

HISTORICAL NARRATIVE

1 CITY OF TANKS 16TH-18TH CENTURY

In the absence of any perennial source of water, the natural topography of the city allowed settlements to develop a system of interconnected tanks (*keres*) which were water holding structures built for the daily needs of the settlements. This system of harvesting water, maintained by communities, was adopted across the region. Over a period of time, along with being functional, these tanks became important cultural places. With conducive weather, the art of planting supported by water from this system, evolved to such an extent that, in the decades to follow, the region became a national hub of horticulture and plant related fields.

Many historical evidences suggest that from the fourth century onwards, the region, comprising the present day city of Bengaluru, was part of several successive South Indian Kingdoms including Ganga dynasty, Cholas, Chalukyas, Hoysala and Vijayanagara Empire. It was however, Kempe Gowda I (1510-1570), who owned allegiance to a vassal of Vijayanagara Empire in Mysore region, who formally established a new capital city formally on the existing site in 1537 CE.

CAPITAL CITY OF KEMPE GOWDA IN 1537 CE

The city evolved into a structured settlement with a well defined road network that was flanked by various sectors organized in a grid pattern and segregated into different functions- religious, business, commercial and recreational. Two prominent streets in the network of roads intersected at Doddapeete square – the heart of the town.

Maps Reproduced by grafniti



The region didn't have any perennial source of water like a river in close proximity. Following the existing tradition of water harvesting structures (since 9th century), a series of tanks (*keres*) were built for the daily needs of the population and for irrigation purposes. They were engineered by embanking the natural streams of the city's valleys and recharged shallow aquifers that were further linked to open wells. The natural topography with hills, plateaus, valleys and small streams (*kaluves*), further supported the creation of this ingenious system. Various settlements, temples and other religious structures emerged around these tanks. It gave much impetus to agriculture and also encouraged cultivation of fruit orchards, gardens and tree plantation in the new town. Kempe Gowda II, added a few more tanks, including Kempapura and Karanjikere, which were connected through streams thus forming a network across the three natural valleys of the region – Koramangala Challaghatta valley, Hebbal valley and Vrishabhawathi valley. These tanks were both ecological and cultural assets, performing environmental functions of recharging ground water, harvesting water, biodiversity habitats, controlling floods as well as acting as growth nodes around which new settlements got established.

In the centuries that followed, the region was ruled by Kempe Gowda's descendants, the Marathas for few decades and very briefly by Mughals. The town was then sold to the Wodeyar kingdom of Mysore. Under Hyder Ali, Commander in Chief of Wodeyar Kingdom, the city prospered both economically and culturally. One of its landmark contributions to the city was Sultan's Garden, presently known as Lalbagh, which is a garden complex laid on a site of forty five acres (originally) near one of the gateways of the old city. It was designed on the concept of Mughal Gardens with a geometrical layout and intricate irrigation systems. Later, it was extended by Hyder Ali's son, Tipu Sultan who imported many exotic species of tropical plants from across the borders of the country. Hence it became the Botanical Garden for the State of Mysore- a first of its kind in the country. The Garden (now covering an area of over two hundred acres) remained a working laboratory for many international designers, botanists and horticulturists, especially under the Colonial rule.

In a fast growing city, the place of nature is very challenging. On the one hand, it forms the core framework based on which the city develops while on the other, it faces serious challenges in the realm of urban development. This research document attempts to construct a perspective to recognize the role and value of nature in making our cities more livable. 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. In a fast-growing metropolis it is helpful to know the natural context while we analyze the opportunities for the conservation of its natural resources.

MAPPING NATURE

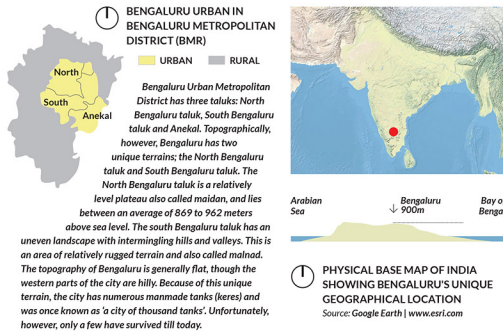
The map lists ecologically significant areas, both natural and manmade – forests, rivers, parks, lakes and tanks in the city.

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

THE REGION

Bengaluru, the capital city of state of Karnataka is located on the Deccan Plateau at an average elevation of 900 meters above the main sea level. With an urban area of more than 700 sq km, it is situated at approximately 300 kilometers from both the eastern and western shorelines in the southern plains of Karnataka. The region has a much evolved geological structure, one of the world's oldest, that includes ridges (*betta*), valleys (*kanive*) and plains (*maidan*).

Due to its high elevation, Bengaluru enjoys a moderate climate with rainy summers. The climate is considered to be Aw according to the Köppen-Geiger climate classification with distinct wet and dry seasons. The temperature here averages 23.6 °C with an average annual rainfall of more than 800 mm. The region experiences summer season during the months of April to June, followed by the southwest monsoon winds from Arabian Sea from June to September, followed by retreating of these winds and, thus, is also called the northeast monsoon. From November to March, the northeast winds blow towards the south from Bay of Bengal. The location combined with the region's high elevation contributes to its cool, dry and pleasant weather that persists almost throughout the year.



SOILS

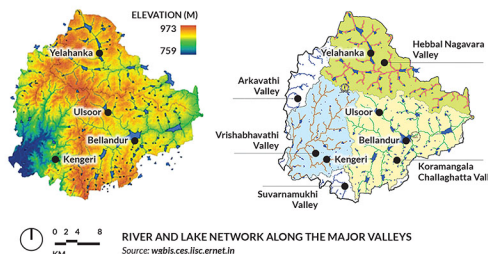
The region has distinct red colored, loamy and clayey soils that occur in vast tracts. It gets its distinct color due to the presence of iron in the residual products of the Granites and Gneisses that make up the region's landforms. The southern part of the region is hilly and the rest of the areas form an undulating terrain. The major part of the area slopes towards south and southwest with a series of NNE-SSW trending hills. The chief rock types occurring in Bengaluru North Taluk are granites and gneisses. These are prominently exposed as the ridge running NNE and SSW. Bengaluru South and Anekal Taluk comprise granites and granitic gneisses belong to Pre-Cambrian age. The granitic gneisses are exposed as continuous chains of mound raising 30 to 70 meters above ground level in the southern region of the taluk. One of the best exposed rock masses of Peninsular Gneiss, the older gneiss believed to be 2.5 billion years old, can be seen at Lalbagh.

Gneiss exposure at the Lalbagh hillock



DRAINAGE

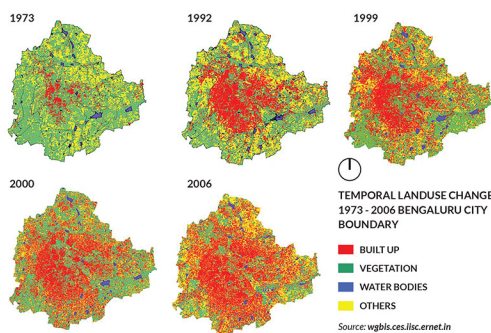
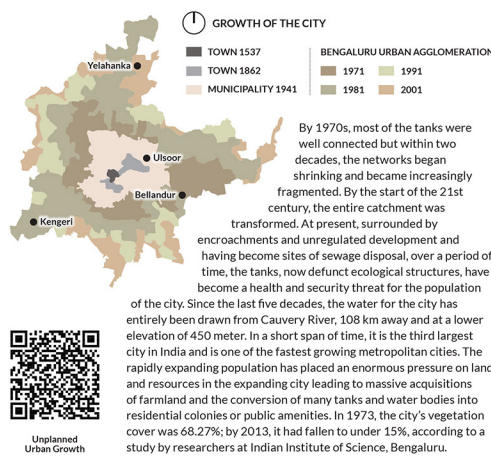
The city has no perennial source of water and no major river through it. The natural flow of the water- and its network of streams slopes away from the city and into the surrounding valleys. Depending upon the topography, the catchment area of rainfall and surface runoff gets divided into three valleys - Challaghatta, Hebbal and Vrishabhavathi. The drainage of the north is governed by the granitic ridge running from north-east to south-west, while the drainage system on the eastern side comprises of a network of channels generally flowing from west to east. The region has two river basins. Cauvery and Dakshini Pinakini. In the western half, the drainage pattern comprises of a network of channels flowing from east to west and pouring in Arkavathi river. The Southern region is marked with series of hills, through which several rivulets flow to drain west into the river Arkavathi and drain east into the South Pinakini basin while Vrishabhavathi tributary, in the southern region, drains into the Arkavathi.



4 NATURE IN A HI-TECH METROPOLIS 21ST CENTURY

The scale and pace of development in a fast growing metropolis has drastically changed the character of the city. Most of the traditional water harvesting structures of tanks (*keres*) are now covered and reclaimed for urbanization, the surviving ones, having becoming defunct, are a threat to health and safety. With the distant river Cauvery, flowing at a lower elevation, becoming the main source of water, the present and future trends in planting and gardening is being guided by the idea of only "aesthetic" rather than ecology, there is an urgent need to reconsider the direction of growth in which the city is proceeding.

With the liberalization of Indian economy, new government policies both at State and Centre levels, along with other socio economic factors, a conducive environment was created for the city of Bengaluru to become the country's first IT Hub, much like Silicon Valley. Various global companies, new start ups, BPOs, multinational companies, institutes, and corporations set up their offices in the city. Various world class commercial hubs were created with the world's top most brands addressing the aspirations of new prosperous middle class. The resulting urbanization, on a fast track mode, changed its urban character within a short span of few decades. Information Technology offices, mostly located in large campuses (referred as IT parks), gated residential enclaves, management of which would often be handed over to private companies or residents' welfare associations (RWAs) – all contributed in converting a large part of public space of the city under exclusive and restricted domains.



Another important function of the *keres* was to mitigate floods. Historically, tank system was planned to drain storm water into *keres* providing major relief during heavy rainfall events. With much encroachment of these tank beds, this cannot happen anymore; a very recent example being the Sampangi *kere* converted to Kanteerva stadium was filled with water during an extreme rainfall event in the city in May 2015, converting the low-lying landscape into a waterbody again for a short period of time.



Basavanagudi near Bugle Rock Park



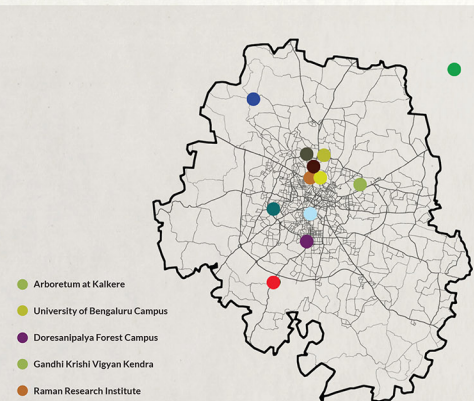
State Central Library at Cubbon Park



Road in Cubbon Park



BENGALURU & NEIGHBOURING AREAS



BIODIVERSITY HOTSPOTS

The forest patches in the city harbour heritage trees with historical and ecological significance and are home to diverse living beings. Biodiversity hotspots in the city range from community agri forest (*gundutopus*) and sacred grove (*devarakadus*), pasture land for community use (*gomal*) and even revenue waste lands, bamboo plots, Banyan groves, Ficus plots, arboreturns and so on.

CURRENT CONDITION MAP →

- FORESTS**
 - Turahalli
 - Kalkere
 - Bannerghatta National Park
- PARKS / OPEN SPACE**
 - Cubbon Park
 - Lalbagh
 - Bangalore Palace
- KERES / TANKS**
 - Ulsoor
 - Bellandur
 - Madivala
 - Hebbal
- INSTITUTIONAL**
 - Indian Institute of Science
 - Bangalore University
- MILITARY**
- PLANTATIONS**
- CEMETERIES**
- LESS DEVELOPED / AGRICULTURAL**
- URBAN DEVELOPMENT**
- BANGALORE URBAN DISTRICT BOUNDARY**

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MAPPING NATURE

0 1500 3000 6000
METRE



6 km
6000 m
6 km

URBAN FOREST

The urban forest of Bengaluru provides shade and puts up a year-long show of sequentially blossoming trees. Common street trees include: Gulmohur (*Delonix regia*), which blooms bright red; Cassias, which bloom in pink, red, and yellow and Rain tree (*Samanea saman*), which have a very large canopy and leaves that fold up and "go to bed" after the sun sets. Polyalthia avenue in Cubbon park, the huge exotic trees of Baobab (*Adansonia digitata*), Scarlet Flame Bean (*Brownea cocinea*), Silver Oak (*Grevillea robusta*), candle trees (*Parmentier acerifera*) with indigenous Neem (*Azadirachta indica*), Mango trees (*Mangifera indica*) in the Lalbagh garden gives an idea of the rich diversity of trees in this region.



Urban Park



Kempegowda Tower on Peninsular Gneiss in Lalbagh Botanical Garden

LALBAGH - THE FIRST NATIONAL BOTANICAL GARDEN

Originally about 40 acres, the Lalbagh Botanical Garden, which has now expanded to more than 200 acres, was commissioned by Hyder Ali in 1760, who designed it to resemble the Mughal Gardens that once stood at Sira in the Tumkur district of Karnataka. The gardens were further developed by Hyder Ali's son, Tipu Sultan, who contributed towards adding horticultural wealth to the garden by importing exotic plants from distant countries - Tenerife, Turkey, Persia, Kabul, Muscat and Mauritius, thus, changing its character from an imperial garden to the nation's first botanical garden. He employed the Thigala community from Tamil Nadu, who were equipped with special expertise in gardening - to look after the garden. In 1856, this Sultan's garden was revived from the state of disrepair it had fallen into after a siege by the East India Company. Many British experts and Indian patrons have made significant contributions to the development of the place including Major Gilbert Waugh, Dr. Nathaniel Wallich, William Munroe, Sir Mark Cubbon, Dr. Hugh Cleghorn (botanical advisor to Sir Mark Cubbon), William New (curator of Lalbagh), A. Black (curator of Lalbagh), John Cameron (a Kew trained botanist), Gustav Hermann Krumbeigel (German horticulturist and city planner), Rao Bahadur H. C. Javaraya, K. Nanjappa and Dr. M.H. Marigowda. Under Colonial rule, it saw various stages of expansion and acted as a site for undertaking horticulture, floriculture and gardening practices on large scales. Lalbagh has many structures and buildings notable amongst which include Darwinia, originally used to carry out all scientific works regarding the garden. It was constructed in memory of Charles Darwin, the person behind theory of evolution in 1856 (demolished in late fifties). Another notable building is the Central College, completed in 1860, a Gothic building with its tall majestic clock tower and molded entrance porch. Glass House is the most famous in housing an assortment of flora and being the venue of city's famous flower shows. Built in 1889 to commemorate the visit of Prince of Wales, the Glass house was designed on the lines of the Crystal Palace of England. Today, Lalbagh has become a treasure-house of botanical and environmental significance with nearly 673 genera and 1854 plant species.



Lalbagh Botanical Garden West Gate Road



Lalbagh Flower Show

TANKS - LIFELINES OF SETTLEMENTS

The hills (*betas*) and the valleys (*kanives*) of the region fed rain water into tanks (*keres*), which in turn supported the farms and orchards (*thotaas*). These tanks, embanked on sides, recharged shallow aquifers that were further linked to massive open wells that provided an additional measure of water security to populations dependent upon them. Although created by imperial patronage, the tanks were historically managed by communities. They were the lifelines of the various settlements that thrived around them. These structures have served to replenish ground water resources in the vicinity, which are tapped into through wells for drinking water and have also influenced the microclimate of the city. The tank system harvested water and mitigated floods. Storm water was channeled into keres providing major relief during heavy rainfall events. Activities dependent on them included fishing, cattle grazing, fodder and firewood collection, clothes washing, brick making, and agriculture. Some important tanks include Sankey tank, Hebbal tank, Nagavara tank, Chellaghatta tank, Bellandur tank, Madivala tank, Sarakki and Kempambudhi tanks. Over a period of time, they were interconnected-flowing from higher elevation to lower elevation. The overflow from the tank goes into culverts (*kodis*). They were used for waste water management, flood control, recreation and biodiversity conservation.



Lakes of Bengaluru



Sankey Tank



Ulsoor Lake

CUBBON PARK (SRI CHAMARAJENDRA PARK)

The public park was named after the longest serving commissioner of the time, Sir Mark Cubbon. Located in the heart of Bengaluru city, approximately a 250 acres, the park was designed by the then Chief engineer of Mysore, Major General Richard Sankey in 1864. Over a period of time, it has become home to many important public buildings - High Court, Public Library, Government Museum, Cheshire Dyer Memorial Home, Ottawa Charter, Jawahar Bal Bhavan and State Archeological Museum. Cubbon Park has become a landmark 'lung' of the city, offering many experiential outdoor green spaces comprising of around 6000 plants of different genera.



Trees of Bengaluru



Trees of Bengaluru



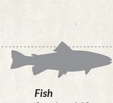
Diverse Flora in Cubbon Park

BENGALURU'S BIODIVERSITY

Bengaluru is home to many different species and ecological features. The region has a moderate climate, abundant vegetation and many man-made water bodies which make it an attractive place for fauna. Some of Bengaluru's biodiversity hotspots include Bannerghatta National Park, Lalbagh Botanical Garden, Cubbon Park and Bangalore University. The city's rapid growth is threatening some of Bengaluru's species and ecological areas and it is important that these features be preserved in order to sustain and increase the biodiversity of the area.



Mammals Species: 41



Fish Species: 140



Butterflies Species: 152



Reptiles Species: 36



Amphibians Species: 15



Birds Species: 334

Current population of wildlife in Bengaluru
Source: Local Assessment of Bangalore: Graying and Greening in Bangalore - Impacts of Urbanization on Ecosystems, Ecosystem Services and Biodiversity.



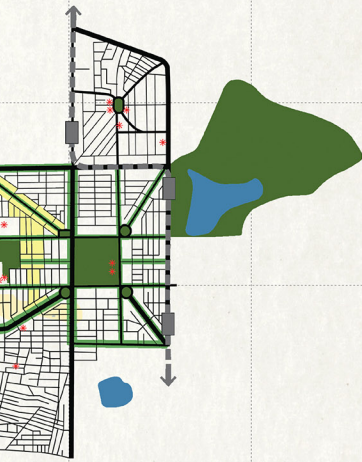
Birds of Bengaluru

BIODIVERSITY HOTSPOTS

Old institutional campuses, academic complexes, the Government and Cantonment area and cemeteries are hotspots of biodiversity in the city. Extensive tree plantations were conducted in the early twentieth century across the city to provide shade, greenery and visual relief with species of local and exotic trees flowering at different seasons. They are responsible for the large urban areas under green envelope throughout the year. Over hundred surviving keres are hot spots of biodiversity in the city with a thriving bird population, especially in winters. The natural aquatic ecosystem of grasses and shrubs encourage the existence of a large bird population including Spoon Bill (*Platalea leucorodia*), Indian white Ibis (*Threskiornis melanoccephalus*), Grey Heron (*Ardea cinerea*), Black Winged Stilt (*Himantopus himantopus*), Sandpiper, River Tern (*Sterna aurantia*), Pin-tailed Duck (*Anasacuta*) and Spot-billed Duck (*Anas poecilorhyncho*). Home gardens are repositories of various plant species grown for medicinal, religious and at times produce values, including varieties such as jackfruit, mango, drumstick, papaya and banana.



Turahalli Forest



- BASAVANAGUDI: 1894**
Source: July 31, 2013, The Deccan Herald
- TREES ALONG STREETS**
- PARKS / OPEN SPACE**
- KERES**
- MARKETS**
- METRO STATIONS**
- METRO**
- ROADS**
- RELIGIOUS SITES**

WELL PLANNED NEIGHBOURHOOD

Basavanagudi, a well planned neighborhood lies on the foothills of the Bull temple. One of the oldest layouts of the city, Basavanagudi came into being in the year 1895 in response to the plague that year, and was meant to provide temporary shelter to the population during the epidemic. Later on it was planned to accommodate all communities and sections of the society present in the city at the time.

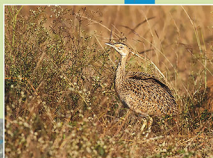
Basavanagudi can serve as a primer for planned development even today. With its parks and open spaces, keres, its tree-lined streets, mixed-use development, gridded streets, it serves as a perfect example of smart development today. Other features include convenient public transportation, walkability, numerous religious sites, schools, etc encouraging active engagement of the community.

DISAPPEARING SPECIES

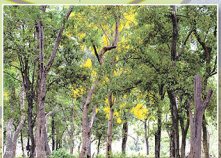
Urban growth has resulted in the habitat loss of many different species. Many have been forced elsewhere, and this displacement is leading to declining populations. Some of these species include; the Slender Loris (*Loris lydekkerianus*) which is an arboreal species that lives in the canopy of trees; the Lesser Florican (*Sypheotides indicus*), which has been displaced by the destruction of grasslands; and the Sandalwood tree (*Santalum album*) which is a valuable wood that is being illegally logged from the forests around Bengaluru. All of these species play a role in the environment and are important to the region's biodiversity.



Slender Loris | Source: flickr.com



Lesser florican | Source: conservationindia.org



Sandalwood forest | Source: livemint.com

WAY FORWARD

Kaikondrahalli keres is a 48 acre bio-diverse ecosystem and is a great example of a tank that was once a dump yard but is now a community maintained entity looked after by Mahadevpura Parisaara Samrakshane Mattu Abhivrudhi Samiti (MAPSAS). With a lot of greenery around, plenty of birds are spotted nesting, feeding and perching here. The place also has an island which serves as a resting spot for migratory birds. Other tank restoration works are those of Jakkur tank by Jalaposhan; Kasavanahalli and Sowlekere tanks also by Mapas and Puteenahalli tank by PNLIT. The city's surviving tanks provide habitat to many types of flora and fauna and are an important part of the city's ecology.

For a growing metropolis, a sustainable water source is a must. They need to be revived as a perennial source of clean water. Methods like biotic cleaning, de silting and other engineering interventions may be adopted to recover these lost tanks. The city sewage system needs to take in account the ecological significance of these water structures which have taken care of the water requirement of the city for many centuries.

As Bengaluru moves forward, it is important that the health of the city's natural resources be made a top priority of both the citizens and the government. Bengaluru must continue to improve its city planning practices and incorporate the fields of Urban Planning, Landscape Architecture, Environmental Planning and many others. This will enable the city to make decisions that are in the best interest of the people, while preserving and restoring natural resources. The region has a rich ecological and cultural heritage and the city's developing culture of environmental activism has the potential to positively influence the city as it moves forward.



Growth of Bengaluru