

## **ANALYSING THE IMPACT OF OIL AND GAS EXPLORATION PROCESSES ON THE ENVIRONMENT, A CASE ON THE YIELD OF BEANS AMONG SMALL HOLDER FARMERS IN WESTERN UGANDA**

### **Abstract**

In Uganda, agro-ecological distortion and community uprising has been of great concern since the year 2006 when oil and gas energy was discovered (Tumusiime, 2018). With 21 discovery wells equivalent to 6.5 billion barrels and the potential to discover more (Mbabazi, 2017), Environmental degradation is a big concern. Environmental pollution, loss of pasture for the grazing animals coupled with reduced arable land surface is some of the impacts (Mawejeje, 2019). By its strategic location, this non renewable energy resource forms a potential threat (Ogwang, 2019) to the environment both during exploration and actual production, particularly for farming through land degradation and the alteration of soil nature. This is caused by solid, liquid and gaseous pollutants in form of oil spills together with the associated particulates, waste pits and high temperatures from gas flares. This contributes to global warming that finally causes climate change on a long run (Herndon, 2019). It's no doubt that this will cause the extinction of flora and fauna sensitive to hydrocarbon smell, noise pollution from drilling machines, poor water quality in Lake Albert and other devastating problems on the tourism industry (Albert, 2018). This study focused on the threat of the oil and gas exploration process to the farming households by considering the direct effects on the yield of beans and specifically among the small scale farmers close to the oil and gas camps. According to the field observations, Yield loss was distinctively caused by soil pollution and direct impact on both crop root and shoot systems. This was in addition to farm size reduction and farmer displacement that emanated into the willingness to abandon farming. Being one of the main food crops complementary to cassava, singling out beans helped in assessing the technical responses the farming communities undertook to adapt. In order to maintain stable food systems as a rural livelihood strategy, Yield changes between 2015 and 2018 in terms of kilogram per acre was determined and analyzed. To make sure that yield loss is

distinctively caused by the Oil and Gas exploration process, the comparison of both test and control results were from the same agro-ecological zone with similar farming constraints in that given the same opportunities and solutions, livelihood status would change towards the same projection. The motivation behind this study is based on the significance of agriculture to the Uganda's' economy as it contributes 25% of Gross National Income (from agricultural exports), employs 60% of the total population, 99% of rural population work both in crop and livestock sectors. It is also a food basket for all the rural and urban dwellers. Findings of the study reveal that there was a significant yield loss in terms of kilograms, loss in agricultural income, displacement farmers and wild animals and hence a number of strategies have been adopted to mitigate such impacts and so, to sustain and improve the livelihoods. These include but are not limited to: nonfarm sources of income like market vending, local tax collection, *boda (local motorcycle transport service)*, seasonal fishing, charcoal making and trade, local beer brewing, hiring out labor, local village bank called VSLA (Village Saving and Lending Associations). Empirical data findings propose the possible solutions like developing biodiversity action plans to protect and preserve the ecologically affected ecosystems, restore chemically depleted soils, Government support through economic and capacity empowerment, create a transparent comprehensive resettlement and compensation plan for the entire environmental conservation process

### **Keywords**

Oil and Gas, Bean yield, Smallholder farmers and Environmental Conservation

### **Introduction**

Uganda has a land surface area of 241,037 km<sup>2</sup>, total population of 44,270,563 people according to Uganda Bureau of Statistics 2016 (UBOS). Climatically, it is distinctively characterized by wet and dry seasons except for a few parts in the North and East of the country which are dominated by semi-arid and arid conditions respectively (Kisembe, 2019). Uganda is endowed with a diversity of both renewable and non-renewable resources ranging from land, energy (biomass, oil and gas and hydro-

electricity), forests, water, wetlands and wildlife/biodiversity. Therefore, activities like agriculture, tourism, fishing and fossil fuel exploration could have progressed Uganda to a middle economy. It is no doubt that this wealth tank remains untapped justifying a natural resource curse scenario due to a number of hindrances related to the exploration impacts like direct effect on the environment, agriculture and tourism. In terms of Oil and Gas Quantification, there are five potential discovery sites of fossil fuels which include: the Albertine Graben, Kadam-Moroto Basin, Lake Kyoga Basin, Lake Wamala Basin and Hoima Basin. Exploration in the Albertine Graben region has revealed a lot of hydrocarbon deposits. A sum of 37 exploration wells out of the 39 has exposed the underground unutilized basket of Ugandan wealth which makes it one of the largest oil and gas reserves in Sub Saharan Africa. Estimated reserves stand at about 6 billion barrels and which is enough to produce 200,000-3500, 000 barrels of oil per day for 30 years by the Ministry of Energy and Mineral Development, 2006 and is expected to generate US \$ 2 billion per year. This has to be taken critically as it precludes the future of other economy sectors and resources mostly smallholder farmers along the Oil and Gas production areas. Existing institutional frameworks include: Petroleum exploration and production department responsible for oil and gas exploration and production, National Environment management Authority which plays a key role in the partnership together with the ministry of Agriculture, Animal Industry and Fisheries to countercheck the impacts on agriculture sector. The leading legal and policy framework is Oil and Gas policy with Energy policy and petroleum regulations. The 2010 research conducted by Uganda Wildlife Society (UWS) about Uganda's environment and natural resources highlighted loopholes, capacity gap and political interference in the existing policies. For example, Communities surrounding the hydrocarbon energy exploration and production areas are engaged in agriculture, fishing and other activities sensitive to the impacts of oil and gas upstream processes and yet these Communities are not protected at all in the policy. For the case of Oil and gas sector, there is a need to fill existing capacity loopholes in which the existing Oil and Gas companies like Total-France, CNOOC-China and Tullow-United Kingdom to develop biodiversity action plans to restore, preserve, protect and enhance biodiversity (Dickinson, 2020). A detrimental impact on tourism mainly on Kabwoya wild reserve has

been shocking. All wild animals and other species sensitive to upstream operation outcomes like noise and smell have disappeared (Nnakayima, 2018). There is a need to meet the energy demands of the increasing population and economy without negatively impacting the environment and agriculture sector.

The aim of this study was to investigate the impact of Oil and Gas (OAG) Exploration stage on agriculture and specifically on the yield of local beans and cassava among the small holder farmers. Results were achieved through examining the effects on yields (Kg per acre per year), translating into the farm income changes and to see to what extent are the farming systems change in order to sustain livelihood strategies.

### **Results Summary**

Yield data for common beans (*Phaseolus vulgaris L.*) collected within a radius of 2km from Oil and Gas sites became higher than production data after (within 2km). This is for all the villages of Buseruka and Kigorobyia and for all the years 2015, 2016 and 2017.

Fishermen are among the main victims affected by the exploration. As a result of water contamination in Lake Albert, aquatic diversity mortality is high. The fish catch has basically reduced by 50% and yet these are landless low income households who cannot integrate farming. The presence of many household dependants (Above 6) with low productive family labor (3 or less) is highly attributed to the low levels of education (Samir, 2017).

### **Hypothesis**

OAG exploration processes produce oil wastes and gas flares which reduce the crop yield. Yield loss is also through farm size reduction/abandoning the severely affected land and farmer displacement. This is through direct effect on soil fertility (crop root system) and the entire plant (shoot system). Expected the yield after the effect was lower than the yield before. A decline in yield was due to willingly abandoned and evicted land and low production from the existing crop fields.

### **Methodology and data collection**

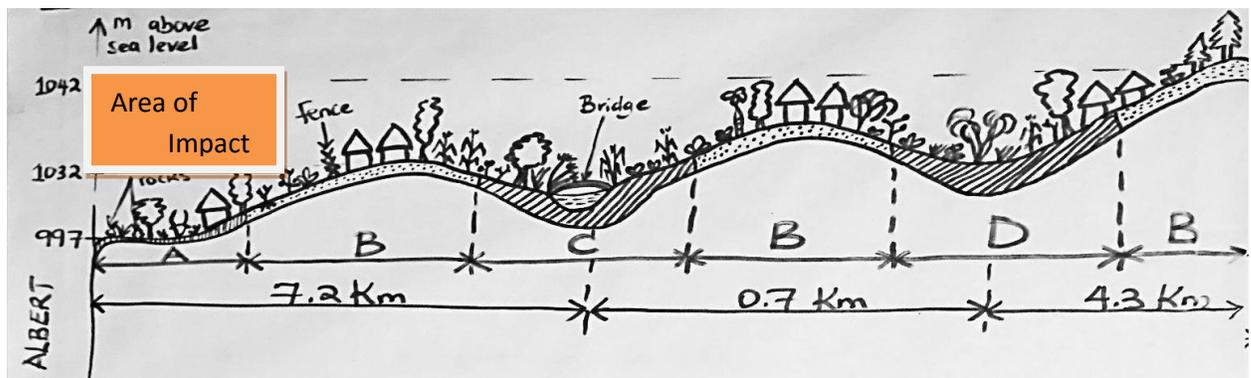
This was achieved by administering a semi structured questionnaire to individual small holder farmers who were sampled randomly within the OAG affected area (radius of

2km) and the control beyond 2km from the exploration and production camps. Attention was given to those practicing the cultivation of Cassava and beans as their home food and cash crops. Three surveyors holding a bachelor of science in Agriculture were recruited, trained and deployed for data collection. Each surveyor was assigned each village. This criterion was chosen because of heterogeneity within the respondent's themselves like language, culture and value chains adopted. Also holding focus group discussions of eight persons (gender sensitive; four men and four women) at a village level to understand the existing farming systems and confirm data findings. A sample size of 200 farmers in total (100 famers for the treatment and 100 more for comparison) was considered. Using excel method, data was analyzed and processed. Three villages along the OAG exploration camps of Nyabuhukuru, Biso and Pakwach were focused on during the survey.

A questionnaire was administered to 200 respondents in Western Uganda within the villages of Biso, Nyabuhukuru and Pakwach along the Oil and Gas Production camps. The information collected was only on two value chains: Local beans and Cassava (Sweet and Bitter varieties). The collected data is for the period 2011\_2012\_2013 before the actual OAG exploration began and 2015-2017 after the exploration

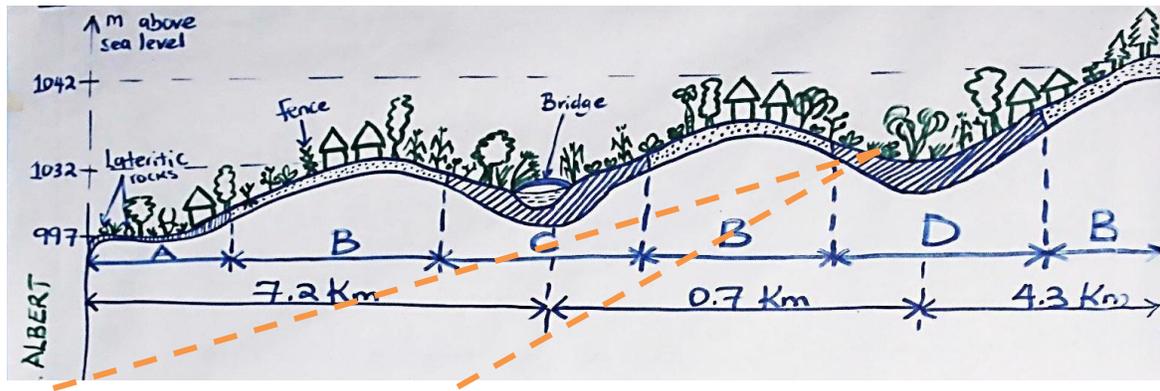
### Results

The research area was divided into four agro-ecological zones A, B, C & D but the main area of focus was A.



The area of impact is within a radius of 2 kilometers from the exploration sites and Lake Albert. This has resulted into arable land shortage and in response, local game reserves and Queen Elizabeth National parks together with wetlands marked C and D is encroached. Such secondary effects have resulted into ecosystem degradation and other associated water contamination impacts(Acio, 2018). It is therefore necessary for the Uganda Government through the ministry of energy and mineral development to strategically relocate the affected farmers to other non conservation areas

**Figure 1: Displaced farmers encroaching on wetlands/conserved land in other far to reach villages**



**Figure 2: Contaminated water sources as a result of ecosystem degradation**



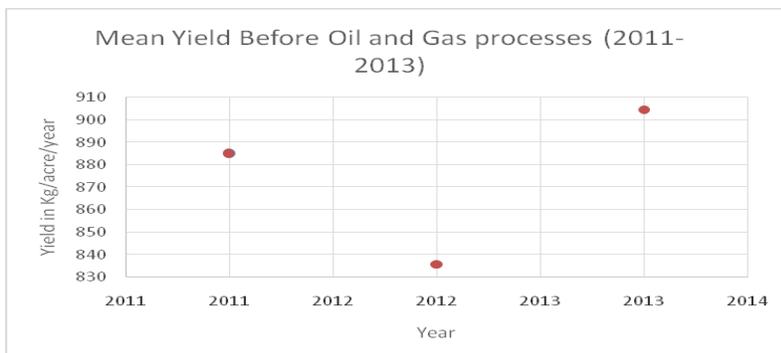
Wetlands and other low land vegetation play a key role in water purification through filtering and recycling. Therefore, they must be left unhampered in their stable ecosystems



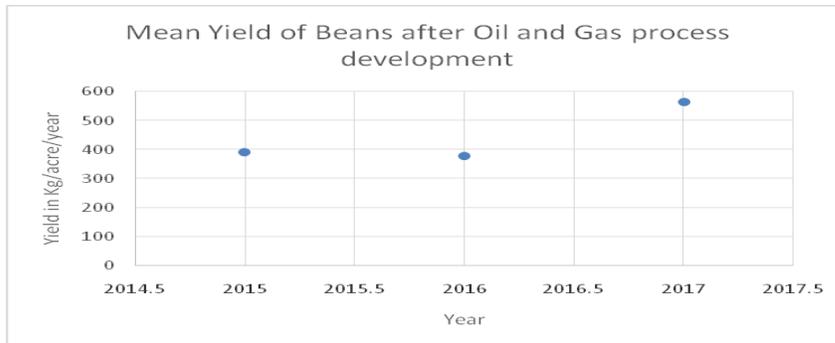
By nature, these wetlands are in low lying geographical sites. Therefore, rain deposition as a result of erosion accumulates floods. However, encroachers/displaced farmers create heavy and deep terraces to facilitate the



**Figure 3: Panorama view of the displaced households (Field photo)**



**Figure 4: Mean Yield per acre before exploration**



**Figure 5: Mean Yield per acre after the exploration**

From Figure 4: Mean Yield per acre before exploration, Mean yield in kilograms for the year 2011-2013 for all the villages of Buseruka and Kigorobyia is higher compared to the year 2015-2017 in Figure 5: Mean Yield per acre after the exploration.

### **New upcoming livelihood strategies**

Community group formation to form a local *bank* known as VSLA (Village Savings and Lending Association) in which members after the sale of the produce, contribute at least 30% to for social charity in case of loss of a member, also to use for hiring land and tractor plough services, transportation of the final product and market information through their democratically elected leaders

Because of communal farming, many groups dominated by women have been able to hire larger pieces of land (above 5 acres), employ tractor hire service for plowing and harrowing. Remaining operations like sowing, weeding and harvesting are done by the group. And because of such strategy, more yields have been realized, collective bulking, access to market information, collective and competitive bargaining to attract better prices has been realized. It is through such collaboration that small saving schemes have been created, social corporate responsibility affairs have also been included.



### **Conclusion and future research**

The results of quantitative research helped to confirm that actually the OAG exploration stages have reduced the yield of the 3 value chains: cassava, beans and maize through land surface reduction since most farmlands were abandoned, also the yield from the existing crops reduced gradually over years compared to comparison areas far away and not affected. It is therefore important that future research focus on other crops but more importantly consider the sustainability of the new livelihood strategies taken between 2013-2019. A government legal framework is needed to develop a working and enabling policy that will look into the sustainable livelihood of these communities both technically and financial wise. This should supplement the restoration of depleted soils, water treatment and ecosystem conservation

Value chain development from production, agronomy, post harvest handling, and marketing and value addition will attract better prices for the new crops. Small financial institutions like VSLAs at a village level will require capacity building in form of infrastructure, technical organization and training from commercial banks on banking, saving and lending. Another fundamental way is to deeply analyze the profitability of the new adopted enterprises to confirm whether they would be the strategic substitutes of the abandoned farming systems and if not, other possible solutions

### **Limitations of the Study**

During this study, the selected respondents were individuals interested and available to participate (willingness to attend) and so, do not represent the yield data for the whole country farmers within the entire Oil and Gas region. Also, the

statistical numbers generated are not the exact yield figures but rather what a farmer remembers since there were no substantial written records for each chain in every year. In each of the villages (Nyabuhukuru, Biso and Pakwach) had representatives among the target small holder farmers and therefore, the generated data is the view, experience and feeling of a few 200 respondents.

These challenges were solved by two approaches: Conducting group interviews and review meetings with village leaders, men and women to verify the findings. Also, three enumerators with a degree in agriculture from the region were selected to conduct the interviews. These were accepted locally as they were known as the children of the land. This enhanced a free and conducive environment for the respondents to interact and hence correct data was produced. Similar results were presented to stakeholders including the local Non-Governmental Organizations like Hoima District Farmers Association (HODFA), Trias and Local government.

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