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4. The Contribution of Eritrea in Nile Basin

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Abstract

Nile basin comprises eleven countries which are mostly located in the flooded area of the basin but a large population of the Sudan and Egypt depended on this river. Sudan and Egypt receive their major water supply drained from upper stream countries like Ethiopian highlands and Lakes regions in the south. More over the contribution of Eritrea in the Nile basin has a great role as it has strategically located and also the major fertile area in the country contributed in the basin. Eritrea's contribution is important because the state neither favorite black Africa which found south of Eritrea or the northern part which is basically dominated by the Sudan and Egypt. About 95 percent of the Egyptian population lives within 20 kilometers (12 mi) of the Nile river banks. Almost a large part the Sudanese population depends on the same river to sustain their livelihoods. The present paper outlines all past experience of upstream countries of the Nile basin regions to supply water to flourish the Sudan and Egypt nations to develop their irrigation activities. Above all Eritrea's role could be evaluated as the country is not sided with northern downstream countries or nor with upstream countries. Rather Eritrea is usually considered as a country wants to promote negotiations between downstream and up stream regions of Nile basin. The secondary data gathered showed that the Sudan and Egypt have mostly exploited the Nile basin regions. The Nile river although it starts from different topographic regions of the east Africa it only supplies a large amount of water and silt particles to the Sudan and Egypt. In fact currently Ethiopia has started to build one of the biggest dams in Africa inside the country along Abby River or Blue Nile River in the Nile basin. While the construction process is undergoing conflicts has aroused between Ethiopia and down stream countries like Egypt and Sudan. Hence, Eritrea acted freely from this division and wants to contribute peacefully and make to settle the conflict by negotiation between these countries. Eritrea has enough irrigable area contributed in the Nile basin and most of its area could be highly used for agricultural activities in the county. The

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statistical information provides seem to be old in order to refer to understand the data from its original sources and as a result to make the current data easily compared with previous information. Therefore it is very important to mention the role of Eritrea it plays to settle the problems arise between Egypt downstream nation and Ethiopia an upper stream country to the table peacefully. In future if any conflicts arise with Nile basin countries they should discuss the issues within them selves and they have to settle to it peacefully within the basin. Almost eleven countries have comprised the Nile basin region therefore all are responsible for any type of water related conflict happened within them.

Key words: *Nile basin, riverbank, downstream, upstream, black Africa and tributary.*

Introduction

The Nile River, with an estimated length of over 6800 km, is the longest river flowing from south to north over 35 degrees of latitude (Tvedt, 2010, Tafesse, 2001, Safiel, 1967 & Chiras, 1994). It is fed by two main river systems (Figure 1): the White Nile, with its sources on the Equatorial Lake Plateau (Burundi, Rwanda, Tanzania, Kenya, Zaire and Uganda), and the Blue Nile, with its sources in the Ethiopian/Eritrean highlands (Tafesse, 2001, Chiras, 1994 & Ashok 2002). The total area of the Nile basin represents 10.3% of the area of the continent and spreads in eleven countries (see Table 1). As table 1 indicates the share of Burundi, Rwanda, Zaire, and Eritrea are very small compared to the rest of the Nile Basin countries. However as it has clearly indicated in the table the contribution of Burundi, Rwanda, and Uganda in the total area of their countries have large enough to contribute in Nile basin region. In these three countries more than 47 % of the total areas of have been used to engage in the Nile sharing. The involvement of Eritrea in the Nile basin has seen from different angles. In the first place the geopolitical situation of Eritrea in the Nile basin and Red Sea is strategically very essential because it represents the relationship between the Nile basin regions and the world. Particularly, the share of Eritrea focused in strengthening such type of relations at the highest level between the Nile basin countries and the rest of Middle East, Asian nations. In fact the location of Eritrea in the Red Sea is very important because the country lies between Middle East and Asian countries and the Sub-Saharan Africa (Mohamoda, 2003, Ashok, 2002 & Metawie, 2004).

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Secondly the contribution of Eritrea in the Nile basin has more than 20 % and in fact the share is not small comparing to Keya, Tanzanian and Zaire. In fact some tributaries of Eritrea like Tekeze and Mereb rivers are the major ones which contribute a lot in development of the Nile basin sharing. These two rivers have the major ones for Eritrea because every agricultural and industrial development of the country has depended on such type of rivers. Moreover the areas around Tekeze and Mereb basin have seen rainy season and the first type rainfall have occurred in those areas. In fact rainfall distribution in Eritrea has stated from these regions after that it passes the rest of the country. The third aspect in the contribution of the Nile basin has seen the outlook of Eritrea in the perception of ethnic and religions backgrounds. Eritrea has entirely looks the Nile basin regions as free from the influence of any cultural affiliations and basically free from religious believes. In fact the orientation of African population in the Nile basin countries have some reflections either sided to black Africa regions or that of Arab countries (Lebon, 1960, IRIN 2003, & G. Hardin 1968). However Eritrea has the single most important nations which could be free from these believes. The country can not favored any of those ideas like black Africa and Arab nations. Another important idea which Eritreans has accepted is that the division of people by various religions and ethnic backgrounds. In fact Eritrea had passed through various struggles which faced by the proponents of religions sects however finally it had defeated all their tricks against Eritrean masses. The country had faced all the above problems but due to hard struggle of the Eritrean people against all odds finally it would be able to achieve successfully all the causes. Eritrea is the only nation which could present all the problems it had challenged during its arm struggle which spent about thirty years in fact the country encountered by so many problems however the above ones were successfully archived and that is why the country can help to solve the problems engaged the Nile basin countries. The above three problems revealed in the Nile basin countries can be easily solved by Eritrea if it gets an opportunity to involve to settle the conflicts.

According to Table 1 countries like Burundi, Rwanda, Uganda, Sudan and Egypt, are almost completely integrated into the Nile basin.' However, all the waters in Burundi and Rwanda and more than half the waters in Uganda are produced internally, while most of the water resources of Sudan

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and Egypt originate outside their borders: 77% of Sudan's and more than 97% of Egypt's water resources as shown in Table 1 can be used by the population in their own country.

Objectives and Methodology

The paper has outlined several research objectives and also shows that the methodology employed during data sources and interpretation. The objectives will list as follow:

1. To identify the role and share of Eritrea in the Nile Basin countries.
2. To make awareness the world community the contribution of Eritrea in handling the conflicts that would raise among Nile basin countries.
3. To analysis the importance of geopolitical location within Nile basin countries.
4. Understand the climatic and vegetation types prevailing in the Nile basin countries.

The study has also referred different types of secondary data sources to enrich the contents from various ministry offices, local communities and administration offices. In addition, the text will be enriched by referring some written documents such as journal, magazines, and others. Data gathered from secondary sources will be essentially interpreted to fill full the demand of objectives listed above.

Rivers and Discharges of upstream countries

The most distant source from the sea is the Luvinzora River in Burundi, a tributary of the Kagera River (Safiel, 1967, El-sham 1968, & Miller, 1988). The Kagera River forms the border between Rwanda and Tanzania, then between Uganda and Tanzania and then flows into Lake Victora, (Figure 1) the second-largest freshwater lake in the world with an area of about 67000 km^2. Total flow into the lake is about 20 km^3/year, of which 7.5 km^3 from the Kagera River, 8.4 km^3/year from the forest slopes in the north-east (Kenya), 3.2 km^3/year from the drier Serengeti Plains in the south-east (Tanzania) and from 1 to 2 km^3/year from the swamps in the north-west (Uganda) (Raven, Berg, ,Johnson 1993& Sene 2000). Hence Luvinzora and Kagera rivers are important tributaries of Nile basin (Tafesse, 2001,Tvedt 2010 & John, 2001).

Uganda is a humid country with numerous lakes and wetlands and with internal renewable water

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resources globally estimated at 39 km^3/year. However, the total annual flow into the country (at Ripon Falls and from Zaire) is about equal to the total annual outflow to Sudan, which means that a lot of water disappears within the country through evaporation and evapotranspiration from the lakes and wetland (Tvedt ,2004, Safiel,1967 & John, 2001).

Entering Sudan, the Albert Nile becomes the Bahr el Jebel. It flows into the Sudd (barrier) region, the great wetlands which are a maze of channels, lakes and swamps in South Sudan, and which also receive water from the Bahr el Gazal River, originating in south-west of South Sudan (Tafesse, 2001, Tvedt, 2010, Safiel, 1967 & Gabler, 1975).

The most remarkable topographic feature of the Sudd area is its flatness: for 400 km, from south to north, the slope is a mere 0.01 % and much of it is even flatter (Raven, Berg, & Johnson 1993 & Safiel, 1967). The soils of the whole area are generally clayish and poor in nutrients. Rain falls in a single season, lasting from April to November and varying in the Sudd area from about 900 mm in the south to 800 mm in the north (Safiel, 1967, El-sham 1968 & Miller, 1988). As the rainy season coincides with, though is slightly shorter than, the flood seasons of the rivers, there is land of water and mud for half of the year and, away from the rivers, land of desert-like dryness for the other half. The main natural channels flow through a swamp area waterlogged throughout the year, and are then flanked by grasslands flooded at High River and exposed when the river level drops. Because of the important rainfall in the Equatorial Lake Plateau during the 1960s and 1970s the permanent swamp area increased from 2700 km^2 in 1952 to 16200 km2 in 1980.

Less than half of the water entering the Sudd region flows out of it into the White Nile. The rest disappears through evaporation and evapotranspiration. The quantity entering the Sudd region varies greatly over the years, mainly depending on the rainfall in the upper catchment area, and hydrological measurements have shown that the greater the flow of water into the Sudd, the greater the percentage of water 'lost' in evaporation (Tvedt, 2010, Chiras, 1994 & Safiel 1967). The amount of river discharge in Sudd region from 1905 up to 1980 would be shown in Table 2.

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In order to bypass the Sudd region and to direct downstream a proportion of the water considered lost each year by spill from the river and evaporation in the swamps, the construction of the Jonglei Canal had been planned. This water could then have become available for irrigation and other uses downstream in Sudan and Egypt (Allen, 1994 & Metawie, 2004). Construction of the canal began in 1978 for a planned total length of 360 km, but work stopped in November 1983 after 240 km because of the civil war. By that time it had also become clear that these 'losses' create resources in pasture and fisheries and that the canal causes enormous human and environmental problems in the area. The issue is now how much water can be drained from the Sudd through the construction of the Jonglei Canal without serious and irreparable damage to the local environment and economy and its potential expansion (Tvedt, 2004, Raven, Berg, & Johnson 1993).

The Sobat River that flows into the White Nile just upstream of Malakal is fed by the Baro and Akobo Rivers and others with catchment areas situated mainly in the southern Ethiopian foothills (Selassie, 2000 ,Tafesse, 2001 & Ashok 1997).

The Blue Nile and its main tributaries, the Dinder and the Rahad, rise in the Ethiopian mountains and around Lake Tana (Arsano, 2004 & Tafesse, 2001). The confluence of the White Nile and the Blue Nile is at Khartoum. Further downstream is the Atbara tributary, the last important tributary of the Nile system, again deriving from the Ethiopian plateau north-east of Lake Tana and forming the border between Ethiopia and Eritrea before entering Sudan (Selassie, 2000, Tafesse, 2001 & Gabler, 1975). The contribution of Eritrea must see here in fact Mereb river is also missed to mention as most frequently enrich the volume of Atbara river. In other word, Settit and Mereb rivers are the most exploited rivers as far as the economic and social background of Eritrea is concerned. In fact let us consider that both Tekeze and Mereb are always considered as major tributaries of Nile basin. The catchment area of Tekeze and Mereb in Eritrea are largest than any other river which are not considered to flow outside the country. However the courses of the flows are passed by many ups and downs except that when they joined in the sand plain of Sudan they will run smoothly. There are no important tributaries further downstream in Egypt as it only receiving rivers from other countries.

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The contribution of the rivers of the Ethiopian catchment area (Blue Nile system) to the Nile is about twice the contribution of the rivers of the Equatorial Lake Plateau catchment area (White Nile system), but it is characterized by the extreme range in discharges between the peak and low periods, while the flow from the Equatorial Lake Plateau is more uniform (Arsano, 2004, Tafesse, 2001, Gabler, 1975 & Ashok 1997). At its peak the former provides nearly 90% of all water reaching Egypt, the latter only 5%. During the months with low flow the contributions are nearer 30% and 70% respectively. All in all Ethiopia is providing 80% of water to Nile basin so it has a lion's share contribution comparing to other regions in the area (Selassie, 2000, Tafesse, 2001 & Last, 1962).

As already mentioned, variations in rainfall amount over the years can cause quite considerable variations in discharges and lake levels. This seems to be more explicitly the case for the White Nile River system. For this reason, average discharge figures might vary greatly depending on the period under consideration, as shown in the Table 3. Actually the figures in the table seem to cover only from 1912 up to 1982 which means it show how the White Nile receives its courses from the original one up to Khartoum. The whole process from the origin up to Khartoum the White Nile flows almost over smother surfaces.

In addition to variations due to rainfall, the discharges might vary also due to water abstractions, mainly for irrigation purposes. In these three periods of White Nile flow the rate of discharges per square km is almost the same which show that even from earlier time in 1912 and up to 1982 as it has been shown in table 3 the pattern of discharges is the same.

Irrigation potential and water requirements of Nile basin regions

Both **Burundi** and **Rwanda** are characterized by a rolling topography with a continuous pattern of hills and valleys, with lakes and marshy lowlands at the bottom of the valleys. Improving the drainage network in part of the swamp areas, combined where possible with an irrigation network, would allow year-round cultivation, which is important for these small, but very densely populated countries. The total area of these valley bottoms in the Nile basin is estimated at 105000 ha for Burundi and 150000 ha for Rwanda for **Tanzania** the irrigation potential has been estimated at 30000 ha, but this would

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require the construction of considerable water conveyance works.

The Lake Victoria basin in **Kenya** covers only 8.5% of the total area of the country but it contains over 50 % of the national freshwater resources. The national water master plan identified an irrigation potential of 180000 ha based on 80% dependable flow. As part of the plan, dams and water transfers to other (sub) basins are proposed. At present only about 6000 ha are irrigated. Moreover, in Kenya there has been lengthy debate as to whether, given adequate technology, Lake Victoria basin water should be transferred to arid areas of the country for irrigation (Tvedt, 2004 ,Sene 2000 & Metawie, 2004). It is considered that perhaps the most appropriate location for such an experiment would be the Kerio Valley (located in the Rift Valley) for which a special development authority has been established by the Kenyan Parliament. The feasibility of such a project is a question of engineering and several observers consider it possible. Such an undertaking would use significant quantities of water.

The Nile basin in **Zaire** covers less than 1 % of the area of the country. The area is hilly and does not really lend itself to irrigation. This area is rather densely populated with most people engaged in cattle rearing and fishery activities around Lake Albert (Tvedt, 2010 & Metawie, 2004). It is considered that about 10000 ha could be developed for irrigation.

Uganda has large swamp areas covering about 700000 ha. The irrigation potential is estimated at 202000 ha, requiring, however, major works such as storage, river regulation and large-scale drainage. At present only 5550 ha are irrigated.

The irrigation potential in the Nile basin in **Ethiopia** has been estimated at more than 2.2 million hectares. The irrigated area was about 23000 ha in 1989. So it is essential to know the original irrigation potential of Nile basin in 1989 (Selassie, 2000, Tafesse, 2001 & Ashok 1997).
The seasonality of the flows in Ethiopia is very high, as shown in Table 4. This means that very considerable regulation would be necessary for their full utilization. The risk of rapid siltation of the reservoirs because of the steep slopes is a real problem. Construction of dams would augment the

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quantity of water available, because of a loss of only 3 % by evaporation as against a loss of almost 16% in the Aswan reservoir. Egypt, however, would no longer be the beneficiary of additional water in years of high flood, which would then be stored and regulated in the Blue Nile reservoirs instead of Aswan. It is essential to mention some aspects of the usage of Nile basin resources particularly for Ethiopia (Raven, Berg, & Johnson 1993 & Tafesse, 2001). As we know currently Ethiopia has not been used any thing from Nile basin resources. Imagine the country like Ethiopia which is the major supply of water in the Nile basin could not be used any water potentials from the basin. It is unbelievable to think that Ethiopia as major supplier of water potential in the Nile basin is not to be alienate from the basin for centuries (Last,1962). As we seen in the previous tables Ethiopia's share in the Nile basin highest from all countries in the basin and not used so far which cross the source of Nile the hinterland of the country (Selassie, 2000, Tafesse, 2001 & Raven, Berg, & Johnson 1993). Almost for thousand years Ethiopia has not used any potential from this basin and yet it supplies huge amount of soil resources to down stream countries (Last, 1962). Abbay in this case the prime sources of Nile River in Ethiopia is so far only transport not only water but a lot of soil materials to Sudan and Egypt which could be used to irrigate a large amount of farm lands and producing different types of products to world markets (Arsano, 2004, Tafesse 2001& Ashok 1997). Therefore it is not surprising to see Ethiopia at present to focus to build one of the biggest dams called Renaissance in Africa to hold sufficient amount of water along Abay river which is the main tributary of Nile basin.

The irrigation potential in the Nile basin in **Eritrea** has been estimated at between 60000 and almost 300000 ha, though these figures are based on very limited studies. Most of it would be in the Tekeze-Setit basin, which Eritrea shares with Ethiopia. The Mereb-Gash basin has mainly spate flows and its water reaches the Atbara River in Sudan only during extremely high floods. In this review the average irrigation potential has been estimated at 150000 ha. The most important thing to mention about Eritrea is its total irrigable land under Nile basin has very great comparing to total agricultural area used for other purposes. Impinge when compared with other countries of the Nile basin regions Eritrea's share is about 20% which is magnificent to mention. However when the question of Nile basin is raised most of time Eritrea and other countries are not mentioned mostly because of their

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share and smallness of the area in the basin have considered like not recognized by rest of countries. Eleven countries should be mentioned as far as Nile basin is concerned which in one way or the other sharing their own contribution. The eleven nations vary in terms of contribution and they also vary greatly when we see their climatic and vegetation types in the region. Therefore it is unfair to distinguish them by smallness of the area they contributed in the basin so each of them has some contribution in the basin.

Irrigation potential in **Sudan** has been estimated at over 4.8 million hectares, but this figure does not take into consideration the available water resources (Chiras, 1994 & Barbour, 1961). The irrigated area was about 1.6 million hectares in 1979 and 1.9 million hectares in 1990. There are plans to increase irrigation to about 2.8 million hectares by the year 2000, almost all to be irrigated by Nile water. Actually at present time Sudan has divided in to two countries such as like North Sudan and South Sudan. South Sudan has more tributaries of While Nile in its area than Sudan itself. A number of tributaries are originating from southern parts of Nile basin countries including also from south western region of South Sudan. Sudan is only receiving water which comes both from White Nile and Blue Nile basins which are all flowing in smooth direction. Of course Sudan has required much to investigate about what will happen the flowage of rivers in future and specifically Ethiopia has doing something to cataract the Abaoy river in its country (Tvedt, 2010, IRIN 2003,Ashok 2002 & Metawie, 2004). Similar majors could be taken in future for White Nile River from South Sudan. In fact Sudan should strengthen its diplomatic ties with southern countries in order to get enough supply of water in future.

The figures in Table 5 for irrigated area in 1979 and 1990 correspond to the area equipped for irrigation. The actual irrigated area in 1990 was about 1.2 million hectares, or about 63 % of the total equipped area of 1.9 million hectares. About 16.8 km^3 of water was used, corresponding to 14000 m^3/ha. Despite this relatively high value, water management is a problem, for example water supply on the old established cotton schemes of Gezira- Managil was and is about 12% below crop requirements at crucial points in the growth cycle. At the same time, as much as 30% of the water delivered is not used by crops. In large state-run irrigation projects, like Gezira-Managil and Khashm

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al Girba, average water deliveries to the command area are between 9700 and 12600 m^3 per cultivated hectare per year. Sugar cane, a very water-consuming crop, uses between 28000 and 40000 m^3 per ha per year. Many projects and including major dams were constructed in Sudan to carry out its farm land which found along the courses of Nile basin and some points the country has to think in future very attentively. As you know Khartoum the capital city of Sudan has the confluence of both White Nile that comes directly from south and Blue Nile which originates from Ethiopia (Arsano, 2004, Selassie, 2000 & Tafesse 2001).

In fact Table 5 it shows clearly what was done to irrigate farm lands in Sudan and in most part of the Table some activities had done to irrigate the area in three periods that cover around 1979 up to 2000. Some of the activities are difficult to carry out at present because some stream could be reduced their flow because of the construction of new dams in their up streams.

As it is indicated in Table 6 consider an availability of 25 km^3 of water for irrigation in 2015 and a water requirement of 14000 m^3/ha, only about 1.8 million hectares could be irrigated as opposed to the proposed 2.8 million hectares. In fact this idea was perfect at that time however currently it is not workable at all because in the first place Sudan itself has been divided in to two parts and more than these facts Ethiopia has already stated its renaissance dam and it is going to collect enough amount of water in the this summer (Arsano, 2004 & Selassie 2000). The construction of the dam in Ethiopia has worried the down stream countries like Sudan and Egypt. But negotiation in the table among Nile basin countries will be essential thing to solve their problems.

Under the Nile Water Agreement between Sudan and Egypt, the quantity of water located to Sudan is 18.5 km^3/year at Aswan, which corresponds to 20.55 km^3 further upstream Ashok 2002). This is according to the agreement of the Sudan and Egypt.

In **Egypt** several activities had done to perform to exploit the potential sources of Nile basin flow of courses for the agricultural and industrial benefit of Egyptian population. Egypt has been concerned too much about the usage potentials of Nile basin regions (Chiras, 1994, Kendie, 1999 & Ashok 1997). Historically Egypt has been dominated the use of Nile basin resources more than any country

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in eastern Africa region. For example Table 7 has indicated the use of water basin in the Nile region by Egyptian government for all types of reclamations list below in 2000:

It should be noted that each time new land is reclaimed it is of a lower quality than the already cultivated land. The best soils in Egypt cover an area of only about 1 pillion ha, while the best plus suitable soils cover an area of about 3.6 million ha (Little, 1965, Kendie, 1999 & El-sayed,1955). Adding the still more marginal land, the maximum area for agriculture could be 4.8 million ha. The remaining soils are unsuitable for agriculture.

As can been shown in Table 6 and in Table 8 the sum of the irrigation potential of the countries leads to a water deficit of over 26 km^3/year, without considering possibilities of reusing water as indicated by Egypt and Sudan in their water balance, but after deducting the water 'losses' in the Sudd region (Raven, Berg, Johnson 1993& Ashok, 1997).

This deficit corresponds to an area of almost 2.2 million hectares, considering an average water requirement in the region of 12000 m^3/ha per year. This leads to an irrigation potential for the basin as a whole of 8 million hectares instead of the nearly 10.2 million hectares.

However, even these 8 million hectares are still a very optimistic estimate and should be considered as a maximum value, requiring very important storage works and optimum water use. In fact all these activities were planned before by Egypt particularly to increase reclaiming capacity from 8 million up to 10 million however at present it is hard to implement it because of the division of Sudan as well as the constriction of new dam in Ethiopia. May be it also important to consider that is Egypt is stile dominating the Nile basin regions. Because many countries of Nile basin regions have saying that Egypt has been dominating the Nile basin no country can inter in the internal affairs of Egypt. Therefore the situation now is slightly different and will the southern basin regions including Ethiopia repeat the same mistake (Arsano, 2004 & IRIN 2003).

Eritrea's role and share in the Nile basin regions

The total share of Eritrea in the Nile basin region is not so small and even remarkable when we

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consider the strategic and diplomatic relations it plays in the regions. After all when we consider the total area covered by the Nile basin in the case of Eritrea is not negligible because it is about 20% of the area is under coverage. If we include the Mereb basin which is the major exploitable river in Eritrea it will increase to 30 % so that its increment would be important in the Nile basin. In short the over all potentials of belongings of Eritrea to the Nile basin regions can be summarized in the following ways:

In the first place, it is important to mention the location of Eritrea where the Nile basin regions have been distributed. Eritrea is located in the Horn of Africa between 35 degree of longitude to 43 degree of longitude east word latitudinal it stretches between 7 degree north and 18 degree north latitude (Mohamoda, 2003). This type of location makes the country to occupy the central location in between northern and southern regions of the Nile basin countries (see map 1). The central location gives the population to look over the usage of the basin regions to share equally of courses it depends on the total contributed in Nile basin. Now Eritrea has been considered by many nations of the basin as an outlook to be shared equally among the Nile basin regions. In this sense Eritrea has seen as the country to be not lined with black Africans like South Sudan, Kenya, Tanzania, Rwanda, Burundi and Zaire and not with countries of Sudan and Egypt in the north east and north. In this case Eritrea has seen a country not to favor black Africa and Islamic regions of the Nile basin. In fact this type of consciousness had been developed by Eritrean population during arm struggle period. The fact that all regions of the Nile basin countries irrespective of their area they contributed in the region can be summoned for discussion in the resolving conflicts arise in the Nile basin regions. The importance of the river and the efforts to control it during the British colonial period are relatively well documented and analyzed but for the post-independence period except renaissance dam which is built by Ethiopia there is no comprehensive and empirical description of the riparian countries' efforts to manage the watercourse.

The construction of the new renaissance dam in Ethiopia has been good example to request Eritrea to settle the conflict raised by Egypt and Ethiopia. In this occasion it is very important to consider settling the conflict between Ethiopia and Egypt because Eritrea has part of Nile basin region and

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secondly the consciousness developed by population of Eritrea could be matters a lot.

Secondly the role and share of Eritrea is more concerned on the area it occupies in the Nile basin regions (Mohamoda, 2003). In fact the share seems small however compared to Zaire, Rwanda, and Burundi it is stile bigger than them nonetheless the area is not only concern but the responsibility of a country is more important. Moreover, currently almost many countries have only mentioned to Sudan, Ethiopia and Egypt to discuss the issues of water distribution that means they are missing the rest of Nile basin countries to include in the region. Actually any conflict arise in the region between two or more are concerned every nation in the basin. All countries must convey for any type of consultation to discuss water sharing among them without distinguishing by the size of catchment area the contributed. Whether the River Nile will be an object of violent conflicts or of peaceful cooperation in the years ahead the way its water is managed in coming decades will definitely have worldwide implications.

Hence any type of water related conflict must, settle peacefully among the countries like Sudan, Egypt, Eritrea, Ethiopia, South Sudan, Kenya Tanzania, Zaire, Uganda, Rwanda and Burundi must be invited (Arsano, 2004,Tafesse, 2001 & Mohamoda 2003). If any country is missed then the negotiation can not be sustained. Because the river flow of Nile basin is responsible for every eleven nations mentioned above so any one should be concerned as far as the river flow will cover every country. Therefore Eritrea is responsible for any type of conflict or peaceful negotiation that arose among the Nile basin countries to settle on ground. The total area of Eritrea inscribed by the basin is more than 20 % and covered most fertile land of the country. Tekeze river is almost shared by Ethiopia and Eritrea and it is located along south western part of Eritrea (Selassie 2000). All fertile land belongs to Eritrea is located along the right flank of the Nile basin tributary and most fertile soils exist in the region. Most large and intensive farming of agricultural activities has been conduct in Eritrea in these areas. North of the Tekeze river there is also another area which can be mostly used for agricultural and can be considered also the major area of Nile basin tributary.

Finally it is also essential that Eritrea is strategically important place in the location of Res Sea when

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we consider in the Nile basin regions. Unlike other countries of the Nile basin Eritrea's location has astride comparing to others in the horn and east Africa countries. This type of location gives Eritrea to have special benefits comparing to other region of the Nile basin countries. The special benefits are like Eritrea locates at the junction of the three regions the northern part connects with Europe, eastern region covers mostly the Middle East and Asia and southern part includes Africa. All the regions met together in Eritrea when they want to consult each other therefore they could miss the country. Eritrea is therefore develops the sentiment all regions so it is advisable to nominate Eritrea for such purposes. Some says Eritrea is reflecting Arabism others indicates that it is representing Africans and stile others are saying the country adheres European sentiment. All these there types of sentiments are prevailed in Eritrea as such it is very important ways not forget Eritrea in consulting the Nile basin initiatives.

In addition Eritrea has enjoyed another thing to be a member of Nile basin country. This is therefore it has enjoyed three types of seasons with in distance of movement of not more than 300 km. This means that it has received three types of rainfall and all rainfall types are responsible to fill the Nile basin with annual flowage pattern. The three types of rainfall occur in Eritrea during summer, winter and spring. They are important to mention the benefits they contributed to increase the capacity of water in the Nile basin region. Eritrea is the only country benefits form all these three types of rail fall.

Therefore, any country whether they are from Nile basin regions or from world nations if they want to convey a meeting they must not forget Eritrea to attend on it. Eritrea shares many things to say to world nations cancers to Nile basin regions.

Relief of Nile basin

Sudan and Egypt form the north-eastern portion of the great African plateau. They also contain the middle and lower reaches of the Nile system. The Nile headwaters and its principal tributaries rise in mountains, or higher plateaux, to the south and south-east (Selassie, 2000, Tafesse, 2001, Tvedt 2010 & Raven, Berg, & Johnson 1993). This more varied relief is the product of the earth movements and

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volcanic activity that created the great rift valleys of Eastern Africa (Mohamoda, 2003, Lebon, 1960, & Ashok 2002).

The main rift valley runs northwards through Kenya to Lake Rudolf (which is the centre of a basin of inland drainage) and then turns north-eastwards towards the southern end of the Red Sea. No part of this main rift valley drains to the Nile; but on mountains immediately to the west both in Kenya and Ethiopia-the headwaters of the main Nile and some of its tributaries rise (Selassie ,2000 & Tvedt, 2010).

Western Kenya, most of Uganda and north-western Tanzania occupy a somewhat elevated portion of the African plateau. The general altitude is about 1075 m and the central lowest area is occupied by Lake Victoria-one of the larger freshwater lakes of the world-measuring 400 km from north to south and 320 km across. The rivers entering this lake from the south and south-west are the true headwaters of the Nile, because they are remotest from its mouths. The river leaving Lake Victoria near the middle of the northern shore, to convey surplus water northwards, is the beginning of the Nile proper (Tvedt, 2010, Sene, 2000 & Mohamoda 2003). It is some- times called the Victoria Nile, and it passes over several rapids and falls, of which the best-known are the Owen, Ripon and Murchison Falls. It also flows through a smaller lake-called Kioga-before reaching the floor of the western Rift valley and Lake Albert. Between Lake Victoria and Lake Albert, the Victoria Nile descends some 430 m from 1 140 to 710 m.(Sene 2000)

Lake Albert occupies part of the floor of the western rift valley, and is elongated but shallow. At this point, its name changes to Bahr el-Jebel, and shortly afterwards it leave the higher plateau for the lower, main plateau of Sudan and Egypt (Tvedt, 2010). The flow of Nile basin reaches the Ethiopian highlands which are larger and higher than those of Kenya. Numerous lava flows built up a plateau now at a height of about 2 500 m; and above this many extinct volcanoes rise above 4 000 m. These highlands are transverse to the south-west monsoon, and receive heavy rain- fall from May or June until October. More than2000 mm falls in the wettest places. This heavy seasonal rainfall has enabled the main rivers-the Sobat in the south, the Abbay (Blue Nile) in the centre, and the Takkaze in the

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north-and their tributaries to erode very deeply into the crust (Arsano, 2004 & Tafesse, 2001). Thus these Ethiopian highlands have a grandeur and variety of scenery that is unequalled in Africa. One result of the heavy seasonal rainfall and the intense erosive activity of the rivers are seen in the waters of the Nile tributaries as they leave the highlands. They are colored chocolate-brown when in flood, because they bear a load of fine silt and clay washed down from the highlands. The substances composing this load have been derived from volcanic rocks, including valuable mineral plant nutrients, and when they are deposited as alluvium, form fertile soils. The Abbay, when it reaches the foot of the Ethiopian highlands, changes its name to Nil el-Azraq, or Blue Nile (Arsano, 2004). This name is of course not descriptive of its appearance during the flood season, but during its low-water season, when it is clear and reflects the cloudless sky of the dry season in Sudan (Selassie, 2000 & Tafesse (2001).

The middle portion of the Nile basin lies in the eastern part of southern and central Sudan. It is a large, shallow, triangular depression in the African plateau. Its eastern side is longest (1 200 km) and corresponds with the western edge of the Ethiopian highlands. The south- western side is about 960 km long; and beyond it is a low plateau composed of ancient crystalline rocks, called the Ironstone Plateau. The north-western side is about 1040 km long, and is bordered largely by a plateau of wind-blown sands; but near the middle of this side, the scenery is varied by the appearance of granite hills, called the Nuba Mountains, rising to rather more than 1000 m. The main trunk of the Nile system traverses it from south to north; and is a very gently flowing stream throughout.

At Juba (close to the southern apex) its water is 450 mabove sea levels. At Khartoum, 1 744 km downstream and close to the northern apex, it is at 350 m. In the south, the main stream is called the Bahr el-Jebel. As it proceeds into the plain, its gradient becomes so gentle that even a slight rise in its water level causes it to overflow. To the west, the Clay Plain receives a number of rivers from the Ironstone Plateau. These become flooded at the height of the rainy season, and their waters spread out widely over the plain. One of these rivers, called the Jur maintains channel across the plain which joins the Bahr el-Jebel (Tvedt, 2004). But it does not contribute very much water to the Nile system, because when it is in flood, most of its water spills on to the plain on either hand. These floods extend

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over the entire plain south of about latitude 10"N because the heavy rains cannot drain to the rivers. So the whole area is flooded to a depth of between 1 and 2 m by the middle of the rainy season, in August, and the water does not begin to dry up until nearly the end of the year. The disappearance is due mainly to evaporation and not to any drainage to the main rivers, which is impossible because the plain is so level.

The Democratic Republic of the Sudan is under- populated, and has great reserves of land, which can sustain a growing population for many decades. Its irrigation schemes, watered from the Nile, are still expanding; and may possibly double in area before a limit to the use of Nile waters is reached. Its immense expanses of savanna are locally misused; but are generally under-used. There are many technical, social and economic obstacles to be overcome, before the rural population of Sudan enjoys adequate living standards but these problems are being studied and are gradually being solved (Ashok 1997). Determination and resourcefulness to apply modern science on the part of both government and people will provide the foundations of progress. There are practically no resources for industrial development, except some of the crops and animal products; but as population grows and incomes rise, there will be scope for a range of consumer-oriented industries, especially if electrical power can be transmitted from Ethiopia (Tvedt, 2004). Already there is a cotton ginning industry based on Gezira cotton and textile mills using the lint. Much cotton is still exported as a raw material from Port Sudan which has an oil refinery.

The Arab Republic of Egypt has some problems with land management and population. Many people are poorer than the simple cultivators and herders of Sudan, despite the more advanced character of Egyptian agriculture. Essentially this poverty is due to shortage of cultivable land, which cannot be remedied. In the battle to provide an adequate sustenance for the poorest third of the Egyptian population, some gains are possible in agriculture, by taking advantage of the reserve of water held by the High Dam to improve the seasonal distribution of water and increase the yields of summer grain crops (Little, 1965). Electricity from the High Dam is proving useful in industrial development and some textiles, cement and phosphates are now being exported. The Suez Canal was a useful source of revenue, and the equivalent of an export industry in its earnings of foreign currency (Tvedt, 2004).

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The country has been using the Nile drainage basin in many aspects (Little, 1965).

Climate situation and irrigation in the Nile basin

The climatic zones of tropical and middle latitudes are very well displayed in Africa and the Nile basin includes within its watershed portions of the three main zones.

1. In the extreme south of the Nile basin within a few degrees of the Equator, rain falls throughout the year; but is heavier between March and June, and again in November and December (Sene, 2000). The yearly total varies between 1250 and 2000 mm and is highest on the mountains. There is only a small seasonal variation of temperature, and a limited diurnal range. The altitude, which is between 920 and 4 900 m, however, causes the climate to be some- what cooler than at sea level on the Equator (Tafesse, 2001 Tvedt, 2010, Chiras, 1994) Haggag,1961).

2. From about 2" or 3"N to 18"N-that is, from the vicinity of Lake Albert to the beginning of the great S-bend in northern Sudan-the Nile basin is within the Tropical Continental climatic zone. Rainfall gradually decreases, from between 1250 and 1500 mm in the south to almost nothing in the north. There is no rainless season in the south; but the amounts of rain falling between November and February are small. In other words, there is a short dry season (Tafesse, 2001, Kendie, 1999 & Chiras, 1994). Further north, the dry season lengthens, and in latitude 10"N there is a drought lasting several months. This drought becomes more marked as latitude increases. Near the northern margin of the zone, between latitudes 15" and 18"N, about nine months are rainless, and the rainfall is concentrated in a short season between July and September.

3. From latitude 18”N almost to the Mediterranean coast, the Nile flows through a region with a hot desert type of climate. In the summer, from April to October, days are very hot; and the maximum day temperature in mid- summer often rises above 43°C (Haggag, 1961 & El-sayed ,1955). During the remaining months, however, the mean temperature is lower. Nights are often cold, with some frost. Hence, the climate is somewhat extreme, both seasonal and diurnal temperature differences are great and the difference between the hottest summer afternoon and the coldest night may be as much as

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50°C (Tafesse, 2001& Tvedt, 2004). This is one of the driest regions of the world; and sometimes rain does not fall for several years. When it does, however, there are local rain storms; brief, but severe.

In Table 9 all of the Nile basin countries indicated that the actual area which are used under irrigated concentrated mostly to Egypt and Sudan and the rest of Nile basin countries are sonly mentioned as part of the basin nothing more that they can do in the activities of the basin water. According to the information in Table 9 almost above 1,935, 200 hectares have used for Sudan and about 3,078,000 hectares for Egypt under irrigation project in Nile basin. The shares of other countries have between zero and 23160 hectares. The only East African country which is being tried to use the basin by constructing huge type of renascence dam have challenged by leagued of Arab Nations and similar other organizations (Tafesse, 2001). Ethiopians have fought a lot in convincing the United Nations and the OU (Africa Union) would be appropriate one for solving Africa type of problems (Arsano, 2004, Tafesse, 2001& Tvedt, 2004).

Conclusion

The key to the geography of Egypt and the Sudan is the Nile River, the second longest river in the world. In Africa no river can be found as Nile as it brings and influence the activity of man. In fact the distribution of land under irrigation by Nile basin in Egypt and the Sudan are about 6 and 3 percents respectively. The tow countries support of a population over 100 million. Most of these people live on land which depends upon the Nile for water. Mostly in Egypt 98 percent of the population lives along the valley of the Nile basin. In the Sudan without distinguishing into two regions ns the population is more widely spread but a high percentage depends upon the Nile waters. In this case the Nile River carries a great volume of water through the desert regions of the Sudan and Egypt and that river floods once a year. Actually, in the Sudan it has slightly receives little amount of water from its regions however, in case Egypt it contributes nothing to increase the flow of the Nile from its area. Ethiopia provides most of rainfall form itself however it only supplies a large amount of water and silt particles to the Sudan and Egypt. Nowadays Ethiopia has constructed a renaissance dam which is biggest in Africa and the Sudan, Egypt and Ethiopia are negotiating about the size of flow flowing to the Sudan and Egypt. Ethiopia has waited for a long time without any canal or dam construction along

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its major basin of Nile. It is apparent for Ethiopia to construct a new dam to use for social and economic benefits from its river waters originate from the country. Almost about 90 percent of water could come to the Sudan and Egypt from neighboring countries like Ethiopia and the rest. The main tributary of the Nile basin in Ethiopia which discharges water into the Sudan and Egypt are Baro, Atbara, and Abbay. These rivers are either contributing water to White Nile or the Blue Nile as a whole they are draining to the Sudan and Egypt. In fact the share of Eritrea will be important to mention here because partly Tekeze shares with Ethiopia as well as the most exploited river in the country will be considered as the main part of Nile drainage basin. Almost more than 20 percent of land in Eritrea is used for agriculture is also part of the Nile basin. Therefore Eritrea shares geopolitically important location along the Nile basin countries. It is insignificant to consider the smallness the area of Eritrea in the basin however the most important point is to know how it plays a great role in connecting the Middle East, Africa and some European countries. The Sudan and Egypt have considered that a lot of water could be lost due evaporation of water in the Nile river so in the first place a great care is needed to modernized the technical aspect of water to keep at the a desire level. Mostly as we see the data indicate in this text for almost a century the sole countries used Nile basin countries are the Sudan and Egypt. These two countries have built a number canals and dams and of course from this investment they exploited a largest amount of revenue from the basin. So it is not surprising to see the original source of Nile like Ethiopia and other countries will start to build dams.

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Figure 1 The Nile basin countries

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Country	Total area of the country	Area of the country within the basin	As % of total area of basin	As % of total area of country	Average annual rainfall in the basin area (mm)		
	(km^2)	(km^2)	(%)	(%)	min.	max.	mean
Burundi	27 834	13 260	0.4	47.6	895	1 570	1 110
Rwanda	26 340	19 876	0.6	75.5	840	1 935	1 105
Tanzania	945 090	84 200	2.7	8.9	625	1 630	1 015
Kenya	580 370	46 229	1.5	8.0	505	1 790	1 260
Zaire	2 344 860	22 143	0.7	0.9	875	1 915	1 245
Uganda	235 880	231 366	7.4	98.1	395	2 060	1 140
Ethiopia	1 100 010	365 117	11.7	33.2	205	2 010	1 125
Eritrea	121 890	24 921	0.8	20.4	240	665	520
Sudan & South	2 505 810	1 978 506	63.6	79.0	0	1 610	500
Egypt	1 001 450	326 751	10.5	32.6	0	120	15
For Nile basin		3 112 369	100.0		0	2 060	615

Table 1: Nile basin: areas and rainfall by country

Period	Discharge at Mongalla (km/year)	Discharge at tail of swamps (km^3/year)	Quantity disappeared (km^3/year)	% disappeared
1905-1960	26.8	14.2	12.6	47.0
1961-1980	50.3	21.4	28.9	57.5
1905-1980	33.0	16.1	16.9	51.2

Table 2 Average annual discharges at different locations in the Sudd region

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Location	Average annual discharges in km^3		
	period 1961-1970	period 1948-1970	period 1912-1982
Lake Victoria exit	41.6	29.4	27.2
Lake Kyoga exit	44.1	30.1	26.4
Lake Albert exit	48.8	33.7	31.4
Mongalla (White Nile)	52.6	36.8	33.1
Malakal (White Nile)	37.8	31.6	29.6
Khartoum (Blue Nile)	45.9	49.8	50.1
Mouth of the Atbara	10.9	12.1	10.6
Dongola (Nile)	86.2	86.2	82.7

Table 3 Variations in discharges at different locations on the Nile

Nile sub-basin	Annual surface runoff (km^3)	Irrigation potential (ha)	Irrigated area in 1989 (ha)
Baro-Akobo	13.4	905500	350
Blue Nile (Abbey)	54.7	1001500	21010
Setit-Tekeze/Atbara	12.0	312700	1800
Total Nile basin	80.1	2219700	23160

Table 4 Irrigation potential Nile Basin regions

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in ha	Available fertile land	Irrigation in 1979	Irrigation in 1990	Planned irrigation in 2000
Nile system:				
White Nile upstream of Malakal	n.a.	16800	16800	121800
White Nile betw. Malakal & Khart.	752220	209580	196140	380100
Blue Nile upstream of Khartoum	2633820	1132740	1270080	1525860
Main Nile betw. Khart. & Egypt	226800	130620	147000	249060
Atbara	571200	168420	168000	407820
Mereb-Gash	285600	n.a.	25200	> 25200
Other non-Nilotic streams	372960	n.a.	29400	> 29400
Groundwater	n.a.	n.a.	55430	> 55430
Total	4842600	1658160	1908050	>2794670

Table 5 Irrigated land use in Sudan

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(in km^3/year)	1995	2015
Water Inputs:		
Sudan share of Nile water (1)	20.55	20.55
Other regional surface runoff	1.45	1.45
Internal runoff	0.70	2.50
Jonglei Canal + swamp reclamation (2)	0.00	4.00
Groundwater	0.70	1.10
Total Water Input	**23.40**	**26.60**
		based on 2%
Water Demands:		growth/year
Irrigation	16.80	25.00
Domestic	0.80	1.10
Industrial	0.20	0.30
Other (incl reservoir evaporation)	0.20	0.20
Total Water Demand	**18.00**	**26.60**
Net surplus	5.40	0.00

Table 6 Estimated water balance of Sudan in 1995 and 2015

(in 1000 ha)	Nile Valley	Nile New Delta	Coastal Valley	Sinai Plains	Total	
Rainfed + supplementary irrigation				126	42	168
Irrigated old lands	798	1596				2394
Reclaimed land (pre 1980):						
. cropped	42	210				252
. uncropped	42	42	42			126
Reclaimed (1980- 1987):						
cropped		126				126
uncropped		84				84
Reclamation (1987-1992)	42	252				294
To be reclaimed by 2000	42	294	84		126	546

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Total cropped in 1990	840	1932		126	42	2940
Total area including reclamation	966	2604	126	126	168	3990

Table 7 Agricultural land use in Egypt

(in km^3 /year)	**1993**	**2000**
Water Inputs:		
Surface water resources (1)	56.0	58.0
Groundwater in Nile Valley and Delta	2.3	4.8
Agricultural drainage water	4.0	6.5
Treated sewage water	0.2	1.2
Improved water management	0.0	1.0
Total Water Input	62.5	71.5
Water Demands:		
Irrigation	47.4	57.4
Municipal	3.1	3.1
Industrial	4.6	6.1
Navigation, etc.	1.8	0.3
Total Water Demand	56.9	66.9
Net Surplus	5.6	4.6

Table 8 Estimated water balance of Egypt in 1993 and 2000

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Country area within the Nile basin	Irrigation potential	Gross irrigation water requirement		Actual flows		Flows after deduction for irrigation and losses		Area already under irrigation
		per ha	total	inflow	outflow	inflow	outflow	
	(ha)	(m^3/ha.year)	(km^3/yr)	(km^3/yr)	(km^3/yr)	(km^3/yr)	(km^3/yr)	(ha)
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Burundi	80 000	13 000	1.04	0.00	1.50	0.00	0.46	0
Rwanda	150 000	12 500	1.88	1.50	7.00	0.46	4.09	2 000
Tanzania	30 000	11 000	0.33	7.00	10.70	4.09	7.46	10 000
Kenya	180 000	8 500	1.53	0.00	8.40	0.00	6.87	6 000
Zaire	10 000	10 000	0.10	0.00	1.50	0.00	1.40	0
Uganda	202 000	8 000	1.62	28.70	37.00	23.83	30.51	9 120
Ethiopia	2 220 000	9 000	19.98	0.00	80.10	0.00	60.12	23 160
Eritrea	150 000	11 000	1.65	0.00	2.20	0.00	0 55	15 124
Sudan	2 750000	14000	38.50	117.10	55.50	90.63	31.13	1 935 200
Egypt	4 420 000	13 000	57.46	55.50	rest to se	31.13	minus 26.33	3 078 000
Sum of countries	10 192 000		124.08					5 078 604
Total for Nile basin	< 8 000 000							

Table 9 irrigation potential Nile basin

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