

"A boat cannot go forward if each rows his own way."

Be it to improve irrigation, manage floods and droughts or generate energy, dams have played a significant role in humanity's progress. But the dam building development model also has its flaws. And with the impacts of climate change

starting to threaten livelihoods, many argue it's time to protect and even restore our free-flowing rivers the world over. The development-conservation-dilemma is hard to address, particularly for trans-boundary rivers such as the Nile. Saving the

shared resource while providing for the Nile Basin's growing populations requires transboundary co-operation. The Nile Basin, have tackled the highly sensitive dam topic and have

no easy answers. But self-aware that they all are in the same boat, they agree that it is time to start rowing the same way.

The Dam Issue

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The Niles

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Editor-in-Chief: Dominik Lehnert
Editors: Jess Smee, Leila Bendra-Lehnert
Art Direction & Design: Gunnar Bauer
Finance Manager: Dirk Spilker

Contributors:
Waakhe Simon Wudu, Rehab Abdalmohsen, Francis Wani, Nema Juma, Alaa Eliass, Essameldin Mohamed, Elzahraa Jadallah, Elfatih Mohammed, Mohamed Hilali, Dagim Terefe, Asmaa Gamal

Pictures:
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Contact:
Media in Cooperation and Transition
Dirk Spilker
dirk@mict-international.org
Brunnenstraße 9
10119 Berlin, Germany
Phone +49 (0)30 4849 3020
www.mict-international.org
www.theniles.org

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The dam conundrum: To build or not to build?

MiCT The Niles
Berlin, Germany

The ancient technology of dams has fuelled human progress. Yet countries building and managing dams, especially in transboundary river systems like the Nile, face complex and difficult challenges.



The Nile Basin's population is rising, as is the demand for clean water, food and energy. Over the past 50 years, six Nile Basin countries have built 25 hydroelectric dams.

Despite their drawbacks, dams are seen as a necessary step to provide for growing populations by the Nile Basin countries and their leaders.

By definition, dams are an obstruction to the flow of water. Some of the risks associated with them, in addition to negative impacts on biodiversity, include conflicts, the danger of them failing, and sometimes the displacement of local populations.

As rivers, such as the Nile, often cross multiple countries, building a dam in one country can also create problems in nations further along the river.

This is clear when we take a closer look at the dams, existing, planned and under construction, in the Nile Basin.

Dams are impressive structures that require vast investment and can be part of a government's legacy. On the negative side, as well as carrying debris and silt, they can also generate local conflict.

The potential for disputes between upstream and downstream countries is only one example of how dams can have major consequences for political, social, economic and ecological dynamics in the basin.

And there is much to learn from the past: Investigating dam failures, not only structurally, but also in their impact on humans and nature can pave the way towards a more open discussion on how cooperation can really take place.

But first and foremost, we need to understand how dams work.

Despite having a decisive effect on the Nile's ecosystem, some science and environmental journalists, including Rehab Abdalmohsen, had never visited a dam until she investigated Sennar for this publication.

In this issue of The Niles, journalists from the Eastern Nile Basin shed light on the key themes of the region's dams, probing them from a range of perspectives.

Our correspondents zero in on Sudan's long history of constructing dams as well as South Sudan's plans and what they mean for the country's future.

The reports reveal how it is all interconnected: for example, Dagim Terefe investigates how the changing climate of the Ethiopian Choke watersheds increases silting and other impacts in downstream countries like Egypt, where Asmaa Gamal homes in on the history and popularity of the Al-Qanater al-Khairiya dams.

Guided by this The Niles issue's proverb "A boat cannot go forward if each rows his own way", we end on a question and with a spark of hope: Cooperation is primordial in the Nile Basin – and it is a key ingredient in a dams' success. So how can we ensure it happens?

Construction activity
at Sudan's Merowe Dam.
Photo: David Haberlah

Sudan's Roseires Dam.
Photo: OFID / F. Albassam

Why dams matter

Waakhe Simon Wudu
Juba, South Sudan

Nile Basin countries are in a race for time as growing populations require significant amounts of electric power. Dams are a solution but also pose new challenges.

M

Michael Abebe is the Regional Coordinator for Water Resources and Dam Safety at the Eastern Nile Technical Regional Office (ENTRO) and currently the Vice President of the International Commission on Large Dams (ICOLD). During the Nile Day celebrations in Sudan's capital Khartoum on February 23, 2020, he spoke with Waakhe Simon Wudu about dams, why they matter and some pressing issues.

The Niles: *What would you tell a South Sudanese person in Juba who does not know about dams in the region?*

Michael Abebe: A dam is to regulate variability of flow in the river systems. If there is any variability in the Eastern Nile countries, there is a need to develop dams, because they regulate the flow during the rainy season.

Usually, in the Eastern Nile, the flow is mostly dominated by three or four months of rain starting from June or September, but the other months are very dry. There is a need for irrigation, energy, water supply and navigation. To ensure this water is available throughout the year, you need to develop a dam.

TN: *Why do some countries in the Eastern Nile Basin region (South Sudan, Ethiopia, Sudan and Egypt) establish dams and others do not?*

"We have more than 30 large dams in the Eastern Nile Basin region."

MA: To have a dam you have to have the water resources, the topography and also demand for water. If there is a scarcity of water or the wrong topography in the area, you cannot build a dam. If the water is scarce and variable, you have to develop a dam to secure water supply or to sustain irrigation or energy.

If you have a continuous flow of water in the river system, you don't need to develop a dam. But when there are scarcity and variability of flow in the rivers, you need to provide a regulating mechanism, and that is often a dam.

TN: *Do we have dams in the Eastern Nile Basin region, and if yes, where?*

MA: We have more than 30 large dams in the Eastern Nile Basin region. Mostly these are located in Egypt, Sudan and Ethiopia. At the moment, South Sudan does not have a dam. But I know that there are dams in the pipeline for hydropower purposes in the future.



TN: *What considerations need to be taken into account while constructing a dam?*

MA: Proper planning and investigations have to take place before you begin construction. Luckily, we have a lot of experience around the world, and we can learn from that.

First, you have to conduct proper studies, planning and even consultations. Unless you do this properly, you may repeat mistakes made by other countries. I suggest that South Sudan has to properly assess the possibility of constructing a dam in its river because there are other options rather than developing dams.

For instance, many dams are constructed in the region to provide energy. If there is the possibility of power trading with neighbouring countries, you don't need to develop a power plant or a dam.

Or, if you have sufficient vegetation or rainfall in the region – for example, six months or nine months of rainfall per year – you may not need to develop your irrigation system. You have to make efficient use of the rain-fed system for agriculture.

TN: *Are there basic other things to take into account while planning to construct a dam besides environmental studies?*

MA: Yes, when I say planning, it means the planning process in the study phase. This includes environmental and technical aspects, including whether the material is available to construct the dam itself and whether the foundation is strong enough for a dam.

Similarly, you have to explore the environmental and social aspects in that area. For example, you have to be careful if there is a high amount of displacement or resettlement.

TN: *What advantages and disadvantages come with a dam?*

MA: A dam has multiple benefits. It can be used for flood control, irrigation, recreation or navigation. However, it needs proper operation and maintenance. You need to monitor the safety or the health of the dam properly. If the structure is not maintained, you lose the benefits of energy or irrigation as well as maybe affecting the downstream communities.

So from the structural point of view and also in terms of environmental and social aspects, you have to be very careful. However, dams also offer a wide range of benefits.

TN

The cascade effect: sharing information, knowledge and experience

MiCT The Niles |
Based on a presentation
by Michael Abebe
Berlin, Germany

The interdependency of dams in a river system demands coordinated operation, so all dams have an optimal configuration that, in the interplay with all others, minimises risks and maximises mutual benefits for all riparian states.



The flow of the Nile differs depending on the seasons. Any particular area along the banks of the Nile might therefore get too much water, leading to floods, or too little, causing droughts. This fluctuation between excess and deficit is typical, with irregular periods of balance in between.

The term 'cascade dams' refers to two or more water storage dams situated along the same river or in the same river basin. These dams are coupled such that the operation of one reservoir affects the function of the others. Depending on how harmonised these operations are, the overall impact can be either positive or negative.

If the operators of each dam are aware of the needs of the others, and if all operators agree to work cooperatively, the overall negative impact would decrease.

For a coordinated operation of cascade dams to succeed, all dams must follow some fundamental principles. These include the need to access and share accurate data, particularly relating to weather and hydrology forecasting. Each dam must operate with a view on maximising overall benefits for the entire river basin. Sharing these increased benefits between, and within countries, as equitably as possible, is a must.

Additionally, it is vital to set up operating procedures and the necessary legal and institutional frameworks. Both the procedures and the frameworks must also include a degree of reasonable flexibility to allow future operators to deal with unexpected and unforeseen situations.

Finally, all stakeholders representing various sectors affected by the operation of cascade dams must be consulted regularly, and their views and concerns must be addressed.

The case of the Blue Nile

Along the Blue Nile river, there are five particular dams of interest to look at: The High Aswan Dam in Egypt, the Merowe, Sennar and Roseires dams in Sudan and the Grand Ethiopian Renaissance Dam in Ethiopia.

Dams are used for diverse reasons such as to produce hydropower, to supply water for consumption and irrigation, to mitigate floods,

but also for navigation, fisheries and recreation.

Conflict may arise when the operation of one dam adversely impacts the purposes of another. For example, to generate hydropower, one dam might keep most of the water coming in, therefore filling its reservoir. Less water will then be available for subsequent dams on the river.

It is important to note that the Nile's water is not evenly distributed amongst Nile Basin countries, which leads to an unevenly distributed potential to develop water resources. According to the Nile Basin Initiative (NBI), the projected water demand in the 20 years from 2014 to 2034 will increase by 60 percent in the Nile Basin.

Balancing needs and interests means that the needs of each party must be acknowledged as legitimate, and served in a sustainable, equitable and efficient manner.

So what is stopping the Nile Basin countries from enacting such cooperation agreements based on balancing needs?

Cooperative operation of dams could bring many opportunities, such as helping to adapt to climate change by bridging droughts and preventing flood damage, in addition to providing hydropower for the whole of the Eastern Nile region.

It is critical to capitalise on the hydrological knowledge already existing and to take advantage of the enabling environment created through the continuous cooperation between the Nile Basin Initiative and its Eastern Nile Technical Regional Office (ENTRO).

This could help encourage countries to jointly set up data exchange and consultation mechanisms and common standard guidelines and rules for dam operation. Bringing together all the actors of the Eastern Nile region in a concerted effort to bridge weaknesses and fortify strengths would help build a future of increased prosperity and harmony.

Levels of cooperation

To support countries in building this future, NBI/ENTRO is involved in several projects related to improving forecasting and improving dam safety, for example. Maybe

most urgent of all, NBI/ENTRO is currently developing a roadmap containing different options for coordinated operation of the existing and planned dams.

Concretely, there are different levels of cooperation possible concerning a coordinated dam cascade management in the Eastern Nile.

The first level is data exchange amongst different stakeholders. Cooperation is based on a local perspective, which translates into minimal changes to already established operations. Still, it leaves the door open for the possibility to adjust operation, depending on the data received from other dams.

The second level of cooperation includes the local perspective and a system perspective. The local operation rules are in place but are subject to adjustments, making it possible to share benefits if agreements on joint objectives are developed.

Full cooperation comes at the third and last level. It is based on a system perspective where the assessment of operation rules follows joint objectives across borders. Different organisational structures for regulation, management and operation can also be set up.

To exemplify these levels of cooperation in real life, ENTRO ran several models on the Atbara-Tekeze sub-system, which consists of three dams: the Tekeze Dam, located upstream in Ethiopia, operated to meet hydropower requirements; the Upper Atbara Dam, located downstream of Tekeze at the confluence of Setit and Atbara River; and Khashm el-Girba Dam, downstream of Upper Atbara, operated to supply the New Halfa irrigation scheme.

Whichever level of cooperation the model relied on, the total benefits for both Sudan and Ethiopia were higher than the baseline. Following the current mode of non-cooperation operation of dams deprives both countries of a multitude of benefits – just in monetary terms worth millions of dollars.

This modelling was a successful way to describe and demonstrate the different levels of cooperation and coordination of cascade dam management. Looking at the whole Eastern Nile as an interconnected system, therefore, is an essential step on the road towards full cooperation.

How to report on dams without having seen one

Rehab Abdalmohsen
Cairo, Egypt

Reporting on dams in the Nile Basin is a tricky endeavour – even more so if you've never seen one.

D

uring a Media Training Workshop on dams in Khartoum, Sudan, the trainer asked the group journalists if they had ever visited a dam. Surprisingly enough just a few hands went up, prompting me to wonder if a journalist can write about dams without having seen one.

Of course, it is always better to visit a dam site, but the answer that jumped to my brain was: yes you can write about something you haven't seen. As long as journalists who cover dams take the time to inform themselves about how dams work, what they look like, and the different types of dams. This desktop research becomes easier thanks to Google, Youtube and other online resources.

This is how I personally became the journalist responsible for covering dams and cascade dams, starting by studying the issues relating to dams in Africa and the Middle East.

I found that dams amount to more than just blocks of concrete or other materials: they are structures that have a complex impact on the surrounding ecosystem. They may help regulate water flow, preventing floods and saving crops, but they also decrease the flow of sediments. However, the removal of natural vegetation and leakage from new reservoirs or dams can mean that the water table rises, carrying stored salts to the surface and harming crops.

I learnt that dams have pros and cons. While some big dams are built to store water for emergency needs, water lost via evaporation might be more than expected. Similarly, producing hydroelectric power means providing electricity for houses, but it also means destroying others as citizens are forced to give up their homes because of a dam project.

"Dams amount to more than just blocks of concrete or other materials."

Attending events related to this topic and being surrounded by a community of water management and dam experts is vital for a journalist like me. I am able to listen to researchers and experts discussing the topic, I can pose questions to them on the sidelines of the event, and this helps me hone a story idea to send to my editor.

But what if this golden moment comes, and the journalist was not prepared? Let me tell you a story: In 2018, while I was attending World Water Week in Stockholm, I was in the press room, and I heard that the Iraqi Minister of Water was attending. I alerted my editor and we agreed that I would interview him.

And all of a sudden, I looked up and saw the minister passing me. I went over and asked him for an interview, and he agreed. Because of my preparation, I managed to touch on the real, local problems like

the huge hydroelectric dam built by Turkey on the Tigris river, and the risks of creating water shortages downstream in Iraq, not to mention the effect of this on soil salinity which is one of the most significant problems facing the country, putting food security at risk.

So carefully reading the event agenda before attending and then targeting some specific sessions and speakers top my "must do" list before attending a conference. I google the names of speakers and organisations to know more about their work and getting familiar with some dam-related glossaries like dead storage, aquifers, evapotranspiration and others.

I try to keep myself up to date on the topic of dams: the Grand Ethiopian Renaissance Dam in particular and Nile issues in general. This means taking some other steps, such as setting a Google Alert with keywords and following all the players in this topic on social media. Such steps reliably help me find story ideas to pitch to my editor.

Over years of working as a journalist specialising in dams, I learnt to hunt for the human-related angle. While interviewing a source or pitching a story, I keep my mind fixed on the question: What impact does this have on humans?

After all, to convince the editor, I need to show him/her that this story will engage the reader, that it relates to them.

As a journalist living beside the Nile, it is hard to resist the temptation of writing about conflict. The minute you talk about "war" "blood" or "the death of the Nile" the clicks climb, but it is important to recall that, so far in the history of humankind there was never a war over water between countries.

In my stories, I try to address questions like: What are the solutions to this problem? Am I missing or ignoring any perspective? And if the story is about cascade dams in an international river, I try to bring in the voices from the different riparian countries, with their diverse opinions.

In 2013, I wrote my first story on dams – a long feature focused on the establishment of the Grand Ethiopian Renaissance Dam and its effects on both Egypt and Sudan. I interviewed two experts from Egypt, each with a different scientific point of view, and though I didn't have any contacts with Ethiopian journalists or experts at this time; I managed to find two via social media, each with their specific viewpoint.

My personal take-aways from that story: teamwork is crucial when covering transboundary stories, and prioritise the voice of science all the time.

Finally, before sending the story, I check everything, from scientific accuracy to the names of the organisations, sources, and the numbers mentioned in the story. I also check that the various voices and perspectives have been given the same space and attention. I re-read my story to see if there is any jargon that needs explanation, or any questions which need answering.

Covering water can be either be shallow, just stating the obvious and copy and pasting press-releases, but, with journalistic attention to detail, it can also go much deeper, boosting awareness and even exposing corruption.




A photojournalist from
Egypt at Sudan's Sennar Dam,
February 21, 2020.
Photo: The Niles / Dominik
Lehnert

Dam safety:
Coordinated operation
of transboundary
cascade dams

Infographic: Nile Basin
Initiative (NBI) / Gunnar
Bauer

RISKS



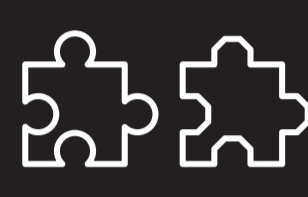
Climate extremes

- + Extreme floods
- + Prolonged droughts



Dam failures

- + Loss of lives, properties & services
- + Regional insecurity
- + Environmental damage



Uncoordinated operation

- + Energy underproduction
- + High & low releases
- + Inefficiency of irrigation water use
- + Evaporation loss

ACTION



Adaption strategies

- + Strengthen forecasting system
- + Drought & flood management plans



Dam safety standards

- + Institutional & legal framework
- + Setting construction, operation & safety standards



Regional cooperation

- + Regional optimised planning
- + Setting up basin organisation
- + Standardise tools

BENEFITS




Flood & drought control

- + Reliable water supply
- + Resilient economies



Functional safety

- + Safety of downstream lives, property & environment
- + Regional security
- + Sustained economic services



Maximised returns

- + Energy uplift
- + Irrigation expansion
- + Improved navigation
- + Sustained environmental flow

Do dams cause more problems than they solve?

All across the Nile Basin, dams generate power, store drinking and irrigation water, as well as prevent flooding and create spaces to relax. On the downside, dams, especially poorly maintained structures, can endanger local people, especially in the context of a rapidly changing climate.

MiCT The Niles
Berlin, Germany

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A dam is a barrier or structure which blocks a stream, river, water-way to confine and control the flow of water.

Dams are classified according to the materials from which they are built.

Embankment dams, for example, can either be earth-filled or rock-filled. The dam contains more than 50 percent of either soil and gravel-sized or smaller rocks (earth-filled) or cobble-sized or larger rocks (rock-filled).

This type of dams represents about 75 percent of all of the dams in the world. Concrete dams, on the other hand, are mainly constructed from cast-in-place or roller-compacted concrete. Composite dams are composed of both, with concrete gravity or buttress section in combination with earth-filled or rock-filled embankment sections.

Earth filled dams were constructed as far back as 2000 BC. Built from 276 to 303 AD, and restored in 1901, the Minneriya dam in Sri Lanka is the oldest still in use.

Today there are over 60,000 large dams in operation. A large dam, according to the International Commission on Large Dams (ICOLD), has a height of over 15 metres or is both between 10 and 15 metres high and has a storage capacity of over 3 million cubic metres (MCM).

A typical swimming pool (25 m x 10 m with an average depth of 1.5 m) would have a volume of 375 cubic metres. For context, 3 MCM is equivalent to 8,000 of such swimming pools.

In comparison, the Grand Ethiopian Renaissance Dam (GERD) is planned to have a reservoir with a volume of more than 74 billion cubic metres, or more than 197 million typical swimming pools.

The Eastern Nile dams

The Eastern Nile Sub-basin is home to several large and complex dams, with other dams under construction and in the planning phase.

At present, the Eastern Nile countries host more than 30 large dams with a combined total storage capacity of more than 200 billion cubic metres (BCM) (>25 percent of existing African dams' storage capacity). It is also estimated that more than 300 small dams exist in the Eastern Nile countries.

These dams hold several risks, but, if these are overcome, the structures can benefit all eastern Nile Basin countries.

Climate variability

"More than 90 percent of the world's rivers will be fragmented by at least one dam within the next 15 years" according to a study by researchers at the University of Waterloo and the Université libre de Bruxelles.

The same study investigates the impacts of dams and reservoirs on the earth's climate, as they "trap nearly one-fifth of the organic carbon moving from land to ocean via the world's rivers".

"In similar recent studies, the group of researchers also found that ongoing dam construction impedes the transport of nutrients such as phosphorus, nitrogen and silicon through river networks. The changes in nutrient flow have global impacts on the quality of water delivered to wetlands, lakes, floodplains and coastal marine areas downstream."

The impact of dams on climate has also been documented, but it is essential to remember that humans can also decide how much they want to influence the environment through building dams. Dams are

built to be used for irrigation, water supply, energy, or flood control.

Dams can also be multipurpose and be used for two or more of the above purposes. They can also mitigate the effect of floods

*"90 percent
of the world's
rivers will
be fragmented
by at least
one dam."*

or droughts, thus contributing towards local communities becoming more resilient.

Within the Nile Basin, the High Aswan Dam is an excellent example that demonstrates both positive and negative impacts.

On the one hand, its consequences include "an explosion of water hyacinth, outbreaks of bilharzia [an infection caused by a parasitic worm that lives in fresh water], polluted irrigation channels and a build-up of sediment inland that would otherwise compensate for coastal erosion from Egypt to Lebanon,"

according to Tim Harford's article on the BBC.

On the other hand, it "shielded Egypt from what would have been a disastrous drought throughout the 1980s, followed by potentially catastrophic floods in 1988", the article continues.

And although they are hailed as a poster child for green economy initiatives and a worthy investment by agencies supporting developing countries, it is essential to recall

*Up to 2018,
there have
been 30 dam
failures in
Africa alone.*

that dams worldwide are also being removed to limit their disastrous environmental effects.

According to a study by several institutions including the World Wildlife Fund and the European River Network, up to 30,000 dams are obsolete in France, Poland, Spain and the UK alone. These dams "no longer have a beneficial function for society yet continue to suppress the healthy functioning of our rivers".

This casts a new light over the Nile Basin area, sparking questions like: Are projects double-checked to ensure that they are all really beneficial? Are the dams fulfilling their promises? Do the risks they pose outweigh their benefits?

Dam failures

Dam safety has two main aspects: the safety of the dam and appurtenant structures; and the safety of the population, property and the environment in the vicinity or downstream of the dam.

A dam failure is a catastrophic incident when water is uncontrolledly released from the structure, often when it is no longer structurally sound.

Up to 2018, there have been 30 dam failures in Africa alone, and over 300 failures worldwide, according to ICOLD.

Erosion, defects during the building process or overtopping (water spilling over the top of a dam) can all cause a dam to break down.

Generally, these risks can be alleviated by closely monitoring the building process and performing multiple quality checks. It is also essential to regularly maintain the structure and to be alert to the risks of any pending environmental challenges.

It is crucial to raise the awareness of people living near dams, educating them about emergency plans in the event of dam failure. After all, the toll for local populations can be high: In 2018, the Patel dam in Kenya, a small earth dam used for agriculture, failed after heavy rains and flooding. It killed 40 people and displaced 500 families.

This tragedy is only a snapshot of the risks posed. With more dams planned in the Nile Basin, it is all the more important to make sure that these legacy structures are built for local people and are not to their detriment.

In the Nile Basin, several issues must be addressed. With the growing number of large and complex dams located along a transboundary river, it is crucial to reassess ageing dams, to check they are up to date with current standards to protect people and their environment.

Additionally, institutions and individuals, for example, those responsible for repairing the structures, should also be trained to deal with potential risks posed by dams.

This also entails updating or creating institutional structures responsible for dam management and repairs, both at national and regional levels.

With over 150 million people living in major urban centres along the Nile corridor, the lack of a coordinated system of transboundary dam safety management imminently threatens the survival and wellbeing of Nile Basin citizens.

Uncoordinated operation

Any single dam failure in a transboundary river would entail more than economic damage. It would exacerbate social and political instability and complicate regional security.

There are significant challenges and conflicts of interest when it comes to the rights of use and access the Nile, a vital resource for local populations.

It comes as no surprise that all parties consider its use and access as key for security, survival and progress. Compromising on such issues can sometimes be interpreted as a failure, and yet, it has become clear that failure to cooperate can trigger violence and abuse, thus extending cycles of mistrust and fear.

Several points are vital for cooperation in managing dams to become a reality. First, weather, hydrology data and forecasting are essential in order to operate dams properly.

Second, future planning is a priority. Legal and institutional mechanisms must be set up on national and regional levels to agree on cooperative management.

Third, any agreements reached must be flexible enough to allow future operators to deal with unforeseen issues. On this point, it is essential to deal with all stakeholders with clarity, fairness and dialogue.

As of the time of writing, there are neither regional nor national guidelines for dam operations in Nile Basin countries. Similarly, a cooperative dam safety regulatory framework is yet to be developed.

Nile Basin countries operate according to different guidelines and standards for building, running and managing dams.

Other gaps are yet to be bridged, especially raising awareness on the benefits of coordinated dam operation, improving technical and institutional capacities and encouraging upstream-downstream data exchange to ensure successful coordinated dam operation.

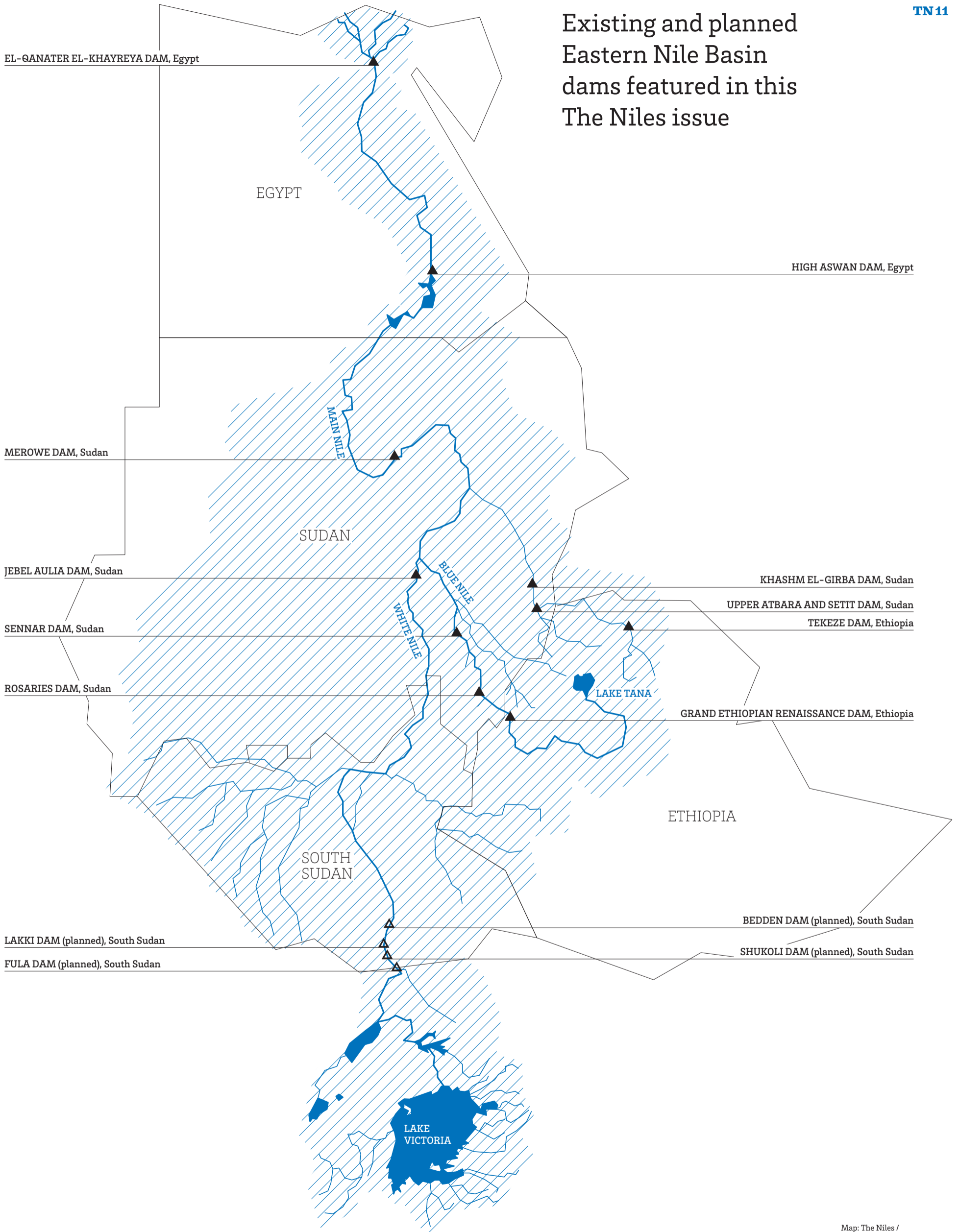
The Nile Basin Initiative (NBI) Eastern Nile Technical Regional Office ran a cooperative model between the Atbara dam in Sudan and the Tekeze dam in Ethiopia.

With increased levels of data exchange and mutual support, benefits were seen in both countries, running into millions of dollars. Extending this scenario of cooperation to more dams and more countries promises a range of advantages, economic and otherwise.

Maybe most importantly, cooperation would reduce water loss, maintain the environment and create a brighter economic future for all involved.

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Existing and planned Eastern Nile Basin dams featured in this The Niles issue



The road- map towards a dam in South Sudan

Comment by Francis Wani
Juba, South Sudan

Many people are thinking about introducing dams to South Sudan – but a systematic approach is needed before they become a reality in the country.



“Many people believe that dams are only for electricity.”



The pressing need for electricity is the main argument of those pushing for the construction of dams in South Sudan – mostly people who returned to the country after the end of the civil war which divided Sudan into two independent countries.

After all, electricity remains an urgent need across South Sudan. When the Ministry of Electricity, Dams, Irrigation and Water Resources was established, and electricity was not forthcoming, the people of Juba even nicknamed the new ministry as the “Ministry of Darkness”.

Hydroelectric dams could help provide electricity but usher in many new issues and complexities to the region. To consider this option, the government and the general public should focus on five important mechanisms.

The first mechanism is that the country should define why dams should be built and how they should be managed and operated. We know that dams have different purposes, such as electricity production, flood control or both.

Once the purpose of building the dams is widely known and understood by the public, it will be easier for the government to push the project forward. After all, many people believe that dams are only for electricity, but the fact is that they have other benefits which should be clearly communicated.

Meanwhile, the ministry should explain the disadvantages and the price of building and operating dams. This is important to avoid public expectations being impossibly high, sparking complaints and condemnation further down the line.

The second mechanism is for the ministry to develop a policy, legal and institutional framework for dams and cascade dam management in the country. Policies and laws are fundamental to manage dams. These documents enable an understanding of the purpose and goals of dams and give stakeholders, in particular donors or development partners, a clear view of how the project is progressing.

The third mechanism is that the country’s responsible ministry should ensure solid management and operation of dams or cascade dams. In the past, many dams in the Eastern Nile Basin region have been constructed, but their management has proven incompetent. Institutions are needed to oversee this management.

The fourth mechanism involves the country securing funding, either from the government budget or from development partners and donors communities for this important project. Without sufficient funding, it will be impossible to build and maintain the new dam. Similar programmes elsewhere have stumbled because of a lack of funding.

The fifth mechanism is that the country should consider entering into both bilateral and multilateral agreements for cooperation and collaboration to manage and operate single or multipurpose dams. The issues of dams are critical, especially in a transboundary river, like the Nile, where tensions are running very high. Partnerships and cooperation are vital to secure the future of cascade dams in the country.

In conclusion, these five considerations are vital to manage and operate dams in any country. They should be taken on board by South Sudan if it is to succeed in managing and operating dams in the country.

This path is important, not only for South Sudan but for the entire basin. After all, the failure of one country means the failure of all the countries within the same river system.

Can South Sudan relaunch its Fula Dam project?

Nema Juma
Juba, South Sudan

South Sudan's plans for the Fula Dam have long been in place, but a multitude of obstacles have halted the project.

S

outh Sudan's government says it is working towards reviving construction plans for the Fula Dam, a hydropower project which stalled due to outbreak of conflict in late 2013.

The Fula Dam project idea dates from 2009 when Sudan and South Sudan were still one country. Back then, Juba and Khartoum set up an Implementation Committee, but the project was put on ice due to lack of funding and expertise when South Sudan became independent.

Tom Remis Pitia, Director General / Engineering & Grid Operations, Ministry of Electricity, Dams, Irrigation and Water Resources, South Sudan, says construction will cost SSP 493 billion (USD 1.47 billion).

South Sudan has vast potential to generate electricity from hydropower, especially along the Nile. South Sudan was undertaking feasibility studies for various hydropower projects with a combined capacity of 2,000 megawatts.

The planned projects include Fula (890 megawatts), Shukoli (235 megawatts), Lakki (410 megawatts) and Bedden (570 megawatts). Small hydropower plants with capacities ranging between three and 11 megawatts are also in the planning stages.

"We have to involve financial investors," Pitia says, hinting that the country is keen to undertake the construction of all hydropower plant projects.

South Sudan has one of the lowest rates of electricity access, with over 90 percent

"Constructing Fula Dam is very important for economic progress of South Sudan."

of its over 12 million population without a connection. Most businesses in the country depend on diesel-powered generators to operate.

The Fula Dam was envisaged to generate hydroelectric power, a move that would boost economic growth in the world's poorest country, Remis said.

James David Kolok, civil rights activist and Director of the Foundation for Democratic and Accountable Governance applauded the government's plan to restart the project, saying it will diversify the country's weak economy.

"Constructing Fula Dam is very important for economic progress of South Sudan," Kolok said. "The dam will help citizens along the Nile to produce food, and it will help with irrigation."

The Fula Dam project was an initiative launched with support from the Norwegian government, Remis said.

From 2011 to 2014 the project "involved environmental assessment and resettlement planning for the proposed Fula Rapids hydropower plant and transmission line in South Sudan," according to Multiconsult, a Norwegian company dealing in planning and development of hydropower stations, dams, underground facilities, onshore wind farms and solar plants.

"Fula Rapids is planned as a run-of-river project on the Nile River, near the Ugandan border. It includes an intake structure

(overflow weir), 950 metres headrace canal and a power station with an installed capacity of 40 megawatts," Multiconsult explained on its website, adding "the power will be evacuated via a 132 kilovolts overhead transmission line to the capital city Juba. In addition, electricity will be distributed to the nearest town and village."

According to Pitia, work on the plan would resume if South Sudan secures finances. Such efforts would mean that South Sudan's project would join other dams across the Eastern Nile Basin region, especially the Great Ethiopian Renaissance Dam (GERD).

Looking at the dam's likely regional impact, it is unclear how other countries on the Nile would react to any dam construction by South Sudan, the only country along the Nile River without any major water-driven projects.

Currently, the population of the Nile Basin Initiative (NBI) member states is estimated to be around 505 million and increases by 2.5 percent annually. The basin's total population is on track to double by 2050. This will mean increasing usage of the Nile waters as the population increases.

This trend in population growth and its increasing demand on the waters is likely to increase competition on the usage of the Nile waters among the countries in the Nile Basin. The situation may worsen when underdeveloped countries like South Sudan start to industrialise their economies, sparking tensions in the region.

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South Sudan has vast potential to generate electricity from hydropower. Photo: The Niles / Bullen Chol

Sudan's dams

Alaa Eliass &
Essameldin Mohamed
Khartoum, Sudan

There are six major dams along the Nile in Sudan, all built at different times for different purposes.

D

ams are ancient human constructions that have evolved with scientific progress and technological developments. Dams have shifted from solely enabling water conservation to generating electricity and cultivating large areas of land through flow irrigation, which has contributed to economic and social development in many countries.

Wherever a dam is built, a diligent weighing of the advantages and the disadvantages of dams, as well as the cost for local ecosystems is required. The overriding question is whether the advantages outweigh the disadvantages.

Sudan is part of this global discussion, especially when we look at the destruction of local environments and communities as a consequence of building some dams in the past. Most of Sudan's dams were built to obtain electrical power and decrease the danger of catastrophic floods that hit Sudan every autumn.

But, the fact is, we still witness floods in fall, and the electricity sector in Sudan is still weak, with power shutdowns in Sudan sometimes lasting for several days. This makes us question whether they are effective, especially given the impact on the environment.

In an African context, Sudan is one of the nations with the most potential for hydropower. It is covered by 10 percent of wetlands and has about one million hectares of surface water. The river Nile and its streams form its most important source of water.

Sudan started building dams in the 1920s utilising the country's diverse water resources, the most important of which are the Blue and White Niles, in addition to seasonal rivers such as the Setit and the Atbara.

There are six major dams along the Nile in Sudan (Jebel Aulia Dam, Khashm el-Girba Dam, Merowe Dam, Roseires Dam, Upper Atbara, Setit Dam Complex and Sennar Dam) which were all built at different times for different purposes – supplying electrical power, irrigation, protecting land and people from floods and using dams in various projects such as fish farms on the dams lakes.

A closer look at these dams and their history shows a multitude of beneficial outcomes for the people and the country:

THE SENNAR DAM

Sennar Dam was constructed on the Blue Nile, approximately 320 kilometres south-east from Khartoum and 270 kilometres downstream of the Roseires Dam.

The construction started in 1922 and was completed in May 1925, while Sudan was colonised by the British Empire. It was built to irrigate the lands of the Gezira scheme through flow irrigation and the provision of electricity to Khartoum. This is the oldest water dam in Sudan, and it has a production capacity of 15 megawatts.

The dam is 3,025 metres long, with a maximum height of 40 metres. The dam's 80 low-level sluice gates regulate the dam's reservoir.

"The initial reservoir storage capacity was 930 million cubic metres at a maximum water surface elevation of 421.7 metres," according to an International Hydropower Association case study.

Today the reservoir has a storage capacity of 390 million cubic metres of water, and its reservoir lake extends to more than five kilometres South of the dam.

Sennar Reservoir contributed to the irrigation of the Gezira and Managil project, which boosted the productivity of cash crops such as cotton, beans, and wheat, transforming the Gezira region into a meeting place for all the tribes of Sudan.

The project contributed to raising production and productivity rates for Sudan and exporting cash crops, mostly cotton, to European factories.

THE JEBEL AULIA DAM

The Prime Minister of Egypt addressed a letter to the British High Commissioner in 1929, explaining that Egypt will build the Jebel Aulia Dam to stand opposite to the Gezira project.

The dam was inaugurated in 1938 under Egyptian administration. It was handed over to Sudan after the Egyptian government decided to dispense with storage there, following the creation of Egypt's Aswan High Dam in 1963.

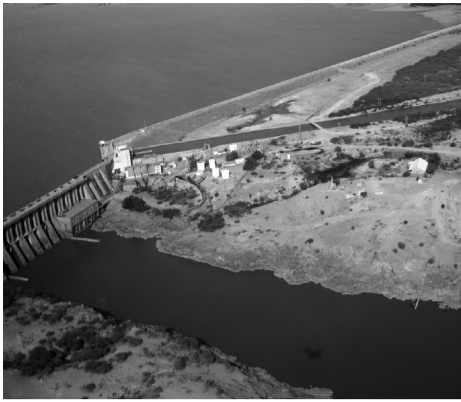
The Jebel Aulia Dam was designed on the White Nile, 44 kilometres south of the capital Khartoum, with a height of 22 metres and a lake capacity of 3,5 million cubic metres. In 2003 the Sudanese government implemented a project to generate electricity from the dam with 30 megawatts.

The Jebel Aulia raised the water level in the areas in front of and behind the dam, so that the White Nile agricultural projects in Abu Qouta, Al Fatisa, Al Hashaba, Umm Jarr, and Al Duwaim areas could be irrigated by pumps.

The Jebel Aulia dam and reservoir have helped provide water for sugar and agricultural projects, and also underpinned the economic and social life in the Jebel Aulia region, south of Khartoum. The Jebel Aulia dam formed a barrier against weeds, preventing them from passing behind the reservoir and affecting the main Nile.

Besides, the reservoir region is a tourist area regularly visited by residents of Khartoum.





THE KHASHM EL-GIRBA DAM

Khashm el-Girba Dam is a concrete dam located on the Atbara River, west of the city of Khashm el-Girba, 560 kilometres east of the city of Khartoum, about 80 kilometres west of the town of Kassala and at 438 kilometres from the city of Atbara.

It is the fourth-smallest of five dams erected on the Nile and its tributaries in Sudan. It was built from 1961 to 1964, within the framework of a project to resettle the residents of Wadi Halfa affected by the construction of the High Dam in Egypt after the waters of Lake Nuba (Lake Nasser in Egypt) flooded their villages and towns.

The French company, Sogreah, prepared its engineering design, while the Italian company Torno built it, completing it by 1964, with a design capacity of 1.3 billion cubic metres of water. This capacity has now decreased to one third as a result of the siltation. However, the Upper Atbara and Setit Dams Complex had a positive impact on the storage capacity by reducing siltation.

The Khashm el-Girba reservoir targeted the irrigation of 450,000 acres in the new Halfa agricultural project in addition to cultivating large areas outside the areas of displaced people from Wadi Halfa, which contributed to the stability of the people in the eastern states.

The new Halfa Sugar Project also increased the development of the area, as did the manufacturing plants in the new Halfa region.

THE ROSEIRES DAM

The Roseires Dam is a concrete hydroelectric dam named after the town of Roseires in Sudan which is located nearby on the Blue Nile in Blue Nile State, and it is 550 kilometres from the capital Khartoum. It was built in 1952 to store water from the Blue Nile River to use for agricultural irrigation.

The Roseires Dam project was executed in two stages. The first stage was completed in 1966, and a hydroelectric plant was attached to it and the second phase was completed in 2013, by Sudan's Dams Implementation Unit (DIU).

The storage capacity of the reservoir increased from 3 to 7.3 billion cubic metres after the dam raised from 68 to 78 metres. The purpose of the Roseires Dam was to increase the capacity of the Sennar reservoir, and therefore, expand the cultivation of winter crops, which have a high economic yield.

This second stage of the project required the resettlement of people affected by the project, who received compensation for their lost properties, and the resettlement. "We have resettled 20,000 families in 12 modern cities equipped with all the necessary services," said Dr Ahmed al Karori, social affairs commissioner of the Dams Implementation Unit (DIU) in an interview in November 2012.

THE MEROWE DAM

The Merowe Dam project is considered one of the most important and largest economic projects implemented in Sudan during its recent history, and it has had a significant impact on the lives of citizens.

The proposal for the Merowe Dam project began with the preliminary study carried out by the Egyptian government in 1946, followed by the study by the Swedish company Sweco in the period 1983-1986 and then studies by the Canadian company Monaco-Agra in 1989-1993.

Then the complete project design work followed by the Hydro-Project Institute. The project was designed with a production capacity of 1,250 megawatts.

The project is located on the main Nile River on Meroe Island, 346 kilometres north of Khartoum and 330 kilometres from the northern border of Sudan.

The Dams Implementation Unit has implemented several projects accompanying the Merowe Dam project, constructing roads, bridges, houses, a college, a hospital, a railway station and an airport.

The Implementation Unit established four agricultural projects for those affected by the construction of the Merowe Dam, with a total area of 207,000 feddans (86,940 hectares), namely: 1. Al-Hamdab el-Gedida: 35,000 feddans (14,700 hectares) 2. Amri el-Gedida: 67,000 feddans (28,140 hectares) 3. Al- Manasir el-Gedida: 60,000 feddans (25,200 hectares) and 4. Kahila East: 45,000 feddans (18,900 hectares).

THE UPPER ATBARA AND SETIT DAM COMPLEX

These are two hydroelectric dams with a mud nucleus and a shared storage lake located on the Atbara River with a storage capacity of 3.688 billion cubic metres and a height of 52 metres. One is located on the Atbara River and the other on the Setit River in the locations of Bardana and Rumila.

The establishment of the Upper Atbara and Setit dams aims to add new agricultural projects in the region and provide a radical solution to el-Gadarif's water shortage problem.

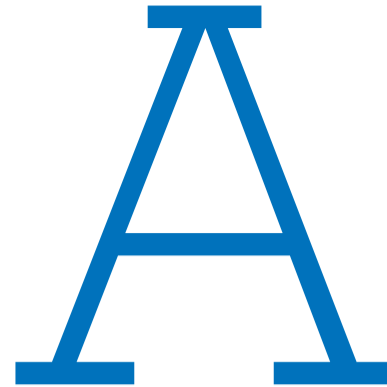
The project also helps revive the Khashm el-Girba Dam reservoir, protect it from floods, and revive the new Halfa agricultural project, whose agricultural areas have decreased due to the silting on the Khashm el-Girba reservoir.

The Dams Implementation Unit has established residential cities for those affected by the project, including houses with electricity and water services, as well as hospitals, sports clubs, places of worship and schools, as well as agricultural projects that were distributed to those affected, which created development and stability in the region.

TN

The White Dam: a tale of big ambitions and big problems

Elzahraa Jadallah
Khartoum, Sudan



imed at boosting development and securing water supply, the Upper Atbara and Setit Dam Complex is a twin dam with a shared reservoir. It was inaugurated by the then President Omar al-Bashir in February 2017, wrapping up many decades of surveying, planning and construction. However, its completion ushered in a new set of challenges for the local area.

Located in the East of the country, about 460 kilometres from Sudan's capital Khartoum, in the eastern part of Sudan the dam is upstream of where the Atbara and Tekeze rivers meet.

Spanning two states, Kassala and el-Gadarif, the idea for the complex dates back to 1946, a few years after the creation of Khashm el-Girba Dam (about 80 kilometres downstream), designed to irrigate the New Halfa Agricultural Scheme. The project hung in limbo for decades until feasibility studies began in the seventies and updated studies followed in 2007-2009.

Building work started in 2011, intending to reduce the sediment affecting Khashem el-Girba, solve el-Gadarif's historical water issues and advance development in areas including fish production, agriculture and power generation. But when al-Bashir finally officially opened the project in 2017, the majority of residents didn't celebrate as the dam's side effects had dented initial enthusiasm.

Environmental impact

A study into the dam by Sudan University of Science and Technology (SUST) graduate, Abazar Ali states: "A dam built across a river will

In 2017, Sudan completed the Upper Atbara and Setit hydroelectric project, bringing the country closer toward its goal to increase hydroelectric power generation from 1,500 to 2,000 megawatts by 2020. The years of planning and construction tell a tale of big ambitions and big problems.



The Burdana Dam, part of the Upper Atbara and Setit Dam Complex in Sudan.
Photo: SaWaM, KIT / Frank Zöllner

obviously have a major effect on the river valley upstream of the dam which will be flooded as the new storage reservoir fills.”

“Less obvious is that the river downstream of the dam will also be significantly affected,” he surmised, adding that large dam projects have varying impacts according to their specific design, geological setting and construction materials. “They are also individual in their impact on their environment.”

The study mentions several potential effects of dams to the riparian area, whether it is downstream or upstream. While the upstream might be flooded, the downstream ecosystem might be impacted by the alteration in water properties depending on the dam’s design and discharge methods. However, it says since the 1980s there had been efforts to address those issues.

In the case of the Upper Atbara Dam Complex, the French company Sogreah did the impact study for Sudan’s Dam Implementation Unit (DIU) before construction. The document provides a “Preliminary Resettlement Action Plan that will have to be actualised and detailed in a further stage after completion of an official census of people and goods that will be affected, and a Public Information and Consultation Campaign”.

The study states that regarding the Sudanese legal framework, “The Environmental Health Act, 1975 contains detailed provisions for the protection of water and air from pollution and assigns defined administrative responsibilities to District Councils with respect to

*“A dam
built
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preservation of environmental health in general”. However, it doesn’t contain a chapter about the environmental impact.

Mohamed Abdelkarim, a resident of the area and an activist on the local consequences of the dam spoke to The Niles about the environmental impact of the construction.

“The dam has impacted the area in several ways, even safety standards and measurements while building the dam were not followed,” he said.

Abdelkarim noted changes such as flooding, variations in the length and amount of rain falling during the rainy season and the increase in insects that threaten crops, and therefore impacts farming.

Prof Hussien Suliman, an environmental expert who participated in the environmental assessment study by Sogreah told The Niles that the downstream area naturally contained diverse vegetation that hadn’t been erased by agriculture like other places in el-Gadarif State.

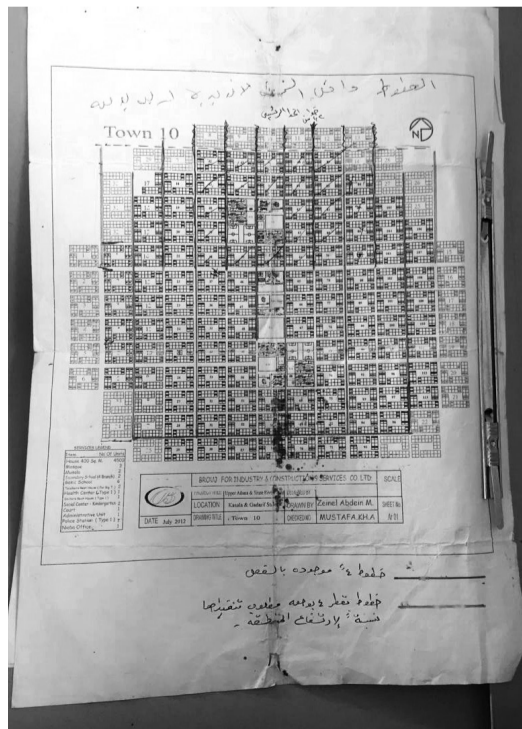
“The area didn’t witness agricultural activity, and the grazing was limited which meant most of its diversity was intact - some now extinct plants species existed there. All that is now underwater is lost. It would have been beneficial to save some samples at least. I suggested that the authorities make an artificial garden and keep samples from the area to save them, but I don’t think they did,” Suliman said.

Regarding the aquatic environment, he said a significant change must have happened: “We can’t determine for sure, but shallow water fishes can’t exist. The dam also changed the conditions for some wild animals,





"They call Atbara Dam Complex 'The White Dam.'"



Well-established houses, infrastructure and basic services fall behind what was promised in towns created for people who had to make way for the Upper Atbara Dam Complex. Photos: The Niles / Elzahraa Jadallah

and they fled the area. It also impacted fruit trees, gardens and seasonal farming, all that drowned, and it impacted people in many ways. Grazing was also impacted as natural grazing lands were lost".

"I don't think that the government had followed the recommendations of the studies done by Sogreah upon constructing the dam," Suliman said.

"The former Minister of Health had stated that the bathrooms weren't fit as the pits were only 160 centimetres deep. But the Dams Implementation Unit ignored that, leading to disastrous problems.

People usually dispose the waste from their bathrooms every three months in the farms – they were told by local leaders that it helps to fertilise the soil – and that led to even more contamination issues," Manahil Edris from The Supreme Council for Environment of el-Gadarif State told The Niles.

"We formed a committee to address those issues and filed a complaint to the Governor of el-Gadarif State about five years ago. That caused a row and newspapers wrote about it, but shortly afterwards the National Security stopped the process and told us not to pursue it any further. Samia Mohamed, the General Secretary of the Council in el-Gadarif, is determined to pursue the fight," Edris added.

The resettlement

After the study and design phase in 2010, the Dam Implementation Unit started to resettle people living close to the dam site. They had Sogreah's Preliminary Resettlement Action Plan from 2009, which recommended that, as far as possible, World Bank policies must be followed regarding involuntary resettlement, indigenous people and cultural property.

These policies cover issues like eligibility for benefits and planning instruments for involuntary resettlement.

The Preliminary Resettlement Action Plan acknowledges the dam's multiple impacts on the area, for example, loss of residential land, village areas, buildings, socio-economic infrastructure, services (health units, schools, markets), not to mention the loss of both agricultural and non-agricultural income.

Besides, the building site and camps also affect the area, for example through increased traffic, social disruption, loss to agricultural production as farmers and their families are moved, loss in fish production, changes to public transportation.

"Efforts have been made at this stage of the Preliminary Resettlement Action Plan to minimise the displacement of villages and population, to resettle in the vicinity of the present villages and to minimise also land acquisition needed in actual rain-fed agricultural land, giving priority to village reinstallation in not affected karab land or shrub savannah in the neighbourhood of the rain-fed agricultural lands of the villages," the study states.

A member of the former administration of the Dam Implementation Unit was asked for comment and detail on the relocation process and compensation but declined to comment.

The dam also covered several historical sites that would be saved, according to an arrangement between the Dam Implementation Unit and the National Museum of Sudan from 2013.

The White Dam

"They call Atbara Dam Complex 'The White Dam' as it witnessed no conflicts or protests from the locals upon construction, unlike other dams in the country," Abdulrahman Awadelsied, a resident of a town of resettled people, told The Niles.

Some 13 new towns were created; eight complexes within el-Gadarif State and three in Kassala. When the officials came, locals welcomed the overall benefits of the dam. The population had been settled in the area for hundreds of years and had houses, farms, livestock and services.

Awadelsied, like many citizens, has complaints about the



resettlement, saying that the authorities cheated them into moving without offering alternatives. “The construction of the dam moved people from their homes and lives, and the whole geography of the area changed,” he says.

“People were moved to those new complexes and expected the services and the well-established houses and facilities they were promised; they expected proper water-pipeline networks, electricity, decent infrastructure and other basics; instead they were shocked by the poor quality of buildings and the lack of almost everything.”

Awadelsied explained that the standard home was meant to cost more than SDG 200,000 (approx. EUR 3,000) according to the budget: “But when we moved here in 2012, the actual houses couldn’t have cost more than SDG 20,000-30,000 each. The quality was so poor. Relocation companies were highly corrupt.”

Also, as part of their relocation, every family was promised a small project to help them make a living, Awadelsied said: “The plans included agricultural machines and equipment, but no one received anything.”

Many citizens from the 11 newly created villages voiced complaints. They lacked staff and facilities like schools and health centres. Some of the buildings also needed repairs.

Town ten, which is home to about 4,500 families, for example, has only one health centre. It has three elementary schools and two high schools but no staff to teach the scientific track. Classes are overcrowded, and they are short of books and other vitals, according to locals.

Marwan Abdulla, a doctor at the town ten health centre, says it lacks beds and medical devices. “We most severely lack staff, and the biggest struggle is water, and that’s a general issue in the area. We have just two general doctors, four nurses, one gynaecologist,” he said.

“As a general doctor, I see all patients. Those who need specialists have to be transferred to more equipped hospitals, but there is no ambulance or a car. We have x-ray and dentist equipment, but we don’t use them as there are no specialists. The lab has only basic equipment. There’s a pharmacy with an assistant, but the supplies usually don’t last more than a week.”

Some people in the towns also lack electricity, and there is no clean water access in most of them. The pipeline is flawed and in need of repairs. “Every autumn people drink directly from the lake or other shallow water sources and face disastrous health complications and water-borne diseases,” an engineer told The Niles.

Some people are yet to be relocated, and they also struggle. Those living in the eastern neighbourhood say that water floods their houses every autumn.

“We suffer from flooding, the bad environmental situation, and many of our children drowned during the rainy season, the insects caused diseases. We need to be moved like anyone else. The dam made the lives of women and mothers very difficult,” says Aisha Awad who lives there.

Ali Adam, a resident of the eastern neighbourhood living with disability, said water reaches his door during the rainy season. “My children are at constant risk of drowning. As a person with disability, things are tough for me. When people were getting relocated, I went to the authorities to discuss my compensation for lost land. Every time I go, they tell me to wait.”

Adam is not alone. In fact, all of the lands where the 11 new towns have been built belong to people that are seeking replacements, compensation or justice.

The World Bank Policy on resettlement advises that displaced persons should be told about their possible options and rights. They should be offered choices and provided with technically and economically feasible resettlement alternatives.

However, Abdelkarim said citizens were largely excluded from the decision-making process: “The authorities used citizens to accomplish their agenda, taking advantage of the lack of awareness among the people in the area. They also took advantage of the local leaders

“What happened wasn’t humane, and there was great injustice.”

who were mostly loyal to the Islamic Movement and the National Congress Party (NCP).”

Surveys were conducted to count citizens and their assets before resettlement. However, this process was reputedly flawed: “Local leaders – who are from the NCP - chose the people. They were extremely biased: they controlled the lists and the compensation,” Abdelkarim said.

The DIU did most of their work in the dark. Even bidding for infrastructure permits wasn’t transparent.

“What happened wasn’t humane, and there was great injustice. We’re demanding investigations and accountability from the government and the companies involved – a group of about 11 - which executed the project in the absence of competition or public consultation – and with the government’s blessing.”

In the absence of any response from the authorities, citizens formed the association of Atbara and Setit displaced people. In 2015, they together with Marawi dam displaced people and in cooperation with the youth committee against the Kajbar dam formed a union and an initiative called “this land belongs to us”. They sought to join forces and write a draft of rights to open investigations.

The union launched awareness-raising campaigns, conducted studies, and wrote papers about the areas impacted by the dams. After the revolution, they decided to expand the alliance, and now it contains more than 48 advocacy bodies.

There are different secretariats within the alliance dealing with issues beyond dams’ problems, including land grabbing, environmental issues related to mining and border-line-conflict issues.

“We believe that the answer to all the issues in Sudan is a just civil government that achieves sustainable development and invest in the human resources in the country,” says Abdelkarim.

Economic impact

According to Sogereah’s study, the World Bank’s policies advise against involuntary resettlement unless necessary, and argue that resettlement should take the form of sustainable development programmes with sufficient investment resources. The project definitely received funds, but activists and locals ask where they ended up. “Where did they go?” questions Awadelsied.

“Displaced persons should be assisted in their efforts to improve their livelihoods and standards of living or at least to restore them,” states the Preliminary Resettlement Action Plan.

But Awadelsied said that local people are relying on their relatives in cities for support after losing their financial stability.

Murtada Ahmed, a local teacher, says that a ferry was part of the transportation plans after the construction of the dams. However, it was taken over by NCP officials, and they charged people unreasonable amounts of money to use it and cross the river with their crops.

That led many people to stop cultivating crops and abandon their lands. “Before moving the villages, we had markets. We still don’t have an official market, but people made a local market on their own, yet the authorities still take taxes and fees from them”.

Abdurrahman Faki, a teacher from the area, told The Niles that resettlement authorities asked people about their income sources, jobs and houses, which should have subsequently been replaced. “They cheated people,” he added, pointing out that authorities only compensated people with marriage certificates, regardless of what they had owned before their relocation.

“The property in which housing schemes are built belong to other people. I have the legal papers to two lands, we went to court and got orders to retain our properties which have been occupied by corrupt individuals loyal to the previous regime. It’s four years now, and we couldn’t implement those orders. In total, 700 families in the eastern neighbourhood lost their rights. They face an uncertain future”.

Sennar: A dam, a scheme – but water suffi- ciency remains a pipe dream

Alaa Eliass, Elfatih Mohammed
& Mohamed Hilali
Khartoum, Sudan

Musatim Musa, who also lives in the eastern neighbourhood says that authorities even oppressed those who tried to speak out: “When the displacement happened, they came with security forces, and any of us who complained were arrested. When we went to our farmlands, we were met with force and thrown out. We blame our local committee; they are the ones who cheated us. I am married and wasn’t compensated, while their children as young as six have houses. We demand that the committee be held accountable, and we can prove our cases,” he said, adding that favouritism by local leaders is the reason why they lost out.

New administration

After the revolution, a change of administration occurred in the DIU, Eng. Ahmed Sidig spoke to The Niles on April this year, shortly after being appointed as the DIU’s new manager of Dams and Reservoirs.

He stated that most of the information on the resettlement belongs to the committee of resettlement, adding that as he’s new to his position, he can’t comment on past projects.

Regarding the environmental problems and health hazards people suffer from, the location of the housing scheme and the agricultural nature of land people had been resettled to that caused them issues, Sidig says that every reservoir has prior studies that determine the area where people should be relocated to.

“When DCUAP was constructed, people didn’t follow the instructions and weren’t committed,” he said.

Lessons learnt

Adam Babicker, a professor in el-Gadarif University who participated in the study of social impact told The Niles that the dam’s issues would have been avoided if they had adhered to the recommendations of the studies done by Sogreah.

“It seems that the unit only did the studies to be able to access funds,” he said, adding that the community that lost their farms and livelihoods should have been more adequately compensated.

“The health problems due to restrooms in the rainy season could’ve also been avoided by building houses to good standards. Authorities knew that people of the area are simple-minded and peaceful, so they mistreated them. This is a political issue,” he told The Niles.

Along with the loss and injustice people experienced, some of their current issues are pressing: “Residents in all the 11 towns currently suffer from water shortages as the water stations rely on electricity and gasoline. Why didn’t they use the electricity produced by the dam to solve the water issues,” Adam asked.

He added that authorities need to act to prevent possible clashes between residents from different backgrounds and who are struggling to survive with limited resources.

Although many continue to seek justice, they have still not received a clear response from the new government.

[This in-depth report was realised with an additional grant from IHE Delft & InfoNile]

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or some farmers in the Gezira Scheme, one of the largest irrigation projects in the world, the last winter season was a failure, as they faced severe water shortages.

Mohamed Abd Elrahim, one of the affected farmers, told The Niles how the wheat crop was damaged: “The wheat was irrigated only twice with streamlined irrigation, the rest with pumps – until the water was cut off. The result was that more than 100,000 acres were lost.”

Elrahim and other affected farmers reported that they did not receive any assistance from the authorities.

Sudan’s Minister of Irrigation and Water Resources, Prof Yasir Abbas Mohamed Ali, said that the biggest problem is the rising amount of cultivated land. While 400,000 acres of wheat was planned for cultivation, he said that “the actual areas cultivated amounted to more than 500,000 acres”, consequently leading to water shortages.

He announced measures to halt agricultural activities requiring irrigation beyond what is planned for. He said police and a special office for irrigation would monitor for any violations exceeding the plan.

Agricultural production in the Gezira Scheme depends mainly on industrial irrigation, as well as rain between July-October, which helps to water some summer crops.

The scheme

The Gezira Scheme started in 1911 as an experimental farm for cotton cultivation covering an area of 250 acres. After the success of the experiment, the area was increased year by year until it reached 22,000 acres in 1924.

A year later, the Sennar Dam was opened, and the irrigated area was expanded to about one million acres in 1943. Then, between 1958 and 1962, agricultural land with an area of another million acres was added, known as the extension of Managil, bringing today’s total area to 2.2 million acres.

It is located in central Sudan between the Blue and White Niles, in the muddy plain between Sennar and the capital Khartoum. The project was created to supply the British cotton factories, which continued to form the backbone of Sudan’s economy after independence.

Gezira is Africa’s largest irrigation project and the largest farm in the world with one single administration. It houses more than three and a half million people, and individual farmers have plots measuring between 15 and 40 acres.

“The project is irrigated by what is known as flow irrigation,” said irrigation engineer, Muawia Mohamad Eltayeb. “Water is distributed through a network of canals covering 375.14



kilometres in length, with a storage capacity of 31 million cubic metres”.

The dam

Built in 1925, the Sennar Dam is Sudan's oldest dam, constructed during British colonial rule. It is located in Sennar on the Blue Nile in the Gezira region. It is 3,025 metres long and 40 metres high. It took ten years to complete.

The Sennar Dam was created to store and divert water for the Gezira Scheme irrigation, in addition to generating hydropower, flood control and water supply.

There is no mention in the Ministry of Environment records of any environmental study before the dam was built, reflecting a lack of ecological awareness at that time.

Obtaining hydroelectric power was one of the reasons for building Sennar Dam. Although it is considered renewable energy, it still impacts the environment. For example, the lake formed by the dam destroyed the natural habitat for animals in the area.

Impeding the flow of rivers can also prevent fish from moving freely from one area to another. In addition, there is the risk of lethal floods in the event of the dam collapsing, which could kill thousands of people.

Talal Mohamed, an ecologist living in Sennar, noted other disadvantages, including the prevalence of diseases like Malaria, Bilharzia and Guardia. “Those diseases are all caused by insects living in the dam's lake,” he said.

However, he noted the dam offers advantages. “It is a source of income for many people around the dam's lake, enabling fishing and gathering of firewood caught in the dam's lake. Also, many farmers irrigate their crops from the dam's water supply, and Sennar's electricity is more stable than that of many other cities in Sudan.”

Originally designed with a capacity of 930 million cubic metres, today, it can store only 390 million cubic metres of water, around 60 percent less, due to accumulated sedimentation and silt in its reservoir.

As reservoir capacity was lost, channel design became disordered, with silt blocking major canals, minor canals and field canals.

“Modern techniques would avoid [...] the large quantities of wasted water.”

During the rainy season in the Ethiopian highlands, the vast amounts of water in the Blue Nile lead to embankment erosion. Besides the silt, the water carries drowned animals, trees, and rubbish into the reservoir, and finally to the cultivated fields, often devastating crops.

On the way to Sennar Dam, mountains of silt can be seen along the Gezira's main canal east embankment, indicating a significant amount of silt coming from upstream highlands.

Wubalem Fekade, the Head of Social Development and Communication at the Eastern Nile Technical Regional Office (ENTRO) observed that without the Sennar Dam and the adjacent Gezira Scheme, where upstream sediments are caught, “there would definitely be much more sedimentation downstream”.

The silt

Dr Younis Abdallah Gisamallah, from the Directorate of River Engineering and Dams of the Hydraulic Research Centre (HRC) said that while the Blue Nile has an average sediment load of 146 million tonnes per year, sediments inside the Gezira Scheme accumulate to approximately 7.5 to 8.5 million tonnes per year.

“Efficient workers and engineers at the Excavation Corporation and the Irrigation Authority used 40 percent of that silt at the beginning of irrigation, which contributed to fertilising the soil, and then they removed the rest professionally and without damaging the space and volume of channels,” said Hassabu Ibrahim, the 70-years-old Chairman of Gezira and Managil farmers Alliance, who lived all his life at the scheme.

In 2005, things took a different turn, as private businesses got involved in the silt excavation. Elsadig Ali, a farmer living in the area, said that “companies working in the silt removal caused a water shortage due to over digging”, reducing the water level.

“They worked without technical guidance and changed canal design – the depth and width,” Elsadig explained, adding that “the water of the canal couldn't even reach field channels” anymore.

Managing the silt is a delicate procedure, as too much or too little of it causes water shortages in the irrigation scheme. This comes at a high cost. Officials in Sudan say that 50 percent of the operation and maintenance cost from the ministry budget is used for managing the sediments.

Is there a long-term solution?

Given the resources spent on managing the sediments, and the recurrent water shortages associated with too much or too little sediments in the Sennar reservoir and the Gezira irrigation canals, the search for a long-term solution is on.

“We must change the planting times gradually until the canals and the irrigation network return to what they once were,” said Ibrahim.

The agricultural engineer, Abeer Ali, meanwhile, agreed that planting times should be changed. She also spoke out in favour of stopping the cultivation of crops that consume large quantities of water, like animal feed, for example.

Ali also recommended using modern techniques: “Modern irrigation techniques such as pivot and drip irrigation should be used instead of flow irrigation,” which would increase water application efficiency and minimise fertiliser and nutrient loss due to a localised application and reduced leaching.

Ali, who specialised in the field of plant protection, pointed out that “modern techniques would avoid the risk of harmful weeds growing, plant disease, and would reduce the large quantities of wasted water”.

The HRC Directorate of River Engineering and Dams see the Grand Ethiopian Renaissance Dam (GERD) as part of the long-term solution. They say, once operational, the GERD reduces the amount of sediments in the Blue Nile and maximises the Gezira Scheme's irrigation efficiency.

TN

"I don't think the dam has a big effect"

Alaa Eliass
Khartoum, Sudan

Hatim Abdelhadi, a 30-year-old lawyer in Sennar, talks about how the Sennar Dam changes the lives of those living alongside it.

The Niles: *In your opinion, what are the good and the bad aspects of the Sennar Dam?*

Hatim Abdelhadi: I can't say that there are many adverse effects from the dam, except the many mosquitos living and reproducing in the dam's reservoir. The dam was built for its positive impact of providing irrigation for the farms of Gezira, Managil and other agricultural projects near the city, as well as generating electricity.

TN: *Are there any diseases in Sennar that are linked to the dam?*

HA: Malaria is the disease that I believe is connected with the dam. After all, mosquitos live and breed in the lake. That has made malaria one of the endemic diseases in Sennar.

TN: *Do you think air humidity is higher in Sennar than elsewhere in Sudan because of the dam's lake?*

HA: The air humidity is normal to me – it's not very high or low. I don't believe that the dam has affected air humidity.

TN: *Are there big populations of mosquitos, scorpions or house flies in the area?*

HA: We have big numbers of mosquitos in the city linked to the dam, but I think we don't have an excessive number of other insects, although there are scorpions and snakes in the grass near the dam's lake.

TN: *Is electricity stable in Sennar?*

HA: Electricity is more stable here than in other cities: the electricity is cut off once or twice a week, except in the autumn.

TN: *From your information, were people forced to move due to the Sennar Dam? Was compensation paid to these people?*

HA: Yes, there was forced transfer of some

families near the dam area because they were at risk of drowning and their agricultural lands were sinking in the dam's lake. From what I heard they were compensated.

TN: *Have you been personally negatively affected by the dam?*

HA: Yes, I have had Malaria many times, but other than that, I don't see any evident impact.

TN: *Do you personally benefit from Sennar dam? How?*

HA: Yes. We can get a lot of fresh fruits and vegetables from different farms around the dam which are directly irrigated by it.

TN

"Electricity is more stable here."

A fisherman at work in Sennar.
Photo: The Niles / Dominik Lehnert



Choke Mountain sediments stifle downstream reservoirs

Dagim Terefe
Addis Ababa, Ethiopia

Growing populations and their needs put pressure on the Choke Mountain ecosystem – and the consequences reach as far downstream as Egypt.

"We are suffering as flooding washes away the soil with our seeds."

A

t an elevation of over 4,000 metres, Choke Mountain in the tropical alpine environments in Ethiopia's Amhara region is experiencing rapid population growth, deforestation, land degradation and seasonal flooding.

The Choke watershed is the water source for the Upper Abay (Blue Nile) river system, which includes more than 59 rivers and 273 springs.

Belachew Miherete, a 52-year-old farmer, has five children and works on his father's farm. "I have been farming with my father and getting crops and produce from his land," he said.

Belachew, like other farmers in the area, underlined that the Choke's regional ecosystems are deteriorating as the climate warms. "We are suffering as flooding washes away the soil with our seeds during 'Kiremet' (Winter)," he said.

Choke means "very cold" in Amharic. Until about 20 years ago it was covered with a glacier, but these days it is rare to see snow and frost, not to mention vegetation like the giant lobelia gibberoa tree which was traditionally found in the region.

The Choke Mountain ecosystems are also under pressure as agriculture reduces biodiversity and the alpine zone retreats. Land use pressures of a growing population are affecting the agro-ecological systems.

Land degradation associated with over-cultivation impacts watershed-wide erosion rates and affects the quality of water for downstream users, including the Great Ethiopian Renaissance Dam.

Siltation, the increasing amount of sand and other particles in the water, increasingly affects the downstream countries Sudan and Egypt.

According to a United Nations Office for the Coordination of Humanitarian Affairs (OCHA) report of 2019, higher than average rainfall during the first weeks of August triggered flooding in South Gondar Zone in the Amhara region of Ethiopia and killed two people and inundated many households.

The flooding occurred in the Fogera and Libo Kemekem districts on August 11 and 12, and is attributable to the overflow of the rivers that are tributaries of Lake Tana and the Blue Nile. Reportedly 25,000 people were affected, 6,653 houses were flooded, 18 schools were damaged, and 3,428 hectares of crop-areas were covered by water.

This year the pattern was repeated, and the damage was even worse. On the same dates in August, a large number of communities were affected, but the extent of the damage has not yet been officially announced.

Local livelihoods on the line

Studies by Debre Markos University reveal that the Choke Mountain watersheds have been facing flooding and erosion resulting from population growth, settlement,

overgrazing, deforestation, and unsustainable agricultural practices.

The Choke agro-ecological problems have been noted by environmentalists, government and non-governmental organisations, sparking a series of initiatives and projects.

Debre Markos University and Addis Ababa University have conducted several surveys, identifying socio-economic aspects of the Choke Mountain communities.

"We have conducted a research on what kind of livelihood options are recommended to avert the existing severe ecological problems," said Abiyot Molla, Director of Choke Watershed Research Project Development Department at Debre Markos University.

The university is working with East Gojjam Zone Rural Land Administration Authority and the Federal Environment Commission's project office of Mainstreaming Incentives for Biodiversity Conservation funded by the Global Environment Facility.

Extreme rainfall has been a significant problem in the Choke watersheds, causing floods that can significantly damage agriculture, ecology, infrastructure, disruption to human activities and the loss of property, especially downstream of the watersheds.

The high cost of sedimentation

Sudan and Egypt have been building many dams along the Nile for various purposes, valid experiences upstream riparian countries, including Ethiopia, should take into account.

According to Dr Eng Manaye Ewenetu, Associate Engineer at Me Consulting Engineers, siltation of these reservoirs has been a major issue for storage and the structural integrity of the dams.

The sedimentation, within their reservoirs, reduces their storage capacity and their effective life span, he said.

He also mentioned that the Sennar Dam built on the Blue Nile in Sudan for irrigation purposes has lost more than 60 percent of its original water storage capacity due to the sediment deposition over 61 years, according to publicly available studies.

The Roseires Dam, which was constructed on the Blue Nile (Sudan) to store water for irrigation lost 36 percent of its original water storage capacity over 28 years.

The High Aswan Dam Reservoir (Lake Nasser) has a total length of about 500 kilometres (350 kilometres inside Egypt and 150 kilometres inside Sudan). More than 124 million tons of sediment per year is deposited in the Lake Nasir reservoir, which has reduced the reservoir volume tremendously.

Sedimentation is seen as a critical problem for Ethiopia, and it could cost millions of dollars to avoid the silts from the Grand Ethiopian Renaissance Dam's reservoir.

However, according to experts, the Grand Ethiopian Renaissance Dam will substantially reduce the sedimentation problem to reservoirs in Sudan and Egypt.

"This will directly benefit the downstream countries with additional agricultural production, energy generation, river navigation and water supply", Dr Manaye said.

As the Nile is a shared river, both the Ethiopian government and several academics call on basin countries to share responsibility for conserving the environment.

More ambitiously, the Ethiopian government also wants countries downstream of the Nile, including Sudan and Egypt, to contribute financially towards maintaining Choke's ecosystem services.

Some 85 percent of the Nile River emerges from the Ethiopian highlands. "Choke Mountain by itself contributes more than 10 percent of the Nile water. So the ecosystem is not just invaluable for Ethiopia – the downstream countries Sudan and Egypt should also take a share in the problems facing this landscape and act accordingly," said Abiyot.

Adding legal support to this argument, Article 2 of the Convention on the Protection and Use of Transboundary Watercourses and International Lakes (Water Convention) also states that "the Parties shall take all appropriate measures to prevent, control and reduce any transboundary impact".

TN



Farmers are ploughing their field on the slopes of Choke Mountain.
Photo: The Niles / Dagim Terefe

'The Dams of Welfare'

Author | Photographer:
Asmaa Gamal
Cairo, Egypt

The city of El Qanater El Khayreya emerged after a dam was built and has since become a magnet for local and foreign tourists alike.



The Mohamed Ali Bridge on the Damietta section of the El Qanater El Khayreya dam was named after Mohamed Ali Pasha, the Albanian Ottoman governor and the de-facto ruler of Egypt from 1805 to 1848. Many tourists consider the bridge as one of the most beautiful places in El Qanater El Khayreya.

El Qanater El Khayreya is a city in the El Qalyubiya Governorate, North of Cairo, where the Nile splits into the Damietta and Rosetta branches - right at the beginning of the Nile Delta. Its unique location led to the construction of the El Qanater El Khayreya Dam, which in Arabic means "The Dams of Welfare", and soon a city grew around it.

It is believed that the foundation of a modern irrigation system in Egypt started when Mohamed Ali Pasha laid the cornerstone for the two-section dam in 1840. Its main purpose was to protect the Nile Delta from getting flooded whenever the water rose above dangerous levels. The dam was also accompanied by water management schemes to distribute water to the West, East and centre of the Nile Delta region.

The dam sections – the 465-metre long Rosetta section and the 545-metre long Damietta section – were completed in 1862. Since then, the city which lies just 22 kilometres from Cairo has flourished, attracting millions of local and foreign tourists every year with its many parks, gardens and stunning views across the Nile.

For today's residents of El Qanater El Khayreya, 'The Dams of Welfare' have lived up to their name, providing income, food and an economic boost for the region.

TN



El Qanater El Khayreya is a top tourist destination, especially among Egyptian families living in Cairo. The short drive from Cairo makes the city an ideal spot for longer holidays or short weekend trips, offering an escape into nature with an abundance of plants and birds.

Farming is not the only source of income. Seyed Ahmed, a 20-year-old living in El Qanater El Khayreya, makes a living by driving foreigners and locals around the city's historical sites. He says every morning they wash the horses and carts on the shores of the Nile.



Fishing is common in El Qanater El Khayreya. These two men fishing near one of the dam sections say they have an excellent spot to catch a variety of fish.



The 465-metre long Rosetta section has 61 arches of 4.8 metres in length, each containing an adjustable floodgate. The floodgates are operated with a crane on rails, controlling the flow of the Nile into the Nile Delta.



The dam sections serve as bridges to cross the Damietta and Rosetta branches of the Nile. This comes in handy for the local farmers and herders who benefit from fertile lands surrounding the city of El Qanater El Khayreya.

El Qanater El Khayreya offers a variety of foods cooked in traditional styles, as well as museums and chalets, all of which are affordable for all classes of people. It shouldn't come as a surprise that Egyptian leaders, such as King Farouk and President Anwar Al-Sadat, had holiday homes near 'The Dams of Welfare'.

Do we need a framework for dams?

Waakhe Simon Wudu
Juba, South Sudan

The Eastern Nile Technical Regional Office (ENTRO) is drawing up a coordination framework for dams in the region, aiming to ease conflicts about dams and water supply in the future.

The planned framework seeks to organise and coordinate the operation of dams in the Eastern Nile Basin, according to Michael Abebe, the Regional Coordinator for Water Resources and Dam Safety at the Eastern Nile Technical Regional Office (ENTRO) in Addis Ababa.

“In the last ten years many more dams were constructed in the Nile Basin, so the issue is getting more attention,” said Abebe, of the planned coordination mechanism, which comes against a backdrop of rising tensions between countries about dams and water usage.

It aims to maximise dams’ benefits, helping to make the most of the water resources in the basin for the riparian states who share the waters of the Nile. It also reduces risks of inefficient or unsafe operation of dams along the Blue Nile.

Work began on the framework back in 2018, and it will detail how countries can cooperate on dams’ operation.

Once the ENTRO technical team, in close coordination with the countries of the Eastern Nile region, has finished the framework, likely in two- or three-years time, it will need to be adopted by ENTRO member states.

Rising conflicts

Tensions have emerged between the Nile Basin Initiative (NBI) member states as dams are constructed. For example, a long-running dispute between Ethiopia, Egypt, and Sudan over the waters of the Nile flared in 2020, as Ethiopia moves toward completion of Africa’s largest hydroelectric power project, the Grand Ethiopian Renaissance Dam (GERD).

Dr Mohsen Alarabawy, Regional Technical Specialist at the NBI, says the region’s population increases by 2.5 percent annually. The basin’s total population is on track to double by 2050. This will mean increasing usage of the Nile waters as the population increases, putting intense pressure on water supply.

Although organisations such as the NBI have worked for decades to ensure the best use of the Nile’s waters in the region, there is still no overarching coordination mechanism for dams.

“Unless you manage them properly or you coordinate your operation, there might be a scarcity of water in the region again because of security issues,” Abebe said.

Averting water wars

Nhial Tiitmamer, an environmental expert from South Sudan, said a framework on dam management “will reduce conflicts between member states and build cooperation instead of antagonism”.

“Most of the focus on dams has been on safety and environmental and social impacts of the dams, but there has been less focus on the rights and obligations of member states sharing an international river such as the Nile River,” he added.

The World Commission on Dams has underscored the need for moves to eliminate conflict relating to dams. It outlines best-practice models and bleakly states: “when rivers cross borders within or between nations, water scarcity leads to water stress which leads to water wars.”

“Decisions on dams must respond to a wide range of needs, expectations, objectives and constraints. As matters of public choice and policy, they will always reflect competing interests and require negotiation.”

“The Nile riparians must understand that the river is a common resource whose effective management must be approached from a basin-wide perspective. Thus, it is only through cooperation that Egypt, Ethiopia, Sudan, and the other riparians can peacefully resolve conflicts over the Nile and achieve the type of water use that will contribute significantly to regional economic and human development,” recommends John Mukum Mbaku.

Coordinating the operation of dams in the Eastern Nile Basin is a crucial pillar of managing the Nile waters. If adopted by the ENTRO member states, the suggested coordination framework for operating dams would significantly contribute to ensure equitable water supply for all Nile Basin citizens in the future. And with every new dam being constructed, the need for such a framework increases.

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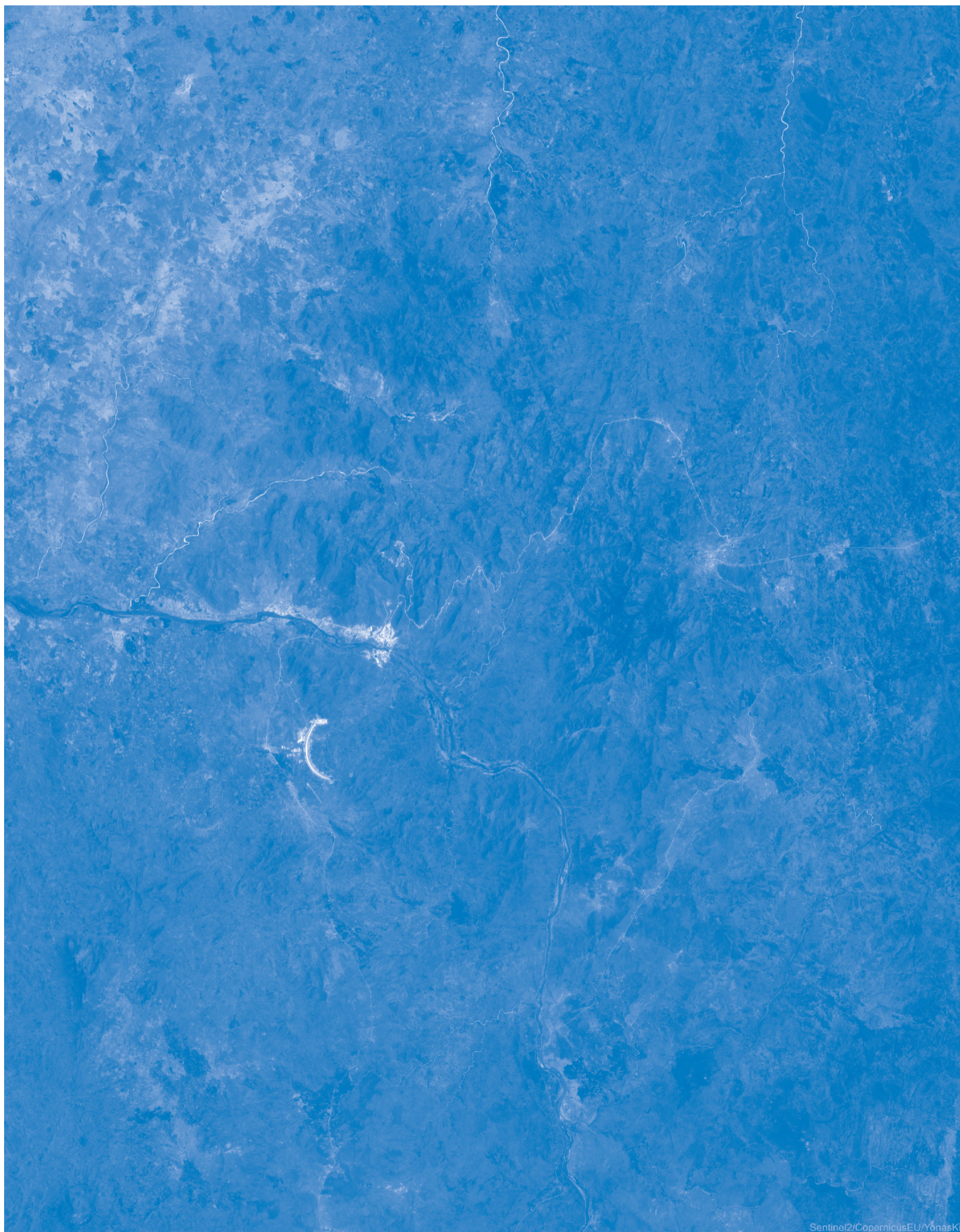
“Effective management must be approached from a basin-wide perspective.”

“The dispute over the GERD is part of a feud the downstream states on the one hand, and Ethiopia and the upstream riparians on the other over access to the Nile’s waters, which are considered a lifeline for millions of people living in Egypt and Sudan,” writes John Mukum Mbaku, Nonresident Senior Fellow - Global Economy and Development, Africa Growth Initiative in an article published on Brookings.

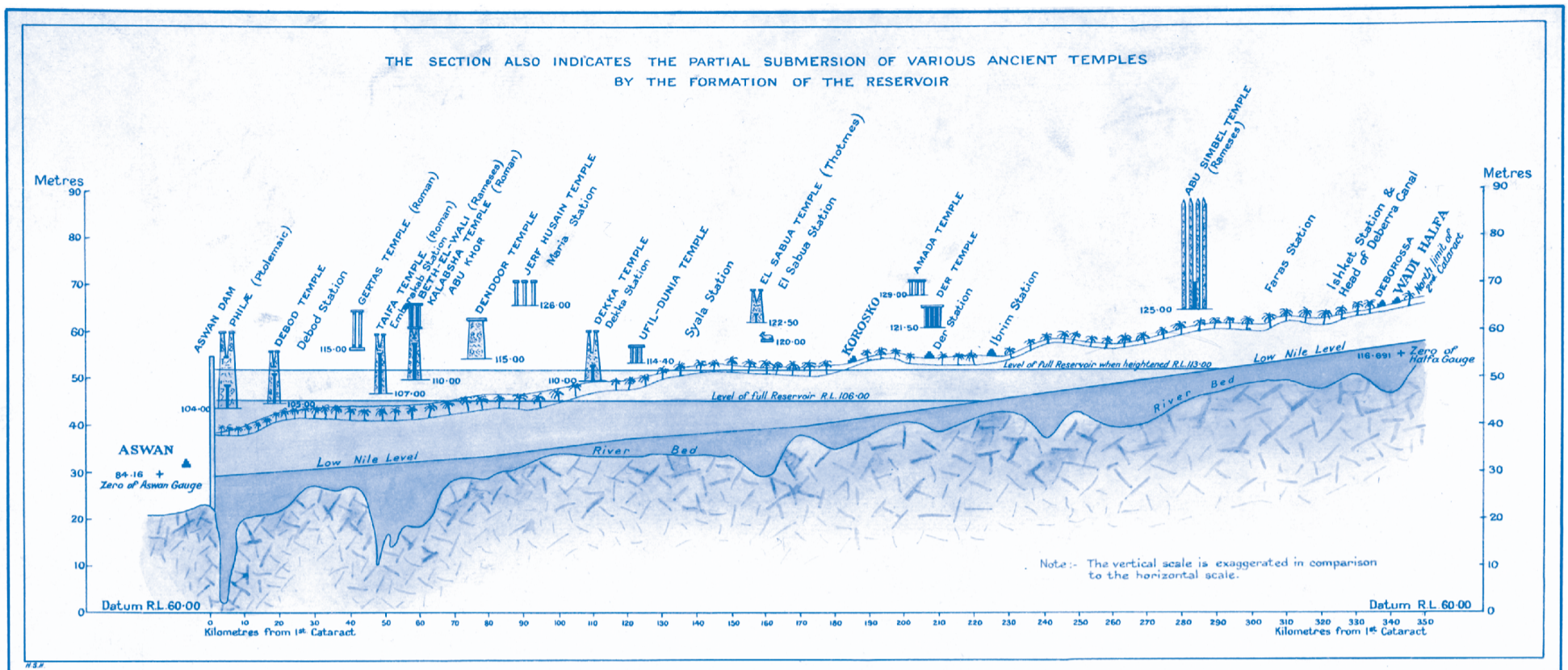
“Despite the intense disagreements, though, Ethiopia continues to move forward with the dam, arguing that the hydroelectric project will significantly improve livelihoods in the region more broadly,” he adds.

Observers say that more dams are likely amid rising demand for water and other services. Currently, the population of the NBI member states is estimated to be around 505 million.

The Grand Ethiopian Renaissance Dam (GERD) captured by the Sentinel-2 satellite on April 4, 2020.
Photo: Copernicus Programme



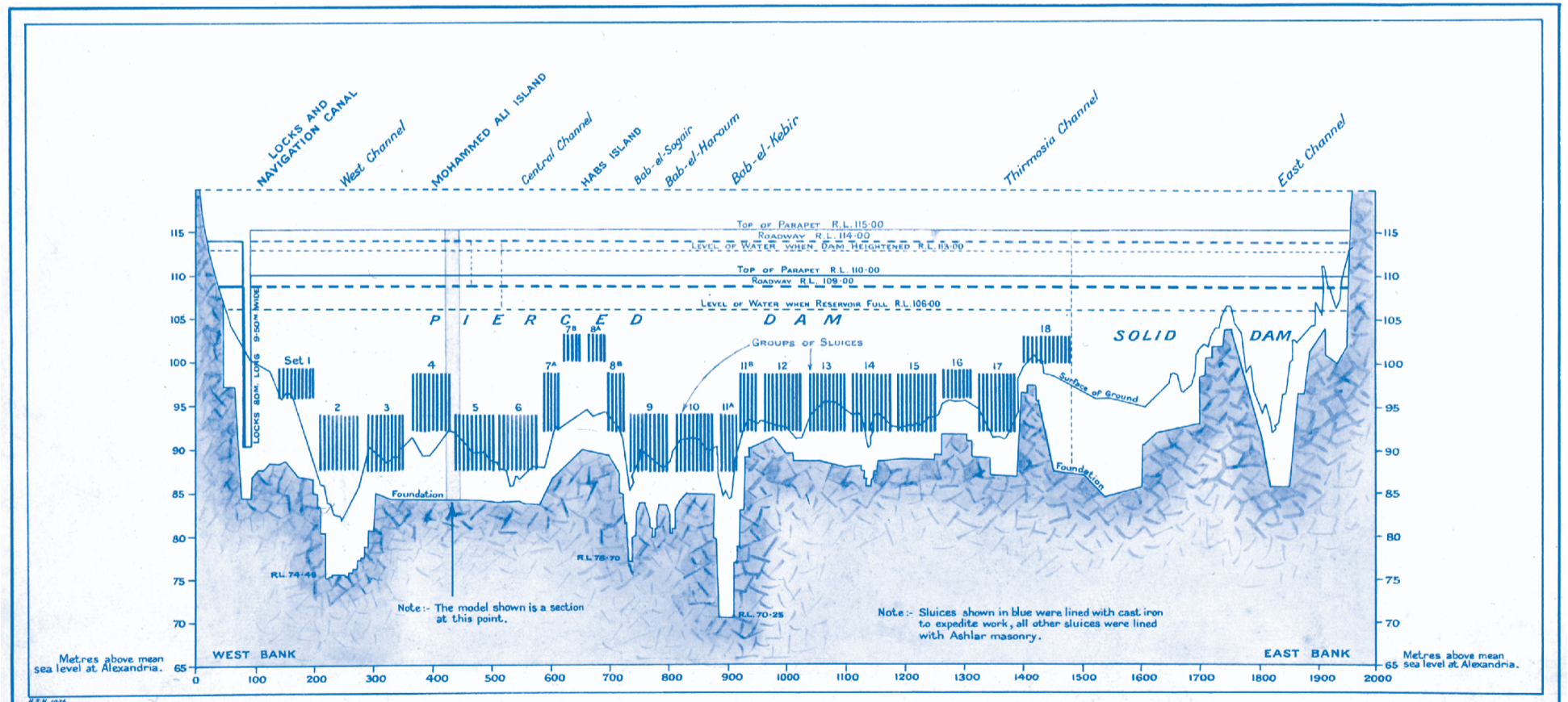
THE ASWAN DAM ACROSS THE NILE



LONGITUDINAL SECTION OF THE ASWAN RESERVOIR

SHOWING LEVELS OF WATER AT R.L. 106.00 (ORIGINAL HEIGHT)
AND AT R.L. 113.00 (AFTER HEIGHTENING OF DAM)

Note:- Reduced levels are in metres above mean sea level at Alexandria.



LONGITUDINAL SECTION OF DAM

The Aswan Dam across the Nile, Egypt, 1926:

Two longitudinal sections, one of the Aswan Reservoir, showing the partial submersion of various ancient temples by the formation of the reservoir and the water levels before and after heightening the dam. The other section is of the dam itself. Built between 1898 and 1902, the Aswan Dam was designed to better control the massive annual Nile floods for irrigation as well as providing hydroelectric power. After the dam was completed, it became clear that its height and the size of the reservoir behind it were insufficient. As a result, the dam's height was further raised in 1907-1912 and again in 1929-1934. Even after this the dam ultimately proved inadequate for its purpose, leading to the building of the much larger Aswan High Dam between 1960 and 1970.

Photo: SSPL / Getty Images