OVERVIEW

Main Nile Sub-basin is the largest one of the Nile Sub-basins (1,027,806 sq.km size)
Total wetland extent is 29,332 sq.km, with a share of 28% permanent wetland area
Main Nile System is divided into the Sudanese part, upstream of Aswan Dam and the Egyptian part, downstream of Aswan
8 wetlands delineated, located in Egypt: 3 Ramsar sites, 7 IBA’s with 2 wetlands having a high threat score
Wetlands are surrounded by desert or bare land (85%) in MN
Region near the Nile Delta is industrialized, populated and cultivated, holding over 60% of the country’s population
Major uses are irrigated agriculture, oil and gas deposits, hydropower, fishery, aquaculture, fresh water, grazing
Hotspots are fast population growth, urbanization, land reclamation, wetland degradation, illegal fish farms, sediment retention by reservoirs
Impacts include fertilizer increase, decline in wetland vegetation and growth of aquatic vegetation, increasing salinity levels, wastewater, heavy metal pollution
INTRODUCTION

The Main Nile Sub-basin encompasses 1,027,806 sq.km and is the largest one of the Nile Sub-basins. The total wetland extent is 9,869 sq.km. The identified overall wetland extent is 29,332 sq.km large, with a share of 26% permanent wetland area.

The transboundary sub-basin begins where the White Nile and Blue Nile converge in Khartoum (Sudan) flowing north through Sudan and Egypt until it disemboques in the Mediterranean Sea. The Main Nile System is divided into the Sudanese part, upstream of Aswan Dam and the Egyptian part, downstream of Aswan.

The Nile Delta extends along the Nile River from the Aswan High Dam, 1,100 km downstream to the Mediterranean Sea. The Delta is about 175 km long and 260 km wide.

Historically, flood recession farming was common all along the Nile river floodplains, but after the completion of the second Aswan Dam in 1970 the loss of seasonal flood pulse and wetland habitats allowed year-round agriculture (Dumont, 2009; Rebelo & McCartney, 2012).

Since then this is the most important agricultural region of Egypt (Rebelo & McCartney, 2012).
WETLAND EXTENT IN THE MAIN NILE SUB-BASIN (2015)

<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>Lake Burullus</td>
<td>450</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>Lake Idku</td>
<td>55</td>
<td>16</td>
<td>30</td>
</tr>
<tr>
<td>Lake Manzala</td>
<td>847</td>
<td>637</td>
<td>75</td>
</tr>
<tr>
<td>Lake Maryut</td>
<td>66</td>
<td>26</td>
<td>39</td>
</tr>
<tr>
<td>Lake Nubia/Nasser</td>
<td>5541</td>
<td>5757</td>
<td>104</td>
</tr>
<tr>
<td>Lake Qarun</td>
<td>242</td>
<td>274</td>
<td>113</td>
</tr>
<tr>
<td>The Nile Delta</td>
<td>21480</td>
<td>1303</td>
<td>6</td>
</tr>
<tr>
<td>Wadi El Rayan Protected Area</td>
<td>90</td>
<td>90</td>
<td>100</td>
</tr>
</tbody>
</table>

Climate & hydrology

The Nile builds a flat, triangular delta of about 25,000 sq.km (Hamza, 2009; Dumont, 2009) comprising natural and artificial freshwater and brackish wetlands, lakes and intertidal zones (NBI, 2016).

As a result of high flow rates from the Blue Nile, peak flows in the Main Nile occur between August and September (NBI, 2016).

The Main Nile receives the least amount of rainfall of all the sub-basin. Mean annual rainfall in the greater part of the basin can be as low as 50 mm. At the Mediterranean Sea, the Nile Delta rainfall can be up to 200 mm per year with a peak from November to February (El-Ghani et al., 2011; Hughes & Hughes, 1992; Fraser & Keddy, 2005). Average annual potential evapotranspiration is 2,200 mm (NBI, 2016).
Since the construction of the Aswan High Dam, the riverine floodplains and delta are no longer subject to annual flooding, and the Cyperus papyrus swamps that used to exist in the wettest areas have largely disappeared. The remaining marshland is associated with lakes and lagoons along the seaward face of the delta. The outer margins of the delta are eroding, and salinity levels of some of the coastal lagoons are rising as their connection to the sea increases (Dumont, 2009; Hughes & Hughes, 1992; Fraser & Keddy, 2005).

The vegetation around the Delta consists of Phragmites australis, Typha capensis, and Juncus maritimus, with some small sedges. Lake shore species are e.g. Ceratophyllum demersum, Potamogeton crispus, and P. pectinatus. The salt tolerant Halocnemum spp. and Nitraria retusa grow in marshes along the Mediterranean coast. Farther south along the river, dense swamp vegetation grows unchecked without the seasonal fluctuations of the Nile, held back by the Aswan Dam. Phragmites and Typha grow along riverbanks that were previously bare. (Hughes & Hughes, 1992; Fraser & Keddy, 2005; WWF, 2019).

The Nile Delta is part of one of the world’s most important migration routes for birds. Every year, millions of birds pass between Europe and Africa during spring and autumn, and the wetland areas of Egypt are important resting sites. Some of the many different bird species that pass through the Nile Delta include Ciconia ciconia (white stork), Ciconia nigra (black stork), Grus grus (European crane) and Pelecanus onocrotalus (white pelican), (Hughes & Hughes, 1992; Fraser & Keddy, 2005; WWF, 2019). The delta is home to the largest breeding population of Larus genei (slender-billed gull) in the Mediterranean Sea (BirdLife, 2019; Hughes & Hughes 1992; Fraser & Keddy, 2005).

Fish flagship species for the delta are e.g. Heterobranchus longifilis (Vundu Catfish); Anguilla anguilla (European Eel); Lates niloticus (Nile perch). Common fish species caught in the Nile Delta include Oreochromis niloticus (Nile tilapia), O. aureus (Blue tilapia), Sarotherodon gallaicus (Mango tilapia), Tilapia zilli and Clarías gariepinus (African catfish) (Hamza, 2014).

**THREAT STATE OF ANIMAL AND PLANTS IN THE NILE DELTA WITHIN THE MAIN NILE SUBBASIN**

- **Shrimps**: Critical Endangered
- **Reptiles**: Endangered
- **Plants**: Near threatened
- **Mollusks**: Vulnerable
- **Mammals**: Least Concern
- **Insects**: Least Concern
- **Fish**: Least Concern
- **Birds**: Least Concern
- **Amphibians**: Least Concern

*Image: Shrimp fishery in the Nile Delta, Egypt.*
The two Aswan dams have turned the former seasonal floodplains into permanent floodplains enabling year-round cultivation (Dumont, 2009; Rebelo & McCartney, 2012). Hence, the small stripe along the Nile River is densely populated. The region near the Nile Delta is one of the most industrialized, populated and cultivated areas in Egypt, holding over 60% of the country's population (Rebelo & McCartney, 2012).

In the fast-growing city Cairo lived in 2019 estimated 9,840,591 inhabitants (15,333 people per sq.km, Citypopulation, 2019).
Ecosystem services of wetlands in the Main Nile Sub-Basin

The Nile Delta is an area with deposits of oil and natural gas (Hamza 2009; Dumont, 2009). The local communities living in the wetland area of Lake Burullus (#67) depend on fishery resources, followed by agriculture (Nile-Eco-VWU, 2016). Although aquaculture has been developed in the Nile delta (Rebelo & McCartney, 2012), fisheries exploitation in Lake Burullus is still unsustainable, illegal fish farms have been established, and the annual fish catch from this lake has decreased over the past 10 years (Nile-Eco-VWU, 2016).

Other provisioning services of Lake Burullus include provisioning of fresh water and grazing areas for buffaloes, cows, sheep, goats and camels along the lake’s shores within the protected area. Hunting of birds, although illegal, is still a common activity. Salt extraction from the marshes and the use of several plants of economic importance (fuel, medicinal, food, building materials) are also products the local communities’ benefit from (Nile-Eco-VWU, 2016).

Other potential ecosystem services could be the use of water as a means of transportation, regulating services like water purification, natural hazard regulation, erosion regulation, pollination and biological control.

WETLAND SITES

<table>
<thead>
<tr>
<th>Wetland Site</th>
<th>Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lake Nubia/Nasser</td>
<td>61</td>
</tr>
<tr>
<td>Wadi el Rayan Protected Area</td>
<td>62</td>
</tr>
<tr>
<td>Lake Qarun</td>
<td>63</td>
</tr>
<tr>
<td>The Nile Delta</td>
<td>64</td>
</tr>
<tr>
<td>Lake Maryut</td>
<td>65</td>
</tr>
<tr>
<td>Lake Idku</td>
<td>66</td>
</tr>
<tr>
<td>Lake Burullus</td>
<td>67</td>
</tr>
<tr>
<td>Lake Manzala</td>
<td>68</td>
</tr>
</tbody>
</table>
Sea level rise up to 1m is predicted the Nile Delta region until end of the 21st century (Hasan et al., 2015). Different scenario results were calculated by using ASTER and SRTM digital elevation models to forecast for future flooding in the Nile Delta (Hasan et al., 2015).

The impacted wetland area due to sea level rise is in the range of 6.6% and 21%. The increased sea water intrusions will have an impact on salinity and the protective sand belt in the delta will be further limited and might be a threat for groundwater and freshwater sources; inland freshwater fisheries and cultivated agricultural land (Rebelo & McCartney, 2012).

Even without climate change impact, salinity may continue to increase in the delta from infiltration by seawaters as the delta face erodes and as erosion opens the existing lagoons to the sea. In the Damietta governorate, salt-water intrusion due to sea level rise will lead to an estimated loss of USD 905 million by 2100 in agricultural sector (IDRC, 2015).

INCREASING SALINITY LEVELS BY SEAWATER INTRUSION AND FERTILIZER OVERUSE, AFFECTING AGRICULTURE AS WELL AS FISHES’ COMPOSITION (DUMONT, 2009; REBELO & MCCARTNEY, 2012)

<table>
<thead>
<tr>
<th>Agricultural production</th>
<th>Without Salt Water intrusion</th>
<th>With Salt Water intrusion</th>
</tr>
</thead>
<tbody>
<tr>
<td>Value in USD billion</td>
<td>0.0</td>
<td>3.5</td>
</tr>
</tbody>
</table>

Decrease in agricultural production in Damietta Governorate up to 2100 by impact of sea level rise (Diagram: IDRC, 2015).
MAJOR HOTSPOTS

- Urban development, agricultural activities and illegal fish farms
- Delta is Egypt’s main source of hydrocarbons and natural gas, located chemical industries are a major source of hazardous waste
- Aswan dams turned seasonal floodplains into permanent floodplains enabling year-round cultivation, densely populated Nile river « affects seasonal flooding reducing siltation » increased use of artificial fertilizer
- Increased metal and nutrient pollution in water, sediment and fish are risks in the main Nile Delta wetland ecosystems Manzala, Burullus and Idku lagoons
- Sea level rise to 1m is predicted the Nile Delta region until end of the 21st century » sea water intrusions are risks for groundwater and freshwater sources; inland freshwater fisheries and cultivated agricultural land
- Delta belt erodes further on and opens the existing lagoons to the sea (estimated loss of USD 905 million by 2100 in agricultural sector)

MAJOR POTENTIALS

- Nile Delta is part of one of the world’s most important migration routes for birds

MANAGEMENT INITIATIVES

- 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
REFERENCES

management Plan with a nested case study on the Sudd.