Available online at http://www.journalijdr.com

IJDR

ISSN: 2230-9926

International Journal of Development Research
Vol. 09, Issue, 08, pp. 28861-28874, August, 2019

RESEARCH ARTICLE OPEN ACCESS

NEGATIVE IMPACTS OF EGYPTIAN HIGH ASWAN DAM: LESSONS FOR ETHIOPIA AND SUDAN

***Nader Noureldeen Mohamed**

Department of Soil and Water Sciences, Faculty of Agriculture, Cairo University, Egypt

ARTICLE INFO

Article History:
Received 03rd May, 2019
Received in revised form
16th June, 2019
Accepted 20th July, 2019
Published online 28th August, 2019

Key Words:
AHD, logging, Salinity,
Degradation, Contamination,
Climate change.

ABSTRACT

River Mega dams are not always having positive advantage, but also have several negative impacts. The negative impacts will affects aqua fresh water lives; alluvial soils environment, fishing and fish migration, water quality; physical changes, agriculture sector, socio-economic, increases greenhouse gas emission, and human health. Since finishing the construction of Mega Aswan High Dam (AHD), in 1971 and even though it's several benefits, but it has also several negative impacts. The main negative impacts of AHD are alluvial soil water logging, building up of soil salinity, overuses of chemical fertilizers and pesticides due to preventing of fine earth fertility particles by the dam, which affects the food productions and farmers health. Moreover; another impacts of AHD are decrease fishing in quantity and quality especially disappearing of Sardine fish species, contamination of groundwater; irrigation and drainage canals by the residual chemical fertilizers and pesticides, salt accumulation after absence of natural frequent annual leaching of soil by flooding for four months; and increases the vulnerability of delta lands against climate change and the raise of the Mediterranean Sea level that threating the delta coasts and ground water. Land degradation also become a common phenomenon needs to be mitigated. The increase of water demands in Egypt and the obligation of re-uses of all type of wastewater such as agriculture drainage water industry and sanitation will need to create more water treatments and remediation to keep the soil and food production more safety. The same impacts will similarly repeated in Sudan and Ethiopia after the finishing of Great Ethiopian Renaissance Dam (GERD) in 2022.

Citation: Nader Noureldeen Mohamed. 2019. "Negative impacts of egyptian high aswan dam: lessons for ethiopia and Sudan", *International Journal of Development Research*, 09, (08), 28861-28874.

INTRODUCTION

River dams always have negative impacts in agriculture and ecosystem even it were constructed on upstream or in downstream. Lakes created by dam to reservoir water causes permanent destruction of terrestrial ecosystems through inundation. Usually, all terrestrial plants and animals disappear from the submerged area. Reservoirs trap sediment and obstruct migration for some aquatic species. Downstream rivers will suffered from changes in flow regime, absence of sediments, and the changes in water temperature, quality and quantity. Many of these changes are immediate happen. Moreover, dam causes changes in thermal regime, water quality and land-water interactions result in changes in primary production, which in turn has long-term implications for fish and other fauna higher up the food chain.

*Corresponding author: Nader Noureldeen Mohamed
Department of Soil and Water Sciences, Faculty of Agriculture, Cairo University, Egypt

Dams also cause changes in ecosystems extends to long distances, such as changes in sediment load that transport with river stream results in changes in river, floodplain and even coastal delta properties. The response of river ecosystems to dams are varied and complex (Ecosystem Impacts of Large Dams, 2001). The complex inter-relationship between dams and their environment make it extremely difficult to predict all the consequences that dam construction will have for any particular river ecosystem. The impact of each dam is unique and dependent on the dam dimension, and local sediment supplies, slopes and river velocity, geomorphic constraints, climate and the key attributes of the local biota. Another significant impact especially in upstream river dams is the transformation of the dam from a natural free-flowing river to a manmade controlled slack-water reservoir habitat. This changes will lead to changes in water temperature, chemical composition, less level of dissolved oxygen and bad physical properties of a reservoir will not be suitable to the aquatic plants and animals that evolved with a given river system (Ecosystem Impacts of Large Dams, 2001).

Constraints of Mega Dams

There are many constraints that hinder the full exploitation of the vast hydropower potential in the region which are (The State of the Nile River Basin, 2012):

Transboundary context

- Cost and benefit sharing: In a transboundary basin with no legal/institutional framework for cooperative development of basin resources, there is usually no mechanism for quantifying and equitably sharing the costs and benefits related to investment projects, making it difficult to proceed with such projects.
- Cumulative impacts and competing water uses: delays in implementation of transboundary hydropower projects may arise due tocomplaints from co-riparian states who object to the proposed projects on grounds of potential harm to the uses and benefits they are currently enjoying from the shared water resources.

Environmental considerations

- Damage to global environmental assets:The Nile Basin has several globally significant environmental assets such as the 17 international Ramsar sites and a similar number of national parks and game reserves with rare and threatened species. Dam construction can also result in loss of exceptional scenic and cultural assets, such as waterfalls and rapids, and traditional worship shrines.
- Water quality, sedimentation, and soil erosion: Poor project design can lead to soil erosion, water quality deterioration, and eutrophication during the construction and operation of hydropower facilities. The very high sediment loads in the headwater areas (especially in the eastern Nile region) will affect the economic feasibility of possible hydropower projects by reducing the storage capacity and water volume available for generating electricity. Trapping the sediment load in the new reservoir has the effect of altering downstream scour and deposition patterns, ultimately producing changes in river morphology.
- Greenhouse emissions and aquatic weeds: Improper excavation methods during construction may lead to disturbance of soils or sediments rich in organic matter and lead to greenhouse gas emissions.
- Eutrophication during the filling and operation of reservoirs may also lead to proliferation and cross-border transfer of invasive aquatic weeds.
- Climate variability and change: Large areas in the basin are vulnerable to drought because of high variability in rainfall and high evapotranspiration rates. Seasonal shortages in water associated with natural climate variability make it difficult to maintain peak generation capacity throughout the year, and may reduce the long term economic feasibility of candidate hydropower projects. The negative impacts of climate on the power sector are expected to greatly increase with global climate change.

Social considerations

- Land and resettlement issues – Dam construction brings considerable hardship to local communities. Some people lose their land and assets because of the newly created reservoir and need to be resettled. Those who remain may find their livelihoods affected by changes in river flow. Typically, local communities do not share the benefits of the hydropower project, while carrying most of the burden.
- Public health – Newly created water bodies can introduce water related diseases such as malaria and bilharzia that affect public health.

Lead times and financing

- Long lead time – Many potential hydropower options in the region are very preliminary levels of preparation, although it is well known that hydropower development involves very long lead times.
- The period between project initiation and commission exceeds 10 years or more in a transboundary context where there are competing interests and unique environmental assets. When electricity demand is rising rapidly – as is the case in the Nile Basin – the long lead time of hydropower projects is a major obstacle to power security.
- Financing – Hydropower development typically involves large capital requirements that are beyond the financial resources of most governments in the Nile region and have to be provided by external financing agencies. These agencies – such as The World Bank – follow strict rules with regard to environmental and social appraisal, mitigation management, and transboundary consultation that result in high electricity demand growth rates, but the new generation has not been forthcoming due to challenges associated with resource mobilization. The countries have found it difficult to attract private investment for power development in the absence of a working regional electricity market.

Absence of alluvial loam and clay particles

Importance of alluvial sediments inside Egypt: River sedimentsareusually comprised of solid particles of sand, silt, clay mineral and mixed of fresh and decomposed organicmaterial. In river systems the amount of sediment transported is controlled by both the transport load capacity of the flow and the supply of sediment according to water velocity. The “suspended sediment load” refers to the fine sediment that is carried in suspension and this can comprise material picked up from the bed of the river (suspended bed material) and material washed into the river from the surrounding land of water catchment areas (wash load). The wash load is usually finer than the suspended bed material. In contrast, the “bed load” comprises larger sediment particles that are transported on the bed of the river by rolling, sliding or saltation. Most rivers will transport sediment in each of these “load” forms, according to the flow conditions and water velocity (UNESCO / IRTCES, 2011). Before the construction of Aswan High Dam (AHD), the River Nile flooded each year

Table 1. Some characteristics of soil separate [7, 8]

Soil Separate	Diameter in mm		Number. of particles/gram	Surface area cm^2/g
	International	USA		
V. Coarse Sand	---	2.0 – 1.0	90	11
Coarse Sand	2.0 – 0.2	1.0 – 0.5	720	23
Medium Sand	---	0.5 – 0.25	5,700	45
Fine sand	0.2 – 0.02	0.25 – 0.10	46000	91
V. Fine Sand	---	0.10 – 0.05	722,000	227
Silt	0.02 – 0.002	.005 – 0.002	5,776,000	454
Clay	Below 0.002	Below 0.002	90,260,853,000	8,000,000

during summer months; July, August, September and October, as water flowed down the valley and delta; mainly from its East sub-basin in Ethiopia. These floods brought high water and natural nutrients and minerals that annually enriched the fertile soil along the floodplain and delta; this made the Nile valley ideal for farming since ancient times. Because floods vary, in high water years, the whole crop might be wiped out, while in low-water year widespread drought and famine occasionally occurred. Egypt used to receive an average of 3 billion ton of sediments in the deep past, reduced to one billion last century which created the Nile alluvial soils instead of its desert soils (Egypt is a donation of the Nile). This amounts reduced again to average of 195 million tons (140 – 260 million tons) just before the construction of Aswan High Dam of different fine sedimentation particle during the Nile floods between July to November (Abdalla, 2007; Biswas, 2012 and The International Bank for Reconstruction and Development, 2008). These fine particles (fine earth) ranged between very fine particle of clay with a diameter less than 2 micron, silt between 0.02 – 0.002 mm, fine sand between 0.2 – 0.02 and coarse sand with a diameter between 2 – 0.2 mm (Table 1). These fine particles especially clay and silt particles, are secondary minerals resultsfrom the weathering of rocks and primary minerals. This reaction of chemical and hydro weathering, releases the essential nutrients for the plant growth and soil fertility. These include the changes of mica as primary mineral to secondary semectite clay mineral "vermiculite" plus potassium, and like so many other primary minerals when exposed to weathering it produces secondary minerals (especially clay minerals) plus calcium, magnesium, iron, phosphorus, zinc and many plenty of nutrient minerals that fertile the soil.

Thus, we can say that, the clay particles that come with the Nile floods are "colloidal and colloidal like" (has the same behavior of colloids) have high fertility, high surface area and have intensive negative charges. These negative charges particles attract and absorb the soluble nutrient mineral in the soil to keep it as exchangeable in the outer surface of minerals and conserve it from leaching during irrigation or downward water movement during rains. These huge surface areas of the clay minerals also keep the added chemical fertilizers to the soil on these charged surfaces. Moreover, clay; as colloidal, is sticky, and that helps to stick the single particles together to build up good soil aggregates. This aggregate contains small pores for water retention against gravity and also large pores for aeration, water movement down and root respiration between aggregates of the soil structure (HENRY, 1990 and Grain, 1968). In addition; fine particles also have several sites of positive charge to keep the conserve the negative charge nutrients such as phosphorus, chlorides, and sulfates and so on. The conclusion; the fine particles that comes with the Nile stream every year especially clay and silts particles create alluvial fertile soils, and richen the plant nutrients which reduce the uses of chemical fertilizers and keep the soil and the crops safety and healthy. It also saves it from the hazardous effects of chemical fertilizers residues which accumulate in foods. In addition, it keeps the shallow ground water from contamination. Moreover, clay minerals and silt have large surface areas (Table 1) which conserves the nutrients from leaching; creating good and stable soils structure with good balancing between small soil pore space for water retention and good field capacity, with large soil pore spaces for aeration and oxygen supply for root breath and leaching requirement. particles of coarse and fine sands which are relatively larger than clay and silt have a good effect in soil aeration and the balance between drain pore space (large pores) and water retention pore space (capillary pores) in addition to its effect in strengthening soil body against wind erosion, and balancing the effect of high clay percentage in decreasing soil infiltration rate and soil permeability (HENRY, 1990). Another important matter is the bulk of sedimentation that used to come with Nile water keeps the delta soils higher than the Mediterranean Sea level because it usually adds to the soil surface almost of 2- 3 mm every year after floods. This bulk protects the delta land from surface seawater intrusion. The situation after AHD has become worse because the delta soil level frequently loses one - two mm depth every year and drop down by the same value (under the effect of compaction of continuous irrigation and the particle that is lost by sticks with the tuber and root crops). At the same time, the sea level rises by one mm a year according to the IPCCC report from 1997 to 2007, which we call "the double effect".

This means that the delta land surface gets down and the sea level gets up. This also wills threats the delta by sea water intrusion even from up or down in the water table and the shallow ground water. Accordingly, all the water table of the north delta became salty, shallow and threatens the above soil layer by salinity under active capillary rise dominant in the clayey soils of delta. The delta soil deeply misses the Nile sedimentation, and Egypt should find an economic way to bring this sedimentation from the mouth AHD Lake in Sudan (Nubian lake) to add it to the delta soils to protect it from threats of the rise of the Mediterranean Sea level. This is not all, but the Nile stream also used to brings huge amounts of organic matter from Ethiopia highlands and material washed into the river from the surrounding land in the river in Sudan. These organic materials are also considered as sources of nutrients, after their decomposition, which add to the soil fertility. Moreover, organic matter is sticky material which enhances the formation of soil aggregation in addition to its high cations exchange capacity according to its large surface areas. That means it has plenty of negative charges on its surface areas that attract and absorb the positive nutrients and keep it from leaching out from the soil. The organic matter also has some site of positive charge that keeps the other negative charge nutrients such as nitrate, phosphate, sulfate, chloride, and borate and so on; in addition to high water retention capacity (Grain, 1968; FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS, 2008 Bolt, 1978 and Bolt, 1982). The organic matters also increase the fish community and fishing.

According to the high slope between Ethiopia highland and Sudan on one side and Egypt on the other side (the altitude of Tana Lake where the blue Nile drives, is 1820 m above the sea level, decline to 400 m in Khartoum the capital of Sudan, while it is only 200 meter in Aswan city south Egypt where the High dam was constructed). When Nile stream water arrives to the Nubian lake (The name of the first part of the Aswan High dam in Sudan land) with its high velocity which accepts the stream high capability to carry huge amounts of sedimentation, then it bumps into the stagnant and stable water of the lake which this causes a sharp reduce in its speed and its capability to carry more sediments. This creates an immediate precipitation of the mud in the mouth of the Nubian lake (El-Manadely, 2002 and Kantoush, 2013). These effects create a new small delta in the entrance of the lake at “Abu-Hammed” area which this may cause some problems to Egypt due to the possibility of the large sedimentation to that pushes the river to change its route to the west direction or may cause a sever block to the Nile effluent like a clot in the Nile artery. Egypt sent some scientific and military campaigns to this area between 1980 - 1990 to watch the real situation under the fear in this time from president Qaddafi of Libya to of stealing the Nile water and transferring/changing its way to Libya especially after its huge project of the Great River that takes the water from south Libya to transfer it to North Libyan cities on the Mediterranean coast (UNESCO, 2008; John, 1993; Halim, 1967). The lifetime of the dead zone of High Aswan Dam Reservoir is expected to be 311years and for the live zone is expected to be 1202 year; other studies show that the life time could reach 500 years (El-Manadely, 2002; Afifi, 1993). The Ministry of Water Resources and Irrigation (MWRI) of Egypt (Ministry of water resources and irrigation, 2005), carries outsediment investigations three times a year, before, during and after the flood period. The measurements cover a distance of about 220 km up to the tail zone of the backwater curve (behind which no sedimentation is observed). It can benoticed from the historical records that the sediment concentration decreases from3000 ppm to around 40 ppm, before and after AHD respectively. Table (2) and Figure (5) show the longitudinal profile and suspended sediment distribution along AHD reservoir.

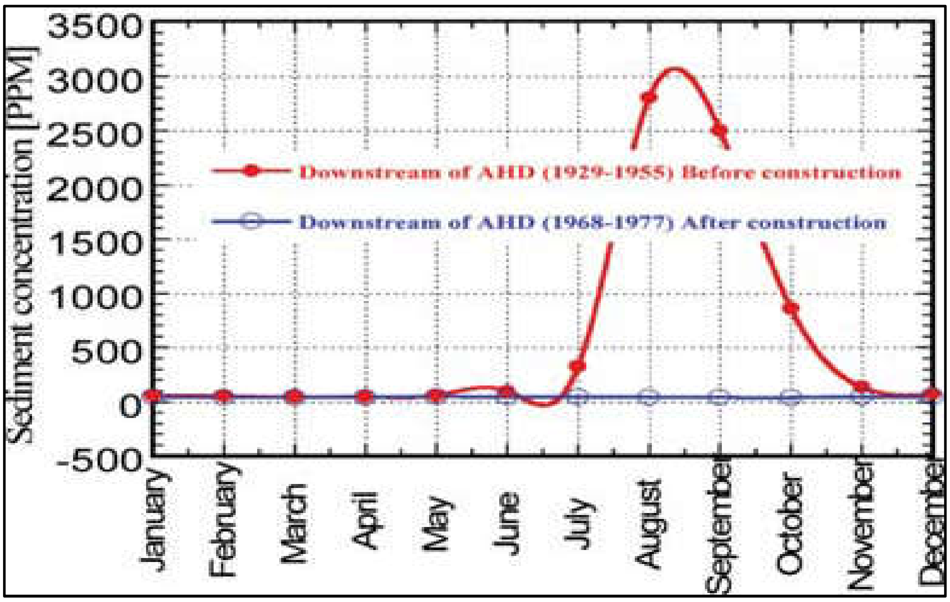

Fig. 1. Sediments before and after construction of Aswan High Dam [12]

Outside Egypt Sedimentation in Sudanand Lake Nasser

The dam created a major lake that extended from Aswan Egypt to Nubian land in Sudan. The lake extends to 500 km long with average width of 10 km with a total store capacity of 162 BCM. The storage of this enormous quantity of water in the reservoir ensured that the river flow velocity began to declineto be stubborn water; and this lake becomes the end point of river as a natural resource not the Mediterranean. As the flow velocity declined, its carrying capacity of suspended sediments declined as well. Consequently, suspended sediments began to deposit especially in the mouth of the lake. For all practical purposes, the river lost nearly all the sediments it carried as the flow approached and entered the reservoir. This meant that when water was discharged forwards downstream of the dam, it was almost clear and free from sediments (clay, silt and sand particles) except some colloidal particles which needs a long time to precipitate. Even during flood seasons when the sediment loads in the river were at their maximum, virtually all the sediments were captured at the mouth of the dam lake. Historically, some 90% of the annual sediment capacity flow in the river occurred during the flood season. The average suspended sediment load passing Aswan before the dam was constructed was estimated at 194 million tons (El-Manadely, 2002 and Kantoush, 2013). During the planning of the dam, it was estimated that the annual sedimentation in the lake would average at about 60 million m^3. Consequently, the reservoir was designed for a dead storage capacity of 31.6 km^3, and the altitude level between 85 m and 147 m were reserved for dead storage. The reservoir has a live storage capacity of 90.7 km^3, up to level 175 m, and then a provision for flood storage of 39.7 km^3 up to level 182 m. Monitoring of the actual sedimentation in the reservoir indicates an annual deposit of 60–70 million m^3, which is well within its design considerations. Studies have also indicated that the sedimentation is mostly occurs within the first 250 km upstream of the dam.

Table 2. Storage capacity of AHD reservoir (Abul-Atta, 1978 and Abu-Zeid, 1997)

Storage	From level (m)	To level (m)	Storage capacity BCM
Dead storage	85	147	31.6
Live storage	147	175	90.7
Flood control storage	175	182	39.7
Emergency flood control storage	182	183	7.0
Total			169

Fig. 2. Distribution of Sedimentation Depth in AHD Reservoir (m) (UNESCO, 2008)

The total deposited sediment volume is estimated to be 2.5 billion m^3in the period 1964-1995. This reflects that the average rate of sediment depositionannually is 140 million m^3 i.e. the rate of sedimentation is 0.1 %. It has been noticedthat almost all the sediment deposition occurs in the Nile reach between 345 km and430 km south of the dam site. In this region, sediment has already deposited in thelive storage zone as shown in Fig. (5). However, several studies showed that until1973, 99.98% of sediment was deposited in Lake Nubia. Available data suggests thatsuspended sediment dominates the total sediment in transport, which accounts toapproximately 90% of the total sediment load. This means less than 10% is left for thebed load. If we assumed all the suspended sediment isdeposited in the reservoir plus 10% for the bed load (10 million tons), hence theexpected life span of the AHD is over 1000 years. However, the dead storage requiresabout 200 years to be filled, but unfortunately most of the sediment if not all isdeposited in the live storage, which slightly reduces the function of the dam. It can be noticed that sediment deposition starts at the tail zone of the reservoir and steadily progresses northward along the river bed. Several research studies suggest that the dead storage capacity was estimated to be sufficient to accommodate sediment load (130 million m3/ year) for 300 to 500 years. It has been proved that the characteristics of the rocky-narrow channel of the southern part of Lake Nubia work as a place for a new delta formation on the sides of the lake. However, almost all the sediment load reaching the AHD reservoir is deposited in the live storage. A number of estimates of the potential life span of Lake Nasser located in Egypt and Sudan was published, ranging from 20 years to over 1500 years, (Abul-Atta, 1978; Abu-Zeid, 1997 and Ministry of water resources and irrigation, 2005). The time forecasted for filling the reservoir by sediment deposition is estimated by MWRI to be 362 years, which is less than the original design life span of 500 years (Ministry of water resources and irrigation, 2005). The Great Ethiopian Renaissance Dam (GERD) Effects: The Mega Ethiopian dam constructed on the border of Sudan at a distance between 5 – 20 km only (because it takes curved shape), thus the impacts of dam will hit the Sudan lands only specially in the Blue River and Sennar stores, east of Sudan as shown in Fig 2. Officially, The GERD will prevent 86% of the sedimentation of the Blue Nile which reached 136.5 million tons. This fertile silts and clay particle will affect the fertility of The Blue Nile state agriculture lands, and consequently will have the same result of the AHD on Egypt.

Increases the Uses of Chemical Fertilizers due to the absence of sedimentations

Although one of the benefits of the Aswan High Dam was givingthe capability to farmers to produce crops at all year round byprevent the Nile floods, but it have had negative effects as well. The yearly flooding deposited a layer of rich, fertile soil with fine earth especially clay minerals and silt that was excellent for growing crops. Without the fertile sedimentations, farmers in Egypt have had to begin using chemical fertilizer to replace these fertile sedimentations and organic matters. Many fertilizers consist of harsh and dangerous chemicals that can leak into the ground and drinking water systems if not used properly. There are several hazards of the residual effect of fertilizer on food safety especially the residual Nitrate (NO_3). Moreover, urea fertilizers, which common use in Egyptian cultivation, produce “ammonium Carbamate” during its break down in the soil and uptake by the plants, which are classified as a carcinogenic (23). The urea fertilizer is the amid form of nitrogen element ($CO(NH_2)_2$), which isionized into ammonia and carbamate (H_2N-COOH).

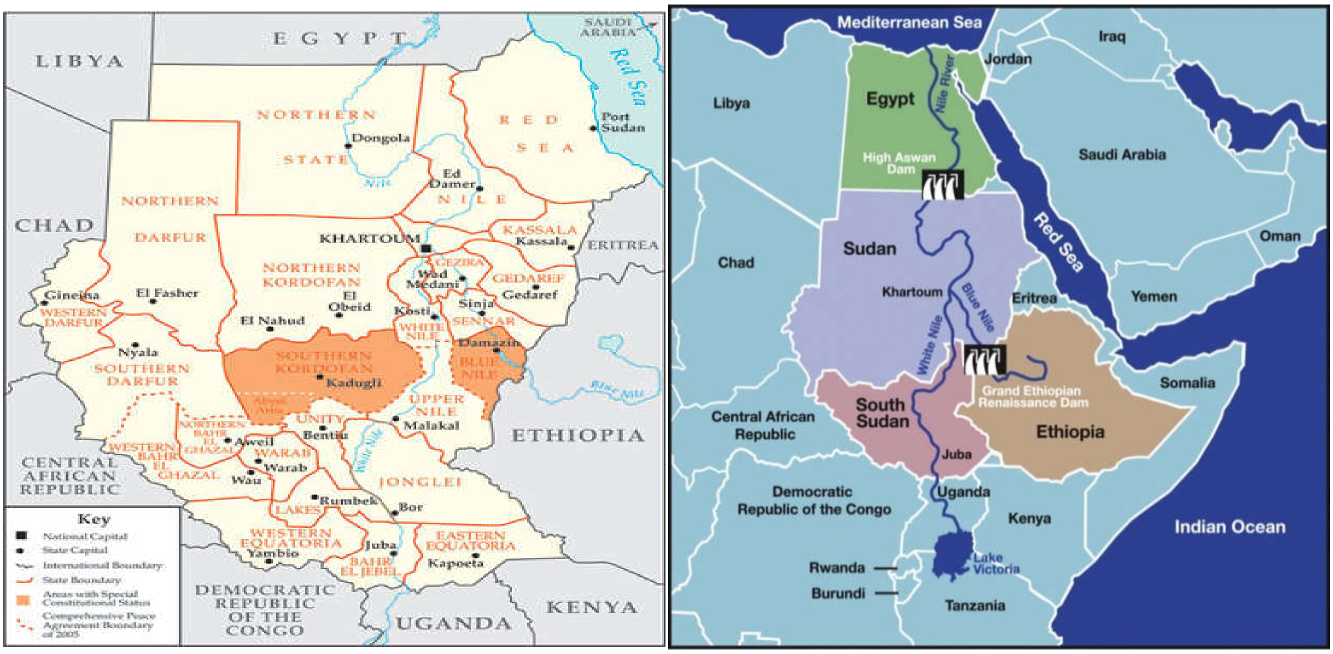

Figure 3. The location of Blue Nile State East of Sudan near the GERD (Google maps)

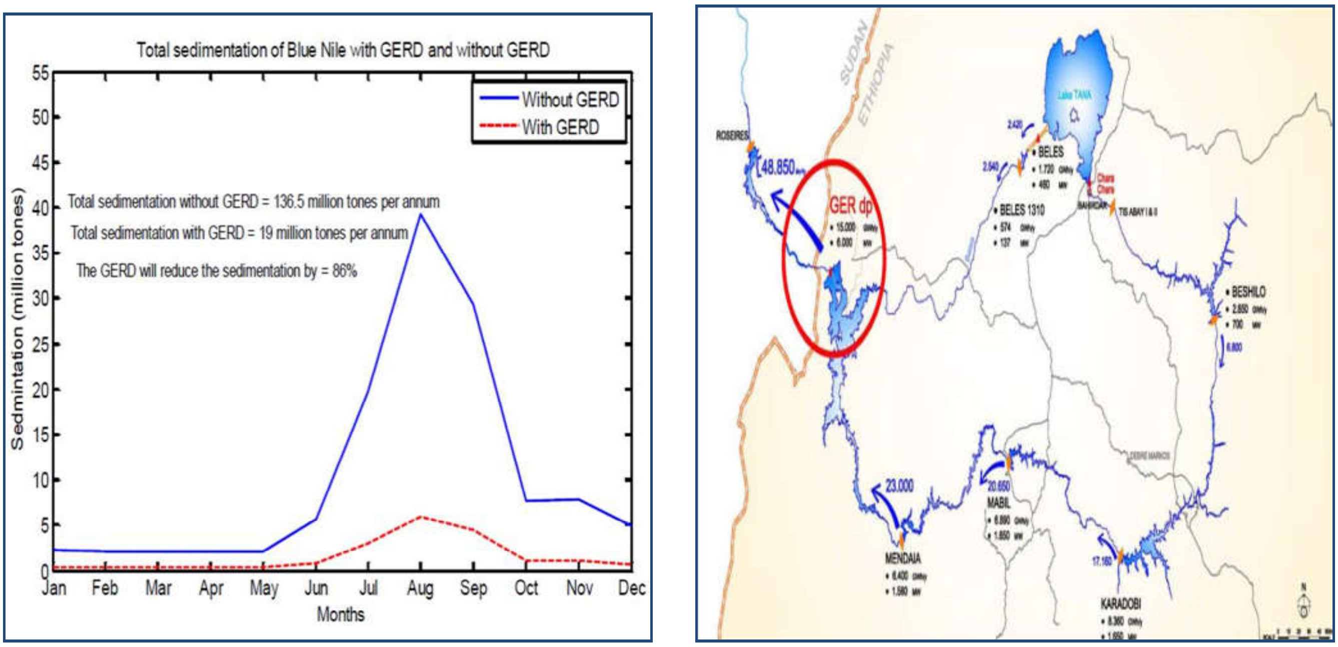

Figure 4. The sedimentation of Blue Nile before and after GERD (Belachew Chekene Tesfa 2013)

Ammonium carbamate has toxic effects, andhas significant acute toxicological data identified in literature search. The material may produce severe irritation to the eye causing pronounced inflammation. Repeated or prolonged exposure to irritants may produce conjunctivitis; therefore it is, as mentioned before, classified as carcinogenic material (Belachew Chekene Tesfa 2013 and FAO/WHO, 2003). It is generally assumed that all of the common nitrogen fertilizers used in agriculture are water soluble. Nitrate applied as such, or formed from both ammonium phase and urea, is liable to be lost by denitrification or leaching and only about 30 to 50% is recovered by plants. The increasing use of chemical fertilizers, the disposal of wastes, and changes in land use are the main factors responsible for the progressive increase in nitrate levels in groundwater supplies over the last 20 years. In Denmark and the Netherlands, for example, nitrate concentrations are increasing by 0.2–1.3 mg/l per year in some areas (FAO/WHO, 2003; Science for Environment Policy, 2013 and White, 1998). Because of the delay in the response of groundwater to changes in soil, some endangered aquifers have not yet shown the increase expected from the increased use of nitrogen fertilizer or manure. Once the nitrate reaches these aquifers, the aquifers will remain contaminated for decades, even if there is a substantial reduction in the nitrate loading of the surface. The excess uses of Nitrogen fertilizers after HAD, has increased the Nitrate concentration in the crops especially leaf crops and vegetable crops, in addition to contaminating the shallow ground water that most village in the rural areas rely on it for drinking purpose (maximum depth of 20 meters). Accordingly, most people in Egyptian villages suffer from health problems in the blood, kidney and (liver), Figure (6) shows some of hand suction pumps to save for drinking and domestic uses.

Fig. 5. Shallow water pump found in every home in rural area in Egypt (personal photos by Author)

In the other hand, cadmium (Cd), occurs naturally in all phosphorous minerals and rocksraw material uses in manufacturing of phosphorous fertilizers. Thus, all phosphorous fertilizers that added to the soil contain appreciable amounts of Cadmium will accumulate in the soil profile with time passing. Cadmiumhazards the kidneys, causing excess production of proteins in the urine – the duration and level of exposure to cadmium determines the severity of the effect. Skeletal damage is another critical effect of chronic cadmium exposure at levels somewhat higher than those where protein in the urine would be an early indicator. Cadmium is also carcinogenic if inhaled (Science for Environment Policy, 2013). Mainly stored in the liver and kidneys, excretion of cadmium is slow and it can remain in the human body for decades. Levels of the element tend to build up in most body tissues with age. Cadmium is associated with skeletal damage, evidenced by low bone mineralization, a high rate of fractures, increased osteoporosis and intense bone pain. These were features of itai-itai disease, first described in Japan in the 1940s among people who had eaten rice grown on fields irrigated with cadmium-polluted water. A low calcium diet plus high cadmium exposure led to kidney disease followed by bone disease. The excess uses of phosphorous and Nitrogen fertilizers in the Egyptian soil after construction of HAD attributes to the spread of cancer tumors in the different body organs and the spread of damaged bone tissue and skeletal irregularities among the rural peoples and farmers.

GERD Impacts

The absence of alluvial sedimentation to the Sudan soil will lead to same results occurred in Egypt. More Nitrogen and phosphorous fertilizers will be added to the soil. This will lead to decrease the food safety criteria and will increase the contamination of the shallow ground water by Nitrates especially with the high rainy areas in the eastern Sudan. Moreover, the expected use of phosphorus and potassium fertilizers will also increase the soil contamination especially with cadmium and other heavy metals as well as increasing the chemical fertilizer residues in all food products of this area.

Different opinions of the responsibility of AHD on increasing uses of chemical fertilizers

It is argued that the dam created increased demands for chemical fertilizer use due to the blockage of the sediments that came with the floodwaters and prevented agricultural land from reaping its benefits. However, increased use of fertilizers within Egyptian agriculture was to happen with or without the dam. A number of references stated that the fertilizer effect of the Nile flood is a longterm process, and that about 70 to 80 per cent of the sediments were washed into the Mediterranean Sea. The soil-enhancing process of the Nile is of a 100-year or greater time scale. In addition, animal and industrial fertilizer uses were greatly increasing even before the High Dam was built. The reasons for such a rapid growth of commercial fertilizer after the Dam can also be attributed to the following (White, Gilbert, 1988 and The International Bank for Reconstruction and Development, the World Bank, 2008).

- The co-incidence of Green Revolution varieties that required high chemical inputs.
- The control of the Nile flood prevented the flooding of summer crops and greatly increased the expected value of fertilizer applications even if it’s not the most suitable alternative

Disease

Another side effect of the construction of the Aswan High Dam is an increase in the rate of people infected with a disease such as schistosomiasis, or Bilharzia. Bilharzia is caused by a parasite carried by snails that bores itself into the skin of humans, and it flourishes in stagnant water. Bilharzia has been a problem in Egypt for millennia—some mummies from the Pharaonic period show visible symptoms of advanced stages of the disease. The flow of the Nile once helped with the problem, because bilharzia needs slow moving or standing water to develop. However, with the construction of the dam, the parasite has found a new home in the static water of Lake Nasser. From there, it is sent with the Nile water downriver and is often transmitted into the feet of farm workers in their fields. This caused the rate of infection to increase rapidly. Bilharzia is a disease that is easy to treat if it is caught in its early stages. The problem is that it can take as long as 20 or 30 years for symptoms to develop, at which point the disease is incurable and will eventually lead to death. By the early 1980s experts estimated that nearly 70% of the population in some rural communities was infected with the disease. From the mid-1960s until the mid-1980s, a nationwide campaign to treat the infection and spread awareness of how to prevent it was organized in villages throughout the country. Patients came to small clinics where they received a series of ten injections to remove the parasite from their system. An educational campaign alerted people not to swim in the Nile or irrigation canals in the fields. In the late 1980s, an oral treatment was introduced, finally bringing the disease under control (White, Gilbert, 1988 and The International Bank for Reconstruction and Development, 2008). Although the campaign was very successful in reducing the rate of bilharzia infection, it had another result. In the mid-1980s, it was still not known that blood-borne diseases such as AIDS could be spread by using needles that were not sterilized properly between uses. As a result, Egypt now has one of the highest infection rates of Hepatitis C, an incurable and potentially fatal disease of the liver, which has been directly linked to the campaign to eradicate bilharzia. It is estimated that 12–15% of Egypt's population has the disease, one of the highest rates of infection in the world. (The rate of infection in the United States, for example, is about 1.8%). Some Egyptian researchers reported that the reason of the disappearance of Bilharzia is attributed to the contamination of Nile water and irrigation canals by industrial, sanitation and polluted agricultural drainage water by residuals of pesticides and chemical fertilizers.

- Worldwide, it is estimated that over half a million tons of banned, obsolete and unwanted pesticides are threatening the environment and human health.
- Twenty-three percent of Indian farmers, 25 percent of Mexican farmers and 43 percent of Zimbabwean farmers in control groups said they had been ill at some time due to pesticides, according to pesticide industry surveys conducted in 1992and 1993.
- Between one and three agricultural workers per every100 worldwide suffer fromacute pesticide poisoning and adolescents are often the victims, according to *Childhood Pesticide Poisoning, 2004,* published by the United Nations Environment Programme (UNEP).
- More pesticides are used on cotton than any other crop. In Asia, an estimated 30 percent of all pesticides are applied to cotton.
- Pesticides are different from other hazardous chemicals: they are released intentionally into the environment and applied directly to food crops.
- Pesticides are one of the main chemical problems for developing countries.

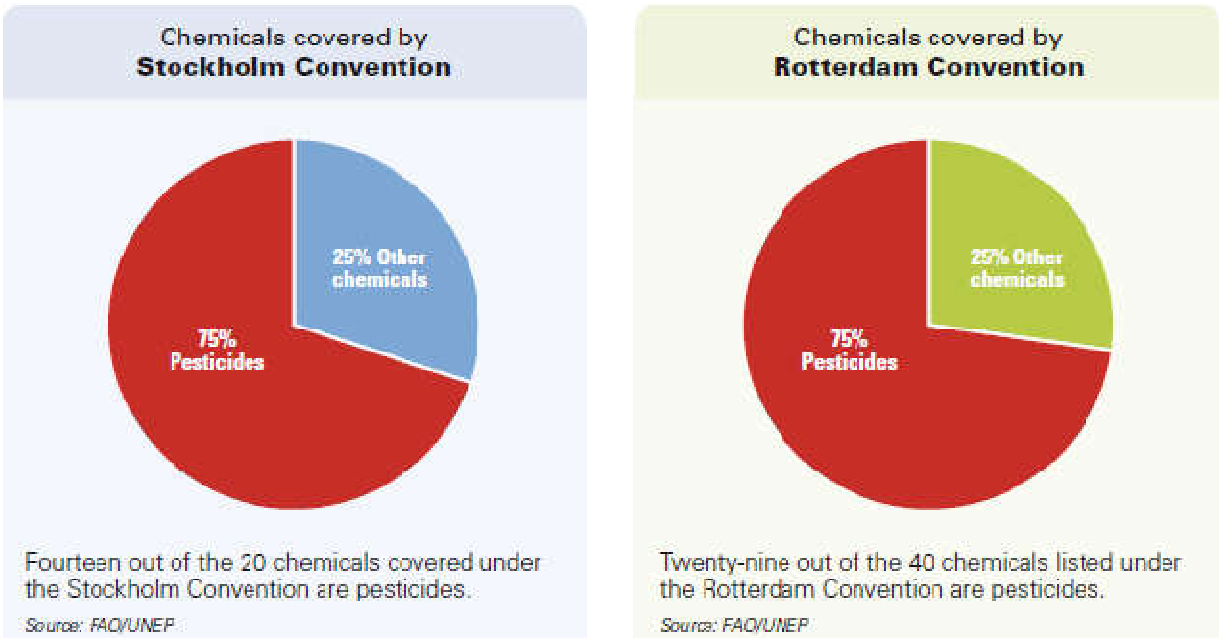

Fig. 6. Effect of chemicals and pesticides on human health [28]

Pesticides and cancer

Possible cancer hazards from pesticide residues in food crops have been much discussed and hotly debated in the scientific literature, the popular press, the political arena, and the courts. Consumer opinion surveys indicate that much of the U.S. public believes that pesticide residues in food are a serious cancerhazard. FAO publication through the plant production and protection division published some key facts and key lesson for pesticides uses as follows (FAO, 2016).

Key facts

- Pesticide sales are valued at about US$35 billion a year.
- An estimated 200 000 people a year die from pesticide poisoning.
- There are some pesticides that are sodangerous that they cannot be used safely under normal and affordable developing country conditions.

The changing of the cultivation system after HAD from basin agriculture to continuous agriculture means more usage of chemical fertilizers and chemical pesticides which reflects in the high residual of them in food and consequently in the people body organs. The hospital of children cancer and adult tumor increased every day in Egypt with much accused in extension uses of pesticides and chemical fertilizers.

GERD Impact

The pattern of agriculture in Blue Nile State in Sudan will be changed from the basin Agriculture which relies mostly on the water of floods that stored in the soil profile and root zone depth, to permanent irrigated agriculture after preventing the floods by GERD. Irrigated continuous agriculture means the economic production by using chemical fertilizers and chemical pesticides, which will leads to same results occurred in Egypt after preventing floods by AHD and changing from basin agriculture to irrigated agriculture. Using of pesticide in irrigated agriculture after GERD will cause wide cancer disease in the east Sudan states.

Water logging

The water table is the upper level of underground water (water table is the transfer from unsaturated to saturated condition of the soil). In swampy areas, the water table is very close to the surface (or ground level), which is why marshy conditions are found there. In other areas, the water table is very low, which is why deep wells must be dug to reach water and bring it to the surface. In desert areas, places where the water table comes close enough to the surface to allow plants to grow are called oases. In many places in Egypt's Nile Valley and Delta, the water table has been rising much closer to the surface than before and, in many places, the rising levels are threatening ancient monuments. One particular danger is the salt formation and its accumulation. The soils of the Nile basin are not naturally salty because the soil particles were completely leached by the Nile water during its long journey from Ethiopia to Egypt. The effect of water logging on plant growth depends on the duration of saturated conditions, the proportion of the potential root zone affected, and the limitation on root elongation. It also depends on the rate at which oxygen is depleted, the effect on availability and uptake of nutrients, and the accumulation of toxic elements. The rate of oxygen depletion, and degree of harm caused by water logging, depends upon a number of factors—temperature, organic matter content, salinity, acidity and the stage of growth of the plant. There are three basic requirements for water logging to occur in the root zone of plants: (1) supply of water sufficient to produce saturation of the soil within the root zone, (2) mechanisms and physical characteristics by which water is supplied to, and retained within the root zone, (3) adequate time for saturation of the plant roots to produce anaerobic conditions and associated changes in biological and chemical activity which is detrimental to plant health (FAO, 2016). From my field of experience for more than 40 years in delta lands, the water table in most delta lands does not exceed 1.5 meter even in the soils covered by drainage net. The heavy clay soils in the Nile delta have an active capillary rise and very slow or stagnant water table velocity. This stagnant shallow water table encourages the capillary rise that wets the root zone and brings water with saline and contaminators of pesticides and soluble nitrate in addition to organic and heavy metals toxicity. Shallow ground water means also continuous building up of soil salinity and sodicity (if the water table reach in Sodium Carbonated or bicarbonates) especially in case of intruded by sea water in the north delta land that adjacentto Mediterranean coast. Shallow groundwater table level causes root rotting of most crops.

Impacts of GERD

Irrigated agriculture without construction of good drainage system will cause water logging and shallow ground water. Some areas in Egypt has a depth of ground water more than 65 meters before applied of irrigated agriculture and becomes now with only one meter of water table and shallow ground table. Sudan as poor country is not able to construct a complete drainage system for its new pattern of irrigated agriculture and expected to postpone that until the water table raise and becomes a serious problem. Thus the same results of water logging and poor drainage will hit all agriculture land of Blue Nile and Sennar States in Sudan.

Soil Salinity

Before the Aswan High Dam was built, the annual flooding of the Nile would wash the salt out into the Mediterranean. But AHD stopped flooding and its natural and periodic leaching of soil, along with the increase use of chemical fertilizer with its high salt index, remove been lead to salinity building up over time. There are two problems with the buildup of soil salinity. First, the saline soil increases the salinity of water table, which limits its use for drinking or irrigation. Second, salt causes limestone and un-soluble calcium carbonate forms to decay much quicker than normal, and most of Egypt's ancient monuments are built with limestone. Archaeologists fear that the rising water table could cause the destruction of many of these structures, from the temples of the pharaohs in Luxor to the great Sphinx in Giza. There are several possible solutions, such as installing wells to lower the water table (but this way increases the sea intrusion to the water table), replacing the foundation stones with other materials, or injecting a chemical sealant between the structures and the soil to create a barrier. All of these are very expensive and risk possible damage to the ancient monuments. The cultivated area of the Nile Delta is 4.354 million acre (1.8 million ha), about 93% of them are old dark lands of alluvial soils that have a texture ranging between heavy clay to clay. This area represents 71.6% of the total old alluvial land in Egypt of 6 million acre and 55.5% of the total officially cultivated lands of 8.6 million acre(3.5 million ha)that includes 2.6 million acre (1.1 million ha) new reclaimed lands. Land degradation in the Nile Delta land includes salinity, alkalinity, soil compaction and nutrient depletion, water logging, pollution & contamination, sea water intrusion and urban encroachment. There are three main sources of the salt in the Nile Deltas which are: irrigation water, shallow water table and Mediterranean water intrusion. The average of salt affected soils in the North Delta is 47%, and in the Middle Delta is 36% and in the south delta is 24% with total average in the Delta of 37% [30]. Nile Delta soils have been formed through the Nile flooding by adding about 5 mm of Nile siltation layer/year. Figure (8) show the distribution of salinity in the delta land. The absence of flood water after AHD that used to leach the delta soil every year becomes the main reason of salinity buildingup in delta lands. The limited water resources in Egypt and the water scarcity are additional reasons for delta land degradation even when it is the main agricultural capital of Egypt.

Effect of GERD

Soil salinity in alluvial soils of Egypt mainly depends upon water logging, warm weather and high evaporation rate, sea water intrusion and the salinity of irrigation water. Salinity of irrigation water from Nile not exceeds 300 mg/l or 300gm/m^3. If we supposed that the rate of irrigation water in arid regions should not be less than on 5000 m^3. That means that the Nile water will add 2.5 ton/acre or 3.57 ton per hectare. This amount of water needs to be leached out of the root zone by leaching fraction or will cause a building up of soil salinity within the 10 years whereas the amounts of soil salinity added to hectare will be 35.7 tone.

The high rate of the rain in eastern Sudan my reduce the salinity building up, but the expected water logging and shallow water table in the absence of efficient drainage will return the salinity back to the soil under the effect of active capillary action from the shallow ground water. Soil salinity will be the main problem in the Eastern Sudan lands within the next 30 years as the same happened in Egypt after preventing of flooding and its effect on leaching the agriculture lands from the salt accumulation.

Delta stops to extension and becoming shrinkage

The Nile delta nowadays becomes smaller due to the absence of receiving additional sediment as impacts of AHD. The pebbles and sediment get stuck in the mouth of the reservoir of the dam. Wildlife is losing its home because the delta is shrinking insize. The delta soil according to the soil pedology and soil morphology will be on its way to be mature soil instead of young and developed soil under the absence of any new sedimentation.

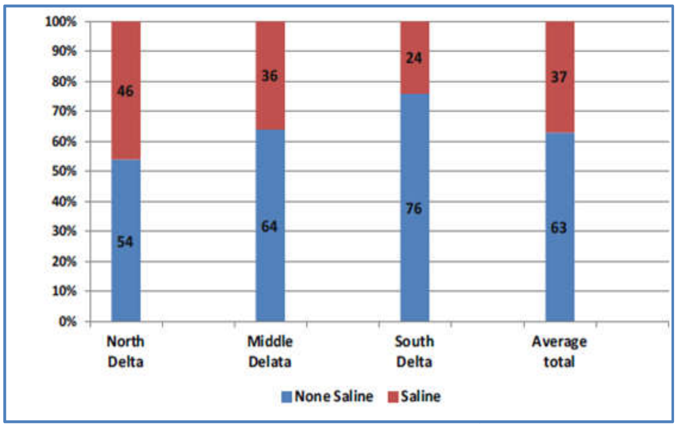

Fig. 7. Salinity distribution in the Nile delta lands, author from data of [30]

Degradation and erosion of downstream river banks

River bank erosion is one of the most serious problems in river morphology. Theprocess of river bank erosion is a natural process that is unavoidable, therefore the right protective measures must be selected and designed to provide effective, efficient, and durable works after construction. It is a source of sediment in the Nilesystem especially in the Main Nile (from Khartoum Sudan to Mediterranean). Many factors contribute to the bankerosion; one of them is the interaction between the Nile river water levels during the wet and dry seasons and the groundwater table level. This movement of the water levels up and down causes the bank soils to collapse. Moreover, the high velocity ofthe Nile water near the outer bends creates serious bank erosion and bank sliding. All these contribute significantly to the sediment in the Nile system. On the other hand, landowners complain of bank erosion and channel shifting, which cause the loss of some parts of their valuable land. It is well known that the cultivable land extends only fora few Kilometers along the Nile banks, therefore, it is clear how serious is the problem of bank erosion in such areas. This requires an urgent need for using effective protection measures. The rapid sedimentation near the mouth of the AHD reservoir may cause the narrowing Nile valley in a relatively short time. Therefore, the erosion increased along the lower Nile courses and the transgression of the Nile delta on the Mediterranean coast is taking place. Degradation of downstream river bank due to the clear water has a high possibility of happening in the near future. Revetments such as rock riprap, stone pitching, gabions in addition to flow deflectors like spurs dikes are the most widely protective methods used to prevent bank erosion in most of the Nile Basin countries. Rock riprap and stone pitching (revetment) are commonly used in Northern Sudan while in Egypt spurs dikes are used in addition to different types of stone revetment.

Fig. 8. Bank erosion of the main Nile [14]

Effect of GERD: GERD will change the river Nile to almost of irrigation canal due to the controlled and daily water discharge delivered from the dam according to power generation needed. This will cause a sever changes in river rout way stream, and bank erosion will expected to increase in the Blue Nile in Eastern Sudan States.

Increase desertification and land degradation

Agricultural soil is our natural capital. But healthy, productive land is diminishing rapidly, along with the usual coping mechanisms done by the over one billion people, who depend on degrading land and live in poor countries or fragile states. If we secure productive land, we will strengthen the livelihoods of households; promote agriculture for national progress and economic development. Desertification is the change of land and its vegetation that makes it unable to support life, becoming like a desert (act as a desert in not producing food). Desertification also, is a process of turning the productive land into non-productive desert. Desertification is the permanent decrease in biological productivity of dryl and areas. Actually desertification means that, productive soil **is** turned into non-productive desert. For to connect land degradation and desertification the United Nation convention to combat desertification [31, 32, 33] stated that" desertification" means land degradation in arid, semi-arid and dry sub-humid areas resulting from various factors, including climatic variations and human activities. Desertification is a silent, invisible crisis.

What cause desertification?!

- Wrong human agricultural activities and bad practice's
  - deforestation
  - overgrazing
  - over-cultivation and nutrient depletion
- Over use of land area
- short schedule for crop rotation
- Climatic changes
  - increase in temperature
  - decrease in precipitation

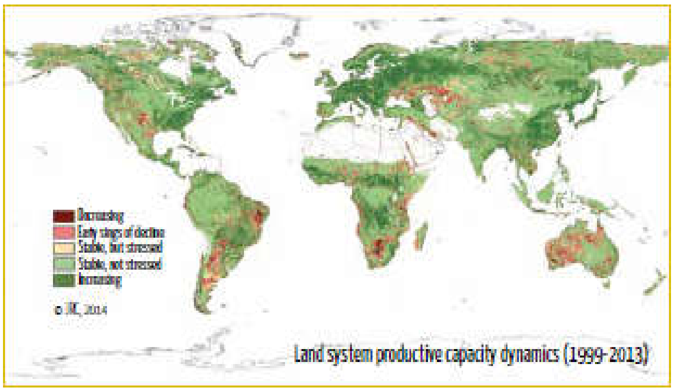

Fig. 9. Land system productive capacity dynamics (1999-2013) [34]

From the last figure and the causes of desertification, it is clear that Egypt is suffering after AHD from absence of leaching salt accumulation by floods water, consequently the salt building up and salt accumulation even in the soil root zone or in shallow water table. The second reason of land degradation and possibility of desertification is the overuse of land area and having a short schedule for crop rotation according to the high population growth rate and high population of 104 million capita. This whole population relies mostly on only 3.6 million acre of agriculture land in addition to a deep gap of water shortage that reached 42 BCM/yr. Certainly, there is also the effect of climate change and global warming that hit Egypt within the last 20 years causing an increase in evaporation, highevapotranspiration and more contamination in water bodies suffering from water shortage due to the located at the most dry and warm area in the world. Less irrigation water, less available water for leaching fraction for soils and uses of shallow ground water in irrigation means more water intrusion and more soil salinity and water table. Thus the delta lands is really under dangerous threats of salinity, water logging, sea water intrusion, nutrient depletion of the soil under intensive cultivation, absence of crop rotation even short or long, and lowering the soil surface in the absence of new sediments since 50 years associate with the rising sea water level.

GERD Effects

The cause of land degradation and consequently desertification are overuse of land area, human agriculture activity, deforestation and salinity. All these points will appear in the Eastern Sudan States after GERD. Changing to irrigated agriculture under water shortage and controlled water comes from GERD in absence of water requirement for leaching the soil profile, in addition to absence of efficient drainage and the overuses of chemical fertilizers and chemical pesticides will all leads to land degradation by salinity, water logging and soil contamination.

High evaporation from the huge surface area of the reservoir in AHD Lake

The next items were reported about the evaporation from Aswan High Dam (Kenneth, 2008 and Ahmed, 2001).

1. The average of the evaporation rate from Lake Nasser is 6.3 mm/day;
2. The average of the annual water volume lost by evaporation is about 12.5 Billion Cubic Meter.

In order to reduce reservoir siltation, Palmieri *et al*. (2001) list the following sediment management methods:

1. Reduction of sediment yield by measures in the catchment area or by debris dams, which intercept coarse grained sediments in mountainous streams.
2. Sediment routing through off-stream reservoirs, construction of sediment exclusion structures, and by passing through the reservoir (e.g. sluicing).

GERD Effects

The Blue Nile River is too small to refill two big reservoir lakes at the same season one in Ethiopia and another one in Egypt. It’s strongly expected that the GERD will decrease the water level sharply in the lake of AHD in Egypt and other two reservoirs in Sudan. This will increase the evaporation effect of the small water stored in Nubian and Nasser lakes in Sudan and Egypt. The socio-economic impacts will hits the fisher and the fishing from the AHD Lake according the sharp reduction in fish population expected in Egypt and Sudan even in the AHD lakes of in the river itself. Moreover, the evaporation from the GERD Lake from its 500 km^2 area will increase according to the high temperature in the Ethiopia-Sudan border as well as the evaporation from AHD which means more water will be wasted from the Nile water. The capture of silts and organic matter in the front of GERD Lake will cause a huge activity of microorganism to decompose the organic matter. Thus the results will be, big reduction of soluble oxygen leads to dying of fish, increasing amount of gas emission in the GERD area and increase the global heating in addition to change the water quality and water temperature.

Resettlement of Nubian people

Nubia is the name of the area that was subject to inundation due to the construction of the AHD. It extended from the north near Aswan city in south Egypt down to the third cataract of the Nile in the north of Sudan. More than 100,000 Nubians occupied this inundated area before the construction of the AHD; some of them lived inside the Egyptian borders while others were settled in Sudan (Marefa.org, 2013 and Merdan, 1990). Although the Nubians lived in two different states, but demographically, they are considered as one community. Their unique cultural heritage distinguished them from both the Egyptians and the Sudanese (Marefa, 2013; Merdan, 1990 and Merdan, 1999) because the people found there inhibited this area previous to border creation, the same situation is repeated in the western Egypt whereas the tribes of Red Ali and White Ali was were found across the border of Egypt-Libya. Same situation repeated in the eastern border whereas the Egyptian Rafah city and the Palestinian Rafah, but they are cousins and brother. The same trend is repeated also again in south East Egypt in the triangle of Hala’ib, whom belongs to both Egypt and Sudan people. Their economic activities were limited to agriculture, herding, and fishing. They used to live in small scattered communities that yearned for services regarding health, roads, social care, and schooling. The Nile played a major communication role among these communities. At the time of the AHD construction, northern parts of Nubia had already suffered from the inundation of their land and properties. In 1963 the entire Nubian population (Egyptian and Sudanese) that was subjected to resettlement represented about 0.4% of the Egyptian population. The Nubians resettlement plan was very successful according to (Marefa.org, 2013;

Merdan, 1990; Merdan, 1990 and Fernea, 1973). About 55 000 Egyptian Nubians were resettled in the vast fertile plain of “KomOmbo” 60 km downstream of the AHD, called “New Nubia”. In the “KomOmbo” area, 28 000acres were reclaimed and provided with the required irrigation infrastructure. The resettlement plan included more than 25 000 houses in 33villages that combined both modern public utilities and Nubian architecture in their design. Nearly 53,000 Sudanese Nubians were resettled in “KhashmEl-Girba”, in the east of Sudan on the bank of Atbara River that stems from Ethiopia. A new irrigation scheme called “new Haifa” was developed for them. Although migration to the north was very well planned, the immigrants to the south were luckier in terms of the compensation they received and services provided during the transportation and early phases of the immigration process. The Egyptian Government in 1962 estimated the Egyptian Nubians loss of property to be six million Egyptian Pounds. Nearly 50% of indemnities were paid in advance to help the Nubians move to their new settlements. The other 50% were used to pay part of the cost of land, infrastructure and houses.

The rest of the cost is being paid in 40 annual installments without any interest [37, 38]. According to the 1959 agreement between Egypt and Sudan, resettlement of the Sudanese Nubians was the responsibility of the Sudan Government. Nubians, as a distinctive community, being deeply attached to their lands, lost something they cannot be compensated for and suffered psychologically. "After 25 years, the social impacts of migrants have been remarkable. They were mixed with people of Aswan and Qena provinces and got used to their culture and traditions and were thus leading normal happy life" (Merdan, 1999 and Fernea, 1973). Nubia had monuments, temples, tombs, fortresses and other remains from Pharaohs, Ptolemaic and Roman ages.

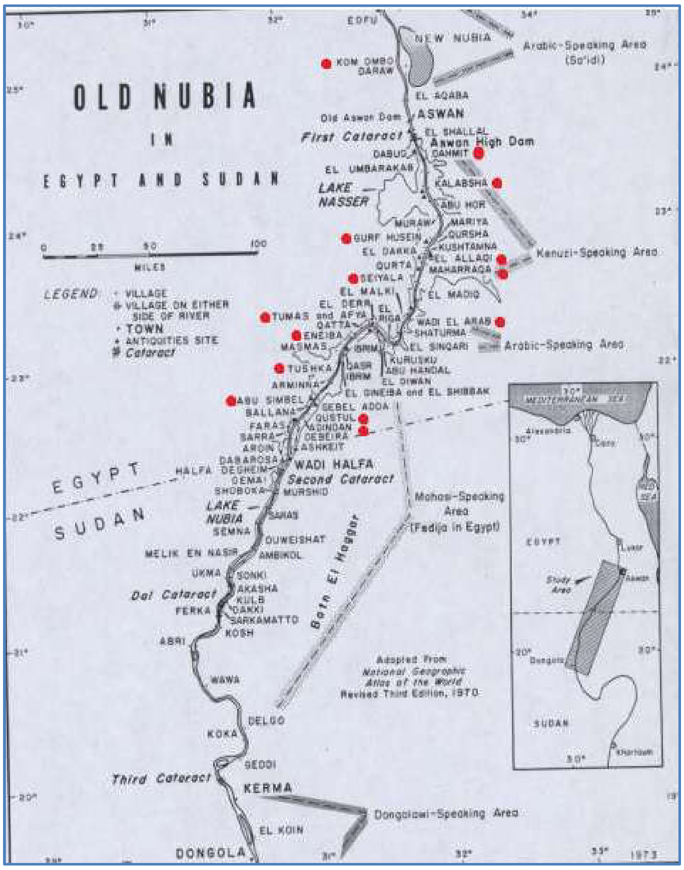

Fig 10. Old Nubian lands in Egypt and Sudan [38]

GERD Effects

The same think happen in the GERD area whereas the Ethiopian newspaper reported that the construction of GERD cause a resettlement of 200 thousand of people lives in the dam area in addition to deforestation of great forest area in the dam site. The same resettlement problems repeated with GERD projects in the same way in Nubian people in Sudan and Egypt.

Impact on ecosystems

Further ecological consequences of damming are the loss of forests and wildlife habitats, loss of species populations and the degradation of upstream catchment areas due to inundation, loss of aquatic biodiversity including upstream and downstream fisheries, and loss of the services of downstream floodplains, wetlands, and riverine, estuarine and adjacent marine ecosystems (Halim, 1995). There is also some cumulative impacts on water quality, natural flooding and species composition and, when a number of dams are sited on the same river, there could be habitat loss (fragmentation, barriers to migration), and changes in flow conditions, changes in sediment supply, and decreased nutrient delivery. Former to the construction of AHD, the aquatic weeds growth represented a serious problem in irrigation systems during the winter time, where the irrigated water is clean without sediments and the environment is favorable for weed growth. Most of Sudan irrigation systems suffer from irrigation management difficulties due to this problem. However, the Egyptian irrigation system is even worse regarding the aquatic weeds in spite of the limited amount of sediment they receive after the construction of the AHD. Growth of aquatic weeds aggravates the sedimentation rate while the sediment depositions furnish good environment for weeds to grow. Ahmed and Ahmed (Ahmed, 1993) reported that there are three types of aquatic weeds in Sudan Nile irrigation systems, especially the Gezira Irrigated Scheme, namely: submerged, emerged and floating. More than 60% of the operation and maintenance costs of the irrigation management in the Sudan irrigated schemes go to sediment and aquatic weeds clearance, plates. Therefore, these two problems create many irrigation difficulties leading to water shortage and hence reduction in crop yields coupled with increase in the cost of operation and maintenance.

On the other hand, the hyacinth weeds in the White Nile started in 1957 disrupting river traffic, inlet channels and river life. It is now spreading all over the equatorial lakes requiring regional and international efforts to combat it. However, both sedimentation and aquatic weeds require joint efforts and cooperation between the Nile Basin countries. For example the problem of sediment, although it creates many difficulties and problems to Sudan has its negative impact on the Ethiopian Highlands, from where it originates, degrading the land by erosion, and reducing its productivity. The most evident adverse impact of the AHD on ecological sustainability is the disappearance of sardine in the Mediterranean near Rosetta and Damietta Nile estuaries. Most of the silt carried by the Nile flood was flushed to the Mediterranean through the Rosetta and Damietta branches. Mediterranean fishing and brackish water lake fishery declined after the dam was finished because nutrients that used to flow down the Nile to the Mediterranean were trapped behind the dam. For example, the Sardine catch off the Egyptian coast declined from 18,000 tons

in 1962 to a mere 460 tons in 1968, but then gradually recovered to 8,590 tons in 1992 (Abul-Atta, 1978;) [19, 43, 44, 45, 46]. A scientific article in the mid-1990s noted that "the mismatch between low primary productivity and relatively high levels of fish production in the region still presents a puzzle to scientist.“ The Aswan Dam tends to increase the salinity of the Mediterranean Sea, and this affects the Mediterranean's outflow current into the Atlantic Ocean.
The condition of ecological sustainability that requires preservation of the minimum number of individuals to ensure the natural evaluation of each species is totally violated in the case of the sardine species. On the other hand, 20 years after the construction of the AHD, the total number of fish species has increased in the Nile and its estuaries [(General Authority for Fish Resources Development, 2012; Kenneth, 2008 and Biswas, 1994).

GERD Effects

The same results of effect of Mega dams in ecosystem will completely repeated with GERD. Changing in loss of forests and wildlife habitats, loss of species populations and the degradation of upstream catchment areas due to inundation, loss of aquatic biodiversity including upstream and downstream fisheries, and loss of the services of downstream floodplains, wetlands, and riverine, estuarine and adjacent marine ecosystems are expected to repeated with GERD. The aquatic weeds growth in Eastern Sudan irrigation canals will represent a serious problem in irrigation systems during the winter time, where the irrigated water is clean without sediments and the environment is favorable for weed growth.

Conclusion and Recommendation

Mega dams always have negative impacts in river and agriculture lands ecosystems. The main impacts of Aswan High Dam in Egypt are building up of soil salinity, water logging, land and water contamination, land degradation, decreasing fishing in quantity, quality and types, deprivation the Egyptian lands from huge amounts of fine particles sedimentation and that increases the uses of chemical fertilizers and pesticides. The overuses of fertilizers and pesticides affects the food safety and human been health in Egypt. Thus Egypt should take strong and deterrent process to control the overuses of pesticides and control the uses of chemical fertilizers according to food safety instructions. Water logging and building up of soil salinity needs qualified and efficient agricultural draining systems should cover all agriculture land in Nile Valley and Delta to control soil salinity. The Vulnerability of Delta land to climate change against the raise of Mediterranean Sea level after AHD needs good effort to protect the Nile delta coasts using recommends methods for this matter. The contamination of irrigation and drainage canals should have a restrict processes to treat and ameliorate the agricultural, sanitation and industrial wastewater to become suitable for reuses and recycle.

REFERENCES

Abdalla, A. A. 2007. Sedimentation in the Nile River, Advanced Training Workshop on Reservoir Sedimentation, 10 - 16 Oct. 2007, IRTCES, Beijing , China

Abul-Atta A. 1978. Egypt and the Nile after the Construction of High Aswan Dam (Cairo, study for Ministry of Irrigation), Cairo, p 222.

Abu-Zeid M A and El-Shibini F Z 1997. Egypt’s High Aswan Dam,Water Resources Development, Vol. 13, No. 2, pp. 209±217.

Afifi, A, b., 1993. “Role of Aswan Dam in safeguarding Egypt from floods and droughts”, ICOLD 61 executive meeting and symposium, Cairo, Egypt.

Ahmed, A.A. and Ahmed, S.E, (1993), "Irrigation and Drainage Systems Management in the Sudan", R67/Q44, Volume I-B, 15th International Congress, ICID, The Hague, Netherlands.

Ahmed, M., Moustafa S. and Medhat A. 2001. ENVIRONMENTAL EVALUATION FOR HIGH ASWAN DAM SINCE ITS CONSTRUCTION UNTIL PRESENTSixth International Water technology Conference, IWTC 2001, Alexandria, Egypt

Ali M. Hamdan* and Mohamed Zaki 2016. Long-Term Estimation of Water Losses Through Evaporation from Water Surfaces of Nasser Lake Reservoir, Egypt. *International Journal of Civil & Environmental Engineering* IJCEE-IJENS Vol: 16 No: 05, 160905-7878-IJCEE-IJENS © October 2016 IJENS.

BelachewChekeneTesfa 2013. Benefit of Grand Ethiopian Renaissance Dam Project (GERDP) for Sudan and Egypt. EIPSA Communicating Article Energy, Water, Environment & Economic, Energy, Volume 1; Issue 1; Dec 2013, Pages 1-12.

Biswas, Asit K. 1994. International Waters ofthe Middle East: From Euphrates - Tigris to Nile. Oxford University Press. New Delhi, 221 p.

BiswasA. K. and Tortajada, C. (eds.) 2012. Impacts of Large Dams: A Global Assessment, Water Resources Development and Management, DOI 10.1007/978-3-642-23571-9_17, © Springer-Verlag Berlin Heidelberg 2012.

Bolt, G. H. 1982. Soil Chemistry, B: Physic-chemistry Models, El-Sevier Scientific Publication Company, Amsterdam.

Bolt, G. H., and Bruggen wert, M. G. M 1978. Soil Chemistry, A: Basic Elements, El-Sevier Scientific Publication Company, Amsterdam.

Ecosystem Impacts of Large Dams 2001. Background Paper No. 2 Prepared for IUCN / UNEP / WCD By M.P. McCartney, C. Sullivan and M.C. Acreman, 2001 International Union for Conservation of Nature and Natural Resources and the United Nations Environmental Programme.

El-Manadely, M.S., Abdel-Bary, R.M., El-Sammany, M.S. and Ahmed, T.A. 2002.Characteristics of the delta formation resulting from sediment deposition in Lake Nasser, Egypt: approach to tracing Lake Delta formation. Lakes and Reservoirs: Research and Management, 7, 81–86.

FAO 2016. Submission and evaluation of pesticide residues data for the estimation of maximum residue levels in food and feed, FAO PLANT PRODUCTION AND PROTECTION PAPER Third edition 225. ISBN 978-92-5-109133-3.

FAO/WHO 2003. Nitrite (and potential endogenous formation of N-nitroso compounds). In: Safety evaluation of certain food additives and contaminants. Geneva, World Health Organization, Joint FAO/WHO Expert Committee on Food Additives (WHO Food Additives Series No. 50; http://www.inchem.org/documents/jecfa/jecmono/v50je05.htm).

Fernea, R. and Grester, G., 1973. Nubians in Egypt: Peaceful people, University of Texas.

Fewtrell L 2004 Drinking-water nitrate, methaemoglobinaemia, and global burden of disease: a discussion. Environmental Health Perspectives, 112(14):1371–1374.

FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS Rome, 2008.Guide to laboratory establishment for plant nutrient analysis, ISBN 978-92-5-105981-4.FAO Vialedelle Terme di Caracalla, 00153 Rome, Italy.

General Authority for Fish Resources Development (1996–2008) *Fisheries Statistics Yearbook*(General Authority for Fish Resources Development, Cairo, Egypt 2010).

Grain R. E., 1968. Clay Mineralogy, second edition, McGraw Hill, New York.

Halim Y, Morcos SA, Rizkalla S, El-Sayed MKh, 1995. *Effects of Riverine Inputs on Coastal Ecosystems and Fisheries Resources*, The impact of the Nile and the Suez Canal on the living marine resources of the Egyptian Mediterranean waters (1958–1986) FAO Fisheries Technical Paper 349. Available at http://www.fao.org/docrep/003/V4890E/V4890E02.htm#ch2. Accessed October 25, 2017.

Halim, Y., Guerguess, S. K., and Saleh , H. H., 1967. Hydrographic conditions and plankton in the southeastern Mediterranean during the last normal Nile flood (1964). Int. Rev. GcsamtenHydrobiol. 52 : 401-425.

HENRY D. F., 1990. FUNDAMENTALS OF SOIL SCIENCE EIGHTH EDITION, JOHN WILEY & SONS, ISBN 0-471-52279-1.

John, L and Elsaid A. 1993. The upcoming Water War in Middle East, Go lancer Victor publication, London, 1993 (in Arabic).

Kantoush S.A., T. Sumi 2013. Reservoir sedimentation and sediment management techniques in the Nile River basin countries, *2013 Taylor & Francis Group, London, ISBN 978-1-138-00062-9.*

Kenneth M., Strzepeka,b. c, Gary W.Y, Richard S.J. Tole,F. G and Mark R 2008. THE VALUE OF THE HIGH ASWAN DAM TO THE EGYPTIAN ECONOMY, Ecological Economics, February 2008, Research Gate. Fount at: https://www.researchgate.net/publication/4842897.

Mahmoud Medany, Samar Attaher& Ayman F. Abou-Hadid 2010. Land-use change and adaptation in the Nile Delta region, regional assessment of the FP6 project of ADAPTATION OF AGRICULTURE IN EUROPEAN REGIONS AT ENVIRONMENTAL RISK UNDER CLIMATE CHANGE (ADAGIO).

Marefa.org, 2013, Nubian People Migration, http://www.marefa.org (seen July 2013).

Merdan, A., 1990. Nubian architecture: The Nubian character in urban composition, unpublished MSc. Thesis, Ain Shams University, Cairo.

Merdan, A., 1999. Development concepts and implementation strategies for new settlements: with spatial reference to Aswan Dam Lake region – Egypt, limited publishing PhD. Thesis, Stuttgart University.

Ministry of water resources and irrigation, 2005. “Water for the future, National water resources plan 2017,” Cairo, Egypt.

Palmieri, A., Shah, F., and Dinar, A. 2001 Economics of reservoir sedimentation and sustainable management of dams. *Journal of Environmental Management*, 61, 149–163.

Reda M.A.Hassan 1, Nasr T.H. Hekal2 , Nader M.S. Mansor 2007. EVAPORATION REDUCTION FROM LAKE NASER USING NEW ENVIRONMENTALLY SAFE TECHNIQUES. Eleventh International Water Technology Conference, IWTC11 2007 Sharm El-Sheikh, Egypt (p 179 – 194).

Science for Environment Policy 2013.Soil Contamination: Impacts on Human Health, European Commission, September 2015, issue number 5. http://ec.europa.eu/science-environment-policy.

Sharaf El Din, S. H.1977. Effect of the Aswan High Dam on the Nile flood and on the estuarine and coastal circulation pattern along the Mediterranean Egyptian coast., LIMNOLOGY AND OCEANOGRAPHY, MARC11 1977, V. 22(2).

The International Bank for Reconstruction and Development *I*The World Bank 2008. Indirect economic impacts of dams: case studies from India, Egypt and Brazill editors, Ramesh Bhatia, Editors RAMESH BHATIA, RITA CESTTI, MONICA SCATASTA, R.P.S. MALIK). ISBN 13:9788171886814 ISBN 10: 8171886817

The International Bank for Reconstruction and Development, the World Bank2008. Indirect economic impacts of dams: case studies from India, Egypt and Brazil editors, Ramesh Bhatia, Editors RAMESH BHATIA, RITA CESTTI, MONICA SCATASTA, R.P.S. MALIK). ISBN 13: 9788171886814 ISBN 10: 8171886817, NW Washington DC 20433.

The State of the Nile River Basin 2012. The Nile Basin Initiative (NBI), October 2012. ISBN: 978-9970-444-00-7.

UNCCD 2009. Climate Change in the African Drylands: Options and Opportunities for Adaptation and Mitigation

UNCCD 2016. DESERTIFICATION THE INVISIBLE FRONTLINE

UNESCO / IRTCES – 2011. Sediment Issues & Sediment Management in Large River Basins Interim Case Study Synthesis Report, International Sediment Initiative Technical Documents in Hydrology UNESCO Office in Beijing & IRTCES 2011

UNESCO, International Hydrological Programme, International Sediment Initiative 2008. Sediment in the Nile River System, Abdalla A. A, Usama H. A. E. I., January 2008 Khartoum – Sudan.

Walaa Y. E 2013.The Combined Effect of Water-logging and Salinity on Crops Yield, Journal of Agriculture and Veterinary Science (IOSR-JAVS) e-ISSN: 2319-2380, p-ISSN: 2319-2372.Volume 6, Issue 4 (Nov. - Dec. 2013), PP 40-49,www.iosrjournals.org.

White, Gilbert F. 1988 “The Environmental Effects of the High Dam at Aswan.” *Environment.* Vol. 30. No.7: 5-11; 34-40.

WMO 2013. Climate Change and Desertification.

****