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**ASSESSMENT OF SUSTAINABILITY AND RELATED SOCIO-ECONOMIC
AND CULTURAL FACTORS OF LARGE SCALE AGRICULTURAL INVEST-
MENTS IN GAMBELLA, ETHIOPIA**

BY

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Declaration

I, the undersigned, declare that this study “**Assessment of sustainability and related socio-economic and cultural factors of large scale agricultural investments in Gambella, Ethiopia** ”is my original work and has not been presented for a degree in any other university, and that all sources of material used for the study have been correctly acknowledged.

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List Abbreviation and Acronym

LSAIP	Large scale agriculture investment project
TDS	Total Dissolved solid
COD	Chemical oxygen demand
TN	Total Nitrate
AVP	Available phosphorus
TP	Total Phosphates
BOD₅	Biological oxygen Demand
SRS	Soluble Reactive phosphates
CEC	Cation Exchange Capacity
GPNRS	Gambella National Regional State
GW	Ground Water
EIA	Environmental Impact Assessment
NO₃-N	Nitrate -Nitrates
PLC	Private Limited Company
Ha /ha	Hectare
GIS	Geographical Information System
SD	Sustainable Development % Percentage
FDG	Focus Group Discussion
KIIs	Key Informant Interviews
L	Litre
SNNP	Southern Nation and Nationalities Region
Km²	Square Kilometers

°C Degree Celsius

mm millimeters

LULC Land Use /Land Cover Change

Ppm Parts per million

PSPP_s Sustainable Development Policies, Strategies, Programs or Projects

GADD Sustainable Development Analysis Grid

ERDAS Earth Resource Data Analysis System

Cmol kg⁻¹ Cent mole kilogram

UNDP United Nation Development Program

\$ US Dollar

E.C Ethiopian Calendar

Ph-H₂O Acidic/Basic in soil water

NO Nitrogen mono Oxide

N₂O Nitrous Oxide

NO₂ Di-Nitrogen Oxide

% OM Percent Organic Matter

Abstract

Background:

Large scale agriculture in Sub-Sahara is debatable issues and in the global for its impact on rural communities and environment. Beside these many of study was conducted but the sustainability of this farms on socio-enomic,cultural factors ,projects farms operation, impact on water ,soil ,plants and sustainable development and mitigation method of Assefa Birhane ,Saudistar ,Verdanta ,Gelana farms ,Sannati and Toren farms was not studied .

Objective: To assess the sustainability and related socio-economic and cultural factors of large scale agriculture investment in Gambella, Ethiopia.

Materials and Method :Cross-sectional descriptive study design was employed from August to September .Data was collected purposely by FDG,KI from Local community, youth and farms manager ,field observation ,soil ,water.4L water was collected accordingly ;1L from Saudistar GM,1LSuadistar pond ,1L from Toren GW and 1L from Gelana GW .9 composite soil was collected from farms accordingly Assefa Birhane 1,Toren 2 ,Gelana 2,Saudistar 2 ,Akula 1and Abobo forest and analyzed for nutrients .GIS was conducted to quantify forest cover change .Method for assessing overall performance

Results: In the region the performance and operation of the project farms is low because many challenges .The investments farms have shown have positive impact to local community through employment opportunities ,corporation of social responsibility and negative impact by losing the land right local community ,displacement ,loss of indigenous land right ,disruption of traditional way of life ,land disputes ,deprivation of access to vital resource and damage to cultural herniates .Water analyis has shown high nutrient of TN,TP,SRP ,Nitrates ,TSS and TDS.The soil PH was found in normal range ,Low %OM,High range of CEC,Very high range of AvP ,Medium range TN and High range of Mg and Ca nutrients .The impact of soil is mitigated by constructing buffer to control erosion , biological ,soil management .The impact of water can be mitigated by soil conservation, water source buffer zone protection and water pollution prevention. The impact plant or forest can be mitigated by re-vegetation.

Conclusion and Recommendation

Projects farms have caused serious social, economic, environmental, and cultural impacts soil and water pollution by agrochemical, deforestation, Loss of local land right and indigenous land use, forced displacement/Villagation, Land dispute/boundary dispute between investor and natives disruption of tradition way of life and deprivation of access to vital resources settlement. The performance of the project farm in terms of sustainable development have shown problematic in Social, Ecological and Cultural dimension .Whereas improvable condition in social dimension theme of the sustainable development .Gambella region Environment and Climate change need to protect the region.

Key words: Sustainable development, socio-economics, mitigation measure.

CHAPTER ONE: INTRODUCTION

1.1 Background of the study

Large scale agriculture investment is an international debate and it has raised a concern in developing countries (Lay *et al.*, 2018). Because of feeding the population and to meet the global food demand (FAO 2018). No doubt as it is a driver of 80 % for forest destruction in the global and 70 % water withdrawal (IPCC, 2019). Intensification of large agriculture production has increased in the global where natural resources are degraded (Angelo *et al.*, 2017). It is considered a positive when there technology transfers, infrastructure development and solve community problem. Community have been evicted from their move to other side and their forest that was used for their ecological service and source of livelihood is damaged (Moreda, 2017).

Increasing in agriculture investment in Africa and some part of the world can maximize productivity (Croz *et al.*, 2019). Expansion of large scale commercial require large area of land including the land of small holder and concentration camps do not provide for more land them to plant whatever they want due shortage land (Lavers, 2016). Very fast expansion of large scale agriculture investments by foreign investors in emerging countries has brought a big debate because it impact on small holders (rural communities) in the recipient regions. Large scale agricultural investments in developing world do potentially increase productivity, generate rental and opportunities by which small holder (rural communities) can benefit. However legal and economic theory has reveals that the benefit to small holder rely critically on the power and sharing of property right over the land sought by foreign investors. According to enclosure theory there is a significant threat if these large scale agricultural investments farms denied the property right of the small holder (Aisbett and Barbanente, 2016).

The federal government of Ethiopia has said that introducing foreign investors will bring change because there is shortage of capital formulation in the country by empowering and benefiting small holders. The benefits could be creation of employment opportunities, development and improvement of rural infrastructure, arrival of new source of knowledge transfers and productive sale opportunities for the African countries pursuing to invest in other industries (Besada, 2019). The federal government of Ethiopia has been promoting the agricultural investment in low land periphery

areas saying it is because they are intangible lands .The land leased to foreign and domestic investors is located in sparsely population regions with rivers fit for irrigation for example in Gambella Baro river, Alwero river, and Gilo river), Benishangul-Gumuz (Blue Nile) and south omo in SNNPR (Keeley *et al.*, 2014; Lavers, 2016).

1.2 Statement of the problem

Large scale agriculture in Sub-Sahara is debatable issues and in the global for its impact on rural communities (Bruntrup et al.,2016).More than 800 peoples in Africa and emerging Asian countries are facing food problems (Sakuyama.,2007).Agriculture is very significant for African countries to improve their living standard (AGRA,2013).Land demand for agriculture for is under pressure (AEA,2018).Expansion for the agriculture investment was report as a driver for decling of forest (Franks *et al.*,2017). The environmental issues of these projects farms pollution of water by agro-chemical(Network for African Science Accadamies,2019).It is also the cause for soil and water pollution in developing countries (IFAD,2011). The Performce of these farms projects is very low in developing countries (FAO, 2017).

According to (Bossio *et al.*, 2012) sustainable agriculture that protect water, forest and improved the life of local peoples is needed. According to (Degefe and Mauser, 2017) for any investments projects they need to conduct EIA before they start their activities. Thus, this research plans to fill the gaps that other researchers slightly fail to assess in the region. So this research is to assess the sustainability and related socio-economic and cultural factors of large scale agriculture investment in Gambella.

Beside these many of study was conducted but the sustainability of this farms on socio-enonmic,cultural factors ,projects farms operation, impact on water ,soil ,plants and sustainable development and mitigation method of Assefa Birhane ,Saudistar ,Verdanta ,Gelana farms ,Sannati and Toren farms was not studied .Therefore, the study would be conduct to assess the sustainability and related socio-economic and cultural factors of large scale agriculture investment in Gambella, Ethiopia .

1.3 Significant of the study

The finding of this research will be great significant for different purposes .Will help both federal and Gambella regional state to take corrective measure in relation sustainability of the large agricultural investments farms in the region. It will be used as a source of reference for further research for those interested to conduct research in the same area .Will provide basic information about sustainability and socio -economic and cultural impacts of large agricultural investment on indigenous people in Gambella region. It will provide Sustainable utilization and protection of environmental resources. Will be used as a bodies as input to make different policies reforms. Will provide significant reliable information by discussion the sustainability of the farms and contribute the challenges and sustainability of the large sale agricultural investments on socio-economic, sustainability and cultural perspectives in the region.

CHAPTER TWO: LITERATURES REVIEW

2.1 Concept of larger agricultural scale investment

Large scale agriculture investment project is a mechanized farming because it utilized different machine to cultivate wide area of lands, it is known for its deforestation and spraying of chemicals that pollute the environment as well as biodiversity. It is the leading for forest lost and wildlife in our continent (Jaleta and DeBella, 2017). (Kathiresan, 2010) has defined large scale agricultural farm as a farming activity that utilizes different machine for crop production, harvesting and preparation for storage, and on-farm processing.

According to (Reid and John, 2011) large scale agriculture uses machinery for mechanizing agricultural work to maximize their productivity. In the present time powered machinery has substituted many jobs formerly carried out by manual labor or by working animals such as oxen, horses and mules. As (Miguel and Alfieri, 2010) has stated Large Scale Agriculture maximizes production, minimizes dependence, decreases the cost of crops and maximizes multiple cropping patterns that need urgent land preparation, planting, weeding, harvesting and processing.

2.2 Impact of larger scale agricultural investments

One of the environmental consequences of LSAIP is the slashing, burning and clearing of grasslands, woodland, mangrove and other vegetation covers from the land during preparation for large scale mechanized agriculture by the investors. The transfer of these lands for large scale agriculture investment not only resulted in socio-economic losses to the local people, it also affected the environment (Taddesse, 2015). Even though LSAIP provides capital for Africa's land-dependent economies, in the presence of weak domestic governance of investments they could pose socio-economic and environmental risks (Richards, 2013; Cotula, 2011, Dessalegn, 2011).

2.2.1 Social impact Impacts of LSAIP

2.2.1.1 Food insecurity

Agricultural investment as the most important and effective strategies for economic growth, food security and poverty reduction. Foreign and local investors grab the farm area on an industrial scale and that deprives their livelihoods and increases food insecurity. Large land acquisition is a tremendous environmental devastation, forest is cleared and burnt, wetland drained and people are largely dependent on international food aid and financial assistance. It leads smallholder farmers

to be displaced, pastoralist loss the grazing land, people loss incomes and livelihoods. Due to corruption, lack of good governance and transparency the natural resources are depleted and societies became food insecure (Degife, 2017).

Study conducted by (FAO, 2015) has shown that for about 70 percent of people in Africa and roughly 80 percent of the continent's poor live in rural areas. Because these people depend mainly on agriculture, and increasingly are unable to meet their basic food needs as population pressure on land grows, and land and water resources become scarce or degrade and agricultural productivity stagnates. Ethiopian government promote land 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. But the main pillar of the food security strategy is to rely on intensification of smallholder farming in the highlands, through improved technologies, investment and institutional change (Keeley *et al.*, 2014). Food security might also be affected by the increasing global scarcity of natural assets (IFPRI, 2012). Food and Agriculture Organization (FAO), has reported that food production must be doubled by year 2050, in order to satisfy the growing population's food requirement. The majority of the population increase will occur in developing countries, where rural poverty and hunger already is widespread (FAO, 2009). It is a waste when land are prepared for commercial farms, while the local population is losing their means of income. The state argues that the foreign agricultural production will contribute to long-term food security, since technology will be transferred to small-scale agriculture (Berger, 2014). Sustainable agricultural intensification in Ethiopia is needed, given the low productivity of water and land resources and, at the same time, the dire situation of the poor in terms of water and food security. Accordingly agricultural development that is equitable and locally appropriate is needed to improve local and national food security now and into the future (FAO, 2017).

Investment could bring positive outcomes for food security, including nutrition, particularly by farmers and the government, which improve farm productivity, can increase the affordability and availability of food on the market (Liu, 2014). Large-scale agribusiness investments that integrate smallholder farmers as out growers have had positive outcomes for food security, through higher incomes (Mirza *et al.*, 2014). Large scale agro-investment projects (LSAIP) in Sub-Saharan Africa

(SSA), in particular if including large scale land acquisitions, are fiercely debated worldwide with regards to their impacts on rural development and food security (German *et al.*, 2013).

Accordingly to be responsible investment in agriculture and food systems supports State obligations regarding the progressive realization of the right to adequate food in the context of national food security, and all intended users' responsibility to respect human rights. Investment in agriculture and food systems contributes to food security and nutrition, particularly for the most vulnerable, at the household, local, national, regional, or global level, and to eradicating poverty by the following criteria.

- i. By maximizing sustainable production and productivity of safe, nutritious, diverse and culturally acceptable food, and reducing food loss and waste,
- ii. Income improving and reducing poverty, including through participation in agriculture and food systems and/or through improving the ability to produce food for oneself and others;
- iii. Enhancing the fairness, transparency, efficiency and functioning of markets, in particular taking into account the interests of smallholders, improving related infrastructure, and increasing the resilience of agriculture and food systems;
- iv. Enhancing food utilization through access to clean water, sanitation, energy, technology, childcare, healthcare, and access to education, including on how to prepare, provide and maintain safe and nutritious food (CFS, 2014).

2.2.1.2 Loss of local land use right and rural livelihood

According to study conducted by (Mosisa, 2016) Small-scale farmers and pastoralists are being denied access to arable farmland, grazing and water points, and hunting grounds and at best, they are being turned into day laborers doing back breaking work while living in extreme poverty. Government is moving ahead with its plans for so called “progress,” which relies on tactics of widespread human rights abuses including harassment, rapes, arbitrary detention and imprisonment without trial, displacement, increased food insecurity, destitution, and destruction of the environment .In the Human Right Watch, report, and commentary letter to Ethiopian government, UNDP Country Representative, Karaturi and other concerned bodies, described that the resettlement program being implemented was unconstitutional, involuntarily, and it has been supported with different human right abuses (HRW, 2012).

The Villagization and resettlement program mainly caused Shortage of land the majority. This condition resulted in consequences. , Shift in means of income from farming to Charcoal, wood, lack of land which can be given for their future generation, being labour in investors camp , it has resulted in unemployment and non-productivity of the man power (Mosisa, 2016).Small hold farmers are displaced, pastoralists are lost their grazing land and local people are losing their incomes and livelihoods .The indigenous and local peoples lost 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. Land governance supports food security and ensures sustainable livelihoods that are essential for people and countries that rely on land as one of their main economic, social and cultural assets (Degife, 2017).Conversion of land to large scale farms or plantations operated by foreign labor causes loss of local land rights and generates little employment for local skilled or unskilled labor (IFPRI, 2009).As people are forced to limit their investments in land, there is probably little chance of an increase in small-scale production. Perhaps the land regulation can be regarded as a way to keep people in poverty. Given peoples loss of land access, it has already erupted conflicts in some areas where land-grab takes place (Berger, 2014).(Shete, 2011) argue that in Benishangul-Gumuz agricultural FDI, respect and recognize land and natural resource use rights of the community members . Policies that promote equitable access to land are futile, and may in some scenarios render a disservice even to their intended beneficiaries, unless they fit under broader schemes for rural development (De Schutter, 2015).In the context of rural Ethiopia, although land remains at the centre of livelihoods, access to land and the ability to defend claims to land are becoming difficult challenges for the rural poor, thereby affecting food security and livelihoods (Moreda, 2018).

2.2.1.3 Dispute over access to land between investors and natives

The most common risk from large-scale private sector investments is land disputes that adversely affect all stakeholders, with a particularly negative impact for local communities (Fiedler and Iafrate, 2016). Land disputes the most prominent negative impact arising from large agribusiness investments (Mirza *et al.*, 2014).Land disputes and insecurity of tenure adversely affect investors as well, in some cases incentivizing behavior that compounds the negative impacts on local communities(Barney, 2016).Negative impacts from land loss and disputes are more severe in countries that are predominantly rural and where land rights are often informal (Liu, 2014; Sylvester and

Phaophongsavath, 2017). Gambella people are strongly tied to natural resources (land, water, forest resources) and their livelihoods are highly dependent on these resources. But, recently due to LSLAP resources become scarce and conflicts between local people and investors have emerged (Degefe, 2017). Land mapping and titling to improve security of land tenure and minimize disputes is especially important (Mirza *et al.*, 2014).

2.2.1.4 Forced displacement /Villagization

The indigenous groups that live in areas with agricultural land and where the interests for land have increased. For the state to have access to certain land they have removed locals, using methods such as expropriation, redistribution of land and forceful removal through the villagization programme (Berger, 2014). The targets of Villagization is provide efficient and effective economic and social services (safe drinking water, optimum, health care, education, improved agronomy practices, market access etc.). Create an access to infrastructure (road, power, telecommunication etc.) and ensure the citizen's full engagement in good governance and democratic exercise (HRW, 2012, Cultural Survival Inc, 2012a, Ambaye, 2013).

Process of the program implementation is neither voluntary resettlement nor involuntary resettlement; rather it is deceived resettlement or provoked resettlement where the people were deceived by the unfulfilled promises of the government official. Hence the process is neither voluntarily nor involuntarily rather it can be called as induce resettlement (push) or deceived resettlement or persuaded or provoked resettlement (Mosisa, 2016). (Ambaye, 2013) considers the programme to be a good example of clearing land for investment purposes, while also providing locals with electricity, water and health services at the new settlements in contrast to Ambaye, several NGOs claim that the program is an action intended to clear areas for the benefit of land grabbing, leaving locals without access to land or compensation (Bertelsmann Stiftung, 2014, HRW 2012a, Cultural Survival Inc, 2013).

The implementation of the program has been with full of human rights abuses, not constitutional, people are not voluntarily moved to villagization sites and it was not with the participation of the local people and their institutions (OI, 2011, HRW, 2012). As a result, small scale farmers and pastoralists lose their lands, thus local people are forced to migrate from rural areas to neighboring countries Sudan and if possible the global north (notably to Europe) to sustain their lives (Degefe, 2017). Where resettlement takes place it is vital that the right to free, prior and informed consent

(FPIC) is upheld. This allows communities to give or withhold consent to a project that may affect them or their territory. Currently, the right pertains to indigenous peoples and is recognized in the United Nations Declaration on the Rights of Indigenous Peoples (Smaller, 2014).

2.2.1.5 Deprivation of access to vital resources

LSAIP involves the use of natural resources and usually acts as a solution to satisfy the need for food in foreign countries, without sharing benefits with locals where the land-grab takes place. Land grab is also often associated with lack of consideration for social implications (Riddell, 2013), displacement and dispossession of local populations (Scoones, 2009). Expansion of state-led industrial development, which requires extensive areas of land, might act as an obstacle for locals' to access land for living or agriculture. (Berger, 2014). Brown (2013) claims that Ethiopia's land-grab deals have resulted in forcible relocation of more than one million Ethiopians. Land, such as areas of shifting cultivation and forest, have been taken by investors, with no notice in advance (HRW, 2012a) and access to land has become worse in several regions (DESA, 2009).

Losing access to land can also result in lost access to livestock paths and roads to water sites. One study concludes that an investment project in Ethiopia, led to the loss of common property. This had a direct impact on herder's access to essential and strategically located pastures and water points. The consequences were so great that the herders were forced to sell their livestock's (Anseeuw *et al.*, 2013). Because of the loss of land, ethnic minorities have begun to cross other group's territory, which has resulted conflicts and ethnic clashes. The mutual interest in land can increase the risk of conflicts between locals' and the actors involved in land-grabbing (Potts, 2013). Displacement and resettlement for LSAIP can disrupt communities' ability to grow their own food and access traditional and indigenous food sources, as well as grazing land and other livelihood resources that are important for food security (Fiedler and Iafate, 2016). Involuntary resettlement can cause households to lose access to their land entirely, and the demarcation of project sites can cut off indigenous peoples and local communities' access to natural resources, water, and foraged food sources (Golay, 2015).

Study conducted by (Shete, 2011) in Benishangul-Gumuz has stated that Livelihood activities such as beekeeping, collecting wild foods from the forest, hunting of various wild animals, etc are important components of household food system. The impact of LSAIP on the bio-diversity has contribute negatively to food security by affecting the livelihood of traditional bee-keepers, hunters

and fishermen, which depend on the bio-diversity (Mesay Girma , 2015).Local water resources are the other assets lost following the LSLAIP. It is claimed that large scale agricultural investments result in increased competition between projects and local communities over access to scarce resources such as water (Rahmato, 2011).This, in turn, creates resentment and protest among local communities. It was observed that competition over water is becoming serious as the project monopolized water resources in the land, thereby forcing local communities to turn to sources far away from their residences. In Oromia region in general, investment projects are given not only the investment lands, but also control of water resources thereby depriving the local communities of their essential supplies (Getnet, 2012).

2.3. Economic impact

2.3.1 Foreign direct investment (FDI)

For countries like Ethiopia with vast untapped natural resource base with limited public/government capital for utilizing it, participation of domestic and foreign investors could be a good source of economic growth. This could be realized, however, if deals maintain a win win scenario (Shete, 2011).Ethiopia is often highlighted as a country in which a lot of foreign land acquisition is occurring (Butler, 2010; Time Magazine, 2011; The Guardian, 2011a). Estimates of the extent of the land assigned for foreign direct investment) range from 600,000 ha (Cotula et al., 2009), 1.2 million ha(World Bank, 2010a), 2.9 million ha (Access Capital, 2010) and 3.6 million ha (Mousseau and Sosnoff, 2011).FDI is very growing in response to a number of global drivers and incentives from the Government of Ethiopia and could in principle bring benefit (improved technologies, innovation, increased productivity, market access, etc) to local populations (Bossio *et al.*, 2012). In Ethiopia FDI agriculture has increased significantly in the last few years. Which is connected to the increasing interest of transnational companies in land investments, as well as the investor-friendly environment developed by the Ethiopian government through multiple reviews of national policy and legal frameworks (LucieWeissleder, 2009).Other debate about foreign direct investment is that it helps local people in the form of technology transfer, increased crop production, creation of jobs and construction of rural infrastructures such as roads, school, health centers and so on (Dheressa, 2013).

Flowing of Foreign Direct Investment in agriculture has increased substantially and the Least Developed Countries (LDCs) attracted \$1,833 billion in 2007. In Ethiopia alone, agricultural investment increased from \$135 million in 2000 to \$3500 million in 2008(UNCTAD 2008).The drivers of FDI in agriculture are: reduction of production costs since labor is cheap in LDCs, seeking new markets, attaining food security following the world food price crisis in 2007 and securing financial returns following world financial meltdown in 2007 (GRAIN, 2008).Large scale farmland acquisition in developing countries is partly seen as an opportunity that injects huge capital and creates new jobs to the rural poor. However it seen as a threat to the rural poor whose livelihood heavily depends on land and associated natural resources (von Braun and Meinzen-Dick 2009; Deininger *et al.*,2011).Looking into the roles of FDIs in creating employment for local people, we may not expect significant employment opportunities as a result of such investments. However, some of the large scale agricultural investment projects which started operations in the country have provided employment opportunities to local people in the form of short term and seasonal employments (Rahmato, 2011).

2.3.2 Employment opportunity /Job opportunity

One of the perceived benefits of large-scale commercial agriculture is the massive amount of wage employment that these operations will provide. However, in recently times, women from local people are taking significant proportion of employment in these large companies in order to generate income for the family although salaries are insignificant (Degefe, 2017).Job opportunities improve rural livelihoods. The benefit for the rural poor is the creation of a potentially large farm and off-farm employment. Effective contract negotiation and adjunct policy measures are useful tools to enhance these positive spillover effects (Gurara and Birhanu, 2012 LSAIP can have both positive and negative impacts on the economic status and livelihoods of local populations. For instance it contribute to poverty reduction and the improvement of local livelihoods by generating local employment opportunities (Otsuka and Yamano, 2006).Promoting large-scale farms in Ethiopia the government expects large scale investments to create job opportunities to the community in the area, which are said to have high rates of unemployment.According to World Bank, the promoters of large scale commercial farming, found that there is no impact of large farms on local labor demand except possibly on imports of casual labor (World Bank, 2016).

If large-scale land deals are made by a win-win approach, they are believed to help provide jobs (Verie Aarts, 2009). Lack of the spillover effects could result in the creation of an enclave of modern agriculture and traditional smallholder agriculture will remain sidelined. The negotiations need to address these gaps (Gurara and Birhanu, 2012). Another benefit is said to be increasing employment opportunities for locals (Anseeuw *et al.*, 2013). Baumgartner (2013), notes that the increasing global demand for agricultural products and large-scale land investments can open up for employment opportunities, especially off-farm, which can drastically reduce poverty, among local population. The actors involved in land-grab tend to promise large quantities of jobs, in order to gain support from locals for the land investments (Anseeuw *et al.*, 2013). Jobs creation is the benefits from large-scale agribusiness investment (Mirza *et al.*, 2014). The majority the jobs paid wages is higher than the local job market (Zhan *et al.*, 2015). Employment opportunity is the evaluation for the social impacts of the LSLAIP, which was expected to generate different types of direct and indirect employments. Many studies suggest that the contribution of FDI to agricultural employment in Ethiopia is very limited (Getnet, 2012). The direct and indirect employment to the local people seems far from being reality since there is a tendency to bring workers from other areas than hiring the ones in the district. Local people were employed as casual laborers during land clearing and other heavy works, Most of the workers who carry out the skilled jobs came from urban areas of the country and India (Dheressa, 2013). The government of Ethiopia need expect that large-scale farms would create vast employment opportunities. According to the investment proposals in commercial agriculture, about 86 percent of the farms were expected to employ both permanent and temporary workers while the remaining employed either of the two. Accordingly, the mean ratio of temporary workers to permanent employees was projected. Therefore, a farm operating land, for instance, was expected to hire permanent workers and temporary workers (EEA, 2013).

2.3.3 Technology transfer and innovation

Technology transfer is the measure of the social impacts of the LSIAIP. It shown that shows that the overwhelming majority of the respondents (96%) said they have not been introduced with new technologies of farming as a result the project. The remaining 4% claimed they benefited from the investor's technology in the form of paving rocks in adjacent farms they hold. Nevertheless, this does not constitute a direct technological transfer to the households. Besides, the technologies

being used by the company are not transferrable to the local people because they are expensive and/or require technical know-how to operate them. The company has stocks of heavy machinery which in most cases are operated by skilled workers from urban areas or personnel who came all the way from India. Consequently, the local people are not capable to either buy such equipment's or operate them given the fact that most of these people are poor and not adaptive to new technology (Dheressa, 2013, Keat, 2017, WB, 2017).

Large agricultural investment projects have offer a greater opportunities for economic development and poverty reduction by initiating growth in the local economy through job and income creation, technology transfers, and infrastructural improvements (Okumu and Olay, 2017). Land investment has the potential to create significant amounts of employment on farms, whether preparing land, planting, weeding, harvesting crops, managing facilities, or providing security or other services. Jobs may also be created in transport, hotel, restaurant and other sectors as a result of land investments. Regional officials in Benishangul-Gumuz also saw employment as one of the major ways in which land investment would contribute to food security in the region (Keeley and Seide, 2014).

2.3.4 Access to basic services

The strategy called Agricultural Development-Led Industrialization (ADLI) and that sees agriculture as the engine of growth. ADLI main objectives are: 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 and MOA, 2010). (Getnet, 2012) has cited that the contract signed between investors and the government do not oblige investors to undertake social investments, the government and other large-scale farming promoters expect these investments to benefit local communities through the construction of infrastructure and social assets such as health posts, schools, and access to clean water. Those commitments has as of yet, not been materialized (Anseeuw *et al.*, 2013).

On a global scale, the implementation of investors commitments to locals, have generally been uneven. (Woertz, 2013) claim that it is usually due to lack of infrastructure in rural areas and implications with state's policies. There is no significant evidence of infrastructural expansion in the district as the result of the LSAIP the respondents claimed that they benefited from infrastructures built by the company). Such infrastructures as school fencing, electricity, roads and health

care centers were promised by the investor to the local people prior to commencement of the project. Although the area has seen, to some extent, the construction of roads, there are no schools or health centers built until the field work was concluded. The only infrastructure provided by the investor was paved road connecting the main road to the village (Dheressa, 2013).

2.4 Environmental impact

Large scale land acquisition has adverse social and environmental impacts, in particular the degradation of natural resources such as forest has been cleared and burnt, and wetlands are drained. Further, large scale land acquisition can also have huge adverse impacts, especially in countries where there is a lack of good governance and rule of law, lack of transparency and unclear land tenure rights (Degefe, 2017).

2.4.1 Pollution of soil and water resources by agrochemicals

LSAIPs has both direct and indirect effects on the quality of surface water and groundwater and is among the leading causes of water quality degradation, mainly as a result of the excessive use of agrochemicals (Shabalala *et al.*, 2013; Schilling and Wolter, 2001).

It can cause pollution of water bodies and, over time, cumulative effects can lead to the depletion of water quality. Typical sources of water pollution associated with agricultural systems include livestock manure, nitrate and phosphate in fertilizers, metals, pathogens, sediments and pesticides. The two most common agricultural pollutants are nitrogen and phosphorus. Many studies have shown that non-point sources of nitrogen from agricultural activities include fertilizers, manure application and leguminous crops (Almasri and Kaluarachchi, 2004).

Nitrate in the water body indicates that agricultural applications of manure and fertilizers may be a potential source of nitrate contamination. Agricultural run-off, during the rainy season, would raise the conductivity due to the presence of chloride, phosphate and nitrate in the run-off. The pH of a body of water is also affected by factors such as the bedrock and soil composition through which the water moves. Some rock types, such as limestone, can, to an extent, neutralize acid, while others, such as granite, have virtually no effect on the pH. Nutrients, mainly nitrogen and phosphorous, are applied to croplands in the form of fertilizers to promote plant growth. An excessive amount of these nutrients can cause water quality problems when entering water systems (Shabalala. *et al.*, 2013).

The intensive use of external inputs and technological improvements in plant and animal production although have increased agricultural production, but they have caused widespread ecological damage and a growing negative impact on human health. New technologies have led the agricultural sector to tremendous growth but have also resulted in soil depletion, pollution of groundwater and in increasing economic instability and other social costs (Seada *et al.*, 2016). Intensive agricultural production can threaten biodiversity, carbon stocks, and land and water resources. Converting forests and rangelands to mono-cropping reduces diversity in flora, fauna, and agro biodiversity, as well as aboveground and subsurface carbon stocks (IFPRI, 2009).

Large farm projects which confirmed that agricultural investment could cause deforestation, wild life habitat destruction, and shortage of water and soil pollution by using different chemical to increase their productivity (Okok and Okumu, 2017). Fertilization may affect the accumulation of heavy metals in soil and plant system. Plants absorb the fertilizers through the soil, they can enter the food chain. Thus, fertilization leads to water, soil and air pollution FAO, (March, 2009). It is one of the most important inputs of fertilizers in agricultural production. Whenever applied inadequate, rates of productivity and quality are caused significant losses. When it is too much applied, it causes air pollution by nitrogen oxides (NO, N₂O, NO₂) emissions (Savci, 2012). The agricultural activities in the Gharb (Morocco) are considered to be among the potential factors that may contribute to the degradation of the quality of water and soil (Al-qawati *et al.*, 2015).

One of the biggest concerns associated with this pollution in the environment is the risk of contamination to farmland, fisheries, and potable water since most of the people's livelihood depends on farming, fishing, and usage of water for domestic purposes (Ugwuanyi *et al.*, 2012). Environmental impact of the land acquisition is soil degradation due to extensive slash and burning process carried out to remove bushes and grasses from the land. This in turn severely damaged the soil and its nutrients as observed during the field work (Dheressa, 2013). Soil quality (SQ) assessment in light of land use variation is very critical in tropical regions to improve land-use decisions (Sağlam *et al.*, 2015). Agricultural water quality has been identified as a major environmental issue in Organisation for Economic Co-operation and Development (OECD) countries, and as a topic for policy analysis is an issue of relevance across all OECD countries. The primary agricultural sector is mainly responsible for nitrate, phosphorus, pesticide, soil sediment, salt, and pathogen pollution of water from crop and livestock activities, but it can also play a role under certain farm practices

in terms of improving water quality through a water purification function. Water pollution from agriculture has associated costs in terms of removing pollutants from drinking water supplies, as well as damage to ecosystems and commercial fishing, recreational, and cultural values associated with rivers, lakes, groundwater and marine waters. The limitations to identifying trends in water pollution originating from agriculture are in attributing the share of agriculture in total contamination and identifying areas vulnerable to agricultural water pollution (Kelvin, 2011).

2.4.2 Damage to wild life and habitat

Large scale agriculture increases the production however, it has a great impact on forest, wildlife, soil, water and the climate. Intensive monoculture depletes soil and leaves it vulnerable to erosion. It affects the distribution and abundance of wildlife in the area because large scale agriculture is associated with practices such as deforestation and monoculture. The demand for agriculture as well as technological change in agriculture significantly impacts the mode and rate of transformation of forested area, which leads to the loss of wildlife habitat and the loss of animals from the area (Angelsen and Kaimwitz, 2001). Deforestation is the removal of a forest or stand of trees where the land is converted to a non-forest use. Deforestation not only affects the climatic condition of the world, it also poses a big threat to the plants and animals that live within the forest (FAO, 2011). When the act of deforestation occurs it entails cutting down massive amounts of trees and vegetation. Many animals, big or small are herbivores and when their food supply gets taken away they are forced to move elsewhere. Some of them are able to find different food sources and make do with what they have; however, others die and in some cases become extinct altogether. Deforestation is the conversion of forest to an alternative permanent non-forested land use such as agriculture, grazing and urban development (Barraclough and Grimier, 2000). In the world wide, the major pressures on biodiversity is the transformation of natural habitats to agriculture, especially though forest clearance (Jenkins, 2003).

Large farms is the major factor that negatively affected on the forest cover. Large Scale Agriculture is linked with deforestation of large areas of forest land which are the habitat of wildlife. When forests are cleared away wildlife that has been living in the forest lose cover (shelter) as well as food sources and decided to leave the area. When wild animals are migrating from one area to the other area they might be killed by poachers, eaten by predators, then becoming extinct or reduced in number. Deforestation leads to the loss of wildlife, that is, there is a direct relationship between

forest and wildlife. (Jaleta and Debella, 2017). The national park and forests are the sources of food for the Gambella people (Nuer and Anywaa people). Both regional and federal governments allocated large ha of lands to foreign and local investors within the National Park. Wetlands with abundant fish populations and birdlife are presently being altered for rice production while extensive forest cover in nearby areas has been completely cleared without consultation of communities (Degefe, 2017).

(Lucie, 2009) has reported that the impact on the environment and wildlife of the investment project is also becoming quite apparent and is likely to be aggravated as the projects become fully operational. Production of one or two crops can be chemicals intensive, contributing to land and water degradation and biodiversity loss through chemical drift, aerial spraying and water contamination (Mirza *et al*, 2014) and it is not limited to large operations (ADB, 2014). LSAIPs impacts on water resources of the area. First, the pond water that existed on the land has later dried up due to conversion of the wetland to farm land and clearing of the vegetation covers surrounding it. As a result, the wetland water and the biodiversity it hosted have been lost due to the LSAIP (Dheressa, 2013). LSAIP in Ethiopia often harm the environment through, among other things, large scale land clearance, removal of woods and other vegetation covers, which will expose soil to serious erosions and degradation, and damage natural water resources. It cause a significant damage to the indigenous birds, wild animals and fishes. The construction of canals and irrigation dams which changed the pattern of natural water flow which affected the bio-diversity, furthermore the clearance of vegetation cover have played a negative role by limiting food resource and shelter of the birds, wild life and fish (Taddesse, 2015).

2.4.3 Hazard or risks pose by agrochemicals

In the absence of sustainable water, waste and pesticide management the commercial agriculture sector will create long term ecological effects (IFPRI, 2009; Getnet, 2012). According to (FAO, 2017) phosphate is not as soluble as nitrate and ammonia and tends to get adsorbed onto soil particles and enter water body thorough soil erosion. It was reported that insecticides, herbicides and fungicides are applied intensively in agriculture in many countries (Schreinemachers and Tipraqsa, 2012). When improperly selected and managed, they can pollute water resources with carcinogens and other toxic substances that can affect humans. Pesticides may also affect biodiversity by killing weeds and insects, with negative impacts up the food chain. (FAO, 2016a).

Fertilizers, herbicides and pesticides used in modern agriculture, in order to improve yield and productivity of agricultural products. However, nutrient leaching from agricultural soil into groundwater resources poses a major environmental and public health concern (Nikolaidis *et al.*, 2008). These company has also tougher working conditions for those who are employed, some of whom even quit their job alleging the harsh working environment (Dheressa, 2013). LSAIPs create jobs, but how many and with what impact is not always clear. Claims around employment creation from agricultural investments rarely provide details on the types of jobs created, the beneficiaries of those jobs, and the associated working conditions (Cordes *et al.*, 2016). Mechanized commercial farming required the use of large quantities of fertilizers and pesticides and therefore rivers crossing project areas, especially several tributaries of Baro River, had been contaminated (Taddesse, 2015).

2.4.4 Deforestation

Agriculture was estimated to be of the proximate driver for around 80 percent of deforestation in the global. It was driver of deforestation in Latin America, accounting for around two-thirds of total deforested area. In Africa and tropical and sub-tropical Asia, subsistence agriculture accounts for a larger share of deforestation than commercial agriculture (Kissinger, Herold and De Sy, 2012). Removing the land of forests leads to severe environmental degradation that can make the competition for other natural resources more acute among different users. For instant, clearing forests in highland areas causes soil erosion, which reduces the quality of drinking water for downstream users and water used to sustain aquaculture. The loss of forestland owing to the expansion of commercial farms deprives forest communities, particularly the most impoverished forest communities, of plant and animal biodiversity that is often critical to their food security. The loss of forest biodiversity also has repercussions for global food security, as it reduces options for breeding new crops and plant varieties that may allow food systems to better adapt to climate change (FAO, IFAD and WFP, 2013).

Unsustainable land use and improper tillage and soil management in agriculture are increasing erosion and sediment runoff into rivers, lakes and reservoirs, with massive quantities of soil lost and transported to water bodies every year. The global rate of erosion in croplands is estimated at 10.5 mega grams (Mg) per ha per year, which corresponds to 193 kilograms of soil organic carbon per ha per year. Estimates for pastureland are lower, at 1.7 Mg per ha per year, which is equivalent

to 40.4 kilograms of soil organic carbon per ha per year. It was point that 43 % of the agricultural sediment flux is in Asia (Doetterl *et al.*, 2012).

It was reported that happen erosion in areas where precipitation is very high, slopes are steep and vegetation cover is low. It is aggravated by overgrazing in pasturelands, by inappropriate ploughing on steep slopes and, which is largely, by deforestation, land clearance and the degradation of riverine vegetation. Water pollution from agriculture is complex and multidimensional, and its effective management requires a comprehensive package of responses. Such responses need to act on key drivers of agricultural expansion and intensification, such as unsustainable dietary shifts and food waste and loss; limit the export of pollutants from farms; protect water bodies from agricultural pollution loads; and help restore already-affected water bodies (FAO, 2017).

Clearing forests to convert it for agricultural use is a major cause of land and water degradation, biodiversity loss, and carbon emissions. The value of the timber for immediate sale within the region is often high, attracting investors who then fail to further develop the land after clearing it, compounding losses to the local community (Zhan *et al*, 2015; Barney, 2016). One of the environmental consequences of the land acquisition is the clearing of grasses and vegetation covers from the land. Grasses have been cleared and trees were cut to ready the land for large scale farming, which resulted in deforestation and elimination of vegetation cover. The grasses and bushes that were used to feed animals and make roof thatching for local houses have been slashed and burned down (Dheressa, 2013). Deforestation supplemented by large scale farming threatened livelihood security of community members. This negatively affect the distributional impacts of such projects for the coming generation (Shete, 2011).

2.5 Conceptual frame work

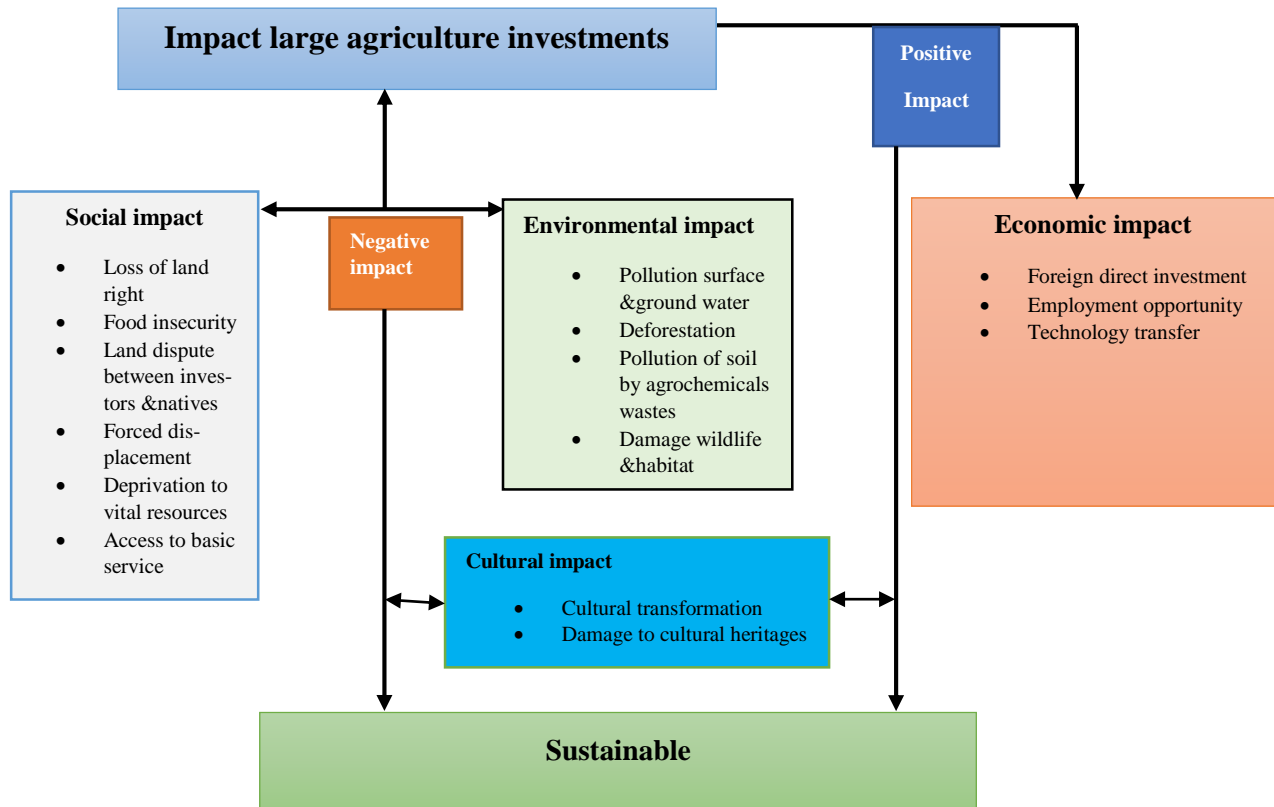


Figure 1: Conceptual frame work

CHAPTER THREE: OBJECTIVE OF THE STUDY

3.1 General Objective

To assess the sustainability and related socio-economic and cultural factors of large scale agricultural investments in Gambella, Ethiopia.

3.1.1 Specific objectives

The specific objectives to:

- ❖ Assess the performance and operation of agricultural investments in Gambella region.
- ❖ Identify the Socio-economic and sustainability of the agricultural investment projects in the region.
- ❖ Assessment of Environmental and cultural factors of the investments projects in the region.
- ❖ Indicate proper mitigation measures of the adverse impacts of the investments projects in the region.

3.2 Research questions

To meet the objectives we hopefully help to answer the following research questions:

1. Are these investments projects are in operation or not?
2. What are the social-economics impacts on the projects on local peoples?
3. Is there any impact of the projects on water, and soil?
4. Is there impact of the investment projects on forest cover change of the studies area?
5. Are these investments projects are sustainable in terms of sustainable development?
6. What mitigation measure approaches are needed to reduce the impacts of the investments projects on soil, water, air and plants?

CHAPTER FOUR: MATERIALS AND METHODS

4.1 Description of the study area

4.1.1 Location

Gambella region is one of nine administrative regions of Ethiopia located in West. It covers a total area of 25,521 Km². The region is located between 6° 28' 38" to 8° 34' North latitude and 33° to 35° 11' 11" East longitude. It shares borders with Oromiya region to the North and East and the Southern Nations, Nationalities and Peoples' Regional State (SNNP) to the South.

To the west it shares a border with South Sudan. Gambella region consists of three administrative zones (Anywaa, Nuer and Majang) and 13 districts (woredas), one special district and one city administration (Alemayehu et al., 2014). The study areas was Gambella Zuriya, Abobo, Goge and Dimma Districts in Anywaa zone and Godere District in Majang Zone shown in figure: 2 below.

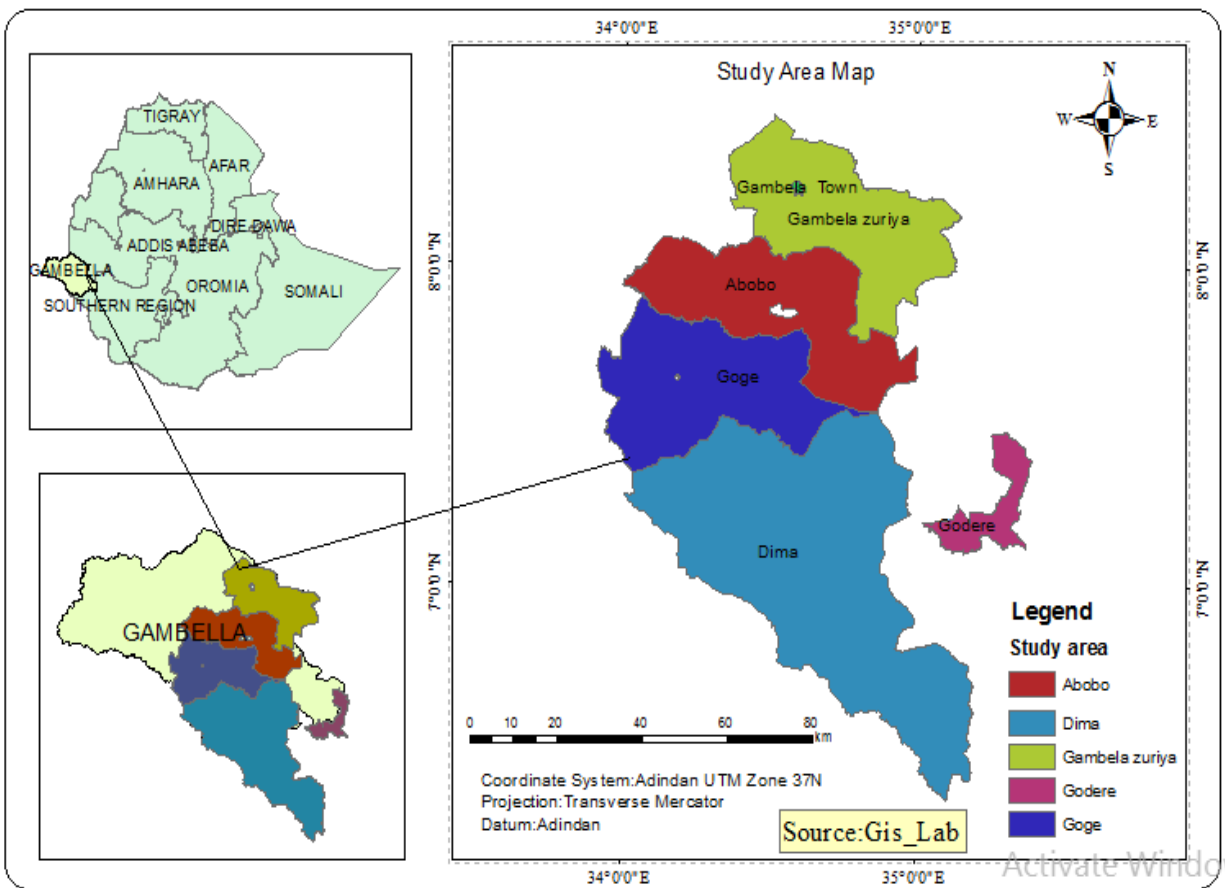


Figure 2: Map of the study area

4.1.2 Topography

Topography divides the region into two broad sub-regions, which are between 900 to 2200 masl (metres above sea level) and the flood plains below 500 masl. Due to favorable soil, topography and climate conditions, it is known to be one of the most fertile regions in Ethiopia and is suitable for growing various types of crops (Kottek *et al.*, 2006).

4.1.3 Climate and rainfall

This region lies within the hot to warm humid low land agro-ecological zone. The climate is classified as tropical savannah (Aw) by Koppen and Geiger (Kottek *et al.*, 2006). The average temperature is 27.6°C and 1,197 mm of average annual precipitation (Climate Data, 2014). The rainy season in the region starts at the end of April and lasts until October with the maximum rainfall in July (Degife and Mauser, 2017).

In addition, there are two main harvesting times known as *Meher* and *Belg*. In the *Meher*, crops are harvested from September to February and in the *Belg*, crops are harvested from March to August.

4.1.4 Water resources

Numerous perennial rivers cross the Gambella landscape, including the Alwero, Akobo, Openo and Gilo Rivers (Degife and Mauser, 2017). They all enter into the Openo-Akobo/Sobat river, which is the second most important river (after the Blue Nile/Abay), as it eventually drains into the White Nile, contributing 14% of the total Nile flows. The Baro Akobo river basin has an area of 75,912 Km², covering parts of the Benishangul-Gumuz, Gambella, Oromia, and SNNP (Awulachew *et al.*, 2007).

4.2 Study Design and approach

Cross sectional descriptive study design was employed for this study. Data was collected from August to September, 2020.

4.4 Sampling Techniques, Procedures

For this study purposive sampling techniques were used to collect data on Toren agro industries, Saudistar agro PLC, Assefa Birhane farm, Toren agro industries, Verdanta Harvest, Sannati and Galana Agro industries.

4.5 Large scale agriculture investments farms selection

In the region there are more than 818 investors in which 806 domestic whereas 12 are foreign investors. Accordingly after this investors have given a land lease both federal and regional governments they have shown have presence clearing the forest in region and disappear after they cultivated the land for some years. The only investors that are performing are Assefa Birhane, Saudistar star and Galana which are domestic and Verdanta Harvest, Sannati and Toren which are foreign investors.

4.6 Methods of data collection

4.6.1 Water sample collection

A total of 4 L of water samples was collected from selected farms. Hydrogen power (PH), Dissolved oxygen (DO) Electrical conductivity (EC) of Saudistar pond, Saudistar groundwater, Gelana ground water was measured onsite using portable digital multi parameters probes (Hanna LP 2000). For farms water quality parameters analysis water was sampled by using 1 L polyethylene bottles. Accordingly; 1 L from Saudistar pond, 1L from Saudistar ground water, 1 L from Toren farm ground water and 1 L from Gelana farm ground water. The sampled water was kept in cool box Having 4⁰ C and transport them to Jimma university environmental laboratory for analysis of Total nitrogen (TN), Nitrate-Nitrate (NO₃-N), Total phosphorus (TP), Total Suspended Solids (TSS), BOD₅, Total Hardness (TH), Chemical Oxygen Demand (COD), Soluble Reactive Phosphorus (SRP), Chloride (Cl⁻), Magnesium ion (Mg²⁺), Calcium ion (Ca²⁺) by following the standard method of (APHA, 2005).

4.6.2 Soil sample collection and preparation

Soil was sampled in the side the farms and outside the farms in Toren farm, Saudistar agricultural development PLC, Assefa Birhane farm, Galana and Sennati farms. A total of 9 Composite soil samples was collected from Assefa Birhane (1), Toren (2), Gelana (2), Saudistar (2), Akula (1) and Abobo forest (1) by digging a depth of 0-20 cm with help of soil auger.

Samples was collected and store in a clean polyethylene bag, labelled appropriately and taken Jimma University College of Agriculture and Veterinary Medicine soil laboratory and Addis Ababa University soil testing laboratory for further analysis. Samples was dried in the laboratory for two weeks and ground with mortar. The ground samples were then sieve through a 20-mesh sieve (> 2mm diameter) to make the sample suitable for chemical analysis as described by (Hesse, 1971;

Peterson, 2002; Dikko and Ibrahim, 1999; Ayodele and Gaya, 1998). Then soil samples were analyzed to determine the parameters accordingly.

The pH of the soil was measured potentiometrically by a digital pH meter in the supernatant suspension in ratio of 1:2.5, soil: liquid mixture (Van Reeuwijk, 1992). The organic matter (OM) content was analyzed by wet oxidation method Walkley and Black (Nelson and Sommers, 1982). Total nitrogen was determined by micro Kjeldahl procedure (digestion, distillation and titration) (Carter et al., 1997). Available phosphorus soils was extracted by the Bray-II method quantified using spectrophotometer (wave length of 880nm) calorimetrically using vanadomolybdate acid as an indicator (Bray and Kurtz, 1945). Cation exchange capacity (CEC) was determined by ammonium acetate saturation method (Van Reeuwijk, 1993). Exchangeable Ca and Mg in the extracts were determined by atomic absorption spectrophotometer whereas Na and K were determined by flame photometer (Chapman, 1965; Rowell, 1994).

4.6.3 Forest cover change Analysis in Gambella region

GIS and Remote sensing approach was conducted to quantifying the forest cover change of the commencement and current large scale agricultural investments in the region to know the magnitude of the change. For Spatio temporal analysis of land use /land cover change with emphasis of forest cover change, two season satellite images (Land images) of 2010 and 2020 were taken.

4.6.4 The Overall Performance of the projects farms intern of SD sample collection

The performance of large scale agricultural investments projects balance and their overall performances sample was collected. The purpose of the sustainable development analysis grid (GADD) is to give direction to sustainable development policies, strategies, programs or projects (PSPPs), in order to address their shortcomings and/or assess their progress. The sustainability of farms data interns Social, Economical, Ecological and Cultural, was assessed (Villeneuve *et al.*, 2016).

4.6.5 Key informant interviews

5 KIIs was selected from local community, youth, farm managers, model from house hold, local authorities to generate data on the large scale farms positive and negative impact of the projects. Audio taped with permission from participants to ascertain an accurate account of interview which can replay for analytical purpose and anonymity was used during the course of recording.

4.6.6 Field observation: Observation was carried out.

4.6.7 Personal communication: with experts and organization

4.6.8 Focus group discussion:

To understand the impact project on the community, focus group discussions (FGD) were conducted with the local community and farms managers. 3 FGD was conducted separately in three groups, local community kebele model, and youth and farms managers having 12 members' participants.



Figure 3: FDG with local community



Figure 4: FDG with local youth

4.6.9 Mitigation method suggestion of adverse impact of the projects

Mitigation method was suggested based on adverse impact Plants, soil, and plants.

4.7 Study variables

Dependent variables: Sustainable Development

Independent variables: Land use and land cover, socio-economics, soil characteristics, water quality.

4.8 Method of Data Analysis

The data collected through FDG, KIIs, Personal communication, Observation, Interview with tape recording was repeated, read and listen well, when it was well understood was edited, Organized in to meaningful fact and explained in detail. Data obtained from water and soil physico-chemical analysis reference guidelines was used. Sustainable development

GADD_EN_2017_SB.xlsx_microsoft Excel (Sustainability Grid) was used. The cover change analysis of the forest of the study area in the region was done by downloading satellite of 2010-2020 year from earth explorer website by classifying them using supervised classification method by ERDAS Imagine 2015 software. And calculating the matrix using union tools in ERDAS Imagine software then finally change detection (magnitude of change) in the study areas was analyzed.

4.9 Ethical consideration

Ethical clearance was taken from Institutional Review Board (IRB) Research Committee of Jimma University, College of Health Sciences to officially ascertain that the research will be relevant and approved by the college as well as by the Department of Environmental Health Science and Technology.

4.9.0 Dissemination of the study

After data is analyzed, based on the findings obtained, conclusions and recommendations will be made. Then the results of the study will be submitted to the Department of Environmental Health science and Technology, Institute of Health, Gambella region Environmental protection and climate change. The result will be presented during thesis defense, as a partial fulfillment of Master degree in Environmental Science and Technology. Finally the presentation of the results will be present on scientific conferences and to publish the results of the study on national as well as international journals.

CHAPTER FIVE: RESULTS

5.1. Performance and operation of large-scale agricultural investments projects in Gambella region

5.1.1 Status of Large-scale agricultural investments in GPNRS

During our field visit, regional district level respondents in the region have indicated that after issuance of land lease, almost all of them have shown up their physical presence in the area by establishing temporary offices and shelters for limited permanent workers. It was reported that the investors first cleared large tracts of land though they cultivated a limited part of the cleared land. The researchers observed that forests have been cleared to a wider extent in all the sample farms with insufficient part of it cultivated as shown in figure 3.

For instance, from the sample large scale agricultural farms included in this study areas, no single farm is found cultivating at least half of the land it received in the region. Only few of them such as Saudi Star, Toren Agro industries, Verdanta Harvests, and Galana Agro farms in the region have promising start but have developed only a small part of the total land sizes they received Shown in (table: 1) below.



Figure 5: Plant species removal in Gambella Zuriya.

Table1: Sample Large scale agricultural Farms in GPNRS.

S.No	Location of the project	Name of the company	Origin of the investors	Size of the land leased (Ha)	Year transferred	Land use agreed (crop types)	Size of land Developed (Ha)	Current land use
1	Gambella (Zuria District)	Asefa Berhane	Ethiopian	500	2006 E.C	Cotton, Sesame, maize and Sorghum	Less than 40	Maize
2	Abobo District	Saudi Star Agricultural Development P.L.C	Ethiopia/Saudi	10000	Aug. 2009	Rice	1200	Rice, cotton and Sorghum
3	Godere District	Verdanta Harvests P.L.C	Indian	3072	2013	Tea	500	Tea and Coffee
4	Dima District	Galana Agro-industries	Ethiopian	1500	2009	Sesame	760	Rice, Masho, Sorghum
5	Dima District	Sannati Agro-industries	Indian	10000	2011	Rice	**	Rice, Sesame, <i>Masho</i>
6	Gog District	Toren Agro-industries P.L.C	Turkey	6000	2011	Cotton and Soya bean	2000	Cotton, Maize

** The researcher couldn't get clear figure on the size of land developed (neither the investor nor the farm manager was on site during the field visit).Source: Sample Large scale agricultural Farms obtained during field visit by author.

5.1.2 Performance and Operation of the projects farms

Despite the hundreds of thousands of hectares of land lease to investors for large scale agricultural investments in GPNRS the performance and operation of the farms is not promising due to many challenges. One the problems we observed during our field visit is the lack of well-organized data on the number of investors in the region and the exact size of land they received. Discrepancies regarding the number of investors was observed at regional and districts level. Investors in the region are not utilizing machineries for example in Gambella Zuriya Assefa Birhane farm operating in a very traditional way which limits their production capacity. Toren Agro industries and Saudi Star have expected machineries which if they utilize it to the fullest level would help them carry out mechanized farming. The result of this study as shown that actual performance and operation of the farms in the region shows that because of a number of challenges from investors' side and the various actors. The performances of the majority of large-scale agricultural investments that were surveyed in Gambella Regional State were low.

5.2 Socio-economic Impacts of Large-scale agricultural investments in GPNRS

5.2.1 Positive Impacts

5.2.1.1 Employment opportunity and its implication on livelihood

In the projects under investigation, few of the local people for about 60 -60 were employed as daily laborers, 2-3 security guards around farms. According to our respondents this is because of two factors: one the local communities are few in numbers who do not fill the labor demand of the farm. The second reason is their traditional work experience does not go with such intensive task and the lack of interest among the local communities to engage in the laborious seasonal activities (STM, 7). To be productive and profitable the farm imports experienced workers in cotton and sesame crops from Amhara and SNNP regional states. It is reported that many of the investors employed workers from their own locality rather than using the local communities. For instance most of seasonal laborers in Gambella large scale agricultural investments farms were mainly come from the Oromia region and SNNP (GZLC 4, 5, 6). Verdanta PLC in Godere district employs as high as 1500 daily laborers from the local community. Sanati in plc in Dimma district employs as high as 400 workers during harvesting time.

In this study the result has shown that Verdanta PLC in Godere district employs as high as 1500 daily laborers from the local community. Sannati in PLC in Dimma district employs as high as

400 workers during harvesting time. V. Kumar, delegate of farm manager of Sanati Agro Industry has criticize the local people saying that recruiting of seasonal workers will be carried out after searching seasonal laborers in some other regions this is because the local population work tradition is too backward and are not hard workers not willing to engage on farm lands.

In Saudi Star Agricultural Development Plc, however, due to extended nature of the farm as compared to other farms under investigation, the project employees about 2000-3000 seasonal laborers which were recruited from Oromia regional state (Dembidolo) and SNNPR. Insufficient consideration towards training locals for skilled jobs is observed during our observation. Only two Anywaa youths were trained as tractor operators and have been serving the project as permanent worker (ABLC 9, 10).

5.2.1.2 Technology transfer

This study has revealed that Saudi Star Agricultural Development PLC supported the local community to produce rice on their own cultivation land by providing improved rice seed. The company has installed a grain mill which estimated 100,000 birr in Abobo town (ABLC7, 9, 10, 11). In 2014, Saudi Star Agricultural development PLC provided 26 tractors which estimated 30 million Ethiopian Birr to 13 *weredas* of Gambella regional state. (For each *wereda* two tractors) The company has installed a grain mill which estimated 100,000 birr in Abobo town (ABLC 7, 9, 10, 11).

5.2.1.3 Corporate Social Responsibilities

The Saudi Star Agricultural development PLC have distributed water filters for 20 household and constructed dry weather road in Abobo town. The clinic of the company is providing free medical service for the local population. Also provided insecticide treated bed net. During the construction of Gilo river irrigation dam, the Saudi Star Agricultural Development Plc provided a water pump. (SSTM 9, 10). The Senati Agro industry supported the local community of Bandira *kebele* by providing their machinery to clear farm land (SATM, 12).

5.2.2 Negative Impacts

5.2.2.1 Loss of Local Land Rights and Indigenous Land Use

According to the information obtained from our key informant at *Dimma Woreda*, because of the large-scale land acquisition by the agricultural investors, forests have been cleared and the local communities of the *Anywaa* are forced to relocate to other area. Accordingly, many of the communities impacted by the land deal are being targeted for forced relocation and have no land tenure security over their ancestral lands as the region lacks formal systems of land tenure and property right.

5.2.2.2 Displacement and Disruption of Traditional Way of Life and Deprivation of Access to Vital Resources

According to the information we secured from Godere Woreda local communities, there is still an ongoing disagreement with Verdanta Harvest Plc which has started its tea plantation in the wereda on 3012 hectare of land. The project is situated on highly forested land where the local community depends on the forest and forest based resources for their livelihoods.

5.2.2.3 Land/Boundary Dispute between Investors and Natives

In our investigation, we found that the land transfer process is quite challenged by the lack of transparency. Among the large scale farms we have included in this study, most of them secured the land directly from the federal government without clear communication with the regional governments. This has resulted in the encroachment investment lands to the local community's farming ground which served as the source of conflict between the investors and the villagers. As the investors started to clear the forest, the local communities started to oppose and show their dissatisfaction.

5.2.2.3 Perception of the local Community about Large Scale Land Acquisition and Social Conflict

In region, following the ongoing land acquisitions, there has been a growing influx of seasonal migrants laborers coming mainly from Oromiya regional state, SNNP, Tigray and Amhara to the area for wage employment in areas such as weeding and mowing .Since they were employed on seasonal agreement basis, many of the laborers resorted to stay in the area after the completion of their contracts. They tend to encroach into the forest to acquire land so that after cultivating for a year or so they in due course bring their families. As a result, mainly in Gambella Zuriya and Abobo woredas, "illegal" settlements has been established which became a source of contention

between the “settlers’ and the local community. As they notify that they have gained no economic or social benefits from the investment projects, local communities are developing negative attitudes and hostilities towards large scale land investment (GZLC 1, 2, 11).

5.3 Cultural impact of large scale agricultural investments in GPNRS

5.3.1 Negative impacts

5.3.1.1 Damage to cultural heritage

Omedboki is a home of indigenous Anywaa peoples containing five villages in Gog district .These villages have been inhabited Anywaa peoples for hundreds of years. According to KIIs Mr Obang Ongeili on May, 8, 2020 Kidane Agro PLC investment project Have Bulldozered and excavated their ancestral Kings and Chiefs graves areas and transformed the area in to the farm field. This investment have destructed and excavated the graves of the villages’ kings and chiefs and burn their bones. According to him for clear boundary and for land return he went to Anywaa zone for better solution but no one could listen to him.

5.3 The impact of large-scale agricultural investments project on water quality

As shown in Table 2, the water quality analysis results show that high concentration of nutrients (TP, TN, SRP and Nitrate) and high turbidity measured in terms of total solids (TSS and TDS).

Table 2: Physico-chemical characteristics of large-scale agricultural investments fresh water sample collected from selected farms in GPNRS

Parameters	Unit	Sampling Woreda/Districts/			
		Abobo	Gog		Dimma
		Name of the sampled farms			
		Saudi Star Pond	Saudi Star GW	Toren Farm GW	Gelena Farm GW
PH		8.18	6.33	6.89	7.23
EC	µs/cm	74.4	125.6	361	48
DO	(mg/l)	5.6	3.5	**	**
COD	(mg/l)	23.8	7.67	8.74	18.2
BOD ₅	(mg/l)	19	6.14	7	14.56
TN	(mg/l)	1.33	0.192	8.33	0.364
NO ₃ -N	(mg/l)	0.13	0.03	1.12	0.06
TP	(mg/l)	2.11	0.61	2.63	1.89
SRP	(mg/l)	0.64	0.49	2	0.48
Chloride	(mg/l)	9.99	13.99	19.99	11.99
Alkalinity	(mg/l)	28	48	112	24
Total Hardness	(mg/l)	56	68	132	76
Ca ²⁺ Hardness	(mg/l)	38	43	89	57
Mg ²⁺ Hardness	(mg/l)	18	25	43	19
TSS	(mg/l)	590	319	325	64
TDS	(mg/l)	1168	1004	1568	1372

Note: PH is unit less, Conductivity is in S/cm and the rest parameters are in mg/l. GW is groundwater; SRP is Soluble reactive phosphorous; TDS is Total Dissolved Solid; TSS is Total Suspended Solid;

5.4 Soil qualities of large-scale investments in Gambella region

5.4.1 pH-H₂O

The soil pH in the large-scale agricultural farms found in three districts (Gambella Zuria, Gog, and Abobo) was found to be at normal range. However, the soil pH in Dima district at Gelana Large scale agricultural farm was found relatively acidic when compared with the references sample from Akula in the same district shown in (Table3). The soil laboratory results indicated that with the current condition, soil salinity is not a problem in the large-scale agricultural farms of the region.

5.4.2 %OM

Most soils contain 2-10% of organic matter. As shown in (Table 3).The laboratory results revealed that the percent organic matter of the soil of the large-scale agricultural investments farms in Gambella region is low (less than 5%). Nevertheless, the soil texture of the large-scale agricultural farms in Gambella region except Saudi Star and Toren were sandy clay loam which is not fertile by nature.

5.4.3 Cation Exchange Capacity

The CEC in the project farms found in three districts (Gog, Abobo and Dimma) was found in High range. Where as in Gambella Zuriya, Dimma and Abobo was in medium range. But the CEC of Saudi star in Abobo district was high CEC compare to its control which was in medium range.

5.4.4 Available phosphorus

The Av. P was very high range in Gambella Zuriya, Gog and Abobo large scale agricultural investments farms.

5.4.5 Total Nitrates

The TN of the large-scale agricultural investments projects was in medium range in Gambella Zuriya, Gog and Dima Districts projects farms. However, the TN of Gelana farm in Dima was in medium range compared to its reference in Akula which was found in high range. Similarly, in Abobo district in the forest area the soil TN was found in low range.

Table 3: Soil quality characteristics of large-scale agricultural investments projects farms in Gambella region.

S. No	Farm Name	Woreda	Site/crop type	Soil Quality parameter & units									
				pH-H ₂ O	%OM	TN%	Av.P(ppm)	CEC(meq/100 gm)	cmol(+)/kg				Soil texture
									Ca ²⁺	Mg ²⁺	K+	Na+	
1	Assefa hane	Bir-Gambella	Maize	6.97	3.01	0.151	48.18	20.53	16.01	2.13	9.64	0.066	Sandy clay loam
2	Toren	Gog	1(sediment)	6.68	5.16	0.258	29.65	27.81	21.69	2.88	5.93	0.029	Clay
			2	6.1	4.13	0.206	2.9	37.75	29.43	3.91	0.58	0.04	Clay
3	Gelana	Dimma	1	5.9	2.38	0.119	33.95	23.26	18.14	2.41	6.79	0.036	Sandy clay loam
			2	6.3	4.44	0.222	12.65	23.39	18.23	2.42	2.53	0.028	Sandy clay loam
4	Saudi star	Abobo	Impacted	7.26	1.82	0.091	20.41	22.15	17.27	2.3	4.08	0.049	clay loam
			Control	6.25	2.78	0.139	5.23	22.05	17.19	2.29	1.05	0.029	clay loam
Outside the project side		Dimma (near Akula)		6.47	**	0.31	5.5	25.58	**	**	**	**	Sandy clay loam
		Abobo (forest area)		6.5	**	0.11	2.12	39.40	28.4	8.6	0.42	0.89	Clay loam

**Missing value

5.5 Forest cover change Analysis in Gambella region

5.5.1 Land use land cover distribution in 2010 and 2020 of the Gambella region

In the present study land use distribution categories of the study area was examined based on spatial extents of the forest cover and their change using six (6) satellite images of the study areas. For critical examination of the land use covers, sample of four land cover categories were identified. This includes water bodies, settlement, forest, and farm land.

The land use land cover categories in Figure 6 below shows that farm land is the most predominantly land use cover in the study areas followed by settlement in 2010 and in 2020. Though there was forest cover in the past of the study areas, it is decreased from to time due investment projects and settlement.

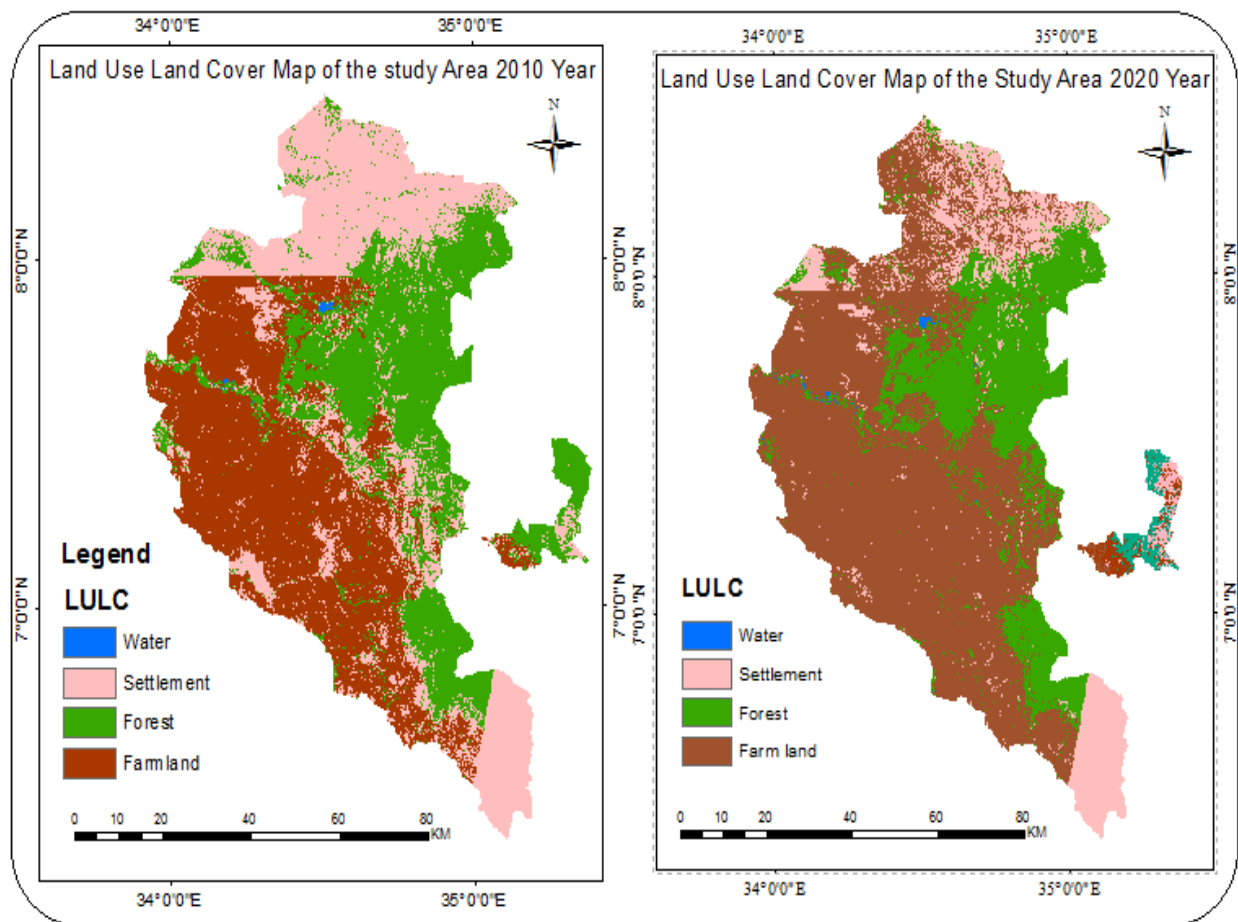


Figure 6: Land use land cover distribution in 2010 and 2020 of the Gambella region

5.5.2 Land use Land Cover change of 2010-2020 Matrix table

Land cover changes of 2010 to 2020 for the study areas of Gambella region was presented on (Table 4). The areal extent of LULC of the study area was summarized to detect the nature of major changes occurred between 2010 and 2020. The 2010 cover analysis land use /land cover class of aerial photo table shown that (4) the land devoted to forest was 99769 ha and 33155 ha of the land that was covered by forest in the year of 2010 and 2020 respectively.

Table 4: Land use Land Cover change of 2010-2020 Matrix table

Year 2020						
Year 2010		Area in Hectares				
		Settlement	Forest	Water	Farm land	Total Class
	Settlement	241925	33155	0.4275	309678	584,758.4275 hec
	Farmland	375.90	0	0	677651	678,026.9hec
	Water	0	0	1634.56	1.1925	1635.7525hec
	Forest	99769	18414059	52904	315591	18,882,323hec
	Total Class	342,069.9	18,447,214	54,538.9875	1302,921.1925	
	Class Change	242,688.527	-17,769,187.1	-52,903.235	17579401.8075	

5.5.3 Forest detection map of Gambella of Gambella from 2010-2020

As the aim of this land sat image of 2010 and 2020 were used to analyze the rate of forest cover change. According to matrix table (7) the rate of forest cover change between 2010 and 2020, the computed result is 6661.4 ha within ten years i.e. (99769 ha-33155/10) years. In the present study between the year 2010 and 2010 the magnitude of forest cover decreases by 6661.4 ha within ten years as shown on figure 7 below.

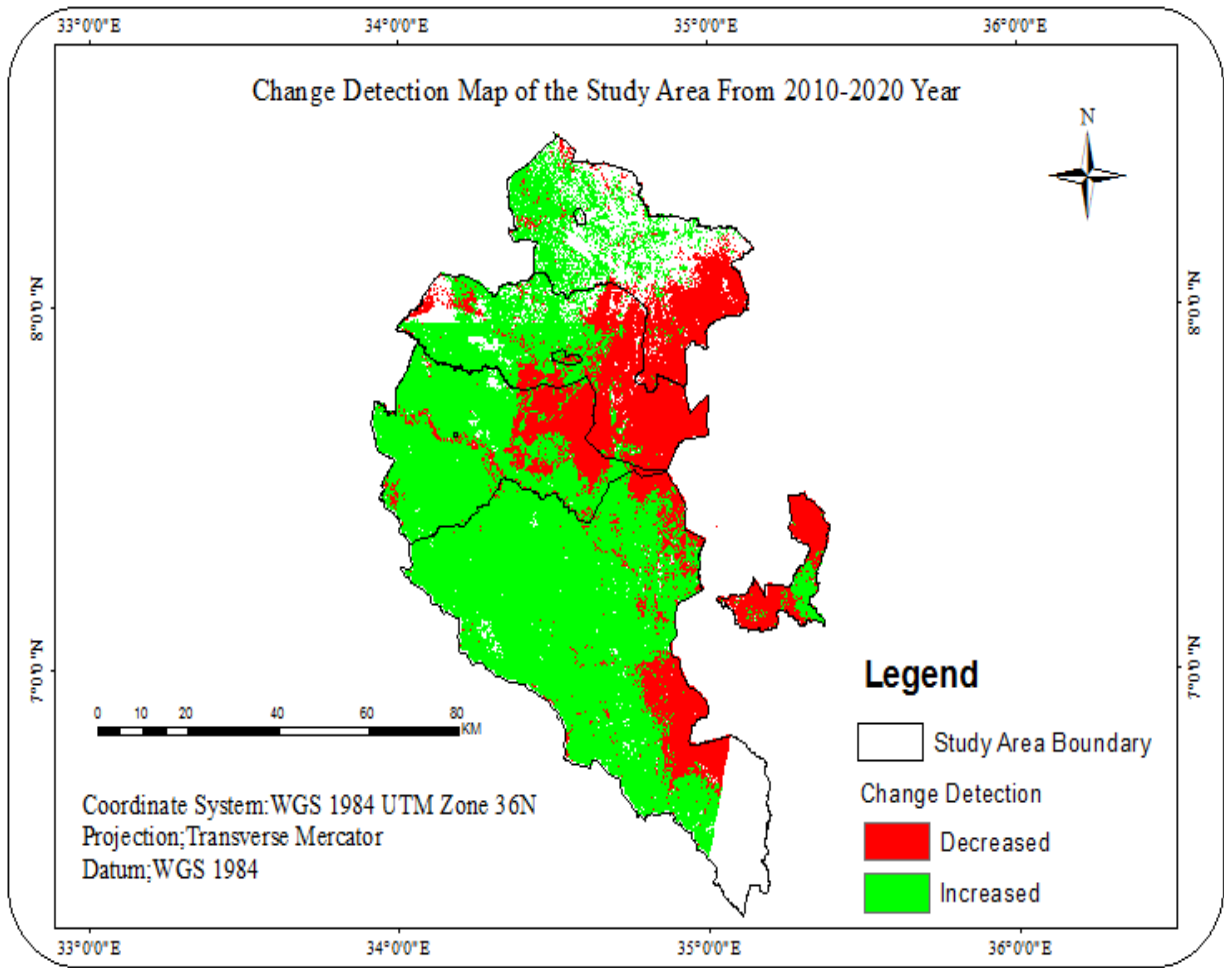


Figure 7: Change Detection Map of Area from 2010-2020

5.6 The Performance of large-scale agricultural investments in GPNRS LSAIPs in terms of sustainable development

5.6.1. Performance of the social dimensions themes of sustainable development

The over performance of the social dimensions themes of sustainable development of the Gambella LSAIP is 34%. The result has indicted that the performances of the projects has problematic situation in terms of social dimension shown in figure 8 below.

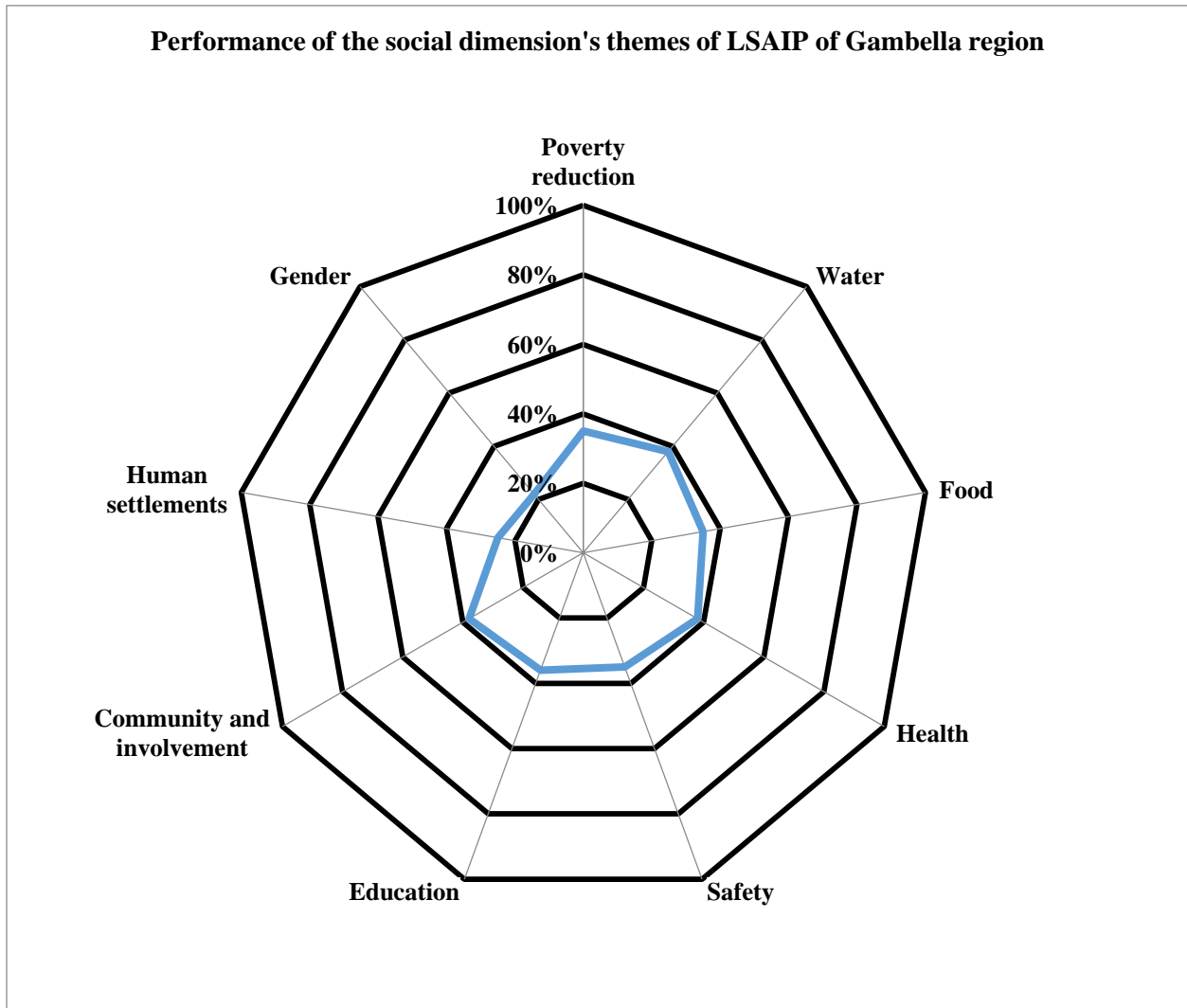


Figure 8: Performance of the social dimension theme

5.6.2 Performance of the ecological dimensions themes of sustainable development

The over performance of the ecological dimensions themes of sustainable development of the Gambella LSAIP is 31%. The result has indicted that the performances of the projects has problematic situation in terms of ecological dimension shown on figure 9 below.

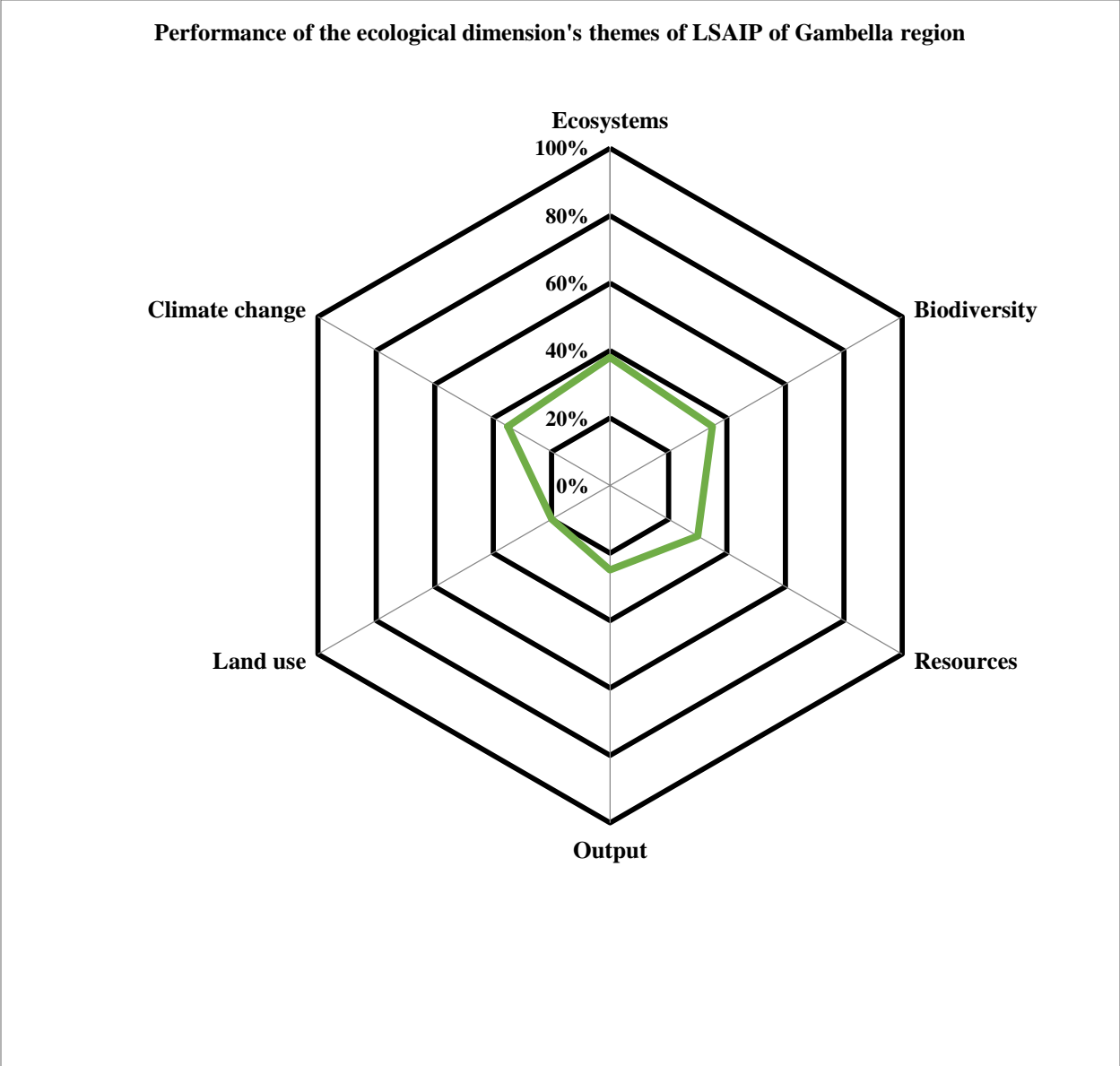


Figure 9: Performance of the of the ecological dimension themes

5.6.4 Performance of the economical dimensions themes of sustainable development

The over performance of the economic dimensions themes of sustainable development of the Gambella LSAIP is 40%. The result has indicated that the performances of the projects has improvable situation in terms of economical dimension shown on figure 10 below.

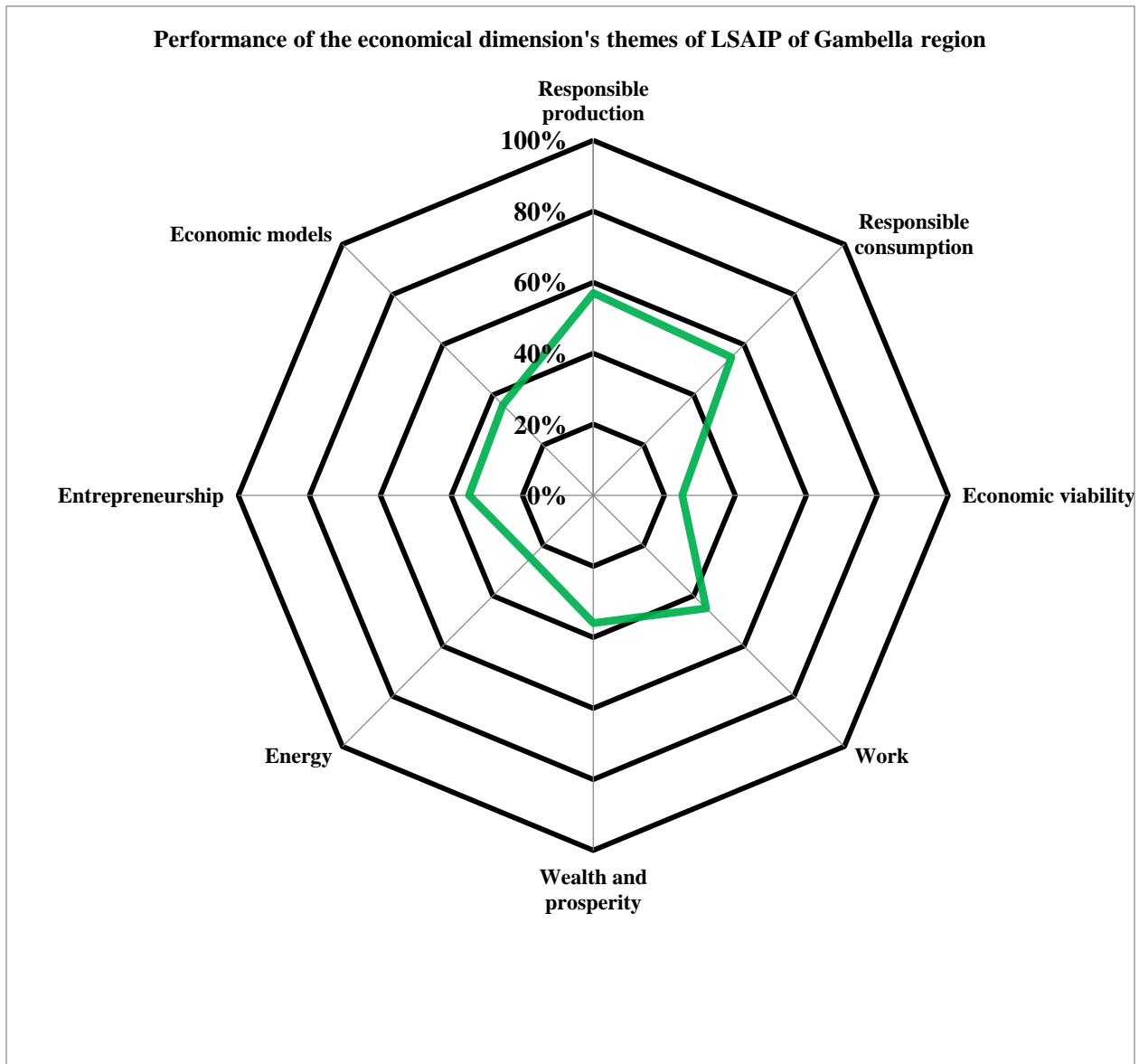


Figure 10: Performance of the economic dimension themes

5.6.2 Performance of the cultural dimensions themes of sustainable development

The over performance of the cultural dimensions themes of sustainable development of the Gambella LSAIP is 29%. The result has indicated that the performances of the projects has problematic situation in terms of cultural dimension shown on figure 11 below.

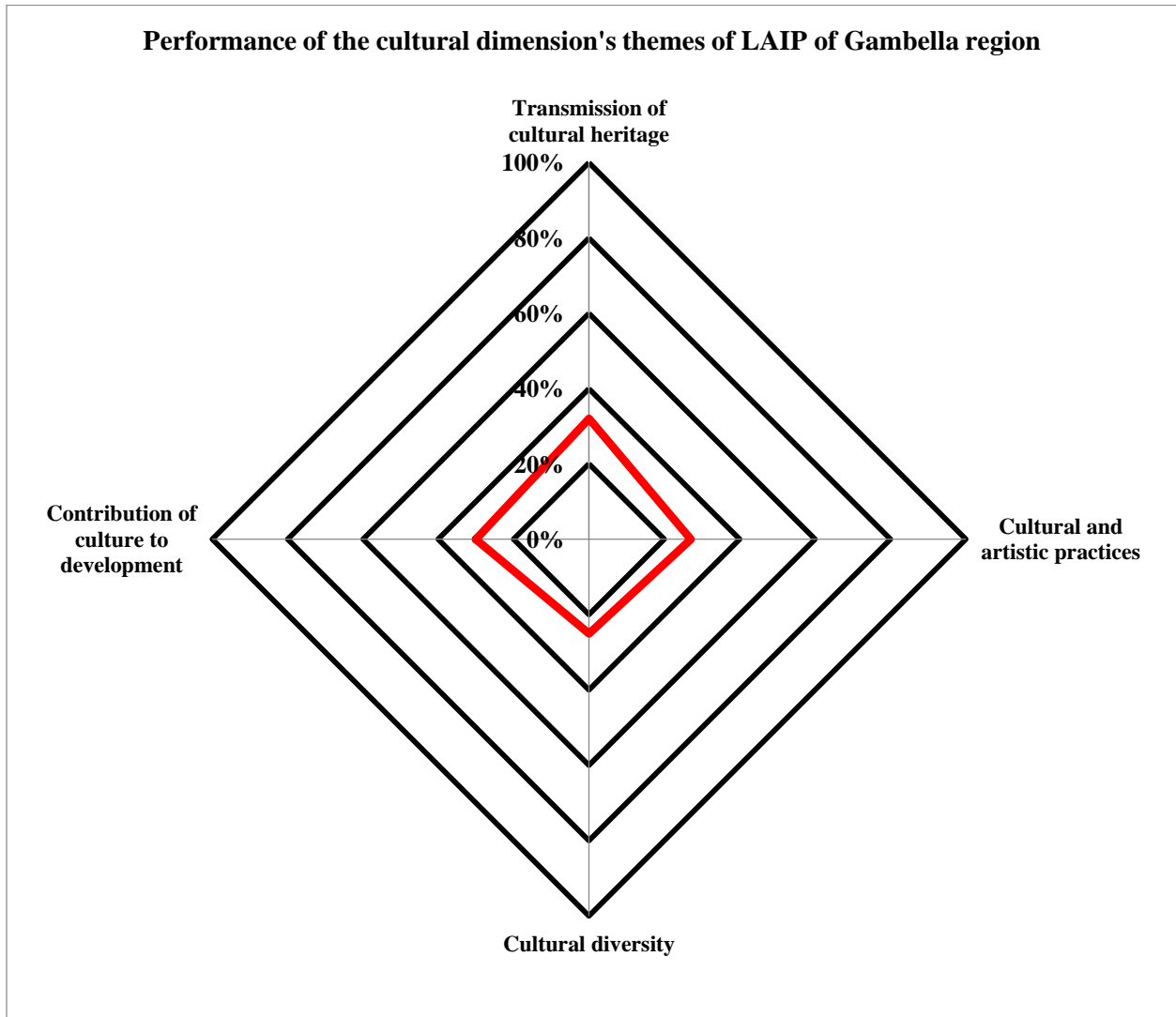


Figure 11: Performance of the cultural dimensions themes

5.7 Mitigation measure on the impact of water, soil and forest

5.7.1 Impacts on soils and mitigation measures

Impacts of intensive farming damage to soil erosion affects productivity because it removes the surface soils, containing most of the organic matter, plant nutrients, and fine soil particles, which help to retain water and nutrients in the root zone where they are available to plants. Improper land development can also cause an impact of soil degradation because of land cover change and conversion of the existing land use type to agricultural land that disturbs the landscape, soil stability and leads to different forms of soil degradations. Based on the climatic conditions, agro-ecological zone, soil types, and topography the forms of soil degradation expected due to the project activities. In the project sites, soil erosion could result from a number of activities through modification of the natural vegetation and landscapes. Erosion could result through forest and grass clearing and destabilization of slopes at cut/fill sites and drainage modifications. The risk of erosion due to slope destabilization was prevalent in the project areas during land development for the inbuilt areas and construction of access roads. In particular, Toren, Gelana plcs were highly susceptible to erosion and slope destabilization.

Table 6: Impacts of Soil erosion in the project farms.

Impact Type	Direct
Impact Effect	Adverse (negative)
Environment before transfer to investors	Since the project in the region were woodland and riparian forest untouched for several years, there was no erosion affected areas.
Affected Environment	Vegetation clearing and land development with machineries created a higher risk of erosion and land degradation. Application of farm chemicals by many of the farms
Impact	Loss of top fertile soil. Siltation of drainage ways and waters, and nutrient enrichment of natural water bodies downstream. Soil contamination by farm chemicals
Spatial Extent	Entire project areas
Temporal Extent	Impacts during land development and during project operation
Impact Scale	Significant

The following mitigation measures are proposed to reduce the adverse impacts of soil erosion. Constructing buffer/filter strip to control erosion and siltation during land development. Applying different biological, soil management (Contour ploughing) and mechanical conservation (bund, terraces,) measures are very important to reduce the effects of water and wind erosion in the project areas. Farm chemicals and liquid and solid wastes from workers might result soil contamination. Contaminated soils and water will pose health hazard on human health and animals. Proper agro-chemical application and proper handling of obsolete chemicals and empty storage containers should be employed.

Besides, apply proper water and sanitation and avoid open dumping of both liquid and solid wastes without adequate treatment.

5.7.2 Impact on water and mitigation measure on the impact of water

Runoff from all categories of agriculture leading to surface and groundwater pollution. In the project areas, the main environmental impacts envisaged on water resources are pollution arise from farm chemicals. In addition, more than 50% of the large-scale farms have no access to improved sanitation and even some farms practiced open defecation. Hence, it pollutes both surface and groundwater.

Table7: Impact of water resources

Impact on Water Resources: Surface water flow modification and pollution	
Impact Type	Direct
Impact Effect	Adverse (negative)
Environment before transfer to investors	Most drainage channels were at their natural state and have no problems of siltation and nutrient enrichment. There was little use of agrochemicals in the area and very sparsely populated area with little human impact
Affected Environment	Risk of surface and ground water pollution.
Impact	Surface water and ground water pollution (from agrochemicals & human waste)
Spatial Extent	Entire length of the project influence area
Temporal Extent	Land development and operation

Impact Scale	Significant
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The following mitigation measures shall be employed to balance the impacts on surface and groundwater flow modification and water quality: All large-scale farms shall be practiced soil conservation, and water source buffer zone protection and water pollution prevention. Avoid also dumping of untreated agrochemicals or wastes into water bodies and unlined pits. Servicing of vehicles, machineries, plants and motors shall be conducted away from water bodies and shall be conducted inside workshops.

5.7.3 Impacts on plants and mitigation measures

Clearing of trees and bushes may also cause habitat loss as well as favours the expansion of alien invasive species particularly those introduced species as a shade plant or for commercial purpose in the study area. Meanwhile, deforestation and introduction of fire might have disturbed the animals and forced to evacuate or exposed to illegal hunting. Regardless of their sizes, fauna and flora diversity boosts ecosystem productivity and plays very important role in the environment. Generally, change in land use by the project activity will contribute to climate change at local, regional and global level through increasing atmospheric carbon concentration through removing carbons stored in vegetation and avoiding further sequestration through vegetation cleaning.

The impact can be mitigated via restoration activities, re-vegetation and leaving patch of vegetation and wildlife corridor at a given interval (35-40 m) width between 100 ha cultivated lands) and applying the principles of biochar production (pyrolysis) instead of burning the removed vegetation in open air.

Table8: Impacts on plant species.

Impact on Flora: Impacts related to land development and farming activities	
Impact Type	Direct and indirect
Impact Effect	Adverse (negative)
Environment before transfer to investor	The project influence area is almost at its natural state and supports a wide variety of plant species diversity and harbours wild fauna. There was no strong destructive wind.
Affected Environment	The entire area of the project site that was used for agriculture and its influence area.
Impact	The direct impacts were forest clearing and ecosystem modifications (habitat fragmentation) that leads to loss of biodiversity (flora and fauna). Loss of livelihood for the local people that depend on the natural forest. Indirect impacts associated with the reduction of forest that can be used for carbon sequestration and its impact on the alteration of climate. Facilitates erosion and aggravate pollution. Strong destructive wind introduced. Introducing of destructive heavy wind.
Spatial Extent	The total stretch of woodland forest within the project influence area
Temporal Extent	Project implementation and operation
Impact Scale	High

CHAPTER SIX: DISCUSSION

6.1 DISCUSSION

6.1.1 Performance and operation of large-scale agricultural investments projects in Gambella region

6.1.1.1 Status of Large-scale agricultural investments in GPNRS

In this study the investors have shown up their physical presence in areas in the land given to them, clearing the forest and cultivating half of the land .But few of few of the them which are interested to invest in the region as it was shown on shown (Table1).According to study of (Molnar, 2014) which is line with our finding who report that many of the investments farm projects fail to develop the land as they promise, impact on other user. (Azeb, 2017) has also reported that this investments projects after cutting and clearing the forest and savanna they are not actively involved in operation results an adverse environmental impact, in particular on natural resources such as land, water, forests and biodiversity. Study of (Degife and Mauser, 2017) go together with this finding according to them after acquisition of the land, both foreign and local investors are cutting and clearing the forest and savanna, they are not involved in operation or operate small portion from the total land covered by crops. An assessment study conducted by the UNDP Ethiopia in 2013 has also indicated the operation and status of 112 large scale agricultural investments and concluded that despite the larger size of leasehold, the greater percentage of land was unutilized and from a land holding of more than 10000 hectares, only 1 percent of the land was utilized though for most of the farms.

6.1.1.2 Performance and operation of large scale agriculture

In the present study the actual performance of the sector in Gambella region shows that because of a number of challenges from investors' side and the various actors, it seems that it is far from meeting the expectations of the people and the government. As it was indicated by scholars like (Desalegn, 2011; Keely *et al.*, 2013) and also observed during field visit in the region in 2020, land allocation to investors was too hasty without identification of the capacity and intention of both the domestic and foreign investors. Study conducted by (Nalepa., *et al.*, 2016) in Benishangul Gumuz support our finding who reported that land banks is overlapping with districts whose population are practicing shifting cultivation .

6.2 Socio-economic Impacts of Large-scale agricultural investments in GPNRS

One of the key mechanisms through which the development of large-scale commercial plantations can bring direct benefits to affected communities is through plantation employment (Schoneved *et al.*, 2011). (Kuto *et al.*, 2018) has also report that large scale agriculture projects firstly they say that the job opportunity would be given to the surrounding community who is owing the land mean while they kept their promise. They decrease the number of employing from the local when they establish their project. Land transfer have been for addressing the country food security, earning foreign currency and generating income, rent fees, income tax and employment creation (Shete and Rutten, 2015). Employment contribute significant livelihood (Schoneveld *et al.*, 2011).

In the present study very few of the local community were employed as a daily laborer, security guard around the project farms. Because they are few in number which does not fulfil the labor demand of the farms and their traditional work experience does not go such intensive task and are not hard worker not willing to engage on the farm lands. Study conducted by (Azeb, 2017) is in line with this finding who report that large scale farm employees came from various parts of Ethiopia rather than the local or indigenous people. Study conducted by (Dheressa, 2013) is in line with our finding who reported that because local peoples are not employed because of they don't have skill they and they bring skilled job from urban areas of the country or from India. Large-scale investment can increase land productivity, improve access to technology, create jobs, diversify the local economy, increase local income, create market linkages, and attract complementary investment (Desalegn, 2011). In the present study the Saudistar agro development PLC supported the local community to produce rice by their own cultivation land by supplying rice seed. It also distributed 26 tractors to 13 districts of the region and installed grain mill in Abobo town. (Kuto *et al.*, 2018) reported that large scale agriculture investments project when introduce to society they promised to fulfilled social services such as road, electricity, hospital, water supply school and etc. According to study to study of (Nolte and Subakanya, 2016) investor are perceive to solve community problem. They build school, electrification and health facilities. In the present study Saudistar agro plc have distributed water filter 20 households, constructed dry weather road in Abobo town, their clinic provides free medical service for the local population, provided insecticide treated bed and provided water pump during construction irrigation dam. The Senati agro plc has provide their machinery to clear farms of the community in Bandira village. (Moreda ,2013)

stated that forced displacement that results from large scale agricultural investment negatively affects the livelihood of the local communities by denying their access to the key resources what have been so far used as common property. In the current study the main reason of displacement of households are smallness of their number and over lapping of with aerial map of investment delineated areas. So this forced displacement has disrupted their livelihood.(Makutsa, 2010) who report the agricultural investments cause loss of access to land for small scale agricultural production including subsistence food production and pastoralism, and loss of access to natural resources such as fisheries, forest products such as honey, water resources among others. In Tana delta in Kenya the issue of land ownership has complicated for local communities, their livelihood is affected, they land ownership even ancestral land. Land grab has been threatening of the livelihoods of local communities which include small scale farmers and pastoralist who use the land and their natural resources for subsistence. Most of the land grabbing is taking place where the land users to not have legal ownership rights over the land regardless of whether or not they have used the land for generations. In present study the local community are feeling that the project farms are depriving them of vital resources from until nown was their common property. In present study in Godere district there is disagreement with Verdanta Harvest this project is situated on highly forested land where the local community depend on for their livelihood. But this project did not allow the local community to use forest-based resources. Study conducted by (Fratkin, 2014) in the region in line with our finding who report that much of the forested have been cleared for farming and local populationswhotraditionallypracticedagricultureandcattlepastoralismhavebeenrelocated. In our finding in Dimma District because of agriculture investments Anywaa community were relocated to other areas. Study of (Shete and Rutton, 2015) is in line with this finding who reported agriculture investments make the local people not to have legal land right and making the living from the land. According to our finding the majority of the community impacted by the projects are forced to relocation and have no tenure security over their ancestral lands and property right.

6.3 The impact of investments on water quality

Improving agricultural productivity, while conserving and enhancing natural resources, such as water, is an essential requirement for farmers to increase global food supplies on a sustainable basis (FAO, 2017). Physiochemical parameter study is very important to get exact idea about the quality of water to enable comparing results of different physiochemical parameter values with

standard values (Kur. *et al*, 2019). The investment project has also impacted on water resources of the area. Large scale farming use large quantities of fertilizers and pesticides and water bodies near the project area get contaminated (Dheressa, 2013). In the present study the water quality analysis results show that high concentration of nutrients (TP, TN, SRP and Nitrate) and high turbidity measured in terms of total solids (TSS and TDS). High total phosphorous is due to higher releasing of phosphate from phosphate containing fertilizers (Korostynska *et al.*, 2012). Total suspended solid content of water is the amount of suspended particle, soil and silt which is related to turbidity of water (Gebreyohannes *et al.*, 2015).

6.4 Soil characteristics of the investments projects of the Gambella region farms

Enhancing soil quality generate production, adaptation and mitigation benefits by regulating carbon, oxygen and plant nutrient cycles, enhance resilience for drought and flooding, and carbon sequestration (Lipper, 2014). (Harizanova-bartos and Stoyanova, 2019) have reported that the major source of soil pollution is agricultural practices. In the present study the soil pH in the large-scale agricultural farms found in three districts (Gambella Zuria, Gog, and Abobo) was found to be at normal range. However, the soil pH in Dima district at Gelana Large scale agricultural farm was found relatively acidic when compared with the references sample from Akula in the same district shown in Table 3. The soil laboratory results indicated that with the current condition, soil salinity is not a problem in the large-scale agricultural farms of the region. Soil texture have a effect on many other properties and is considered as the most significant physical properties (FAO, 2006).

The CEC is the ability to adsorb and releasing cations. Very wanted for the guessing of the contaminant transport potential and sorption capacity for any soil location and for the total number of cations it retain and adsorbent complex at any pH (Ololade *et al.*, 2010). CEC is the ability of soil to retain and reverse K, Na, Mg and Na elements and sustains and retain plant growth. Also an indicator for soil productivity and fertility (Horneck *et al.*, 2011). In this finding the CEC in the project farms found in three districts (Gog, Abobo and Dimma) was found in High range. Whereas in Gambella Zuriya, Dimma and Abobo was in medium range. But the CEC of Saudistar in Abobo district was high CEC compare to its control which was in medium range. TN is the amount of nitrogen available in the soil, in organic matter and is not found in the plants (Hazelton and Murphy, 2007). In this study TN of the large scale agricultural investments projects was in medium

range in Gambella Zuriya, Gog and Dima Districts projects farms .However the TN of Gelana farm in Dima was in medium range compared to its reference in Akula which was found in high range. Similarly, in Abobo district in the forest area the soil TN was found in low range. Similarly, the Av. P was very high range in Gambella Zuriya, Gog and Abobo large scale agricultural investments farms as describe by (Landin, 1991).

6.9 Forest cover change Analysis of Gambella region

Environmental consequences the projects farms is the removing of grasses and vegetation covers from the land. Grasses have been removed and trees were cut to ready the land for large scale farming, which resulted in deforestation and elimination of vegetation cover (Dheressa, 2013).Expansion of large-scale agricultural investments in Gambella region was the cause that contribute to declining of the forest in Gambella region (Othow *et al*, 2017). In the present study land use distribution categories of the study area was examined based on spatial extents of the forest cover and their change using two (2) satellite images of the study areas. Figure 4 show that farm land is the most predominantly land use cover in the study areas followed by settlement in 2010 and in 2020.Though there was forest cover in the past of the study areas, it is decreased from to time due investment projects and settlement. The 2010 &2020 cover analysis land use /land cover class of aerial photo table shown that (6) the land devoted to forest was 99769 ha and 33155 ha of the land that was covered by forest in the year of 2010 and 2020 respectively. According to matrix table (4) the rate of forest cover change between 2010 and 2020, the computed result is 6661.4 ha within ten years i.e. $(99769 \text{ ha} - 33155) / 10$ years. In the present study between the year 2010 and 2010 the magnitude of forest cover decreases by 6661.4 ha within ten years as shown on figure 5.

6.10 The Performance of large-scale agricultural investments in terms of sustainable development

Accordingly,PSPPs meant to be part of a sustainable development approach should reach a minimum threshold of 60% on all six dimensions of the GADD. PSPPs with dimensions less than 60% are unlikely to succeed in the area of sustainable development. They should therefore be reworked (Villeneuve *et al.*, 2016).The performance of large-scale agricultural investments in Gambella region of the sustainable development of the social dimension shown on figure 8, Ecological dimension shown on figure 9and cultural Dimension shown on figure 10is in problematic situation. Where as in the economic dimension shown on figure: 11of the sustainable development of large-

scale agricultural investments is in improvable condition. Based on our result the investments in Gambella they are not achieving sustainable development.

Serious consideration of the social and cultural aspects of any project is strongly recommended. This would be enhanced by the use of ethnographic fieldwork, especially in situations where the communities are culturally differentiated. If cultural aspects are not considered, it is likely that the mitigation plans and compensation arrangements will create negative impacts instead of mitigating those (Hanna *et al.*, 2016).

6.10 Mitigation measure for adverse impact of soil, water, plant and displace community

Displacement, forced displacement occurs when individuals and communities have been forced or obliged to flee or to leave their homes or places of habitual residence, because these communities are located on the aerial map of investment. Displacement, forced displacement occurs when individuals and communities have been forced or obliged to flee or to leave their homes or places of habitual residence, because these communities are located on the aerial map of investment. International (and regional) human rights law guarantees several rights which provide safeguards against forced displacement.

CHAPTER SEVEN: CONCLUSIONS AND RECOMMENDATIONS

7.1. Conclusions

In the region the performances of the sectors are low because of many problem for example there is overlapping of the farm land with the land local communities and discrepancies. These investments projects have already caused serious social, economic, environmental, and cultural impacts in Gambella. Ethiopia. These problems includes soil and water pollution by agrochemical, loss of biodiversity, deforestation, declining water resources, Loss of local land right and indigenous land use, forced displacement/Villagation ,Land dispute/boundary dispute between investor and natives ,climate change, land degradation ,disruption of tradition way of life and deprivation of access to vital resources ,accidents in farm areas, illegal settlement .The performance of the project farms does not achieve sustainable

7.2 Recommendation

Therefore Sustainable utilization and protection of environmental resources is vital for the growth and sustainability of agriculture sectors. So Gambella region Environment and Climate change need to protect the region.

Based on the following finding the investments in Gambella region the following recommendations are forwarded.

- The investment projects need to employ the local community in their farms.
- Seasonal worker after completing they should told to go back and should encroached in the forest.
- Conservation of environmental resources is needed.
- The project have to submit EIA before they start cutting trees.

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**INSTITUTE OF HEALTH
FECULTY OF PUBLIC HEALTH**

DEPARTMENT OF ENVIRONMENTAL HEALTH SCIENCE AND TECHNOLOGY

Questionaries' and checklists for the assessment of sustainability and related socio -economics and cultural factors of large-scale agricultural investments in Gambella region

General overview

The person requesting you to fill these questionaries' is **Ojay Owar** and he is studying M.Sc. in environmental science and technology in Jimma University. He is conducting a research entitled **“assessment of sustainability and related socio-economic and cultural factors of large scale agricultural investments in Gambella region** “for his thesis. These questionaries' are prepared to collect necessary data to conduct the study. The information you provided here is very important for the fulfillment of the study and hence you are requested genuinely to fill or responds the question on the blank space provided. Finally he likes to extend in advance his gratitude thanks for your cooperation.

Information about the farms

Name of the farm _____

Geographical position _____

Date _____

Total hectare _____

Zone/District _____

Year of the farm _____

Code of the questionaries' _____

Date of sampling _____

Appendix 1: Questionnaire Consent Form

This research is being conducted by **Ojay owar** studying his M.Sc. in environmental science and technology in department of department of environmental health sciences and technology at Jimma University.

Purpose: This study assess the sustainability and related socio-economic and cultural factors of large scale agricultural investments in Gambella, Ethiopia

Participants: In order to qualify for this study, you must the farm worker, natural resource experts, land and agricultural experts, farm manager, environmental protection experts, model from household, local authority, development agent, water, mineral and energy experts. We anticipate that between 1 up 12 people will participate in this study.

Procedure: You will complete a questionnaire of occupational health and safety of the farm workers, Safe Drinking Water Supply and Sanitation, Farms products, agrochemical storage and handling and respond the In- depth interview questionnaires for the study of OHS among agriculture investments worker and interview about the performance , large agreements, land transfer and agricultural impact related questions.

Completion of the questionnaire or responding the question takes approximately 5 to 30 minutes. Participation in this study is voluntary, and if there are any questions you do not want to answer, you are free to leave them blank or if you are not will to be interview you have right. Completing this questionnaire or responding the questions no way obligates you to participate in follow-up studies.

Risks and benefits: There are no known risks or accusation associated with this study. The results obtained will be very important for sustainability and related socio-economic and cultural factors of large-scale agricultural investments in Gambella.

Voluntary participation: Participation in this study is voluntary. Refusal to participate will involve no penalty or loss of benefits to which you are otherwise entitled. The alternative to participate in this study is to not participate. What this means is that you can decide to not participate. You are free to withdraw from the study at any time, at no penalty. Withdrawal

from the study will in no way prejudice your future interactions with the personnel administering or supervising the study, or with Jimma University.

Confidentiality: All identifying information obtained from this study will be kept strictly confidential, it will be used as M.Sc., thesis for graduation and will be published on scientific journal, and it will be for policy makers and environmentalists.

Consent: I have read and understood the above information, have had any questions answered satisfactorily, and I willingly consent to participate in this study. I understand that if I should have any questions about my rights as a research subject, I can contact Jimma university institute of health science.

Approved by Jimma University Institute of health science scientific review committee.

Persons to contact: If you have questions / concerns about this study, you can contact;

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Name of the data collector _____ signature _____ date _____

Name of the participant(s) _____ signature _____ date _____

Appendix2: Key informant interview

Key informant interview was carried the farm manager, local community

1. Are these investments projects are achieving their objective require from them?
2. Whom do you think is the owner of the land?
3. Why local communities are displaced from their ancestral areas?
4. Is there conflicts in your area regarding the use of local natural resources and any other?

Appendix3: Field observation checklists

1. General overview of the projects
2. The policies and strategies are used by the projects
3. Geographical features of selected farms as well as their agricultural practices?

Appendix 4: Personal communication

Government offices and partner organizational offices and partner organizational offices was visited. Data of the agricultural will be requested from hard copy and soft copy for by email for unreachable areas by email or telephone from the concerned bodies.

Appendix 5: Focus group discussion

Focus group discussion /**FGD**/for representative of the community, districts office head and farm managers and youth

Focus group discussion /**FGD**/for representative of the community, districts office head and farm managers or delegates

To generate the data at least **8** up **12** participants are required for **FGD**.

1. Did the projects improve the life of the local community? How?
2. What impact does the projects have on the livelihood of the local peoples?
3. Have infrastructures such as road, water, school, clinic etc been supplied for the local Communities?
4. Is there forced displacement in your areas because of land transfers?
5. How do you feel about the overall **LSIAP** in your areas?
7. Does the projects supply new technology to the local house hold farmers?
8. Is there conflicts in your area regarding the use of local natural resources and any other?
9. How do you evaluate the commitment of **LSAIP** regarding your areas to land dispute and land right?

Appendix6: Social dimension themes

SOCIAL DIMENSION: Seeks to address social needs, individual and collective aspirations, health and well-being needs, and quality of life needs.						
Theme Goal	Weight	Justification for weighing	Assessment	Action planned or already implemented	Opportunities for improvement	Priority
1 Poverty reduction						
1.1 Put in place measures to support the most disadvantaged and most vulnerable within local communities						
1.2 Implement measures to support the most disadvantaged and most vulnerable, at the national level						
1.3 Contribute to actions seeking to reduce poverty at the supranational level						
Average weighting : Poverty reduction	0.0	Weighted performance : Poverty reduction	0%			
2 Water						
2.1 Ensure a potable water supply for everyone						
2.2 Ensure adequate quality of water supply according to its uses						
2.3 Ensure access to adequate sanitation and hygiene services						
2.4 Increase the population's participation in mastering water and improving its management						
Average weighting : Water	0.0	Weighted performance : Water	0%			
3 Food						
3.1 Ensure access to food						
3.2 Ensure the nutritional quality of food						
3.3 Ensure food security						
3.4 Enhance food sovereignty						
3.5 Implement sustainable agricultural and fishing practices						
Average weighting : Food	0.0	Weighted performance : Food	0%			
4 Health						
4.1 Improve and maintain the health of populations						
4.2 Ensure access to health care						
4.3 Promote preventive interventions in health, healthy environments and the adoption of healthy lifestyle habits						
4.4 Reduce factors likely to cause mental health issues						
4.5 Reduce irritants						

5 Safety					
5.1 Create a feeling of security					
5.2 Ensure effective safety					
5.3 Provide basic safety education					
Average weighting : Security	0.0		0%		
6 Education					
6.1 Ensure access to a quality educational system					
6.2 Ensure basic functional education for all					
6.3 Allow everyone to acquire the level of education they wish to attain					
6.4 Allow access to continuing education and training					
6.5 Provide education on sustainable development and citizenship					
7 Community and involvement					
7.1 Promote involvement					
7.2 Value and recognize personal and collective achievement					
7.3 Promote social cohesion					
7.4 Promote connections					
7.5 Allow for the development of self-esteem and self confidence					
7.6 Improve the independence and resilience of communities					
Average weighting : Community and involvement	0.0		0%		
8 Human settlements					
8.1 Ensure access to housing					
8.2 Prioritize sustainable mobility					
8.3 Build sustainable infrastructures					
8.4 Promote sustainable cities and human settlements					
8.5 Work to make the real estate sector secure and reliable					
8.6 Promote equity and territorial solidarity	0.0		0%		
Average weighting : Human settlements					
9 Gender					
9.1 Seek to implement equal rights without gender distinctions					
9.2 Seek gender equity					
9.3 Promote the independence of women and girls					
Average weighting : Gender	0.0	Weighted performance : Gender	0%		
Average weighting : Social dimension	0.0	Weighted performance : Social dimension	0%		

Appendix7: Ecological Dimension themes

Ecological Dimension :seeks to address the need for a quality natural environment and for sustainable resource ,and to reduce the relationship between human and nature						
Themes Goal	Weighing	Justification for weighing	Assessment	Action planned for improvement	Opportunity for improvement	Priority
1 Ecosystem						
1.1Develop knowledge of ecosystem s and species that depend on them						
1.2 reserve continental ecosystem						
1.3 Restrict the biological, chemical and physical degradation of the soil						
1.4 Combat desertification						
1.5 Preserve marine and coastal ecosystems						
1.6 Establish objectives for restoring degraded ecosystems						
Average weighing: Ecosystems	0.0	Weighted performance :Ecosystem	0%			
2.Biodiversity						
2.1 Encourage biodiversity protection						
2.2Protect rare, threatened and at-risk species						
2.3Raise awareness of symbolic species						
Average weight :Biodiversity	0.0	Weighted performance: Biodiversity	0%			
3 Resource						
3.1 Preserve the resources needed to sustain life in ecosystems						
3.2 Choose low-impact resources						
3.3 Plan for the prudent use of renewable resources						
3.4 Plan for the prudent use of non-renewable resources						
3.5 Optimize resources that are at the end of their life						
Average weight :Biodiversity						
4 output						

4.1 Identify liquid, solid and gaseous outputs and the impacts of releasing them into the environment						
4.2 Minimize outputs						
4.3 Minimize impacts						
4.4 Manage hazardous waste properly						
4.5 Limit global pollutant emissions						
Average weighing :resources	0.0	Weight performance :output	0%			
5.Land use						
5.1 Optimize land use						
5.2 Limit usage conflicts						
5.3 Maintain landscape diversity						
Average weighting : Land use	0.0	Weighted performance : Land use	0%			
6 Climate change						
6.1 Quantify greenhouse gas emissions						
6.2 Reduce GHG emissions						
6.3 Increase carbon sinks						
6.4 Compensate for greenhouse gas emissions						
6.5 Plan for adaptation measures to respond to the new climate reality						
Average weighting : Climate change	0.0	Weighted performance : Climate change	0%			
Average weighting : Ecological dimension	0.0	Weighted performance : Ecological dimension	0%			

Appendix8: Economical Dimension

ECONOMIC DIMENSION: Seeks to address the material needs and financial empowerment of individuals and communities.							
Themes Goals	Weighting	Justification weighting	for	Assess- ment	Actions planned or already implemented	Opportunities for improve- ment	Prior- ity
1Responsible production							
1.1 Producing quality goods and services							
1.2 Ensure ad equation between needs and the goods and services produced							
1.3 Promoting eco design from a product life cycle perspective							
1.4 Promote sustainable industrialization							
1.5 Implement extended producer responsibility							
2 Responsible consumption							
2.1 Facilitating access to goods and services							
2.2Encourage responsible purchasing and consumption							
2.3 Encourage responsible investment							
Average weighting : Responsible consumption							
3 Economic viability							
3.1To ensure economic viability							
3.2To encourage responsible sources of funding							
3.3To limit the financial risks							
3.4o limit the return on capital							
Average weighting : Economic viability	0.0	Weighted performance : Economic viability		0%			
4 Work							
4.1o promote access to an occupation							
4.2To ensure fair value for people's work							
Average weighting : Work	0.0	Weighted performance : Work		0%			
5Wealth and prosperity							
5.1To stimulate exchanges between people and societies							
5.2To aim for wealth growth							
5.3To establish sustainable tourism practices							
5.4To limit the possibility of capital flight							
Average weighting : Wealth and prosperity	0.0	Weighted performance : Wealth and prosperity		0%			
6 Energy							

6.1To ensure access to reliable and affordable energy services						
6.2To promote the use of energy with less impact						
6.3To plan a wise use of energy						
Average weighting : Énergie	0.0		0%			
7Entrepreneurship						
7.1To develop an entrepreneurial culture						
7.2To support entrepreneurial capacity						
7.3To ensure equitable access to means of wealth production						
Average weighting : Entrepreneurship						
8economic models						
8.1To eliminate distortions from economic models						
8.2To value social and solidarity economy						
8.3To maintain or integrate traditional economic models with the dominant economy						
8.4To support emerging and innovative economic models						
Average weighting : Economic models	0.0		0%			
Average weighting : Economic dimension	0.0	Weighted performance :	Economic dimension	0%		

Appendix9: Cultural Dimension

CULTURAL DIMENSION: Seeks to address the need to affirm, express, protect and promote the diversity of cultural traits						
Themes Goals	Weighting	Justification for weighting	Assessment	Actions planned or already implemented	Opportunities for improvement	Priority
1 Transmission of cultural heritage						
1.1 To promote individual expression, freedom and pluralism of beliefs, opinions and identities						
1.2 To ensure the conservation, restoration and compensation of the cultural heritage						
1.3 To recognize cultural representations of the environment						
1.4 To develop knowledge of the past and of history						
1.5 To value and support linguistic diversity						
Average weighting : Transmission of cultural	0.0	Weighted performance : Transmission of cultural heritage	0%			
2 Cultural and artistic practices						
2.1 To encourage cultural expression						
2.2 To affirm the plural and evolving nature of culture						
2.3 To recognize the importance of minorities and their contributions to society						
2.4 To provide access to culture through education at all levels						
Average weighting : Cultural diversity	0.0	Weighted performance : Cultural and artistic practices	0%			
3 Cultural diversity						
3.1 To promote interculturality						
3.2 To ensure equity between cultures						
3.3 To support the diversity of cultural expressions						
Average weighting : Cultural diversity						
4 Contribution of culture to development						
4 Contribution of culture to development						
4.1 To promote the emergence of a cultural industry that generates jobs and wealth						
4.2 To make explicit the links between culture, development, employment and economic prosperity						
4.3 To ensure an equitable sharing of innovations arising from cultural assets or traditional knowledge						
Average weighting : Cultural dimension	0.0	Weighted performance : Cultural dimension	0%			

