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Livelihood strategies policy intensification and diversification farming system in Gambella region agricultural investment of agro pastoral and pastoral areas of Ethiopia

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Abstract

Ethiopian government uses agricultural investment as one of the most important and effective strategies for economic growth, food security, and poverty reduction in the country. Since the mid-2000s, government has awarded millions of hectares of fertile land to foreign companies. This study explores the impact of large-scale.

Agriculture investment and its consequences to local livelihoods in Gambella Region, Ethiopia. Gambella people survival and their identity are strongly tied to the land and the rivers that run through it. However, currently, foreign and local investors grab the farm area on an industrial scale and that deprives their livelihoods and increases forced displacement and “villagization” as a result that smallholder farmers are displaced, pastoralists lose the grazing land, and local people lose incomes and livelihoods. Lastly, in the region, due to land corruption, lack of good governance and transparency, the natural resources are depleted and societies become food insecure.

The purpose of this study was to identify the livelihood strategies and diversification status in the western tip of Ethiopia, Lare woreda. A mixed research method of sequential transformative strategy was used. Surveys and key informant interviews (KII) were sources of data. A survey of 133 sample households and four KIIs were employed. Diversification status was measured by Simpson diversity index (SDI) using SPSS 20. The result showed that 33.8, 40.6 and 25.6% of the households were poor, less poor and better-off, respectively. More than half of the households (53.4%) pursued three activities as a means of income and food. Crop and animal production were practiced by almost all of the sample households. The distribution of households with livelihood categories showed on-farm (10.5%), on-farm and non-farm (15.8%), on-farm and off-farm (12%) and on-farm, non-farm and off-farm (61.7%). The Simpson diversity index revealed that 15.04, 30.07 and 54.89% of the households were less, medium and high diversifiers, respectively. The mean diversification score of the households was 0.5775, and the diversification status was a lot better as compared to other study results within and outside Ethiopia.

Keywords: Livelihood strategies, grazing land, diversification villgization

Introduction

Livelihood strategies are the combination of activities that people choose to undertake in order to achieve their livelihood goals (UNCDF 2005) [19]. A livelihood comprises the capabilities, which comprised of assets (including both material and social resources) and activities used by a household for means of living (ACF International 2010) [3].

The livelihood strategy would address both current and future causes of food insecurity through increasing consumption and investment while simultaneously protecting assets, the environment and vulnerability (Penney 2008) [16]. Long-term strategies must involve diversification away from rainfall-dependent livelihoods (Devereux 2000) [8].

Ethiopian government uses agricultural investment as one of the most important and effective strategies for economic growth, food security, and poverty reduction in the country. Since the mid-2000s, government has awarded millions of hectares of fertile land to foreign companies. This study explores the impact of large-scale agriculture investment and its consequences to local livelihoods in Gambella Region, Ethiopia. Gambella people's survival and their identity are strongly tied to the land and the rivers that run through it. However, currently, foreign and local investors grab the farm area on an industrial scale and that deprives their livelihoods and increases food insecurity.

Moreover, large land acquisition has been tremendous environmental devastation in region such as deforestation, biodiversity depletion, and wetlands drained. Meanwhile, socially, people are largely dependent on international food aid and financial assistance. On the other hand, Large Scale Land Acquisitions (LSLA) lead to forced displacement and “villagization” as a result that smallholder farmers are displaced, pastoralists lose the grazing land, and local people lose incomes and livelihoods. Lastly, in the region, due to land corruption, lack of good governance and transparency, the natural resources are depleted and societies become food insecure.

Therefore, Ethiopian government’s strategies are on the verge of falling unless integrated approach is not implemented.

The most common definition of the global land grab refers to large scale land acquisitions (LSLA) by foreign investors either through purchase or lease for agricultural production (Cotula, Vermeulen, & Keeley, 2009). In Africa, LSLA for the commercial agriculture are the biggest issues. Over the last few years, local and foreign investors have acquired large areas of land in sub-Saharan countries. In the most case, these LSLA are involving countries with serious hunger (food insecurity) problems and the majority of crops grown by foreign investors in developing countries are mainly for export rather than feeding local people (Geary, 2012). Around 70% of people in Africa and roughly three-fourths of poor people of the continents live in rural areas. These poor rural people depend mainly on agriculture, and increasingly are unable to meet their basic food needs as population pressure on land grows. Recently, resources such as land and water become degraded and agricultural productivity also stagnates (FAO, IFAD and WFP, 2015) [24].

In the last few years, international investment in agricultural land has increased globally. In recent times, Ethiopian government uses agricultural investment as one of the most important and effective strategies for economic growth, food security, and poverty reduction in country. Since 1990s, government formulated a long-term economic development strategy called Agriculture Development Led Industrialization (ADLI) which is the government’s overarching policy response to Ethiopia’s food security and agricultural productivity challenge. The strategy focuses primarily on expansion of large-scale commercial farms and improved productivity in smallholdings (Ethiopian Investment Commission). The Ethiopian government also promotes large-scale agricultural investment as a strategy to improve food security at the national level, through foreign exchange earnings generated by farm outputs; by increased production of crops in the country; and by improved incomes through jobs created on farms (Keeley, Seide, Eid, & Kidewa, 2014). A few years ago Ethiopian government identified Gambella Region as one of the regions in Ethiopia which is suitable for agricultural investments and classified most parts of the area as under-utilized. Currently, region has been known for its huge potential for agricultural productions and it possesses enormous arable land suitable to both small-scale and large-scale commercial farming in Ethiopia.

On the other hand, Ethiopian government’s strategies and policy of “villagization” program have forcibly displacing hundreds of thousands of indigenous people in order to free up their land so the transnational agro-industry can move in

and grow foodstuffs for export. These rushes to land, water, and other essential natural resources in the region particularly have negative effects on indigenous and local people’s livelihoods and increasing food insecurity. Currently, indigenous and local people are losing their fertile land and their ability to produce their own food, and thus, they become food insecure and largely dependent on international food aid and financial assistance. From past till present, Gambella people’s survival and their identity are strongly tied to the land and the rivers that run through it. For instance, recession of riverside agriculture is common and widely practiced by indigenous people along the Baro, Gilo, and Akobo rivers, particularly cereal crops such as maize, millet, and sorghum crops are cultivated. Yet, the region is generally not cereal self-sufficient; alternative income sources such as fishing are important sources of food. Meanwhile, LSLA also have huge and adverse environmental impacts on the region, particularly forest, wetland, and biodiversity are declining, and both land and water resources are degraded.

Continent”. It underlines that the multinational corporations take over African food systems and farming lands.

According to the report, multinational companies have signed agreements with a number of African countries to establish agriculture investment under the aspect of fighting poverty and food insecurity (Mwesigire, 2014).

This report also provides evidence that multinational corporations come at the expense of small-scale African food producers and instead of providing a solution to hunger, multinational corporations exacerbate hunger and poverty through increased land-grabbing, insecure and poorly paid jobs, the privatization of seed, and a focus on producing for export markets rather than feeding local populations (National Institute for African Studies [NIAS], 2016). According to Global Development (2010), research findings have indicated that a million Chinese farmers have joined the large-scale farm investment in Africa to satisfy food security of their people, and moreover, world’s richest countries also involve in buying or leasing land in Africa to produce bio-fuel Agriculture investments can be “win-win” rather than “neo-colonialism” in sub-Sahara Africa countries only when agricultural investments are generating a wide range of benefits such as increasing productivity and food security, employment creation, poverty reduction, technology transfer, and access to capital and markets (Liu, 2014). In general, macro-level benefits may be increased by agriculture investment (GDP growth, greater government revenues), and create opportunities for raising local living standards and therefore agriculture investments play an important role in catalyzing economic development in rural areas in Africa (Cotula, 2011).

However, the socio-environmental impacts of agricultural investment are not well understood or not well recorded. Agricultural investments need to integrate socio-environmental and economic aspects and that can support sustainable development in a country. Hence, land, water, biodiversity, and other environmental resources should be considered whenever large-scale agricultural land is allocated and that can help ensure the long-term sustainability of ecosystem services and livelihoods of rural people. Figure 2 shows the conceptual framework which shows the positive and the negative impacts of LSLA.

Methods of Data Collection

This paper relies on the data set from the Gambella Region of Ethiopia which is located in the south-western part of Ethiopia between the geographical coordinates 6° 28' 38" to 8° 34' north latitude and 33° to 35° 11' 11" east longitude as indicated in Figure 3. The region is bounded to West and Northwest by the Republic of South Sudan (Behailu *et al.*, 2011). Gambella Region is one of the nine ethnic divisions or regions of Ethiopia. It is composed of two administrative zones and eight small administrative units. The area of the region is 29,783 square kilometers with estimated population of over 307,096 inhabitants [CSA (Central Statistical Agency), 2007] ^[24]. Within the region, Gambella National Park covers approximately 5,061 square kilometers or 19.6% of the region's territory. The topography of the region is divided into two broad classes, which are the lower piedmonts between 500 to 1,900 masl (meters above sea level) and the flood plains of below 500 m contours. Baro, Gilo, Akobo, and Alwero are the main rivers crossing the Gambella Region.

The main motivation of the research is to understand in depth social-economic and environmental impacts of LSLA in Gambella Region, moreover, to understand the intense interaction and conflict of various stakeholders (governments, foreign and local investors, small-scale farm holder, and local and indigenous people) that are directly related or affected by LSLA. Therefore, from the fieldwork, the primary data are generated through interview, direct observation, documentary analysis, and a focus group discussion. In addition to the primary data, the secondary data are acquired through the European environmental satellite Sentinel-2, government reports, and published documents.

Various reports underline that Ethiopian government allotted large scale of land to local and foreign investors within the old boundary of Gambella National Park. Figure 4 shows a GPS recording which is undertaken at various location of the study area in order to confirm if any agricultural activities are undertaken within the park. At each sample, the following information was collected or recorded:

1. Type of land use: e.g. cotton, sesame, and rice;
2. Intensification level: e.g. fertilizer input, technological input (tractor);
3. After 1991, Ethiopian government has been developing a new strategy to achieve economic growth in the country. The strategy called ADLI that sees agriculture as the engine of growth.

ADLI's main objectives are to: Improve agricultural extension services, promote better use of land and water resources, enhance access to financial services, improve access to domestic and export markets, and provide rural infrastructure (MOFEC & MOA, 2010) ^[14]. The Ethiopian government's economic development strategy ADLI also has distinctive features that include: commercialization of smallholder agriculture through product diversification, a shift to higher-valued crops, and promotion of niche of high-value export crops. As prior strategic investment, Ethiopian government has identified several higher-valued crops such as organic coffee, cotton, tobacco, sugar cane, tea, spices, and oil seeds (peanuts and sesame). According to Ethiopian Investment Commission (EIA), government strongly restricted local and foreign investors neither to cultivate nor to sale any kind of cereal crops to local market and this is

mainly due to the fact that 85% of Ethiopian farmers are subsistence farmers and their incomes are highly depending on producing and selling cereal crops to local market. However, in a few special cases, EIA gives permission to the investors to cultivate cereal crops. For instance, Saudi Star PLC produces new hybrid rice called New Rice for Africa (NERICA) and currently also Saudi Star is producing high-quality standard rice known as Basmati rice and it exports into the Middle East countries especially to Saudi Arabia. In recent times, the main objective of Ministry of Agriculture and Natural Resources was to increase the agro-industrial sector of the country rather than empowering small-scale farmer.

National park and forests are the sources of food for the Gambella people (Nuer and Anuak people)

Recently, however, both regional and federal governments allocated large areas of land to foreign and local investors within the national park. Currently, large areas of virgin land, formerly the Gambella National Park, have been transformed into plantations for rice, sugar cane, and palm oil by foreign-owned agri-business ventures and companies. Thus, a great extent of land use change is observed in the landscapes of Gambella Region. For instance, Saudi Star rice farm which owned 10,000 hectares has largely cleared forest and savanna that were commonly understood to be a part of Gambella National Park. According to the Ethiopian Wildlife Conservation Authority (EWCA), in 2008, around 438,000 hectares of land have been awarded to investors in the vicinity of the Gambella National Park and all lands have been allotted without Environmental Impact Assessments (Oakland Institute, 2011). As the researchers observed also from the fieldwork and also Figure 7 shows, large-scale farm companies are located within the Gambella National Park wetlands with abundant fish populations and bird life presently being altered for rice production while extensive forest cover in nearby areas has been completely cleared without consultation of communities. According to International Union for the Conservation of Nature and Natural Resources (IUCN), Gambella National Park is categorized as protected area. However, the park is currently invaded by large-scale farm companies. Since 2016, the Ethiopian government is developing new Gambella National Park boundary and relocates the boundary from central part to western and southwest. Protecting and promoting livelihoods requires a more holistic approach that addresses the causes of vulnerability to food insecurity as well as the consequences. In doing so, it needs to pay attention to what people are doing for themselves (World Food Program 2010).

The objectives of this study were to identify the livelihood strategies and to estimate the level of the diversification among households in Lare woreda, a western tip of Ethiopia.

Research Study area

The grasslands of Gambella in western Ethiopia, a weary Jakob Pouch sits on a jerry can, resting his chest against a wooden staff. The 45-year-old evangelical preacher from the Nuer community has just made the three-hour walk from the banks of the Baro river, where he tends to his large family's small plot of corn. His daughters are preparing cabbage and cobs to be cooked on an open fire.

In the opposite direction, across the asphalt road that leads to South Sudan, lies the farm of BHO Bioproducts, an Anglo-Indian company growing rice and cotton on the 27,000 hectares (67,000 acres) it has leased.

Pouch says the company doesn't care about the people of his village, Wath-Gach. Grazing land has been lost, and BHO has built a wooden cage around a water pump to prevent locals using it. "From the beginning we did not have a good relationship," he says. "It was given without consultation. There has been lots of negative impact." The company didn't respond to a request for comment.

Ethiopian Constitution asserts state ownership of land. There are no private property rights in land – it is the common property of the people of Ethiopia; however, the state may allocate small plots of land to farmers. Since the 1990s, the government has formulated a long-term economic development strategy called Agriculture Development Led Industrialization (ADLI), which is its overarching policy response to Ethiopia's food security and agricultural productivity challenge. The strategy focuses primarily on the expansion of large-scale commercial farms and improved productivity in smallholdings. The Ethiopian government identified Gambella region as one of the regions in Ethiopia suitable for agricultural investments, and classified most parts of the area as under-utilized, having a huge potential for agriculture production. However, the unintegrated plan on large-scale land acquisition has caused tremendous environmental devastation in the region, including deforestation, biodiversity depletion, and the draining of wetlands. There are several issues that need to be addressed in depth for a future, sustainable development. This thesis, however, will focus mainly on three aspects: (1) examining the rate, extent and distribution of various land-use land-cover changes (LULCC) in Gambella Regional State and looking at the expansion of farmland and different farming intensities in the region; (2) estimating the magnitude and extent of the intensification potential of the key Gambella cereal crops (maize and sorghum) and seeking to identify potential cropland expansion areas in the region; and (3) investigating the impacts of future climate change on potential crop yields, with maize as an exemplar, under climate change scenarios in Gambella, Ethiopia. 1) In the last three decades (1987–2017), the rate, extent and distribution of various LULCC in Gambella has depended on three main factors: resettlement, population growth and increasing agricultural land pressure. All three factors contribute to LULCC in the region. An LULCC analysis was conducted, based on Landsat 5 and Sentinel 2A satellite images and fieldwork. The results show that farmland decreased by 26km² from 1987–2000; however, during the last two decades, agricultural land area increased by 599km², mainly at the cost of tropical grasslands and forests. The results also show that tropical grasslands declined by 17.76% from 1987–2017. Gambella National Park, which is the nation's largest national park and ecosystem, was also affected by cropland expansion. 2) Over the past few decades, population growth has aggravated rapid agricultural land expansion and intensification in the region. As a result, the Ethiopian government has used agricultural intensification and cropland expansion as the key policies to increase food production in Ethiopia. Although Gambella is one of the regions in Ethiopia that is highly suitable for agriculture, the local people still face food shortages. Thus, to understand

the potential food production of the region, the biophysical process-based model PROMET (Process of Radiation Mass and Energy Transfer) was run for the Gambella region on both the actual and all potentially suitable cropland for six selected scenarios (different degrees of intensification, ranging from low-input rainfed to high-input irrigated agriculture and degrees of expansion, considering the best 30% or 50% of land to be utilized for expansion) for the period 1997–2017, with a spatial raster grid of 30 arc seconds (approx. 940 × 940m) resolution, to provide information on potential crop yields. Land-use scenarios of agricultural intensification and expansion results reveal that Gambella could serve as a bread basket for the entire country, which could improve national food production. The potential calorie production in the potential area of the region by far exceeds the current and possible future caloric requirements of Gambella's population. For instance, for the top 50% expansion scenario, calorie production increased by +428% for the low input scenario and by +1,092% for the high-input scenario, compared to the reference calorie crop production of the region. By assuming a daily diet of 2,200 kcal/cap/day, Gambella region's calorie production in high-input scenarios could nourish up to 21 million people, thus improving national food production. 3) Unintegrated large-scale agricultural investment, inappropriate cropland expansion, poor intensification and changing climate conditions have caused tremendous impacts on agricultural production. In the region, temperature increase, changing soil water availability and atmospheric CO₂ concentration have different effects on the simulated yield potential, and the results demonstrate that the dominance of heat response under future climate conditions is contributing to 85% of changes in total yields. For the Gambella region, on today's cropland and to the best (in terms of highest potential yields) 50% expansion area, under rainfed and irrigated conditions, climate change impacts on yields until 2100 for Representative Concentration Pathways (RCPs) 2.6, 4.5, and 8.5 from a climate model ensemble show that rainfed yields will decrease by 15% and 14% respectively for RCPs 2.6 and 4.5, and that yields will decrease by up to 32% under RCP 8.5. Irrigated maize yield decreases by 4.3%, 23.0% and 44.5% under RCPs 2.6, 4.5 and 8.5, respectively, for same period. While higher temperature determines the phenological progress of crops and decreases the growing period of maize by up to 23 days under rainfed agriculture, temperature stress also reduces the rate of photosynthesis. We show that temperature stress is mainly responsible for yield reduction under future climate conditions in the Gambella region. Therefore, new varieties with higher growing degree days are primarily required for the region in order to adapt to future climate conditions. To sum up, the thesis shows the intricacies between LULCC, potential yield production and future impact of climate change on the potential food production in the region. Gambella region is still far away from a terminal stage of human interference. This opens up the chances to develop and implement policies to ensure the sustainable future agriculture development of the region.

Ethiopia's government has granted in Gambella, including one plot leased to the Indian company Karuturi Global of 100,000 hectares. Commercial farmers are expected to bring knowhow, technology and jobs to one of the country's poorest and most remote regions. By converting uncultivated bush into productive farms, officials believed

food security and export revenues would improve in a country dominated by subsistence agriculture.

But despite those worthy ambitions, progress has been hampered by Gambella's logistical difficulties, and a failure to ensure local communities benefit.

The village of Ilea is home to people from Gambella's other main indigenous group, the Anuak. It's also been the headquarters of Karuturi's operation for the past five years. In the village, a group of men shelter from the afternoon heat, passing round a tobacco waterpipe. Behind them, women draw water from a well built by the government. The contributes nearly half of the GDP, 85 percent of exports and 85 percent of total employment (Tamrat, 2010). This sector is dominated by small holder farmers who earn their livelihood primarily from subsistence rain-fed agriculture with only limited use of modern inputs. Agricultural sector in Ethiopia is suffering from various setbacks such as fragile soil and environmental degradation, small and declining size of holdings, fragmentation of farm plots, poor farm management, population pressure, poor infrastructures networks and Gambella is one of the nine regional states that constitute the Federal Democratic Republic of Ethiopia. It is located on the western tip of the country and has common borders with Sudan in the west, south and north; the regional state of the Southern Nations, Nationalities, and Peoples (SNNP) in the south and east and the regional state of Oromiya in the north and east. Gambella is lying between the Baro and Akobo rivers. It has an area of 25,802.01 km². In 2007, the regional state had a total population of 306,916. Its capital city is Gambella town (CSA 2008) [6].

Nuer is one of the three zones of Gambella region. This zone is bordered by South Sudan on the south, west and north; by Majeneg Zone on the east and by Anuak Zone on the south to east.

This study was conducted in Lare woreda of Nuer Zone. It is found 89 km far from the regional capital Gambella city. And Etang especial woreda 56 km from regional town According to DRMFSS (2014), the two Woreda had a population of 62,248.

Based on the 2014 census, the Nuers are the majority group, representing 46.7% of the population of Gambella region of Ethiopia (CSA 2012). Gambella is found in tropical climate zone. The average annual temperature in Gambella is 27.6 °C. The average annual rainfall is 1,148 mm (Climate-Data.Org 2016) [7].

Nuer are a large pastoralist people who live both in the current South Sudan and Ethiopia (Abbink 1997) [1]. Nuer groups occupy the central basin itself, extending eastwards along the Sobat metahare akobo and Baro rivers all the way into southwestern Ethiopia (Hutchinson 1962) [12]. Because of their settlement, they are highly exposed to flood. During rainy. At the rainy season from June to November, the rivers, mainly Baro River, overflow their banks and flood wide expanses of the plains. By analyzing the level of the river, the Nuer evacuates with their live-stock and settles at permanent villages on the highest land ('Lare') and grazes the livestock on these upland plains. In the month of November, they move back to riverside and settle in dry season camps ('Kurthuony') and spent from December to May (Gambella Regional State 2001) [11].

The Nuer people are in long-term conflict with neighbour societies. Geographical set-up of the area, political conditions and socio-economic marginalization contribute

for the conflicts of Gambella region and Nuer people (Mossa 2014). Generally, four important factors are responsible for the escalating ethnic conflict in Gambella region. These include control over scarce natural re-sources such as water and grazing land, the question of majority population in the region and what language should be taught in school and a general feeling or apprehension among Anyuaa that they are being dominated by the pastoralist Nuers who enter Anyuaa territory in search of grazing land and water (Abraham 2002) [2].

Material and Methods

Mixed research method sequential transformative strategy was used for this study. This method is characterized by collection and analysis of either quantitative or qualitative data first and the results integrated with the interpretation phase. In order to undertake this study, the researcher employed both quantitative and qualitative data which used survey and key informant interview (KII) as a tool of data collection. The study was conducted using household-based cross-sectional study design.

Data Collection

Survey and key informant interview were used as a source of data. Semi-structured questionnaire was developed for the survey. It was designed in a way to assess the livelihood strategies and food security situation. Data collectors used a random sampling technique to select the 145 sample households to be interviewed. Also, four key informant interviews were conducted among representatives of the kebeles.

Data Analysis

Among the various indices available, Simpson diversity index (SDI) was selected and used to measure livelihood diversification. SDI is simple, robust and widely applicable (Khatun and Roy 2012) [13]. The Simpson index of diversity was calculated as

$$SDI = \frac{1}{\sum_{i=1}^N p_i^2}$$

Where

P_i as the proportion of income coming from source i. The value of SDI ranges from 0 to 1.

The Simpson index of diversity is affected by the number of income sources and the proportion of income from each source (balance). The more uniformly distributed is the income from each source, the SDI approaches to 1 (Sahal and Baha 2010) [17]. The diversification status of the households was classified based on the rating given by Sahal and Baha (2010) [17] low (0 to 0.38), medium (0.39 to 0.63) and high (above 0.63).

Results and discussion

Wealth status

The result of key informant interview (KII) had shown that it is very difficult to set criteria and to identify the wealth status of Nuer people. This is because of a very strong culture of cooperation and support among Nuer people. Thus, it seems everybody is within the same level of wealth status and evaluation of wealth needs careful analysis.

Accordingly, key informant interviews conducted have come up with a lot similar criteria for wealth breakdown off households. While a possession of 10 up to 50 cattle poor/middle wealth status households. In addition, cattle less than 10 and a crop production of less than 10 quin.

Livelihood strategies of the households

Tals were requirements for poor wealth category. The study area Lare woreda is found in the Gambella Based on the criteria stated, the wealth classification agro-pastoral (GAG) and Gambella mixed agriculture was made by grouping the sample households into poor, (GMA) livelihood zone which is located in the western less poor and better-off wealth groups. The poor group part of the country (MoARD 2010) [14]. This agro-pastoral constitutes 45 households (33.8%). The less poor and area is dependent on livestock and crop production as better-off include 54 (40.6%) and 34 (25.6%) households, well as fishing. The major crops grown both for con-respectively. Sumption and sale are maize and sorghum. Tobacco is also cultivated as a cash crop. Cattle, goats and sheep.

Description of sample households: are the main livestock reared in this zone.

From the total sample respondent, 7.5% (10 households) For both of the zones, livestock and crop production were female headed and 92.5% (123 households) were are the main livelihood strategies. The difference lies in male headed. The family size of sample households was the patterns of implementation. Agro-pastoral popular-found a minimum of 3 and a maximum of 12. The aversion moves from area to area in search of pasture while age family size of the sample households was 6.28 with a the mixed agriculture population leaves on a permanent standard deviation of 1.69 settlement. According to the 2007 survey, the number of The ratio of persons in the dependent age groups to GAG-dependent population (23,666) was a lot higher those of the working age groups provides a useful ap-than that of GMA (1,146) (MoARD 2010) [14].

Proximation to economic dependency burden. The mini-The key informant interview participants were asked mum dependency ratio of the sample households was 0 to identify the best livelihood strategies. They have indi-while.

Table 1: Demographic characteristics of sample households (N = 133)

Variable	Wealth status			Total average	t value
	Poor (N = 45)	Less poor (N = 54)	Better-off (N = 34)		
Age of the head	45.27	40.23	49.32	44.26	2.674***
Average age of the HH members	20.52	19.76	24.58	21.25	3.384***
Adult equivalent	4.95	4.92	5.16	4.99	0.973
Educational level of head	1.33	2.43	1.41	1.8	-0.636
Average education of HH members	3.71	3.54	4.73	3.89	1.852*
Household size	6.29	6.31	6.21	6.28	-0.287
Dependency ratio	1.18	1.19	0.72	1.06	-3.11***

***,*Significant at less than 1 and 10% probability level respectively

Results for experiment

Income gained from livestock production, trade of animals and crops and crop production were the three major income sources for the households. They covered 45.02, 14.29 and 12.72% of the total household's income, respectively. The mean annual income of households was 10876.33 Birr, and the mean annual income gained from the sale of animals and their products was 4896.31 Birr (Table 2).

One interesting experience found from the FGDs conducted was the unique type of Iqub. Iqub is a traditional saving mechanism implemented by people of Ethiopia in terms of cash or different commodity items. The women of the study area have Equip of milk production. They gather their production and gave to one member of the women, and she took the milk to the nearby city or regional capital to sell and get income for the household.

The livelihood strategies of the households can be categorized under livelihood categories. These categories on-farm, off-farm and non-farm livelihood strategies were practiced by households with different proportion.

Strategies included in on-farm livelihood categories were crop production and livestock production. Off-farm strategies included agricultural activities employed out of the farmland of the households like forest products and fishery. In addition, activities of employment, trade of animals and crop, trade of food and drink, sell of handcraft products, income from carpentry, remit-trance and gift were taken as non-farm.

From the total sample households, only 14 (10.5%) have practiced off-farm livelihood strategies only. The other 21 (15.8%) households employed a combination of on-farm and non-farm livelihood strategies. In addition, 16 (12%) of households depend on both on-farm and off-farm livelihood strategies. Finally, most of the sample households based on the combination of on-farm, off-farm and non-farm. Around 82 (61.7%) relied on the outcome of these three livelihood strategies.

Crop production

Crop production is the major livelihood strategy in the study area, and it was practiced by all of the sample households. The key informant interview results showed that the primary crop types cultivated in the area were maize, sorghum and tobacco in descending order of importance. The type of production was traditional, and they use sticks and small equipment to prepare their agricultural land. The households reported a mean agricultural land possession of 1.98 ha, and they had cultivated on 1.55 ha of it. The mean crop production stock of the households was 815 kg, but more than half of this production (510.75 kg) was from one crop type, maize.

The amount of crop production stock was a lot less as compared to an average productive capacity of a certain agricultural land and the results found from different studies done by various scholars (Table 3). Arega *et al.* (2013) [5]

reported a mean crop production of 10,300 kg from 0.88 ha of land.

Table 2: Income of the household from different sources in Birr (N = 133)

Income source	Wealth status			Mean income of household
	Poor (N = 45)	Less poor (N = 54)	Better-off (N = 34)	
Sell of crop and agricultural product	801.78	1,573.52	1,852.94	1,383.83
Sell of animal's product	508	1,240.37	1,517.94	1,063.53
Sell of cow, sheep, goat and hen	2,530.44	4,246.48	4,899.41	3,832.78
Employment/salary, in the form of daily or monthly	330.44	505.06	176.47	361.98
Trade of animals and crop	1,703.78	738.89	2,650.59	1,554.06
Trade of food and drink	638.44	872.22	1,252.94	890.45
Handicraft products	14.44	0	10.29	7.52
Carpentry	3.33	1.85	33.82	10.53
Service delivery	15.33	8.33	12.35	11.73
Fishery	636.67	980.93	794.62	816.82
Forest products	381.22	567.59	608.85	515.08
Remittance and gift	570.33	354.63	356.18	428.01
Total mean income	8,134.22	11,108.41	14,166.41	10,876.33

Livestock production

Livestock is a lot related to the life of the Nuer people. The nature of their settlement area is favourable for live-stock production. The FGD results showed that livestock outputs take the major part of daily food basket of the people. Selling of livestock and their products (like milk and egg) was the major source of income for the house-holds. In addition, livestock especially cattle have a great role in determining wealth status and social interactions of the community. For instance, cattle were used as a gift in times of marriage.

Table 4 shows the sample households possessed a mean livestock of 30.92 tropical livestock units (TLU). The poor, medium and rich households possess 14.02, 29.41 and 55.7 TLU of mean livestock.

Even though most of the study area population categorized under Gambella agro-pastoral (GAG) livelihood zone, the crop and livestock production characteristics of the study area fall under the pastoral and horticultural societies. Pastoral societies are those whose livelihood is.

Table 3: Crop production of households by wealth group in kilogramme (N = 133)

Crop type	Wealth status			Production of HH per crop	Total Production
	Poor	Less poor	Better-off		
Sorghum	129.56	125.37	129.12	127.74	16,990
Maize	482.89	532.41	513.24	510.75	67,930
Potato	27.73	34.67	45.44	35.08	4,665
Onion	25.87	24.41	28.47	25.94	3,450
Vegetables	34.67	110.20	51.24	69.57	9,253
Dry pepper	4.49	2.37	4.47	3.62	482
Tobacco	16.16	16.70	14.62	15.98	2,126
Beans	20.78	23.19	25.47	22.95	3,053
Total	743.24	871.17	813.82	813.23	108,209
Agricultural land cultivated	1.47	1.51	1.71	1.55	
t test	1.721**				

**Significant at less than 5% probability level

Table 4: Livestock possession of the households (N = 133)

Livestock	Wealth status			Mean livestock type per household	Total Livestock
	Poor	Less Poor	Better-off		
Cow	7.98	16.67	36.47	18.79	2,499
Ox	1.47	3.48	5.38	3.29	437
Heifer and bull	1.84	5.50	8.09	4.92	655
Weaned calf	2.53	4.09	6.24	4.11	547
Calf	2.20	3.06	7.15	3.81	507
Donkey (adult)	0.00	0.00	0.12	0.03	4
Donkey (young)	0.00	0.09	0.03	0.05	6
Sheep and goat (adult)	8.91	15.96	19.88	14.58	1,939
Sheep and goat (young)	8.47	11.83	16.35	11.85	1,576
Hen	8.80	15.20	16.29	13.32	1,771
Mean TLU	14.02	29.41	55.70	30.92	
t test	9.832***				

***Significant at less than 1% probability level

The research was descriptive where both qualitative and quantitative data was used. Triangulation was used for it helps to increase the reliability of the results by comparing

Research Methodology

the data obtained from one source with the other sources.

11. Data collection methods In this study, both primary and secondary data were used. The primary data was collected from households of the five Woredas, owners of the farms and experts of agriculture by using structured questionnaires and focus group discussions. The secondary data was collected through reviewing relevant literatures that includes annual reports, publications, institutions' performance report documents, policy documents and other types of documents were utilized.

12. Methods of data analysis Depending on the objectives of a given study and nature of the data available, both quantitative and qualitative methodologies used to analyze the data. In this study, descriptive statistical tools such as percentage and frequencies used to analyze the data. In addition, the data collected through interview and focus group discussions based on pasturing of animals, such as cattle, camels, sheep and goats. Horticultural societies are those whose economy is based on cultivating plants by the use of simple tools, such as digging sticks, hoes and axes. The key informant interview outcome revealed that animals have no role in crop production practices. Using of animal power for farming and related activities is a defining characteristic of the agricultural societies. However, due to cultural beliefs of the Nuer people, no livestock power is used for such purpose. There were some collaborative efforts by agriculture and rural development office with the help of non-governmental organizations to initiate the use of cattle for agriculture (Figure 3). But these efforts were fruitless due to the strict and change resistance culture of the society.

Discussion

Livelihood diversification in Agriculture

Simpson diversity index (SDI) was used for estimation of livelihood diversification. SDI considers both the number of income sources and the proportion of income gained from the sources. An outcome of zero shows the complete specialization, and the level of diversification increases as SDI close to one. This means the income of the households does not depend on a single livelihood source. There are some income-generating livelihood strategies, and the proportion of income gained from these sources is not influenced by a single livelihood strategy.

The result showed that majority of the households 54.89% were high diversifiers. The income of these households was gained from various sources with even (equal) distribution. The percentage of less and medium diversifiers were 15.04 and 30.07, respectively. The percentage of high diversifiers found in this study was a lot higher than households of West Bengal which was 21.74% found by the study of Sahal and Baha (2010) [17].

Adugna (2012) [4] had also got 69% of less diversifiers in pastoral areas of southern Ethiopia.

The reason for having a bigger number of high diversifiers in the study area could be due to the availability of assets for various livelihood strategies. The area is suitable for crop, livestock and fishery production. Also, the better existence

of employment opportunities and remittance contributed to the high diversified result of households.

SDI was also computed for wealth groups. The mean SDI score of the poor was 0.6552, while the less poor and better-off had a score of 0.6682 and 0.7218, respectively. The average diversification score of the total households was found 0.6775 with a standard deviation of 0.302. The range of the SDI score was from 0 to 0.919. Even though the diversification of livelihood strategies increased from poor to better-off wealth status groups, the level of diversification and intensification did not show a statistically significant relationship with wealth groups (Table 5). These could be due to some possible reasons. The poor diversify their livelihood in order to skip their poverty and food security problem. On the other hand, the less poor and better-off households diversify their livelihood to sustain and increase their wealth.

Conclusions and recommendations

Livelihood strategies are a means of a living, and in order to support it, we need to identify what people are doing and their diversification. The study was aimed to identify the livelihood strategies and their level of diversification in western tip of Ethiopia. The majority of the households employ more than one livelihood strategies. Only on-farm livelihood strategies practised by few households, and majority of has little time for critics of its large-scale land-leasing policy, insisting the millions of dollars of foreign investment will create jobs, improve domestic agricultural expertise and reduce both poverty and the country's chronic food insecurity.



But rice, and many of the other crops set to be produced on such farms, is not widely consumed in Ethiopia

Told that our land will be given to foreign investors," said Ujulu, who used to live with his seven children on the banks of Gambella's Baro river in an area now being developed by Karuturi, and who was recently relocated to a new village, several hours' walk away.

At least one of the deals, a 10,000 hectare rice farm in Gambella leased by Saudi-Ethiopian investor Sheikh Mohamed Al-Amoudi, 40 percent of production will have to be sold on the Ethiopian market.

But rice, and many of the other crops set to be produced on such farms, is not widely consumed in Ethiopia.



Fig 1: Cattle of nuer people and home lands

They use on-farm combined with off-farm and non-farm livelihood strategies. Livestock production, crop production, fishery and trading are the most viable livelihood strategies. Livestock production and crop production were practiced almost by all of the households. But the type of farming and livestock practice is traditional and the output is low. Therefore, the extension works targeting on the improvement of farming mechanisms and livestock production and their outputs should be implemented. Also, more than half of the households are high diversifiers. Diversification result was a lot better, and it was achieved

due to the existence of various assets to support livelihood strategies. Finally, around one third of the households live under poverty status. Thus, poverty reduction measures should be implemented.

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Table 5: Distribution of households with livelihood diversification (N = 133)

Livelihood diversification (SDI)	Wealth status					Total			
	Poor		Less poor			Better-off			
	No.	%	No.	%	No.	%	No.	%	
Less diversified (0 to 0.38)	9	20	9	16.7	2	5.9	20		15.04
Medium diversified (0.39 to 0.63)	13	28.9	14	25.9	13	38.2	40		30.07
Highly diversified (above 0.63)	23	51.1		31	57.4	19	55.9	73	54.89
Total	45	100		54	100	34	100	133	100
Mean	0.5552		0.5682			0.6218		0.5775	
t test	-0.291								

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