Addis Ababa University

(Since 1950)

ADDIS ABABA UNIVERSITY
COLLEGE OF DEVELOPMENT STUDIES
DEPARTMENT OF ENVIRONMENT AND DEVELOPMENT

Opportunities and Challenges of Jatropha Development on the Livelihoods of Local Community in Ethiopia- the case of Offa Woreda.

By,

Kefelegn Getahun

June, 2010

May 2010

ADDIS ABABA UNIVERSITY
SCHOOL OF GRADUATE STUDIES

COLLEGE OF DEVELOPMENT STUDIES (CDS)

Title

Opportunities and Challenges of Jatropha Development on the Livelihoods of Local Community in Ethiopia. The Case of Offa Woreda.

By

Kefelegn Getahun

DEVELOPMENT STUDIES

APPROVED BY THE BOARD OF EXAMINERS: SIGNATURE

Dr. Belay Simane _____
INSTITUTE DIRECTOR

Dr. Feyera Senbeta _____
ADVISOR

Dr. Belay Simane _____
INTERNAL EXAMINER

Acknowledgments

This is to give words of thanks to those individuals and institutions that contributed to my career and assisted me to the successful completion of my study.

First, I would like to acknowledge my advisor Dr. Feyera Senbeto for his professional advice and critical comments from inception to the final completion of this thesis work. His valuable remarks, timely feedbacks and continuous advice enabled me to work hard on my research.

My special thanks go to my aunt Tsehaynesh Bekele and her husband Andargachew G/Mariam for all their invaluable material and moral support in many ways to make this thesis worthwhile.

I would like to thank all my friends and classmates for their moral support especially Hailemariam Mesfin, Fasika Kebede, Haileyesus Worku, G/Micheal G/Medihin and Paulos Beyene for supporting me with their valuable suggestions and moral support.
I also thank my mother Misaye Abera and my father Getahun Legesse for their endless love and support.

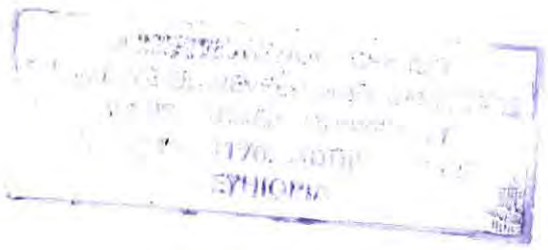
My appreciation goes to the College of Development Studies, which provided me material support. I also forward my thanks to all CDS staffs particularly Tsega and Marta.

Table of Contents

List of Tables

List of Figures

List of Appendices



List of Acronyms

MOME	Ministry of Mines and Energy
USA	United States of America
SNNP	South Nations, Nationalities and peoples
NGO	Non- governmental organization
OPEC	Oil producer European countries
EU	European Union
UK	United Kingdom
GDP	Gross Domestic product
ADLI	Agricultural Development led Industry
UNDP	United Nation Development program
EPRDF	Ethiopian people Revolutionary Democratic Front
FDRE	Federal Democratic Republic of Ethiopia
HIPC	Heavily Indebted poor countries
PRSP	Poverty Reduction Strategy paper
SDPRP	Sustainable development and poverty reduction program
RDPS	Rural Development Policies and Strategies
USD	United states Dollar
BIS	Bio-fuel Industry strategy
ETB	Ethiopian Birr
PAs	Peasant Associations
HH	Household
SPSS	Statistical packages for social science
KII	Key Informant Interview
EIA	Environmental impact assessment
EIAR	Ethiopian institute for agricultural research

Abstract

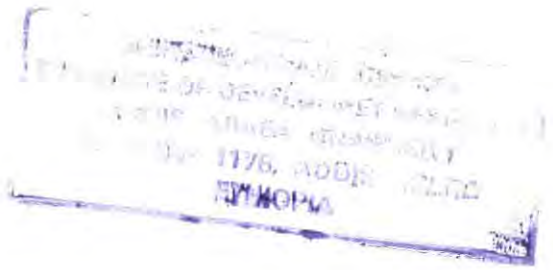
The energy system in the country is characterized by the predominance of biomass fuels which account nearly 94% of the total national energy consumption. The demand for modern energy sources such as petroleum fuels is increasing with increase in population and economic growth. Even though the share of petroleum fuels is about 7% of the total consumption, the increasing demand for it and the associated price hike have hit the national economy very hard. As a net importer of petroleum, Ethiopia is highly vulnerable to price shocks and supply problems of oil in the world market. It is therefore the government's priority agenda for alternative fuels to partially substitute imported petroleum. This is the major reason for the government to include large scale commercial production of bio fuels as part of the range of other development programs proposed to insure supply of modern energy services.

Bio fuels have a great potential for a number of countries worldwide and have a number of benefits economically, environmentally and socially. On the other hand, it has created a large degree of controversy relating to the issues of its usage and the likely consequences such as loss of biodiversity, deforestation, increased use of fertilizers, which results in green house gas emissions, and also its effect on food security.

This study made a thorough investigation on the existing opportunities and threats of Jatropha plantation on the livelihood of rural community, particularly Offa Woreda,Wolaita Zone. For this purpose adequate data was generated from both primary and secondary sources using various techniques. In the primary data collecting process 100 households and other stakeholders were administered by way of survey questionnaire. The process was backed by discussion; interview and observation in the study area where the author believed that factual information make the paper more meaningful.

As has been seen from the practices of bio-fuel development in the study area, almost all lands cultivated for Jatropha plantation are mostly farm lands and forest lands. Productivity in degraded land is low and as a result developers can hardly be sustained

in such situations. The major reason for Sun bio-fuel to leave the plantation site in Offa is that the land is not suitable for Jatropha. This situation leads the developers to use farm lands which get biannual rainfall. Likewise, many out-growers use their croplands for the production of Jatropha hoping that they will get better income. As a result the price of food crops is increasing because the supply of food crops decreased due to the introduction of Jatropha plantation. The inappropriate use of fertilizers and pesticides are also affecting the fertility of the land though it needs further research. On the other hand, Jatropha plantation has big job opportunities for those farmers who do not have enough farmlands. Given all the uncertainties in the benefits and consequences of bio fuel development, large scale development is likely to cause harmful impacts if adequate monitoring methods are not put in place.



1. Introduction

1.1 Background

In recent years, bio-fuels have emerged as counter piece of option for the global energy crisis. Bio-fuels are products that can be produced from agricultural and forest raw materials and processed into liquid fuels for either transport or heating purposes. Biodiesel and ethanol are two of the most common forms of bio-fuels (MOME, 2007).Ethanol can be produced from three main types of biomass raw materials namely, sugar-bearing materials (Such as sugar cane, molasses, and sweet sorghum) which contain carbohydrates in sugar form, starches (such as corn, cassava, and potatoes) which contain carbohydrates in starch form, and celluloses (such as wood and agricultural residues) whose carbohydrates form is more complex (Thomas and kwong, 2000, as cited by Beniyam Almaw, 2008). Biodiesel production, oil is extracted from oil seeds by mechanical crushing or solvent extraction. By product is a protein-rich residue cake that can be used for animal feed. The major crops for bio-diesel feedstock are Jatropha curcas, castor crop and palm tree. Jatropha curcas is a multi-purpose bush or small tree.

Global interest in bio-fuels has grown strongly since the rise of fossil fuel oil price during 2004 – 2006. Many scholars also believed that bio-fuels could provide less developed countries like Ethiopia with a means to invest in their own rural areas instead of exporting their capital to purchase fossil fuel. The rapidly depleting sources of fossil fuel and the desire to achieve energy security and mitigate climate change have combined to heighten interest in bio-fuel production as an alternative source of energy (Santa Barbara, 2007). In addition to producing energy from solar, wind, nuclear and marine sources, there is strong effort to expand bio-ethanol from grains, and bio-diesel from vegetable oils and animal fat in many countries. Like developed countries, many developing

countries such as Brazil, Tanzania and Ethiopia are also now launching bio-fuel program based on agricultural feed stock biodiesel from palm oil, oil-rich in edible plants such as Jatropha and bio-ethanol from sugarcane (Geunwald, 2008; McGahey, 2008).

However, there are a number of concerns regarding bio-fuel expansions. If bio-fuels are to contribute significantly to global energy requirements, new lands are needed for its production. As land perceived by many is having limited economic use, dry lands are likely to become increasingly targeted for bio-fuel cultivation in Ethiopia. Existing dry land crops such as Jatropha and the opportunities for harvesting plant material from rangelands that some second generation technologies create are particularly critical. By focusing production on supposedly unused degraded arid wastelands, these options theoretically represent an opportunity to address issues surrounding food security, carbon debt and biodiversity loss. However, bio-fuels production offers both opportunities and challenges to local community living in the vicinity of the project area (Brown, R.1980). According to Brown (1980) successful small-holder development of Jatropha would provide farmers and local communities with new cash-crops, if a successful small-holder model of cultivation can be developed. Out-grower schemes, already operating in Mali and Ethiopia, could provide farmers with additional income. Large-scale plantation /cultivation could provide wage labor opportunities. On the other hand, the cultivation of non-edible dry land crops like Jatropha as presently planned seems likely to take over substantial areas of seasonal pasture essential to rural livelihood systems. Even if Jatropha cultivation failed for agronomic reasons, land once alienated from local communities is rarely returned to its former users and the toxicity and lifespan of this crop means a return to permanent pasture is likely to be difficult and costly. Therefore, policy-makers and local communities need greater awareness of the risks and opportunities of bio-energy

development before engaging with the industry. This study investigated what the bio-energy boom could mean for agro-pastoralists and their arid rangelands. It explored the sun bio-fuels Ethiopia development scenario operated in the regional state of SNNP, Wolaita Zone Offa Woreda on 150 hectare of land.

1.2. Statement of the problem

Across the globe, bio-fuel demand is rising, because of many reasons. Currently the increase of fuel prices is challenging for the economic developments, especially for those countries which are registering accelerated economic development. Fuel demand is getting higher while the supply is getting less. Political and social unrest in some oil producing countries also contribute to the escalation and destabilization of oil prices in the world. The oil price increase, which is the result of the mismatch between demand and supply, is becoming the barrier for stable and sustainable economic development for many countries, particularly for the developing world (MOME, 2007). Moreover, since it is believed that fossil fuel use is the main cause for atmospheric air pollution and global warming, international effort is being exerted to minimize the use of fossil fuels and to substitute by renewable energy sources.

Under this general direction, wide range of development and research works on bio-fuels to use them as an alternative or substitute fuel for transport, rural industries and rural electrification is being carried out. At present, bio-fuel use is already started and the utilization is expected to grow in the forthcoming years in Ethiopia. Yet, at present, little is known regarding the potential scale of its impact through scientific research. Some government officials and NGOs have started to campaign on the wasteland issue in order to hold governments accountable for protecting the resource access rights of the rural poor. However, to

engage with this new development paradigm effectively, local communities and policy makers need better information and greater awareness of the challenges and opportunities associated with bio-energy crops such as Jatropha curcas. The Jatropha development activities in Wolaita Zone Offa Woreda were resulted in competing with the agro-pastoralists farm and rangelands. It also resulted in clearing forests for the farm and unwise use of scarce ground water resources for the development of non-edible crops like Jatropha curcas.

Therefore, it became essential to study the likely environmental and livelihood impacts as well as opportunities of the development scheme for better understanding of the general situation in the area. Different studies have attempted to examine the challenges of introducing bio-fuel technologies and its socio-economic impact at the international and regional level. However, researches conducted in the area so far do not touch the internal factors and the problems of Jatropha curcas development for the livelihood of agro-pastoralists. This study incorporates all the major issues and fills the gap in previous assessments about the impact of Jatropha development on agro-pastoralists in Wolaita Zone Offa Woreda.

1.3 Objectives and research questions

The overall goal of this study is to assess and raise awareness and understanding of the challenges and opportunities emerging from bio-fuel development in the dry lands of Ethiopia, particularly Wolaita Zone Offa Woreda in the regional states of SNNP.

Specific Objectives;

- Assessing the likely environmental and livelihood impacts of Jatropha development in the study area.

- Evaluating the socio-economic importance of Jatropha development around the study area.
- Generating a sound set of policy considerations illustrating the issues relating to bio-fuel development as it affects agro-pastoralists in order to promote clear policy discussion at local and national level.

Research questions

1. What are the objectives of developing Jatropha curcas and what implementing strategies are set for to achieve the given goals?
2. What are the losses and benefits of Jatropha curcas development for local communities?
3. What are the challenges of producing bio-diesel from Jatropha curcas?
4. What are the requirements to realize the objectives of bio-fuel development plan in the locality?
5. Who are vulnerable due to the introduction of Jatropha development in the area?

1.4. Research significance

The researcher believes that in adequate study in the Ethiopian bio-fuel development activities in general, and the potential of Jatropha curcas development in Wolaita Zone Offa Woreda in particular might have partly contributed to develop sound strategic alternatives to currently followed /pursued models of development. In adequately investigated problems

that do not enable to take appropriate measures aggravate the challenges of Jatropha plantation. This study did a thorough investigation on opportunities and challenges of Jatropha development and somehow the requirements to realize the objectives of the bio-fuel development strategies. Therefore, it would benefit the energy endeavor, environment and development actors, as well as policy makers at all levels of government to bring change on the negative implications of Jatropha curcas plantation. It would contribute towards the effort of access to energy and will serve as an input to attain ecologically sustainable energy development in the agro-pastoralist areas. The literary review, findings and recommendations in this study would improve the knowledge and understanding of nature conservation and management of natural resources for local government bodies in particular. Besides, this study would provide an initial view and supplementary information for researchers who would like to see the problem of Jatropha curcas development in Offa Woreda of the SNNP regional state.

1.5 Scope and limitation of the study

The geographic scope of this study is confined to Wolaita Zone, Offa Woreda. Due to resource constraints, the study could not address and assess other issues about Jatropha curcas which could have had, otherwise, vital importance for its betterment. Moreover, the temporal and spatial mobility of people in the sample kebeles couldn't enable the researcher to collect data whenever necessary and, hence, it may lack consistency.

2. Literature Review

2.1 Jatropha curcas: Basic facts and uses

Jatropha curcas is a tall shrub of the Eupharbiaceae family that reaches between 2 to 6 meters in height. The plant has green leaves, 6 to 15 cm long, and presents small yellow-greenish flowers. It produces oval fruits averaging 1.8cm in length and 1.2 cm in diameter, usually containing 3 seeds /http:// Encarta.msn.com/.

Figure 1: Jatropha Plantation in Offa Woreda, Wolaita Zone (Source: the author)

Jatropha is indigenous to Central America and the northern part of South America and was distributed to other tropical regions by European sailors as early as the 16Th century. It now grows in tropical regions throughout the world. Jatropha seed is high in oil content, and this is what is processed for agro-fuels, specifically bio-diesel. The oil is also

used in domestic lamps and stoves, and the plant has medicinal uses. Jatropha is known to be resistant to periods of stress (cold weather, drought and low radiation) partly due to its ability to relocate its nutrients in its stem and root system. This ability to survive in stressed environments has led to the assumption that it is good crop for marginal lands, but survival in these conditions does not imply that it can yield high or sustainable quantities of oil, especially considering that its main survival mechanisms under conditions of stress is to relocate its resources away from the leaves, flowers and fruits/seeds. The productivity and profitability of the plant; therefore, depends on the agro-climatic conditions of the area where it is cultivated. In order to get a good quantity seeds, Jatropha must be grown in fertile land or with additional nutrition, must be grown in areas with high rainfall or irrigated, and requires efficient pest control implementation (Fact foundation,2006).

2.2. The Expansion of Jatropha plantation

In recent years global interest in bio-fuels has grown rapidly. Driven partly by global concerns over the depletion of oil reserves and the rising price of oil, and partly by the search of ways to mitigate climate change, bio-fuels are now high on the international agenda. Although the consumption of bio-fuels in western countries still accounts for a minute share of total global energy consumption-1 percent of total fuel for road transport-the contribution is growing rapidly. Global bio-ethanol production, for example, increased from 29 to 51 billion liters between 2000 and 2006. In 2009 the agro-fuel industry consumed 100 million tons of grain, which is 80 percent increase on consumption as compared to eight years ago. The bio-diesel sector is also booming, with production

increasing nearly fourfold between 2000 and 2005 (Daniel J McGahey, 2008).

As the bio-fuel industry expands, so do concerns about the positive and negative implications of bio-fuel crops and the development scenarios they give rise to. Major issues include links to food price rises and food security, deforestation, restricted resource access for the rural poor, and concerns that fuels produced on cleared land or using intensive processing techniques may produce more carbon than fossil fuels. If bio-fuels are going to represent even a small share of global energy production, the implications for land use are substantial (Action Aid International, 2008).

The energy industry is closely regulated and linked to political structures. As scientists and advocacy groups flag social and environmental concerns, the focus moves from one bio-fuel crop to another. Recently, the debate has concentrated on inedible bio-fuel feed stocks, such as Jatropha curcas. Originating from Central America, the plant grows throughout the dry lands of Africa and Asia, where it is often planted as a living fence surrounding fields and houses (SOS Sahel International UK, 2008).

To some, Africa's dry-lands represent the last agricultural frontier where abundant land and labor provide the conditions for a new green revolution, based on the intensification of arable and livestock production (JA & UNAC, 2009). This view is held by a growing number of investors and governments for whom Jatropha represents the answer to the bio-fuels /food security crisis: a multiple purpose crop able to promote food and energy security, rural development and agricultural exports, based on the use of unproductive arid wastelands.

2.2.1 Why Marginal or wastelands for Jatropha plantation?

As a practical alternative to fossils fuels, bio-fuels must: (i) offer a net energy gain; (ii) be produced on a large scale without competing with food security; and (iii) not cause social or environmental problems. To date the focus has been on 'first generation' bio-fuel, most of which is derived from edible crops harvested for their sugar, starch or oil content. However, to produce a significant amount of energy, first generation bio-fuels would require a significant percentage of the land already used for arable production today. For Europe to fulfill its bio-ethanol targets, for example, would take 70 percent of its farmland, for the USA 43 percent. Thus mandatory targets are clearly impossible without use of land in developing countries (http://WWW. Top news in/Mozambique-tackle-high-energy-bill-rural darkness).

Africa has long been viewed as the last agricultural frontier; rich in land and labor, a place where the farming potential has barely been scratched. The continent is now termed 'the green OPEC' by bio-fuel capitalists presently investing heavily in land. For most African governments, bio-fuels are an attractive way to boost the agricultural sector and intensify production. With 2 million hectares of idle arable land in Mozambique, 3 million in Benin, and 1-2 million in Ethiopia apparently available for agro-fuel production, could this be a new green revolution?

In spite of increasing investment, political enthusiasm for first-generation bio-fuels has waned lately following mounting pressure from scientists and environmental lobby groups. Western governments are increasingly conscious of the global consequences of their agro-fuel policies. The debate has now focused on the potential of non-edible first or second generation bio-fuel feed stocks. For example, when the EU reconsidered its bio-energy targets in 2008 and postponed the 10 percent target to 2020, legislators committed to 5 percent by 2015, at least a fifth of which

must come from new alternatives that do not compete for feed production (SOS Sahel International UK, 2008).

To date few second-generation bio-fuels have moved beyond the experimental stage, prompting renewed emphasis on non-edible first generation feed stocks such as Jatropha curcas. However, investment in Jatropha has expanded faster than global trade, and the crop still accounts for less than 1 percent of global bio-diesel production. Nevertheless, with processing plants established earlier in the US and UK, and increasing amounts of land appropriated and pledged in Africa for its export production, a global trade is imminent. (http://WWW.mother Jones. Com/ environment/2009/03/bio-fuel-african-land grab#com)

The current and likely future impact of bio-fuel production demand for land in developing countries has recently been reviewed. These reports show the impact on the poor. Governments throughout Asia and Africa are under pressure to locate new lands for Jatropha cultivation which do not compete for food production, and are identifying idle, abandoned arable lands. However, many are going beyond this and mapping areas of degraded range lands or forest land. In Ghana, for example, a bio-fuels corporation appropriated and cleared 38,000 hectare of communal rangelands for Jatropha production (Fact Foundation, 2006). Similarly in Ethiopia 10,000 hectares were recently cleared, 86 percent of which were part of an elephant reserve. In the absence of clearly defined and rights, poor marginalized groups are losing access to land for crop farming, herding and gathering of natural resources (Forum For Environment,2008).

The bio-fuel industry is highly risky and controversial, increasingly dependent on political support for market liberalization and subsidized demand. Clearing rainforest, rangelands, savannas or grasslands to produce bio-fuels creates a 'bio-fuel carbon debt' by releasing 17 to 420 times more Co_2 than those bio-fuels would provide by displacing fossil

fuels. Yet alongside claims that inedible dry land feed stocks grown on degraded wastelands can reverse desertification and promote local energy security, some bio-energy companies also maintain such land use changes will improve biodiversity and increase carbon sequestration (MELCA, 2008).

Uncertainty surrounds the development of bio-fuels in Africa and so far few studies have evaluated the size of the threat to pastoral production and the pastoral commons. Many claims are made about the performance of dry land feed stocks such as Jatropha under large-scale commercial production in dry lands, but few of these can be scientifically sustained (SOS Sahel International UK,2008).

2.3. Jatropha development nexus agro- pastoralism

Pastoralism is a livelihood system uniquely adapted to uncertain, variable environments such as the world's dry lands. The term refers to livelihood systems where livestock represent 50 percent or more of the economic income of a smallholder globally there are approximately 200 million pastoralists and extensive pastoral production is practiced on 25 percent of the world's land. In African roughly 59 percent of the continent's ruminant livestock are found in arid and semi-arid areas, and pastoral production takes place on 66 percent of the continent. The dry land of Africa is therefore essential to the survival of a significant number of its people.

Figure 1. Agro-pastoral communities in Offa Woreda (source:Author)

Estimating and predicting the future demand for land in dry lands for bio-fuel production is highly complicated. Some of the increased demand for bio-energy could be met by alternative second-generation bio-fuels derived from freely available products such as waste or crop residues. More bio-fuel could also be produced from existing arable lands using new intensive, technical modes of production. However, this is likely to create more carbon emissions and environmental problems in the long term. Estimates vary but some reports predict that between 56 to 166 million hectares of additional land would be required to meet 50 percent of global petroleum demand by 2020. Thus to avoid competing with food crops for arable land between 4 to 16 percent of permanent pastures would have to be converted to bio-fuel cultivation.

Given that the yield potential of dry land feed stocks such as Jatropha curcas are poorly understood and expected to be lower on marginal land unless irrigation and fertilizers are used, these estimates could be conservative. Another issue is the likely carbon debt clearing large areas of pastoral land would create. Grasslands contain 2.8 tons of carbon per hectare above ground (biomass and litter), 4.4 tons per hectare in their roots and 43.6 tons per hectare in the top 30cm of soil (McGahy, 2008). 13 percent of this carbon is lost upon conversion. Thus to expand the production of any bio-fuel feedstock on to permanent pastures (i.e. rangelands, savannas, grasslands) would release approximately 46 tones of Co_2 per hectare. Supporters of such assumption claim that this figure is far lower than the carbon debt for tropical forests and that on degraded pastures such a conversion would soon result in greater carbon sequestration. Yet few studies have accurately investigated the carbon sequestration of degraded lands, especially quantities of soil carbon.

2.4 Government policies on pastoralism and agro-pastoralism.

The history of development policies and program in Ethiopia shows that they have neglected pastoralism even though the system contributed to the national economy. There have never yet been appropriate pastoral development policies and program in the country. Previous policies did not even guarantee the land use rights of pastoralists. Pastoral land is often perceived as unoccupied and underutilized. In 1994, research was conducted by UNDP in Somali region on "watering points and grazing reserves." During the research one old man said:

> "Those who are close to the pot are always the
> First to enjoy the food and we are far from it."

The explanation of this saying was that policies are designed by highlanders, the Somali are not among the policy-making body, and are

the losers-those who are politically peripheral are also economically peripheral which is the characteristics of pastoralists in general (UNDO, 1994).

However, in the early 1990's Ethiopia saw enormous political changes, with the overthrow of the Mengistu regime by the EPRDF, decentralization, including the creation of ethnically- based regional states, and steps towards democratization. The Transitional Government charter was adopted in 1991 paving the way for the present federal system of government established by the 1995 FDRE constitution. As a result of the change in government, some positive changes took place towards the pastoral communities. Accordingly, for the first time in the Ethiopian history, the constitution makes various provisions in the interest of Ethiopian pastoralists. Some of the important issues provided under the constitution are:

Article 40: Ethiopian pastoralists have the right to free land for grazing as well as the right not to be displaced from their own lands.

Article 41: Pastoralists have the right to receive fair prices for their products that would lead to improvement in their conditions of life which should be the objective that guides the state in the formulation of economic, social and development policies.

These provisions for pastoralism and agro-pastoralism have contributed to the inclusion of pastoralism in government development policies, program and strategies.

In 2000, the Ethiopian government drafted a poverty reduction strategy paper, a process initiated by the World Bank and the IMF under the Heavily Indebted poor countries (HIPC) initiative. The PRSP was developed in consultation with various stakeholders and it is now the major development policy document of the government. The Interim

PRSP had a very weak section on pastoralism, thus failing to adequately address one of the major sectors of development of the country (Mohammed Mussa, 2001). The interim PRSP was discussed at different forums including at a national conference organized by the pastoralist forum of Ethiopia. Some improvements were made after the national conference and the final PRSP (now referred to as the sustainable Development and poverty reduction program-SDPRP) was produced in 2002. The SDPRP views settlement as the way forward in the longer term for populations in pastoral areas:

> "Selective and voluntary settlement program are believed to be the only viable options in the long run. As this change goes beyond a change of location for pastoral people and entails a drastic alteration in their cultural life, settlement will be conducted over a long period of time with the aid of training and initiative work."

According to these strategies, the government will support both pastoral and sedentary livelihoods. These include interventions to improve water supply and irrigation development, livestock and range resources development and strengthening infrastructure and institutional support.

The Ethiopian government has also published a document entitled "Rural Development Policies, strategies and instruments" in 2002. As before, a significant portion of the document focused on crop cultivation, although it also addresses some pastoral development issues. There are two aspects of the policy and strategy of the government towards pastoralism, short and medium term and long term.

As indicated in the document, the short and medium term strategies emphasize the mobility of pastoralists. Here the RDPS starts from the fact that pastoralists gain their livelihood from traditional livestock production based on mobility. According to the RDPS, any attempt to ensure food security and sustainable development must start from the agricultural system upon which the life of the people is based.

2.5 Bio-fuel Development and Utilization Strategy of Ethiopia

The bio-fuel development and utilization strategy of Ethiopia has been formulated by Ministry of Mines and Energy at the end of August 2007. The overall objective of the strategy is to facilitate production of adequate bio-fuel energy from domestic resources for substituting imported petroleum products and to export excess products (MOME, 2007).

The strategy is formulated based on principles that development of bio-fuels should not have unintended consequences on food security, land access, the environment, cultural values and the economy. It has also outlined that bio-fuels development should participate farmers and pastoralists so that they can be beneficiaries of the development. The bio-fuels strategy document identified some energy crops such as sugarcane, Jatropha, castor and palm trees as potential feedstock for bio-fuels production.

Generally, the bio-fuels strategy has tried to provide an implementation guideline in order to ensure the achievements of the objectives stated, while at the same time avoiding unintended consequences. The Ethiopian Bio-fuels Development and utilization strategy has addressed many of the concerns that are important elements for a sustainable development of bio-fuels. However, there are still some important elements that the strategy failed to mention.

- The strategy paper stated that any bio-fuels development programs (project) should take environmental and social issues in to consideration but failed to put Environmental Impact Assessment as a mandatory process for new and expanding bio-fuels projects.
- One of the objectives of the strategy is to create opportunities where already cultivated arable lands could be used for more productive and economically viable purposes (Art.4).This

objective could open a loophole for increased effect on land access (land holding security) where land from local users could be dislocated and reallocated to bio-fuels investors based on the assumption that bio-fuels crop cultivation is more economically viable than the current forms of land use. In such cases, this objective may seem to contradict the development and utilization strategy (Art.7.2.2.2) which seems to emphasize bio-fuels development only on marginal or degraded lands,

- The strategy recommended certain types of energy crops for bio-fuels production but did not disallow use of food crops. Use of food crops for bio-fuels production may lead to food insecurity particularly if the value added is higher when using for bio-fuels.
- The strategy document stated that less fertile, or marginal or degraded lands should be used for cultivation of energy crops that are particularly used for production of bio-diesel (Art.7.2.2.2). It was also stated that carefully selected and properly managed cultivation of perennial energy crops such as Jatropha could help reclaim degraded lands. However, an important consideration here should be that the ecosystem of already degraded or marginal land is highly fragile-over-utilization of such type of land can easily result in long-term or permanent ecological damage such as salination or severe erosion. It is not clear also what is marginal. Marginal land could be grazing lands and lands on which the community, including women, depends on for various livelihood activities (Cotula et al, 2008).
- On the strategy paper, the figures for available land for development of bio-fuels were obtained from the respective Regional bureaus. However, the method for estimation of available land for such purposes is not clear. In some regions,

the amounts of land claimed to be available for bio-fuels development, were disproportionately large compared to the size of the regions. For instance, the stated available land for cultivation of bio-fuel crops in Gambela and Benshangul Gumuz were given as about 88% and 60% of the total size of the regions respectively. These bureaus are perhaps the same bodies that are responsible for allocation of land for investors. In such cases, there is the likelihood of allocating fertile land or preserved forest areas for cultivation of energy crops. Given that Ethiopia is a novice in the field of bio-fuels development and uses; learning lessons from practices of other countries not only avoids social and environmental losses but also helps to lead development in the proper direction right from the beginning (MELCA,2008).

2.6 Experiences of other countries on the development of Bio-fuels

The EU bio-fuel directive on the promotion and use of bio-fuels has been undergoing several reviews and changes since it was first released in 2003 until it was published in December 2008. Even though the socio-economic and environmental settings of the EU is very much different from us, the process that the EU bio-fuels Directive has undergone and the reactions of the member countries towards its implementation can still be a useful source of experience where we can learn lessons from.

The EU directive for bio-fuels was initially prepared in 2003 based on the proposal for a council of Directive on the promotion of the use of bio-fuels for transport purposes in 2001. The proposal, which was a strategy for the security of energy supply, introduces the objective of a 20% substitution of gasoline and diesel in the road transport by

alternative fuels by the year 2020 with a dual purpose of improving security of fuel supply and reducing green house gas emissions. Out of the 20% alternative fuels substitution, the contribution from bio-fuels was targeted to be up to 8% (The European parliament Directive, 2003).

However, based on the realities observed on the ground during the implementation of the Directive and due to a growing recognition that the bio-fuels targets are likely to cause serious environmental and social concerns, the EU has agreed on December 2008 to reduce the initially proposed 20% target to 10% . This includes other renewable energy sources (MELCA, 2008).

Among developing countries, the South African Bio-fuel Industry Strategy adopted a five year short term target to achieve a 2% penetration level of bio-fuels in the national liquid fuel requirements. The initially proposed target in the draft strategy document was 4.5% but revised down to 2% after public consultation. The proposed energy crops for the production of bio-fuel in the country are sugarcane and sugar beet for bio-ethanol production, and sunflower, canola and Soya beans for bio-diesel. Maize, Jatropha and other plants are excluded for the concern raised regarding food security and environment. The Bio-fuel Industrial Strategy has put the doubts in Jatropha plant that it could be invasive and the crop will have to be monitored before any further promotion.

The total arable land in South Africa is 14% of the total land area of the country. BIS has further analyzed that 1.4% of this land will be required to achieve the proposed target. It was also noted that out of the totally available arable lands in South Africa about 14% is underutilized. The proposed land requirement targets this

underutilized arable lands in the country. BIS has also been seriously argued against and criticized by several civil societies but the points of arguments are important lessons to consider (Bio-fuels Industrial Strategy of South Africa, 2007).

Even though both the EU bio-fuels Directive and the South African BIS that we draw as examples are not blameless, the critiques rose against them and the changes made through their evolution have so much information and lessons for us to learn not to repeat the same mistakes again.

2.7 Current Bio-fuels Development status in Ethiopia

The major rationale of the economic development policy of the Ethiopian government is based on bringing rapid economic development. Bio-fuel development strategy adoption is, therefore, among the government efforts being carried out to secure energy demand for the nation. The primary product of bio-fuel development was first started by a private owned national Bio-diesel corporation which is a subsidiary of a UK based private limited company. The company was allocated the first land for cultivation of Jatropha to produce bio-diesel in Benshangul Gumuz regional state in 2006. This initiated other stakeholders including the government, the private sector, NGO'S and civil society organizations. After the introduction of bio-fuel development by sun bio-fuels Corporation, several private companies have come to the scene. Fincha sugar factory; however, has been producing bio-ethanol as a by-product (MELCA, 2008).

Fincha sugar factory has started ethanol production in 1997 for a purpose of blending it with benzene for automobile engines. Fincha has the capacity to produce eight million liter of ethanol per year. The

Metehara and Wonji sugar industries are planning to start ethanol production in the short run. In our country production of ethanol is expected to reach 35.1 million liter at the end of 2002 Ethiopian fiscal year (Beniyam Almaw, 2008). According to the ministry of water resource studies, the production of ethanol can grow to 1 billion liters per annum. This could be true if 0.7 million ha of land suitable for cultivating cane sugar is made available (MOME, 2007).However, only three sugar factories namely Fincha, Metehara , Wonji and Tendaho sugar plantation project are expected to produce 100,331m and 128,165m of ethanol in 2004 and 2005 E.C. respectively(Table 1).

Table 1: Planned ethanol production by year and industry in m3

No	Sugar industry	1999 E.C	2000 E.C	2001 E.C	2002 E.C	2003 E.C	2004 E.C	2005 E.C
1	Fincha	8000	8,448	11,009	13,834	16,585	18,515	21,221
2	Metehara	-	-	7,311	11,700	11,700	28,183	35,527
3	Wonji	-	-	-	-	-	15,428	20,728
4	Tendaho	-	-	-	9,602	24,428	38,205	50,689
	Total	8000	8,448	18,320	35,136	52,713 -	100,331	128,165

Source: Ethiopian sugar Agency, July 1999 EFY

The imbalance between fossil fuel demand and supply, and the skyrocketed price of it has confronted the sustainability of the economic growth which has a negative impact on the import and export trade balance of the country. Due to the existing fossil fuel shortage, the

government urged both the national and international bio-fuel developers to participate in such new investment areas.

Following the national endeavors for the development of energy, many local and international private and non-private bio-fuels developers have registered in the country. Most of these companies have the intention of going for large-scale commercial development. Currently there are over 64 developers registered for the cultivation of energy crops for bio-diesel production. Among these bio-fuel developers 19 of them are at operational where as the rest of the bio-fuel developers are at the pre-implementation stages (MME, 2007).

Southern Nations and Nationalities and peoples (SNNP) region has a long list of investors that applied for land for development of bio-fuels particularly for bio-diesel development. According to information obtained from the Regional Investment Office, there are about 22 national and international private companies involved in bio-fuels development in the region. Most of them are at pre-implementation stages of the project. Only 4 of them namely Global Energy Ethiopia, Omo Sheleko Agro-industry, Sun Bio-fuels Ethiopia and National Biodiesel Corporation have actually started operation (Table 2). As indicated in the Table 2 below, about 8 bio-fuel developers in Amhara regional state have applied for granting land of which 5 of them are at the operational stage.

Table 2: Regional distribution of bio-fuels developers in Ethiopia

No	Region	Number of developers		Progress report
		Ethanol	Bio-diesel	
1	Benshangul			
	Gumuz	-	3	Operational
		-	1	Pre-implementation
2	Amhara	1	5	Operational
		-	2	Pre-implementation
3	Oromia	1	5	Operational
		3	13	Pre-implementation
4	SNNP	-	4	Operational
		-	18	Pre-implementation
5	Gambela	-	4	Pre-implementation
6	Tigray	-	3	Operational
7	Afar	1	-	Operational

Source : The ministry of mines and Energy and designed by the Author.

2.8. Conceptual Framework

Any energy development is unsustainable if it leads to irreversible biophysical changes in the ability of the land to produce equally well in a future cycle of similar land use, or if the costs of reversing the changes are prohibitive. The most common categorization to describe and come close to "sustainability" is economical, ecological and social dimensions (UNDP, 2004).

Figure 3 shows the factors that lead to sustainable bio-fuel development in Ethiopia. According to the conceptual framework, the central and thus critical ingredients to implement sustainable bio-fuel development are issues related with economy, ecology and social dimensions. The key issues that need to be addressed with respect to economical viability are tradeoff between food and Jatropha plantation, income generation, import substitution and job opportunities. In the case of ecological soundness, the designed energy development should protect the biodiversity, reduce use of fertilizers and pesticides and should able to reduce GHG emissions. With regard to social acceptance, the proposed energy development should be implemented with respect to policies and strategies designed by national and international institutions, and also should protect the cultural values of the local communities. Here, political will plays a vital role to protect the human and ecological well-being from the energy development endeavor.

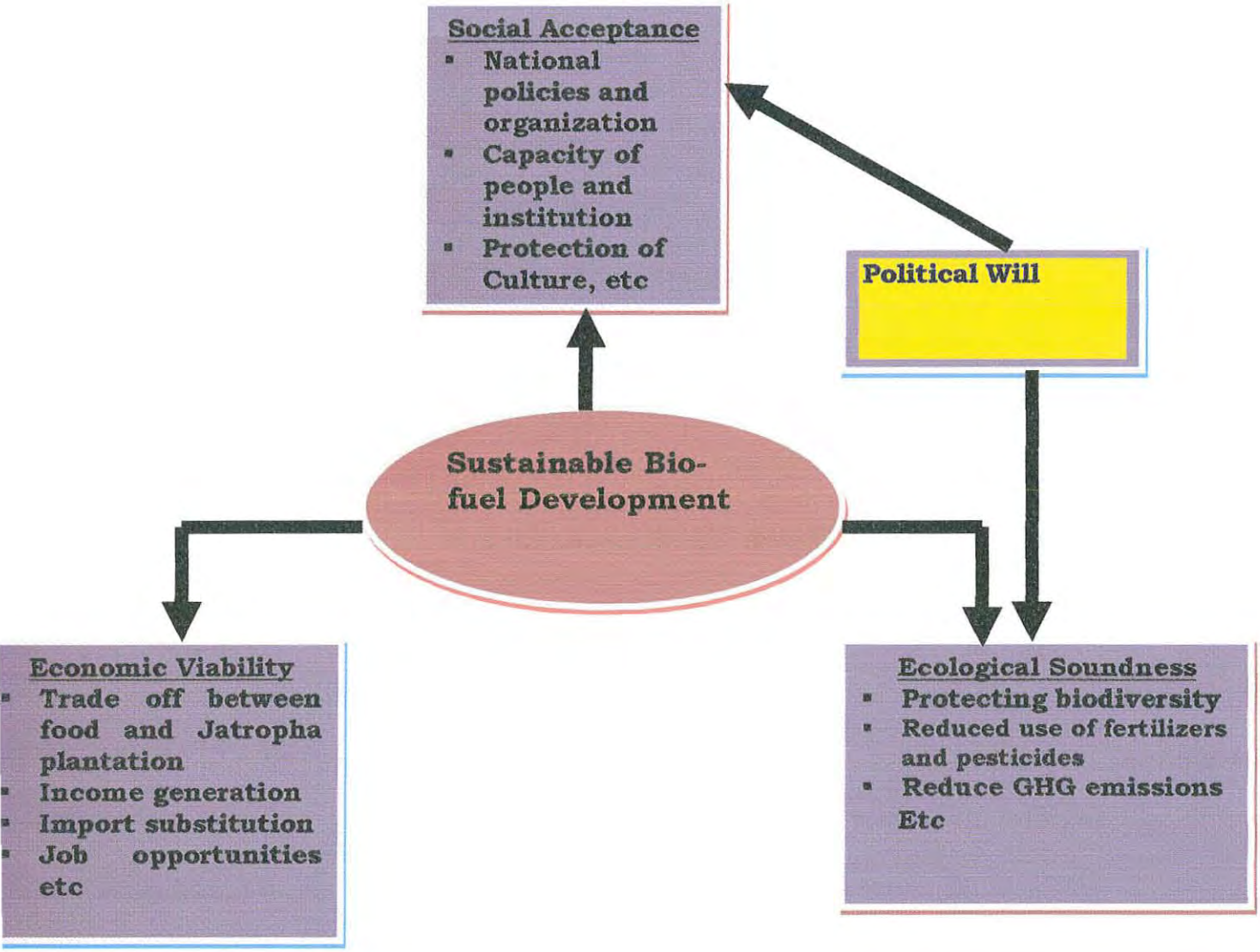


Figure 2: Factors that leads to sustainable bio-fuel development (source: own formulation).

3. Description of the study area

3.1 Location of the study area

The study area is located in the south part of Ethiopia, Wolaita zone, Offa Woreda/district/. Offa Woreda is situated in the south of Sodo town, the capital town of Wolaita Zone. Its geographic boundaries are the Humbo district on the north, the Kindo Kucha district on the south, the district of Sodo on the east, and on the west. It has an area of 37.4km^2; and is transected by the Manissa and Woyo rivers and some of its tributaries, Milkie, Zega,and Sura .Offa Woreda has an estimated population of 115,000 in which 90.5% living in rural areas and the remaining 9.5% are urban residents. It has 20 kebeles with a total of 18525 households. Mencha Gogara and Wachiga Asho are among the 20 kebeles in Offa district in which Sun Bio-fuel Ethiopia has started operating Jatropha plantation. The climate is dry with an annual average temperature that ranges between 23^o - 14^{o}c and annual rainfall between 580 mm- 590mm.

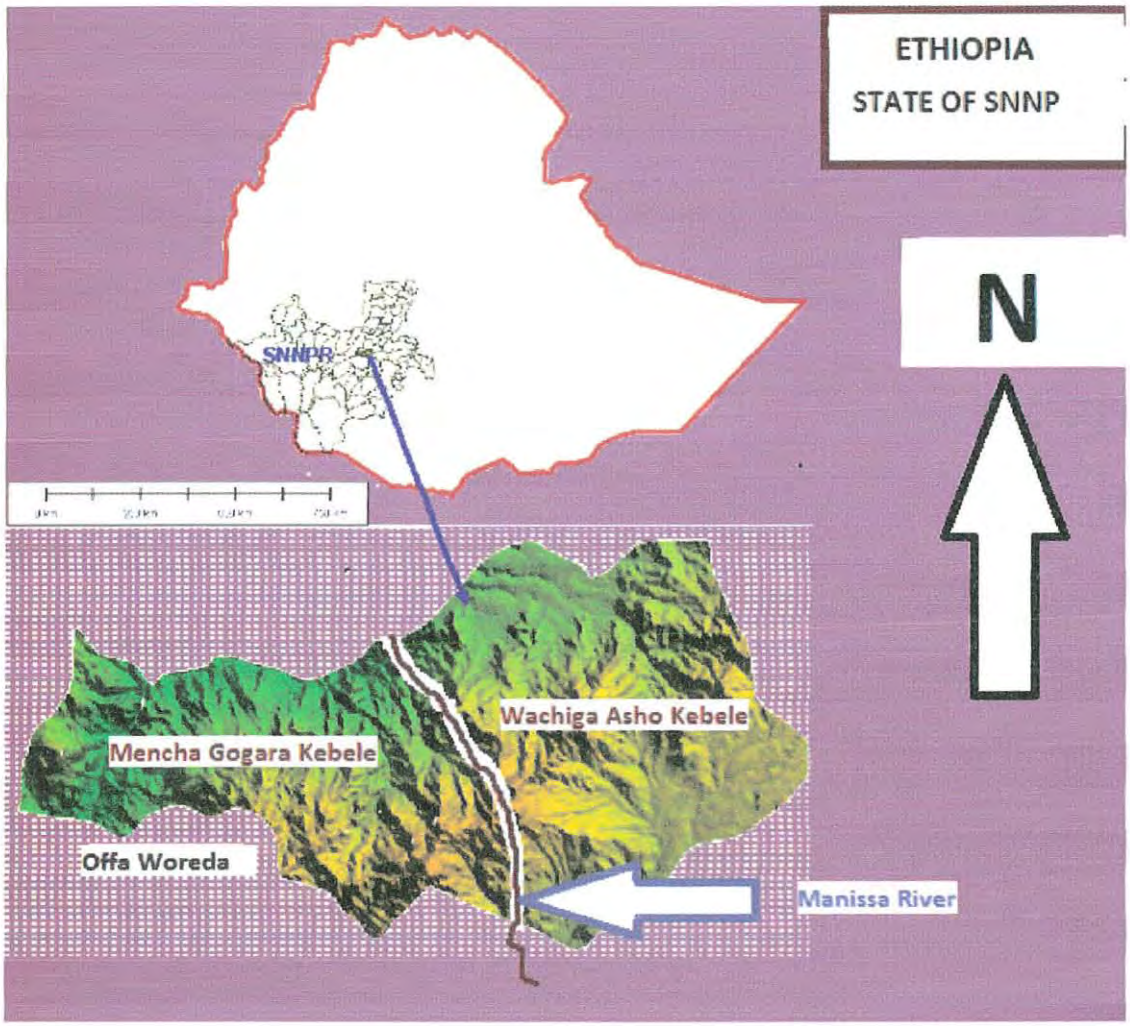


Figure 4: Location Map of the study area

3.2 Topography and Soil

Generally, Offa Woreda is surrounded by escarpment which having a height between 600-750 meters above the valley floor in the east, west and south directions. The altitude of the study area ranges between 1250-1700 m.a.s.l.

The soil of Offa is developed from alluvial materials and complex rock formations derived from the surrounding escarpment. The major soil types in the valley are Luvisols and Vertisols. Luvisols are red to reddish

brown in color found mostly at well drained/leached portions of the field. Vertisols are heavily black mostly occupy the depression site of the place. Both Luvisols and Vertisols are with PH value of 3.5 to 5.5 from extremely acidic to neutral state (Solomon, 2008 as cited in MELCA, 2008).

3.3 Vegetation

There are many different types of vegetation in Ethiopia. The type of vegetation differs from one area to another. They are found throughout the varying agro-climatic zones starting from the desert to the low land or 'Kola' extending to the freezing afro alpine or 'Worch'. In the lowlands of some kebeles of the study area, different indigenous trees cover the land. The Montane evergreen scrub occurs mainly along the top of the escarpment in Offa Woreda between 2,200-2,300 meters in a rainfall of 700-800mm. It consists of species like Cordia africana (Wanza), Acokanthera schimperi (Kararo), and Olea chrysophylla (Weira) (Hiruy Simie, 2008).The central and north parts of the district are covered by moist ever green closed forest. There are also areas covered with open savanna woodland. Ficus SSP, Acacia gerrasdi, Acacia amythethophylla, and Entada abyssinia are among the important tree species found in the district of Offa.

3.4. Economic activity

The most important income generating activity for the people in Offa district is intensive farming and animal husbandry. Largely, rearing of cattle, sheep and goats for the daily subsistence need of milk and milk products, meat and hide is central. The people in the district are agro-pastoralists who earn their living from their livestock and farming.

According to the agriculture and rural development office of the district due to the aridity of the environment and widely dispersed nature of the natural resources, the people increase their movement from place to place in search of pasture and water. About 2912 hectares of land is assumed to have potential for crop production. There is seasonal cultivation of staple crops such as teff, wheat, potetoes and sorghum.

Figure 5: Rural communities used sweet potatoes as a source of income.

3.5. Description of the project

Sun bio-fuels Ethiopia is a private limited company with an investment capital of 365 million Birr for development of bio-fuels from Jatropha for export purposes. It has also a plan to set up a processing plant. The company obtained 5000 ha of land at a lease price of ETB 47 per hectare in Wolaita zone Offa Woreda in Mencha Gogara Kebele. It has already started plantation on 150 ha of land. In addition to the 5000 ha of land the company is cultivating for bio-fuels production, an additional 6000 ha of land has already been agreed with over 25,000 out-growers. The

farmers have agreed to use one percent of their farm land for Jatropha plantation to supply the seeds to the company at an agreed price. As indicated in Figure 5 below, the sun bio-fuel planted Jatropha on 5000 ha of land in Offa Woreda.

Figure 6: Sun bio-fuel's Jatropha plantation Farm (source: The Author)

4. Research Methodology

4.1. Research Design and data sources

The study generally aimed at analyzing the possible challenges and opportunities of Jatropha development in Offa Woreda. Hence a combination of different data collection techniques that is both quantitative and qualitative data collection methods was employed. Uses of both quantitative and qualitative techniques to collect and analyze data are helpful to address the research questions. This is because such methods are useful to find adequate information on the subject matter from different stakeholders (individuals, groups, institutions, e.t.c). In this study both primary and secondary sources of data were employed. The primary data was gathered through household survey, investor's survey, focused group discussion, key informant interviews and direct observation techniques. Secondary data sources included published and unpublished materials, books, Journals, reports, maps and photographs.

4.2. Sampling procedure and sample size

In the SNNP regional state, many national and international bio-fuel development companies have already shown interest to invest because of the environment and availability of labor forces. As a result, Offa Woreda in Wolaita zone of SNNP region is selected from which to take the sample kebeles for the study. Preliminary survey, discussions with different Woreda officials and Jatropha developers and other review of literature helped the researcher in identifying the sample kebeles. The Offa district is preferable to the study because the largest agro-pastoralist land resources are given for the investors by the regional investment commission.

From 20 kebeles in Offa district, two of them; Mencha Gogara and Wachiga Asho were selected purposefully because of Jatropha plantation.

Mencha Gogara and Wachiga Asho Kebeles are a place where Sun bio-fuel/ National Bio-diesel Corporation planted Jatropha for export purposes on 5,000 ha of land. The company has also agreed to collect 9000 tones of Jatropha seeds from out-growers on 6000 ha of additional land at initial stage. From each of the two sample kebeles, 10% of their total households, a total of 100 households were taken for the survey. This sample size (10%) is assumed to be representative, because the population is homogenous with regard to opportunities gained and problems faced by the production of Jatropha curcas in the district.

4.3. Sampling Method

The agro-pastoralist people who live in the Offa districts move from place to place with their herds in search of water and pasture to the surrounding areas. Some move as far as neighboring Woredas and Zones such as Jimma Zone and Alaba boarder during the dry season. There is temporal and spatial mobility of people in the sample kebeles as well. However, not all the community members leave their areas; some stay behind to protect their land and property in their living village.

This situation couldn't enable the researcher to use random sampling. Convenience sampling is found to be suitable to address and interview the sample households in this study. Therefore, the household survey was conducted on 100 respondents in Mencha Gogara and Wachiga Asho kebeles. Regarding the assessment of the investors view, 4 local and foreign investors were asked by way of self-administered questionnaire using purposive sampling. This method was also used to interview government officials with the instrument of self-administered questionnaire purposefully.

4.4. Data Collection Methods

4.4.1. Primary Data

4.4.1.1 Survey questionnaire: Household survey is conducted using questionnaires administered to 100 sample households. Educated enumerators were hired to collect the data. They were given three day training and enough elaboration about the aim of the study, contents of the questionnaire and what kind of care they should have to take during interview.

4.4.1.2 Key informants interview /KII/: Collecting information from different stakeholders is believed to increase the validity and reliability of the data. Accordingly, interview with key informants was found to be important. Therefore, consultation and interview with different stakeholders such as investors, government officials at local and regional levels was conducted.

4.4.1.3 Focused Group Discussion: This is another qualitative method of data collection instrument. It is arranged to support the data obtained from the household survey and key informants interview. For this purpose, discussion with one group that consists of 10 individuals was conducted. Individuals were selected randomly and the discussion was made using the local language.

Figure7: FGD with the Local Community in Offa Woreda.

4.4.1.4 Field observation: In addition to the mentioned techniques to collect data, field visit in the study sites was made to observe and identify issues related to the development. Informal discussion and interview with the local communities and the investment employees were used. Field observation in the area was possible with the help of guides from the Woreda administration offices.

4.4.2. Secondary Data

The primary data collected using different techniques is backed by information from secondary sources. In each stage of the study, reviewing different literatures and /or documents is the basic means of information gathering. This is done through internet search of Journals,

books, reports, scientific researches and other published and unpublished sources.

4.5. Data Analysis

The collected data was coded and analyzed using descriptive statistics. The household and workers survey data is analyzed using descriptive statistics with the help of statistical packages for social sciences (SPSS) soft ware. Therefore, frequency tabulation is used for statistical description. Non-quantifiable information from open-ended questions, key informant interviews, observation and focus group discussions, were used in the triangulation of evidences through qualitative description.

5. Result and Discussion

This chapter is divided into five different sections. The first section comprises the demographic information of the study population. The second section briefly outlines the socio-economic characteristics of the sample population before the introduction of Jatropha production. Here the source of income and major problems they face to produce crops and livestock are analyzed. The third section covers how the sample households produce Jatropha including their mode of agreement which indicates the farmers' relationship and contractual agreement with the company. The fourth section discusses the socio-economic conditions of the sample farmers after the introduction of Jatropha production. Here the socially controversial issues such as the tradeoff between food security and Jatropha production, Job opportunities, income generations, and infrastructure developments are discussed. The fifth section is concerning with the ecological dimensions of developing Jatropha namely Green house gas emission, increasing land use for Jatropha production, deforestation and use of fertilizers and pesticides.

5.1 Demographic characteristics of the sampled households

With an objective of identifying the opportunities and threats of introducing Jatropha plantation development, 100 households were selected from two kebeles in Offa Woreda, Wolita zone. In each kebele, 50 respondents got the chance to respond to the interviews.

The gender profile of the study population indicates that the majority of the respondents were males (Table 3). The reason for more number of male respondents is because of the fact that the majority of the

households in Ethiopia rural community are headed by male. About 81% of the farmers were married, 16% of them were single, 2% of the farmers were divorced and the rest 1% were widowed (Table 3).

Table 3: Sex and Martial status of the sample farmers

Sex of the HH

Sex	Frequency	Percent	Cumulative percent
Male	82	82.0	82.0
Female	18	18.0	100.0
Total	100	100.0	

Marital Status

Marital Status	Frequency	Percent	Cumulative Percent
Married	81	81.0	81.0
Single	16	16.0	97.0
Divorced	2	2.0	99.0
Widow	1	1.0	100.0
Total	100	100.0	

Table 4 shows the age category of respondents. Accordingly about 27% were in the age category of 20-30, and 38% were within the category of 31-40.

Table 4: Age of HH respondents

Age of the HH

Age category	Frequency	Percent	Cumulative Percent
20-30	27	27.0	27.0
31-40	38	38.0	65.0
41-50	28	28.0	93.0
Above 51	7	7.0	100.0
Total	100	100.0	

Education plays a vital role to speed up the economic development of any nation. When we look at the educational level of respondents, it was very low. As we can see from the Table 5, 65% of them were illiterate and the rest 35% were literate (can be able to read and write).

Table 5: Educational status of the sample farmers

Illiterate=cannot be able to read and write

Literate=can be able to read and write

Educational Status

Literacy level	Frequency	Percent	Cumulative Percent
Illiterate	65	65.0	65.0
Literate	35	35.0	100.0
Total	100	100.0	

Table 6 shows the household size of the respondents; 50% of the household comprises 11 to 15 family members. The average household of the respondents is 6.53 persons per household which is much higher than the national average family size of 4.9 persons per household (CSA, 2001). The division of labor between male and female shows that 97% and 21% of the respondents said that ploughing and planting are done by men respectively. 54% and 74% farmers mentioned that weeding and harvesting activities are done by both male and female respectively. From the respondents 18% of them said that marketing is done by female and 43% of them said that it is done by male and the rest 39% said that it is done by both male and female.

Table 6: Household size and Division of Labor

Family Size

Household Size	Frequency	Percent	Cumulative Percent
1-5	1	1.0	99.0
6-10	48	48.0	98.0
11-15	50	50.0	50.0
Above 16	1	1.0	100.0
Total	100	100.0	

5.2. Socio-economic characteristics before the introduction of Jatropha seed.

5.2.1 Major source of income

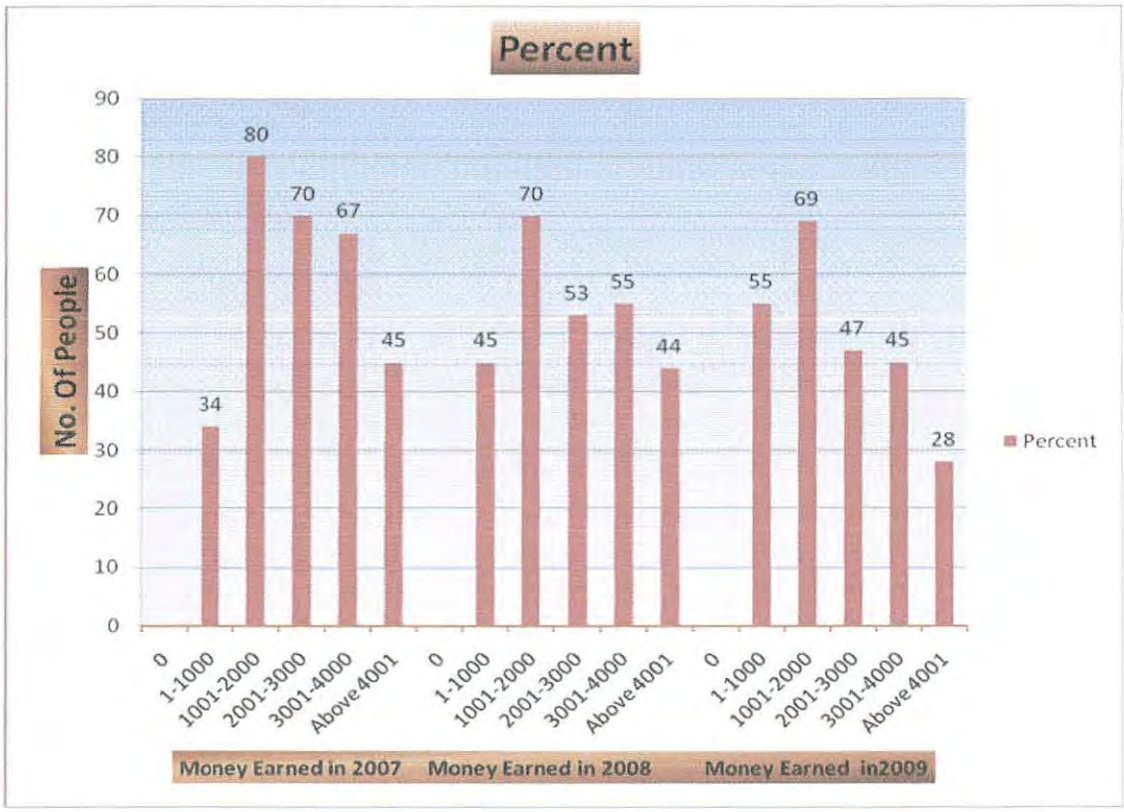
Before the introduction of Jatropha into the study area, the major source of income for the households was farming. The major crops produced were maize, teff, and potatoes. Livestock production was the second major source of income for the farmers living in the study area. About 77% of the respondents said that maize is the major crop produced in the study area, 21% of them have also said that teff is produced and the rest 2% potatoes. This shows that the farmers in the study area do not depend on one type of crop rather they depend on diversified crop production.

Figure 8 shows the farmers' income from cereal sales in the last three consecutive fiscal years. About 45% of the respondents earned above 4001 birr in 2007 and 44% of them earned above 4001 birr in 2008. The rest 28 % of them earn above 4001 birr in 2009. The number of farmers who earned money from cereal sales decreased from 2007 to 2008 and 2009 respectively.

In this study it was assessed whether planting Jatropha has contributd to the decreasing of sampled farmers income of cereal sales from 2007-2009.The triangulated data showed that there is a systematic association between income decrease of farmers from cereal sales and Jatropha development.This is due to the fact that shifting crop farms for Jatropha plantation in addition to shortage of farm/grazing land has contributed to the decrease of income from cereal sales.Because there is a shortage of farm land for crop production, the annual income of the farmers from cereal sales was decreased.

Figure 8: Farmers income from cereal sales in Birr (2007-2009)

Source: Survey Data



In addition to the above findings, information from some experts showed that Jatropha plantation could compromise food production. They said that in order to produce sufficient crops for fuel production, larger areas should be used to bio-plants such as Jatropha which in turn compete with food crops that used to be planted in the same plot of land. The other factor that should be mentioned in the case of bio-fuel production is shifting to mono-crop production. When farmers who are producing bio-crops are getting more income, other farmers will be attracted and start producing the same crops which in turn causes a decrease in supply of food crops.

The major reasons for reduction of households' income are lack of farm land, high cost of living and lack of water (Table 7). The respondents said that lack of farm land and scarcity of water was the major reasons for decreasing household income in the past three consecutive years (2007-2009), respectively.

Table 7: Reasons for Household income decreasing

Reasons for HH income decreasing

Reasons for income decreasing	Frequency	Percent	Cumulative Percent
Lack of water	18	18.0	18.0
Low market Price	16	16.0	34.0
Lack of farm land	43	43.0	77.0
High cost of living	23	23.0	100.0
Total	100	100.0	

5.2.2. Farm experience and land ownership of the sample farmers

The majorities (46%) of the sampled farmers have more than 31 years of farming experience and 29% of them have 21-30 years of farming experience where as the rest 12% and 13% of them have 1-10 and 11-20 years of farming experience, respectively. Most of the farmers i.e. 85% of the sample farmers have their own land and 9% of them are using share cropping and the rest 6% of the respondents are using the land owned by the farmers in the study area is 1.24 hectares where as one hectare and

3 hectare of land is the minimum and the maximum size land owned by the sample farmers.

5.2.3. Livestock owned by the sample farmers

Farmers around the study area use the degraded forest lands for grazing, while the plains are used for farming. Although, livestock constitutes the chief saving mechanism, they are also important as power for ploughing and security during crop failure (Bedru 2006). The ownership of cattle is a symbol of respectability and a means of gaining high social status. The survey result on livestock ownership shows that 52% of the sampled households have between 1-10 cattle, and 34% of them have between 11-20 cattle. The extreme case is 1% with no cattle and 13% owns 21-30 cattle. In general, it indicates that more people have less numbers of cattle.

The idea obtained from the key informants interview and from the group discussion with elders also backs this findings. They said that the current generation has significantly fewer cattle per household. Among the reasons they gave for the decline of cattle size is feed shortage due to a decline in grazing land, population growth and expansion of their own farm land.

5.3 Introduction of Jatropha and the socio-economic conditions of HHs.

The beneficial characteristics of Jatropha could offer a means to address the key social and economic issues of rural unemployment, depopulation, land degradation and fuel security that face many developing countries (McGahey, 2008). It is also labor intensive hence creating jobs for poor indigenous people who otherwise are forced from

their ancestral villages and displaced, having to live in extreme poor conditions in city slums (Open show, 2000). Having this in mind a high level of African bio-fuel seminar was held at the end of July 2006 in which the Minister of Mines and Energy spoke of the country's bio-fuel strategy based on the Jatropha curcas for biodiesel production. Currently many local and international companies have started plans for bio-fuel operations in Ethiopia including sun bio-fuel /Global energy in the study area.

The majority of the respondents (88%) replied that Jatropha plantation was introduced in Offa Woreda by the foreign company called sun bio-fuel /Global energy in 2006, 11% of them said it was introduced by the government officials. And the rest 1% of the sampled farmers said that Jatropha was introduced by traders in the study area. Here the major reasons told to the sample farmers by sun bio-fuel/ global energy when they introduced to the local communities were that Jatropha plantation has a high profit than food crops. They told them that it is highly profitable than producing cereal crops.

Jatropha is a suitable crop for Offa Woreda, the study area, which is evergreen with an average rainfall. In this area Jatropha plant is intercropped with other crops such as maize and sorghum. Conditions of soil being very fertile and thick and with an average rainfall much product can be harvested from small plots of land. Jatropha seed is harvested in less than 6 to 8 months time if planted on an irrigated land but depends on the amount of water, soil materials and seed variety.

Table 8: Introduction of Jatropha plantation in the study area

How was Jatropha introduced in Offa Woreda?

Responsible for introduction	Frequency	Percent	Cumulative Percent
Sun bio-fuel	88	88.0	88.0
Government	11	11.0	99.0
Traders	1	1.0	100.0
Total	100	100.0	

The majority (84%) of the sampled farmers uses improved seed from sun bio-fuel / global energy and the rest 16% use the local seed (Table 9).Some experts interviewed from the Ministry of Agriculture and Rural Development said that the improved seed is imported from abroad and was checked by EIAR whether it satisfy the quality and standard requirement of the country. However, it is a high challenge to import improved seeds from abroad as the seeds have less oil content than the local one. In addition, together with the imported seed, many invasive species could prevail in our land like Prosopis Juliflora in Afar region.

Table 9: Type of Jatropha seed used by sample farmers

What kind of seeds do you use?

Kind of Seeds	*Frequency*	*Percent*	*Cumulative Percent*
Local	*16*	*16.0*	*16.0*
Improved	84	84.0	100.0
Total	100	100.0	

5.3.1. Amount of Jatropha seed produced by sampled farmers

All the respondents who were interviewed replied that they have started producing Jatropha seed since 2006. The mean hectare of land they own is 1.24 hectare with a standard deviation (SD) of 0.64. Due to the difference in the size of land holding, the amount of Jatropha seeds they produced was also quite different. Hence, about 46% of the respondents said that they had produced 150-200 kg of Jatropha seed and 29% of them produced 250-300 kg of Jatropha and the rest 20% and 5% of the sample farmers produced 50-100 kg and above 350 kg of seeds ,respectively.

The majority of the respondents (58%) replied that the major problem they faced in producing Jatropha seed is lack of markets (Table 10). Information gathered from key informant and FGD also indicated that lack of market was the main problem. Farmers who produce the seed were forced to sell the harvested crop to only one buyer (the company) at a fixed and very cheap price. If there was a good market, farmers would have a chance to negotiate price when other food prices have gone up.

Table 10: Major Problems of Jatropha seed production by farmers

Problems	Frequency	Percent	Cumulative Percent
Shortage of labor	1	1.0	1.0
Shortage of seeds and fertilizers	41	41.0	42.0
Market	58	58.0	100.0
Total	100	100.0	

5.4 Modes of agreement between out-growers and the company

At the beginning, the company agreed to plant and produce Jatropha on 5000 hectares of land by its own and 6000 hectares with over 25,000 out-growers. Global energy/sun bio-fuel provides the seed, pesticides along with fertilizers for free for the first season. However, in subsequent season farmers have to pay with the market price and/or can buy with credits. The farmers have agreed to use one percent of their farm land for Jatropha plantations to supply the seeds to the company at an agreed price. The project involves participation of local communities for benefit sharing. Based on the information gathered from key informants and FGD held with non-producers, there had been a dispute between the out-growers and the developer on the agreed price. The farmers are complaining for getting low values for their lands. According to the discussion held with the company, some out-growers did not respect the agreement they made with the company to produce the seed. Some of them agreed to plant more than ½ hectare of Jatropha but in practice they only plant less than ¼ hectare of Jatropha. This leads the company to become not profitable. Moreover, these farmers continuously complain on the company although they were not an active producer to have a good turn back from the company.

"When the company arrived here they promised to build schools, hospitals, make water holes, help widow women and abandoned children and provide scholarships for young men, but it has been two years and almost nothing was done.. The one thing done was water hole but they did not install water pumps. How is it going to be possible to get the water from the hole? When we complain they say that by the end of this year, the hospital will be ready but until now we have not seen any movements to build anything." (*Interview with a local community in the study area).*

5.4.1. Training and Market condition

Among the households administered in the survey, 62% of them said that the company gave them training at the beginning. However, 38% of them have pointed out that they did not receive any training. This shows that not all the farmers were given training. The training focused on row planting, cultivation and an inter-cropping Jatropha plantation with other crops.

Market is a serious problem mentioned among the sampled farmers concerning Jatropha. Jatropha seed is being produced by large number of farmers and only one company buys the harvest. Most sampled farmers mentioned that they do not know any other buyers than the Global energy/ sun bio fuel. In addition, because to the sample farmers do not have enough information when to sell the production, they were forced to sell the product at an average price of the seed per kilogram with 3 birr. Accordingly payments for the farmers need to be revised and need to get paid more and on time.

About 64% of the sampled farmers will continue to plant another cereal crops if and only if the company leaves its development. The other 34% of the respondents said that they will engage in different activities by their own (trade, livestock production etc). The rest 2% of them would like to engage in business activities. This shows that the sustainability of Jatropha plantation among sample farmers is at risk. The sample farmers said that if the company stopped buying the seed from the out-growers, the producers will automatically quit producing Jatropha because there is no other market for Jatropha seeds other than the company.

Table 11: The sustainability of Jatropha plantation if the company leaves the farming activity

What will happen if the company leaves the area?

I will	Frequency	Percent	Cumulative Percent
Continue the work on my own	34	34.0	34.0
Plant another crops	64	64.0	98.0
Engage in other business	2	2.0	100.0
Total	100	100.0	

5.5. Socio-economic Aspects of Jatropha Plantation

5.5.1 Crop production versus Jatropha

In the study area, after the establishment of the Jatropha plantation farm, a rise in the price of food crops had occurred though other factors such as shortage of rainfall have their own contributions. As stated in Table 12, 75% of the respondents responded that the price of food crops highly increased after the introduction of Jatropha in the study area. This is probably due to the expansion of Jatropha plantation in addition to shortage of rain fall, lack of farm lands, and lack of money to buy fertilizers. However, this needs a detailed analysis to conclude whether Jatropha plantation has directly affected the price of food crops or not.

Table 12: The price of food crops after the introduction of Jatropha

What happened to the price of food crops after the introduction of Jatropha

Price of food	Frequency	Percent	Cumulative Percent
Increased	75	75.0	75.0
Decreased	15	15.0	90.0
No change	10	10.0	100.0
Total	100	100.0	

The information from the key informants interview showed that the production of maize (the major staple crop in the area) has increased in some Kebeles and at the same time has decreased in the other areas which are attributed to different reasons other than Jatropha plantation. Shortage of farm land and rainfall was found to be the major reasons for limited amount of food crops production.

Moreover, the information gathered from experts stated that bio-fuel production will not compromise food production. Bio-fuels could have an incentive effect on food production and the land allocated to that purpose could have indirect positive impacts in the long term. Crop-residues from some feed stocks can be used as fertilizer which benefits small scale subsistence farmers to produce more food crops. Some studies also supported the potential livelihood opportunities associated with the Jatropha development. According to McGhey (2008), Jatropha development could offer significant improvements in household incomes. For example, women in Zimbabwe earn supplementary incomes selling soup and fuel for cooking and lighting extracted from Jatropha. Similarly, the local communities of Benin have exported Jatropha seeds to France for soap production since the 1940's. So, the opportunities of Jatropha for local communities have to be critically evaluated. Those experts interviewed from Ministry of Agriculture and Rural Development strongly argued that Jatropha plantation will have negative effects when

more lands are used for bio-fuel production rather than food production. But, in Ethiopia, it is most unlikely to happen for different reasons. The first major reason is that there is excess arable land that can be used for the production of Jatropha without compromising food crops. The size of Ethiopian land is 111.5 million hectare, out of this 74 million hectare is suitable for agriculture. However, the actual land cultivated is estimated to be only 16.5 million hectare (MOME, 2007).

On the contrary, some of the key informants that were interviewed said that bio-fuel production could compromise food production via food crop prices. According to them this will happen if large number of farmers changed their crop cultivation trend to Jatropha plantation, it will have a direct impact on the price of food crops. In addition, the farmers may use fertile farm lands to produce Jatrtropha rather than producing food crops hoping that the cultivation of Jatropha plantation will have high profit than food crops. This will lead to the decrease of food crop supply in the near future.

5.5.2 Income Generation

According to Hazell and Pachauri (2006), bio-fuel production present agriculture and rural areas with a long term opportunity in which demand could actually outpace the growth in supply and generate the resources to increase income and capital in rural areas. Bio-fuel production is labor intensive and believed to create job opportunities for rural poor. This will get the poor to increase their per capita income.

Among the sampled farmers, the majority (37%) of them believed that their per capita income after the establishment of the farm has not been changed while 32% of them believed that their per capita income is increased over the last three years (Table 13).

Table 13: The per capita income of the sample farmers over the last years

How do you evaluate your per-capita income after the establishment of the farm?

Per-capita income	Frequency	Percent	Cumulative Percent
Increased	32	32.0	32.0
Decreased	31	31.0	63.0
No change	37	37.0	100.0
Total	100	100.0	

The survey result showed that those farmers whose per capita income increased were benefited by using farm inputs and fertilizers with the assistance of extension workers. But, using of high inputs like fertilizers may harm the fertility of soil. In addition to this, the farm created additional source of income which can increase income for farmers. According to the information gathered and triangulated, the income of most farmers working with the farm is not increased. The major reason they gave for this is the price settled by the company to buy the seeds from out-growers. It is too cheap and will not benefit the farmers due to the price hike of food crops.

5.5.3. The linkage of the farm with non-producers in the study area

The Jatropha plantation farm benefits both skilled and unskilled workers in the study area. Likewise, farmers who are not engaged in the Jatropha plantation programs will be benefited indirectly by working in the farm. As indicated from the survey study, 61% of the sample farmers believed that the farm has a linkage with non-producers in the rural community

and 39% of them said that the farm has no relationship with the non-producers in the study area. Those respondents who are saying that the farm has a direct link with non-producers gave their own reasons. They said that many rural famers come to the farm and working as a daily laborer or an employ for the farm. These farmers got some more money which will help them to lead their life conveniently. Labor, market, transportation and other social services are some but not the end that let the farm and rural community interrelated to each other. This shows that the Jatropha farm in the study area benefited not only the out-growers but also the non-producers in and around the farm plantation.

As indicated in the table 14 below, 69% of the sample farmers said that there is no change on their life style after they join the farm. However 28% of the respondents believed that their life has changed after they started working with the company. These respondents said that they have constructed new houses with iron sheet. The rest 3% of the farmers believed that their life is on the way of changing. The first benefit they have got is just to establish family which is the basic pre-condition to live with some sort of success in their life. Of those respondents who said that their life has changed after joining the company, 51% of them believed that the farm has a direct contribution for their life improvement. But, 49% of them denied that the farm does not have any role in the improvement of their life style.

Table 14: Change of life among farmers who joined the farm

After you join the farm what types of changes you feel in your life?

Change of life	Frequency	Percent	Cumulative Percent
Family established	3	3.0	3.0
New house constructed	28	28.0	31.0
No change	69	69.0	100.0
Total	100	100.0	

Generally, the farm is also a big opportunity for those farmers who did not have enough farm land. They produce Jatropha seed on marginal lands and earn money which is used to buy food crops. In addition many individuals who are working for the farm have got different technical skills which are valuable for their future career. They also adopt a good work culture from the foreigners who are working in the farm. Therefore, many farmers are benefiting from the farm established in the study area.

5.5.4. Farm contribution for the development of local infrastructures

There is a belief among different stakeholders that the farm has to bring positive changes and economic benefits for the community and reduce poverty. This can be explained through constructing some socio-economic infrastructures which will be useful for economic growth.

According to the households respondents (73%) the infrastructure in the study area has improved over the last three years; while 26% of the respondents responded no improvement. Only about 1% of the respondents said no change. Infrastructure improvement is attributed to the establishment of the farm by many of the positive respondents. Information gathered from key informants and FGD also supported this

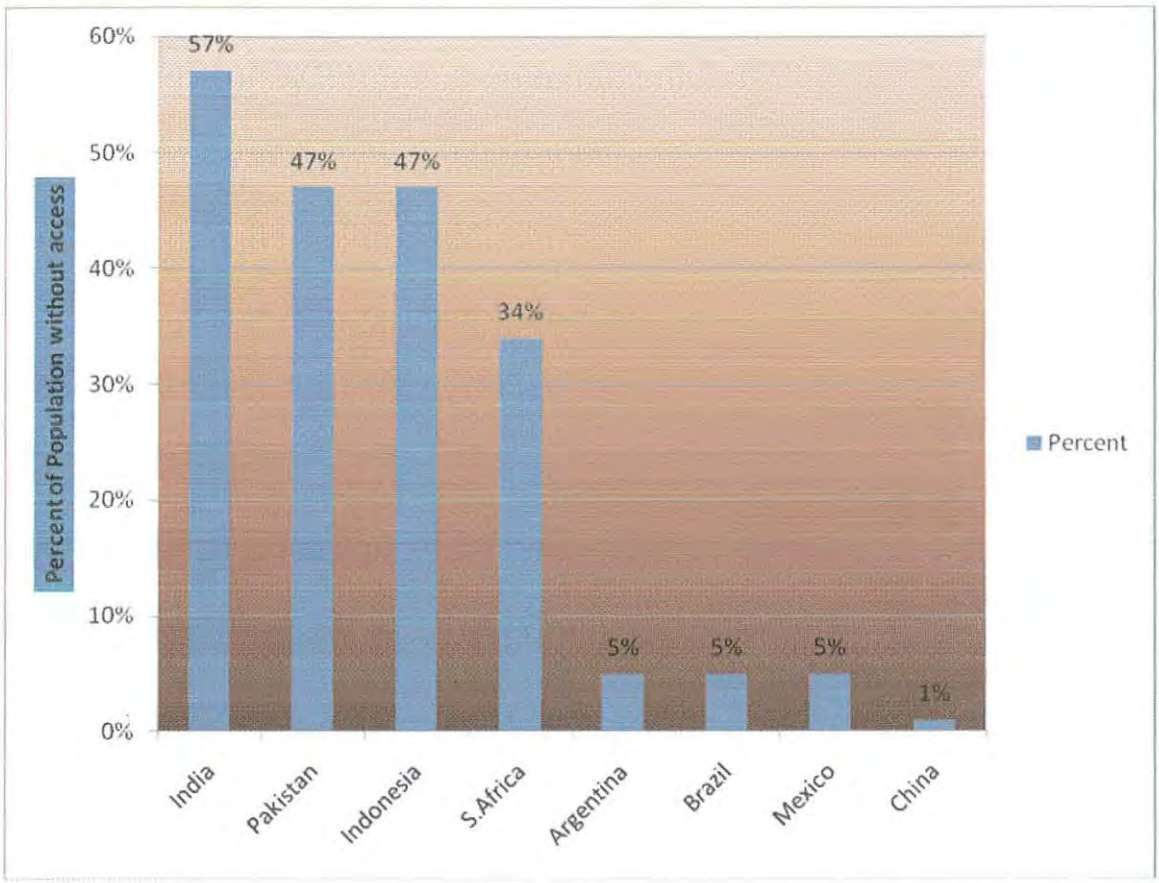
idea. The farm in collaboration with local development agents has rehabilitated 5 km long road in Gesuba town.

Information gathered from key informants and FGD also shows that the farm together with the local government has improved the 5km road to Gesuba a town of Offa Woreda. This is happened because of the farm, they said.

5.5.5. The impact of Jatropha on poverty alleviation

Poverty alleviation and energy provision are linked: availability of local energy is fundamental to intensifying agriculture and agricultural development is essential to poverty alleviation. Impact of rural electrification on poverty is best demonstrated by comparing the statistics between India and China(Figure).In this context, FAO notes the insufficient emphasis on bio-energy as a solution to the needs of the 1.6 billion people who lack access to electricity and on its potential to improve the lives of the 2.4 billion who use traditional biomass, which accounts for 90 percent of energy consumption in poor countries but is often unhealthy, insufficient and environmentally unsustainable.

Figure 9: Population without access to electricity in selected countries.
(Source: IEA, 2002).



Two thirds of the low-income food deficit countries for which data exist are also energy deficit, with 25 of the 47 poorest countries totally dependent on imported fuels, again showing the impact of energy on poverty. These countries use much of their available funds to import oil with little left to support economic growth. Therefore, many of these poor countries and their poor farmers can benefit from the production of bio-fuels, especially from crops that do not compete with production of food crops such as Jatropha.

5.6 *Environmental aspects of Jatropha development*

5.6.1 .Land use

As has been seen from the current practices of Jatropha plantation in the study area, almost all lands cultivated for bio-energy crops are used to be a farm and/or forest lands. There were various types of plants and animals species in the area. Tree species growing in the area includes Cordial africana, Palm tree, acacia species, Rosa abyssinia, Ficus Symons, Kara butugi, etc. Wild animals include hyena, leopard, wild cat, fox, baboon; bread-duck, etc used the forest as their habitat. The company started operation by clearing 150 hectares of land for trial plantation. However, it stopped its operation on February, 2010. One of the reasons for stopping the operation was that the land was not suitable for growing Jatropha. Some of the experts in the company said that the land productivity was very low, so the company was unable to make any profit from the investment. Productivity in marginal or degraded land is low and business can hardly be sustained in such situations. Some of the key informants who are working for the company also supported the above controversial issues as the major problem the company faced during operation. According to them, the lands the company has been given for Jatropha plantation was degraded and remote area. Moreover, there was a serious shortage of water around the farm to plant Jatropha. As a result, the seedlings they have planted were dried and out of use. Therefore, the farm could not sustain for a long period of time and hence they stopped operation around the study area.

Developers that requested land, even after the bio-fuel strategy prepared by Ministry of Mines and Energy (2007), are still getting prime agricultural lands. It can be argued that such things may be happening on the ground because of lack of proper communication among government organizations in terms of implementing the strategy, or the

strategy itself may not be clear enough as to what type of land should be allocated for Jatropha plantation.

As indicated in the Table 15, 80% of the respondents said that they used the land to produce food crops before the introduction of Jatropha plantation, and 20% of them used it for grazing land. Those farmers who are now converted the land for Jatropha production used to produce food crops such as Maize, Sorghum, teff, wheat, barley etc. Based on the survey data, the majority (60%) of the sample farmers used to produce sorghum, 36% of them produced maize and 2% of them produced barley. The rest 1% of sample farmers used to produce teff and wheat, equally. From the above survey data, one can conclude that out-grower farmers are compromising food crop production to Jatropha production. Here, if the production of Jatropha seed is more profitable than producing food crops, it will have a positive livelihood impact on the farmers. However, some out-growers are regretting with the land to be used for Jatropha plantation. This is because the price they delivered to the company is too small to buy food crops. Therefore strategies for improvement of agricultural productivity should take priority over promotion of bio-fuel development.

Table 15: The use of land before Jatropha plantation

For what purpose did you use the land if jatropha was not introduced?

Using the land	Frequency	Percent	Cumulative Percent
For grazing	20	20.0	20.0
For producing crops	80	80.0	100.0
Total	100	100.0	

5.6.2. Loss of Biodiversity

Perhaps the most salient set of issues of bio-fuel policy relate to their local, national and global impacts on the natural environment. The sun bio-fuel/ global energy is expanding Jatropha plantation by clearing the existing land cover, that is, a natural forest in the study area. The forest used to provide a free grazing area and a source of firewood for the local community. The project has to clear the forest for cultivation of Jatropha trees, which will result in sever environmental consequences including loss of biodiversity, wild life and their habitat. Soil erosion and land degradation are possible long term impacts due to the project intervention. The project has not conducted any form of environmental impact assessment so far. Some experts in the Federal Environmental Protection Authority explained that licensing agencies are required to ensure that prior to issuing license and permits; they must require proponents (company) to submit authorization, a letter of approval or Environmental Clearance Certificate awarded by the appropriate Environmental Agency. However, in many projects including the sun bio-fuel/global energy, they fail to require the Environmental Clearance Certificate before giving them a license to start operation. The investment proclamation (No.280/2002 and No.375/2003) also states that implementation of the investment should be according to the relevant laws of the country. While the investment proclamation facilitates the investment process, it fails to put EIA requirement as a prerequisite for the issuance of the necessary operational licenses. It simply requires notification of the sect oral government organization by letter, requesting the necessary support and follow-up of the implementation. This is in direct contradiction to the EIA proclamation that obliges any government body to ensure the approval of the authorized government body for implementation permits prior to issuance of operation licenses.

According to the information from key informants interview and FGD, the destruction of forests cannot be seen in isolation from the scarcity of forest goods and services. The forest goods can be provided to the society at prices that are within the capacity of the majority of the users if there were sufficient forest resource. However, there is acute shortage of forest products and hence prices of forest products have been increased more than double since the last three years. Another result of forest destruction is that, it produces soil erosion and increased runoff water so that it reduced the availability of water and caused more soil erosion.

According to the findings(Table 16), 38% of the sample farmers said that an indigenous trees called 'Warka' were chopped down for preparing land to Jatropha plantation, 30% of them said that 'Acacia' were chopped down and 20% of them said 'Kerkeha' were cleared for the plantation. Similar to this study, some researches in Brazil show that the basic problem with most bio-fuels, largely ignored until now, is amazingly simple, using land to grow fuel leads to the destruction of forests, wetlands and grass lands that store enormous amounts of carbon (Grunwals: the magazine, April 14,2008). Agricultural practices that are not environmental friendly could lead to soil degradation and depletion of natural resources. Policies promoting sustainable farming activities, such as conservation agriculture, can protect the natural resource endowments of the poor and avoid bad practices such as deforestation that would increase hydrogen gas emissions.

Table 16: Clearing forests for Jatropha plantation

What kind of forests you chopped down to prepare land for Jatropha plantation?

Kinds of trees	Frequency	Percent	Cumulative Percent
'Wanza'	7	7.0	7.0
'Acacia'	30	30.0	37.0
'Warka'	38	38.0	75.0
'Kerkeha'	20	20.0	95.0
'Tid'	5	5.0	100.0
Total	100	100.0	

5.6.3. Increased use of fertilizers and pesticides

An increased use of fertilizers and pesticides to get maximum yield from crops bring some negative effects if it exceeds the limited amount. According to Mahlet Eyassu (2008), excessive use of inorganic fertilizers and pesticides degrade the land and also affects the environment. It is also supported with the paper presented for round table organized during the thirty-first session of IFAD's governing council, 14 February 2008.According to the paper presented on the session, for rural areas that fertilize with crop wastes and manure rather than external inputs, biomass production could lead to dramatic declines in soil fertility and structure. But, there are also exceptions. Bio-fuel plants such as Jatropha have potential to improve soil quality and coverage and reduce erosion while their oilcakes can provide organic nutrients for improving soil.

The majority of the sample farmers (95%) are using fertilizers while 5% of them are not using it. Out of those who are using fertilizers, 31% of them use Dap and 62% of them use both Dap and Urea. The rest 7% of them

said that they use Urea only. Among the farmers who use fertilizers, 87% stated that they get the fertilizer from the sun bio-fuel/Global energy, 9% of them get from the market and the rest 4% get fertilizer from government.

Additionally about 77% of the respondents said that they are using pesticides to protect the Jatropha plant from diseases and 23% of them replied that they are not using pesticides on their farm because of lack of money to buy the pesticides.

This study found extensive evidence pointing to Jatropha vulnerability to diseases and problems with fungi, and insect pests. In the cases when the plants were heavily infected by diseases, the Jatropha plant would stop producing leaves and stay in a state of stress which left the out-growers with no choice other than to remove the plant. The key informants and some experts have also proved that extensive use of fertilizers and pesticides has still not solved the problems of the plant from diseases. Even there is greater concern in the study area that the pests will spread to surrounding food crops. More research is required to better understand the extent and impacts to subsistence farmers and food sovereignty in general, but the current food deficit, weak support and lack of safety nets characteristics of the subsistence farming sector makes even minor impacts serious.

In addition to the above threats of Jatropha plantation, it was also mentioned that the plantation could have negative effects on the livestock they breed which is caused by the pesticides they are using. Farm inputs including fertilizers and anti-pests such as Endosalpine are used and a practical test was done regarding that.

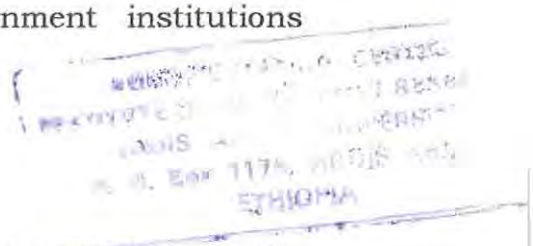
5.6.4. Compatibility with the Environmental Policy of Ethiopia

The environmental policy of Ethiopia was adopted in 1997 with the objective of improving and enhancing the quality of life of all citizens. It promotes sustainable social and economic development through the sound management and utilization of natural, cultural and environmental resources of the country. The environmental policy promotes energy development from renewable resources, and the need for rigorous environmental impact assessment for energy and other development activities to avoid unintended consequences on the environment in general.

The Environmental policy of Ethiopia contains the provision for the enactment of the environmental impact assessment proclamation. The EIA proclamation laid the foundation requiring an EIA both at the level of project implementation of activities, as well as for strategic assessments. The EIA proclamation obliges that no project shall commence implementation without first getting the approval of the relevant government organization for its EIA (Article 3). It also force licensing institutions to ensure that a certain project must obtain an approval of the EIA document and a permit for the implementation from the authorized government organization before issuing investment license (Article 3).

Given all the above proclamation of rules and regulations of Environment, the companies did not have any EIA document before starting operation in the study area. This is the major problem faced the new Jatropha boom in the dry lands of Ethiopia. The researcher has also tried to assess the work relationship among government institutions concerning Jatropha plantation. However, some experts in Environmental protection Authority criticized the investment commission

for giving license without ensuring the developers to conduct EIA as a pre-requisite to issuance of operational license. The Federal investment commission, on their side, also makes the EPA experts responsible for the given problem by saying that the EPA did not make a quick evaluation process of EIA documents submitted by developers. This shows that there is a gap between the government institutions concerning EIA implementation.



5.7. The dilemma of Jatropha development

From the information gathered through different techniques, the researcher was able to understand that there is a dilemma going on as to the balance between the benefits and costs of Jatropha plantation. As it was clearly shown under the benefit (section 5.5) above, the plantation has many advantages. If Jatropha seed is produced in a large scale, it could provide less developed countries like Ethiopia with a means to invest in their own rural areas instead of exporting their capital to purchase Fossil Fuel. The rapidly depleting sources of Fossil fuel and the desire to achieve energy security and mitigate climate change have combined to heighten interest in bio-fuel production as on alternative source of energy. It is also provides job opportunity for rural poor and will have come positive results in increasing their per capita income.

However, the introduction of the plantation is also accompanied by the costs it incurred both at an individual and community level. The sheer speed of bio-fuel expansion may generate new pressures on land tenure arrangements, leading to alienation. There is considerable fear that the poor may either sell or be forced to relocate as the rush to meet increasing demand gathers momentum. As bio-fuel development is taking place rapidly, this issue needs to be addressed as a matter of urgency to move beyond debate and advice farmers and governments of

the opportunities and risks associated with bio-fuel production. The destruction of forests for Jatropha plantation should also be considered which will result in serious environmental crisis.

Accordingly, the information collected from FGD and key informants indicated that the local people in Offa Woreda have encountered both the benefits and costs because of Jatropha plantation. However, when they compare the two, they retaliate that the benefits overweight that of the costs and called up for its expansion. The major reason they forwarded was that even though it has costs, it is now benefiting from the farm for their livelihood.

On the other hand, some key informants from civil society and NGO's worked on environment strongly argue that in order to say Jatropha plantation is beneficial or harmful, it is too early and there are two major things to be taken into consideration. These are the livelihoods of the people when there are Jatropha plantation and the ecology of the area. They explained that the livelihood might be one of the major factors that could aggravate the negative impact of the plant. The people in Offa Woreda is highly related with farm and grazing land. Anything that could affect the availability of the land has a direct implication in their lives which has been observed because of the expansion of Jatropha plantation. However, if it was introduced in a different environment where the livelihood of the people is not heavily dependent on crop and livestock production, for instance, traders the impact might not have been as that of the agro-pastoralists. The second factor they put forward as a precondition to compare the benefit and costs of the plantation is in relation to the ecology where it is introduced. Based on these two conditions, it can be deducted that Jatropha plantation can be harmful or beneficial to that specific area. As a result, it is too early to say that Jatropha plantation is harmful or beneficial.

6. Conclusion and Recommendations

6.1 Conclusion

This research has dealt objection of assessing with the opportunities and challenges of Jatropha plantation development in Offa Woreda, South Nations, Nationalities and Peoples regional state. As in many parts of the world, the initiative for bio-fuel development in Ethiopia originally came from the private sector, though it did not take too long to get the government to buy-in. Mitigation of climate change is often presented by governments as a key policy goal for biomass fuel developments. But in the case of Ethiopia, the government is explicit about its reasons for promotion of bio-fuels. The reasons among others are energy security through the use of bio-fuels and to improve the balance of trade by import substitution and new export market development.

The government of Ethiopians has also been formulated a bio-fuel development and utilization strategy in August 2007. The strategy is formulated based on principles that development of bio-fuels should not have unintended outcomes on food security, land access, the environment, cultural values and the economy.

Based on the findings from the study, after the introduction of Jatropha plantation, a rise in the price of food crops have occurred in the study area. The results of the study show that the main reason was many farmers were switched from crop production to Jatropha production hoping that they will have better price for it. Due to this reason, the supply of food crops decreased over the last three years.

The research findings also showed that many farmers who are producing Jatropha seed are forced to sell in a very low price. This was happened because the company which is operating around the study area had signed a contractual agreement with the farmers to buy their products with a fixed price. This did not benefit the farmers and it did not give

them a chance to negotiate the price. Moreover, the farmers are using improved seeds delivered by the company from abroad. This situation gets the farmers to be dependent on the company for seed supply by passing local seed sources. Here, the company is using energy crops which are imported without getting proper permission from the concerned government organizations.

According to the survey results, the program (Jatropha plantation) created an alternative income for the local communities. The program has also benefited the non-producers by letting them to engage in different activities such as employed as a guard, daily laborer, transportation etc. In addition to job opportunities, the farm contributed technology and knowledge transformation which will help the farmers to produce more. This was happened through continuous training the farm given to the out-growers and the non-producers.

Concerning the infrastructure development, there result of the study indicated that road construction; electricity and telecommunication services were expanded or improved than before because of the project operation. However, many farmers who were working for and/or with the company became poorer due to lack of compensation in case of natural disaster. This makes very difficult for small farmers to sustain the production of Jatropha as they depend on one type of crop. The local communities are complaining on the company because they said that the company did not respect its promises to build social services such as health center, and school.

The subsistence farmers do not have much information about Jatropha: they know that the plant produces oil to make biodiesel, that they know that the seed is not edible. Because of these farmers have limited information about Jatropha, they are vulnerable to the extensive marketing campaign around Jatropha. These force subsistence farmers

to grow food crops such as maize, sorghum, teff etc. than growing Jatropha. Moreover, the company used to export the oil seeds without converting it in to biodiesel. This showed that Jatropha plantation is not directly contributing to the country's energy supply or substitute the fossil fuel that is imported from abroad. If the oil was converted to biodiesel in the study area, there would have been more employment opportunity for farmers and small industries could be developed in rural areas.

Large scale Jatropha plantation in the study area was replacing natural vegetation. The local authorities made the land available for the developer without taking in to consideration the impact of deforestation. Not only the developers but also the out-growers of Jatropha used to cut additional forest lands when shifting plots. Therefore, the claim of large areas of marginal lands by the bio-fuel development and utilization strategy of Ethiopia does not take into account either the ecosystem service or the resource contribution of these lands to livelihood. In the current climate change crisis, the loss of major carbon sinks like forests have to be taken seriously, otherwise agro-fuels in Ethiopia is a threat in the drive to decrease the country's carbon foot print.

In relation with the use of fertilizers and pesticides by the out growers, the study identifies that excess use of such kinds of farm inputs may affect the environment or the ecosystem. But, the sun bio-fuel/ global energy monitored the use of farm inputs by agricultural experts, therefore, the negative impacts of using fertilizers and pesticides could be minimized. However, the risk of spreading of Jatropha pests and diseases into other food crops is great concern. The prices of fertilizers and pesticides are also another problem for the poor out-growers to be benefited from their hard working. Therefore, in addition to basic development, more support has to go directly into the small scale farming sector in Ethiopia before the high risks of Jatropha can be

mitigated (e.g. micro credits, training, market links and information). Jatropha does not present a development opportunity, but rather requires substantial development in the subsistence farming sector to be successful.

The bio-fuels development and utilization strategy of Ethiopia stated that different government institutions have to work together to maximize the opportunities and minimize its risks of the new energy development ambition. However, they are not working together to achieve the intended goals of bio-fuel development. For example, the bio-fuel developers are now operating in different regions without preparing an EIA before starting operation. This shows that there is a gap among the environmental protection authority and Federal Investment Commission which are both government institutions.

In Ethiopia agricultural activity is mainly the subsistence small holder farming sector is the most important. The farm usually covers 3 to 6 hectares and provides the staple foods for a family. Intervening in this kind of agriculture which is characterized by hand to mouth nature of production needs careful attention and policy. Because the production volume is small, flexibility is limited and vulnerability to food in security is high for farmers as well as for the country depending on their production as a whole. Therefore, work to ensure poor people and small farmer's participation in the production of bio fuels and policy formulation is needed to tap the full opportunities it can render.

6.2 Recommendations

There is hope in that bio-fuel production in Ethiopia will begin by reducing the country's dependence on imported oil and saving money for the impoverished small holder dominated economy. However, large scale bio-fuel development has great risk in relation to the social and environmental sustainability. Based on this, to bring the positive

outcome and minimize the negative impacts of the new bio-fuel development boom in Ethiopia, the following measures needs to be taken in to consideration.

- The conductive environment and investment policy, very low lease price, and very minimal investment requirements have attached many foreign and inland investors in the study area. But, proper land inventory has not been conducted by the local officials in the Woreda. Therefore, until proper inventory of land is conducted, the local officials should not allow the project's additional expansion land request.

- Proper monitoring and evaluation must be implemented so as to identify the positive and negative socio-economic and environmental effects of the project. Here, public participation which brings the real needs and problems of the people from the project should be at the center of the monitoring and evaluation process.

- The price of bio-fuel will attract the food crop producing farmers which may cause shifting their farms to bio-fuel that in turn cause competing for land and food insecurity. So, there should be policy and procedures to monitor such threats and to the impact in the future.

- Both the nations and local officials should assess the major problems raised by the local communities towards the farm.

- In most cases the additional crops being harvested for bio-fuels such as Jatropha are not potential food sources. In an emergency famine situation, this crop could not be used to feed people dying of starvation because it is not a food source. This is a country that is already suffering from extreme food insecurity. The researcher

believes that for the sake of food security, the bio-fuel development strategy should clearly disallow replacement of crop farms to produce Jatropha seeds.

- The bio-fuel development and utilization strategy should clearly encourage the production of improved seeds locally so as to save the capital invested for buying seeds from abroad.

- The strategy should force the bio-fuel developers including the company in the study area to prepare EIA document and should also make it as a pre-condition for commencing development activity.

- There should be detail research towards the use of fertilizers and pesticides so as to reduce its impact on the environment due to excess amount of the farm inputs.

- Political commitment is important element in allocating adequate resources to implement policies and to avoid possible threats of bio-fuel development in collaboration with the surrounding communities for objectives to be realized.

- Alternative source of energy such as wind and solar should be widely used since they do not compete with food production. In addition, the use of vegetable oil as it is without any need of converting it to biodiesel should also be promoted for households cooking, lighting and driving machines. This should be emphasized in small scale bio-fuels production for consumption in rural areas.

References

Action Aid International (2008). Food, Farmers and Fuel: Balancing Global grain and Energy policies with sustainable land use.p17-18.

Beniyam, A. (2008). The opportunities and challenges of producing Ethanol from sugarcane and introducing it as a household energy substitute: A study of Fincha and A.A.

Brown, R. (1980). Food or Fuel: New Competition for the world's cropland. World Watch Paper 35, March 1980.

CSA (2001). 'Central Statistics Authority.' Agricultural Sample Survey. Addis Ababa.

Daniel J. McGahey (2008). Bio-energy and Pastoralism: Challenging the Wastelands Myth. Unpublished.

Department of Minerals and Energy, Bio-fuels Industrial Strategy of the Republic of South Africa, December 2007.

Directive 2003/30/EC of the European Parliament and the council of 8 May 2003 on the promotion of the use of bio-fuels for transport.

Fact foundation (2006). Jatropha Hand Book. First draft.p5.

Federal Democratic Republic of Ethiopia Rural land Administration and Utilization Proclamation-456/2005.

Forest Development, Conservation and Utilization Proclamation 542/2007.

G/Micheal, G. (2005). The challenges of tourism resources conservation and management in Abijata-Shalla lakes National park, Central rift valley, Ethiopia.

Grunwald, M. (2008). The Clean Energy Scam. Times Megazine, April 14, 2008. PP.28-32.

Hailemariam, M. (2008). The Effects of Prosopis Juliflora invasion on livelihood and adaptation mechanisms: Case study on Amibara District, Afar National Regional State, Ethiopia.

Henry and Heinke (1990). Environmental Science and Engineering.2nd ed.

Hiruy, S. (2008). The quest for conservation in the midest of deforestation, resource degradation and unsustainable livelihood practices in and around Zeqwala.

Http://encarta.msn.com.

Http://WWW. Top news in Mozambique-tackle-high-energy-bill-rural darkness.

Http://WWW.Mother Jones.Com/environment/2009/03/bio-fuel-African-land grabs.

JA and UNAC (2009). Jatropha! A socio-economic pitfall for Mozambique.

Lorenzo Cotula, et al (2008). The Bio-fuels boom and poor people's access to land.

Mahlet, E. (2008).The challenges and Opportunities of Developing biodiesels in Ethiopia: The Case of Castor seed in Eastern Harerge.

MELCA (2008). Rapid Assessment of Bio-fuels Development Status in Ethiopia.

Mohammed, M. and Associates (2001). A Comparative Study for Pastoralists Parliamentary Group: Case study on the Pastoral Affairs Standing Committee of Ethiopia, Unpublished.

MOME (2007). The Bio-fuel Development and Utilization Strategy of Ethiopia, A.A.Ethiopia.

Open Shaw, K. (2000). A Review of Jatropha Curcas: an oil plant of unfulfilled promise; Bio-mass and Bio-energy Vol.19, P.1-15.

Santa Barbara, J. (2007). Bio-fuels: A special Report from international forum on Globalization and the institute for policy study.USA.

SOS Sahel international UK (2008). The risks of bio-fuel development on marginal lands for the livelihood of pastoralists (unpublished).

The Constitution of the Federal Democratic Republic of Ethiopia.August, 1995.

The Ethiopian Petroleum Enterprise (2008). Petroleum Demand and Import Values Statistical data for 2007/08 (Unpublished).

UNDP (2004). World Energy Assessment: Overview 2004 updates. UNDP, Bureau of Development Policy, New York.

Appendix A. Interview based questionnaires for households:

Dear Respondents,

This is a survey by a graduate student in Addis Ababa University, College of Development studies. The general objective of this study is to assess and raise awareness and understanding of the true opportunities and threats emerging from current bio-fuel boom in the dry lands of Ethiopia, particularly Wolaita zone, Offa Woreda. Several questions directly or indirectly related to the subject matter one included in this survey. Therefore, you are kindly requested to reflect your feeling on the issues.

Thanks for your cooperation's!!!

I. General information

a. Name of the Enumerator _____
b. Date of interview _____
c. Name of Woreda _____
d. Name of Kebele _____
e. Village Name _____

II. Demographic and socio- economic information

1. Name of the HH _____ Age _____ Sex _____
2. Martial Status 1. Married 2. Single 3. Divorced 4. Widow
3. Religion 1. Islam 2. Christian 3. Other (specify)
4. Family size 1. Male _____ 2. Female _____
5. Educational status . 1. Illiterate (unable to read and write)
   2. Literate (able to read and write)
6. Role in the family 1. Head of house hold (husband)
   2. House wife
   3. Daughter
   4. Son
   5. Other
7. No of year you stay here
8. Previous place you lived
9. Land ownership 1. Own land 2. Rent in 3Share Cropping
4. Other (Specify) _____
10. Size of the land owned in timad (Hectare) _____
11. Is the land size you have enough to lead your Livelihood?
    1. Yes 2. No
12. If no, what alternative mechanisms do you use?
    1Honey sales 2. Wild life products 3. Charcoal
    4. fuel wood 5. Others (specify)

III. Main source of income for the house holds.

1. What is the major source of the household income

No	Income source	2007 (in birr)	2008 (in birr)	2009 (in birr)
1	Cereal sales			
2	Vegetable sales			
3	Livestock sales			
4	Milk sales			
5	Trade			
6	Employs			
7	Other (specify)			

2. How do you evaluate your household income over the last year?
   a. Increasing b. Decreasingc. No change
3. If you response to the above question is increasing, what are the reasons?
4. 4. If you response to question No 2 is decreasing, what are the reasons?
   a. Lack of water
   b. Low market price for form products
   c. Lack of grazing land
   d. High cost of living
   e. Other (Specify)

IV. Crop Production

1. What is the major crop produced in the area in the last years?

No	Crop type	Area Covered By The crop			Amount Harvested Local unit In			Amo unt By in	Consu med The house local	Hold unit
		2006	2007	2008	2006	2007	2000 8	2006	2007	2008
1	Sorghum									
2	Maize									
3	Teff									

4	Wheat									
5	Barley									
6	Vegetable									
7	Jatropha seed									
8	Other(specify)									

2. **What are the major problems faced in producing crops"**
   a. **Lack of enough farming land**
   b. **Lack of enough water**
   c. **Lack of money to buy fertilizer**
   d. **Others Specify**

V. Livestock

1. What are the numbers and types of live stock owned?

Livestock you have							
Types of livestock	Cattle	Sheep	Goat	Donkey	Camel	Other specify	Don't hve
Number							

2. What are the major problems faced in livestock production?

   a. Lack of water b. Lack of grazing land c. Lack of market for livestock products d. Others (specify) _____

VI. Pre-Jatropha plantation introduction livelihood information

1. How long did you know Jatropha?
   a. Less than 2.years b. 3-4 years c. more than 5 years
2. How was it introduced in offa woreda?
   a. Sun bio fuel b. Government officials c. traders d. other (specify)
3. If you response for question No 2 is (a) please explain how?----------
   ----

4. If your response for question No 2. Is (b) please explain how?----------
---

5. During Pre-Jatropha plantation introduction, livelihood of the household depend on
   a. Agro-pastrolism b. trade (specify)_____ c. Employed (specify)__
   e. Share crop e. other (specify) _____
6. If your response for question No. 5 is (a) please explain the trend of cultivation you had
   a. Size of the land owned (ha) _____
   b. Cultivated area _____
   c. List of crops cultivated before in the order of importance
      a. _----------_____
      b. _----------
      c. _____

VII. post- Jatropha plantation introduction livelihood information

7. Current livelihood of the household depends on
   a. Agro-pastoralism b. trade, specify _____
   c. Employed, specify _____ e. others (specify)_____
8. If your response for question No. 7 is (a), please explain the trend of cultivation
   a. Size of land you have currently (ha)
   b. Cultivated area.
   c. Lists of crops cultivated now by order of importance
      a. _____
      b. _____
      c. _____
      d. _____
9. If your response for question No. 7 is (b), what kind of trade" and explain why you change the livelihood? ----------
---

_____

10. If your response for question No. 7 is **c**, where are you employed and how you are employed?

_____

_____

_____

11. Main reason for the decrease in crop and/or livestock trend (choose only one)
    a. Shortage of farm / grazing land
    b. Drought
    c. Disease
    d. Others, (specify)
12. If your response for question No. 11 is (a), please specify

_____

_____

13. The size of land for cultivation / grazing in the last 2(two) years
    a. Increased b. decreased
14. If your response for question No. 13 is (b), please explain why? _____

VIII. Jatropha production information

1. Do you produce Jatropha? 1. Yes 2. No

   1.1 How much_----------_____
   _____

2. When do you start production Jatropha?

   a. Six moths ago b. a year ago c. Two years ago

   d. Other (specify) _____

3. Where did you get the seed?
   a. On the market b. Sun bio fuel c. Government offices (kebele)
   d. Other ----------
4. What are the major problems faced in producing Jatropha in this area?
   a. Shortage of labour b. Shortage of seeds and fertilizers
   c. Shortage of information d. Market e. Others _____
5. For what purpose did you use the land if Jatropha was not introduced?
   a. Grazing land b. Other crop plantation c. Forest land
   d. Other
6. Last year what was the type of crop planted on the same land?
   a. Sorghum b. Maize c. Teff d. Wheat e. barley
   f. Vegetables g. others
7. What did you plant on your land before you started producing Jatropha?
   a. Sorghum b. Maize c. Teff d. Wheat e. barley
   f. Vegetables g. others
8. What will be the problem to sustain and expand the Jatropha plantation farm?
9. What do you think is the major purpose of jatropha plantation?
   a. Bio diesel production b. use for light c. use the oil as a fuel
   d. other specify
10. For what other purpose do you use jatropha?
    a. Selling b. Fodder c. fence (to protect crops from cattle)
    d. Other specify
11. What do you know about green energy?
12. What do you know about biodiesel?
13. Farm Activities

Types of farm activities	Responsibility of (family members male/female)
1. Ploughing	
2. Planting	
3. Weeding	
4. Harvesting	
5. Marketing	

IX. Relationship with sun bio fuel corporation

1. What did you know about sun bio fuel?
2. When did you join the corporation to produce Jatropha?
3. How after do you get income? a. Monthly b. Semi-annually c. yearly d. others

4. Have you received any payment until how?
   a. yes b. No
5. If yes, how much did you get?
6. What was your income before you join sun biofuel program?
7. Is there any kind of compensation if Jathropha production failed?
   a. Yes b. No
8. If yes, what kind of compensation is that?
9. Do you have any additional income other than salary from the farm?

X. Jathropha plantation VS food security

1. What happened to the price of food drops after the introduction of Jatropha plantation in the area? a. Increased b. Decreased c. No change

   (Give reasons for your response)
2. How do you evaluate your per capita income after the establishment of the farm?

   a. Increased b. Decreased c. No change

XI Production trend

1. Do you invest in farm inputs? a. Yes b. No
2. If yes, what motivates you to do so?
   a. Better market prices for cash crops
   b. Lesson from extension workers
   c. To meet high cost of living
   d. Experience from neighboring farmers
   e. Others (specify)
3. If your response for question No. 1 is no, what are the reasons for not doing so? a. Lack of capital b. Lack of awareness c. Lack of access to inputs
   d. Others (specify)
4. Do you use fertilizers? a. Yes b. No
5. If yes, what kind?
6. When do you get the fertilizers?
   a. From Market b. From sun bio fuel c. From government
   d. Others
7. Do you use pesticides? a. Yes b. No
8. If yes, what kind?
9. What kind of sees do you use?
   a. Local b. Improved c. Other
10. What kind of water system do you use?
    a. Irrigation b. Rain fed c. Other (specify)

XII Land use and deforestation

1. How did you get the land for Jatropha plantation?

a. Own b. sun bio fuel c. By cleaning forestd. Other (specify)

2. If your answer for question No. 1 is C, what kind of forests were there on the land before Jatropha plantation?

   a. ----------

   b. ----------

   c. ----------

   d. ----------

3. For what purpose do you use the forests before you cleared them?

   a. Shading b. fire wood c. Animal feeding d. Housing construction

   e. Others specify----------

4. How do you evaluate the purpose of cleared forests before Jatropha plantation?

5. Have you increased the size of your land from your previous use?

   a. Yes b. No

6. Have you change your farming system on the land after the establishment of the farm? a. Yes b. No

7. If yes: in what way----------

XIII. Information on Socio-economic effects of Jatropha plantation

1. Have you benefited because of the establishment of the Jatropha plantation?

   a. Yes b. No c. No change d. Other

2. If yes, in what way?----------

3. Have you received any kind of training? a. Yes b. No

4. If yes, what kind?----------

5. Have you earned any benefits from sun bio fuel? a. Yes b. No

6. If yes, what type of benefits did you earn?----------

7. Has the farm created alternative income for the farmers other than its normal production activity? a. Yes b. No

8. If yes, please specify?----------
-

9. Does the farm have any direct linkage with non-productive farmers in the rural community in the area? a. Yes b. No

10. If yes, how do you think the farm and the community are related to each other? a. Labour b. Market c. Service d. Security
e. Transportation f. Other

11. After you joined the farm what types of changes you fee in your life?
a. Family established b. New house constructed c. No change
d. Other

12. If it has improved, does the farm has any contribution?
a. Yes b. No

13. What will happen if the company leaves the area?
a. continue the work on my own b. Plant another feed
c. engage in another business d. Other (specify

CHECKLISTS

A. Questions for focus group discussions with local leaders/ non producer /

1. Do you remember how Jatropha plantation was introduced in this Wereda?
2. What was the situation looks like during that time ?
3. How was the land used by the community before the introduction of Jatropha?
4. What was planted on the land before Jatropha plantation introduced?
5. How was the condition of the bio diversity in the in the area before the introduction of Jatropha?
6. Did you remember when local forest were cleared for Jatropha plantation? If yes, what type of forests were chopped down for the farm?
7. Does the introduction of Jatropha provide any benefit for the community?
8. What are the social benefits of Jatropha plantation ?
9. What are the economic benefit of Jatropha plantation ?
10. What are the environment benefit of Jatropha plantation ?

11. Did you remember when the issues of food security raised ?

12. Do you think that bio fuel production has positive effects ? a)yes b) No

13. If yes please specify?----------

14. Do you think the income of the community increased after the introduction of Jatropha plantation?

15. Do you remember the condition of the infrastructure?

    (Electricity, telephone, road .etc) before Jatropha is introduced a)yes b) No

16. What do you think the condition of the infrastructure development now at this time?

    a) Improved b) deteriorated C) No Change

17. If your answer for the question no. 16 is A does the introduction of Jatropha plantation has any role for it a)yes b) no

18. What about the condition of social services like education ,health water e.tc of the local community after the introduction of Jatropha a)improved b) deteriorated C) No Change

19. If it has improved does ,does Jatropha introduction has any role for the improvement of social services

    a) Yes b) no

20. Do you want expansion of Jatropha plantation in the future? a)yes b) No

21. If yes ,why ?----------

22. Does the sun bio fuel corporation gave on job training for the produced of Jatropha ? on how to use tools and farming activities at production level ?

23. If yes please specify?----------

24. Do you think the population of the woreda increased after the introduction of Jatropha? A)yes b)No

25. If yes ,what are the indicators?

26. Do you know the contractual agreement between the sun bio fuel and local producers of Jatropha A)yes b)No

27. If your answer for question no.26 is (a) do you think the agreement benefits the community? A)yes b)No why?----------

B) Question for sun bio fuel corporation managers

1. what was the situation of this woreda before the establishment of your farm
2. What kind of plants were covered the land before your farm starts its operation ?
3. did you cleared forests when you start your farm ? if yes do you feel bio diversity loss after your farm introduction if yes, how ?
4. who where the users of the current land before you?

a. Other farmers b. Local community c. no one d. Government land e. Other

5. If the land was owned by other farmers ,did you give any kind of compensation

A)yes b)No

6. If yes what kind ?----------
7. Are women participated in your plantation programme
8. If yes ,how many ?----------
9. Are the local communities benefited from jatrphia plantation?
10. What are the social ,economic and environmental benefits of your programme for the local community
11. What are the positive /negative effects of bio fuel production from jatrphia
12. Do you think the per capita income of the local community increased due to the introduction of Jatrphia plantation
13. If yes ,explains the indicators ?----------

14. What do you think has happened to the infrastructure development of the woreda after your farm introduction A)Improved b)detroriated c) No change d)other

15. if your response for question No 14 is a)does your farm has any kind of role its improvement ?

16. what about the condition of social services like education ,health ,water etc services of the local community after your farm a)Improved b)deteriorated c) No change

17. if your response for question no. 14 is a) Does your farm has any kind of role for its improvement

18. Does the farm provide extension services to the farmers? if yes what kind ?

19) Do you have contractual agreement with the local producer of jatrpha seeds ? a)yes b)No

20) If yes do you think the agreement benefited the local producers?

21) did you conduct EIA before you have started operation a)yes b) No

22) If Not why not ?

C) Question for experts

1. What is bio fuel?
2. Do you think that bio fuel production has positive effects for agro pastoralists? A)yes b)No
3. If yes ,how ?
4. do you think that bio fuel production has negative effects for agro-pastoralist A)yes b)No

5. if yes ,please specify ?
6. what are the social economical and environmental benefit of bio fuel production
7 what do you suggest about the mitigation measures for the negative socio economic and environmental impact of bio fuel production?

D) question for environmentalists

1. What is bio fuel
2. What are the social, economical and environmental benefit of bio fuel production ?
3. Do you think the bio diesels plantation has positive /Negative effects?

a) Yes b)No

4. If yes, Please specify?
5. Is there any environmental pollution in producing bio-diesels from Jatropha Plantation? a) Yes b) No

6. If yes, please specify ----------
7. Is there any soil contamination during planning jatropha to produce bio diesel ?
a) yes b)No
8. If yes please specify?
9. What are the negative effects and their solutions for the social and environmental effects of the sector?
10. Do you think EIA conducted before developing bio diesel from jatrophia plantation?
11. Have you given environmental clearance to the Investor?
12. What are the mitigation measures that have to be taken for the likely effects?

E) Question for MOME, EIAR, MOARD

1. What are the major aims of developing bio fuel?
2. Do you have developed management plans, guide line and directive of bio fuel development and land use system?
3. What are the socio economic and environmental benefits of bio fuel development?
4. Do you think bio fuel development has negative effect for rural lively hood?
5. if yes please specify ----------
---
6. What do you suggest about the negative social and environmental effect of the sector?
7. What are the mitigation measures for the negative consequence of the bio fuel development in the rural livelihood?

Picture 1 :-Local jatropha Plant

Picture 2 :- Jatropha Plant used as a fence

Picture 3 :-Jatropha Seeds Storage

Picture 4 :-Jatropha Plant Seedlings

Picture 5: Ripening Jatropha Seed.

Picture 6: Sun bio-fuel's Jatropha plantation farm in Offa Woreda.

Picture 7: Jatropha plantation in the study area.

Picture 8 : FGD with the non-producers of Jatropha in the study area.

Declaration

I, the undersigned, declare that the thesis is my original work, has not been presented for a degree in any other university and that all sources of material used for the thesis have been duly acknowledged.

Declared by:

Kefelegn Getahun

Candidate

Confirmed by:

Tegegn Senbeta

Advisor