

Using satellite imagery and historical maps to study the original contours of Lalbagh Botanical Garden

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The Lalbagh Botanical Garden in Bangalore, one of the country's oldest botanical gardens, has a long history. In 1760, Hyder Ali established a garden here, which was later expanded by his son Tipu Sultan. After Tipu was defeated and killed in 1799, the stewardship of Lalbagh passed through several hands before finally being taken over by the then Government of Mysore and made the Government Gardens¹.

It is generally believed that the garden that Hyder Ali set up in 1760 was located north of and adjacent to the Lalbagh tank. For example, maps published by the Department of Horticulture, Government of Karnataka depict the garden between 1760 and 1856 covering a roughly rectangular patch of about 40 acres adjacent to the tank (Figure 1).

Using a combination of historical maps, old paintings and recent remotely sensed images, we have examined the actual boundaries of the garden as it was in the period of Tipu.

Our research used two maps drawn in 1791. In February–March that year, a battle was fought in Bangalore between Tipu Sultan and the British Grand Army, led by General Charles Cornwallis. The objective of the British was to capture the fort of Bangalore², which was achieved on 21 March 1791. Following the British victory, surveyors in the British army prepared maps of the Fort. We obtained digital copies of two of these maps from the British Library. The first, *Plan of the Fortress of Bangalore, 1791* (British Library, Add 18109-c – referred to as Plan-A henceforth) shows the Bangalore Fort and its vicinity. The second, *Plan showing the position of the British Troops round the Pettah, March 1791* (British Library, Add 18109-d – referred to as Plan-B henceforth) shows the Bangalore Fort as well as its surroundings up to a radius of about 8 km.

These maps predate the Great Trigonometric Survey, and therefore do not conform to the standard projection system followed by later maps. We first registered (geo-referenced or geo-coded) a base map, the 1897 map of Bangalore³, to a current image of Bangalore from

Google Earth using Ground Control Points (GCPs) such as road intersections that have remained unchanged in the intervening period, using a geographic latitude/longitude projection system. Next, the two maps from 1791 were registered to the 1897 map. This process was challenging, as many of the traced features differed considerably between the maps of 1791 and 1897. Some of the points used to register the maps were the still extant Delhi Gate and the bastions flanking it; others included some road intersections in the 'pettah' (walled inner city), and tank bunds. Following registration, spatial errors between the two 1791 maps were quite minimal, with differences of about 25 m in the *x* dimension and about 35 m in the *y* dimension.

The two maps of 1791 show that during the reign of Tipu Sultan, the gardens near the modern Lalbagh consisted not of one contiguous area, but were instead a series of five rectangular plots of varying sizes. The smaller map (Plan-A) does not show one of the plots, as this lies outside the mapped area on the west. We are confident that these five gardens shown on the 1791 maps were indeed the gardens of Hyder and Tipu. First, of the four plots in Plan-A, two rectangular plots are

clearly subdivided into four smaller rectangular plots each, the third plot is subdivided vertically into two rectangular plots, and the fourth small plot is subdivided vertically, horizontally and diagonally into eight triangular plots. This corresponds well with historical information that the gardens developed by Hyder Ali and Tipu Sultan, including those elsewhere such as at Sira and Srirangapatna, were laid out in the Islamic 'charbagh' style, with four plots separated by walks^{4,5}. From the report of Francis Buchanan⁶ too, we know that the gardens of Tipu and Hyder were divided into plots which were separated by walks. Buchanan⁶ also describes these gardens as separate entities, which agrees with the map showing separate plots rather than one contiguous garden.

That the garden in Tipu Sultan's times consisted of a series of plots and not one contiguous plot is also borne out by historical paintings of Lalbagh. In 1791–92, shortly after the capture of Bangalore by the Grand Army, a number of British army draughtsmen, surveyors and artists, both official and amateur, painted scenes showing the Cypress Garden, as the British called it. 'East view of the Cypress Garden' by an official army artist Robert

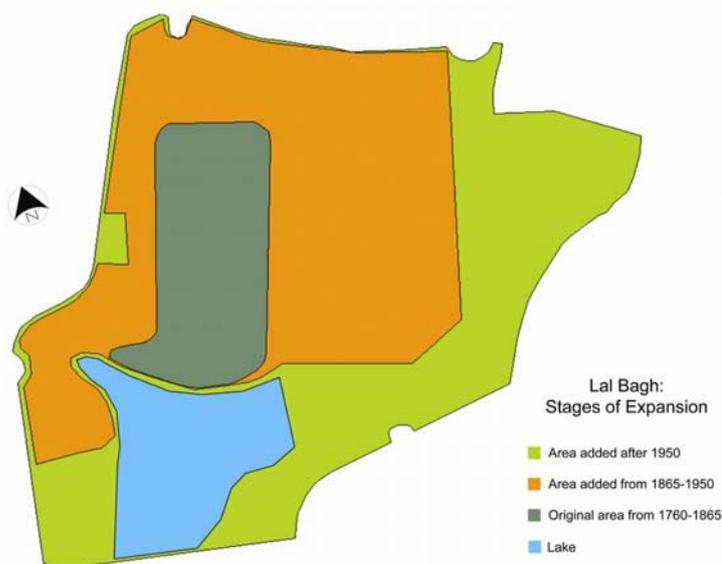


Figure 1. Map showing the presumed original extent and location of Lalbagh in 1760; based on maps published by the Department of Horticulture, Government of Karnataka.

HISTORICAL NOTES

Home (<http://www.bl.uk/onlinegallery/onlineex/apac/other/019wdz000003775u-00005000.html>), 'East view of Bangalore' by army surveyor Robert Hyde Colebrooke (<http://www.bl.uk/online-gallery/onlineex/apac/other/019wdz000-004461u00000000.html>), and 'Southerly view of Bangalore', painted by Col Claude Martin of the Grand Army (<http://www.bl.uk/onlinegallery/onlineex/apac/other/019pzz000000256u00000000.html>) all clearly show distinct garden plots, although it is difficult to discern the exact number of plots.

Of the five gardens clearly demarcated on the maps, four are completely outside the modern Lalbagh. In the Plan-B map, the four plots found outside Lalbagh are of 0.7, 2.1, 2.5 and 5.5 ha. In the Plan-A map, of the three plots that are shown outside the modern Lalbagh, the smallest is 0.6 ha, with the other two plots of 2.8 and 5.5 ha. Most of the southernmost rectangular plot falls within the modern Lalbagh. This plot appears wider in the map Plan-A and has a larger area of 7.2 ha, whereas it appears narrower in the map Plan-B with an area of 6.2 ha. The total area of the plots adds to between 17 and 18 ha (depending on which map we refer to), which matches with the figure of approximately 17 ha recorded for Lalbagh in 1800 (ref. 7).

However, unlike the generally accepted view, the only portion of the Hyder–Tipu garden that is encompassed within the modern botanical garden is not adjacent to the Lalbagh Tank, but is north of it. The other garden plots today form part of the crematorium to the north of Lalbagh, Wakf properties north of Lalbagh, including a burial ground and the Al-Ameen educational institutions (Figure 2).

Can we glean any further information from the maps? Buchanan's account states that Hyder's portions of the gardens were watered 'without the aid of machinery' from a nearby reservoir, while Tipu's gardens were supplied by wells. If Hyder's gardens were watered by a tank, it is reasonable to assume that his gardens would have been adjacent to a tank while Tipu's were not. Of the five garden plots, at least two were indeed adjacent to a tank, the now defunct Malavalli tank northwest of the modern Lalbagh. Being neither adjacent to any tank, and also by virtue of the fact that all the larger plots are more distant from the Bangalore Fort, it is tempting to

speculate that at least some if not all of these larger garden plots were probably established by Tipu. This is also suggested by Martin's painting, which clearly labels the larger, more southerly garden plot as being Tipu gardens. This is the garden that is today encompassed within Lalbagh.

Moreover, watering the southern plot without machinery or mechanical aid would have been a challenge as it is a few metres higher in altitude and around 400 m away from the tank. Though Lalbagh tank is a few metres higher in elevation than the southern plot, it is still 250 m away from it, which suggests this large southern plot was probably not Hyder Ali's garden.

We also used the historical paintings as a second line of evidence to locate the original gardens.

All of these paintings show the Bangalore Fort with its 13 bastions. Based on the details and points of view shown in the paintings, we pinpointed the likely locations where the drawings were made from.

A 3D simulation of the old landscape was generated on ERDAS software virtual GIS module using Digital Elevation Model and overlaying registered maps. Both the 1791 maps were overlaid, first Plan-B showing two mounds in the location of the Lalbagh rock and the temple to its northeast, which are the locations from where the paintings were made (the locations were further checked by going to the spots and taking GPS readings); secondly, Plan-A which clearly marks the Fort and layout of the Lalbagh garden patches (Figure 3). On this terrain 3D model, the shape of Fort was digitized and a rough 3D model of it was created by giving height to the polygons in the shapefile. 3D objects resembling the Kempegowda tower on the rock and the temple that feature in the paintings were placed in their respective spots. 3D models of cypress trees were placed along the central walkway⁶ of the garden patches marked on the Plan-A map, and non-coniferous tree models were placed within the garden (Figure 3). A 3D view

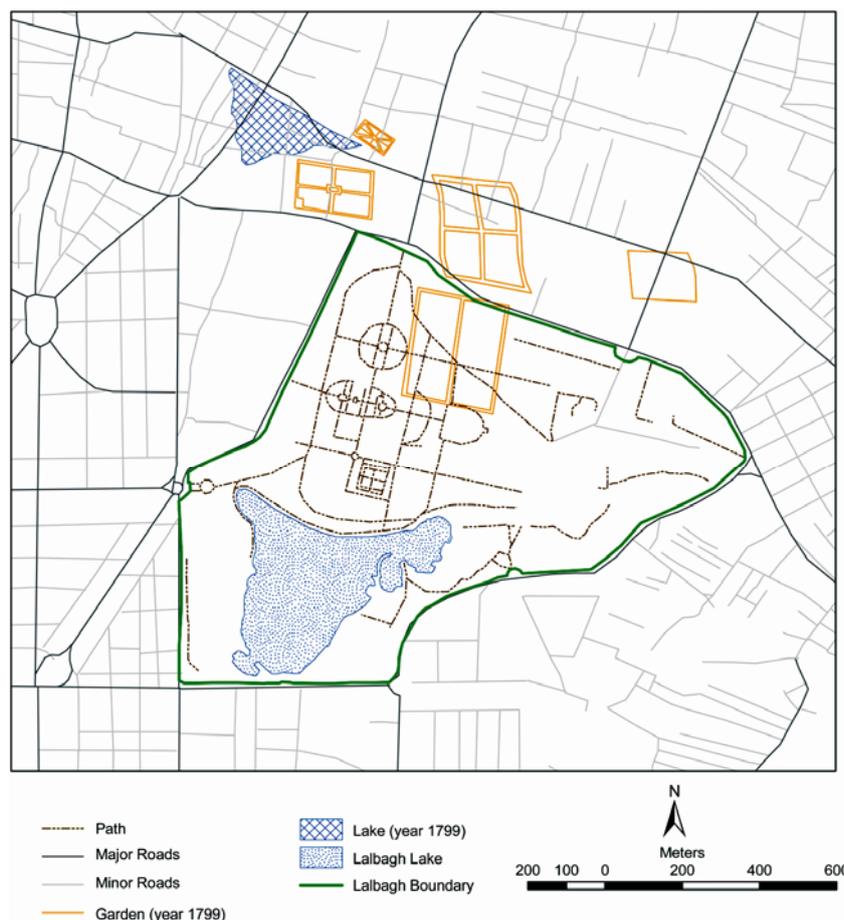


Figure 2. Map of the area around modern Lalbagh, also depicting the locations of the five patches of gardens in 1799, and the lake.

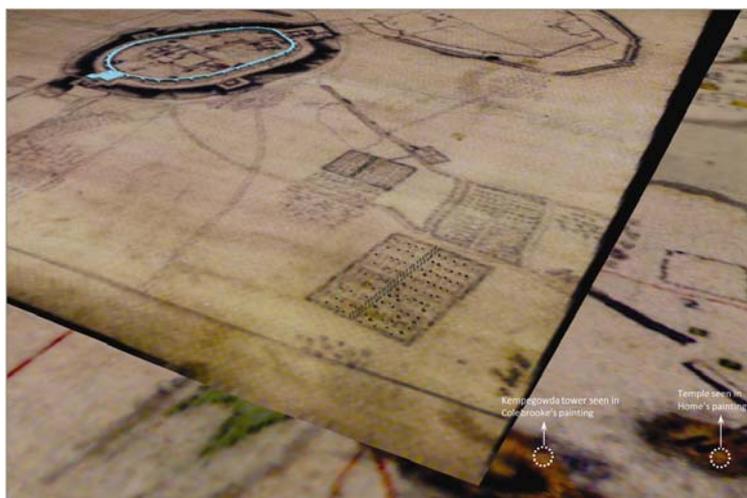


Figure 3. Oblique view illustrating spatial locations and orientation of Lalbagh and its environs in the eighteenth century.



Figure 4. Simulated view corresponding to views in the paintings by Home and Colebrooke.

was simulated, which looks from around the Lalbagh rock towards the northwest direction, showing Bangalore Fort in the background and the old layout of Lalbagh in the foreground (Figure 4). This simulated view closely resembles the views in the paintings made by Home and Colebrooke.

We also used the maps to explore if any of the trees popularly attributed to Tipu period were within the boundaries of the gardens, as they were in his time. Using GPS coordinates, we determined that a white silk cotton (*Ceiba pentandra*) said to date to Tipu's period was not within any of Tipu or Hyder's patches. In fact, it is at a distance of 195 m off the southwest corner of the southernmost rectangular plot. A famous mango tree said to have been planted during Tipu's time, and hence known as Tipu's mango tree, is however within the southernmost rectangular plot, just at the corner a few metres within the southern boundary and a few metres on the west side of the cypress avenue.

Using these methods, we have shown that the views of the gardens and the Fort as shown in these paintings do not allow

the possibility of the Hyder–Tipu's gardens being adjacent to the Lalbagh tank, but instead indicate a more northern location for them, corroborating what we report from the overlay of the historical maps on satellite images.

A complete study of the evolution of the five non-contiguous plots that constituted the gardens of Hyder and Tipu into the modern Lalbagh Botanical Garden is outside the scope of this work. However, a study of contemporary sources suggests that the five plots were abandoned early in second decade of the 1800s. In 1800, Benjamin Heyne, a botanist in the East India Company, was handed the management of these two gardens. He was only able to attend to the garden intermittently. He held the post till 1808. He reports in 1812 that the garden had been abandoned and most of it is brought under the cultivation of rice and ragi⁸. It is likely that the garden was consolidated into one plot⁹ when it was taken over by a military paymaster, Major Gilbert Waugh, in about 1814.

To conclude, our analysis of historical maps and paintings revealed that the gardens laid out by Hyder Ali and Tipu

Sultan were distinct plots. Contradicting popular opinion, only a portion of one of these garden plots overlaps with the modern Lalbagh. Further, unlike what is commonly believed, this garden plot was not adjacent to the Lalbagh tank, but north of it. This portion is likely to have been laid out by Tipu Sultan, and so dates from a little later than 1760, the date of establishment generally given for Lalbagh.

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ACKNOWLEDGEMENTS. M.I. thanks M. B. Krishna for useful discussions and feedback. H.N. thanks the Department of Science and Technology, New Delhi for providing funding through a Ramanujan Fellowship. M.B.R. thanks her former organization, the National Institute of Advanced Studies (NIAS), Bangalore, in whose laboratory all her work for this note was done. She also thanks N. S. Nalini, NIAS, for assisting in image processing and visualisation.

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