IJSES

International Journal of Social and Economic Sciences
E-ISSN: 2667-4904 13(2): 106-112, 2023
Research Article

NILE ECOSYSTEM SERVICES AND TOURISM CAPACITY IN SUDAN

İbrahim Musa Osman[1, 3]*; Ramazan Acar[2] and Mithat Direk[4]

[1] *Selcuk University, Graduate School of Natural and Applied Sciences, Konya, Turkiye*
[2]*Selcuk University, Faculty of Agriculture, Department of Field Crops, Konya, Turkiye*
[3]*University of Khartoum, Faculty of Agriculture, Department of Agronomy, Khartoum, Sudan*
[4]*Selcuk University, Faculty of Agriculture, Department of Agricultural Economics, Konya, Turkiye*

**Corresponding author: imosman00@gmail.com*

(Received 12th October 2023; accepted 21th November 2023)

Abstract
The Nile and its tributaries give an impression of the life of the population located in these areas. Likewise, the Nile Basin countries lie in tropical, arid, and semi-arid regions. The Nile crosses about 11 countries. All these countries depend on the Nile for their livelihood and well-being. it is one of the largest freshwater rivers in the world. The Nile journey begins in the tropical forest to the semi-desert and ends in the hottest desert. Sudan's economy is based on agriculture and livestock, which contributes about a third of the population's gross domestic product (GDP). About 40% of agricultural activities depend on the Nile for irrigation water. Wetlands have multidimensional ecosystem goods and services that contribute to environmental, social, and economic benefits critical to human well-being and are responsible for a variety of important ecological functions and services. The physical benefits people derive from the Nile and its wetlands include domestic water supply, fishing, grazing, agriculture, grasses, and wild plants for food, handicrafts, and medicinal purposes. In addition, the Nile provides pneumatic services to the local and tourist communities. Sudan has a rich heritage and stunning natural beauty making it an attractive destination for adventure seekers and history experts along the Nile as the tourism potential. The potentiality of the Nile should be planned to exploit this valuable resource wisely. The policy of sustainable use must be the priority of all decision-makers related to the ecosystem services and conservation of the Nile. Currently, we trying to stress the significance of the Nile (ecosystem services) to the Sudanese livelihood and tourism capacity.

Keywords: *Nile basin, recreation, welfare, water, wetland.*

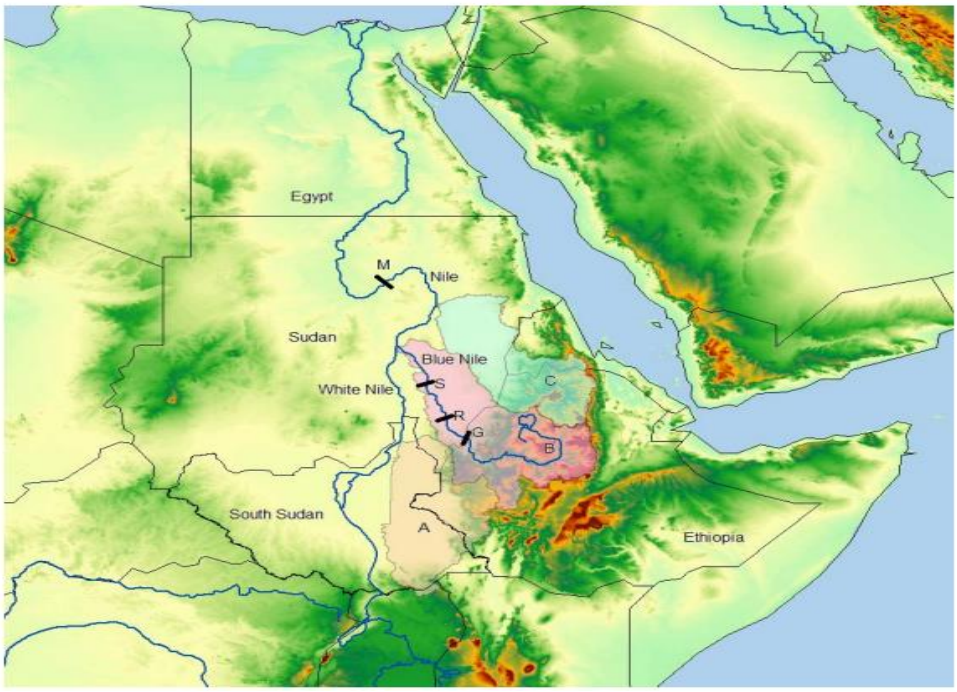
1. Introduction

The Nile represents a crucial resource for the economy of East and Northeast Africa. Water is a vital resource for all countries sharing the Nile basin. Water will be even more important in the future as these countries face larger population growth; hence, the Nile is the main water source for this growing population. Often the Nile Basin countries lie in tropical, arid, and semi-arid regions. Rainfall in arid is highly seasonal and the groundwater contributes as well, requiring reservoirs to meet agricultural needs during the dry season. In some seasons the rainfall is very erratic (Melesse et al., 2014).
At around 6,825 km, the Nile is the longest river in the world. It consists of two major tributaries, the White Nile, and the Blue Nile. The White Nile rises in the Great Lakes region of central Africa, with the most distant source being in southern Rwanda, and thence flows north through Tanzania, Lake Victoria, Uganda, and South Sudan. The Blue Nile begins at Lake Tana in Ethiopia and flows into Sudan from the southeast.

[1] Bu makale 22-24.09.2023 tarihinde düzenlenen "7th International Rural Tourism and Development Congress" de sunulmuştur. This article was presented at the "7th International Rural Tourism and Development Congress" held on 22-24.09.2022.

The two rivers meet in the Sudanese capital Khartoum and flow north through Sudan and Egypt to empty into the Mediterranean Sea.

The catchment area has been estimated to vary between 3.1 million km^2 and 3.3 million km^2. Eleven countries lie and share the Nile Basin: Burundi, the Democratic Republic of Congo, Egypt, Eritrea, Ethiopia, Kenya, Rwanda, South Sudan, Sudan, Tanzania, and Uganda. Around 238 million people live in the Nile catchment area (Melesse et al., 2014). Regularly, the basin countries particularly depend on the Nile in one way directly or indirectly for population livelihoods (Simon, 2019). The Nile journey begins in the tropical forest of (Tanzania, Uganda, and Rwanda or the highlands of Ethiopia) to the semi-desert (Sudan) and ends in the hottest desert (Egypt). It has been estimated that about 60 % of the Sudanese welfare and livelihood are confrontation from the Nile. Though no doubt that the Sudanese depend on the Nile as the source of water or its ecosystem services for their livelihood or some life aspects. Here we are trying to stress the significance of the Nile (ecosystem services) to the Sudanese livelihood and tourism capacity.



Map 1. The Nile Basin (Satti et al., 2015)

Geographically, Sudan is a large country in the Sudano-Sahel region of Northeast Africa between latitudes 10° and 23° N and longitudes 21° 45° and 38° 30° E and is situated in the middle part of the Nile Basin. It covers an area of approximately 1.9 million km^2 and most of the country consists of vast, arid plains intercepted by a few widely spaced ranges of hills and mountains. The country borders are South Sudan, Ethiopia, Eritrea, Egypt, Libya, Chad, and the Central African Republic. The country's population is estimated at around 43 million. Sudan's economy is based on agriculture and raising livestock, which contributes about a third of the population's gross domestic product (GDP). Sudanese agriculture depends mainly on rainfall and the Nile and its tributaries for irrigation. The Nile is considered one of the largest freshwaters around the globe (Adam, 1965; Central Bank of Sudan, 2017; Osman & Ali, 2021; Osman et al., 2023; World Bank, n.d). About 60% of Sudan's population is located around the Nile from the southern part of the Blue Nile state to the northern states depend mainly

on the Nile for water drink and cultivation. Water uses in Sudan are often irrigation and hydroelectric power generation. The intensive agricultural practices and dramatic population growth have led to more attention being paid to consumption policies and the management of Nile water in Sudan. Sudan is rich in water (the Nile, rainfall, and groundwater) and land resources. Surface water resources are estimated at 84 billion m^3. Annual precipitation varies from almost zero in the dry, hot north to over 1600 mm in the tropical zone of the south. The total amount of renewable groundwater is estimated at 260 billion m^3, with half of this amount located in the Nubian Sandstone and Umm Ruwaba Basin. Internal renewable water resources include the average annual flow of rivers and groundwater recharge resulting from endogenous precipitation within country borders (Omer, 2007).

2. The Nile welfare-livelihoods services of the Sudanese

Wetlands have multidimensional ecosystem goods and services that contribute to environmental, social, and economic benefits critical to human well-being and are responsible for a variety of important ecological functions and services (Mulatu et al., 2022). This area offers various ecosystem services for the neighboring settlement. The physical benefits that people derive from the Nile and its riparian include utility services such as domestic water supply, fishing, grazing, farming, grasses for cover, and wild plants for food, crafts, and medicinal purposes. Moreover, the Nile brings pneumatic services to the local and touristic communities. The Nile riparian's play a vital role in the recreative sense. Wetlands in the Nile Basin play an important role in this manner. These ecosystems support the livelihoods of many millions of people by providing numerous ecosystem services. In many places, these ecosystems are closely linked to cultivation and livestock farming. In arid and semi-arid regions with seasonal rainfall patterns, wetlands of the Nile are of particular importance for smallholder agriculture, both for cultivation and for grazing, due to their ability to retain moisture for long periods, sometimes year-round and even during periods of drought. Such wetlands often provide the only year-round source of water for domestic use (Rebelo and McCartney, 2012).

The Nile and their tributaries are considered the backbone of one-third of the Sudanese population's livelihood. It was documented that, the Nile Basin supports agriculture (including livestock) and fisheries and represents an important resource during the dry season, particularly in areas with low and erratic rainfall. The contribution of the Nile to the livelihoods of the local population as well as to the economies is clear. The Nile is important for food security and provides ecosystem services that support agriculture and other food security activities, including water-related services. The value of many of these services is currently a more significant contribution to the local communities' food chain and services. Indeed, a better understanding of the ecosystem services provided by different types of wetlands in the Nile and how these contribute to local livelihoods is well under management for their sustainability. the Nile and its tributaries supply and secure about 60 to 80% of Sudanese food needs. The largest and most important projects are located around the Nile; hydropower projects i.e., Sennar, Roseires, and Marawi dams. In addition, the country's largest strategic and productive schemes (Gezira, New Halfa, Suki, and Rahad), besides all sugar cane schemes companies, depend mainly on the Nile for irrigation water (Osman et al., 2023; Rebelo and McCartney, 2012).

The hydroelectric power and agriculture projects around the Nile are the most important projects for Sudan and Sudanese welfare. In 2016, 55.8% of Sudan's electricity came

from the Nile. Therefore, the country's energy security is highly dependent on river discharges. Five operational hydroelectric power plants are located on the Blue Nile, White Nile, and Atbara Rivers (AlSaidi et al., 2017). Wetlands in the Nile Basin play an important role in the hydrology of the Nile and in supporting the livelihoods of millions of households. Small hydropower plants also offer significant potential: there are hydropower dams along the Nile in Sudan. Sudan has many hydroelectric power plants with a well-generation capacity (Tab. 1) (Saeed, 2020). These hydropower plants are distributed in different locations along the Nile, providing around 60% of Sudan's electricity needs. Besides, wind, solar, and waste power.

Table 1. The hydroelectric dams and their capacity in the Nile Basin in Sudan

Dam	Productivity (MW)	Reservoir Capacity
Sennar Power Dam	15	900 (MCM)
Khashm el Girba Dam	17	4.3 (BCM)
Jabel Awlya Power Dam	30	180 (MCM
Roseires Power Dam	280	7.0 (BCM)
Up Atbara- Sita Dam	320	2.7 (BCM)
Merowe Power Dam	1250	12.5 (BCM)

(Saeed, 2020; Sati et al., 2015)

Sudan has the largest irrigated area in sub-Saharan Africa. It has been estimated that the total area devoted entirely to irrigation is 1,764,635 ha, with a cropping intensity of 65%. The irrigated sub-sector contributes more than 50% to the total volume of agricultural production, although the irrigated area accounts for only about 30% of the total cultivation area. Most of the irrigated sub-sector provided irrigation water from the Nile and its tributaries (Britannica, 2023). Sudan developed many irrigated schemes along the Nile basin and its tributaries, i.e., the Gezira and Managil extensions, the Rahad and New Halfa schemes, as well as the sugar cane production schemes companies.

The largest irrigation scheme in Sudan is the Gezira irrigation scheme, and the Managil extension covers about 882,000 ha. It is a gravity irrigation system that accounts for almost 50% of the total irrigated lands in the country. The scheme requirement for irrigation is completely supplied from the Sennar Dam reservoir (Plusquellec, 1990; Al-Saidi et al., 2017). The Rahad scheme is about 350,000 ha. It is located on the Blue Nile and is irrigated with water from the Roseires Dam. The Khashm el Girba scheme, covering an area of 200,000 ha, is located on the Atbara River. The total area of irrigated agricultural land in Sudan is estimated at 2 million hectares. This accounts for a significant area of the country. On average, the irrigated sub-sector accounts for about 64% of the total crop contribution to GDP (FAO, 2023; Osman et al., 2023; Mahgoub, 2014; Nile Basin Water Resources Atlas, n.d.). Furthermore, sugar production companies' schemes take up a significant portion of the Nile and its tributaries (Fig. 1).

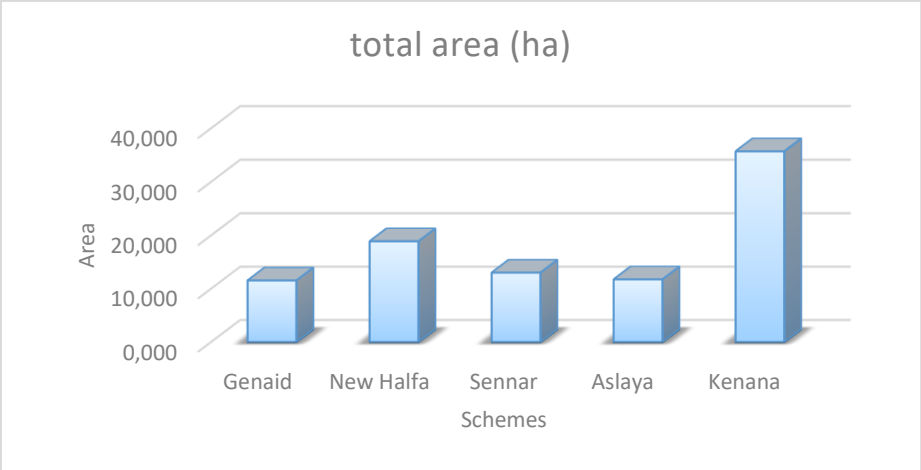


Figure 1. Sugar cane and sugar production schemes and their area on the Nile base of Sudan (El-Desougi, 2022)

3.Touristic places and interactions with the Nile in Sudan

Other wetland ecosystem services are often not explicitly recognized by communities but include a wide range of regulatory services such as flood control, maintenance of dry season river flows, groundwater purification, climate regulation, and erosion control, and a range of supporting services such as nutrient cycling and soil formation. In addition, people also reap non-physical benefits from the cultural services, including spiritual enrichment, cognitive development, and aesthetic experience. In many locations, the different types of services can be closely linked as well as recreation around the wetlands. Sudan wetlands such as the Nile have a vital role in supporting the livelihood of those around the Nile (Mulatu et al., 2022). Nile tourism in Sudan offers a unique cultural and historical experience. Visitors can explore ancient pyramids, temples, and tombs along the Nile, including the famous Cushite and Meroitic sites. Along the Nile on a cruise ship, rafting, and jungle and savannah trekking are some of the most popular activities. The National Museums, zoo Parks, and the Red Sea coast are regularly visited by tourists. The diversity of sights is complemented by archaeological sites around the Nile banks (Ritter, 2015). The country's rich heritage and stunning natural beauty make it an attractive destination for adventure seekers and history experts alike. From the south along the Nile River tourists used to enjoy the magnificent scenery across this area. Sudan Nile has so many cataracts with the different slops. These places face thousands of visitors every year. In addition, the wetlands around the Nile attract tourists as a place of recreation. The cross area between the Blue Nile and White Nile is considered one of the most important tourist areas among the rest. Nile boating, trips, and water sports are common entertainment activities.

4. Conclusion

It's clear the role of Nile ecosystem services in securing the livelihoods of the settlements. The Nile helps in reducing and enhancing the resilience of climatic change, adaptation, and mitigation. Nonetheless, no doubt that the Sudanese depend on the Nile as the source of water or its ecosystem services for their livelihood or some life aspects. The wetland poses and plays a vital role in recreational and tourist areas. The Nile in Sudan poses different and valuable places. That contributes significantly to the tourism sector. The value of many of these services is currently a more significant contribution

to the local communities' food chain and services. Indeed, a better understanding of the ecosystem services provided by different types of wetlands in the Nile and how these contribute to local livelihoods is well under management for their sustainability. On the other hand, Sudanese depend on the Nile as an aesthetic experience and recreation. The potentiality of the Nile should be planned to exploit this valuable source. The policy of sustainable utilization must be the priority of any decision-makers in the manner related to the Nile ecosystem services and tourism potential as well.

References

[1]. Adam, F. H. (1965). Contribution of land tenure structures to agricultural development in Sudan through incentives, knowledge, and capital. PhD thesis, Iowa State University of Science and Technology, USA.

[2]. Al-Saidi, M., Elagib, N. A., Ribbe, L., Schellenberg, T., Roach, E., & Oezhan, D. (2017). Water-Energy-Food Security Nexus in the Eastern Nile Basin: Assessing the Potential of Transboundary Regional Cooperation. Water-Energy-Food Nexus: Principles and Practices, 103-116.

[3]. Britannica (2023) Sudan-Crops, Livestock, Fisheries. Encyclopedia Britannica. https://www.britannica.com/place/Sudan/Manufacturing (Retrieved on 25 August 2023,14:35:00).

[4]. Central Bank of Sudan (CBOS) (2017). Annual Report. Khartoum, Sudan.

[5]. El-Desogi, H. I. (2022). Sugar cane, course note. Faculty of Agriculture, University of Khartoum, Khartoum North, Sudan.

[6]. FAO (2023). Country Profile–Sudan. Food and Agriculture Organization of the United Nations. https://www.fao.org/3/i9808en/I9808EN.pdf.

[7]. Mahgoub, F. (2014). Current status of agriculture and future challenges in Sudan. Nordiska Afrikainstitutet.

[8]. Melesse, A., Abtew, W., & Setegn, S. (2014). Introduction: A Scarce and Shared Resource: Hydrologic Threats, Trends, and Challenges in the Nile River Basin. Nile River Basin: Ecohydrological Challenges, Climate Change and Hydropolitics, 1-4.

[9]. Mulatu, D. W., Ahmed, J., Semereab, E., Arega, T., Yohannes, T., & Akwany, L. O. (2022). Stakeholders, institutional challenges, and the valuation of wetland ecosystem services in South Sudan: the case of Machar Marshes and Sudd Wetlands. Environmental Management, 69(4), 666-683.

[10]. Nile Basin Water Resources Atlas. (n.d.). Nile Basin Initiative. https://atlas.nilebasin.org/treatise/irrigation-areas-in-sudan/ (Retrieved on 25 August 2023, 14:28:00).

[11]. Omer, A. M. (2007). Water in the Sudan. Water International, 32(S1), 894-903

[12]. Osman, A. K., & Ali, A. M. (2021). Sudan - land, climate, energy, agriculture, and development: A study in the Sudano-Sahel Initiative for regional development, jobs, and food security, ZEF Working Paper Series, No. 203, University of Bonn, Center for Development Research (ZEF), Bonn.

[13]. Osman, I. M., Acar, R., Babiker, E. S. N., & Direk, M. (2023). Agricultural Production Systems in Sudan. Eurasian Journal of Agricultural Economics (EJAE) 3(1)

[14]. Plusquellec, H. (1990). The Gezira irrigation scheme in Sudan. World Bank technical paper, 120.

[15]. Rebelo, L. M., & McCartney, M. P. (2012). Wetlands of the Nile Basin: distribution, functions, and contribution to livelihoods (No. 612-2016-40565).
[16]. Ritter, C. (2015). Sudan, tourism. Text Book, Norwegian University of Science and Technology, P, 3.
[17]. Saeed, T. M. (2020). Sustainable energy potential in Sudan. Journal of Engineering and Computer Science (JECS), 20(3), 1-10.
[18]. Satti, S., Zaitchik, B., & Siddiqui, S. (2015). The question of Sudan: A hydro-economic optimization model for the Sudanese Blue Nile. Hydrology and Earth System Sciences, 19(5), 2275-2293.
[19]. Satti, S., Zaitchik, B., & Siddiqui, S. (2015). The question of Sudan: A hydro-economic optimization model for the Sudanese Blue Nile. Hydrology and Earth System Sciences, 19(5), 2275-2293.
[20]. Simon, W. (2019). Make food security the top agenda in the Nile Basin. The Niles site was accessed on 14.08.2023.
[21]. World Bank (n.d), 'Overview: The World Bank in Sudan', Available from: http://www.worldbank.org/en/country/sudan/overview (Accessed on: 19 August 2023).