# Leveraging digital technology for lake monitoring

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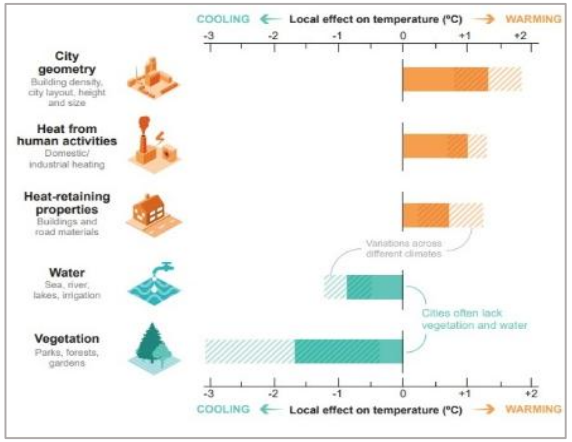
## Global South Academic Conclave on WASH and Climate 2026

**6th – 7th February 2026, Ahmedabad**

# Focus on Lake Management – Increasingly important for climate change

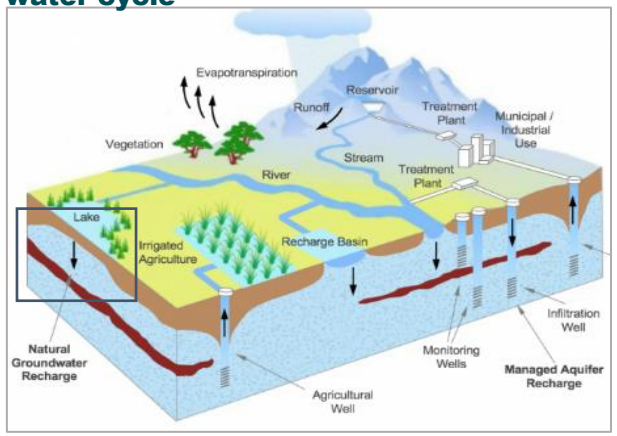
## Lakes critical for adaptation and mitigation efforts

### Regulating urban temperatures



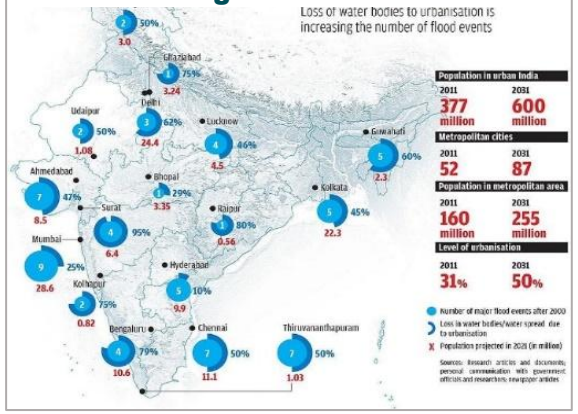

Intergovernmental Panel on Climate Change (IPCC). (2023). Linking Global to Regional Climate Change. In Climate Change 2021 – The Physical Sciencea Basis: Working Group I Contribution to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change (pp. 1363–1512). chapter, Cambridge: Cambridge University Press.a

### Groundwater recharge and maintaining water cycle



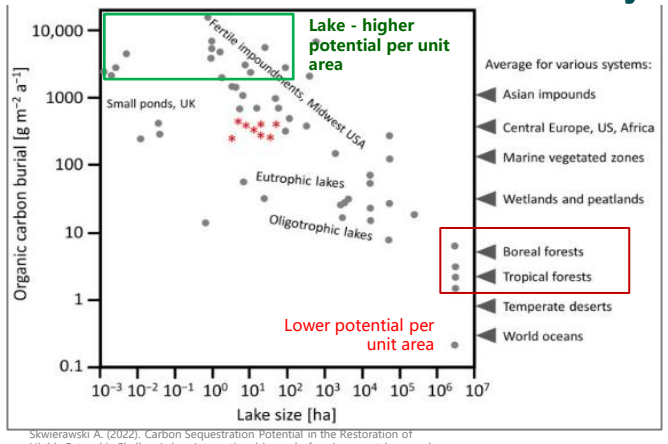

INOWAS, accessed from inowas.com, Feb 2025. (adapted from California Department of Water Resources)

### Stormwater drainage and reduced risk of flooding




Source: Two sides of the same coin: Shrinking water bodies and urban floods, Down to Earth, August 2020

### High potential of carbon sequestration - nature based solutions for carbon neutrality?




Skwierawski A. (2022). Carbon Sequestration Potential in the Restoration of Highly Eutrophic Shallow Lakes. International journal of environmental research and public health, 19(10), 6308. https://doi.org/10.3390/ijerph19106308

## Disappearance and degradation of lakes requires urgent attention!

- 70 % of surface water in India is unfit for consumption due to water pollution and contamination issues.
- **50 % of lakes across the globe** have **shrunk** from 1992 – 2021
- Degradation of lakes also linked to food insecurity and loss of livelihoods

### Bangalore



### Ahmedabad

204 lakes in 1960
to
134 lakes in 2021

70 lakes become extinct in 6 decades!!


Source: 1. "Water Pollution Is Killing Millions of Indians. Here's How Technology and Reliable Data Can Change That." World Economic Forum, October 2019. 2. Yao, Fangfang, et al. "Satellites Reveal Widespread Decline in Global Lake Water Storage." Science, vol. 380, no. 6646, 2023, pp. 146–150, May 2023. 3. Nayak, P.K. Fisher communities in transition: understanding change from a livelihood perspective in Chilika Lagoon, India. Maritime Studies 16, 13 (2017)

# Parameters to define “health” of a lake?

Lake health is defined as the overall ecological, physical, and chemical state of a lake, which determines its ability to support biodiversity and sustain its functions over time. A healthy lake maintains a balanced ecosystem, supports diverse aquatic life, and provides clean water for various human and ecological needs.

“presence” of water

- Does the lake dry out in certain months?
- Is the dry period increasing?
- Is the average surface area coverage decreasing annually?
- Is the lake perimeter protected?
- Is the lake recognized in local land-use plans?

Use-case fitness

Nutrient load, biomass

Water quality index

Too scientific for urban decision makers!

Water quality studies and boundary monitoring – resource intensive exercises!

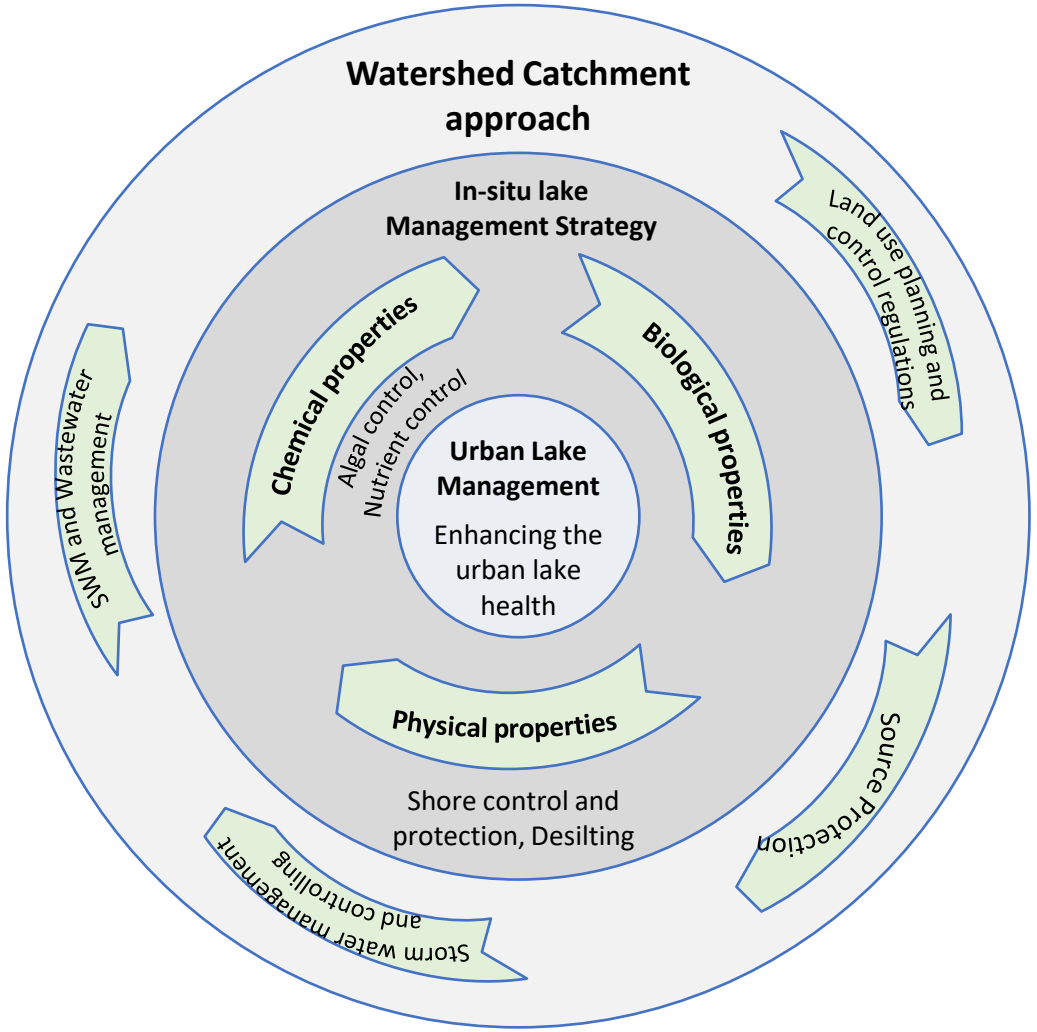
Can we simplify for stakeholders with technology?

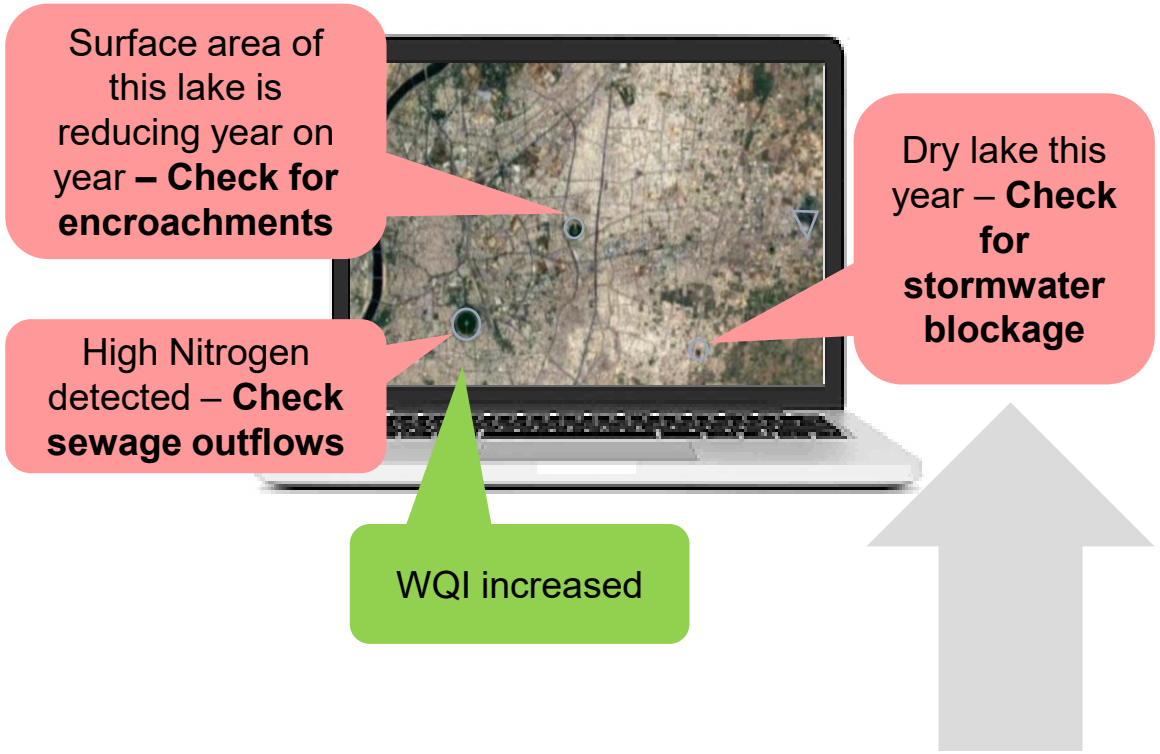
| | | |
|---|---|---|
| | disinfection | ≤ 3 mg/l |
| D | Propagation of Wild life and Fisheries | - pH: 6.5 – 8.5 - Dissolved Oxygen ≥ 4 mg/l - Free Ammonia (as N) ≤ 1.2 mg/l |
| E | Irrigation, Industrial Cooling, Controlled Waste Disposal | - pH: 6.0 – 8.5 - Electrical Conductivity at 25°C (µmhos/cm) ≤ 2250 - Sodium Absorption Ratio ≤ 26 - Boron ≤ 2 mg/l |
| <E | Not meeting A, B, C, D & E criteria | - — |

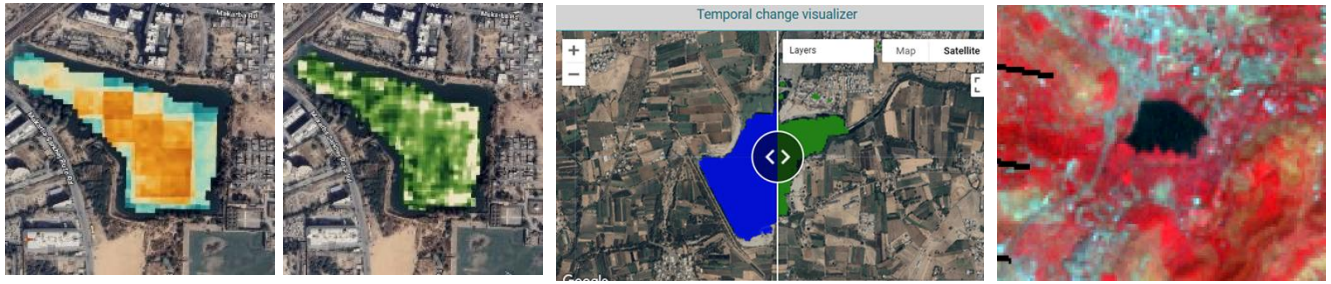
| | | | | |
|---|---|---|---|---|
| ≥ | 60 | 20.0 | 0.20 | 1.2 |
| Eutrophic | 70 | 40.0 | 0.40 | 2.0 |
| | 80 | 80.0 | 0.82 | 3.4 |
| | 90 | 160 | 0.34 | 5.6 |
| | 100 | 320 | 0.58 | 9.0 |

| WQI value | Water Quality | Remarks |
|---|---|---|
| 63-100 | Good to Excellent | Non-Polluted |
| 50-63 | Medium to Good | Non-Polluted |
| 38-50 | Bad | Polluted |
| < 38 | Bad to very Bad | Heavily Polluted |

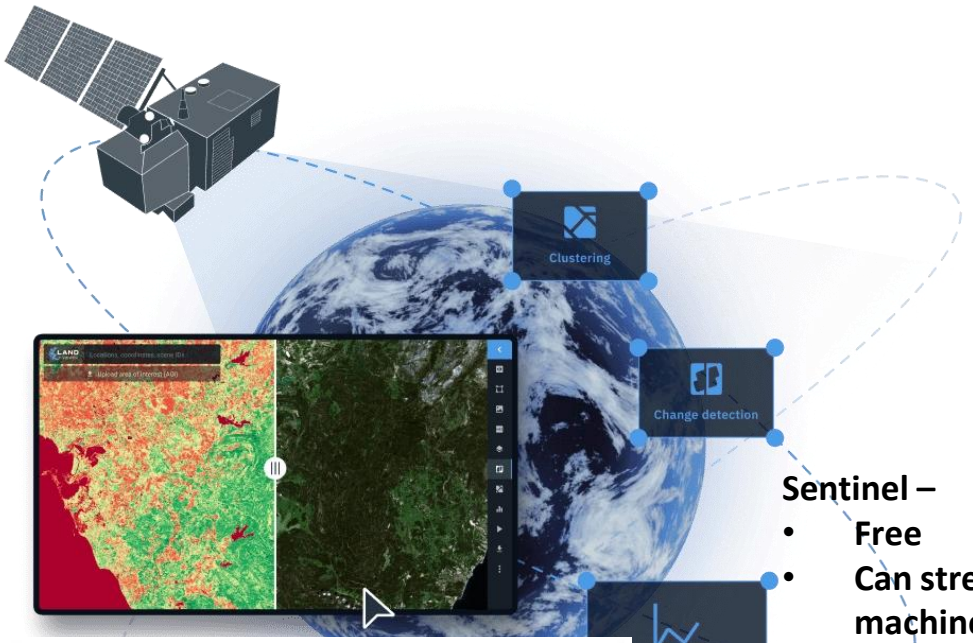
# Envisioning a system that enables decisions



# Remote sensing




| Sentinel-2 Bands | Central Wavelength (µm) | Resolution (m) |
|---|---|---|
| Band 1 - Coastal aerosol | 0.443 | 60 |
| Band 2 - Blue | 0.490 | 10 |
| Band 3 - Green | 0.560 | 10 |
| Band 4 - Red | 0.665 | 10 |
| Band 5 - Vegetation Red Edge | 0.705 | 20 |
| Band 6 - Vegetation Red Edge | 0.740 | 20 |
| Band 7 - Vegetation Red Edge | 0.783 | 20 |
| Band 8 - NIR | 0.842 | 10 |
| Band 8A - Vegetation Red Edge | 0.865 | 20 |
| Band 9 - Water vapour | 0.945 | 60 |
| Band 10 - SWIR - Cirrus | 1.375 | 60 |
| Band 11 - SWIR | 1.610 | 20 |
| Band 12 - SWIR | 2.190 | 20 |

**Sentinel –**

- **Free**
- **Can stream / import directly into machine learning software**
- **Has SAR bands available – non-visible spectrum**

**What can be done through satellite images?**

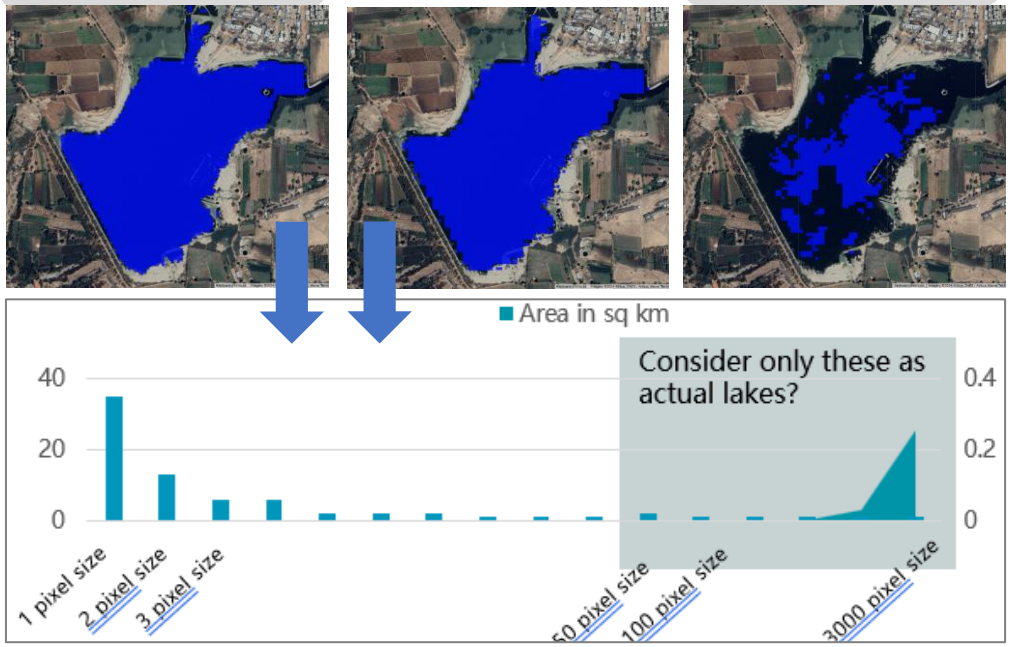
- Water
- Vegetation
- Area
- Water Quality

# Building Module 1- “Detecting” water bodies

NDWI (Normalized Difference Water Index)

MNDWI (Modified NDWI)

AWEI (Automated Water Extraction Index)

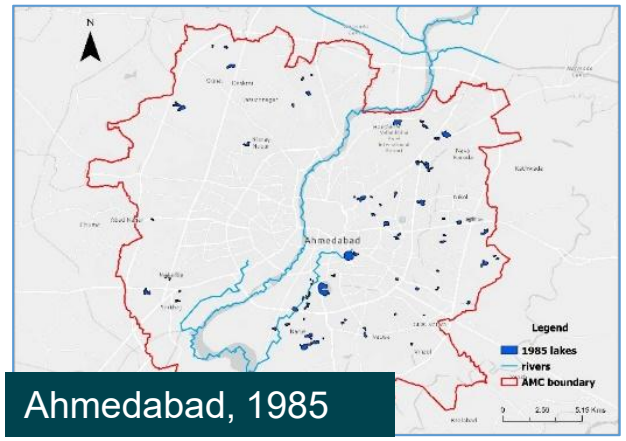



Stacking results and cross checking with Open Street Maps to remove detection of artificial pools

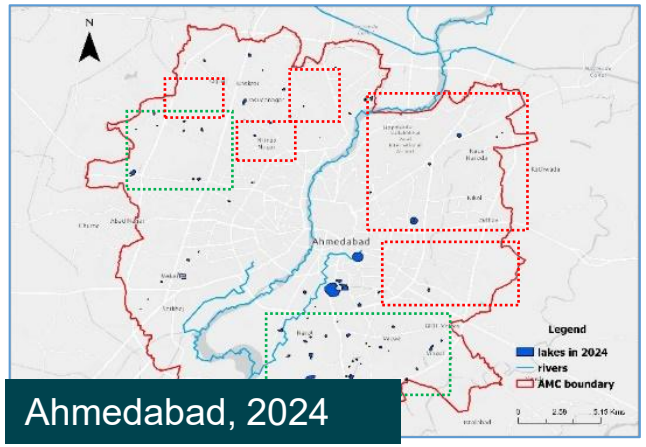
Improve by selection of localized threshold values – generate consistent and unbroken boundaries, accurate number of water bodies

# Results from Module 1 – Many cases of disappearance

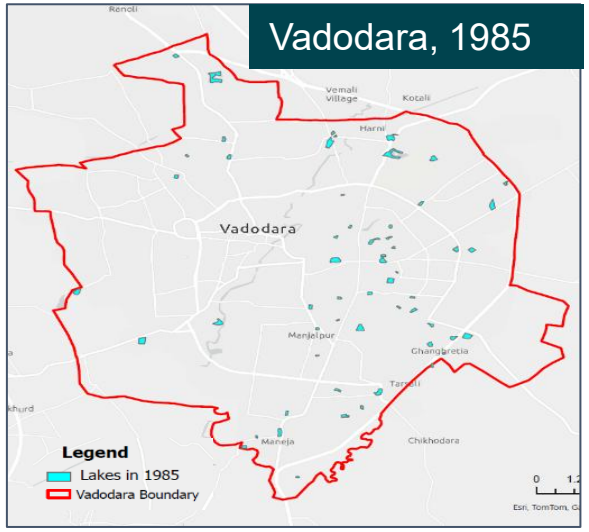
## …but also, visible cases of lake conservation



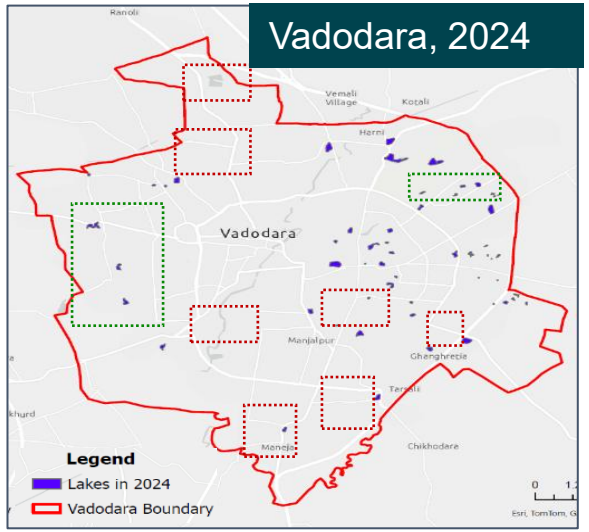
Ahmedabad, 1985



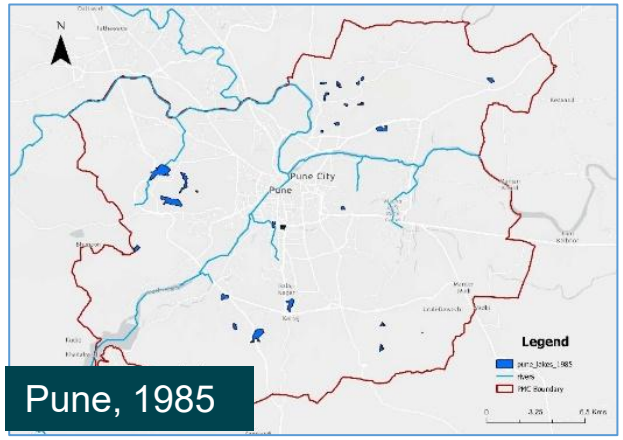
Ahmedabad, 2024



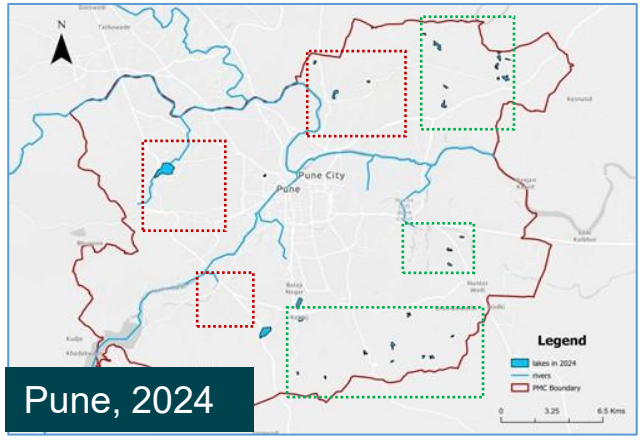
Vadodara, 1985



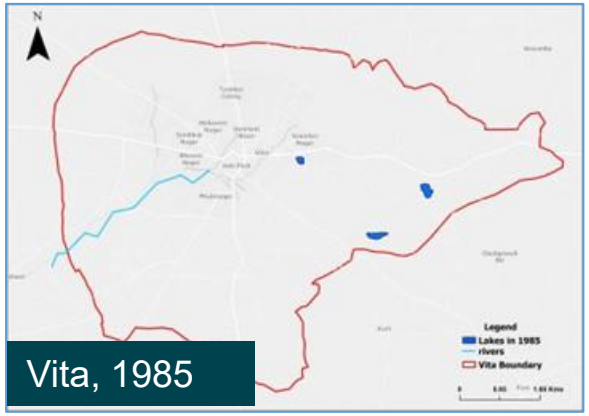
Vadodara, 2024



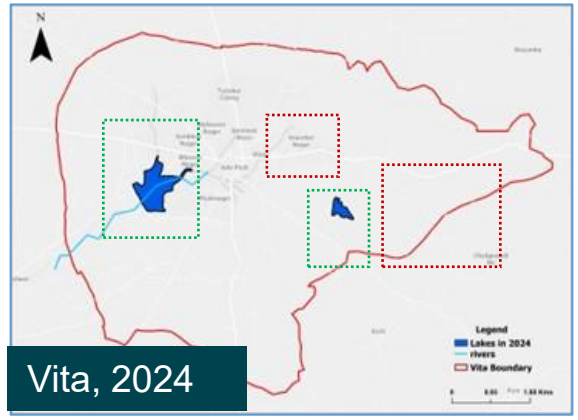
Pune, 1985



Pune, 2024

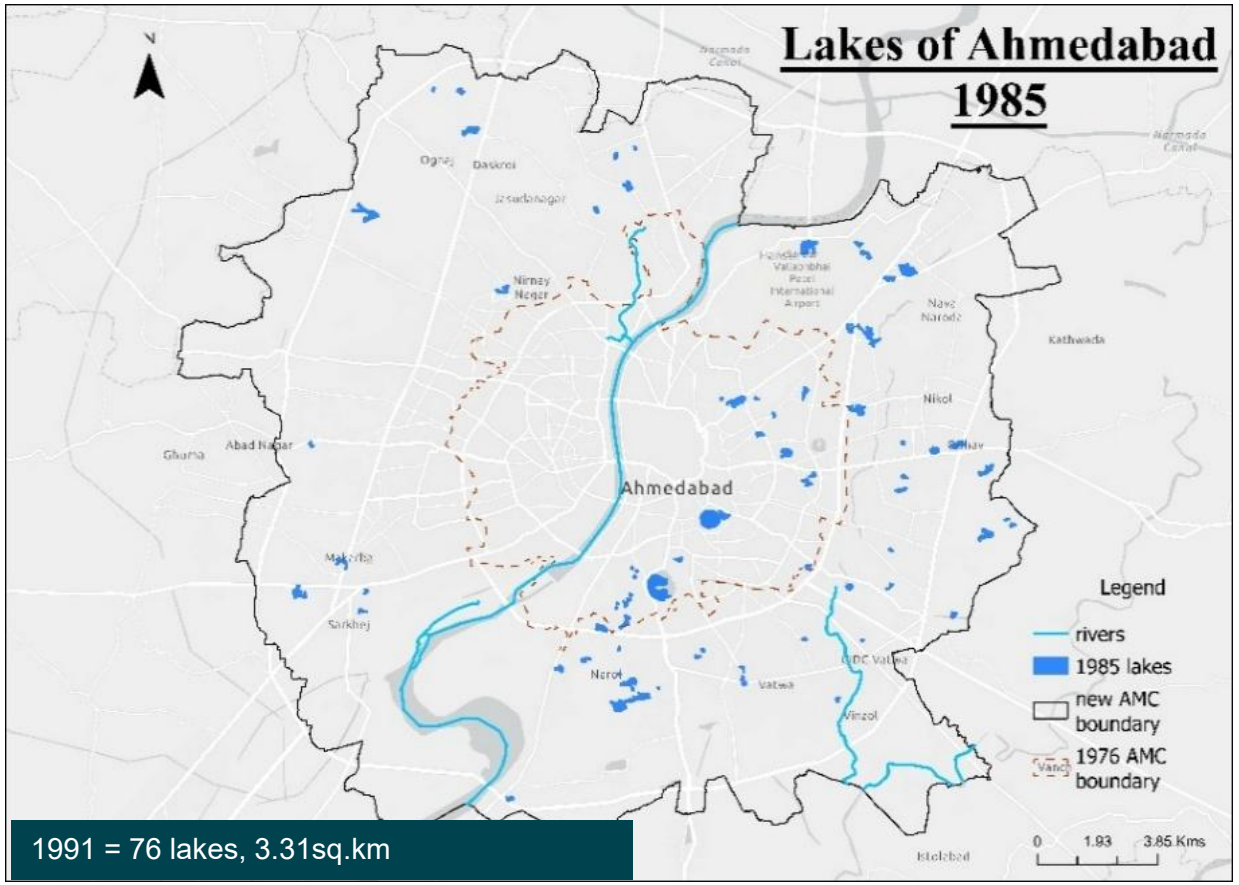


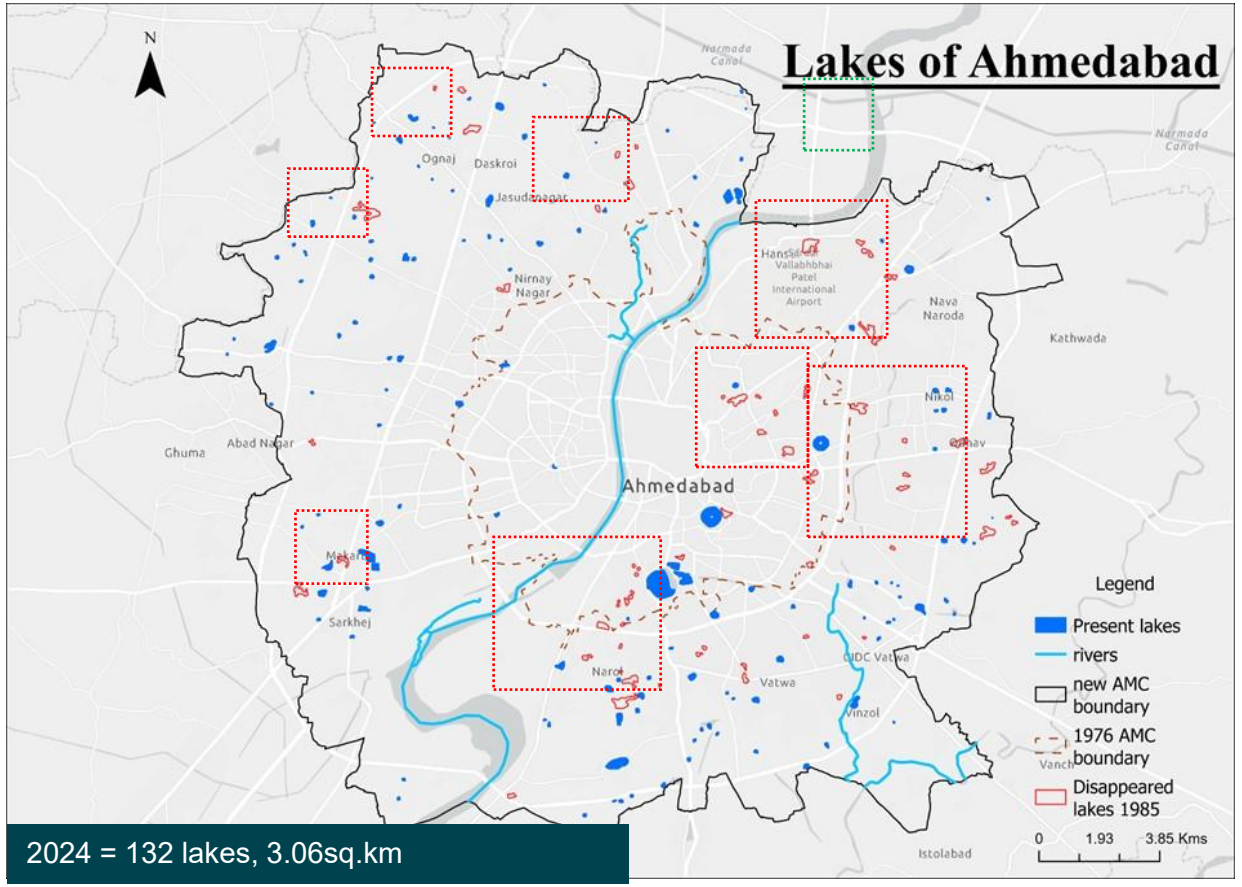
Vita, 1985



Vita, 2024

# Module 1 - In Ahmedabad – Higher count of lakes over the years but many big and ecologically significant lakes disappeared




The lake count has increased but area has decreased over the years, significant **large perennial lakes** are **not preserved**.

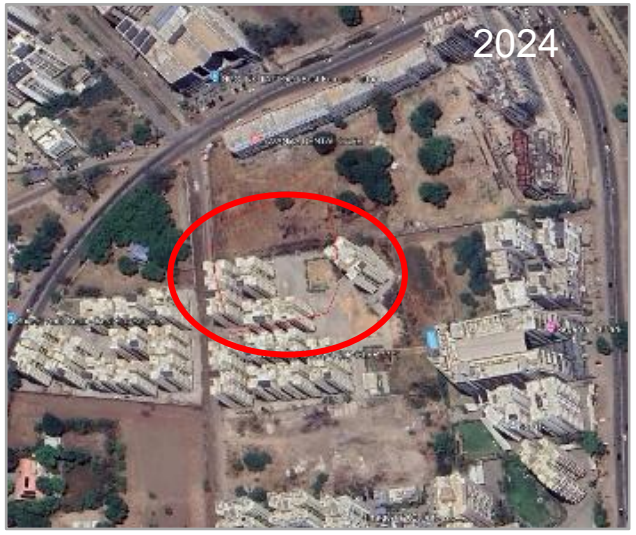
# Reasons for degradation /disappearance?

**Dried up lake or real estate??**

A case of a vanished Lake in Vadodara...

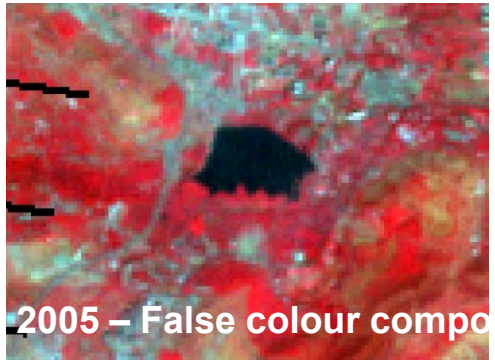
The Lake in the Bhayli area was converted into a residential project.

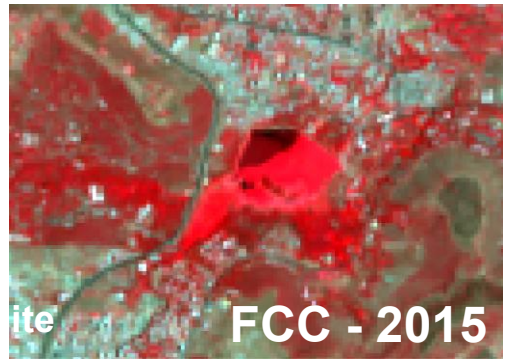


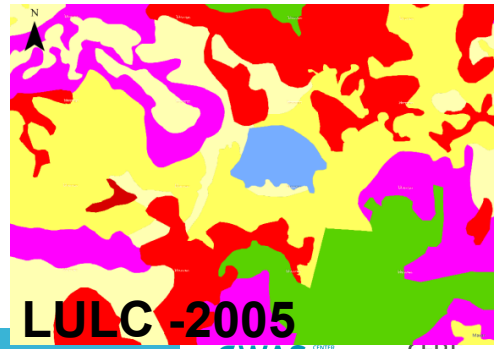



**Landuse change around the lake affected health-** Case of Pashan Lake in Pune where the surrounding land use has changed from agricultural to built-up leading to eutrophication of lake. The surface area remains the same



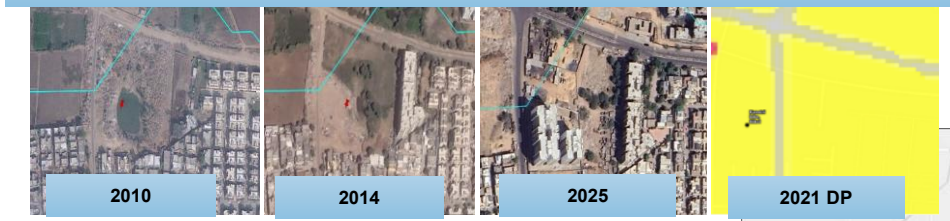



# Why and how do lakes disappear?

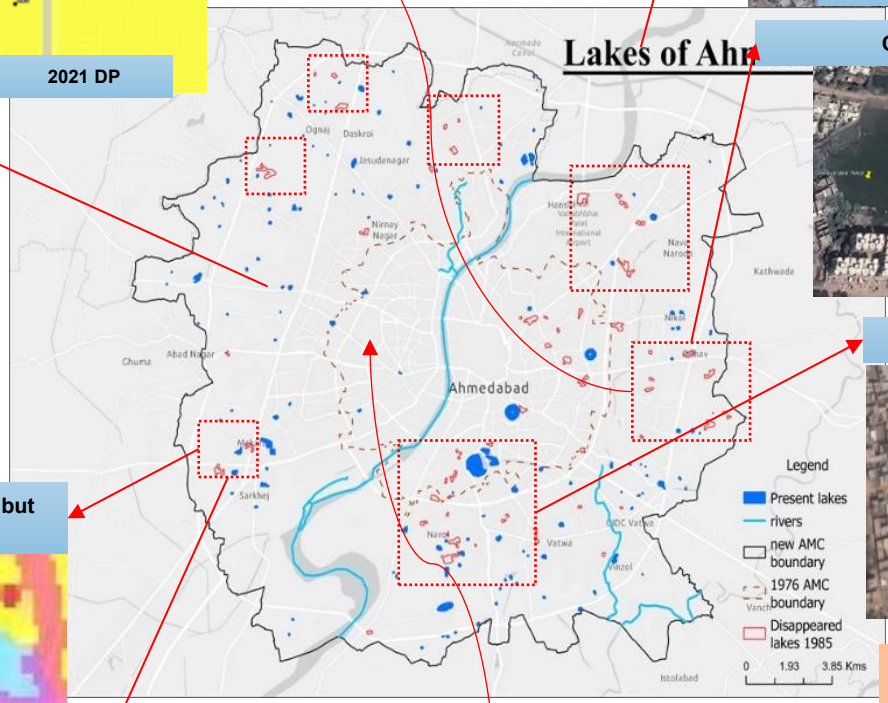
**Case 1: Kanetri lake, Nikol - Lake land encroached, not recognized in DP**




**Case 2: Thaltej lake - construction of boundary wall and removal of encroached areas.**


**Case 3: Navu Talav – Encoached & degraded lake, recognized in DP but no actions for maintenance**


**Case 4: Sakri lake – Shrunk due to less inflow**


**Case 5: Memnagar lake, maintained boundary but no inflow!**


**Case 6: Kamal Talav, Naroda – 2 lakes divided by drainage, one lake encroached, not recognized in DP**


**Case 7: Two lakes in Nikol – interrupted topography due to built up in center**


**Case 8: Sunthal Talav, Narol – Solid Waste Dumping, lake shrunk & dried**


The issue with 4 major lakes (Vastrapur, Memnagar, Thaltej, and Sola) also recognized by the **National Green Tribunal in a** suo motu cognizance and **notice to** district officials, CPCB, GPCB - **total area of 4 major water bodies decreased by 46%**. Source: https://indianexpress.com/article/cities/ahmedabad/ngt-report-ahmedabads-disappearing-lakes-10116651/

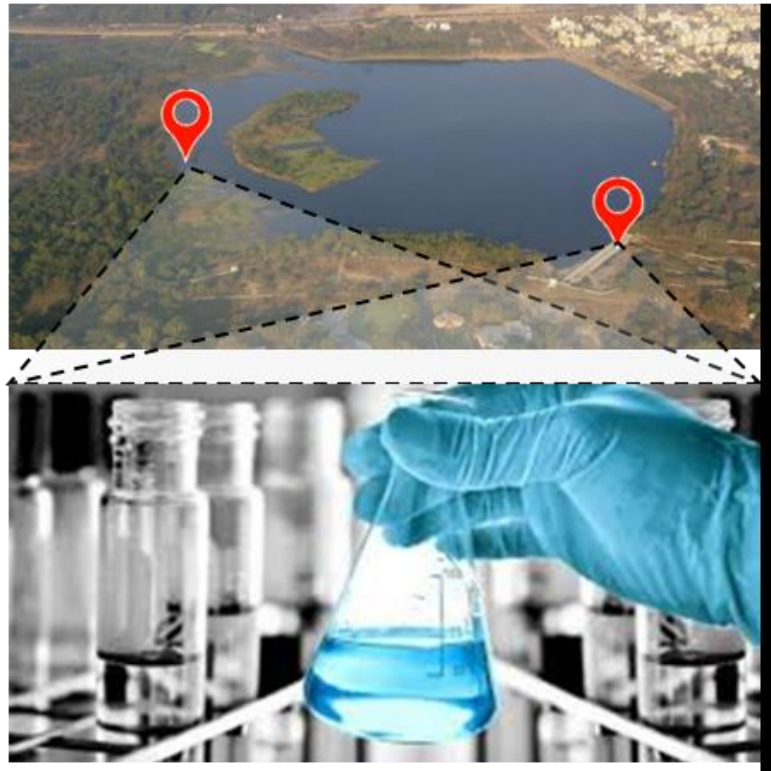
- An internal report by AMC concluded that a major issue is lack of inclusion of water bodies in statutory plans.
- Another report by High Level Committee (HLC) on Urban Planning in Gujarat also noted that “redevelopment in most cases has happened by reclamation of lake land effectively reducing the overall water spread of the lake.”

# Next - Remote sensing techniques for assessing water quality in lakes

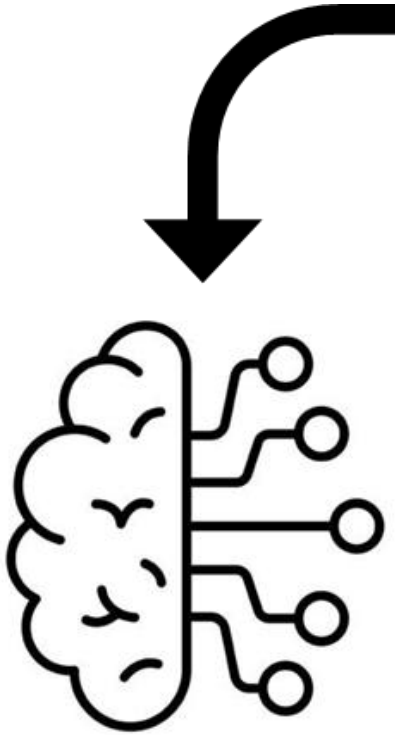
| No. | Parameters | Research paper title | Source |
|---|---|---|---|
| 1 | pH | Satellite Imagery for Monitoring and Predicting Water Quality in Kutch Region | https://www.omdena.com/blog/satellite-imagery-for-water-quality-monitoring - April 2022 |
| 2 | Dissolved Oxygen (DO) | Satellite Imagery for Monitoring and Predicting Water Quality in Kutch Region | https://www.omdena.com/blog/satellite-imagery-for-water-quality-monitoring - April 2022 |
| 3 | Chlorophyll-A | Normalized difference chlorophyll index: A novel model for remote estimation of chlorophyll-a concentration in turbid productive waters | https://doi.org/10.1016/j.rse.2011.10.016 - Sachidananda Mishra, Deepak R. Mishra, November 2011 |
| 4 | Total Suspended Solids (TSS) | Calibration and validation of a generic multisensor algorithm for mapping of total suspended matter in turbid waters | https://doi.org/10.1016/j.rse.2009.11.022 - B. Nechad, K.G. Ruddick, Y. Park, January 2010 |
| 5 | Dissolved Organic Carbon (DOC) | Estimation of water quality in a reservoir from Sentinel-2 MSI and Landsat-8 OLI sensors | https://doi.org/10.5194/isprs-annals-V-3-2020-401-2020 Fernanda M. C. Pizani, Philippe Maillard, Adrielly F. F. Ferreira, Camila C. de Amorim, August 2020 |
| 6 | Colored Dissolved Organic Matter (CDOM) | | |
| 7 | Biochemical Oxygen Demand (BOD) | Water quality change in reservoirs of Shenzhen, China: detection using LANDSAT/TM data | https://doi.org/10.1016/j.scitotenv.2004.02.020 Yunpeng Wang, May 2004 |
| 8 | Turbidity | Satellite remote sensing of water turbidity in Alqueva reservoir and implications on lake modelling | https://doi.org/10.5194/hess-16-1623-2012 M. Potes, M. J. Costa, R. Salgado, June 2012 |
| 9 | Alkalinity | Surface pCO2 variability in two contrasting basins of North Indian Ocean using satellite data | https://doi.org/10.1016/j.dsr.2021.103665 |
| 10 | Surface temperature | Algorithm for Automated Mapping of Land Surface Temperature Using LANDSAT 8 Satellite Data | https://doi.org/10.1155/2016/1480307 Ugur Avdan, February 2016 |
| 11 | Salinity | Mapping water salinity using Landsat-8 OLI satellite images (Case study: Karun basin located in Iran) | https://doi.org/10.1016/j.asr.2019.12.007 Mohsen Ansari, Mehdi Akhoondzadeh, December 2019 |

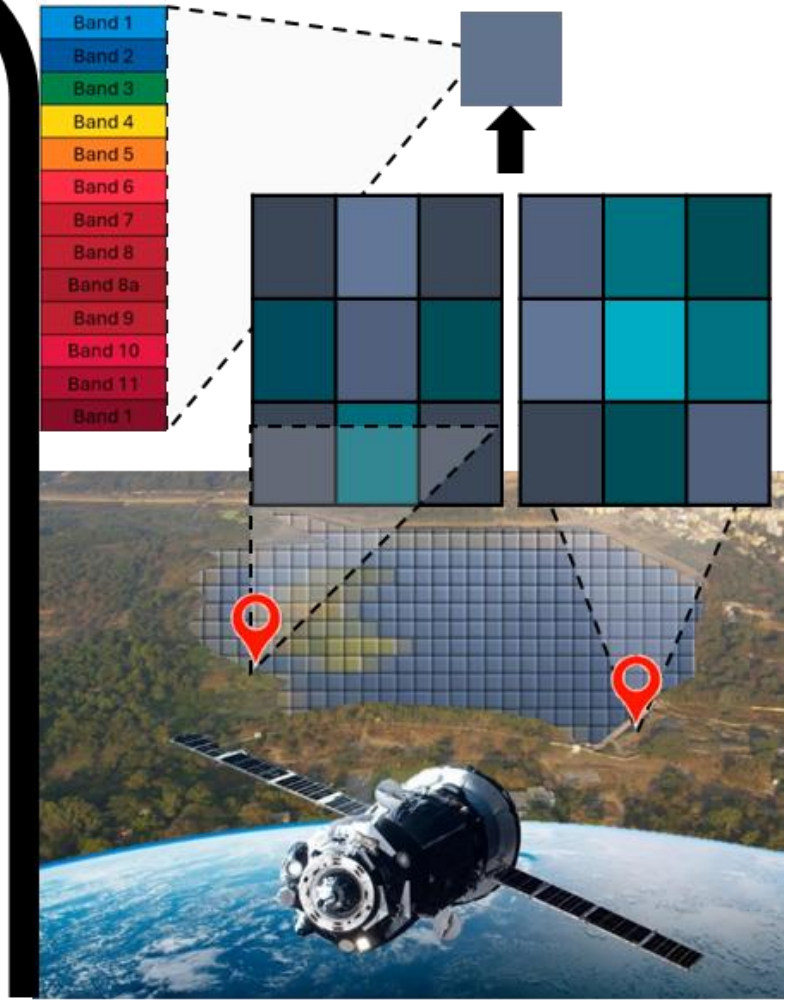
Such formulas only successful in local contexts…

# Machine learning - Equating known water quality values with pixel colors in satellite images to build relationships



| | | | |
|---|---|---|---|
| ph | DO | TDS | TSS |
| DIC | DOC | Nitrate | Phosphate |
| BOD | COD | Chlorophyll | Salinity |





# Selection of 23 lakes across 6 cities for studying lake health

Based on the Geography and Climatology, population and accredited labs availability

**Ahmedabad**

- Makarba lake
- Isanpur lake
- Shilaj lake
- Chharodi lake
- Malek Saban lake

**Pune**

- Pashan lake
- Katraj lake
- Jambhulwadi lake

**Vita**

- Vivekanad lake
- Karve lake

**Gandhidham**

- Kidana lake
- Shinay lake
- Galpadar lake
- Antarjaal lake

**Anjar**

- Sawasar lake
- Satapar lake
- Toral lake

**Vadodara**

- Gotri lake
- Harni lake
- Tarsali lake
- Mahadev lake
- Vasna village lake
- Sama lake

# Quality Samplig

To understand lake health, water quality tests covering 21 water quality parameters. To understand the seasonal characteristics conducted from December 2025 to January 2026.

- From each lakes, two distinct points (opposite sides of the lakes) have been selected.
- For some of the larger lakes **three individual samples were collected.**


**Challenges –**

- **Frequent cloud cover** during Monsoon – difficulty in sampling schedule.
- **Composite sampling points did not provide consistent results**; hence, it was discontinued, and a **new distinct sampling location, P3** was introduced.
- Due to algae growth and solid waste littering collection was bit difficult which was changed for specific locations.

Chharodi Lake

Makarba Lake

Malek Saban Lake

Mahadev Lake

Gotri Lake

Shilaj Lake

Isanpur Lake

Tarsali Lake

Vasna Village Lake

Sama Lake

# Testing different workflows to achieve accuracy

## Estimating water quality

1. Using formulas from existing research — 1 month lab data
2. ML for calibrating only the coefficients on existing formulas — **40%** Training fit — 3 months lab data
3. ML training raw band values against lab tested values to develop fuzzy logic relationships

   Average band value of all pixels in lake area against average of known lab value of parameters from sampling location 1, 2 and composite

   | Ridge Regression model | Random forest model | XGBoost model |
   |---|---|---|
   | **51%** Training Accuracy | **35%** Training Accuracy | **80%** Training Accuracy |

   4 months lab data
4. Combination of Random forest + XGBoost model
   Data cleaning to improve training accuracy. Removing ND / NA / BDL — **80%** Training fit

   Training Accuracy
5. Regression model with RF with XGB + 50m Lake Area Buffer data — **87%** Training fit

   Limiting "unknown value" pixels to 50 m around the sample point instead of average full lake surface. This accounts for variations inside the lake and improvement in accuracy. Dropped composite samples for lab testing and increased point samples at each lake

   6 months lab data
6. Ensemble model / "Best of" model / Optimized ensemble

   Stacking results of different models to give balances results / selecting best fitted result of each model — **71%** Training fit

   7 months lab data
7. Multi output ensemble

| Parameters | Train R2 | Test R2 |
|---|---|---|
| Temperature | 0.96 | 0.94 |
| Dissolved Oxygen (mg/L) | 0.96 | 0.89 |
| Total Organic Carbon (mg/L) | 0.86 | 0.88 |
| BOD (mg/L) | 0.92 | 0.87 |
| pH | 0.98 | 0.86 |
| COD (mg/L) | 0.88 | 0.84 |
| Dissolved Organic Carbon (mg/L) | 0.88 | 0.81 |
| Total Dissolved Solids (mg/L) | 0.83 | 0.78 |
| Potassium (mg/L) | 0.79 | 0.74 |
| Total Inorganic Carbon (mg/L) | 0.74 | 0.72 |
| Salinity (mg/L) | 0.76 | 0.68 |
| Total Suspended Solids (mg/L) | 0.71 | 0.68 |
| Turbidity (NTU) | 0.63 | 0.59 |
| Total Nitrogen (mg/L) | 0.66 | 0.59 |
| Dissolved Inorganic Carbon (mg/L) | 0.64 | 0.58 |
| Chlorophyll-A (mg/L) | 0.58 | 0.48 |
| Total Phosphorus (mg/L) | 0.47 | 0.47 |
| Fecal Coliform (MPN/100 ml) | 0.17 | 0.12 |
| Colored Dissolved Organic Matter (mg/L) | 0.12 | 0.08 |
| Nitrate (mg/L) | 0.053 | 0.03 |

>0.65 | 0.45 – 0.65 | <0.45

# Water quality testing dashboards to understand trends and lab data

### By Water Quality Index,

The lake health can be analyzed by Water Quality Index values which is based on water quality parameters like calculation of pH, BOD, %DO Saturation, Fecal coliform and DO score.

| WQI value | Water Quality | Remarks |
|---|---|---|
| 63-100 | Good to Excellent | Non-Polluted |
| 50-63 | Medium to Good | Non-Polluted |
| 38-50 | Bad | Polluted |
| < 38 | Bad to very Bad | Heavily Polluted |

| Lake Name | Jan | Feb | Mar | Apr - May | Jun | Jul | Aug | Sep | Oct | Nov |
|---|---|---|---|---|---|---|---|---|---|---|
| Makarba | | | | | | | | | | |
| Chharodi | | | | | | | | | | |
| Isanpur | | | | | | | | | | |
| Malek Saban | | | | | | | | | | |
| Shilaj | | | | | | | | | | |
| Pashan | | | | | | | | | | |
| Jambhulwadi | | | | | | | | | | |
| Katraj | | | | | | | | | | |
| Sama | | | | | | | | | | |
| Gotri lake | | | | | | | | | | |
| Vasna Village | | | | | | | | | | |
| Mahadev lake | | | | | | | | | | |
| Tarsali | | | | | | | | | | |
| Harni lake | | | | | | | | | | |
| Sawasar | | | | | | | | | | |
| Toral Lake | | | | | | | | | | |
| Satapar | | | | | | | | | | |
| Vivekanand | | | | | | | | | | |
| Karve lake | | | | | | | | | | |
| Galpadar | | | | | | | | | | |
| Shinay | | | | | | | | | | |
| Kidana | | | | | | | | | | |
| Antarjaal | | | | | | | | | | |

### By Central Pollution Control Board, India

Depending on the water quality parameter ranges, their dedicated usage is allotted, and the lake health is monitored. CPCB has categorized 5 classes of lakes mentioned below.

| CPCB class | Designated Best-Use |
|---|---|
| A | Drinking Water Source Without Conventional Treatment after Disinfection |
| B | Outdoor Bathing |
| C | Drinking Water Source after Conventional Treatment and disinfection |
| D | Propagation of Wildlife and Fisheries |
| Below D | Irrigation, Industrial Cooling, Controlled Waste Disposal |

| Lake Name | Jan | Feb | Mar | Apr-May | Jun | Jul | Aug | Sep | Oct | Nov |
|---|---|---|---|---|---|---|---|---|---|---|
| Makarba | | | | | | | | | | |
| Chharodi | | | | | | | | | | |
| Isanpur | | | | | | | | | | |
| Malek Saban | | | | | | | | | | |
| Shilaj | | | | | | | | | | |
| Pashan | | | | | | | | | | |
| Jambhulwadi | | | | | | | | | | |
| Katraj | | | | | | | | | | |
| Sama | | | | | | | | | | |
| Gotri | | | | | | | | | | |
| Vasna Village | | | | | | | | | | |
| Mahadev | | | | | | | | | | |
| Tarsali lake | | | | | | | | | | |
| Harni lake | | | | | | | | | | |
| Sawasar | | | | | | | | | | |
| Toral Lake | | | | | | | | | | |
| Satapar | | | | | | | | | | |
| Vivekanand lake | | | | | | | | | | |
| Karve lake | | | | | | | | | | |
| Galpadar | | | | | | | | | | |
| Shinay | | | | | | | | | | |
| Kidana | | | | | | | | | | |
| Antarjaal | | | | | | | | | | |

- An **interactive dashboard** has been developed for **lake-wise and city-wise analysis**. It presents the Water Quality Index (WQI) and CPCB classification based on key parameters such as DO, pH, BOD, COD, Total Coliform, and Fecal Coliform.
- The analysis shows that the water quality of most of the lakes in July month improves. Though water quality of some of the lakes remain bad during the same season.

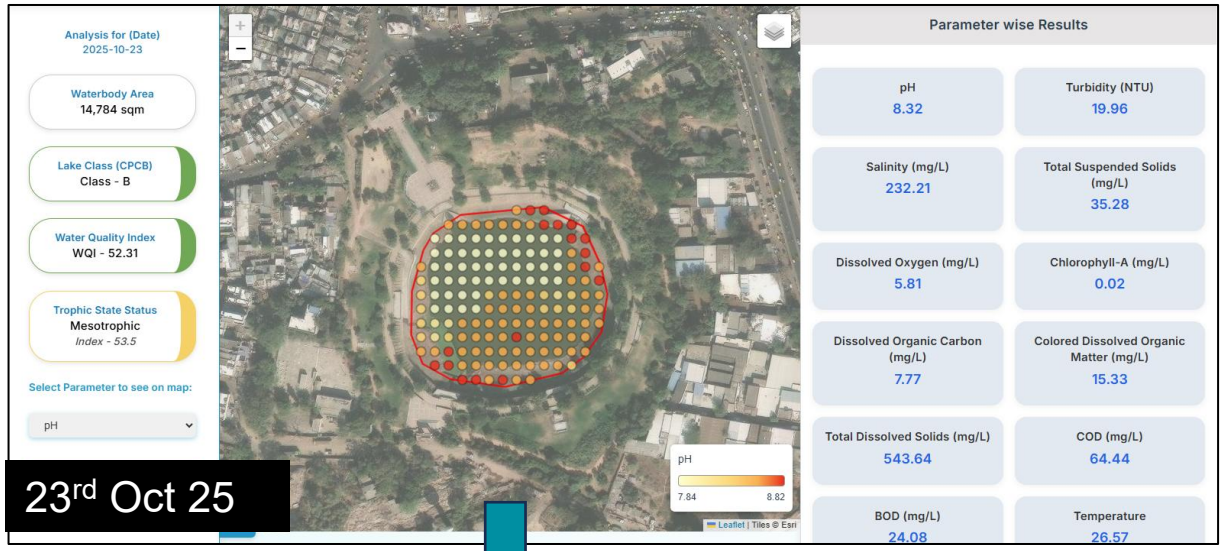
# Ahmedabad - Assessing case of fish death in Asarwa lake

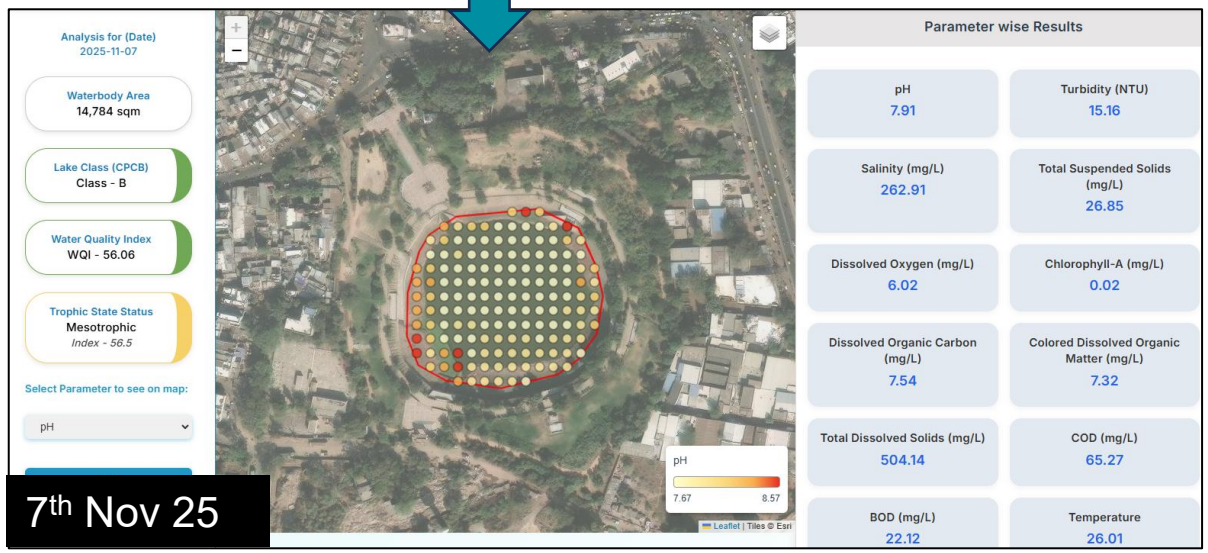
**Reason unknown: AMC begins cleanup operation days after several dead fish found floating on Asarwa lake**

GPCB, FSL, AMC collect water samples, residents cite delayed action by authorities concerned.

Officials of the AMC's central zone administration began the cleanup operation, removing loads of dead fish and algae layer on the lake, after local residents took up the matter with the municipal commissioner and the Gujarat Pollution Control Board.

**Reduction in DO and temperature, increase in algal bloom, turbidity and major reason for death of aquatic life..**




*Information from progressively developing ML model

- It is the only large water body in the Central Zone of the city.
- **Fish death** in this lake was **first reported** on **October 26.**.
- As per the visit by Govt team there was **no sign of industrial pollutants** in the lake. However, there was a **thick layer of algae on top of the water**. The sudden temperature drop due to the unseasonal rain might have led to the fish deaths.
- After demands, the **Ahmedabad Fire and Emergency Services (AFES**) had **sprayed a tanker of water in the lake on October 27**, but after that, **no further action** had been taken **till November 1**. Later, AMC Officials began the cleanup operation, removing loads of dead fish and algae layer on the lake, after local residents took up the matter with the municipal commissioner and the Gujarat Pollution Control Board (GPCB).

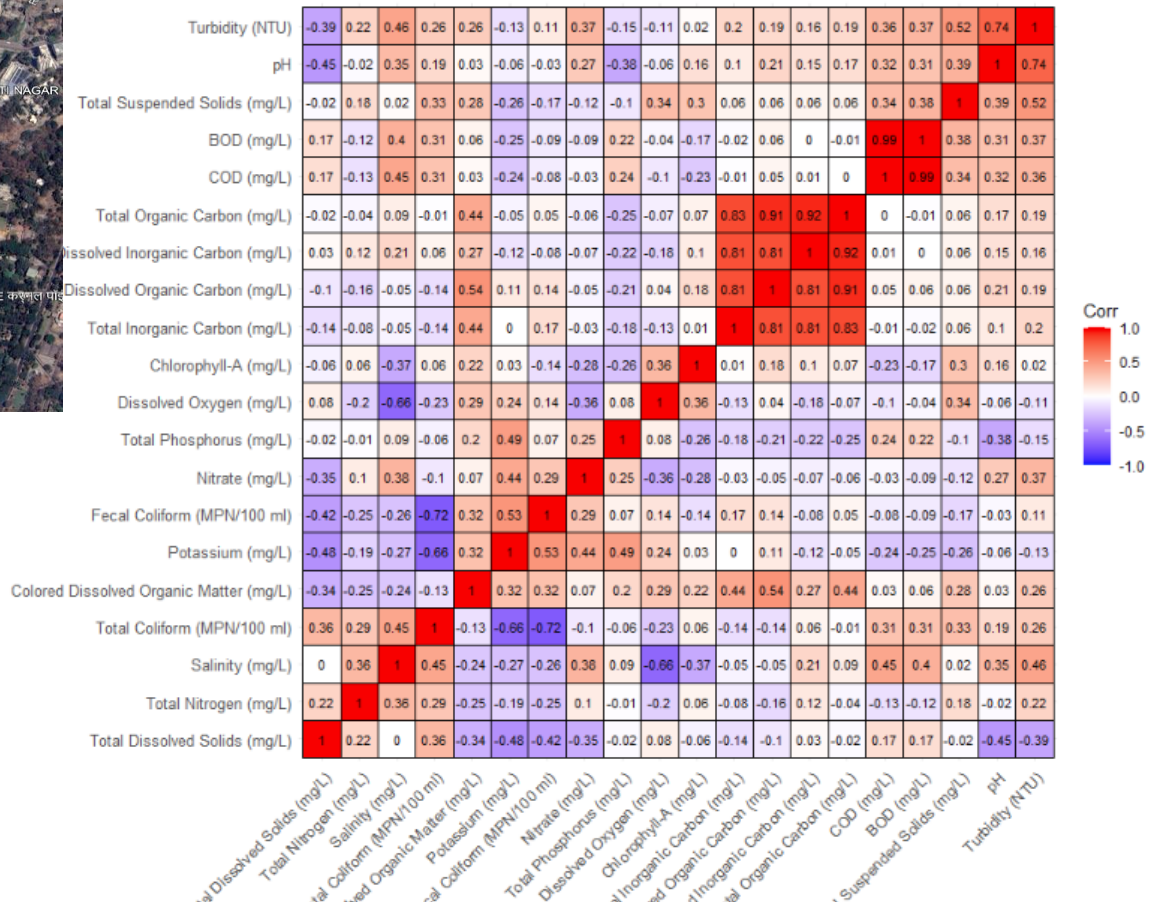
# Ahmedabad - Assessing case of fish death in Asarwa lake


19/11/24


13/03/25

- **In Jan-** Very low Chlorophyll-a and low DO indicate minimal algal activity possibly due to cold weather and less photosynthesis
- **In Mar-** Chlorophyll-a and DO increased which resulted into higher photosynthetic activity, possibly from algal blooms
- TN drops possibly due to consumed by fast-growing algae and Nitrate increased due to possible runoff or sewage discharge
- Slight raise in BOD indicates increased organic pollution due to decomposition of algal bloom and sewage discharge
- Total coliform increased means potential discharge of sewage into lake
- Lake shows eutrophic to hypertrophic tendencies in March 2025

Pune and Vita lakes from March to June




- **In Jan-** Very low Chlorophyll-a and low DO indicate minimal algal activity possibly due to cold weather and less photosynthesis
- **In Mar-** Chlorophyll-a and DO increased which resulted into higher photosynthetic activity, possibly from algal blooms

# Module 3 - Temporal prediction - Will more lakes disappear in Ahmedabad?

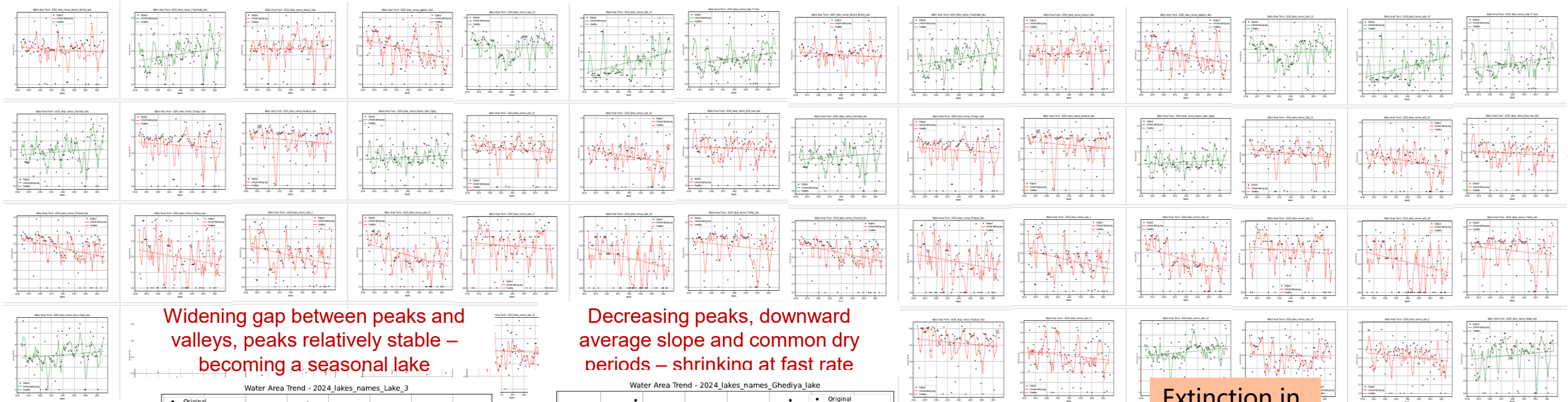
Checking temporal change in water spread for Ahmedabad - Selected 122 lakes

For each lake plotting monthly water surface area visible from 2018-2025 using NDWI nodule

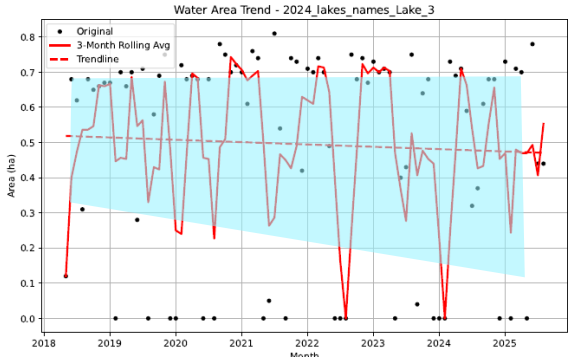
49 Lakes are showing positive trend (Increasing surface area)

73 Lakes are in danger (decreasing surface area trend)

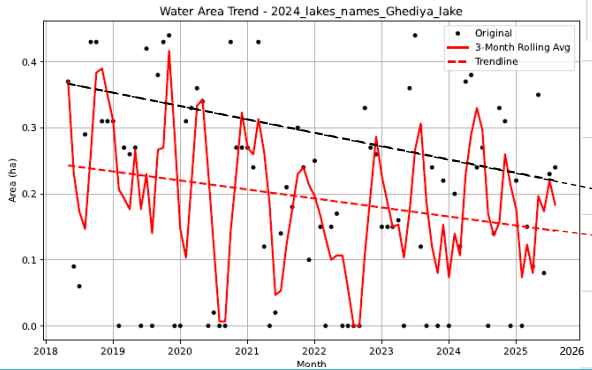
May 2018- Sep 2025



Widening gap between peaks and valleys, peaks relatively stable – becoming a seasonal lake



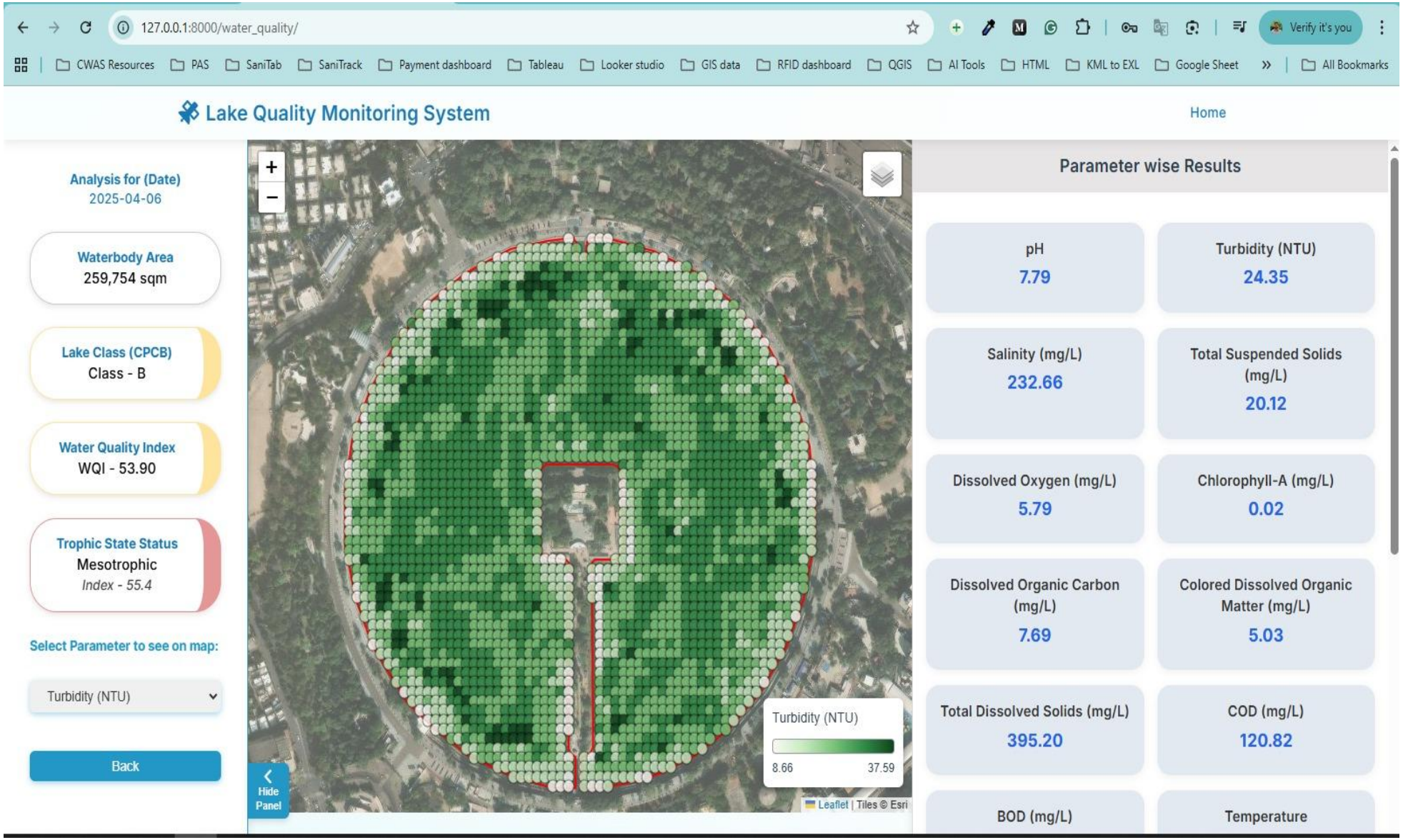

Decreasing peaks, downward average slope and common dry periods – shrinking at fast rate




Extinction in 2036?

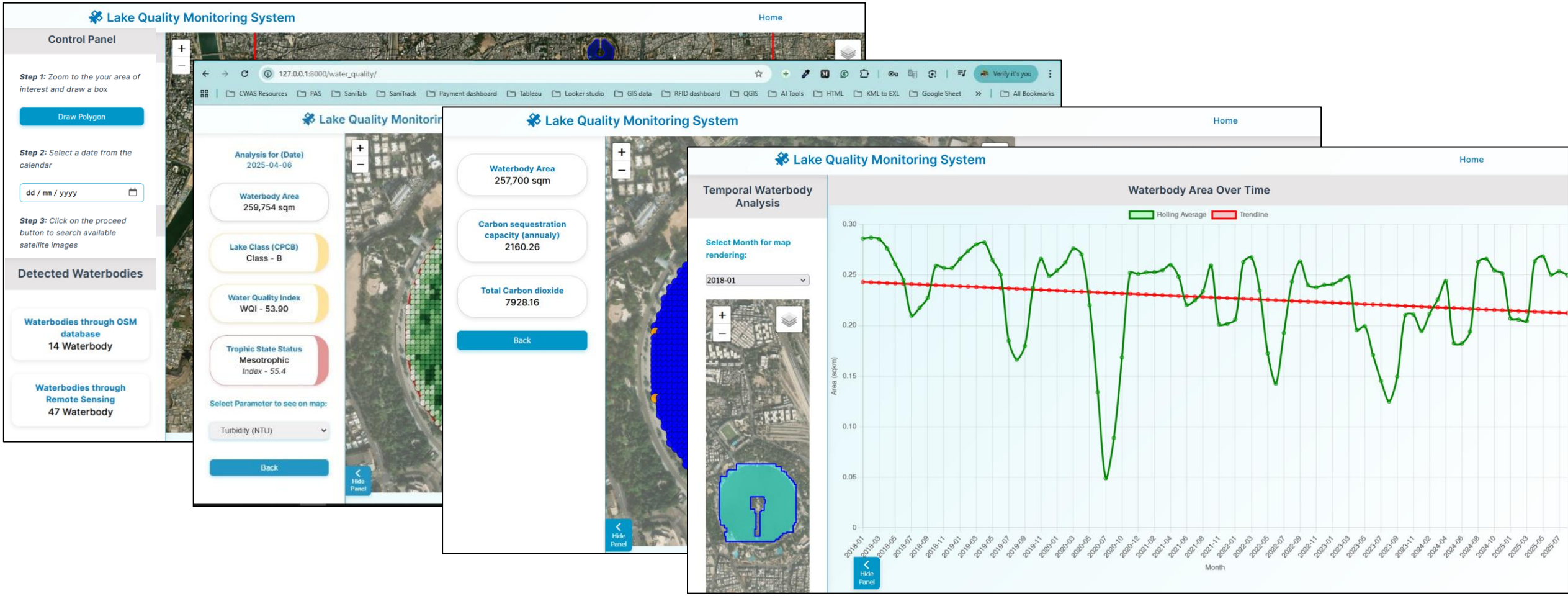
# Developing a user-friendly front end

Tool showing water quality as per CPCB class, Water Quality Index (WQI) and area of the waterbodies identified as per satellite imagery.



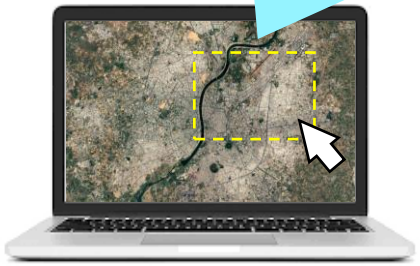
# Analysis modules in the tool

Spatio-temporal analysis – "detect" lakes → Water quality estimation + Sequestration potential calculation + Temporal prediction



# Module 4 - Moving towards actionable insights that enable conservation measures

Select your area of interest



Remote sensing modules run in the background

Actionable insights translating results

Surface area of this lake is reducing year on year – **Check for encroachments**

High Nitrogen detected – **Check sewage outflows**

Dry lake this year – **Check for stormwater blockage**

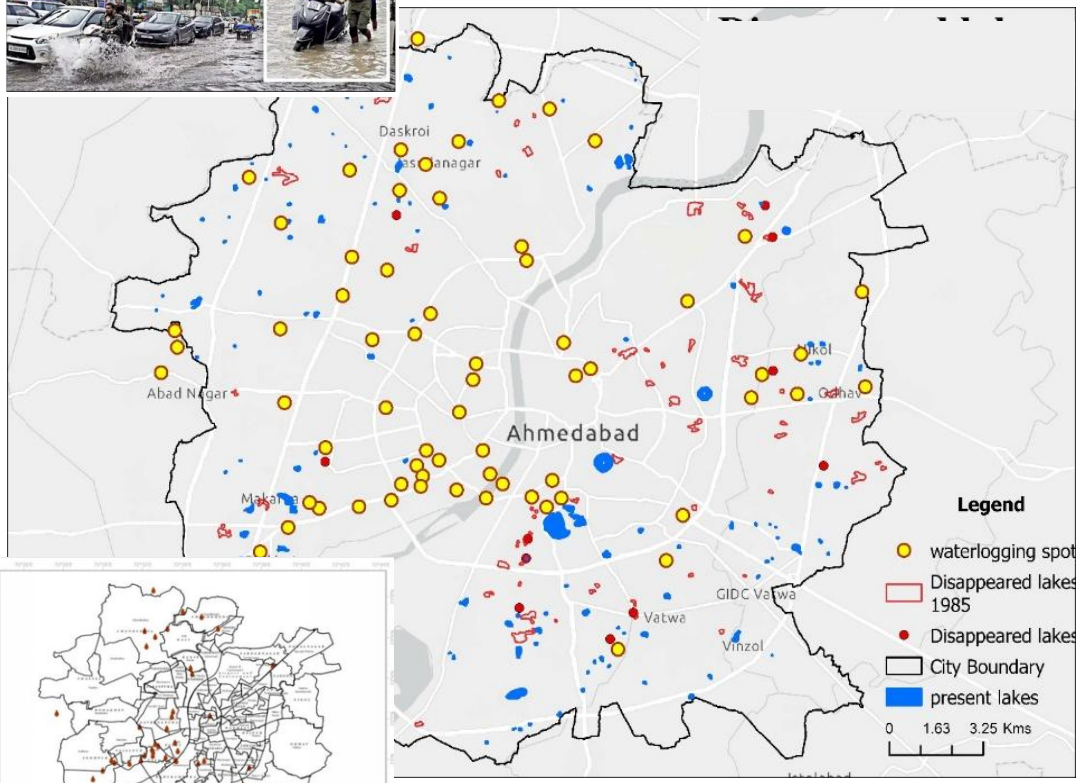
Prompting field visit, priorities in improvement planning and action by city

| Measurable parameter | Potential cause | Potential improvement action |
|---|---|---|
| Area shrinkage and seasonal drying | Area Encroachment | Boundary and embankment protection, encroachment removal |
| High turbidity | Catchment breakdown | Catchment rejuvenation, stormwater management, de-siltation |
| High NDVI inside lakebed area | Siltation | Stormwater inflow debris traps |
| Low DO, High phosphorus/ nitrogen | Algal bloom | Buffer vegetation revival |
| High BOD, COD, Coliforms | Hyacinth invasion | Invasive specie removal |
| High potassium | Sewage inflow | Wastewater diversion or treatment |
| Alkaline pH | Solid waste dumping | Aeration mechanisms |
| Acidic pH | Industrial Effluents | Solid waste management |
| | Agricultural runoff | |

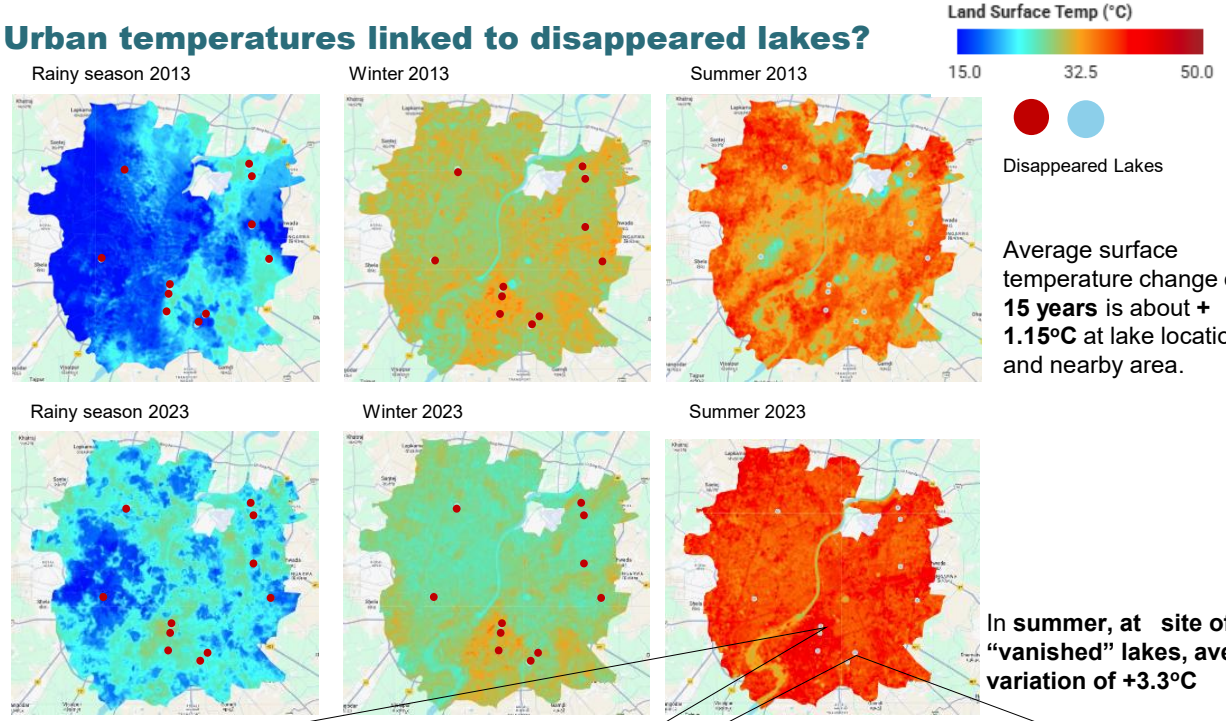
# Further climate analysis possible for researchers

## Lakes related to flood vulnerability?


Localities without lake buffers face flooding in monsoons

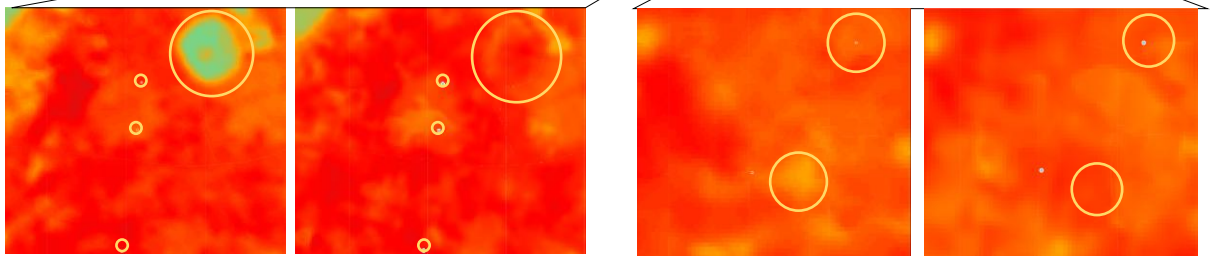



## Urban temperatures linked to disappeared lakes?




Average surface temperature change over **15 years** is about **+ 1.15°C** at lake locations and nearby area.

In **summer, at site of "vanished" lakes, average variation of +3.3°C**



**Chandoliya and surrounding lakes, Ahmedabad**

Summer 2009 - 29.2°C

Summer 2024 – 39.1°C

**Bibi Talav, Ahmedabad**

Summer 2009 - 35.7°C

Summer 2024 - 37.2°C

Source1: https://timesofindia.indiatimes.com/city/ahmedabad/32-new-waterlogging-spots-in-ahmedabad-exacerbate-monsoon-troubles-for-residents/articleshow/113006828.cms | Source2: https://portfolio.cept.ac.in/2022/M/ft/geovisualization-and-spatial-analysis-studio-ge4004-monsoon-2022/study-of-flash-floods-a-case-study-of-ahmadabad-monsoon-2022-pge22459

# Thank You

**Global South Academic Conclave on WASH and Climate 2026**

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CRDF CEPT UNIVERSITY
CEPT UNIVERSITY FACULTY OF PLANNING
Gates Foundation
viega foundation