» Transboundary Tekeze Atbara sub-basin located in countries Ethiopia, Eritrea, and Sudan
» Wetlands of the Tekeze Atbara have a total extent of 355 sq km and encompass 0.14% of the 240,084 sq km large sub-basin area, with 82% permanent wetlands
» One wetland, Khashm el Girba in Sudan

» Wetlands are surrounded by agricultural land (64% cultivation) in TA
» Major uses are hydropower generation, irrigated agriculture
» Hotspots are growth of water demand, water abstraction, forest clearing
» Impacts include sedimentation, land conversion, resettlement, changes in hydrological flow
INTRODUCTION

The wetlands of the Tekeze Atbara have a total extent of 355 sq.km and encompass 0.1% of the sub-basin area (240,084 sq.km).

After the White Nile and Blue Nile converge in Khartoum (Sudan), the Atbara river is the next tributary that joins the Main Nile in Sudan. This river contributes particularly after the summer floods (August-September) before it dries up again (Dumont, 2009).

This transboundary sub-basin is shared amongst the countries of Eritrea, Ethiopia and Sudan. The land is covered by 31% shrubland and 10% desert bare soil, 59% are cultivated. The Tekeze Atbara drains the highlands of central-north Ethiopia. Its main rivers are the Tekeze (also known as Setit in its lower reaches), Gwang and Atbara, which constitutes the ultimate downstream river reaches.

The rivers are highly seasonal in their flows and are used to supply water for hydropower generation and irrigation. There are three dams in the sub-basin, the TK5 in Ethiopia, Khashm el Girba in Sudan and the Atbara dam complex (also known as Rumela-Burdana dam, not yet operational). The sediments loads of the Tekeze are high, but water or sediment retention in wetlands or floodplains is low.

The Tekeze Atbara Sub-basin shows a changing topography from South to North and lies mostly in the ecoregion Sahelian acacia savanna. Rainfall peaks in August and September.

The Ethiopian highlands receive more than 800 mm rainfall annually. Whereas downstream at the junction of the Atbara River and the Main Nile, precipitation decreases to less than 90 mm per year. Annual potential evapotranspiration in the sub-basin is 1,780 mm (NBI, 2016).

### WETLAND COMPLEX

<table>
<thead>
<tr>
<th>WETLAND COMPLEX</th>
<th>TOTAL WETLAND AREA (SQ.KM)</th>
<th>PERMANENT WETLAND AREA (SQ.KM)</th>
<th>PERMANENT TO TOTAL WETLAND AREA (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Khashm el Girba</td>
<td>63</td>
<td>52</td>
<td>82</td>
</tr>
</tbody>
</table>
WETLAND SITES IN THE TEKEZE ATBARA SUB-BASIN

WETLAND POPULATION IN THE TEKEZE ATBARA SUB-BASIN
Forests and woodland areas within this sub-basin provide important ecosystem services to the local communities and for the wetlands downstream. Particularly the administrative sub-zone Dighe in Eritrea is relevant for its biodiversity richness and socio-economic importance, which is threatened by forest clearings for commercial agriculture and resettlements (Aria, 2005).

The forests provide ecosystem products in the form of food like game, fruits, grains, fodder for livestock and farmland, as well as fresh water, timber and medicinal products. They also provide regulating and supporting services like waterflow regulation, water purification, erosion regulation, maintenance of soil fertility, natural hazard regulation, climate regulation, pollination, nutrient cycling and habitat for species (Aria, 2005; Mekuria et al., 2011; Atnafu, 2014; Aymeric et al., 2014).

The forests in Ethiopia, particularly the Semien Mountains National Park, are an important conservation zone for the Walia ibex (Atnafu, 2014). This national park provides habitat for this and other wildlife species, thus aids in maintaining genetic diversity, and provides recreational opportunities.
Impacts to Khashm el Girba in Sudan

The wetlands consists of permanent open water (82%) and seasonal wetland grasses. The wetland is surrounded by a shrubland fringe. The surrounding land use is agriculture. Water abstraction is demanded for irrigation (Mulat et al., 2018).

The importance of a proper sediment management strategy for reservoir planning and river health is shown by the example of the Khashm el Girba dam.

Upstream land degradation caused increased sediment deposition and reservoir capacity was underestimated (IHA, 2017). The dam was designed to implement sluicing on an annual basis over six to eight weeks during the wet season (IHA, 2017) in August (Mulat et al., 2018).

However, this method did not stabilise the reservoir volume, which had become a concern by 1971. Since then, drawdown flushing has been additionally implemented. The reservoir volume has stabilised at about half the original capacity (IHA, 2017).

Downstream impacts to the wetland have been water diversion and changes in the flow regime (Wallin, 2014). The agricultural soils downstream need more fertilizer, as the nutrient-rich sediment is trapped upstream.

« There is a large hydro power development potential in the Eastern Nile Basin (Waterbury, 2002; Swain, 2002), especially in Ethiopia because of the great differences in altitude (Ethiopia, 2000). »
**Management Status and Conclusion**

**Major hotspots**
- Importance of a proper sediment management strategy for reservoir planning and river health is shown by the example of the Khashm el Girba Dam, which is operational since 1964.
- Water abstraction is mainly demanded for irrigation.
- Upstream land degradation caused increased sediment deposition and reservoir capacity, which was underestimated.
- Downstream impacts to the wetland have been water diversion and changes in the flow regime.
- In consequence, agricultural soils downstream need more fertilizer, as the nutrient-rich sediment is trapped upstream.

**Major potentials**
- Large hydro power development potential in the Eastern Nile Basin, especially in Ethiopia because of the great differences in altitude.

**Management initiatives**
- Hydro power development projects should be carried out in a sustainable manner, with green infrastructure-oriented management plan and a coordinated communication strategy between different stakeholders and their interests.