

Environmental Security in Nile Basin Countries: An Econometric Analysis.

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Abstract: *The concept of Environmental Security was firstly introduced in the 1994 UNDP report as a part of the definition of Human Security, reflecting the new threats that were added to the national security agendas of individual states. Along with traditional military aspects, such components such as economic stability, rapid population growth, natural resource depletion and environment degradation became state security issues.*

Although Environmental Security concept is widely used, there is no generally approved definition for this concept. But it covers two main issues: First, the effect of environmental threats on the livelihood of human (economic, health, inequality, poverty ...). And secondly, the role of environmental factors in accelerating conflicts within and between states.

The aim of this paper is to investigate the role of environmental Issues in accelerating conflicts in Nile Basin Region using Two Limits Tobit regression Analysis. The paper concludes that although the environmental issues is not the sole or the primary cause of conflict but with the proper circumstances (bad governance indicators, poverty, inequality...), it could cause the violence.

The paper is divided to three parts, starting with the definition and scope of Environmental Security/Insecurity. The second part is the status of the Environmental Insecurity in the Nile Basin. And finally the role of environmental factors in conflicts in this region.

Keywords: Environmental Security, Conflicts, Nile Basin, Tobit Regression

Introduction:

The Nile River Basin is home to an estimated 160 million people. The majority of people living in the Nile Basin lives in rural areas and depends directly on land and water resources for food, income and energy. The population within the Nile River Basin is expected to double in the next 25 years. The already pressing sustainable development challenges are going to require innovative responses from all sectors of society. These increasing demands for the water sources in the basin is contradicted by a reduction in the water supply due to the environmental threats facing the region specially the Problem of climate change and impact on water scarcity in the region. The increasing gap between demand and supply for the renewable water resources in recent years has become both a source of conflict and Regional co-operation for the eleven countries that share its basin.

This paper aims to address the Issue of Environmental Security, with focus on climate change and its impact on water scarcity as the main environmental threats in the Nile Basin region; we build on the proposition of environmental security literature, identifying potential links between natural resource scarcity and violent conflict.

1. What is Environmental Security?

Although the concept of environmental security has become increasingly used in the past decade, an agreed definition of this concept is not recognized at all, which cause misunderstandings and inadequate conclusions or actions. The debates over environmental security often originate the confusion about who is securing what and how. Most attempts to specify the links between the environment and security have focused on environmental caused scarcities and conflicts, as well as on the influence of environmental problems on health and on economic and political stability.

The concept of environmental security was appeared for the first time in 1994 UNDP report in defining human security, but the debates about environmental threats and the importance of including these threats as a part of national security started earlier in 1970s. *Richard Ullman* was among the first scholars to suggest and provide arguments to the fact that the concept of security requires a broader interpretation, because non military threats at times can very dangerous. According to him, population growth in the developing countries, and, as a consequence, the struggle for natural resources and population migrations can cause series conflicts. There was also a theory that the root of adding the new unconventional threats to security was partly in the world oil crises of the 1970s. And even though the

concept of "environmental security" didn't used in these studies, they formed the basis for developing the concept of environmental security by describing the new threats to security and recognizing that environmental pollution and degradation is one of them (Olga Skarlto 2008).ⁱ

In the beginning of 1980s researchers started addressing the security concept using a broader definition, rather than the narrow military meaning of this term. Two terms of security used to be distinguished: *Collective Security*: which refers to traditional interstate military security issues, and *Common Security* refers to the new non-military aspects of security, including economic development, environmental degradation, natural resources depletion and population growth (S. Lonergan 1999)ⁱⁱ. Then the term of *Comprehensive Security* started to be used, it had two main components: *Political Security*, which include military, economic and human factors, and *Environmental Security*, which includes the aspects of utilization and protection of environment. (A. H. Westing 1989)ⁱⁱⁱ

With the end of the cold war in 1990, the study of international security added a new dimensions and New conceptions of security called: *Human Security* considers that the

traditional notion of state security, defined by military aspects, was insufficient to explain emerging threats. As an alternative, Human Security included other aspects as poverty, environment, and intra-state conflict as threats to an individual's life. Security concept shifted from defining as military power alone to more comprehensive definition includes poverty, environment, health and social instability as threat factors. (Nioly R. Biswas 2011)^{iv}

In 2007, The Environmental Security Assessment Program defines the Environmental Security as: "The current and future availability (determined by the factors – supply, accessibility and management) of life-supporting ecosystem services and goods for human needs and natural processes which contribute to poverty alleviation and conflict deterrence". In the definition, IES uses the term 'ecosystem services and goods'. These services and goods are often grouped into, for instance, the ecological organization level (organism, population, community etc.) with which they are associated (e.g. populations of pollinating bees); their general functions namely provisional, regulating, cultural and supporting services; or by descriptive characteristics such as renewable and non-renewable goods, physical structures, etc. (IES 2011).^v

In general, Environmental Security subject or definition covers two main areas:

- 1) The effect of environmental issues on the livelihood, propensity of humans and on economic development. For example, droughts can become a cause of food shortages and infectious diseases, global warming leads to severe climate changes which may cause deadly floods and hurricanes, etc.
- 2) The effect of environmental issues on armed and non-armed conflicts and political stability.

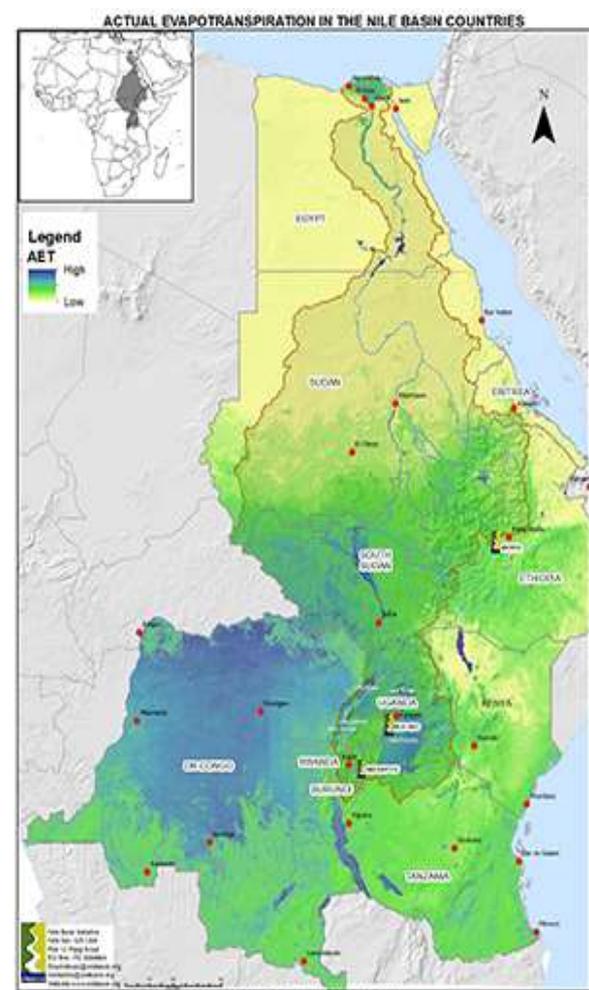
In this context, the environmental problem that can be classified as threats to state security can be defined as an action or sequence of events that:

- 1) Threatens drastically and over a relatively short period of time to degrade the quality of life for the inhabitants of a state, or:
- 2) Threatens significantly to narrow the range of policy choices available to the government of a state or to private, non-governmental entities within the state. (Olga Skarlto 2008)^{vi}

2. Environmental Insecurity In the Nile basin:

Nile basin region consists of eleven countries with a total area of 3 135 224 km². The riparian countries are: Burundi, Democratic Republic of Congo, Egypt, Eritrea, Ethiopia, Kenya, Rwanda, South Sudan, Sudan, Uganda and Tanzania.

The Nile Basin is exceptionally interesting from a



hydrological perspective. The available hydrological assets in the region, is the Nile River and its various tributaries, which are exceptionally strategic and important from a political and socio-economic perspective. The Nile River flows from Central Africa to Egypt. The White Nile originates in the African Great Lakes region, including Africa's largest fresh water lake - Lake Victoria. Through the territories of Uganda and Sudan, the White Nile flows to Khartoum, the capital of Sudan, where it meets the waters of the Blue Nile. The Blue Nile originates in the Ethiopian Highlands. From Khartoum up to the Mediterranean Sea, the combined watercourse (White Nile and Blue Nile) is called the Nile River (IES 2011)^{vii}. By the time the river reaches the Roseires Dam 80 km into Sudan, it begins to lose more water to evaporation and transpiration than it receives in rainfall (UNDP2010).^{viii}

The basin extends over five climate zones – Mediterranean, arid, semiarid, subtropical and tropical. Its landscapes range from mountains, grasslands, forest to a wave dominated delta. This combination results in an array of ecosystems that are home to a rich biodiversity that provide a multitude of benefits to the population through cultural and ecological services, trade, tourism, food, medicines and other product.

There are huge disparities in the demographic and socio-economic conditions among the basin countries. Ethiopia and Egypt have the largest share of the basin population, 21%, 18% respectively. The majority of the basin population lives in the urban areas. And the agricultural sector is the largest contributor in labor in most of the basin countries as shown in table 1.

Population growth in the Nile basin is among the highest in the world with an average of 2.9% which is even higher than the average population growth in the SSA (1.3%). The concentration of the people is very high as indicated from the average population density in Nile Basin that reaches 120 people/km², while the average population density in Africa is only 35 people/km². (FAO 2014)^{ix}

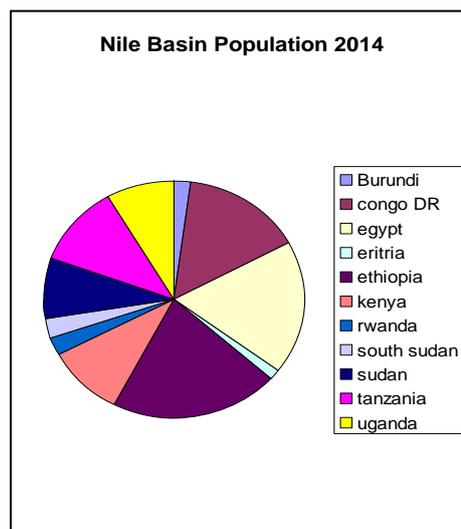
Population growth rates are expected to rise rapidly in the next decades making a hard constraint on the already scarce resources in the region. As shown in figure 2, that's indicates the high expected population growth rates in the highest populated countries in the region.

The Nile Basin also has a great economic variation considering the level of GDP and growth rates. Egypt has the highest GDP in the region with a current GDP of 274 billion dollar in 2014, followed by Ethiopia and Sudan with a Current GDP of 73 and 68 billion dollars respectively. the region as whole witness a high economic growth rates in the recent years where South Sudan and Ethiopia achieve the highest real GDP growth rate of 13.1% and 10.3%. The average real GDP growth rate for the region as a whole reaches 6.7% at 2014. The agriculture sector plays a significant role in the basin economy as share of GDP and more importantly in its share of economic active population as can be seen in table 1.

Environmental Threats in the Nile Basin:

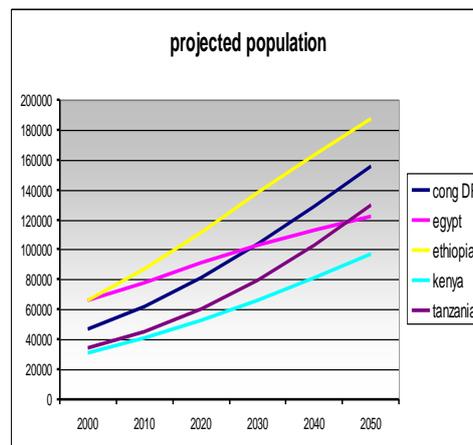
Nile Basin region is currently suffers from several major environmental problems, among which forest degradation, land degradation, pollution and biodiversity loss. But the most important environmental threat in this region is the Climate change and its impact on the water scarcity in the basin.

Figure 1



Source: African statistical yearbook 2015

Figure 2



Source: UNDP: World Population Prospects Data Base, at: <http://esa.un.org/unpd/wpp/unpp/p2k0data.asp>

Country	% GDP	% EAP
Table 1 Importance of Agr. sector		
CDR	24.5	55.1
Egypt	14.5	29
Eritria	17.6	60
Ethiopia	45	77.4
Kenya	29.7	81.9
Rwanda	35.1	86
South Sudan	0	42.6
Sudan	34.5	49.7
Tanzania	33	79.4
Uganda	27	83.4

The accelerating changes in global climate will undoubtedly cause major changes in the patterns of water cycle and geographical distribution, in the near future. Some regions will receive less precipitation, some more, and this will significantly affect agricultural activity. While some regions will see a reduction in arable land, others will have more suitable land for agriculture. The climate change will also alter the geography of traditional crop areas.

Since the 1990s, the scientific community has been warning about the rapidly changing climate. These multiple warnings had been ignored until very recently, but the issue is now a priority with many international organizations. However, all reliable climate scenarios run by Intergovernmental Panel of Climate Change (IPCC)^x and published in the fourth assessment reports show the following results:

- 1) Agriculture and rural development will be violently hit by climate change.
- 2) Poverty and under-nourishment will grow with the uncertainty of food supply.
- 3) The climatologic regime will imply more risk of vulnerability for both humans and biodiversity.
- 4) A reduction of glaciers will imply a growing risk for hundreds of millions living near coasts.

If not addressed and resolved, environmental problems can become security threats. In this respect Nile Basin region is one of the world's most vulnerable areas. Its basic climatic and environmental features, combined with its cultural, geopolitical and economic diversity, have high potential for social and political instability.

The Climate of Nile Basin region has changed dramatically in the last century. There have been major climate and vegetation changes in the Nile Basin, with warmer and cooler periods, and water and drier conditions. The major effects of climate change on African water systems will be through changes in the hydrological cycle^{xi}, the balance of temperature, and rainfall. Water scarcity in this region and its negative impact on socioeconomic development are attributed to the changes and variations in rainfall, which is the main source of both surface and subsurface water in the region (Nioly)^{xii}. Nile flow through the basin is extremely sensitive to temperature and precipitation changes. GCM scenarios provide widely diverging pictures of possible future river flows, from 30% increase to a 78% decrease.

According to IPCC, the region temperature predicted to increase by between 0.2^oC per decade (low scenario) and more than 0.5^oC per decade (high scenario) in the 21st century.

These warmer temperatures may lead to a five to twenty percent increase in rainfall from December to February, and five to ten percent decrease in rainfall from June to August. Rainfall changes and variations are not expected to be constant, but rather more sporadic and unpredictable, resulting in periods of prolonged droughts and periods of high rainfall leading to floods.

Although water is a renewable resource through the hydrological cycle, it is likely to be significantly affected by climate change and variability primarily because the main source of water is rainfall- a component of climate. Rainfall change and variability in the arid and semi-arid zones will result in the uneven distribution of water resources over time and space, and this may have a significant negative impact on access to and utilization of water resources. Consequently, climate change and variability are expected to increase the vulnerability of socioeconomic activities through hydrological extremes such as droughts and extensive floods.

Water Security can be defined as the availability of water for human needs and natural processes. This is highly problematic in the Nile Basin, especially in the arid and semi arid regions. First of all, lack of drinking water gives rise to all kinds of direct and indirect physical disorders. Water insecurity can be regarded as the main constraints for development. Disputes and allocation of water may also strongly impede peaceful relations between different communities and between countries.

The Water Security situation in the Nile Basin is more serious than many other parts of Africa; this is largely due to the existing climate. However, not only natural factors are to blame. Also skills and infrastructure play a large role in maintaining or overcoming water insecurity. For instance, the potential of rainwater harvesting and irrigation is significant, but greatly underutilized. In Ethiopia and Kenya, only 6.5% and 9.6% of the potential irrigable land is under irrigation. This implies that people can enhance water security themselves by adopting innovative adoptive measures or by mitigating some causal factors. (P.Michael Link, et al)^{xiii}

The problem of climate change and its implication on water scarcity is accelerating by knowing that agriculture and rural development will bear the brunt of climate risk. This matter because the rural sector accounts for about three quarters of the people living on less than one dollar a day. Extreme poverty and malnutrition will increase as water insecurity increases. (Terje Oestigaard 2012)^{xiv}

The environmental threat of water scarcity can be analyzed using both demand and supply analysis. From the **Supply Side** the available water

resources in the Nile Basin showed a decreasing trend in the previous two decades the per capita water resources for the whole Nile Basin decreases

by about 25% during the last decade only. Figure 3 shows the decrease of water resource per capita in Nile Basin countries during the past decades.

Table 2
Water Resources Per capita in
Nile Basin Countries

Country	1990	2000	2010
Burundi	2238	1967	1496
congo DR	35241	25853	19447
egypt	1008	847	706
eritria	NA	1718	1199
ethiopia	NA	1860	1471
kenya	1309	982	758
rwanda	1336	1173	894
south sudan	NA	NA	NA
sudan	2435	1887	1481
tanzania	3778	2828	2147
uganda	3729	2726	1975

Source: FAO: **FAO Statistical Yearbook 2013**. at:
<http://www.fao.org/docrep/018/i3107e/i3107e.PDF>

From the previous table, the situation of water scarcity in the Nile Basin can be measures using one of the most commonly used measures of water scarcity: 'Falkenmark indicator" or "water stress index". This method defines water scarcity in terms of the total water resources that are available to the population of a region; measuring scarcity as the amount of renewable freshwater that is available for each person each year. If the amount of renewable water in a country is below 1,700 m³ per person per year, that country is said to be experiencing water stress; below 1,000 m³ it is said to be experiencing water scarcity; and below 500 m³, absolute water scarcity^{xv}. According to this index, almost all the basin countries suffers from accelerating water stress, while three of Nile Basin Countries suffer from Water scarcity.

From the **Demand Side**, there is an intensive dependency on renewable water sources in the Nile Basin. The uses of these water sources vary from the domestic uses of these resources and the agriculture uses, and even for generating energy. Table 3 indicates the water uses in the Nile Basin countries; the table shows that agricultural use is the highest.

Table 3 Water Resources uses in Nile Basin Countries

Country	Fresh water withdrawals (Km3/yr)	Domestic Use (%)	Industrial Use (%)	Agriculture Use (%)
Burundi	0.29	17	6	77
DRC	0.36	53	17	31
Egypt	68.3	8	6	86
Eritrea	0.3	3	0	97
Ethiopia	5.56	6	0	94
Kenya	1.58	30	6	64
Rwanda	0.15	24	8	68
Sudan	37.32	3	1	96
Tanzania	5.18	10	1	89
Uganda	0.3	43	17	40
Total	119.37	7	3	90

Source: **FAO online database**. at:

The key issue regarding Environmental Insecurity in the Nile Basin is the vulnerability of the Nile Basin Countries to climate change effect on the Nile River. The IPCC defines "vulnerability" as the

degree, to which a system is susceptible to, or unable to cope with, adverse effects of climate change, including climate variability and extremes. Vulnerability is a function of the character,

magnitude, and rate of climate change and variation to which a system is exposed, its sensitivity, and its adaptive capacity. If the Nile riparian are highly vulnerable to changing water availability under climate change, their positions regarding the allocation of Nile water may shift, unilateral actions could be taken and the potential of conflict could increase. (P.Michael Link, etal.)^{xvi}

However, a decisive dimension of vulnerability is adaptive capacity, the capability to respond and prepare to resulting challenges. Therefore, another possible outcome is the joint increase of adaptive capabilities of Nile riparian and explores possible pathways to both conflict and cooperation as a result of an additional pressure from climate change. This issue was addressed in detail in the 3rd Nile Basin Development Forum, Which took place in October 2011 in Kigali, Rwanda. The meeting focused on "climate change and its implication for sustainable development and cooperation in the Nile Basin" and aimed at the establishment of sound cooperation in order to successfully adopt to changing environmental conditions. The forum formulated 12 recommendations concerning adaptation governance, adaptation finance and food and energy security that the Nile Basin Initiative should use as a basis to design and implement concrete adaptation measures against climate change in the Nile Basin. (P.Michael Link, etal.)^{xvii}

Environmental security and conflicts in the Nile Basin:

Scholars concerned with resource scarcity and conflict, often termed "neo Malthusians", focus on renewable resources that under conditions of sustainable use regenerate; the most important of these resources are cropland and freshwater. The literature on climate change and security focuses on two interrelated processes expected to produce resource scarcity. Firstly, increasing temperatures, participation anomalies and extreme weather is expected to aggravate processes of resource degradation that is already underway.

In a study of Homer Dixon, one of the main researchers in the neo Malthusians, that investigates the relationship between population growth, renewable resource scarcities, migration, and violent conflict. He concludes that there are three reasons that connect the environment with conflict. These are the degradation and depletion of renewable resources, the increased consumption of those resources, and their uneven distribution.

Water has long served as a key illustration of Environmental Security. Since 1950 global fresh water supply per person has fallen by 60% as world population has increased by over 150% and the world water consumption has increases by 180% ; consumption can be expected to increase by a further 40% within the next two decades. During the past half century there have been more than 450

water-related disputes of hostile sorts, and on 37 occasions rival countries have fires shots, blown up a dam, or undertaken other form of violent action.^{xviii} At least 261 of the world's major rivers are shared, with 176 flowing through two countries, 48 through three countries, and four or more countries. They account for 60% of the world's freshwater supply, and they supply nearly 40% of the world's population with water for domestic use, agriculture, hydropower and other salient purposes. As many as 80 countries with nearly three billion people or two fifth of the world's population already suffer serious water deficits. (Norman Myers)

What has emerged because of water deficits applies also to deforestation, soil erosion, desertification, decline of marine fisheries, and a host of other environmental problems with widespread impact. Desertification, for instance, can generate broad scale problems for human welfare and political stability as it can cause famines, internal displacements and international migration. And so could lead to political instability or tensions between neighboring countries, and even for armed conflicts.

There is no simple relationship between climate change, water resources, and potential conflict in the Nile River Basin. Changes in environmental conditions can influence resource availability, economic wealth, and –depending on the institutional structures- the probability of conflict. The changes in environmental conditions are an external forcing that first influences key resources such as water and land availability. These quantities in turn affect economic production and the consumption of resources, which affects human well being, and because of the trans-boundary nature of the river, relations between riparian states. These can be cooperative or conflictive. Whether possible pressure on societal stability leads to increase conflict or not depends critically on the adoptive capacity or the vulnerability of a society. As long as society is able to successfully deal with challenges imposed by changing environmental conditions, the likelihood of onset of additional conflict is limited. Therefore, the countries in the Nile River Basin should look to increase their joint adoptive capacity despite possible internal tensions due to conflicting resource demands. In this part the paper aims to model the impact of water scarcity on accelerating conflicts in Nile Basin.

Literature Review:

Although there are various studies about the climate change and other environmental security issue and its impact on conflict, the econometric studies that measure this impact is limited. In a study (Clinadh Raleigh etal 2007)^{xix} that investigate the role of environmental problems in accelerating armed conflicts using the ordinal logistic regression the researchers find that in the

national level the demographic and environmental variables only have a moderate effect on the risk of civil conflict. While in the global level, the researchers find that medium to high levels of land degradation are related to increased conflict, as are very high levels of water scarcity. However the relative increases in risks are quite small. Increasing levels of land degradation increases the risk of conflict from a baseline of 1% to between 2% to 4%. Fresh water scarcity appears to extent somewhat stronger effect, increasing the risk of conflict to 6% for areas with very high levels of scarcity.

In (Cullen S. Hendrix, *etal*) study^{xx} about the link between climate change and violent conflict in SSA, using Maximum likelihood logit models, the paper indicates that both short and long term climatic factors affect conflict, through their effects are present only when other political, economic and geographical factors are included. The paper finds that Climates more suitable for agriculture are associated with a decrease likelihood of conflict, while freshwater resources per capita are positively associated with decreased likelihood of conflict. Positive changes in rainfall are associated with a decreased likelihood of conflict in the following year.

In (Amy Richmond Krakowka, *etal.2012*) study about modeling the Environmental security in SSA^{xxi}, that aims to examine the link between the environment and conflict and demonstrates the need for careful environmental analysis by

presenting a model illustrating the relationship between natural resources and political stability in SSA. The result suggests that a statistically significant relationship exists between arable land and access to fresh water, and political stability and non violence.

Data and variables:

This paper use the political stability and absence of violence index as the dependent variable, this index is one of the world bank governance indices forms the world governance index WGI, this index measures the likelihood that the government will be destabilized by unconstitutional or violent means. It measures political stability and non violence through the survey of households and firms, commercial business information providers, non governmental organizations. The index ranges from -2.5 to 2.5 where the smaller number indicates political instability. The Independent variable measuring environmental security is water resources per capita.

To include the economic and social indicators in the model, the researcher uses the real GDP per capita and Access to fresh water^{xxii} as indicators of social and economic effects of the environmental threats that form the environment in which these threats lead to conflict. The following table shows the variables used in the model, except the water resources percapita, the data is gotten from the World Bank online database available at: databank.worldbank.org.

Country	PSV	GDP percapita	access to improved water sources	water percapita
Burundi	-1.3	264	75	1496
congo DR	-2.23	1629	46	19447
egypt	-1.62	3294	99	706
eritria	-0.78	592	85	1199
ethiopia	-1.39	559	52	1471
kenya	-1.15	1593	62	758
rwanda	-0.08	591	71	894
south sudan	-1.76	1269	56.5	4567
sudan	-2.2	2221	55.5	1481
tanzania	-0.15	966	53	2147
uganda	-0.84	673	72	1975

The statistical analysis of the variables, found in the following table, shows that the variation of each variables between Basin countries but the most variation appears in the variable of GDP per capita where the coefficient of variation is about 166%. This large variation in the economic condition doesn't reflected in the condition of population, actually the CV of the percentage of population with access to improved water sources is only 25%.

	PSV	GDP percapita	access to improved water sources	water percapita
Mean	-1.23	1241	66.1	3285.5
SD	0.72	900.67	16.04	5465.5
CV	-59%	73%	24%	166%

Model and results:

In this study, Tobit regression model is applied to analyze the link between environmental security and political stability. Tobit regression is a type of regression models in which the dependent variable is censored or limited by a maximum or a minimum value or both (Esmeralda A. Ramalho 2010), this model was introduced by James Tobin in 1958 (Tobin 1958):

$$y_i = \begin{cases} y_i^* = \beta x_i + u_i & \text{if } y_i^* > 0 \\ 0 & \text{if } y_i^* \leq 0 \end{cases}$$

$$u_i \sim IIDN(0, \sigma^2)$$

For the case of political stability and absence of violence index, it has two bounds (-2.5 and 2.5), so the model takes the formula:

$$Y_i^* = \beta_i X_i + U_i \quad \text{if } -2.5 < y < 2.5$$

$$Y_i = 2.5 \quad \text{if } y^* \geq 2.5$$

$$Y_i = -2.5 \quad \text{if } y^* \leq -2.5$$

From table (4) that indicates the regression results, the following result could be concludes:

- 1) The model as a whole is statistically significant, and explains about 36% of the variation of the dependent variable.
- 2) Although the relatively high coefficient of correlation between the coefficient of the environmental security variable and political stability and absence of violence index (-45%), the estimated coefficient of this variable is statistically insignificant.
- 3) The only significant variable in the model was the GDP per capita suggesting the importance of the economic factors as the main cause of political instability in the region.

The previous econometric analysis of the link between the environmental insecurity and conflict in Nile Basin shows that although the environmental security issue is important to the wellbeing of human in the Nile basin but alone it has not a significant contribution as a sole factor explaining the instability.

Table 4

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. tobit PSV logwpercapita GDP waccess, ll(-2.5) ul(2.5)
Tobit regression                               Number of obs   =       11
                                                LR chi2(3)      =       8.33
                                                Prob > chi2     =       0.0397
Log likelihood = -7.3816108                    Pseudo R2      =       0.3606

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	PSV	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]
logwpercap-a		-.7577091	.4649572	-1.63	0.142	-1.829902 .314484
GDP		-.0004717	.0001717	-2.75	0.025	-.0008677 -.0000756
waccess		.0043394	.0122233	0.36	0.732	-.0238476 .0325265
_cons		1.540564	2.092965	0.74	0.483	-3.285821 6.36695
/sigma		.4733676	.1009108			.2406669 .7060683

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Obs. summary:
               0 left-censored observations
               11 uncensored observations
               0 right-censored observations

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Conclusion:

Environmental Insecurity as a cause of conflict has been a continuous issue in the security literature since the 1990s. While the concerns over the security implications of population growth and resource scarcity goes back to the late 1960s, the issue has featured more prominently in the security debates after the end of the cold war. This emerging "securitization" of environmental issues followed by an increased environmental awareness

combined with an interest among western national security establishments to identify potential threats that could legitimize their continued existence. Despite the attention given to environmental factors as potential security threats, there appears to be a consensus that economic, political and social factors determine how countries handle resource scarcity. Wealthy and democratic countries are likely to be more capable both to adopt to resource scarcity and to mitigate conflict.

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^{viii} UNEP: **Africa Water Atlas 2010**, at:

www.unep.org/pdf/africa_water_atlas.pdf

^{ix} Food And Agricultural Organization: **FAO Statistical Yearbook 2014**. at:

<http://www.fao.org/docrep/019/i3591e/i3591e.pdf>

^x The Intergovernmental Panel on Climate Change (IPCC) was established by The United Nations Environmental Program (UNEP) and the World Meteorological Organization (WMO) in 1988 to assess the scientific, technical and socio-economic information relevant for the understanding of human induced climate change, its potential impacts and options for mitigation and adaptation.

^{xi} Water quality within the Basin is also a serious concern. The major threats to water quality include insufficiently treated domestic, urban and industrial waste, non-point pollution from pesticides and fertilizer residues, siltation and sedimentation, increased salinity and wetland loss. Serious water-borne diseases are becoming more prevalent throughout the Basin and toxic and hazardous mining wastes are a danger in some local areas. The costs of these threats are invariably borne by downstream users, particularly the poor who live in marginal or less desirable areas where their susceptibility to sickness is greater. This also has a negative impact on their work and educational opportunities. The most serious diseases are malaria, diarrhea and bilharzias. Controlling the threat of water-borne disease will also provide direct benefits to people living with HIV/AIDS throughout the Basin as they are more susceptible to opportunistic infections due to their suppressed

immune systems. For more details: UNEP: **Environment, Sustainable Development and the Nile River Basin**. At:

<http://www.unep.org/training/downloads/toolkit/4.3%20-%20Case%20Study%201.pdf>

^{xii} Nioly R. Biswas, **op cit.**, P.66.

^{xiii} P.Michael Link, et al., **On Foes and Flows: Water Conflict and Cooperation in the Nile River Basin in times of Climate Change**. At:

<http://web.mit.edu/12.000/www/m2017/pdfs/nilebasin.pdf>

^{xiv} Terje Oestigaard: **Water Scarcity and Food security along the Nile: Population, Population increase and Climate Change**, African Issue 49, 2012. at:

<http://www.diva-portal.org/smash/get/diva2:545179/FULLTEXT01.pdf>

^{xv} M.J. Falkenmark, J. Lundquist and C. Widstrand, "Macro-scale Water Scarcity Requires Micro-scale Approaches: Aspects of Vulnerability in Semi-arid Development", **Natural Resources Forum**, Vol. 13, No. 4, 1989. pp. 258–267.

^{xvi} P.Michael Link, et al.: **On Foes and Flows: Water Conflict and Cooperation in the Nile River Basin in times of Climate Change**, p.4. at:

<http://web.mit.edu/mission/www/m2017/pdfs/nilebasin.pdf>

^{xvii} **Idem.**

^{xviii} Norman Myers: **Environmental Security: What's New and Different?**, At:

<http://www.envirosecurity.org/conference/working/newanddifferent.pdf>

^{xix} Clionadh Raleigh and Henrik Urdal, "Climate Change, Environmental Degradation and Armed Conflict", **Political Geography**, No. 26, 2007.

^{xx} Cullen S. Hendrix, *etal.*,: **Trends and Triggers: Climate, Climate Change and Civil Conflict in Sub-Saharan Africa**. At:

[http://www.researchgate.net/publication/228337816 Trends and triggers Climate climate change and civil conflict in Sub-Saharan Africa](http://www.researchgate.net/publication/228337816_Trends_and_triggers_Climate_climate_change_and_civil_conflict_in_Sub-Saharan_Africa)

^{xxi} Amy Richmond Krakowka, *etal.*,: **Modeling Environmental Security in SSA**, the Geographical Bulletin 53, 2012.

^{xxii} Percentage of Population with Access to fresh water sources is also one of the indicators of the 7th goal of MDG concerning environmental sustainability.