

3.2 Protected areas and freshwater

3.2.1 Protected areas and rivers and lakes

Africa's water resources are vital for supporting livelihoods and economies across the continent. Water is plentiful in some African countries, while extremely scarce in others. Beyond availability, many people lack access to the benefits from water resources, such as domestic use, irrigation, or energy production.

Africa is the world's second-driest inhabited continent after Australia, comprising just 9% of global renewable water resources. These resources are distributed unevenly. More than 50% of the continent's inland water is found in Central Africa with considerably less across the rest of the continent. The availability of and access to water differs across African countries not only due to geographical and biophysical conditions, but also based on the numbers and living standards of consumers¹. An estimate from 2005 reports that 86% of the water withdrawals in Africa were for agriculture, 10% for municipal purposes, and 4% for industry, including energy².

The feature map shows the African rivers network divided into main watersheds based on the hydrology of a digital elevation model³. These rivers transport people and goods, provide habitat for fish and other freshwater life, and supply water for drinking and irrigation. The Nile is the world's longest river and the Congo and Niger are among the world's top 25 longest rivers. Africa's rivers are characterised by dramatic seasonal variability and inter-annual variation that reflects precipitation patterns in those basins⁴.

Africa also includes hundreds of lakes, the largest of which are shown on the map. The African Great Lakes are seven lakes that span countries in East, South and Central Africa. These include Lake Victoria, the second largest freshwater body in the world, Lake Tanganika and Lake Malawi, the world's 2nd and 3rd deepest lakes, respectively. In order of size, the other Great Lakes are Turkana, Albert, Kivu and Edward. The Great Lakes are famous for the adaptive radiation of cichlid fishes, which led to the rapid diversification of many ecologically varied species from a single ancestral lineage. Cichlid species vary considerably in terms of behaviour, body shape, coloration, and ecological specialisation. However, many of these species are threatened by the combined effects of overfishing, habitat loss, and invasive alien species.

The four largest artificial reservoirs on the continent are the Volta (Ghana), which is also the world's largest artificial lake, Kariba (Zambia), Nasser (Egypt), and Cahora Bassa (Zambia) Dams. Lake Chad forms the largest endorheic basin in the world (i.e. rivers that terminate in an interior drainage basin, rather than the ocean). Its size has shrunk from 25 000 km² in 1963 to 2 000 km² in 2010. Though this trend reverted in the last decade, it remains very sensitive to rainfall regimes, and therefore to impacts of climate change. A similarly large endorheic basin is the Okavango Delta, one of the continent's most iconic protected areas, a Ramsar wetland, and a World Heritage Site.



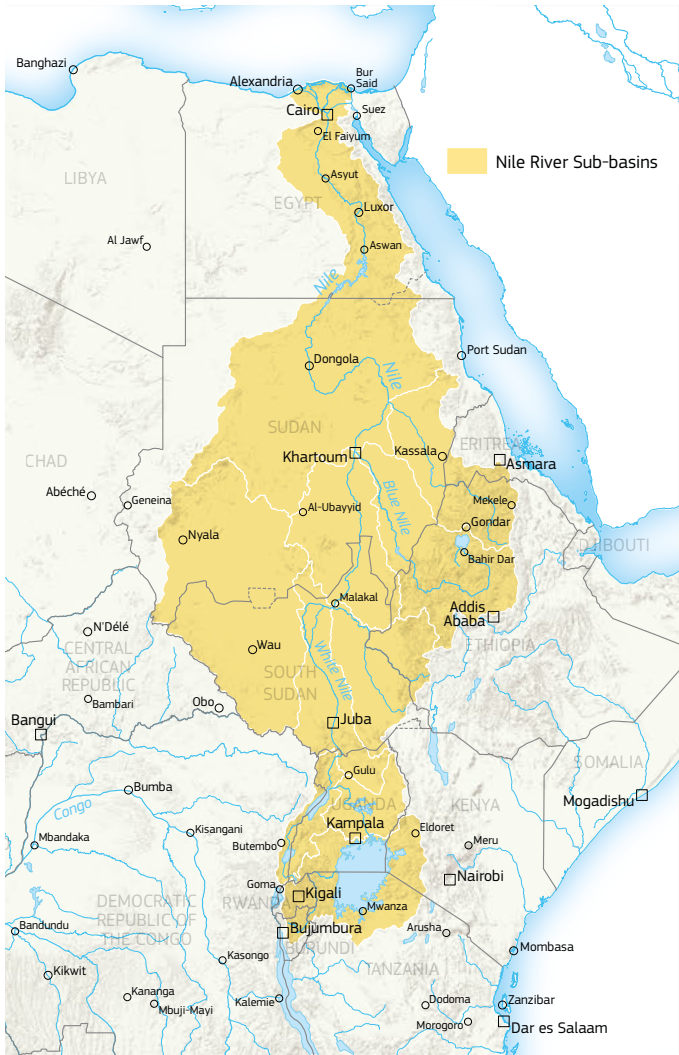
The Nile River basin covers over a 10th of Africa's surface area, and its waters support over 300 million people across 11 countries from the Mediterranean Sea to Lake Victoria and Lake Tana. For millennia, the nutrient-rich waters of the Nile have supported thousands of farmers along its course and provided communities with fish and other natural resources. The river provides a critical waterway for transporting goods and people, and its flow supports energy production. In 2005, the Nile provided US\$ 7–11 billion (potential) annual direct gross economic benefits for irrigation and hydroelectric power (equivalent to US\$ 11–17 billion today, adjusting for inflation)⁵. However, the river's potential may not yet be exploited fully. The recent completion of the Grand Ethiopian Renaissance Dam, which created new lake covering well over 1 800 km² on the Blue Nile, is a case in point. The annual economic value of ecosystem services from the Blue Nile was estimated at US\$ 52 million 2011 (roughly US\$ 72 million today, adjusting for inflation)⁶.



••• An aerial view of irrigated agricultural fields along the Nile near Luxor, Egypt.
For millennia, the annual flooding has deposited new layers of highly fertile sediment along the Nile River. This turns the desert into a breadbasket for domestic use and for export.
Source: Bionet on Wikimedia Commons, public domain.

African freshwater habitats are home to some of the most distinctive and diversified fish fauna in the world. Millions of people depend on freshwater fish. Estimates of the national economic value (gross value added) of freshwater fisheries in Africa can reach US\$ 500 million per annum in larger countries⁶. The value of the catch from Lake Victoria alone is estimated at \$350 million at landing sites with a further \$250 million generated by the export of Nile perch. Inland fisheries contribute between 2–12% of the GDP in Tanzania, Kenya and Uganda⁷. However, this valuable resource is threatened by several factors including climate change, overfishing, pollution, and alien species (including the very same Nile perch that were introduced for aquaculture). Nearly one sixth of African freshwater fishes have been classified as endangered or vulnerable by the IUCN Red List: 40% of these are particularly vulnerable to the effects of climate change. The vulnerability of freshwater ecosystem to climate change is an urgent, but often overlooked, conservation priority⁸.

••• A women selling dry fish at the market in Tanzania.
Freshwater fish are an important livelihood resource, not only for riparian communities, but also for distant consumers who purchase dried fish at markets and even import fish internationally.
Source: George Jaimi on Wikimedia Commons CC BY-SA 4.0.



••• The Nile River basin.
European explorers obsessed over the source of the Nile since the 19th century. The Nile flows into the Mediterranean from the Sudanese city of Khartoum at the confluence of the White and Blue Niles. Although the Blue Nile provides the majority of the Nile's water from the Ethiopian highlands, it is the shorter tributary. During the mid-1870s, Henry Morton Stanley declared Lake Victoria as the source of the White Nile, but the debate over which of the Lake's several feeder rivers is the true source of the Nile continues to today.
Source: Lehner, B. and Grill, G. (2013) Global river hydrography and network routing: baseline data and new approaches to study the world's large river systems. *Hydrological Processes*, 27, 2171–2186.

Africa is predicted to have the world's fastest growing energy demand due to population growth, urbanisation, and economic growth. This expected increase in energy production would apply more pressure on the African water resources and may intensify the competition with the agricultural sector. In 2016, hydropower accounted for 54% of the installed capacity in Eastern Africa, 58% in Central Africa and 30% in Western Africa (excluding Nigeria, which relies predominantly on natural gas). However, building large dams for hydropower increases the surface area exposed to evaporation. The water loss efficiency of hydropower plants in Africa is, therefore, critical for weighing up the evaporative costs relative to energy production. In countries like Ghana, Egypt, Zambia, Mozambique and Zimbabwe, which have four biggest reservoirs in the continent (i.e., Akosombo, Aswan, Kariba and Cahora Bassa), water lost through evaporation can account for almost two thirds of the total water loss⁹.

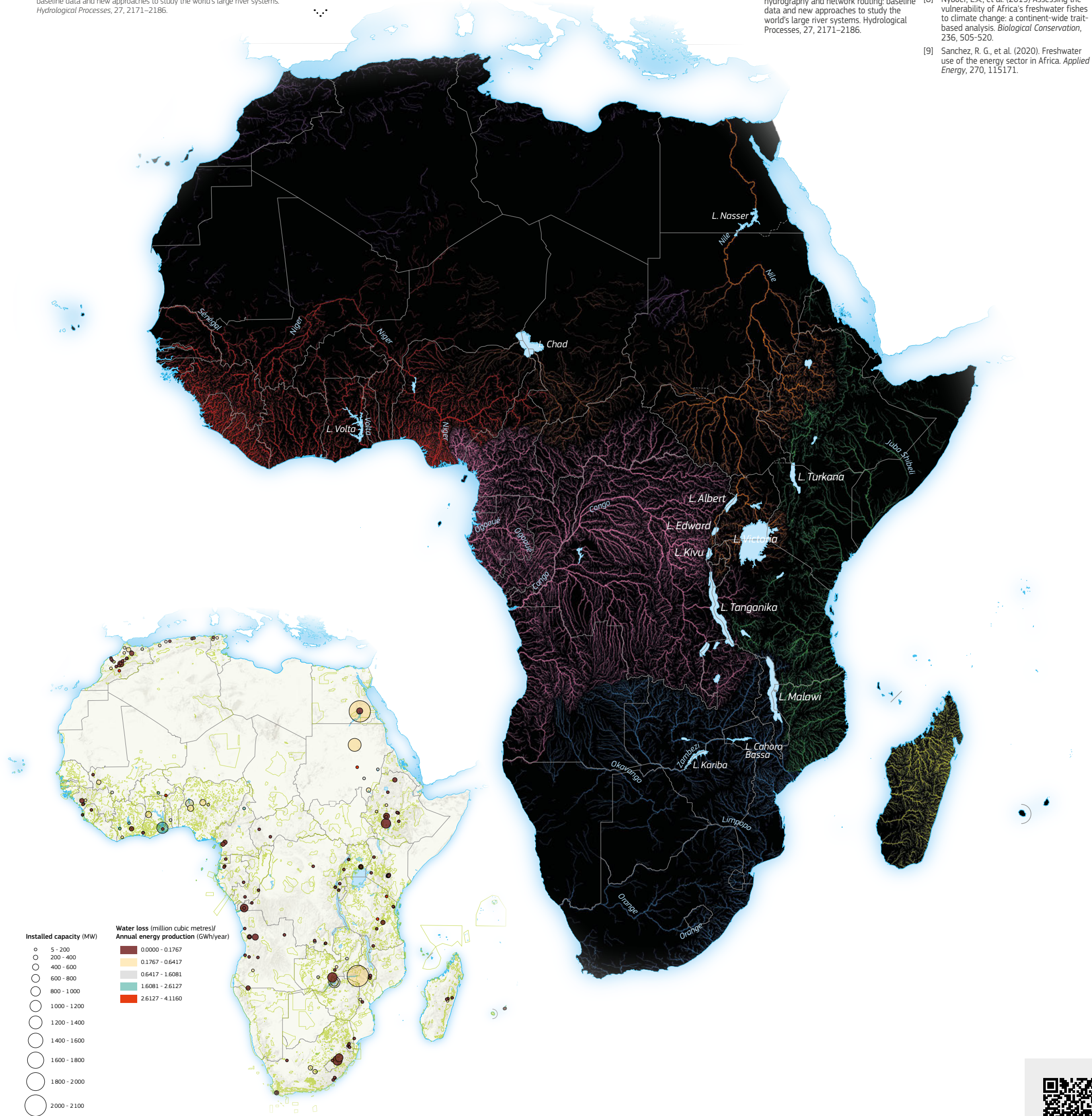
While freshwater, and the services supplied by aquatic ecosystems are vital to Africans, they are often overlooked in protected area planning, expansion, and management. The Global Biodiversity Framework explicitly includes inland water in targets for restoration (Target 2), protection (Target 3) and nature's contributions to people (Target 11). Conservation researchers, donors and policy officials play a role in ensuring that ambitious policies for freshwater are met with comparable attention and resources.

••• Water loss efficiency of hydropower plants in Africa for year 2016.
Many African countries depend on hydropower. This map, with the World Database of Protected Areas in overlay, shows hydropower plants with an installed capacity above 5 MW, symbolised based on the ratio between water loss (million cubic metres) and annual energy production (GWh/year). Some plants have low water losses compared to energy production and installed capacity (e.g. in Egypt and Mozambique), while for others water loss is high relative to energy production, either for high (e.g. Ghana) or low (e.g. Tanzania) installed capacity.
Source: Sanchez, R. G., et al. (2020). Freshwater use of the energy sector in Africa. *Applied Energy*, 270, 115171.

Africa's river network by major watershed, including lakes and reservoirs.

The spatial pattern of rivers network and major water bodies across Africa reveals the unequal distribution of freshwater resources in the continent. Colours represent the main hydrobasins (Pfafstetter level 2), which encompass individual river catchment areas.

Source: Lehner, B. and Grill, G. (2013) Global river hydrography and network routing: baseline data and new approaches to study the world's large river systems. *Hydrological Processes*, 27, 2171–2186.



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3.2.2 Protected areas and wetlands

The word ‘wetland’ defines complex ecosystems occurring in all biomes. The term includes a high variability of habitats, all characterised by the presence of water at or near the ground surface. Shaped by their hydrological and physiochemical properties, wetlands can be classified as marine, estuarine, lacustrine, riverine, and palustrine. Each category encompasses many crucial habitats such as seagrass meadows, mangrove swamps, marshes, peatlands, and many others.

Estimates of wetland extent vary depending on different ways of defining and delineating these ecosystems¹. According to the dataset used for reporting Sustainable Development Goal 6.6.1, inland vegetated wetlands only cover 3% of Africa², spread across diverse environmental settings. These wetlands include some of the largest freshwater ecosystems in the world, such as Sudd and Okavango wetlands, both considered of Outstanding Universal Value by the World Heritage Convention. Furthermore, the continent houses major water bodies such as the Nile, Congo, Zambezi and Niger Rivers and the Tanganyika, Chad and Victoria Lakes. The continent’s coastline includes more than 19% of the global mangrove forests³.

Wetlands play a critical role in providing fundamental ecosystem functions and services and are hotspots of biodiversity. For instance, wetlands are the most important stopovers on bird flyways and provide habitats for many plants, animals, and other forms of life.

Water and nutrient regulation, climate change mitigation, freshwater and coastal fish, cultural and recreational value are some of the vital functions and services supported by wetlands⁴. Wetlands, and in particular peatlands, play an important role in the global carbon cycle since they can be important sinks for carbon dioxide and methane. However, land use and climate change risk turning these systems into sources of greenhouse gasses. This emphasises how important it is to protect and restore wetlands to support people, maintain critical habitats, and mitigate and adapt to climate change⁵.

Earth observation for mapping, monitoring and conserving wetlands to support the Sustainable Development Goals.

According to the First Global Wetland Outlook Report (2018) and its Special edition (2021)⁷, wetlands have declined by 35% between 1970 and 2015 and continue to be lost worldwide. Although data on wetland extent, distribution and trends are fundamental to support policymakers in formulating effective management plans and conservation decisions, reliable information and national inventories are still underrepresented.

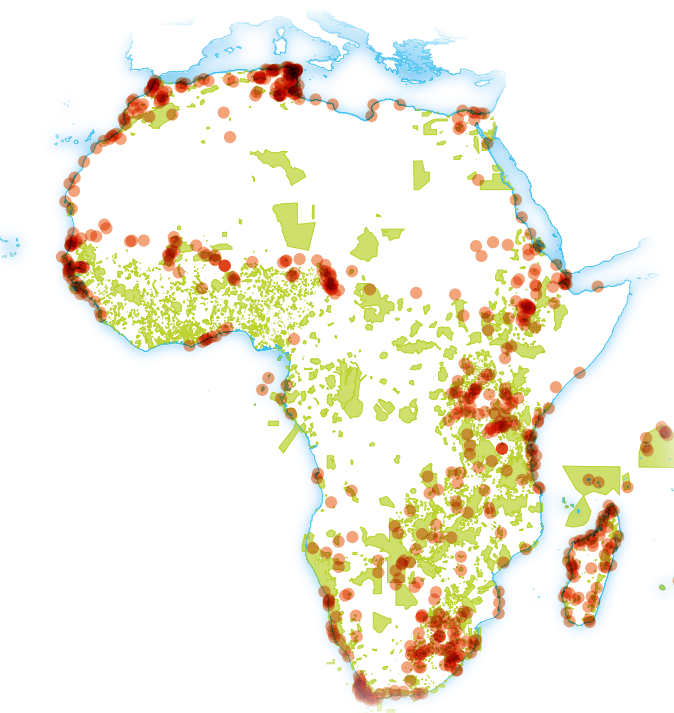
Earth observation data from satellites are increasingly used to monitor wetlands. Time series of images are fundamental for monitoring wetland dynamics and for assessing changes brought about by human activities or climate trends⁸. For instance, the sequence of images shown here demonstrate how the wetting and drying dynamics affect the delineation of wetland boundaries in the Sudd Wetland, South Sudan⁹. Earth observation is also used for monitoring, reporting, and tracking progress towards the Sustainable Development Goals (particularly target 6.6.1) and the Kunming-Montreal Global Biodiversity Framework. Several International initiatives have started mapping the extent of wetlands trends. For instance, Global Mangrove Watch has released the global mangrove forests changes data for several years starting from 1996. Similarly, the Global Surface Water Explorer, an initiative led by the European Commission’s Joint Research Centre, has mapped the distribution of water surfaces at global scale for the last 39 years. The Tropical Wetland Mapping Tool (TropWet) enables users to map vegetated wetlands in tropical regions based on Landsat satellite imagery in Google Earth Engine.

At regional level, GlobWetland Africa was a specific initiative (2016-2019) for the African continent, led by the European Space Agency (ESA) in collaboration with the Ramsar Secretariat’s regional team for Africa. The initiative aimed to support African stakeholders in developing national and regional wetland observatories (<http://globwetland-africa.org/>).

Critical Sites in the Africa-Eurasian waterbird flyways

The Global Assessment Report by IPBES revealed that only 9% of migratory bird habitats (in all stages of their annual cycle) are covered by protected areas¹⁰. The African-Eurasian Flyway is one of the world’s most important flyways for annual bird migrations. Migratory waterbirds rely on wetland areas that form stepping-stones along their routes. The responsibility for protecting migratory species is shared among countries and several critical sites for migratory waterbirds have been identified across Africa and Eurasia.

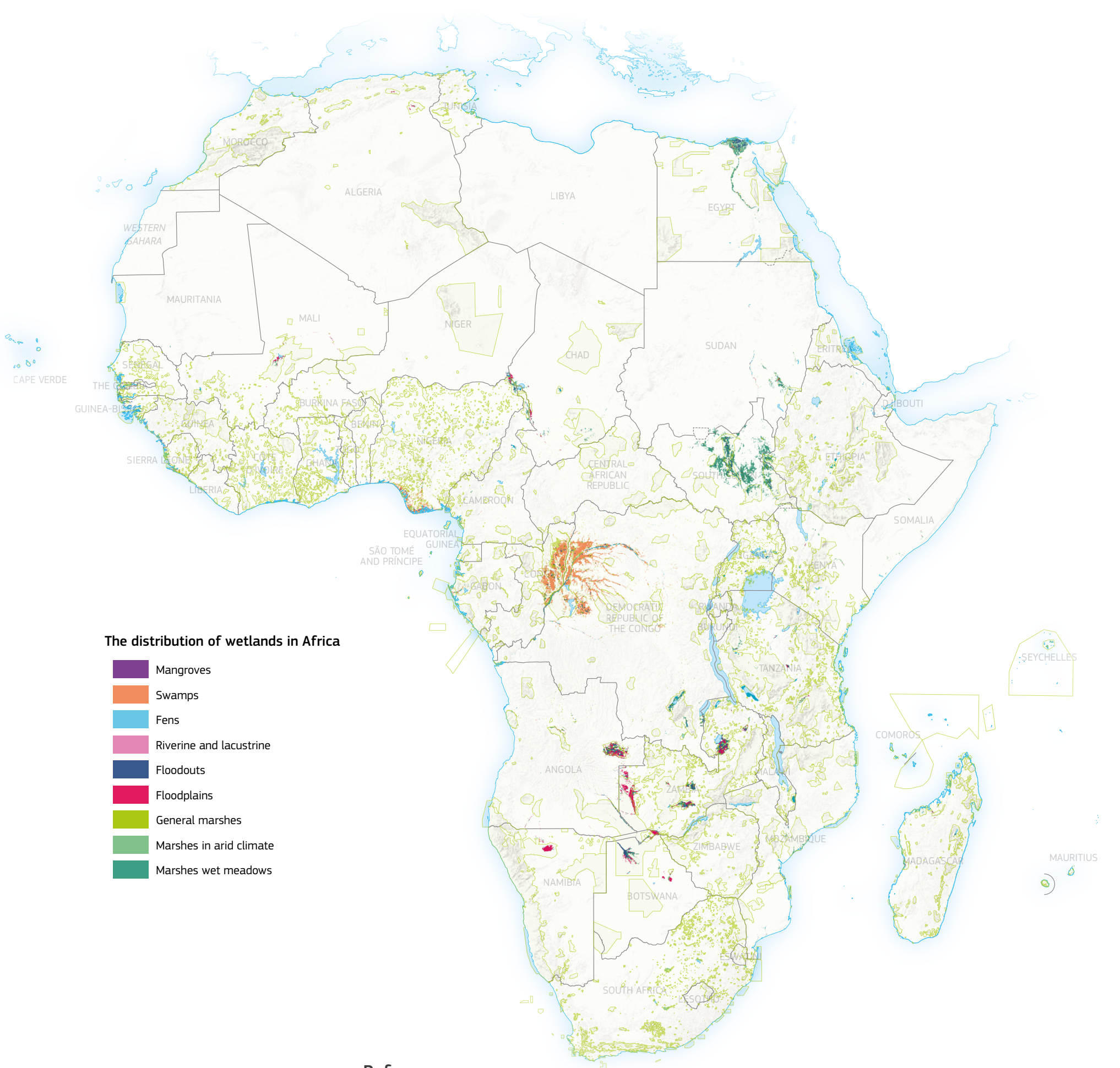
The Convention on Migratory Species is the global legal instrument specialised in the conservation of migratory species, their habitats, and their migration routes. Several agreements underpin the Convention, including the African-Eurasian Migratory Waterbirds Agreement specific to waterbirds. This agreement is dedicated to the conservation and management of the habitats on which migratory birds depend.



Critical sites for waterbirds in the African-Eurasian region. Source: The Critical Site Network Tool 2.0, developed under the framework of the Climate Resilient Site Network in the African-Eurasian Flyway project (<https://criticalsites.wetlands.org/en/sites>)

The distribution of wetlands in Africa, with the World Database of Protected Areas (WDPA) in overlay.

A zoom over the protected area including the Okavango Delta system in Botswana, is available in part 1.2.1, on page 24 of this Atlas. Source: Gumbrecht, T. et al. (2017) Tropical and Subtropical Wetlands Distribution, V7. Center for International Forestry Research (CIFOR): <https://doi.org/10.17528/CIFOR/DATA.00058>



The distribution of wetlands in Africa

- Mangroves
- Swamps
- Fens
- Riverine and lacustrine
- Floodouts
- Floodplains
- General marshes
- Marshes in arid climate
- Marshes wet meadows

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Wetlands play a pivotal role in supporting livelihoods of millions of Africans. Inland vegetated wetlands cover roughly 3% of the continental area and African coastal zones host almost 19% of the global mangrove forests. Protecting and restoring these crucial ecosystems is fundamental for sustaining the health of both the natural and human systems.

Wetland classes

- Inundated vegetation
- Wet soils
- Open water
- Aquatic vegetation

Thematic classification maps of inundation extent in the Sudd wetland. Variation in the extent of inundation in the Sudd wetland (South Sudan) for the October-December months in 2002, 2012 and 2022.

Source: Hardy, A., et al. (2023) Satellite data reveal how Sudd wetland dynamics are linked with globally significant methane emissions. *Environmental Research Letters*, 18, 074044.

