

Water quality deterioration and its linkage with water hyacinth expansion in Lake Tana, Ethiopia

By Minychl G. Dersseh

Authors:

Minychl G. Dersseh (PhD student) – Bahir Dar University, Ethiopia

Assefa M. Melesse (Dr., Prof) - Florida International University, USA

Seifu A. Tilahun (PhD) - Bahir Dar University, Ethiopia

Abeyou W. Worqlul (PhD) - Texas A&M AgriLife Research, USA

Mamaru A. Moges (PhD) - Bahir Dar University, Ethiopia

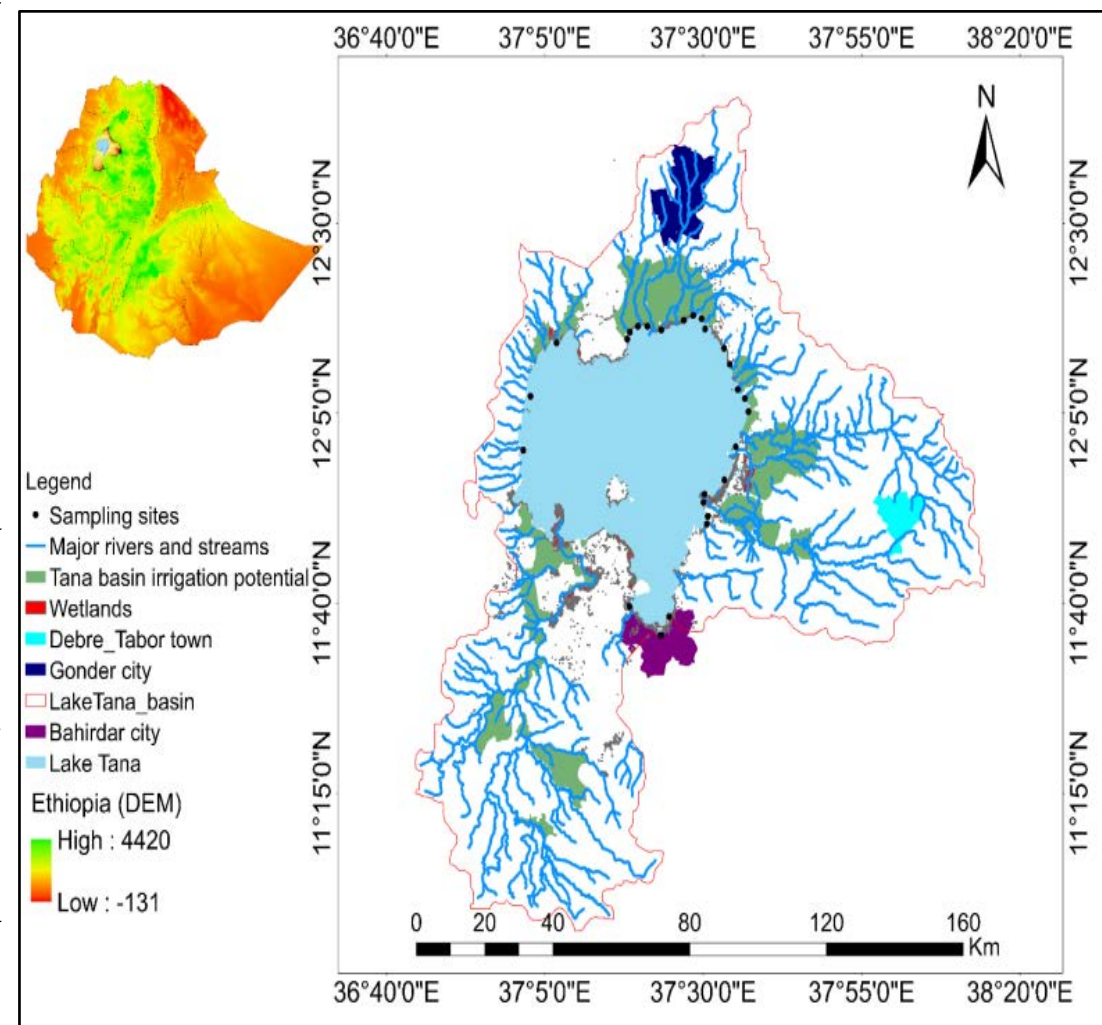
2020 International Conference on Nile and GERD

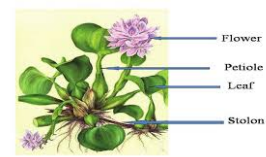
August 20-21, 2020



Lake Tana and its Sub Basin

- Created in ca 5 million years ago (quaternary period) ([Vijverberg et al., 2009](#))
- Source of the Blue Nile
- Average and maximum depth of 9.7m and 14.8m respectively ([Kebedew et al. 2020](#))
- Around 44 monasteries , a place of beauty and one of tourist destination places
- Registered by UNESCO in 2015 as a natural biosphere reserve heritage
- Surrounded by degraded catchments and intensive agricultural fields (15000 km²)

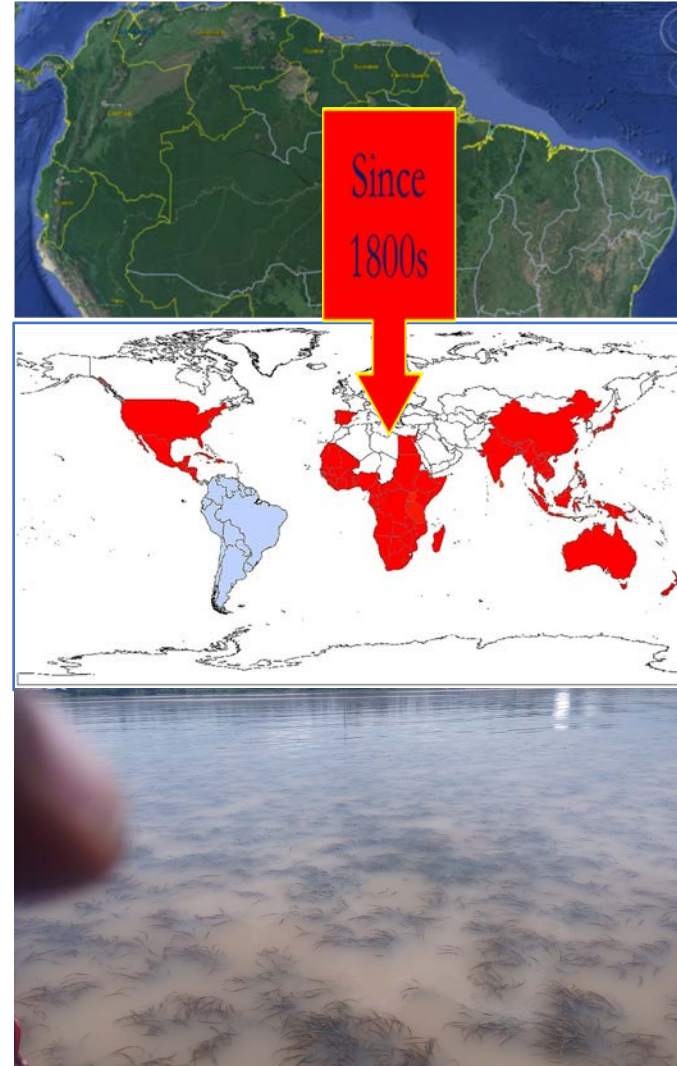


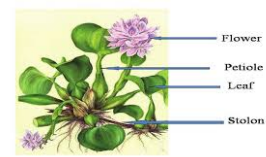


Water Hyacinth



- ❑ Originating in the Amazon Basin, Latin America (Hill & Coetzee, 2008).
- ❑ Since the late 1800s, the weed has spread in large areas of the World by **man, legs of birds, common watersheds and sharing rivers** (Driesche *et al.*, 2002).
- ❑ **In Ethiopia**, first introduced around Aba-Samuel dam in 1965 then spread to rift valley lakes
- ❑ **In Lake Tana**, officially recognized in 2011
- ❑ The lake is shifting from **Oligo-meso to Meso-eutrophic**





Objectives



General objective:

To evaluate the water quality and lake level fluctuation, and their linkage with water hyacinth on Lake Tana

Specific objectives:

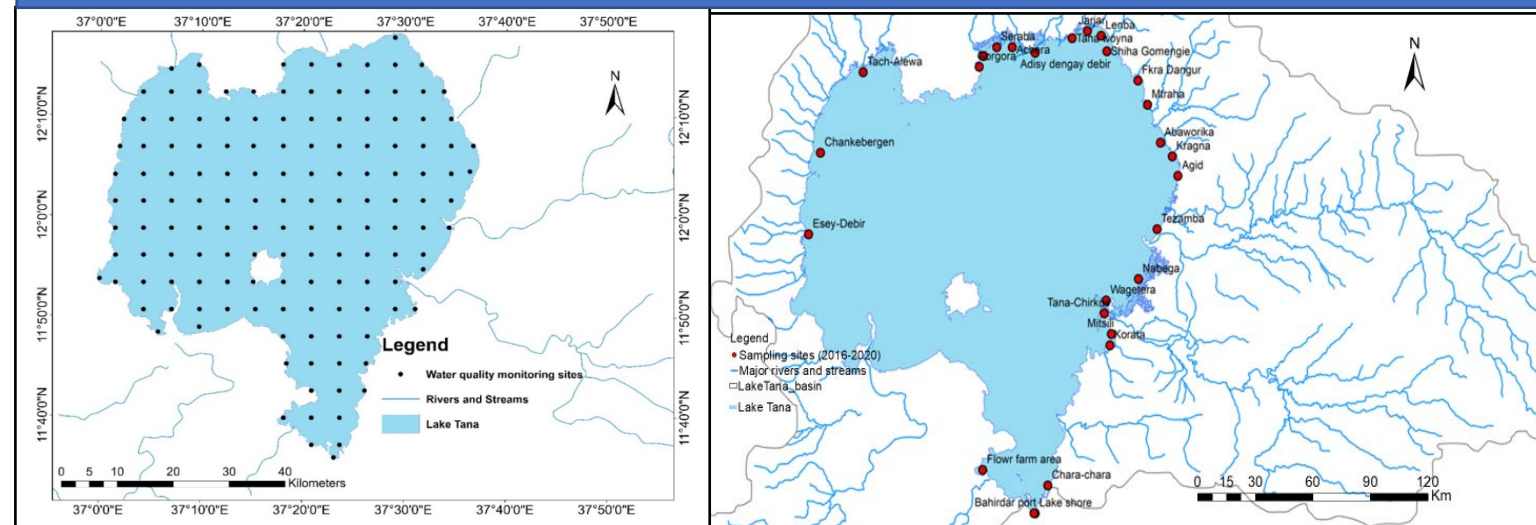
- ☐ Evaluate the dynamic nature of major water quality parameters on the shores of the lake and their linkage with water hyacinth expansion
- ☐ Predict the potential areas of the water hyacinth using GIS-based multi-criteria evaluation (MCE) technique.
- ☐ Determine the spatiotemporal distribution of water hyacinth and its relation with lake-level fluctuation





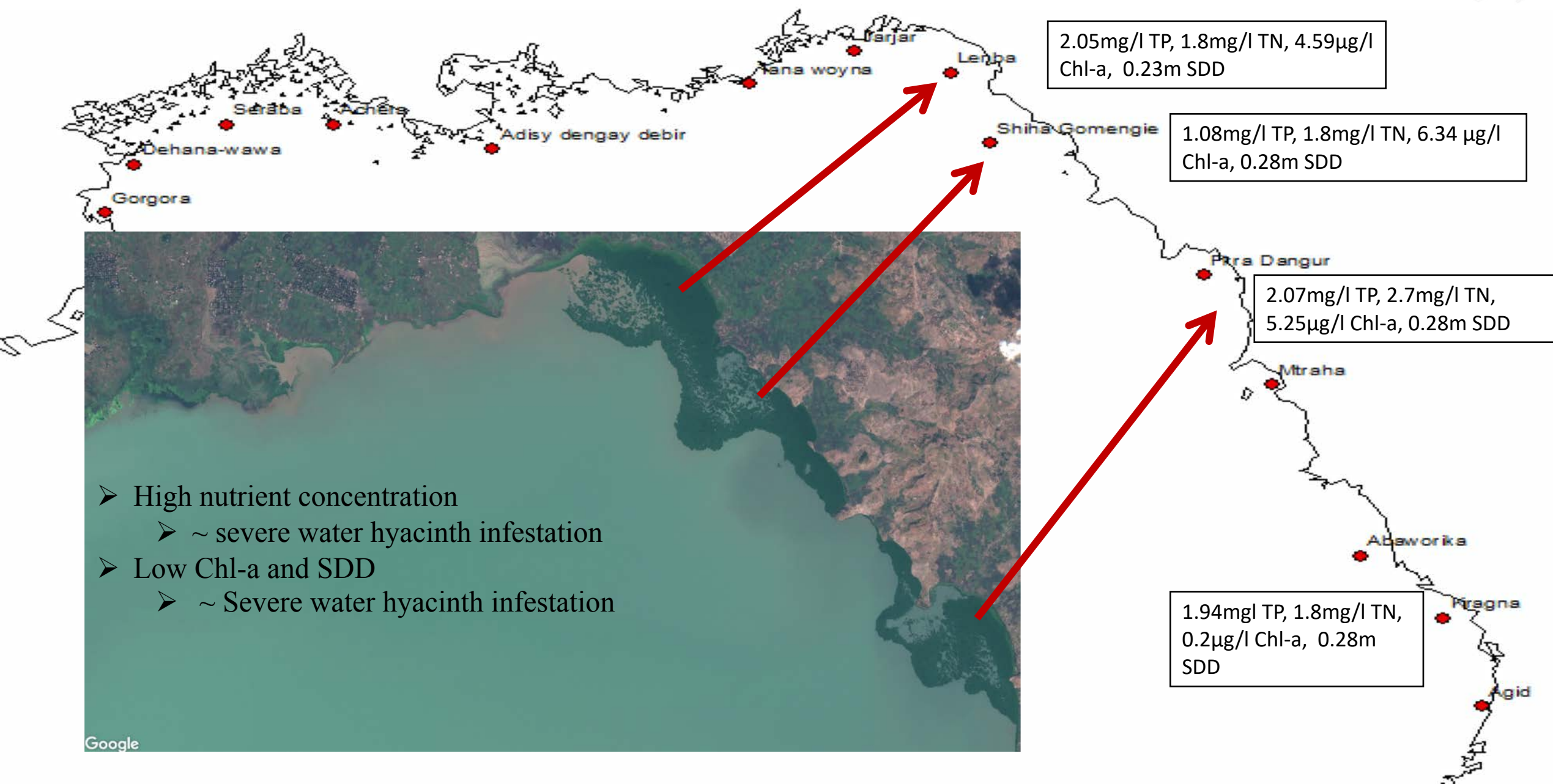
Methods

- ❖ 27 sampling sites for water quality analysis
- ❖ 143 sampling sites for suitability analysis
- ❖ Lake level data
- ❖ Satellite data (Sentinel-2)
- ❖ sample and data collection
- ❖ laboratory work
- ❖ ArcGIS and remote sensing
- ❖ Google earth engine platform
- ❖ GPS tracking for validation
- ❖ Descriptive statistics





Water quality and Water hyacinth





Major sources of pollutants

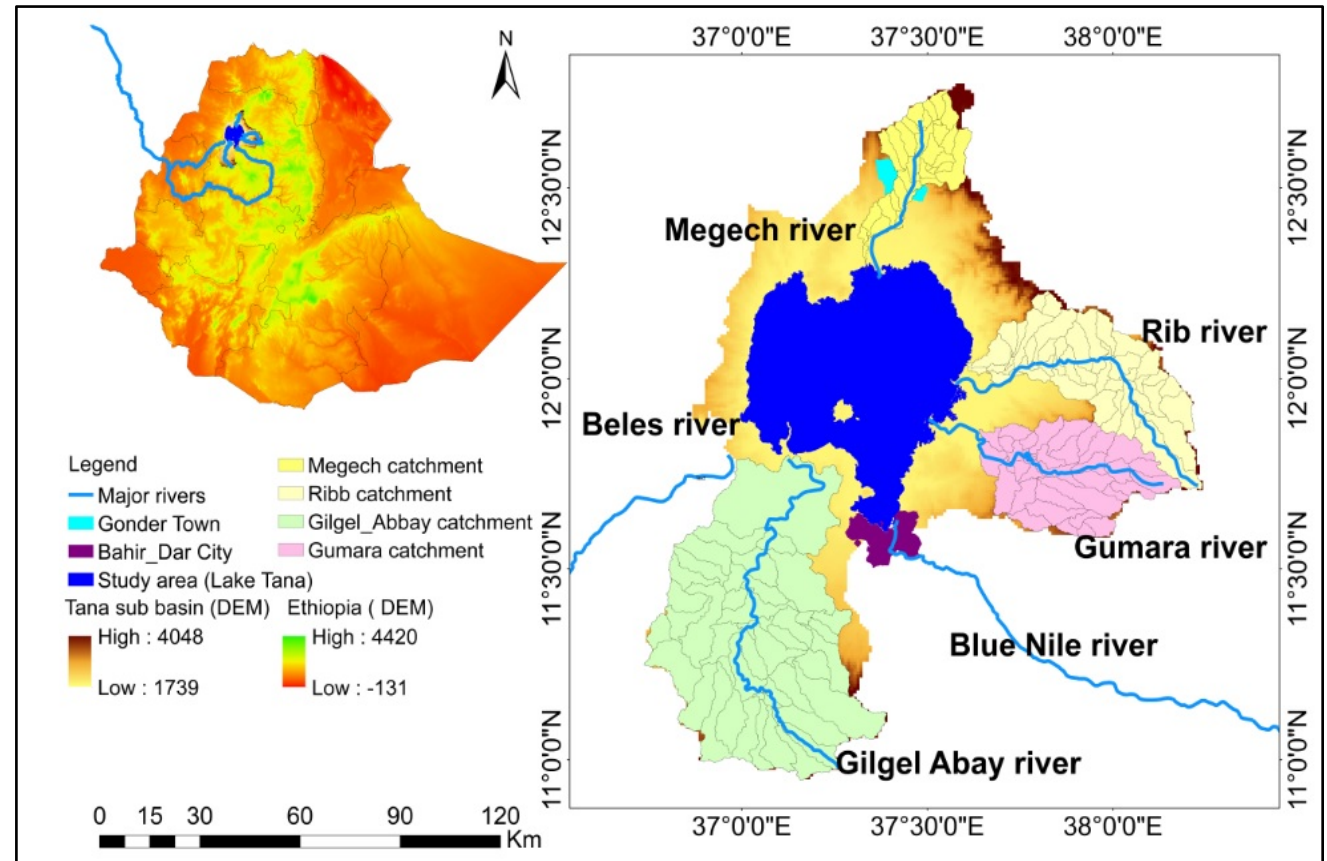
The catchment

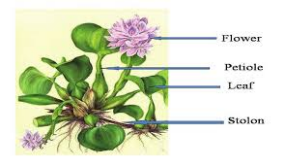
- ❑ Application of fertilizer, herbicides and pesticides and transported by
 - The four major rivers and streams
- ❑ Annual total nutrient load of the four major rivers:

✓ TP: 12,529 t/yr.
 ✓ TN: 22,671,t/yr.

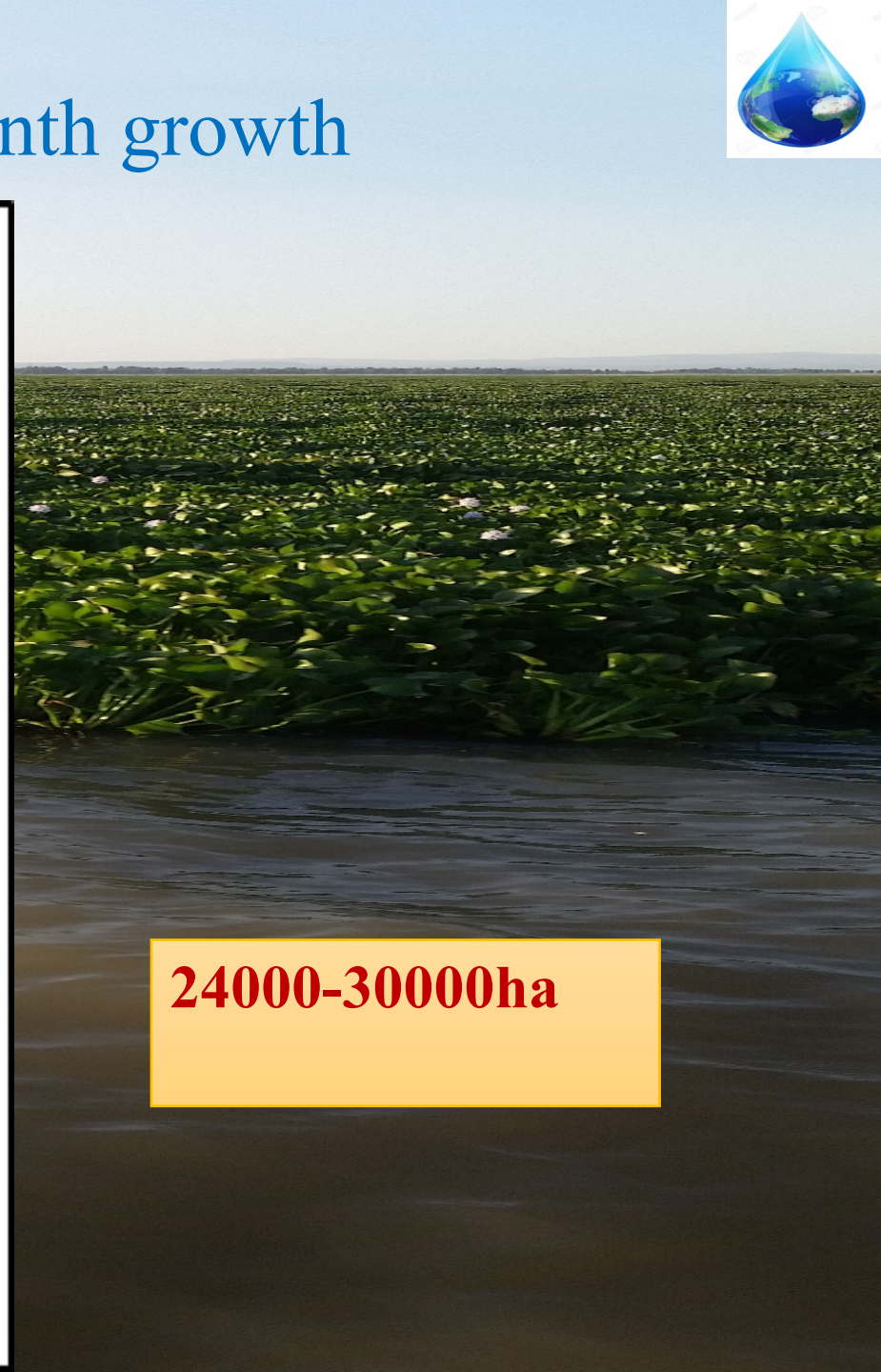
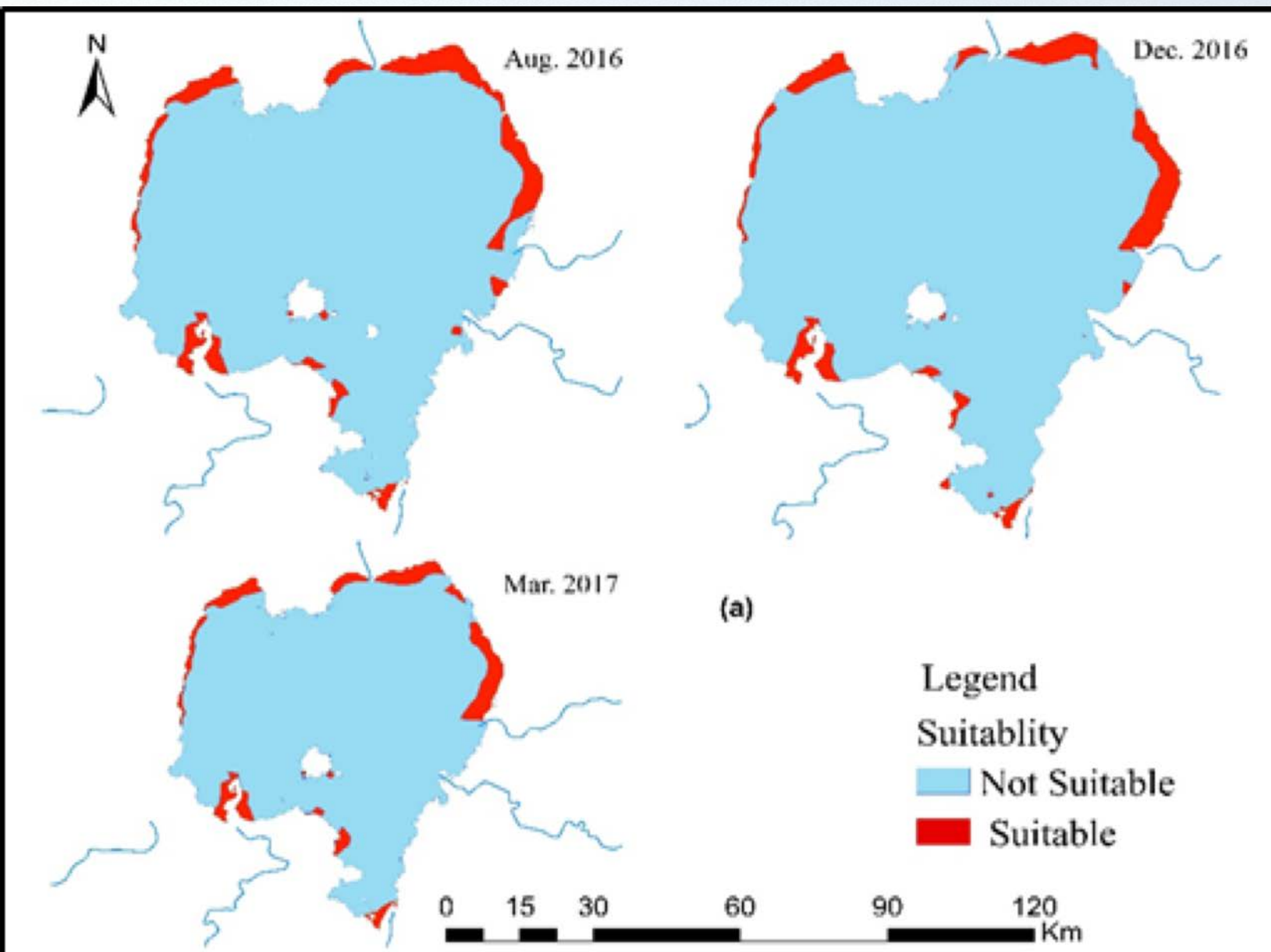
Cities

- ❑ Bahir Dar and Gonder cities





Potential areas for water hyacinth growth

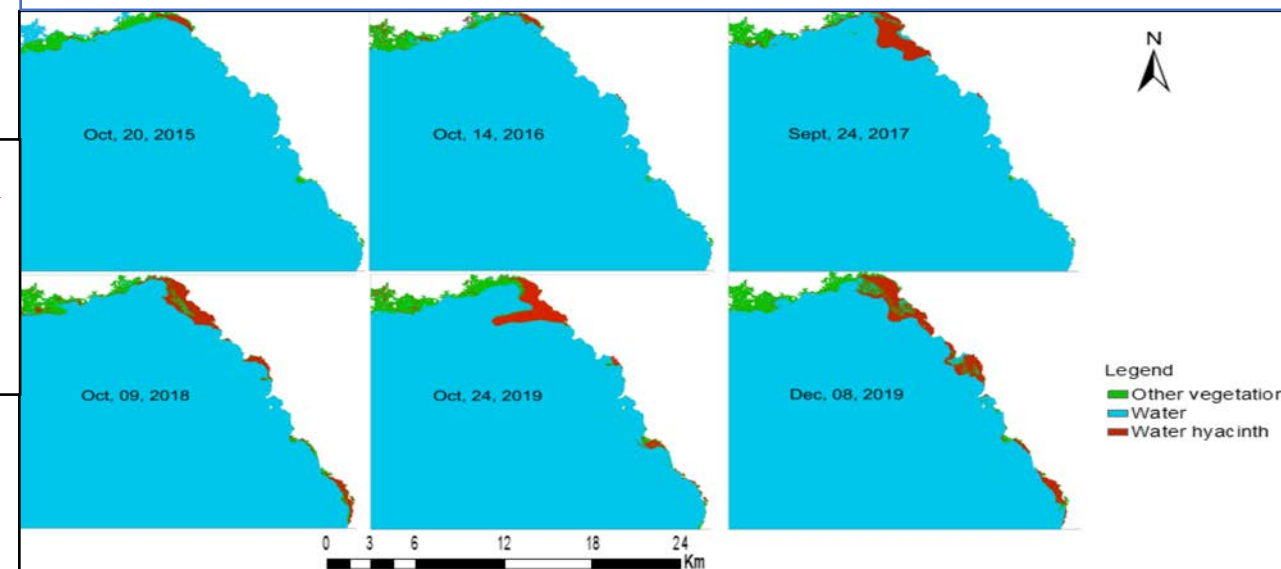
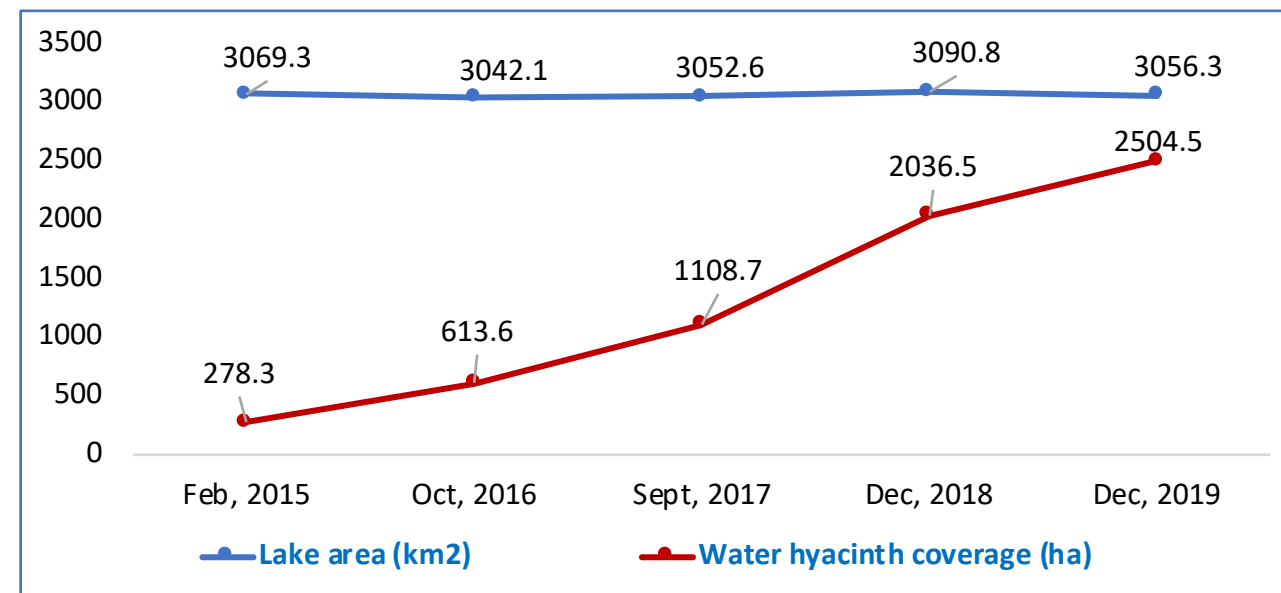


24000-30000ha



Spatiotemporal distribution of water hyacinth and its relation with lake level fluctuation

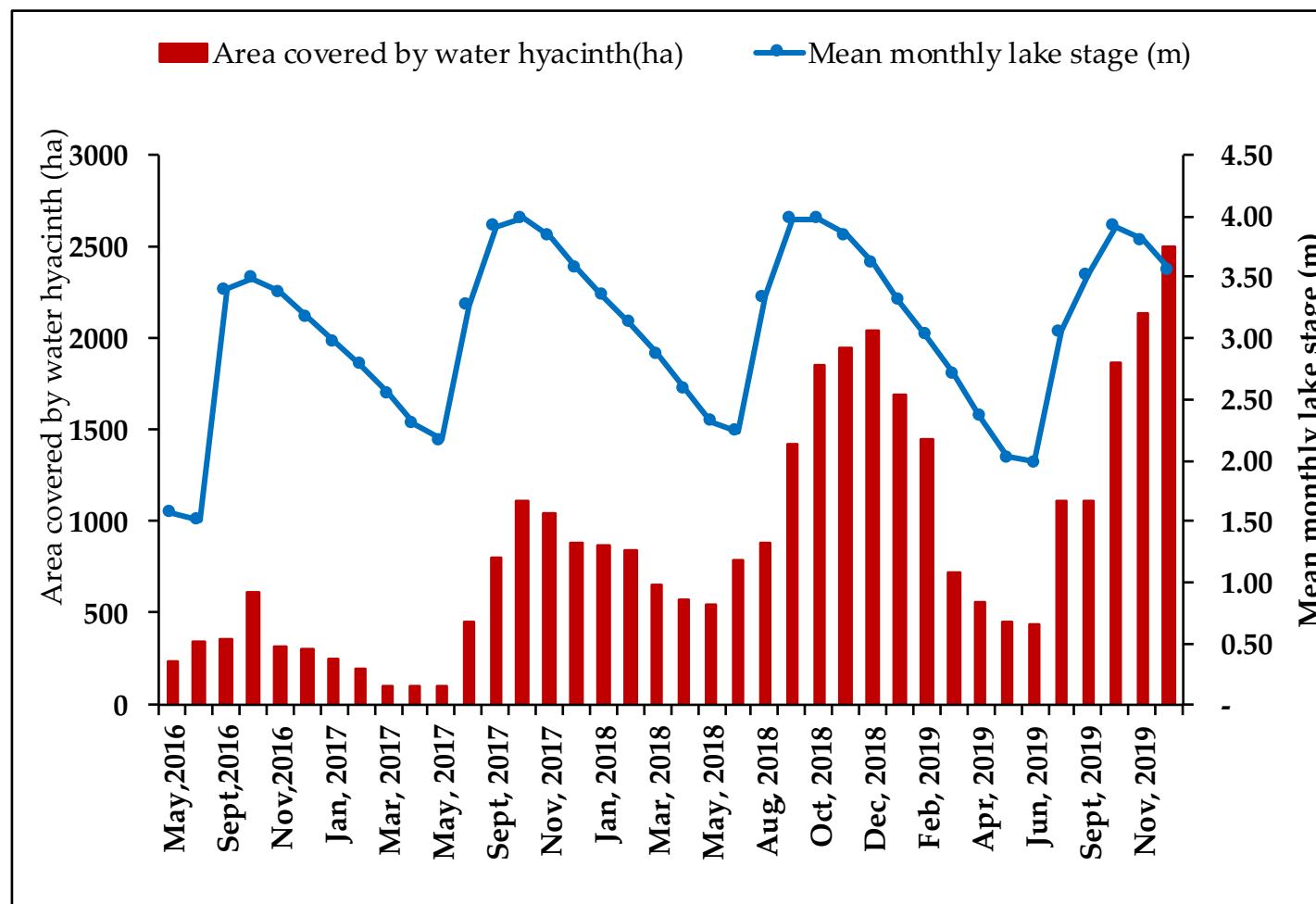
- ❑ 278.3 – 2504.5 ha
- ❑ Significant increasing rate
- ❑ Decreasing in the north and increasing in the eastern shore
- ❑ Severe in the post-rainy season (Sept-Dec)



❑ if not managed properly, there is a possibility to increase to its potential areas covering 10% of the lake



Relation of water hyacinth to lake-level fluctuation



☐ Positive correlation with R values of 0.65

Chara-Chara

- ☐ Minimum operating level is **1783.35 m amsl**
- ☐ Maximum weir OL (**1786.35 m amsl**)
- ☐ Historical flood level (**1788.2 m amsl**)
- ☐ Mean monthly lake-level (**1.5 to 3.98 m**)
- ☐ **0,85 m above max operating level**
 - **Low flushing rate, high resident time and high TP coefficient of retention**



Conclusion

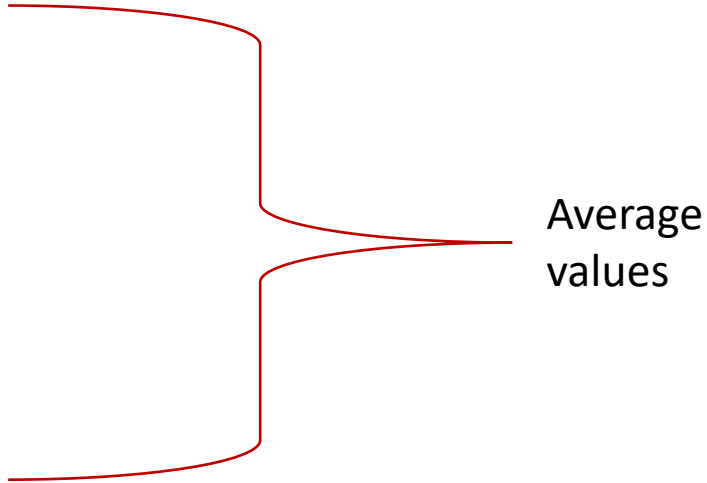
❑ The lake water quality is decreasing

✓ Phosphorus is increasing

✓ Nitrogen is decreasing

✓ Chlorophyll-II is decreasing

✓ SDD is increasing

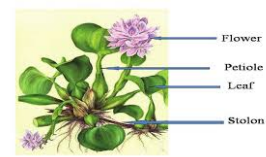


❑ The trend of water hyacinth was increasing significantly

❑ Lake level fluctuation has positive correlation with water hyacinth expansion on Lake Tana

❑ The peak season for water hyacinth expansion on Lake Tana is from September to December.

❑ Northeast shore of the lake is critically invaded by the weed



Possible recommendations

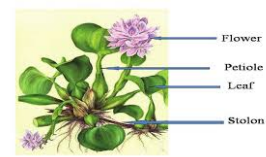


- ☐ Removing the invasive weed
- ☐ Influent from the surrounding cities must not be discharging to the lake or to the rivers which drain to the lake
- ☐ Management of fertilizer and chemicals application must have policy framework
- ☐ Buffer zone delineation
- ☐ Appropriate land management practices
- ☐ The agriculture practice needs a special attention in the sub basin
- ☐ Chara-Chara weir operation needs special attention from water quality point of view





- ✓ Without Lake Tana, the GERD is ???
- ✓ Sudanese and Egyptian water demand???
- ✓ So, all actors of the Blue Nile have to save Lake Tana!!!



Thank you
Stay safe!!