

Erosion And Livelihood Change In North East Ghana: A Look Into The Bowl.

Philip Aniah^{a*}, Emmanuel Wedam^b, Modesta Pukunye^c, Gladys Yinimi^d

^{a, b} *Department of Development Studies, Box 520, Wa Ghana*

^c *Department of Community Development, Box 520, Wa Ghana*

^d *Department of African and General Studies, Box 520, Wa Ghana*

^a *email: mrphilipaniah@yahoo.co.uk*

Abstract

The study was carried out in the Upper East Region of Ghana, Bongo District, to assess the driving causes and effects soil erosion in the District and the Region at large. While soil erosion is widely recognized as reducing environmental resource capacity to provide for the populations, few studies have explicitly measured its effects on the rural farmer and the apparent root causes of erosion in the region. Upper East Region is particularly vulnerable to the effects of soil erosion with one of the highest rates of soil erosion in Ghana.

Some observed indicators of soil erosion-land degradation include sealed and compacted top soils, stones, gravel, concretions and iron pan. The major human activities that affect the physical environment are farming and domestic energy production. Associated practices such as land clearing for farming, total crop harvesting, burning of organic material during land preparation and inadequate manure application aggravate the degradation problem. These activities destroy the soil's physical and chemical properties, thus, resulting in nutrient-depleted soils. A major effect is a progressive decline in crop yields as confirmed by 94% of 120 respondents. For soil rehabilitation to be effective there is the need for provision for soil surveys, research on soil physical characteristics affecting erosion, fertility investigations and the working out of new agricultural systems.

Key words: Soil erosion; apparent and root causes of erosion; socio-economic impacts; poverty; and population growth.

* Corresponding author. Tel.: P.O. Box 520 Wa Ghana +233-240391932
E-mail address: mrphilipaniah@yahoo.com

1. Introduction

Soil erosion is one of the most important forms of land degradation that threatens continued and sustained agricultural production in Ghana. The most severely affected areas are the three Northern Savanna Regions, particularly the Upper East Region, where large tracts of land have been destroyed by water erosion leading to soil depth reduction, soil fertility decline and siltation of rivers and reservoirs [2]. About 80% of the populations live in the rural areas with agriculture as their major economic activity [5].

The climate is semi-arid with an aridity index of 0.54 and a uni modal rainfall pattern of about 1000 mm per annum lasting 5 to 6 months. Rainfall is often erratic with considerable variations between successive rainy seasons, with regard to the time of onset, duration and amount of rainfall. Rainfall intensities are high, often exceeding soil infiltrability with a consequent generation of large volumes of runoff with high potential erosion rates [18].

Sustainable agricultural production also depends on productive soils, but the land resources of Ghana for that matter Upper East Region, particularly the soils, are being degraded as a result of both natural and anthropogenic factors [1]. Soil degradation in its several forms is evident in all the agro-ecological zones of Ghana [4, 20] and therefore a major constraint to the attainment of the desired growth rate in the agricultural sector [19]. Soil erosion is the most potent form of land degradation that threatens continued and sustained agricultural production in Ghana [11].

Soil erosion is a major threat to continued and sustained agricultural production in Ghana particularly in the Sudan Savanna zone [11]. The effect of erosion may be on-site and/or off-site. The on-site damage, which affects the catchments where the erosion originates, includes soil structure degradation, increased erodibility, surface crusting and compaction [2].

The loss of soil reduces depth, water and nutrient storage capacities of the soil. The reduction in moisture reduces the soil's potential to sustain plant growth, exposes the plants to frequent and severe water stress which ultimately results in reduced crop yields. Many of the soils have predominantly light-textured surface horizons and extensive areas of shallow concretionary and rocky soils with low water and nutrient holding capacities and limited capacity for agriculture [20]. The latter attributes are exacerbated by the on-going water erosion in the zone.

For countries such as Ghana whose economies depend heavily on the agricultural sector, the loss of agricultural productivity particularly through erosion, implies loss of revenue for the socio-economic development of the country [7]. In order to contribute the requisite information for filling the above identified gaps in erosion research, this study aimed at assessing (i) Assessing the social and cultural causes of soil erosion in the Upper East Region (ii) the implications on food security.

2. Methodology

The study was carried out in five representative communities in the Upper East Region of Ghana. The Upper East Region is the North Eastern most part of Ghana's 10 regions. It is located between latitudes 10° 15' and 11° 10' north and longitudes 0° and 1° west. It covers an area of 8,842km² with ten Administrative Districts (Bolgatanga, Bongo, Builsa, Kasena- Nankana, Talensi, Kasena-Nankana West, Nabdram, Bawku West, Bawku East and Garu Tempani;). According to the 2010 Population and Housing Census [13], the region has a population of 1,046,545. This study is based on both Primary and Secondary Data sources. Published materials, books, journals are the main sources of secondary data. Records from the offices of the Environmental Protection Agency and Ministry of Food and Agriculture in the area were analyzed to determine the anthropogenic causes, impacts and other relevant parameters of focus. Face to face interview was done to collect the required information and data. Moreover, questionnaire and structured interview were used to collect field level data and information. The collected data were

analyzed by using the statistical software-Excel, and SPSS. Random sampling has been considered in selecting the study population.

3. Results and Discussion

3.1 Evidence of Soil Erosion

Evidences of soil erosion are documented either based on physical observation of land cover changes by people using the land or change detection analysis of satellite data to explain soil erosion. Change detection refers to monitoring land surface change over time using repetitive coverage and consistent data generated from satellite images www.ciesin.org/TG/RS/chngdet.html. Satellite imagery obtained from Advanced, Very High Resolution Radiometer covering Savanna areas of Africa including the Upper East and West Regions and the Northern Region show that these regions have the highest occurrence of vegetation fires; as such the land surface is exposed to degradation [15]. These fires have contributed to soil erosion and leaching as the bare soil surface is exposed to agents of erosion such as rain water and wind [15]. Furthermore, participatory GIS and remote sensing investigations in Bolgatanga and Talensi- Nabdam districts of Northern Ghana reveal decline of healthy vegetation from 1990 to 2004 resulting in about 600km² of land being degraded, hence, the decline in commercial food crop production [3].

3.2 Apparent Root Causes of Soil Erosion

There are many causes' forces at play, which have caused and are causing soil erosion in Ghana. The proximate causes include clearing of woodlands and forests, population growth, poverty, unsustainable arable farming techniques, and overstocking of grazing lands.

3.2.1 Population Growth

Steady growth in human and livestock populations is occurring in the Upper East Region without changes in agricultural and economic systems. The current human population of the area is about 1,046,545 with an annual growth rate of about 3%, and over 80% of the populations live in the rural areas with agriculture as their major economic activity [5]. Rapidly increasing human populations need more agricultural land, so clearing of forests and woodland has increased. As the population grows, more fragile, marginal lands are used, such as areas of steep slope and protected areas.

3.2.2 Poverty

Poor farmers in the region practice mixed rain-fed agriculture. Crop yields are very low, varying between 5 bags and 6 bags/ha for millet and between 7 bags and 8 bags/ha for maize. Many farmers don't achieve food security and depend on food relief. To supplement their livelihoods, farmers clear vegetation and trees from their farms or nearby forest to sell as firewood or charcoal to urban people, thus energy use is a critical factor. As the rural population of Ghana grows, clearing of vegetation for fuel increases and contributes to land degradation. In addition, most of the agriculture in general is still at low level of technology and is inadequately equipped to practice sustainable agriculture and deal with famine.

This research is also consistent with the works of [14]. Rapid population growth and poverty constitute the main driving forces of change in forest land use. Rapid population growth coupled with poverty was responsible for the conversion of woodland and forest areas to cropland and pasture fields in southern Burkina Faso [21]. Ghana's

population growth is equally responsible for land degradation in Upper East and West Regions [22] the research is further confirmed by [17], which associates severe land degradation-soil erosion to high population density in the Upper East Region. Apart from human population pressure on the environment, high animal population density also poses land degradation problems as cattle population density in the Upper East Region, for example, appears to be the highest at 103 and 77 per km² in Navrongo and Bawku districts respectively.

3.2.3 Arable Land Management

The most common farming system in the Upper East Region is small-scale mixed rain-fed agriculture, primarily grain cropping and livestock production. Most of the arable land is covered, in decreasing order, by maize, millet, guinea corn, late millet, groundnut, and rice. Production of all these crops exposes the soil to erosion as it leaves the soil bare during some of the growing season and after harvest. The annual crops are sown mainly after the rainy season begins, allowing early rains to directly impact and erode the soil. Some farmers in the region construct stone terraces/bonds on their sloping lands to protect them from erosion and landslides; however, in most cases the terraces/bonds are not protected with vegetative cover, so are not effective in preventing erosion. As rural population has grown and woodland is converted to cultivation, the use of dung and crop residues for fuel has become much more important than using in agricultural fields.

3.2.4 Woodland Clearing

The clearing of forests has been a long historical process in Ghana and it continues at a conservatively rate every year. This is mostly converted into cropland with a greatly reduced vegetative cover and accelerated soil erosion. Also importantly the change in land use can change the hydrological pattern of runoff, reducing infiltration and increasing stream flow during and after rain. It has been estimated that 25 percent of total soil erosion is from pasturelands and livestock density data show that current stocking rates are well above optimum rates though in some areas for example Tilli improvements have occurred. In an interview with an official of forest commission, he had this to say, *The Region is also notorious for its recurrent bush fires in the dry season. The few forest reserves in Tilli (Bawku West), Bopong, Sissili Central, Pogi, Kandembeli, Wiaga and Gia (Builsa) Siriku (Bolga), etc experience annual bush burning between November and April during the long spells of drought. These fires are set by locals in their quest for Game (bush meat), under the pretext of driving wild animals that advance towards the communities, for new grass to grow so as to feed animals and sometimes as means of land preparation etc. They could also result from the use of fire for honey hunting.* The effect of this is that the fire rips the land of its vegetative cover by burning trees and grasses thus pastures for livestock are largely destroyed. The soil is then exposed to erosion as it lies bare for most of the season between November and April. Many economic trees such as **Buttyrosperrun parkii** (shea butter) experience heat shock resulting in reduced flowering and fruiting.

The findings of this research is confirmed by, [12] Direct land use activities such as agricultural expansion, wood extraction and infrastructure development have collectively contributed to loss of forest and woody vegetation covers which has caused soil erosion.

According to [6], In Ghana, clearing of woody vegetations for agriculture and wood energy exploitation have contributed to 12% of the vegetation cover being converted from grass to cropland an indication of land degradation in Northern Ghana and [3] Besides agriculture as a direct driver of land degradation, small scale mining activities in Bolgatanaga and North East of Talensi –Nabdham contributed to severe land degradation in these areas.

3.3 Physical And Socio- Economic Impacts

the most widely available form of degradation is produced by sheet erosion, the survey indicated that, the area of degraded land in the region increased by about 200% between 1973 and 2006 As a result, grain production per head

decreased from about 245 kg capita-1 year-1 in 1965 to 200 kg capita-1 year-1 in 1975, 156 kg capita-1 year-1 in 1985 and below 100 kg capita-1 year-1 in 2008 [18] Total use of fertilizer has increased in an attempt to counteract this decline in production, but most farmers cannot afford it . Due to lower production per capital and per hectare coupled with increased human population, food shortages have become common in many parts of the Region and dependence on food aid is growing, and as counteracting the problem the government designed a policy of subsidizing fertilizer, however, not everyone gets the opportunity of benefitting from this package. Farmers believed that declining of crop productivity and resultant food scarcity is caused by soil degradation/erosion due to the destruction of woodlands [18].

The findings of this research is consistent with [24] Land degradation does not only affect the biophysical environment but also disrupts the livelihoods of millions of people as activities such as hunting and gathering, are becoming difficult, leading to violent conflicts. The discussions confirmed by Care, [8]. Land degradation in Northern Ghana has resulted in fragile environmental conditions coupled with harsh climatic conditions of droughts and periodic floods and [9]. In some other instances persistent drought has manifested in chronic malnutrition and wide spread poverty. A major non biophysical effect of land degradation in Northern Ghana is migration of farmers from degraded regions to rural areas of the Brong Ahafo Region, that has more fertile agricultural soil unlike the impoverished agricultural lands at the origin of migrants as evidenced by low crop yields coupled with unreliable rainfall resulting in food insecurity problems [23]. Any further worsening of desertification in northern Ghana would in no doubt affect the economy of Ghana adversely as much of the food and animal products come from these regions [16].

4. Conclusion

Many factors are driving long-term soil and vegetation degradation in Ghana, including naturally occurring processes such as drought, floods, poverty, unsustainable land management, population pressure, increased urbanization, and climatic changes. Droughts are a recurrent feature of the area with devastating impacts on vegetation, soil and animal husbandry. Bush fires that destroy the land during droughts are incomparable to any human land-use type. Floods have turned the surface of the landscape into an architectural drawing of gullies and channels that are hardly used as water channels. Vegetation and the rich top soil are carried away during floods, thereby, causing land degradation.

These long term driving factors are reflected in agricultural, mining and other production practices that have led to soil erosion, soil nutrient depletion, overgrazing, pollution, river and groundwater depletion, and desertification arising from deforestation. In the short-term, the causes of land degradation are mainly natural factors and human activities. Natural factors include the physical and other characteristics of the soil, which affect the erodibility of the soil and its capacity to retain and drain water and to hold nutrients; topography; and climatic conditions. The human activities responsible for the fast degradation of the land are shifting cultivation, intensive farming on one piece of land, indiscriminate felling of trees for fuel wood and charcoal production, bush burning, over grazing and small scale mining. The main cause for these harsh human activities towards the environment is poverty, which makes them carry out the activities just to earn income for a livelihood.

Acknowledgements

Special thanks and gratitude to the Navrongo-Bolgatanga Diocese Development office for their support

References

- [1] **Adama, A.I.** (2003). The Effect of Different Tillage Practices on Soil Erosion, Water Conservation and Yield of Maize in the Semi-Deciduous Forest Zone of Ghana. Unpublished M.Sc. Thesis. Department of Crop and Soil Sciences, KNUST, Kumasi, Ghana.
- [2] **Adwubi, A., Amegashie, B. K., Agyare, W. A., Tamene, L., Odai, S. N., Quansah, C. and Vlek, P.** (2009). Assessing Sediment Inputs to Small Reservoirs in Upper East Region, Ghana. *Lakes & Reservoirs: Research and Management*, 14:279-287.
- [3] **Agyeman, I.** (2007). Assessment of Environmental Degradation in Northern Ghana: A GIS based Participatory Approach: PhD Thesis submitted to the University of Leeds, Department of Geography.
- [4] **Asiamah R. D., Quansah C. and Dedzoe C. D.** (2000). Soil Degradation: Management and Rehabilitation in Ghana – An Overview Report, 89–101. In *Proceedings FAO/ISCW Expert Consultation on Management of degraded soils in Southern and East Africa (MADS – SEA), Pretoria, South Africa. 8–22 Sep. 2000.*
- [5] **Birner, R., Schiffer, E., Asante, F., Gyasi, O. and McCarthy, N.** (2005). Analysis of Governance Structures for Water Resources Management in the White Volta Basin Ghana. Final Report. IFPRI, Washington DC, USA.
- [6] **Braimoh, A.,** (2006). Random and Systematic land cover transition in Northern Ghana, *Agriculture, Ecosystem and Environment*, 113, 1-4, 254 – 263.
- [7] **Bonsu, M. and Quansah, C.** (1992). The Importance of Soil Conservation for Agricultural and Economic Development of Ghana. In Proceedings of the 12th and 13th Annual General Meetings of the Soil Science Society of Ghana, Accra, Ghana. pp. 77-80.
- [8] **Care, (2008a).** Local Extension Services for Agricultural Development (LEAD), Component Description , CARE Gulf of Guinea, Agriculture and Natural Resources, portfolio, Ghana.
- [9] **Destombes, J.,** (1999). Nutrition and Economic Destitution in Northern Ghana, 1930 – 1959. A Historical Perspective on Nutritional Economics [www. Esprints.lse.ac.uk/22388/1wp49.pdf](http://www.Esprints.lse.ac.uk/22388/1wp49.pdf) (accessed 08th October 2013)
- [10] **FAO (2005).** Ghana. State of Environment Report 2004. Environmental Protection Agency, Accra.

- [11] **Folly, A. (1997)**. Land Use Planning to Minimize Soil Erosion – A Case Study from the Upper East Region in Ghana. Ph.D thesis, Institute of Geography, University of Copenhagen.
- [12] **Geist, H., J, and Lambin, E. F., (2002)**. Proximate Causes and Underlying Driving Forces of Tropical Deforestation, *BioScience*, 52, (2), 143 -150.
- [13] **GSS (2012)**. 2010 Population and Housing Census of Ghana. Ghana Statistical Service, Accra
- [14] **Lambin, E. F., Geist, H. J., and Leper, E., (2003)**. Dynamics of Land Use and Land Cover Change in Tropical Regions. *Annual Review of Environment and Resources*, 28, 205 – 241.
- [15] **Kugbe, J.M., and Henmi, T., (2009)**. Analyses of Net Annual Nutrient Balance and its Spatio-temporal Dynamics due to Bush Fire Losses and Atmospheric Depositional Gains in the Northern Savanna Region of Ghana.
- [16] **Kwarteng, K.E., (2002)**. Desertification Looms over Ghana, Biodiversity Reporting Award, and www.biodiversityreporting.org (Accessed, 03 May 2012).
- [17] **Millar, D., Dietz, T., Dittoh, S., Obeng, F., Ofori Sarpong, E., (2004)**. Climate and Livelihood Change in North East Ghana, *Environment and Policy*, 39, P.149 – 172.
- [18] **Ministry of Food and Agriculture (MoFA) (2008)**. Agriculture Sustainable Land Management). Strategy and Action Plan (2009- 2015Ministry of Food and Agriculture, Accra, Ghana.
- [19] **Ministry of Food and Agriculture (MoFA) (2009)**. Areas and Production of Main Rainfed Crops in the Upper East Region of Ghana. MoFA, Bolgatanga, Ghana.
- [20] **Quansah, C., Safo, E. Y., Ampontuah, E. O. and Amankwaah, A. S. (2000)**. Soil Fertility Erosion and the Associated Cost of NPK Removal Under Different Soil and Residue Management in Ghana. *Ghana Journal of Agriculture Science*, 33(1): 33-42.
- [21] **Quedraogo, I., Tigabu, M., Savadogo, P., Compaore, H., Oden, P.C., and Ouadba, J.M., (2010)**. Land Cover Change and its Relation with Population Dynamics in Burkina Faso, West Africa, *Land Degradation and Development*, doi.10.1002/ldr.981.
- [22] **Songsore, J., (1976)**. Population Growth and Ecological Degradation in Northern Ghana, The Complex Reality. Chapter 6.

[23] **Van der Geest** (2004). We are Managing Climate Change and Livelihood Vulnerability in North West Ghana. Leiden Afrika- Studies Centrum www.each-for.eu (accessed 05 October 2013)

[24] **World Wide Fund**, (2007). <www.panda.org/about_our_earth/about_forest/deforestation/> (Accessed 15 November 2012)