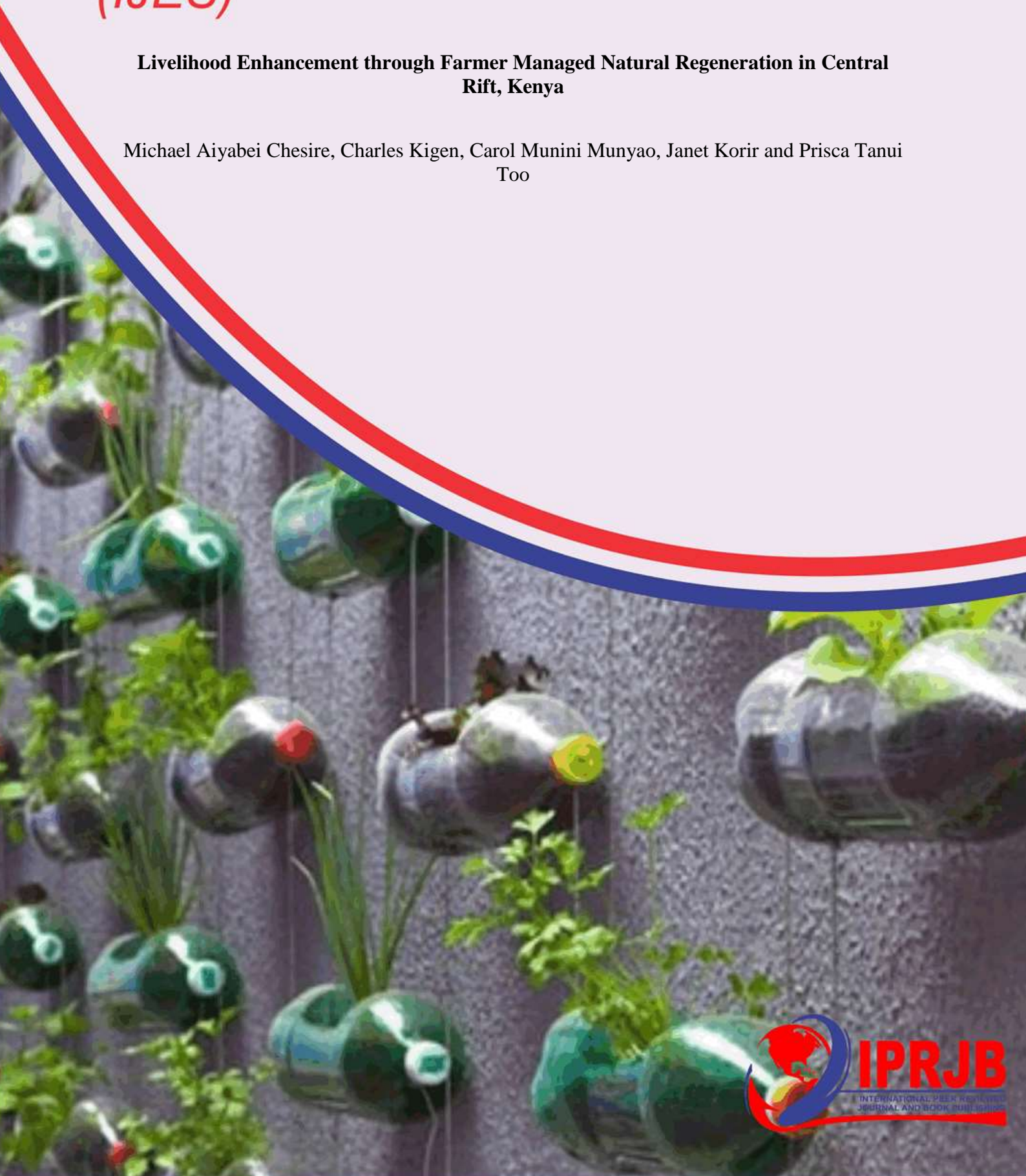


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Abstract

Purpose: Over the past few decades, there has been pressure to meet basic needs by citizens in developing countries as a result of conventional livelihood sources to support such provisions which have gradually dwindled for a variety of reasons, key among these being land degradation, climatic changes and land sub-division. Alternative and sustainable livelihoods for poverty reduction and enhanced income for households are desirable for adoption. This paper discusses the effect of the application of Farmer Managed Natural Regeneration (FMNR) in Kenya's Arid and Semi-Arid Lands (ASAL) regions by World Vision (WV) on food security, household income and livelihood enhancement.

Methodology: Case studies of farmers' success stories supported by WVK are presented. Further, the paper outlines the roles of stakeholders in the implementation of the strategy and associated benefits to farmers in three counties of Baringo, Elgeyo Marakwet and Nakuru. A discussion of the relations between poverty, income and household food security in relation to SDGs 1 and 2 is presented.

Findings: Major findings from the study include; FMNR has contributed to improved food security, from 42.6% in 2018 to 73.6% in 2021 (31%). Increased household income was reported from 25.2% in 2018 to 52.5% in 2021, representing a rise of 27.3%. Emerging alternative livelihood sources include beekeeping, mango farming and processing, poultry, pasture seed production and coffee farming.

Unique Contribution to Theory, Practice and Policy: The paper concludes that the implementation of FMNR in the Central Rift is still small scale and majorly aided by World Vision Kenya in the three Area Development Programmes (ADPs). The adoption of FMNR as a livelihood enhancement strategy in arid and semi-arid areas to enhance food security, improve household income, reduce poverty and support environmental conservation efforts is recommended.

Keywords: *Livelihood, Natural Regeneration, Poverty, Household Income, Food Security*

INTRODUCTION

The co-existence between man and nature dates back to many centuries ago. This relationship has presented both positive and negative consequences to humanity. Socio-economic changes witnessed over the years occasioned by cultural and technological advancements have not only improved man's ability to better utilize natural resources for fulfillment of basic needs but also ensure sustainability of these resources for future generations. The question that needs to be addressed is, what is the contribution of FMNR to food security, household income and livelihood enhancement? The natural resource endowments such as land, forests and water are available for people to utilize to make livelihoods (Guerryet al., 2015; Ibrahim et al, 2017). Rising human population, however and the ever increasing demand for necessities require nations to seek appropriate intervention strategies to address the same. Resource limits on the part of nation-states calls for partnerships with national and international organizations to collaboratively complement efforts to advance development.

This paper presents a discussion of World Vision Kenya's intervention strategies to address household food security and household income in Kenya's central rift region through the implementation of a nature dependent livelihood source –Farmer Managed Natural Regeneration (FMNR).

The region experiences challenges such as drought, overgrazing, conflicts over resource use which impact on their livelihood (Elgeyo-Marakwet CIDP, 2018-2022). The first part of paper gives a general overview of the strategy, its implementation process and select case study beneficiary farmers in the three ADPs of Marigat, Ndabibi and Ngoswet in the counties of Baringo, Nakuru and Elgeyo Marakwet. The last section of the paper discusses the findings and elucidates the study conclusions and recommendations.

The Concept of Livelihoods

Globally, the human race has and continues to derive their livelihoods from a variety of sources. Various environments offer unique forms of livelihoods to support life. The combination of skills, knowledge and capabilities shape how humanity derives their needs from the immediate environment. Nations and organizations alike emphasize the need to provide sustainable livelihoods for citizens for provision of necessities (World Bank, 2007).

The term livelihood according to the Merriam Webster dictionary (2022) refers to 'means of support or subsistence'. This concept however encompasses more aspects to include capabilities, natural and social assets as well as activities undertaken to realize human needs. A livelihood is sustainable when it can cope with and recover from stresses and shocks (Scoones, 2009).

The concept of livelihoods is as old as mankind with transformations occasioned by modernization, social and natural factors. Discussions around livelihoods centre on the sources which are both natural and human. Many livelihood sources especially in developing countries are environment related and therefore dependent on natural resources. In developed countries however, livelihood sources are dominant in the service sector (Scoones, 1998).

In developing countries, rural livelihoods are natural resource dependent and present numerous opportunities to inhabitants in those ecosystems to meet their needs. While mountainous and wetland ecosystems present better livelihood options for inhabitants, desert ecosystems (arid and semi-arid) have numerous but tougher livelihood opportunities. Ngugi and Nyariki (2005)

dichotomized livelihoods as regenerative and extractive. Regenerative (i.e., non-extractive) livelihoods include activities like apiculture, poultry keeping, pisciculture (fish farming), silkworm production, drought tolerant cash cropping, horticulture, community wildlife tourism, processing of livestock and crop products, agro-forestry for tree products, and micro-enterprises in the informal sector. Examples of livelihoods that are extractive or potentially so include timber production, woodcarving, basketry, brick making, sand scooping, and charcoal making.

Governments worldwide are obligated to assist their citizens explore livelihood options most suited to their environments and match their capabilities. This includes providing an enabling environment through infrastructure development and imparting appropriate skills. Undertaking the task requires a strong partnership of actors ranging from citizens themselves, organized community groups and development organizations – local and international (Gurung, et al, 2011).

In rural settings, livelihood sources are many and include crop and animal production, agro-forestry, apiculture, fish farming, arts and crafts, community based tourism (e.g. tour guiding), herbal medicine practice, small scale trading, and small scale processing of agricultural products among others. This is the case in the three counties of Baringo, Elgeyo Marakwet, and Nakuru (Baringo CIDP, 2018-2022; Elgeyo Marakwet CIDP 2018-2022 and Nakuru CIDP 2018-2022). Urban areas are dominated by service oriented livelihoods to include banking, insurance, teaching, wholesaling, brokerage services, and hospitality among others. To complement government efforts to enhance livelihoods are non-governmental organizations. The next section discusses their roles

NGOs and Rural Livelihoods

The desire to attain equitable development is the goal of every nation. Efforts to realize this has however been hampered by resource constraints and competing national priorities. Many governments especially in the third world category of countries experience imbalanced development owing to a variety of factors that include poverty, marginalization, and skewed allocation of resources amongst others. Minimal development is experienced in rural areas in these countries yet a lot of natural resources necessary for stimulating development are found in abundance in some areas/ regions.

Governments' low level of attention to development needs of rural areas over the years has attracted the attention of non-governmental organizations which support rural livelihoods across sectors. Thornton et al, (2019) in their contribution to rural livelihoods debate point out that this sector which is mostly ecosystem dependent require transformation thus the need for concerted efforts by all stakeholders to realize the same. The history of NGO intervention in rural development spans over decades with numerous success stories in many continents. In the seventies and eighties, the focus of many NGOs was relief assistance. Later, with the evolution of development debate, the focus shifted to empowerment of communities to take charge of their own development. The adoption of empowerment approach opened way for many NGOs, in partnership with communities and host governments initiate and implement projects and programmes aimed at improving livelihoods (Forkuor & Korah, 2022).

Non-governmental organizations interventions through livelihood enhancement approaches over the years have positively impacted many communities. This assertion is supported by Gurung et al (2011) who contend that the entry of NGOs into a region significantly changes the livelihoods of local populations. NGOs capacity building component either through

community trainings or education sponsorship programmes have transformed communities from skills acquired by the beneficiaries. The goal of empowering communities with skills and knowledge is to have self-reliant populations and reduce dependency on external assistance.

Livelihood sources developed by the NGOs in rural areas range from agricultural production (crop and animal), value addition of agricultural products, marketing of products, apiculture, tourism, dealership in arts and crafts, mining, processing, wholesale and retail businesses, transportation, hospitality, warehousing and cultural showcasing. World Vision International being a development and humanitarian organization partners with nations and communities to initiate development projects and subsequently uplift peoples' quality of life.

World Vision's Livelihood Intervention Strategies in Central Rift, Kenya

World Vision International is a global organization that operates in all the continents targeting vulnerable communities to complement government efforts. Its programmes are spread across empowering sectors to include health, education, water, energy, food security, and financial inclusion. The rationale for the implementation of this strategy was informed by results from a baseline survey undertaken by World Vision in the central rift region which indicated that the poverty level stood at 45.3% (Ngoswet, 43.9%; Marigat, 39.8% and Ndabibi, 50.7%) (World Vision Baseline Study Report, 2018).

As a child focused organization, World Vision works through livelihood strategies to empower communities in marginalized regions with less privileged populations. The livelihood intervention programmes are community initiated with expert input from World Vision, host government and interest groups. The purpose of having communities initiate the programmes is to foster commitment to implement, make contributions, own and ultimately sustain them. The introduction of livelihood intervention strategies especially in arid and semi-arid regions may be particularly challenging owing to factors such as prolonged droughts, food insecurity and inadequate pastures to graze livestock as noted in the World Vision Baseline report of 2018.

In Kenya, World Vision operations are mainly in rural areas especially in arid and semi-arid regions, disaster prone areas as well as urban slums whose challenges require rehabilitation and provision of livelihood opportunities. While the scale of their interventions is not large, the impact of their programmes has transformed lives in all the productive sectors thus providing livelihood options to communities in areas of operation. The central rift region of Kenya is endowed with numerous natural resources and diverse populations from different cultural backgrounds. Parts of the counties of Nakuru, Baringo and Elgeyo Marakwet where World Vision operates experience moderate to low rainfall and sometimes experience adverse weather conditions. Communities resident in these counties practice crop and animal production, charcoal production, bee keeping and small-scale businesses as major sources of livelihoods. However, these occasionally witnessing crop failure and livestock deaths as a result of extreme drought. As found out in the World Vision baseline survey (2018), livelihoods are adversely affected by poverty, drought and food insecurity. Livelihoods have witnessed significant shifts owing to shocks and stresses resulting in the needs to adapt appropriate strategies to reduce vulnerability to climate change (Thornton, et al, 2019).

Through community mapping and baseline surveys, World Vision in partnership with communities and other stakeholders introduced a new concept introduced in 1983 in Niger–farmer managed natural regeneration (FMNR) as a livelihood strategy and a natural resource management tool in this region. The goal of the strategy was twofold, first, to increase

household income and therefore reduce poverty and secondly to improve the fertility of the soil thereby improving production and conserving environmental resources with less costs to the farmer. Three years later, the strategy has yielded positive impacts with families recording higher household incomes, improved crop yields and enhanced savings.

Conceptual Framework

This paper borrowed the DFID sustainable livelihood framework and the livelihood asset pentagon to illustrate relationships between assets and livelihoods in the central rift region. The two frameworks relate to the FMNR strategy from the natural capital and livelihood strategies perspectives as shall be discussed further in the results section of the paper.

Sustainable Livelihood Approach Framework

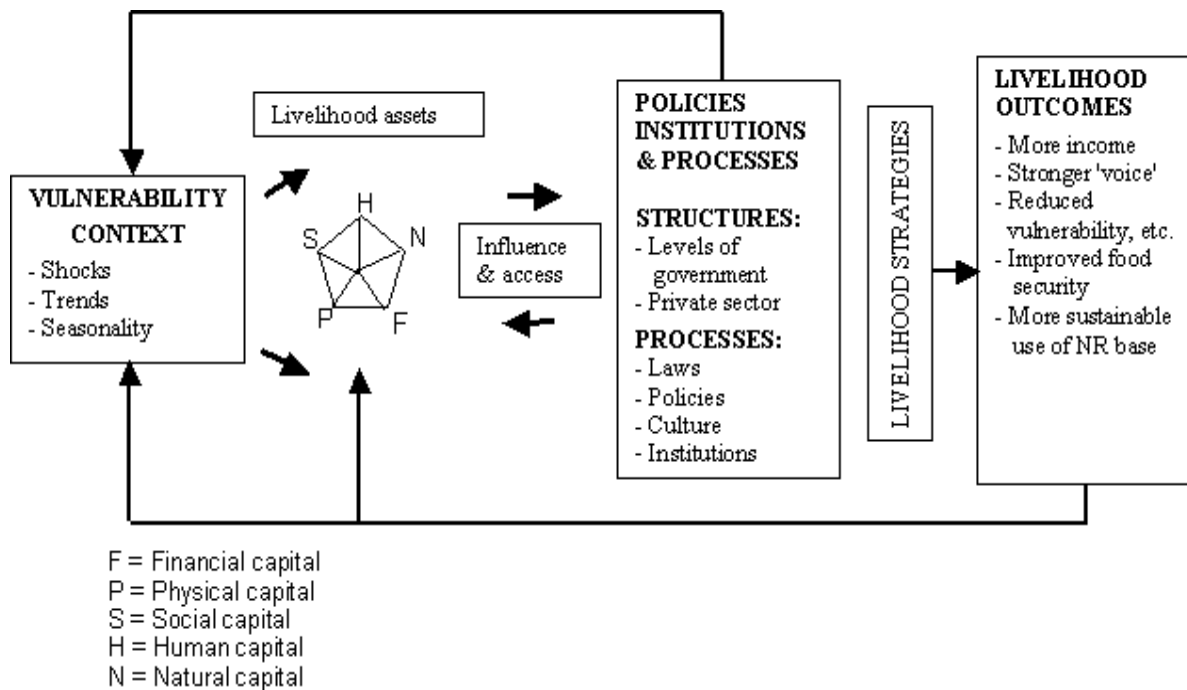


Figure 1: Sustainable Livelihood Framework

Source: DFID, 2001

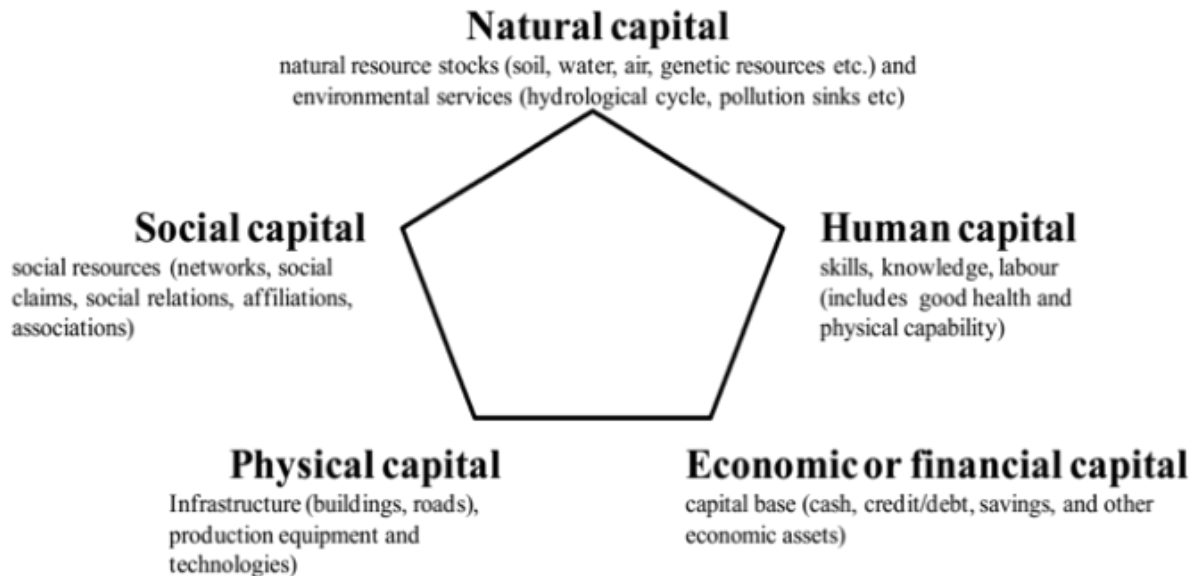


Figure 2: Livelihood Assets Pentagon

Source: DFID, 2001.

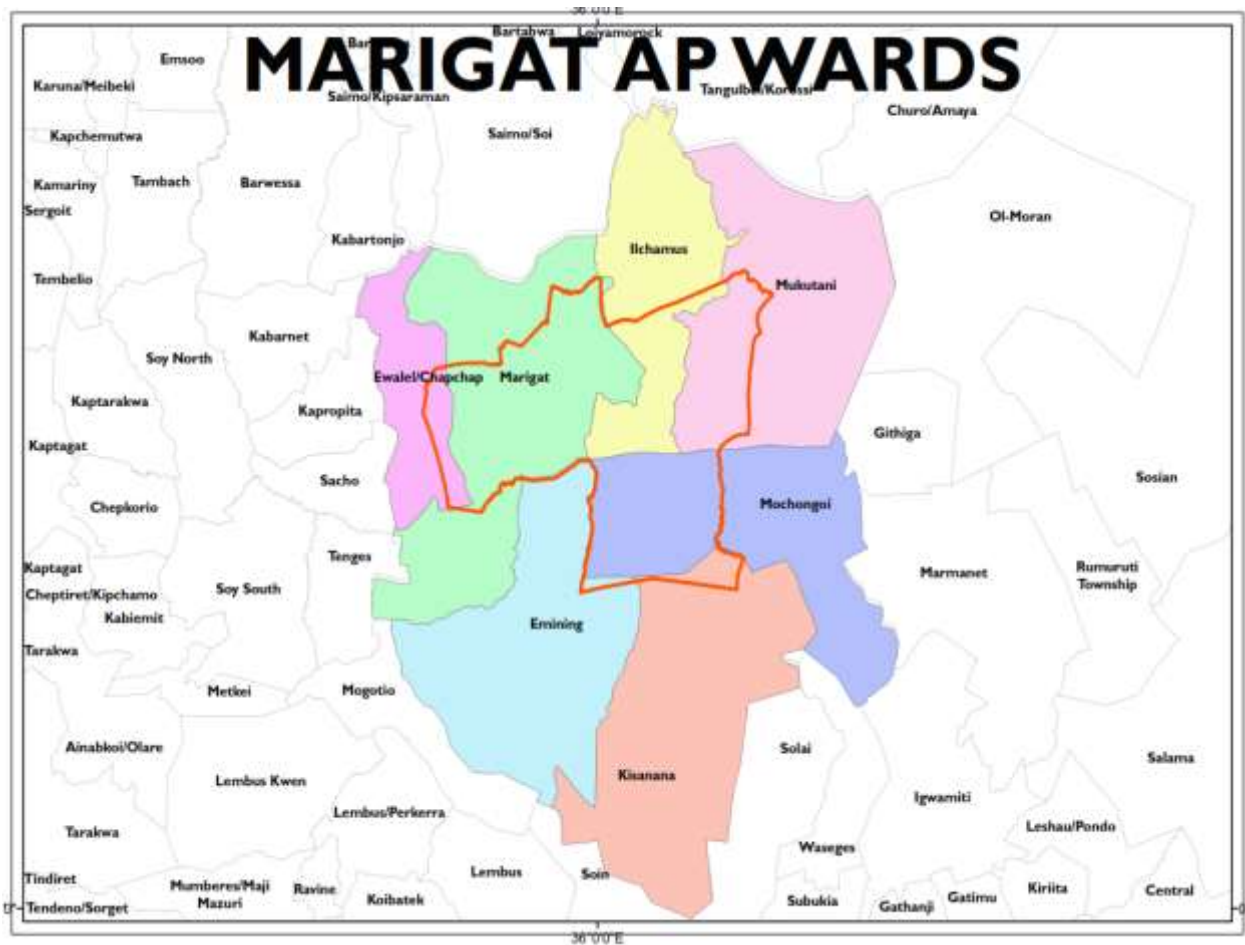
METHODOLOGY

Introduction

This section contains information on the study area, research plan which includes sampling, data collection instruments and administration. Further, procedures of selection of research participants, data analysis and presentation methods are presented.

Study Area

The study area comprises of three ADPs namely; Marigat, Ngoswet and Ndabibi in Baringo, Elgeyo Marakwet and Nakuru counties respectively (Maps; 1, 2 & 3). The region within the central rift is endowed with fertile soils, water resources and vegetation. A majority of the inhabitants of the study area derive their livelihoods from small scale rain-fed agriculture with some engaged in pastoralism, apiculture and micro-enterprises. The areas are arid and semi-arid experiencing low to moderate rainfall and high temperatures during the dry season, often occasioning drought. Food insecurity and reduced household income are the resultant effects of drought necessitating mitigation measures.



Map 1: Marigat ADP

Source: CRIFSUP, 2017.

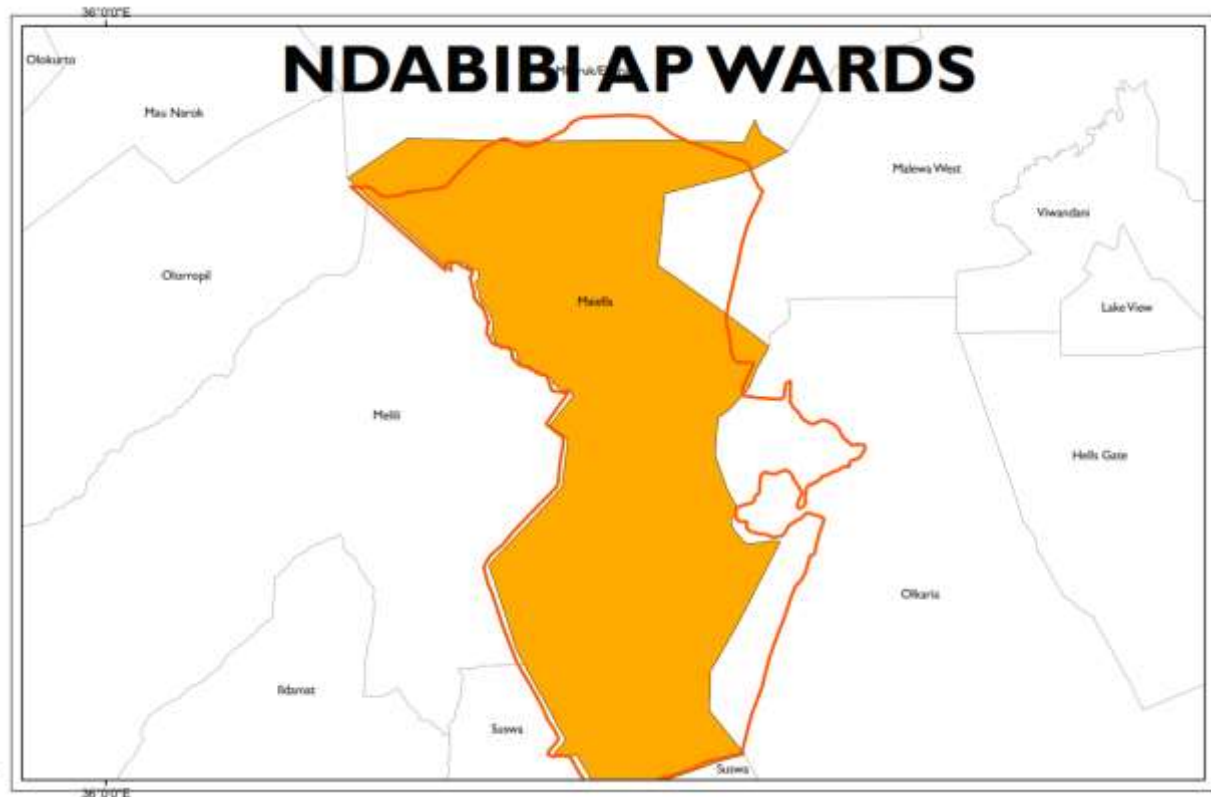
The study was carried out in the highlighted region of the shaded wards.



Map 2: Ngoswet ADP

Source: CRIFSUP, 2017.

The study was carried out in the highlighted area of the two wards (Soy North and Soy South) in the ADP.



Map 3: Ndabibi ADP

Source: CRIFSUP, 2017.

The study was carried out in the highlighted area.

Sampling

A sample of 384 households was drawn from the three ADPs using the Cochran's formula. Cluster, Multi-stage and simple random sampling methods were then used to identify the specific households to participate in the data collection exercise.

Data Collection Instruments

A variety of data collection methods were used to collect data from the three ADPs of Marigat, Ndabibi and Ngoswet in Baringo, Nakuru and Elgeyo Marakwet counties respectively. A mixed methods approach was employed to collect data from research participants. Primary and secondary data collection methods were utilized to obtain both qualitative and quantitative data.

Primary data was collected from households using questionnaires, Focused Group Discussions (FGDs), Key Informant Interviews (KIIs) and observation. A total of fifteen (15) FGDs were conducted in the three ADPs (5 each). The selection of participants of the FGDs took into consideration issues of gender, geographical region representation, occupation and age. A total of twenty-nine (29) Key Informants were selected and interviewed on varying issues related to the study. These included World Vision staff, representatives of government line ministries Environment & Forestry, Agriculture & Livestock Development and Ministry of East African Community, the ASALs & Regional Development, CBO representatives as well as local

leaders. Transect walks and photography were employed to collect data on environmental resource distribution, landscape features and land-use practices.

Primary data from household questionnaires was analyzed using SPSS and Microsoft Excel and presented using descriptive statistics. Data obtained from FGD and Key informants was thematically analyzed and presented descriptively in categories and discussions.

Secondary data was collected from World Vision's CRIFSUP baseline reports from the three ADPs of Marigat, Ndabibi and Ngoswet, annual and semi-annual reports, monitoring and evaluation reports, FMNR assessment reports, maps as well as project fact sheets. Data collected was used to validate and enhance primary data.

RESULTS AND DISCUSSIONS

Introduction

The goal of the CRIFSUP project implemented in 2018 was to improve food security and livelihoods through FMNR and other evergreen agricultural practices. This was to be realized in a period of four years. Three major indicators were identified for use in measuring change after the implementation period; these were –food security; PPI levels of poverty; and household income. Presentation of data in this section is categorized into four sub-sections viz; food security, poverty, income and livelihoods. Data presented covers two phases; the period before implementation of FMNR and the period post implementation of FMNR.

Food Security

In total, a notable proportion, that is 41.3%, of households in the three ADPs, sell and repurchase cereals (42.9% of male-headed households and 34.9% of female headed households), which suggests household food insecurity, as staples repurchased are generally more expensive than the price at which the household sold its harvest. The average household diet diversity score (HDDS) was at 4.54 for the three ADPs combined and showed that there is least diversity in Marigat at 4.19, followed by Ng'oswet at 4.59 and Ndabibi at 4.84. The severe household hunger score (HHS) showed that severe hunger was experienced by 7% of the households in the three ADPs – with 17% of the households in Marigat, 4% of the households in Ng'oswet and 4% of the households in Ndabibi. The coping strategy index for Ndabibi was 27.4, while that for Ng'oswet was 30.3 and for Marigat stood at 73.8. The coping strategy index for the three ADPs combined was 43.8. (World Vision, 2021). The attainment of Sustainable Development Goal 1 (ending poverty) and 2 (zero hunger) in the three ADPs over the study period is significant though more effort is required to progressively end poverty and hunger.

Household Poverty

The poverty probability index (PPI) computation showed that in all the three ADPs combined, 45.3% (46.1% for male headed households and 41.9% for female headed households) of the households were likely to be below the poverty line of USD1.90 per day. In Ndabibi, 50.7% (51.0% for male headed households and 49.7% for female headed households), in Ng'oswet 43.9% of households (47.0% for male headed households and 38.5% for female headed households), and in Marigat 39.8% (41.3% for male headed households and 36.0% for female headed households) of the households were similarly likely to be below the poverty line. In households in which there were one or more persons with disability, the PPI showed that 36.8% of such households were likely to be below the poverty line in the three ADPs combined. In

each of the ADPs, the PPI for such households was 33.3% in Ng’oswet, 33.4% in Marigat and 46.7% in Ndabibi.

The final evaluation found poverty levels more than halved (during baseline stood at 45.3% while during final evaluation it reduced to 22.7%) (Progress Out of Poverty Index), and 60% of household survey respondents agreed there was less poverty in their village than before (World Vision Baseline Study Report, 2018). Multiple food security indicators together confirmed positive impact over the last four years. Parents were better able to meet their children’s needs (77.4%, compared to 71.3% at baseline). Farmers were on average managing 1.6 acres of land each through FMNR and other evergreen agricultural practices; the total land managed currently stands at 6,938 acres compared to 500 acres at baseline. This implies there has been significant adoption of FMNR in the three ADPs.

Access to renewable forestry products, including firewood as a fuel source, has not markedly changed over the WV project’s timeframe. However, associated industries such as honey, fruit and processing are stabilizing, supported by strong uptake of financial services through Savings for Transformation model. The evaluation concluded that sustainability of results through community ownership has been a focus, while capacity of local and national partners to continue aligned environmentally friendly agriculture, including through policy, has been strengthened. After FMNR project implementation, a general decline in poverty and food insecurity was recorded. Results from a study in northeastern Ghana by Kandel et al (2022) found that FMNR contributed to improved access to fruits, medicinal herbs and wood fuel. Further, these results are consistent with those of Chombaet al (2020) who found that the practice of FMNR contribute to availability of wild leafy vegetables, fodder, nuts, fruits, honey and edible seeds. Table 4 provides information on household poverty and food security in the study area.

Multiple food security indicators together confirmed positive impact of the project over the last four years. While 7% of families experienced severe hunger (Household Hunger Scale) at baseline, no household was reported having experienced severe hunger at end line, while 97.3% reported no hunger (baseline 70%). These results are similar to those reported by Vanjaet al (2019) from a study in Ghana which showed that FMNR farmers were more food secure relative to non-FMNR farmers since they could harvest a wide range of on-farm forest products (fruits, nuts and pods) during the dry season when they otherwise would face food shortages.

The hunger scale at the end of the project compared to the baseline is presented in figure 1.

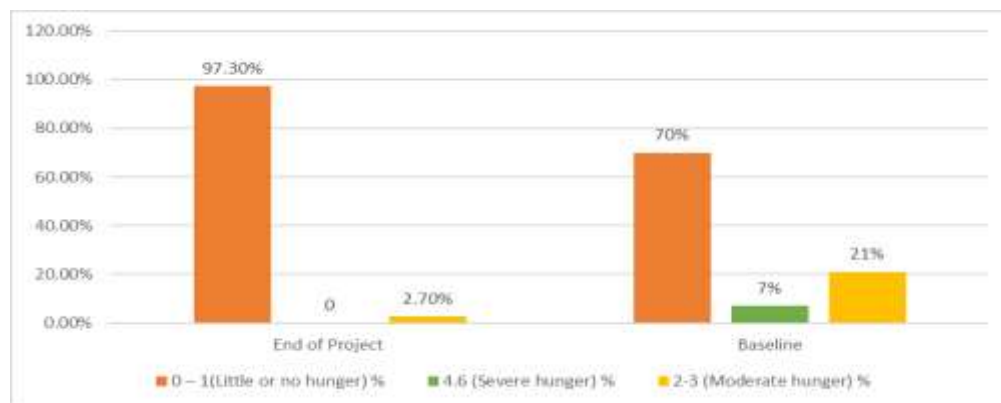


Figure 1: Hunger scale at the End of the Project Compared with Baseline

The number of households reporting sufficient food year round increased from 42.6% to 73.6%. Most of the households produce enough to feed their members through storage of food. Some households depend fully on rainfall while other do practice irrigation. 52.7% of the farmers reported that they observe that (dryland) cereal crop production is improving. As a result of this 60% of the farmers trained preserved their cereal crops to minimize post-harvest losses and sale of surplus. The survey results indicate a positive relationship between FMNR training and cereal production. (Chi-square = 0.037) (Cramer's V = .037). The respondents who had been trained were more likely to record that the cereal production had increased over the past five years.

Table 1: Comparative Household Poverty and Food Security Indicators

Poverty and Food Security Indicators before and after project implementation		
SDG1: No poverty	2018 Baseline	2021 Evaluation
% parents /caregivers able to provide well for their children	71.3%	77.4%
% households reporting reduced poverty in their location	n/a	59.4%
% households living on less than US\$1.90 (Kshs. 192) per day (Progress out of Poverty Index, or PPI)	45.3%	22.7%
SDG2: Zero hunger	2018 Baseline	2021 Evaluation
% of households with year-round access to sufficient food for the family's needs	42.6%	73.6%
% of households with severe hunger (Household Hunger Scale, or HHS)	7%	0%
% households with little or no hunger (Household Hunger Scale, or HHS)	70%	97.3%

Household Income

In the three ADPs combined the average annual income per household was KES65,166 and KES40,598 from farming and agroforestry respectively and KES24,568 from other sources. The total average income per household in Ng'oswet was KES61,302 and KES41,296 from farming and agroforestry and KES20,006 from other sources. In Marigat, the total average income per household was KES65,629 and KES41,280 from farming activities and agroforestry and KES24,349 from other sources. In Ndabibi, the total average income per household was KES54,129 and KES30,914 from farming and agroforestry and KES23,215 from other sources. Over the 5-year period preceding the baseline (before 2017), 62.3% of respondents (53.9% in Ng'oswet, 67.3% in Marigat and 65.5% in Ndabibi) reported a fall in income levels. Whereas World Vision's FMNR intervention strategy to enhance household income has positively contributed to improved household income, there is need for more concerted efforts by households, communities and development agencies to collectively scale up the strategy to realize meaningful impact on the lives of families. Consequently, this will contribute to the attainment of SDG 1 and 2.

Male-headed households at 27.3% were more likely to report a rise in income than female-headed households at 15.8%. Indeed, the rise in household income is strongly linked to the sex of the head of the household since the Pearson chi-square measure is at 12.86, at two degrees of freedom and 95% confidence level, which was far higher than the threshold value of 7.38.

In the three ADPs, the main income source is farming in the form of sale of cereals and livestock. The prevalent perception was that crop production had improved in the last five years. Increased productivity of livestock was not as evident to respondents, but higher than at baseline (24.5%, compared to 16.9% in 2018). The proportion of respondents reporting they could not produce or store sufficient staples for year-round household needs was higher than at baseline, with 75.9% repurchasing what they had originally grown and sold. However, severe hunger had disappeared from surveyed communities and the number of households with little or no hunger had reached 97.3%, indicating that the repurchasing of food was possible and affordable.

Results from the survey indicate that income from crops in particular is not year round. During the dry seasons, respondents seek casual labour, with youth or landless households particularly dependent on this strategy. The project focus on creating sustainable year-round agro-forestry opportunities demonstrated some success, but full market engagement was hindered by inability of private sector to build partnerships over the final COVID19-impacted year. Only 7.6% of respondents reported adopting alternative livelihood options, and therefore the majority of residents are dependent on seasonal income flux. Table 5 provides more information on this.

Table 2: Comparative Household Income

Percentage of Household Income/Item	2018 Baseline	2021 Evaluation
% of household reporting income from sustainable tree products (honey, firewood, fruits, medicine, other)	30.4	35.6
Reported income earned through sustainable tree products (last 12 months, Kshs)	9,617	15,595
% of House Holds HHs reporting increased income	25.2	52.5
% of households who observe that (dryland) cereal crop production is improving	17.2	52.7
% of HHs repurchasing staple crops in the previous 12 months	41.3	75.9
# of months of food insecurity	3.5	3.3

Further, the evaluation found farm-related income increased from average KES 32,574 to 54,714 (per annum) between baseline and end term evaluations. These results favourably compare with those found by Kuyahet al (2020) in a study of four West African countries which found that FMNR had contributed to improved household income from enhanced crop production and sale of firewood. Another study in Maradi, Niger found that adopters of farmer-managed natural regeneration (FMNR) had around 30% more income than corresponding non-adopters (Haglund et al, 2011). In another study in the same region, Rinaudo (2012) found an increase in household income by at least 140 USD per year. In West Pokot, Kenya, income from agroforestry products ranked fourth in total household income (Wairoret al, 2016). In the East African region, households practicing FMNR were found to be more likely to have increased income compared to the non-practicing households (World Vision, 2019).

Livelihood Sources

Crop Production

In the study area, crop production is a major livelihood source among the residents in the three ADPs. Crops produced vary with county and ADP. The most popular crops however include maize, millet, vegetables e.g. cabbage, kales, onions, tomatoes; fruits such as mangoes, pawpaws, oranges and legumes to include beans, green grams. In terms of production, over the 5-year period that preceded the baseline, a majority of households - 84.8% in Ndabibi, 80.7% in Marigat and 59% in Ng'oswet - were of the view that cereal crop production had decreased (Baseline survey report, 2018).

Crop productivity in Ng'oswet during the baseline period was reported to be 8.5 bags of maize per acre equivalent to 1,889kg/ha (compared to optimal 16-24 bags per acre equivalent to 3,556-5,333kg/ha), 7.3 bags of beans per acre and 4.4 bags of millet per acre. Crop productivity in Marigat was 9.5 bags of maize per acre equivalent to 2,111kg/ha (compared to optimal 16-24 bags per acre equivalent to 3,556-5,333kg/ha), 5.0 bags of beans per acre, 13.9 bags of millet per acre and 3.4 bags of sorghum per acre. In Ndabibi, crop productivity was 4.9 bags of maize per acre equivalent to 1,099 kg/ha (compared to optimal 32 bags per acre equivalent to 7,111kg/ha) and 2.7 bags of beans per acre. This implies the huge crop productivity potential in the three regions (see Table 3).

Table 3: Crop Productivity per ADP

Name of ADP	Crop type	Production per acre (Bags)	Optimal Production per care (Bags)
Ng'oswet	Maize	8.5	16-24
	Beans	7.3	-
	Millet	4.4	-
Marigat	Maize	9.5	16-24
	Beans	5.0	-
	Millet	13.9	-
	Sorghum	3.4	-
Ndabibi	Maize	4.9	32
	Beans	2.7	-

Livestock Production

Animal production is the second livelihood source in the three ADPs. Livestock is reared to serve a number of purposes to include production of milk, meat, hides and skins, animal labour and as a source of income. Domestic animals kept comprise of cows, goats, sheep, donkeys and chicken. In the three ADPs, the average number of livestock per household is 3.17 beef cattle, 1.2 dairy cattle, 1 donkey, 6.29 sheep, 8.46 goats and 1 oxen for ploughing. Milk production over the five years preceding the baseline survey was reported to have reduced, by 53.1% of the households in the three ADPs - 42.7% of households in Ng'oswet, 54.0% households in Ndabibi and 62.6% in Marigat.

Other Livelihood Sources

Whereas crop and livestock production were noted as the major livelihood sources, other livelihood sources which support household food security and income include apiculture, agro-

forestry, pastoralism, small business enterprises operations, agent banking and transport. Dixon et al (2020) observe that most of Africa's poor are rural and most rely largely on crops, livestock, trees and fish – along with off-farm income – for livelihoods.

Emerging Livelihoods: Post Project Period

While most income is still derived from cereal agriculture, farmers reported other cash crops, charcoal, livestock and animal products, and tree products as income sources. Small business such as hairdressers, motorbike transport and shops remained important sources of income, especially for youth. Given this finding, the improved income from agriculture and tree products during a time of hardship is significant evidence of the value of this project in context. Members of Savings for Transformation (S4T) groups reported improved access to individual loans to expand business and farming activities had provided financial resilience and diversified income during COVID19. The focus of rural transformation from FAO's (2019) perspective requires a new set of coherent policies that spans across many sectors from agriculture, to trade, natural resources, education, infrastructure, food security and nutrition. A number of these aspects are within FMNR's framework.

By the end of the project, 42 groups were active with 700 members (69% female; 2% (15) with a disability); they reported pooled savings of KES: 2,883,450 (USD 28,834.50). The project also provided a direct income generating activity in 2019-20 to mitigate initial setbacks of COVID19 by supporting construction of 10 environment-themed Community Learning Centers. These centers were then used to expand nature-based Income Generating Activities (IGA) such as beekeeping, mango farming and processing, poultry, pasture seed production and coffee farming to increase farmers' drive to regenerate more trees as well as to increase their HH income and project sustainability. Binamet al (2017) in their study of select Sahelian countries concluded that FMNR in itself serves as an alternative livelihood source as farmers could harvest mature trees and sell them during times of crises to supplement household income and meet other needs. These create long term revenues streams even after project term.

CONCLUSION AND RECOMMENDATION

Conclusion

This paper sought to analyze the effect of farmer managed natural regeneration on household income, food security and livelihoods in the central rift region, Kenya. From the study findings, the following conclusions can be drawn.

The main source of income for the residents of the study area is farming – both crop and livestock. Small scale business and casual labour are alternative income sources. The implementation of farmer managed natural regeneration in the central rift region has significantly contributed to improved household income and halved household poverty after the four-year implementation period in the three ADPs of Ndabibi, Marigat and Ngoswet. Parents in the study area were reported to have a higher purchasing power and capable of adequately providing for the needs of their children.

Food security is central to the health of a population to engage in meaningful productive work. The semi-arid nature of the study area does not guarantee food security due to seasonality of rainfall. Food security situation among FMNR practicing farmers in the three ADPs of Ngoswet, Ndabibi and Marigat has improved. This is evidenced by the production of cereals and fruits as well as livestock to satisfy domestic consumption and have some surplus for sale.

The introduction of the practice of FMNR in the central rift region gave rise to enhancement of alternative livelihood sources key among them being apiculture, agro-forestry, small enterprise development, agent banking and fish-farming to boost existing conventional livelihood sources. These emerging livelihood sources were commonly practiced in the three ADPs of Marigat, Ndabibi and Ngoswet.

Implementation of FMNR in the study area is a stakeholder endeavour which involves the participation of communities, World Vision and government departments. The rate of adoption of FMNR depends on the level of awareness of the farmers and outreach level by concerned agencies especially the lead organization – World Vision.

Recommendations

The adoption of FMNR in the three ADPs has positively contributed to increased household income, reduced food insecurity and enhanced livelihood sources. A scale up of this initiative is recommended in other arid areas of Kenya for residents to realize the benefits of the practice. This calls for establishment and or strengthening of community networks and involvement of partner organizations to spearhead awareness campaigns on programme benefits for the adoption of this practice.

Exploration of other potential benefits of FMNR other than being a provider of alternative food and direct income sources (fruits, honey and fodder) is recommended. FMNR sites set aside by farmers can be considered for academic research/applied research purposes in areas such as insects, medicinal herbs, birds, micro-organisms, soil health among others. The researchers to benefit from the FMNR practice can be drawn from areas such as forestry, apiculture, dryland specialists, pharmacy, soil scientists, botanists etc. To realize this, farmers can be capacity built on marketing skills and pricing of access fees to the FMNR sites. Money earned from researchers will build FMNR farmers' savings and help in further investments.

A scale up of the land area under FMNR is recommended to assist farmers in arid and semi-arid areas especially during the dry season to provide pasture and fodder for animals. This will contribute to animal resilience to drought conditions thereby improving milk and meat production and ultimately increase household food security and income.

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