference between the highest elevation in the city near Bhatti at 320 m and the bed of Yamuna at the old railway bridge is more than hundred meters.

ACKNOWLEDGMENTS

The research has immensely benefited from conversations with Prof. Sunil Kumar, Historian, University of Delhi and Awadhendra Sharan, Associate Professor at Centre for Study of Developing Societies, Delhi. The research team is thankful to Dr. Narayani Gupta, Historian, Malavika Karlekar, Writer and Prof. C.R. Babu, Scientist, CEMDE, University of Delhi for their useful inputs and Shiny Varghese and Simar Kundra for editing the document. Special thanks to Sujata Kohli for organizing funds for the work.

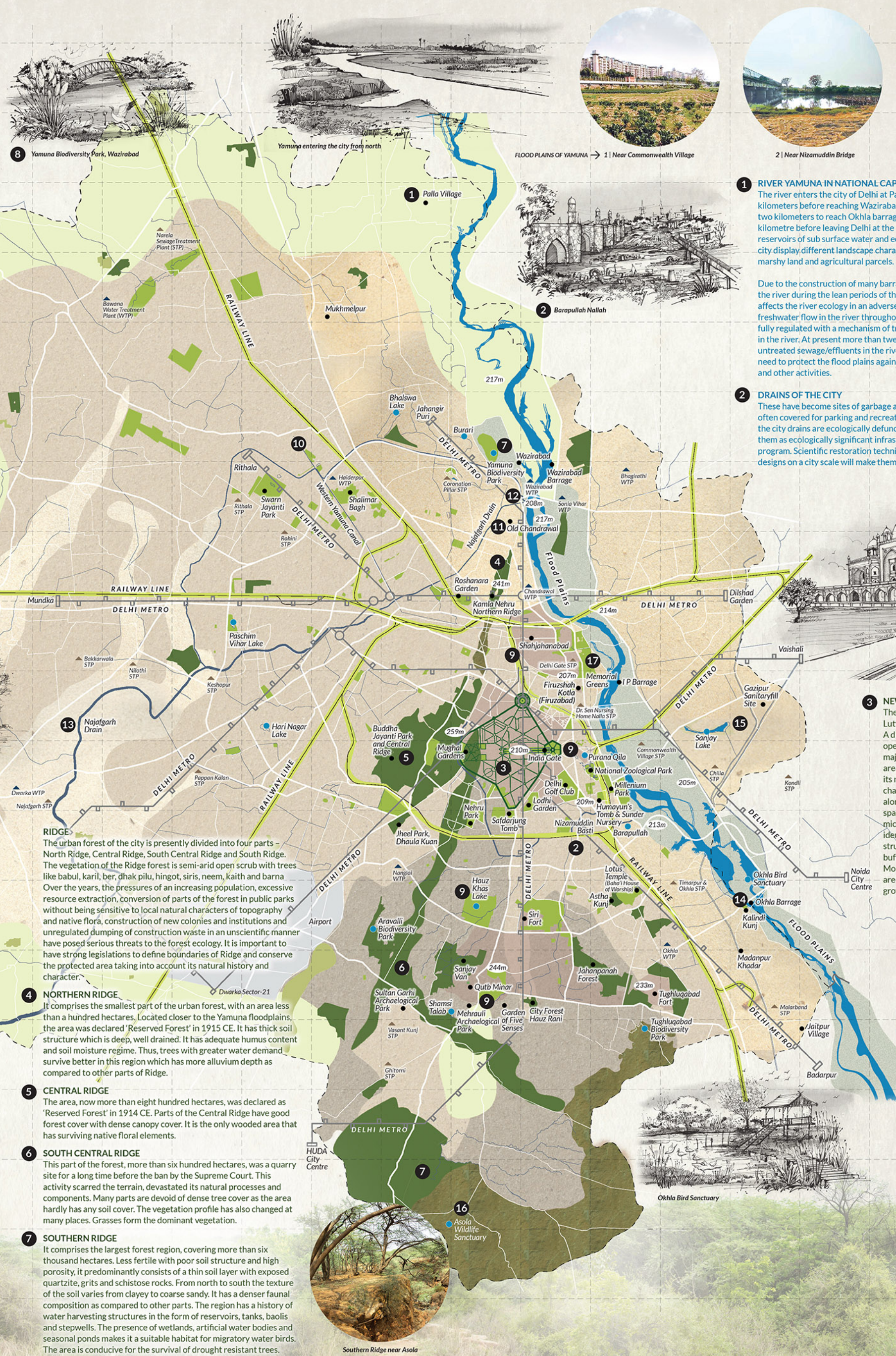
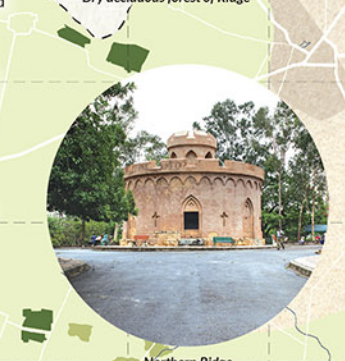
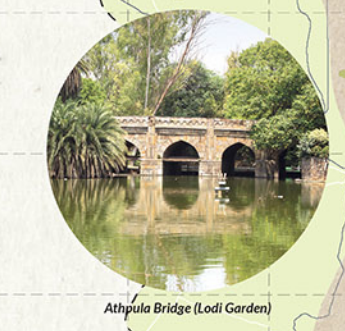
- REFERENCES**
- Maps and Illustrations
Delhi Guide Map, Survey of India, 2016
Open Series Map, Delhi, 2010
Delhi's Ecological Subdivisions, Krishen, Pradip, Trees of Delhi, A Field Guide, DK Publications, 2006
Murray's Handbook for Travellers, 1901
Shahjahanabad, Murray's Handbook, 1906
Plan of Delhi and its Environs, Folio of Cassell, Pether & Galspin, London, 1864
Delhi Master Plan 1962, Delhi Development Authority
The Yamuna in Delhi, Sewage Canal: How to Clean the Yamuna, Centre for Science and Environment, 2007
Delhi City Map, Eicher Goodearth Pvt. Ltd., 2010
Maria Guerrieri, Pilar, Maps of Delhi, Nyogi Books, 2017
Shahjahanabad, Delhi around 1850, Department of Geography, Bonn University
Environ of Delhi, Survey of India, 1807
- Books and Research Papers**
Singh, Upinder, Ancient Delhi, Oxford India, 1999
Gazetteer of Rural Delhi, 1991
Sharma, Y.D. Delhi and its Monuments, Archaeological Survey of India, 1990
Delhi Development Report, Planning Commission, Government of India, Academic Foundation, 2009
Revising River Yamuna, An Actionable Blue Print for a Blue River Peace Institute Charitable Trust, 2009
Krishen, Pradip, Trees of Delhi, A Field Guide, DK Publications, 2006
Tughluqabad, The Earliest Surviving Town of the Delhi Sultanate, Mehrood Shokoohy and Natalie H. Shokoohy, Bulletin of the School of Oriental and African Studies, University of London, Vol. 57, No. 3, Cambridge University Press, 1994
The Tughluqs: Master Builders of the Delhi Sultanate, Anthony Welch and Howard Crane Muqarnas, Volume 1, Brill Publications, 1983
A Medieval Center of Learning in India: The Hauz Khas Madrasa in Delhi, Anthony Welch, Muqarnas, Volume 13, Brill Publications, 1996
Wescott, James, Jr. The Water and Landscape Heritage of Mughal India, INTACH Delhi Chapter, 2011
Koch, Ekke, Mughal Palace Gardens from Babur to Shah Jahan, 1526-1648, Muqarnas XIV: An Annual on the Visual Culture of the Islamic World, Gailura Necipoglu (ed), Leiden: E.J. Brill, 1997
wikipedia.net | archnet.org | delhijahlab.net | dda.org

Sketches by Mahafuj Ali
Photographs by Hema Malini & Gunraagh Singh Talwar

The research has been made possible through crowd funding (miloap.org) and with generous support of many friends and well wishers including Adit Pal, Ajay Kumar Bakaya, Aniket Bhagwat, Anshuman Gupta, Aparna C. Rao, Ashish Bhallo & Suparna Bhallo, B. Ravikumar, Ishwinder S. Dua, Jayanti, Meenal Rohankar, Mohan Subramanian, Nikhil Dhar, Prashanta Bhatt, Ravi & Varsha Gavandi, Rohit Thakur, Sarabhi Srivastava, Shilpa Chandawarkar, Sriganesh Rajendran, Sarabhi Bikhchandani, The Suren & Raj Goyal Trust, Mohit Goyal, Vijay Khurana, Vivek and Urmila Rajadhyaksha among others.

8 YAMUNA BIODIVERSITY PARK
The park is developed as a living laboratory for reviving indigenous plant species of the Yamuna river basin. It acts as a conservatory of medicinal plants, butterfly garden, groves, acacia woodland, wetland and conservatory of fruit-yielding species, grass lands, flood plain forests. More than twenty five forest communities have been developed which offer multiple micro-niches and habitats for a diversity of fauna.

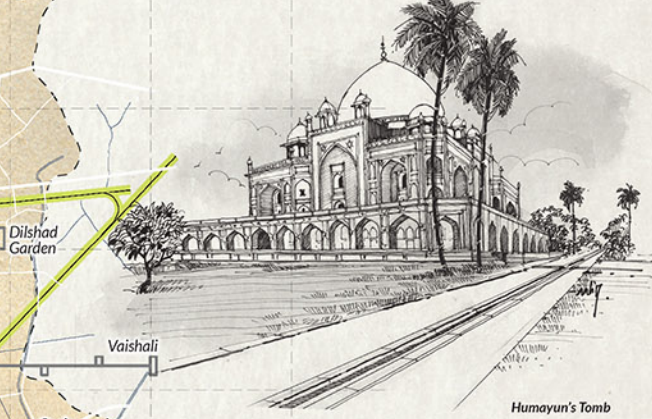
9 GREENS AROUND MONUMENTS
The city with its rich history is dotted by many historic structures and gardens belonging to different eras. The city also houses three World Heritage Sites - Qutb Minar, Lal Qila and Humayun's Tomb. Most of the protected monuments and heritage precincts in the city are developed as public parks and archaeological parks. Purana Qila with a zoological park in close proximity, Mehrauli Archaeological Park, Hauz Khas with a lake and Coronation Park are note worthy.



1 RIVER YAMUNA IN NATIONAL CAPITAL REGION OF DELHI
The river enters the city of Delhi at Palla village and travels twenty six kilometers before reaching Wazirabad barrage. It travels another twenty two kilometers to reach Okhla barrage and then travels another four kilometre before leaving Delhi at the Jaitpur village. Flood plains which are reservoirs of sub surface water and ecologically significant features of the city display different landscape characters - sand pans, natural vegetation, marshy land and agricultural parcels.

Due to the construction of many barrages upstream, there is no water in the river during the lean periods of the year except during monsoon. This affects the river ecology in an adverse manner. It is important to ensure freshwater flow in the river throughout the year. The practice needs to be fully regulated with a mechanism of treating this waste before letting it in the river. At present more than twenty drains from the city pour their untreated sewage/effluents in the river at various sites. There is a strong need to protect the flood plains against any construction, encroachment and other activities.

2 DRAINS OF THE CITY
These have become sites of garbage and sewage disposal, slums and are often covered for parking and recreational (Dilli Haat) purposes. Most of the city drains are ecologically defunct. There is a strong need to revive them as ecologically significant infrastructure of the city's water harvesting program. Scientific restoration techniques with ecologically sensitive designs on a city scale will make them positive features of the urban scape.



3 NEW DELHI - THE CAPITAL CITY
The capital city was designed by Sir Edwin Lutyens along with his team in 1920-30. A distinctive feature of the distribution of open space in the city is that a variety of major open spaces occupy an extensive area at the centre of the city, representing its natural, ceremonial and recreational character. Dense vegetation of trees along the roads with extensive open spaces creates an environment friendly microclimate that gives the area a distinct identity. The abundant vegetation structures the space, acts as a sound buffer and arrests dust and air pollution. Most of the mature trees of the capital are evergreen, shady and have a regular growth form.

