Cooling effect of urban wetlands in Mexico City

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Cities concentrate assets, economic production and people including migrants. Their demand for infrastructure, housing and industry leaves little room for urban green spaces and water bodies such as wetlands. While concrete, buildings and pavement all trap heat into the urban system and contribute to Urban Heat Island Effect (UHI), healthy urban wetlands actually reduce UHI.

Research conclusions of the two sites

- Urban wetlands help its surroundings reduce UHI
- Shrinking/conversion of urban wetlands fuels UHI
- Paved and densely populated urbanised areas take longer time to become cooler at night compared to open-water wetland areas and their surroundings
- Xochimilco's open water surface has a superior UHI reduction than Chalco's eutrophified water body

5,967 hab/km²
Population density in CDMX

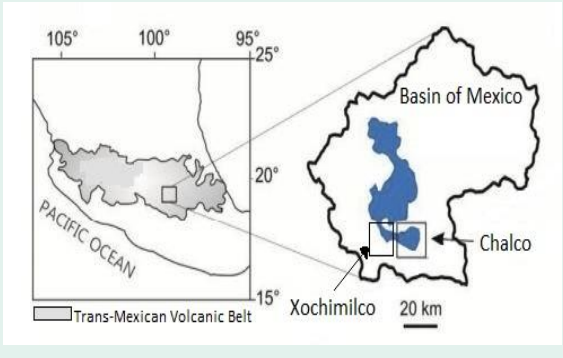
In January–December:
Avg. Max. Temp. 22°C
Avg. Min. Temp. 6-7°C
235-240 sunshine hrs.
10-12 mm of average precipitation

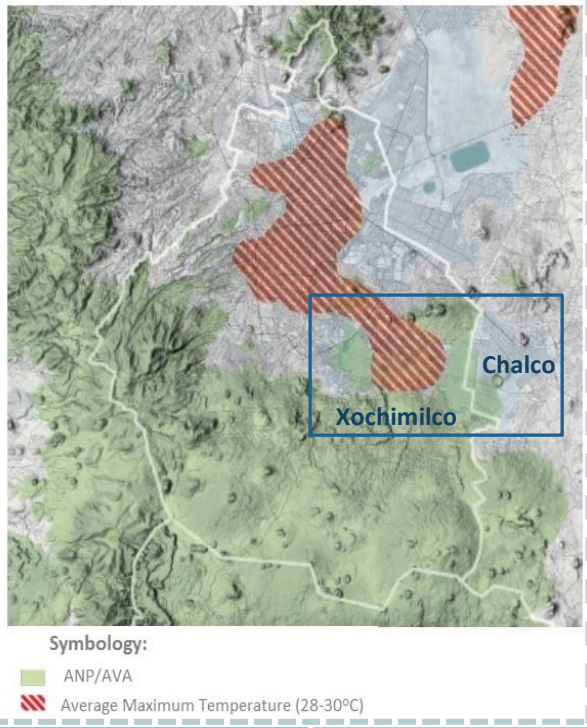
Xochimilco:

- Xochimilco wetlands are important agricultural, cultural and historically significant region, RAMSAR, UNESCO World Heritage site and National Protected area.
- Land use change caused by urbanization is the primary driver for high UHI effect in the area
- Over the years, migration from other states have increased pressure on urban resources and need for housing
- Most of the traditional agricultural area around the water channels is now urbanised which sealed the surface through an impervious layer that keeps the heat trapped during day time
- Built areas use materials with low reflectivity and reduced water absorption capacity

Lake Chalco:

- Lake Chalco is being shared by Mexico basin and Trans-Mexican Volcanic Belt (TMVB) and territorially between State of Mexico and Mexico city
- It used to be a fresh water confined aquifer with springs feeding it, but now the springs have been covered in the process of urbanisation converting it into a shallow sub saline marsh
- The surrounding habitation area towards the east of Lake Chalco has been used as a waste disposal area and the channels have been covered by invasive water hyacinth raising temperatures in surrounding areas compared to distant areas
- Commercial and domestic activities around the lake has generated heat input to the environment causing dependence on cooling devices
- Cutting the lake midway is the State divisional road which connects west and east regions around Lake Chalco. The bitumen on roads also stores heat during the day releases it during the night





- The map highlights areas in Mexico City CDMX region (marked in white) which have average maximum temperatures between 28-30°C in comparison to other regions in the city at average of 24-26°C (Secretary of Integrated Risk Management and Civil Protection, 2020)
- Xochimilco wetland area is closer to the highlighted area in the Southern part of Mexico city while Lake Chalco is part of completely urbanised State of Mexico in the eastern part as marked
- Higher temperatures in this region are effects of high surface built area and lack of green areas and water bodies in the city area.
- Internal migration to the city has rendered areas of informal settlements in high risk zones for earthquakes in the Volcanic Belt, housing covering the green and open areas and constructing houses along on the already sinking part of Xochimilco wetland area
- Internal migration has also increased pressure on urban resources and changing the land-use pattern from open and green areas to concrete built areas and roads
- Location of settlements and urbanised expansion is on the earthquake prone area and volcanic belt which increases the vulnerability of community

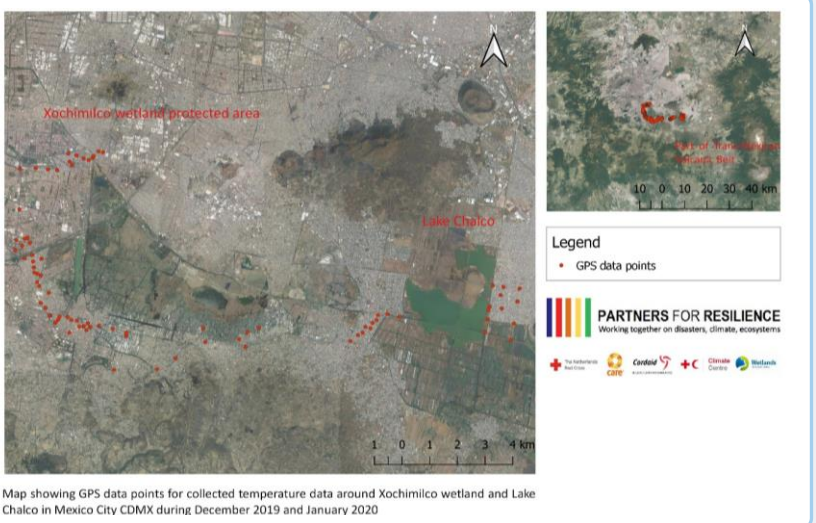
> **In the centre and south east of Mexico City is the area with the highest concentration of hot air. The cause of this phenomenon is associated with highly urbanized areas with lack of green space and water bodies, as well as various weather conditions**
>
> *- Secretary of Integrated Risk Management and Civil Protection Report, 2020*

Research Details

- Data collection by M.Sc. Nupur Jain (IHE/Water Youth Network/PfR), between December 2019 and January 2020 (cool period)
- A total of 67 data points around Xochimilco wetland and 22 around Lake Chalco with GPS and digital thermometer
- Noon measurements were taken from the wetlands outwards into the neighbourhoods measuring at an interval of 35 meters
- Cooling effect of 8 °C for Xochimilco wetland (22 °C at Xochimilco wetland to 30 °C furthest point) and 4 °C for Lake Chalco (24 °C at Lake Chalco to 28 °C furthest point)
- An average variation of ±2°C between 35m intervals

Reflections on two sites

- Lake Chalco has been used as a waste disposal area polluting the water body
- Eutrophication of open water canals was found in both sites affecting their reduction service to UHI
- The densely populated surroundings of Lake Chalco contributed to a slower cooling down during the night
- Mexico City has higher UHI due to canopy effect of buildings and concrete pavements compared to the wetland areas



Map showing GPS data points for collected temperature data around Xochimilco wetland and Lake Chalco in Mexico City CDMX during December 2019 and January 2020

Key recommendations

- **Healthy wetlands can reduce the effects of UHI; they should be incorporated into urban planning (and not converted)**
- **Restoring eutrophified and contaminated urban wetlands is a key strategy for Disaster Risk Reduction and tackling UHI, as clean and healthy open water bodies reduce UHI and cool the days faster compared to eutrophic water systems**
- **To be most effective, urban wetlands must be connected to a wider network of urban green and blue measures**
- **Work with the Partners for Resilience organisations to build UHI resilience in your city: www.partnersforresilience.nl**

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