

Ecological mysteries of Toyyar Lake

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Hidden in the ancient pristine wooded folds of the rapidly urbanising Chimbhel Plateau, Toyyar Lake at the head of a Y-shaped structural valley in Chimbhel village dating from 12,000 to 3 lakh years looks like a simple rain-filled hollow. However, beneath its still surface lies a geological story hundreds of millions of years in the making — a story central to understanding why this lake exists, survives, and matters to people and nature alike.

The lake, lying along a prehistoric route of human migration, pilgrimage, and trade, quenched the thirst of wild animals, travellers, pilgrims, traders, and soldiers for thousands of years. Its deep sediments may hide many archaeological artefacts, a treasure trove of 5,000 years of history.

Chimbhel was a minor port during the Badami Chalukya period and traded with Persia (Iran). Satellite imagery showed that the lake reached its highest level in November 2019. Scientific studies of the Ribandar–Chimbhel region show that the bedrock beneath this plateau is not a simple “hard rock” surface, but ancient sedimentary rock known as Precambrian graywacke, formed from submarine landslides and turbidity currents in deep ocean basins over two and a half billion years ago. These rocks belong to the Sanvordem Formation of the Goa Group and were folded, buried, and metamorphosed during tectonic events long before any humans walked this land. Graywacke is not a uniform or impermeable mass. It contains layers, mineral bands, fractures, and quartz veins that were formed during its long geological history. Over immense time, tropical weathering transformed the upper part of this bedrock into laterite, the red, iron-rich crust that now caps the plateau. However, laterite does not seal the ground as well as concrete. Instead, it sits above weathered and fractured graywacke that can store and transmit groundwater slowly.

Toyyar Lake thus rests on a layered hydrogeological system: monsoon rain infiltrates porous laterite, percolates into weathered graywacke zones, and is retained within structural traps and depressions. The layered, deformed structure of graywacke in the Chimbhel belt creates pathways that guide subsurface water movements. Even when no stream visibly flows from the lake, groundwater can migrate through these structural pathways toward lower elevation. Therefore, plateau lakes can influence hydrology beyond their visible boundaries.

Toyyar's position near the upland divide between the Mandovi and Zuari basins and close to the headwaters of the Santan River suggests that its recharge zone may feed broader groundwater systems across a much larger landscape. In this sense, the lake is not an isolated feature but a functional part of a wider hydrological network that sustains rivers, springs, and soils across the plateau.

The ecological value of the Toyyar Lake landscape extends far beyond water. The lateritic

TOYYAR LAKE CHIMBEL FILLED TO CAPACITY IN NOVEMBER 2019

Write a description for your map.



plateau adjoining Toyyar Lake at Chimbhel represents a seasonal lateritic habitat island that supports a distinct community of monsoon-dependent herbaceous vegetation, known as ephemeral flush vegetation.

The plateau surface is formed of ferricrete with shallow, nutrient-poor soils. During the monsoon, natural depressions in the rock accumulate rainwater, creating a patchwork of temporary pools, moist seepage zones, and slightly elevated dry patches. These sharp microhabitat differences over short distances drive a succession of flowering events between June and September, making this plateau a mosaic of colour and life during each monsoon. The wildflower community is dominated by small, short-lived annuals that are specially adapted to alternating waterlogging and drought. In waterlogged depressions and along shallow seasonal pools, species of *Eriocaulon* form bead-like white inflorescences, often associated with carnivorous plants such as *Utricularia reticulata* and sundews of the genus *Drosera*, which obtain nutrients by trapping small insects in nutrient-deficient soils. With the first monsoon showers, early seasonal herbs such as spider flowers (*Cleome gynandra*, *Cleome rutidosperma*, and *Cleome viscosa*) appear across the plateau surface. These pioneers are followed by mats of *Justicia procumbens*, whose small but abundant flowers attract a range of insect-pollinators. As the season advances, additional species occupy better-drained patches. The sequential flowering pattern of plateau wildflowers provides a continuous source of nectar and pollen for bees, butterflies, and other insects throughout the monsoons. The dense root systems of these short-lived herbs help bind the thin soil layer and reduce erosion during intense rainfall. By slowing runoff across the plateau sur-

face, this vegetation also contributes indirectly to groundwater recharge and hydrological stability in the Toyyar Lake catchment.

Many species of lateritic plant communities contain bioactive compounds of pharmacological interest. Species of *Cleome* have yielded anti-inflammatory and analgesic compounds, *Justicia procumbens* has been investigated for its antiviral and antitumor properties, and *Curcuma pseudomontana* produces essential oils with antifungal activity. *Trichosanthes cucumerina* contains cucurbitacins with documented biological activity. These biochemical traits enhance the conservation value of plateaus, making them repositories of genetic, ecological, and biochemical diversity that cannot be recreated once lost.

The ecological functions of Toyyar Lake and its surrounding lateritic habitats are interconnected. Lateritic plateaus are often misinterpreted as barren or wasteland areas because their ecological value is visible only during a short monsoon window. Given its proximity to Toyyar Lake, the Chimbhel Plateau is an integral part of the broader landscape supporting both terrestrial and wetland biodiversity. Disturbances such as dumping, construction, surface leveling, or altered drainage would not only destroy this specialised wildflower community and its ecological functions but also disrupt the hydrological processes that sustain the lake.

The importance of Toyyar Lake for wildlife extends beyond plants and soil. A recent bird survey at the lake documented 46 species, underscoring its importance as a habitat for avian life and reinforcing the need for sustained conservation efforts. Observers recorded familiar residents such as the white-browed bulbul, which is very common on the plateau, along with greater racket-tailed drongo, spotted dove, greater cou-

cal, Asian koel, and the grey-bellied cuckoo. The presence of such a varied community in a relatively small area is evidence of ecological richness that often goes unnoticed until documented scientifically.

The image of Toyyar Lake brimming after a good monsoon serves as a reminder that this ancient geological system is still alive and functioning. Disrupting the recharge area, altering drainage, or introducing heavy construction near such a system can change the movement of water underground, the way soil holds nutrients, the way seeds germinate, and the way animals find sustenance. When the geology is layered and structurally complex, surface observations alone cannot reveal the complete hydrological and ecological picture.

Toyyar Lake is more than a scenic forest pond; it sits atop rocks formed in ancient oceans, shaped by tectonic forces and tropical weathering, and now serves as a living water reservoir and biodiversity hub. This may have supported wildlife and human movement for millennia, providing dependable freshwater in a landscape that can become dry and challenging during monsoons. It continues to provide ecological stability in rapidly changing regions.

Understanding Toyyar means looking not only at the water we see but also at the deep geological foundation beneath it, the seasonal blooms that carpet the plateau, and the birds that find refuge in its waters and trees. That foundation tells us one thing clearly: this is not an accidental puddle of water. It is part of an ancient, interconnected hydrological and ecological system that deserves careful study, respect, and protection — not just because it is beautiful, but because it is essential to the intricate web of life that surrounds it on the highly urbanised ecofragile Tiswadi estuarine island.