

ambitious world has seen them as wastelands to be filled and drained. [7] holds that the growing populations in Sub-Saharan Africa, competition for fertile farming lands and limited access to resources has led to populations and investors invading wetlands and other marginal areas for agricultural and other life transforming activities. In this fight for survival, they often engage in unsustainable use of these natural resources, causing degradation and other adverse effects. These views are supported by [8] who states that poverty has been identified by scholars as one of the factors that drive communities into wetland resource exploitation for livelihood.

In Kenya, the Yala Wetland had been an important area of interest to the Government for a long time. Efforts for the reclamation of the swamp date back to as early as 1954 when the colonial Government of Kenya assigned Sir Alexander Gibb and Partners to investigate the potentials of wetland reclamation in the Kenyan portion of the Nile Basin (Yala Swamp lies within the Nile Basin). The study recognized the high productive potential of Yala Swamp and its recommendation was to be implemented eight years later when in 1963 the Kenya Government requested the United Nations (UN) for assistance to execute the recommendations of the Commission Report to reclaim Yala Swamp as a realization of the development of the area. The request was granted and under the UN special fund, the Food and Agricultural Organization (FAO) implemented the reclamation of Area I (2,300 ha) in the period 1965-1970.

The specific works carried out included the construction of: a diversion canal and protection dyke on River Yala; a feeder canal to Lake Kanyaboli; retention dyke at Lake Kanyaboli. Area II and Area III were left under water after reclamation of Area I. FAO construction activities started in 1967 under the United Nations Development Project (UNDP)/FAO project. Yala River diversion and protection dyke (7.25km long), Lake Kanyaboli retention dyke (2.5 km long) and Lake Kanyaboli feeder canal (8.8km long) were constructed. By 1970 a total of 2,300 ha of the Yala swamp wetland had been effectively reclaimed but stalled later the same year on the realization that the envisaged works to reclaim the entire swamp area were grossly under-estimated and adequate funds could not be secured from donors. This reclaimed area (2300 ha) remained idle for several years despite the structural works already partly done and it gradually developed into a good grazing land for the local communities.

In 1972 the Ministry of Agriculture commissioned a Dutch Consulting firm, ILACO (Indian Life Assurance Company), to investigate the possible development options of the Yala Swamp. ILACO recommended the reclamation of a further 9,200 ha (Area II), bringing a total of 11,500 ha under development and leaving only 6,900 ha (Area III) to act as a buffer zone. Faced with a rapidly expanding population and the need to increase food production for national food self-sufficiency as well as improvement of earnings in foreign exchange, the Kenya government revisited the issue of Yala swamp regarding its reclamation for agricultural activities. Between 1979 and 1982 another feasibility study was done by the Mehta Group International which revealed more potential for Area II. However, this was never implemented

due to resource and management constraints. Hence, only the already reclaimed Area I was put under agriculture by the Lake Basin Development Authority (LBDA) on behalf of the Kenya Government. LBDA moved into Area I for an integrated development and utilization on a pilot basis and in cognizance of sustainable use of the reclaimed area to boost food production and to raise the standard of living of the local community as well as the nation at large. This they did through intensive crop husbandry based on applied research principles for a holistic agricultural development, including the neighborhoods of the swamp. The agricultural activities included production of cereals, pulses, horticultural crops, seed bulking and massive upgrading of the local agricultural production technologies. Other programmes initiated by LBDA included the community based rehabilitation and conservation of the degraded areas [9].

The Yala Swamp conflict, the motivation behind this study, started in 2003 when regional government authorities granted a 25-year lease for rice cultivation to Dominion Farms (K) Ltd, a subsidiary of Dominion Group of Companies based in Edmond, Oklahoma USA. The agreement as approved by the then local authorities of Bondo and Siaya County Councils was that Dominion would engage in rice production in part of the swamp known as Area I, covering about 2,300 ha. This is the land portion that had been reclaimed before 1970, and previously used by LBDA for agricultural activity. An environmental impact assessment (EIA) was commissioned by Dominion for large-scale rice production, for which a license was issued in 2004, specifically for rice irrigation. However, instead of the originally intended rice cultivation in the 2,300 ha once owned by the LBDA, Dominion embarked on other additional agricultural activities in the swamp that went beyond rice cultivation. This included construction of irrigation dykes, canals, dams and weirs, and an airstrip and road.

The project also engaged in a major aquaculture venture which included fish farms, a fish processing and fish mill factories. For this purpose, the Project required more land and so it engaged in reclamation of more swamp area (Area II and III), in the process displacing families from ancestral lands. These new activities undertaken by Dominion Farms Ltd elicited mixed reactions with a number of stakeholders voicing various concerns pertaining to environmental conservation. It is in light of this acrimonious nature of co-existence in Yala Swamp since 2003 that this study sought to explore the effect of the activities of Dominion Irrigation Project on the environmental conservation in Yala Swamp Wetland.

2. Methodology

The study was carried out in South Central Alego Location, Boro Administrative Division, Siaya District, Siaya County, Kenya. Siaya County comprises six districts as follows: Ugenya, Ugunja, Siaya, Gem, Bondo and Rarieda. Siaya County borders Busia County to the north, Kakamega County to the northeast, Vihiga County to the east, Kisumu County to the southeast, and with Lake Victoria to the south and west. Specifically, the study was carried out in Kadenge and Obambo – the two Sub-Locations that form South

Central Alego Location. A descriptive survey research design was used. The choice of a survey method was pegged on its ability to help in identifying standards against which existing conditions can be compared and also to determine the relations that exist between specific events. The design was very ideal in exploring the perceptions of the head of households in South Central Alego Location pertaining to the transformation of Yala Swamp Wetland. Through proportionate random sampling techniques, the study interviewed 160 respondents (head of households) using a semi-structured interview schedule in each of the two Sub-Locations of Kadenge and Obambo. These are persons who either directly or indirectly relied on the Yala Swamp Wetland for their household livelihoods.

3. Findings and Discussions

Table 1: Type and Cause of Environmental Degradation

<i>Air</i>	<i>Frequency</i>	<i>Percent</i>	<i>None response</i>	
			<i>F</i>	<i>%</i>
Toxins from pesticides and herbicides used in spraying rice fields cause air pollution	142.0	89.0	18.0	11.0
Black soot from burning of papyrus to clear ground for rice fields cause air contamination.	98.0	61.0	62.0	39.0
Water				
Chemicals used in aerial spraying of rice fields pose a threat to water purity in Lake Kanyaboli and River Yala as well as other streams in the neighbourhood (like River Hwiwo).	111.0	69.4	49.0	30.6
Water control up-stream (in the form of weirs, dams, dykes, and canals constructed for irrigation purposes) leads to reduced water levels in the lakes and rivers downstream.	133.0	83.0	27.0	17.0
Burning of or cutting the papyrus destroy the natural habitat and lead to water pollution and reduced fish production in Lake Kanyaboli.	133.0	83.0	27.0	17.0
Land				
Degradation of pasture by poisonous chemicals	108	67.5	52	32.5
Degradation of land by toxins from chemicals (pesticides and herbicides) used in the rice fields.	120	75.0	40.0	25.0

The frequencies in Table 1 above indicate the number of respondents out of the sample size of 160 in each row and the percent indicated is consequently out of 100 in each row. As can be seen, n=142 (89.0%) complained about air pollution resulting from chemical toxins from aerial spraying; n=133 (83.0%) lamented that burning the papyrus reeds to clear land for cultivation lead to destruction of the natural habitat as well as water pollution; n=120 (75.0%) feel that use of poisonous chemical sprays has led to land degradation; n=111 (69.4%) said chemicals used in aerial spraying pose a threat to water purity in Lake Kanyaboli and River Yala when there is a run-off of rain water and also during aerial spraying; n=108 (67.5%) stated that use of poisonous chemicals had degraded the land and pasture; n=98 (61.0%) complained about air pollution from black soot formed by burning papyrus reeds.

3.2 Effect of Dominion Irrigation Project Activities on Environmental Conservation

As a follow-up on the above question on cause and type of environmental degradation, the study sought to know the

3.1 Type and Cause of Environmental Degradation

The study sought to understand what the respondents thought about the activities carried out by the Irrigation Project vis-à-vis the environment. As [10], [11] and [12] hold, despite the realization and wide documentation of the importance of wetlands for biological, hydrological, economic and socio-ecological functions, wetlands are some of the most threatened ecosystems in the world. The respondents in the study talked about air, water and land contamination and the effect of this on human, animal and plant life. Table 1 gives a summary of the cause and nature of environmental degradation as perceived by the head of households.

specific environmental challenges that emanate from Project activities and the nature of effect on the environment. Table 2 illustrates the views of the head of households on this.

Table 2: Effect of Dominion Project activities on Environmental Conservation

<i>Effects</i>	<i>Frequency</i>	<i>Percent</i>	<i>None response</i>	
			<i>F</i>	<i>%</i>
Air pollution lead to ailment of villagers	38	24.0	122	76.0
Ailment and death of domestic animals caused by effect of chemical toxins on air, water and land.	57	36.0	103	64.0
Reduced water levels in the lake and river as a result of water controls in the form of canals, dykes, dams and weirs - hence reduced water for domestic use and fish production.	91	57.0	69	43.0
Land degradation has led to reduced crop production for the households.	140	87.5	20	12.5
Death of fish due to chemical toxins in the run-off rain water into Lake Kanyaboli and River Yala downstream and due to aerial spraying.	36	22.5	124	77.5
Destruction of natural habitat: The Wetland was host to unique species of trees and shrubs that provided medicinal herbs. It was home to the endangered sitatunga antelope and also unique fish and edible birds (like quails). Clearing the forests and the papyrus reeds has led to destruction of the natural habitat for all the above and hence to destruction of source of livelihoods for the residents of Yala Swamp.	123	77.0	37	23.0

The study established that the activities of Dominion Irrigation Project affect plant, animal and human health in a number of ways. A vast majority of n=140 (87.5%) stated that they no longer harvest as much as they did in the previous years and blamed the reduced crop production on the use of chemicals by Dominion Irrigation Project; n=123 (77.0%) feel clearing the forests and papyrus has worked to destroy the natural habitat that was host to unique trees and shrubs that provided medicinal herbs to the community, the endangered sitatunga antelope, unique fish species that inhabited the water below the papyrus, edible bush animals and birds (like quails); n=91 (57.0%) complained about water control in the form of dykes, dams, canals and weirs that has resulted in reduced water levels in the river and lake downstream and hence, reduced water for domestic use and reduced fish production; n=57 (36.0%) lamented about ailment and death of domestic animals caused by effect of chemical toxins in air, water and on land; n=38 (24.0%) of the household heads blamed the poor health of their household members on chemical toxins and black soot from burning papyrus which they said polluted the air and water.

4. Discussion

The Yala Swamp Wetland ensured sustainable livelihoods for the riparian community of South Central Alego. This study looked at the concept livelihood sustainability in the context of sustainable wetlands management. As [13] posits, a livelihood is sustainable when it can cope with and recover from shocks and maintain or enhance its capabilities and assets both in the present and in the future, while not undermining the natural resource base. The study established that prior to the transformation of Yala Swamp, the households in South Central Alego location had sustainable livelihoods and that the natural resource base behind this sustainability was the Yala Swamp Wetland. Asked to compare the financial status and food security situation of their households before and after the transformation of the Wetland, the residents were convinced they led better lives in the period before the transformation.

This study shares the [14] position that communities must be supported to manage the natural resources as they

continue to draw livelihoods from the same. Indeed, natural resources like the Yala Swamp, while being tapped for human sustenance (by the local community, the government or the investor), must also be helped to regain their natural biodiversity and retain the same for future generations. The study was informed that for generations, the residents of Kadenge and Obambo cultivated the Yala Swamp and entirely depended on it for food, clothing, shelter, education and medication. This study is of the opinion that to maintain sustainability for the host community, it is necessary that foreign investors revise their policy on wetland transformation to ensure sustainable wetland management.

The Brundtland Report of the World Commission on Environment and Development (WECD) [15] defines sustainable development as development that meets the needs of the present without compromising the ability of future generations to meet their own needs. Going by the WECD definition, it follows then that all activities that development agencies like Multi-National Corporations (MNCs) (read Dominion Group of Companies) engage in should meet the needs of the host communities (read the riparian communities of Kadenge and Obambo) without compromising the ability of future generations to meet their own needs, using the same natural resource base - the Yala Swamp Wetland. Hence, this definition of sustainable development by the WECD refers to continued improvement in household livelihoods by continued use of the same natural resource base. For the households of Yala Swamp sustainable development depended upon maintaining the ecosystem undisturbed and un-degraded. In their opinion, Dominion has failed on this front. It could be seen that most of the respondents did not realize from the onset that in any large-scale mechanized rice growing venture, the use of chemicals cannot be avoided completely. It is the conviction of this study that a participatory approach from project inception period would have been ideal since environmental challenges that come with large scale rice irrigation would have been explained to the residents and the two main stakeholders would probably have reached a compromised position pertaining to environmental conservation. However, the current situation is of a natural habitat that has been destroyed - fish, wild animal and forest survival threatened. This study relates with [16] who rightly says

that wetlands have too often been lost for very limited benefits and even costs to the neighbouring communities. For the residents of South Central Alego, indeed this has been the situation.

As [17] notes, wetlands or floodplains can be used to achieve sustainable development provided that clearance of natural ground cover, swamp drainage and use of agro-chemicals are carefully controlled. Information gathered from head of households in South Central Alego showed that the wisdom of integrating environment and development is on the notion that variables, such as economic and social factors cannot be simply ignored by individuals, governments or investors in their drive to protect or extract from the natural environment. Indeed, the natural environment cannot be sustained if development policies do not consider the need for change in people's access to resources and the distribution of costs and benefits. For this reason, the political and religious leaders as well as officials at the Siaya County Council offices needed to work with the local communities of Kadenge and Obambo in order to ensure use of the Wetland by the Project in a sustainable way.

[18] views sustainable wetland management as management of a wetland system with sustainable technology options, which ensures the sustainability of its ecosystem functioning and contribution to livelihoods to conserve natural resources, with adequate institutional and economic options. This study observes that degradation of the environmental resource base such as excessive resource extraction and severe land use by Dominion Irrigation Project has not only affected the quantity and quality of the services that are produced by ecosystems, but has also challenged the resilience of the Wetland to ensure sustainable development for the households of South Central Alego. [19] adds that the wisdom of integrating environment and development is on the notion that variables such as economic and social factors cannot be simply ignored by individuals, governments or investors in their drive to protect the natural environment. This study holds that protected area managers need to work with communities in ensuring that conservation actions that cause or increase impoverishment are avoided.

5. Conclusion and Recommendation

The riparian community of South Central Alego is crying foul over environmental degradation in Yala Swamp. The use of chemical pesticides and herbicides is causing land, air and water pollution and this is affecting human, plant and animal life. Further, clearance of wetland vegetation and the loss of wetland products and produce is impacting negatively on the traditional way of life of the local community, as the wetland no longer provides a strong financial base like it did in the previous years. Lack of environmental conservation has therefore, made the household livelihoods of these locals unsustainable.

This study appreciates that there is need for sustainable management of natural resources and that knowledge beyond that of outside experts is required. Since the local

communities have this knowledge, It is necessary that governments and investors engage host communities (participatory development) from project inception period. This would enable mitigations to be planned in an all-inclusive manner by the different parties so as to prevent rather than to adjust impacts afterwards. Political and religious leaders would then need to change their attitude and approach on the vital role they are expected to play at the negotiation tables on behalf of the populations they represent.

In addition to being drained by international and local investors, wetlands in Sub-Saharan Africa are facing threat from population migration, which is directly linked to poverty – this has been identified as one of the factors that drive communities into wetland resource exploitation for livelihood. There is need therefore for governments to address the root causes of vulnerability through a range of interventions, including rural development, agricultural research and building livelihoods. Food shortages pose a recurrent crisis which cannot be solved through rain-fed agricultural production alone. Technologies such as irrigation and water harvesting must therefore be employed to support agricultural intensification. Further, policies governing different sectors of rural economy should be reviewed with an aim of making them more proactive and progressive so as to ensure enhanced rural livelihoods. However, for optimal success, especially with the human capital, all stakeholders must be included in the planning and implementation and outputs must be seen to benefit all parties.

It is expected that the results of this study will challenge policy makers as well as future researchers to work towards a review of policies that govern transformation of wetlands such that the ecosystem continues to function even as livelihoods remain sustainable.

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