BIO-FUEL INVESTMENTS IN SOUTHERN AFRICA:

A SITUATION ANALYSIS IN BOTSWANA, MALAWI, MOZAMBIQUE, ZAMBIA AND ZIMBABWE

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EXECUTIVE SUMMARY

Apart from reducing global carbon emissions, bio-fuel investments offer opportunities to ensure energy security; promote rural development and investment; reduce poverty; and create employment in developing countries. However, such investments might lead to habitat alteration, food insecurity, human displacements and environmental degradation if not properly guided and implemented. It is against this background that WWF commissioned two studies in 2008. The overall objective of the studies was to understand the status of bio-fuels in study countries and identify gaps for follow up work. The first study was on sugarcane based bio-ethanol production in Malawi, Mozambique and Zambia. The second study incorporated more feedstocks and the bio-fuel versus food security versus environment debate. It was carried out in Botswana, Malawi, Mozambique, Zambia and Zimbabwe.

Key findings and recommendations from the studies are as follows:

Production and processing of bio-fuel feedstock

Sugarcane, sweet sorghum and jatropha are the priority bio-fuel feedstocks in the study countries. The latter crop is most popular although its productivity is lower than that of the other two. Bio-fuel processing capacity is underutilized due to feedstock shortages in some countries. There are also reports of farmers failing to secure markets for their feedstocks. Regarding product quality, only Malawi, Zambia and Zimbabwe have national standards on bio-fuels and Southern Africa has no regional product standards. The following recommendations are made on feedstock production and processing:

- Study countries should consider expanding their range of bio-fuel feedstocks to minimize gaps in supply to processing plants;
- Research and development should be carried out on feedstocks such as jatropha whose yield at the moment is very low and probably economically unviable;
- Study countries should, as much as possible, synchronize investments in feedstock production and processing through well planned projections and targets;
- All key sectors in the value chain should be involved in formulating and implementing bio-fuels policies/strategies; and,
- Study countries should develop regional bio-fuel product standards in line with global ones to facilitate trade.

Bio-fuels, livelihoods, food security and the environment

Experiences with sugarcane based smallholder out-grower schemes have been mixed with the majority showing poor economic performance. Results of the two studies also indicate that bio-fuel investments require substantial amounts of land that could lead to habitat alteration, human displacement and food insecurity if not properly guided. The following recommendations are made to address some of these issues:

- A detailed study on the financial and economic viability of smallholder farmer out-grower schemes should be undertaken;
- Out-growers should be capacitated to negotiate favourable terms, including product pricing, with large companies;
- Study country governments should encourage bio-fuel producers to ensure that a certain percentage of feedstock fed into their processing plants comes from smallholder growers;
- Study countries should be encouraged to opt for non food crops for bio-fuel production;
- Strategies that promote the co-existence of bio-fuel feedstocks and food crops should be encouraged;
- Study countries should undertake national land assessment and zoning exercises to identify and map out potential areas for bio-fuel investments and potential "no go' areas;
- Study countries should develop and nurture market links that promote sustainable bio-fuel production.
- Study country governments should provide incentives to investors who implement environmentally friendly practices in feedstock and bio-fuel production and support smallholder farmers; and,
- The region and study countries should review and adopt relevant elements of the draft global principles and criteria on sustainable bio-fuels production.

Bio-fuel policies

Bio-fuels policies in the study countries are still evolving and their provisions are general statements on biomass energy, renewable energy or bio-fuels. They are also not yet harmonized with relevant sectoral policies.

It is recommended that a regional bio-fuels policy and strategy framework/model that informs focused national policy and strategy development in the study countries be developed. The framework should do the following:

- Articulate specific strategies that support and synchronize various parts of the bio-fuels value chain;
- Address issues of product quality and environmental/social standards;
- Set bio-fuel and fossil fuel blending targets and time frames;
- Ensure that local communities benefit from bio-fuel investments and that their land rights are recognized and respected;
- Ensure that a balance between bio-fuels and food production is maintained within participating communities;
- Prioritize capacity building of institutions involved in bio-fuel initiatives across the value chain;
- Ensure that related sectoral policies are complementary to and supportive of bio-fuels investments; and,
- Articulate incentives for investors.

Priority actions that take recommendations of the two studies forward are also proposed.

INTRODUCTION

Some developed countries have committed themselves to measurable levels of bio-fuel use in response to the growing evidence of the adverse impacts of climate change on eco-system health and human wellbeing. For example, the European Union has proposed that its member states should ensure that 10% of all road transport fuel comes from renewable energy sources by 2020. This opens avenues for bio-fuel investments in developing countries. The investments offer opportunities to reduce global carbon emissions and allow developing countries, including those in the miombo eco-region, to benefit from the resultant financial and related inflows as they have suitable land and water resources.

The miombo eco-region covers parts of eight countries in Southern Africa namely: Botswana, Malawi, Mozambique, Namibia, South Africa, Tanzania, Zambia and Zimbabwe (Figure I); stretches over 3.6 million km^2; and is home to 65 million people, the majority of whom are poor and depend on subsistence agriculture and natural resources for survival (WWF SARPO, 2001). It is a net importer of energy in the form of fossil fuels. The introduction of bio-fuels can therefore reduce the region's dependence on imported petroleum products; stabilize fuel prices; ensure fuel security; promote rural development and investment; reduce poverty and create employment (Chundama, 2008; Nhantumbo, 2008: Sibanda, 2008; Shumba, *et al,* 2009). The bulk of the investments will be in bio-ethanol and bio-diesel production for the transport industry. The former bio-fuel is made from vegetable materials such as maize, sweet sorghum, sugarcane and cassava; and the latter from oilseed crops like soyabean, groundnuts, sunflower and jatropha.

A major argument against bio-fuels is that they require large tracts of land to produce feedstock hence they are perceived as an emerging driver of habitat alteration, biodiversity loss, food insecurity and community displacement and disenfranchisement. Consequently, bio-fuel investments might not yield desired results if not properly guided and responsibly implemented. It is against this background that the World Wide Fund for Nature (WWF) Southern Africa Regional Programme Office (SARPO) commissioned two studies on bio-fuels with financial support from WWF-Sweden in 2008. The overall objective of the studies was to assess the status of bio-fuels in the study countries and to identify gaps for follow up work. The first study was on sugarcane-ethanol production carried out in Malawi, Mozambique and Zambia. The three countries have well established sugarcane industries. The study assessed bio-fuels policies; production and processing of sugarcane feedstock; and participation of smallholder farmers in sugarcane based bio-ethanol production. The second study was much broader than the first in that it incorporated more feedstocks; addressed the bio-fuels versus environment versus food security debate; and covered more countries (viz, Botswana, Malawi, Mozambique, Zambia and Zimbabwe).

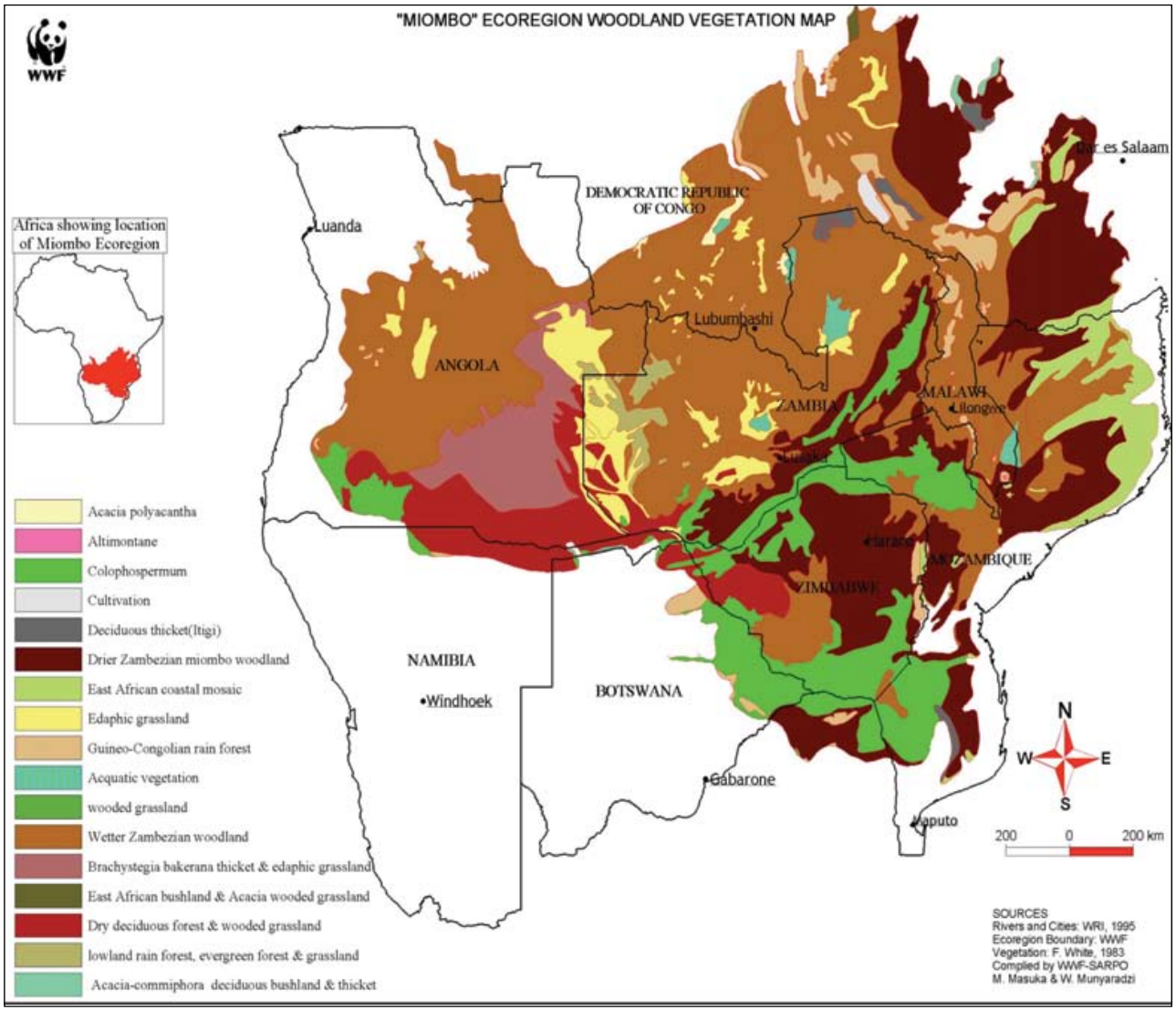

Figure 1: Geographical coverage of the Miombo eco-region

METHODOLOGY USED

The two studies consisted of literature reviews, key informant face to face or telephone interviews; and site visits. Three national and two regional consultants carried out the first and second studies respectively. WWF SARPO pulled together findings of the studies and produced this synthesis report. WWF SARPO and SADC then co-hosted a regional meeting to:

- Receive national reports on the status of bio-fuels in the study countries;
- Review and input into consultancy and synthesis reports; and,
- Identify areas for follow up work on bio-fuel investments.

Some 29 policy and technical experts on bio-fuels from the five study countries, SADC and WWF SARPO attended the meeting (Annex II). Given the cross cutting nature of the subject, participants were drawn from the energy, crop production, environment and community/rural development sectors.

KEY FINDINGS AND RECOMMENDATIONS

Production and processing of feedstocks

Feedstock selection

Climatic and soil conditions of Southern Africa are suitable for the production of a wide range of bio-fuel feedstocks. The region's rainfall ranges from 450 to 1 100 mm per annum and exhibits high intra and inter seasonal variability. Its soils are generally infertile. They include Kalahari sands that cover parts of Botswana, Zambia and Zimbabwe; sandy clay loams in parts of Malawi, Mozambique, Zambia and Zimbabwe; and vertisols or black cotton soils in southern Zimbabwe.

Table 1 shows feedstocks commonly grown for bio-fuel production worldwide. Some of the crops are not new to Southern Africa as they are either cultivated for food (e.g. maize, sweet sorghum, groundnuts and sugarcane) or for commercial purposes (e.g. cotton, sunflower and castor beans). The second bio-fuels situation analysis study prioritized sugarcane, sweet sorghum and jatropha feedstocks for the following reasons:

- The crops have been identified as potential bio-fuel feedstocks by at least two of the five study countries as follows: Botswana-jatropha and sweet sorghum; Malawi-jatropha and sugarcane; Mozambique-jatropha, sweet sorghum and sugarcane; Zambia-jatropha, sweet sorghum and sugarcane; and Zimbabwe-jatropha and sugarcane;
- They do not compete with food production. In fact, countries like Malawi have banned the use of staple food crops for bio-fuel production; and,
- There is a well established sugarcane industry in the region. For example, molasses from the crop has been used to produce bio-ethanol in Zimbabwe and Malawi since 1965 and 1982 respectively. Mozambique and Zambia plan to follow suit.

Table 1: Crops commonly used as bio-fuel feedstock worldwide

Bio-fuel	Crop	
Bio-ethanol	Sugar crop	Starchy crop
	Sugar beet Sugarcane Sweet sorghum	Barley Cassava Maize Potatoes Rice Rye Wheat
Bio-diesel	Oilseed crop	
	Avocado pear Cashew Castor Cocoa Coconut Cotton Groundnut Jatropha	Macadamia Oil palm Rapeseed Sesame Soya bean Sunflower

Source: FAO 2008

A brief description of jatropha, sweet sorghum and sugarcane is given below.

Jatropha

Jatropha can grow on marginal land and has multiple uses. Its oil produces bio-diesel, soap, and a cake that can be used as fertilizer. The crop is used as a live fence by some smallholder farmers and grows well under intercropping situations.

Some problems associated with jatropha are that:

- Despite claims of being a "miracle crop" its commercial production has yet to take off in Southern Africa and no commercial plantings have been harvested to date. In addition, its agronomic requirements, yield levels and economics are largely unknown in the region;
- The crop takes 3-5 years to produce sizeable quantities of seed. This presents a challenge to small farmers who have to tie up land for some time before realizing a return; and,
- The available germplasm has a long fruiting season and its fruits do not ripen at the same time. This makes mechanical harvesting difficult hence the crop's harvesting is labour intensive.

Sweet sorghum

Sweet sorghum has multiple uses that include fuel, food, fodder and fibre and is widely grown by smallholder farmers. It is well adapted to climatic and soil conditions of Southern Africa. Sweet sorghum can be harvested twice per year as it takes about five months to reach maturity. Considerable research has been carried out on the crop. Its only major disadvantage is that it shares the same pests and diseases with grain sorghum, an important food security crop in the region.

Sugarcane

Sugarcane is well adapted to certain parts of the region and is grown on large scale commercial farms and on smallholder out-grower schemes under irrigation. It can grow from the same rhizome for up to 10 years and its cultivation does not offer direct competition for food since ethanol is produced from molasses, a by-product. Considerable agronomic and bio-ethanol processing information on sugarcane is readily available in the region. The major disadvantage of sugarcane is that it requires a lot of inputs such as fertilizer, pesticides, labour and irrigation water.

Figure 2: Sugarcane plantation with a worker setting up an irrigation pipe in Malawi

Production of feedstock

Annex II shows on-going and planned projects on jatropha, sweet sorghum and sugarcane in the study countries. The following inferences can be made from the table:

- Sugarcane is produced in all study countries except Botswana where a proposed project was disqualified based on results of an Environmental Impact Assessment (Box 1). Plans are underway to increase the crop's area in Malawi, Mozambique, Zambia and Zimbabwe. It is primarily grown for sugar production and bio-ethanol is produced from molasses in Malawi and Zimbabwe. In Zambia and Mozambique molasses is used as a livestock feed and exported respectively;
- Sugarcane is grown by big companies and smallholder farmer out-growers in Malawi, Zambia and Zimbabwe. A similar model is planned for jatropha and sweet sorghum by the study countries;
- Jatropha is accorded highest priority in terms of the planned planting area in all the countries; and,
- Malawi and Zimbabwe have commercial level bio-ethanol processing capacity for molasses; Mozambique has some capacity to produce bio-diesel from palm oil; and Zimbabwe has capacity to produce bio-diesel from jatropha. These capacities have generally been under-utilized due to feedstock shortages. There are also reports of jatropha growers failing to secure markets for their feedstock due to the absence or inadequacy of processing capacity in Mozambique. The foregoing highlight a disconnect in the bio-fuel value chain.

Box 1: Aborted sugarcane project in Botswana

Northern Sugar Holdings Consortium proposed to establish sugar plantations in Kasane, Botswana in 2007. The project would have covered 100 000 ha at a cost of P1 million. The planned mill capacity was 106 000 tons of sugar per annum. The project was expected to produce molasses and to generate electricity. However, it did not get off the ground as an Environmental Impact Assessment showed that the project would have disastrous environmental impacts since it would be located in a forest reserve. The reserve is a high value conservation area.

Source: Ramaano, 2009.

Table 2 shows yields of sugarcane, sweet sorghum and jatropha under high and low potential environments in Southern Africa. Good yields are achieved with sugarcane and sweet sorghum and not jatropha. This reflects on the considerable amount of research and development that has gone into the two crops compared to the latter.

Table 2: Yields of bio-fuel feedstocks in low and high potential environments* (t/ha)

Feedstock	Low potential environment	High potential environment
Sugarcane	-	112-120
Sweet sorghum	30-40	40-60
Jatropha	1-2	2-5

**Low potential=Dryland cropping, no fertilizer & no other improved inputs; and High potential=irrigated, fertilized & improved inputs*

Processing of feedstock

Sugarcane and sweet sorghum produce bio-ethanol after fermentation and distillation. Bio-ethanol from sugarcane is produced from molasses, a sugar by-product. Technology for this is well established in Southern Africa. However, some modification is required if distillers designed for sugarcane are to be used for sweet sorghum. Bio-diesel production involves the extraction of oil from an oilseed crop such as jatropha and combining it with alcohol in a process called transesterification. Technology for this is also widely available (Mughogho and Mafongoya, 2009).

Bio-fuel conversion information for sugarcane, sweet sorghum and jatropha is given in Table 3. According to the table, 1 ton of sugarcane produces 10 litres of bio-ethanol via the molasses route compared to 80 litres of bio-ethanol by direct conversion from sugarcane; I ton of sweet sorghum produces 55 litres of bio-ethanol by direct conversion; and I ton of jatropha produces 300 litres of bio-diesel.

Table 3: Bio-fuel conversions from feedstocks

Sugarcane	Sweet sorghum	Jatropha
1 ton of molasses produces 250 litres of ethanol. 4% of sugarcane yield is molasses. 1 ton of cane produces 40 litres of molasses 1 ton of cane produces 10 litres of ethanol.	1 ton of sweet sorghum produces 55 litres of ethanol by direct conversion (Woods, 2001).	Oil content of seed is 30-35%. Conversion from oil to bio-diesel is 1:1. 1 ton of seed produces 300 litres of oil=300 litres of bio-diesel.

Source: Woods, 2001; E. Mutasa, pers com.

Different plant sizes are available for processing bio-fuel feedstocks. They include small (200-2 000 litres/day); medium (80 000-100 000 litres/day); and large (over 100 million litres/day). Study countries use or plan to establish medium sized plants. Existing plants operate on a centralized processing model that also services smallholder out-growers. For example, Zimbabwe has bio-diesel processing plants with capacities of 10 000 litres/day in Mutoko and 60 000 litres/day in Mt Hampden and a 5 million litres per year bio-ethanol plant at Triangle Sugar estates (Mughogho & Mafongoya, 2009).

Malawi, Zambia and Zimbabwe have national bio-ethanol and bio-diesel product quality standards while Botswana and Mozambique have yet to develop such standards. However, Southern Africa has no regional bio-fuels product standards. Europe is the only block with bio-ethanol and bio-diesel product standards (Prankl & Getter, 1999). There are no recognized international product standards for bio-fuels. Such a situation handicaps free trade in bio-fuels.

The following recommendations are made on feedstock production and processing:

- Study countries should consider expanding their range of bio-fuel feedstock to minimize gaps in supply to processing plants during the year;
- Research and development should be carried out on feedstocks such as jatropha whose yield is very low and probably economically unviable at the moment;
- Study countries should, as much as possible, synchronize investments in feedstock production with those in bio-fuel processing capacity based on well planned targets and projections;
- All key sectors in the bio-fuels value chain should be involved in formulating and implementing bio-fuels policies/strategies at national and regional levels. The sectors include energy, agriculture, engineering and community/rural development; and,
- Southern Africa should develop regional bio-fuels product standards in line with global ones.

Figure 3: A bio-ethanol processing plant in Dwangwa, Malawi

Bio-fuels, livelihoods, food security and the environment

Bio-fuels and livelihoods

A major motivation for embracing bio-fuels by study countries is a desire to promote rural development and to reduce poverty. The region's experience with smallholder farmer involvement in bio-fuels is largely confined to sugarcane feedstock production through out-grower schemes in Malawi, Zambia and Zimbabwe

(Box 2). Under this arrangement, out-growers enter into a formal relationship with a large private sugar producer. The latter provides key inputs such as planting materials, fertilizer, pesticides, quality control, technical advice and a market for the feedstock. The land is normally leased by private companies and out-growers have no claim over it.

Box 2: Model for smallholder farmer participation in bio-fuel production-the Kasinthula Cane Growers Ltd.

Kasinthula Cane Growers Ltd (KCGL) represents a model for smallholder farmer participation in sugarcane production in Malawi. The company was established as an out-grower scheme to Illovo Sugar Malawi Ltd in 1997. Its membership has increased from 103 to 282. It was started by government and utilizes customary land given to members by the Chief. It operates as a private limited company on behalf of out-growers. Each out-grower cultivates 3 ha of land (2.5 ha sugarcane and 0.5 ha other crops including a staple food). Illovo provides technical advice and inputs such as fertilizer, chemicals and irrigation water to KCGL. Costs for the services are deducted when farmers sell their sugarcane. In 2002, KCGL was certified to Fair Trade as a natural sugar producer. This helps the company to sell its sugar at a premium in Belgium, Germany, Norway and USA. Out-growers receive an average annual income of $489. However, the scheme is struggling to repay the money borrowed to set it up.

Source: Sibanda, 2008.

Sugarcane based smallholder farmer out-grower schemes face a number of challenges that include limited land for expansion; lack of water rights; and a monopolized market. The latter has been blamed for the non viability of most schemes. Poor economic performance has led some out-growers to plough out their sugarcane and replace it with cash crops such as sugar beans and soyabeans at a Hippo Valley out-grower scheme in Zimbabwe. On the other hand, the Mupapa out-grower scheme under Triangle Sugar estates (Zimbabwe) is doing well financially (Mughogho and Mafongoya, 2009). This is partly because out-growers are also paid for sugar by-products such as molasses and bagasse.

Despite their potential economic benefits, bio-fuel investments can lead to human displacements and disenfranchisement if not properly guided. Box 3 shows some emerging experiences from Zimbabwe.

Box 3: Some experience with bio-fuel investments from Zimbabwe

The ruling party dismissed assertions that it was opposed to a bio-energy project in the Nuanetsi Ranch of the Lowveld. There were reports that the party leadership was opposed to a project where ZBE was developing 100 000 ha of land for sugarcane and bio-ethanol production near Tokwe-Mukosi dam. At least 10 000 families will have to be relocated from Nuanetsi. Clearing of land earmarked for the project has already started after the company signed a Memorandum of Understanding with government under which it undertook to provide funds for the completion of the dam. Addressing a press conference, the party provincial chairman said "We are not against the bio-energy project by ZBE because that is investment in our province but then there must be a clear policy about how the families who have been staying there will be relocated".

Source: The Herald, 2008

Bio-fuels, the environment and food security

A major argument against bio-fuels is that they require huge tracts of land for feedstock production. All study countries have committed considerable areas of land to the cultivation of jatropha, sugarcane and sweet sorghum. The areas range from 10 000ha in parts of Malawi to 190 000ha in Zambia (see Annex II). Table 4 shows the amount of land required to produce feedstock that can run a 60 000 litre per day capacity plant for 200 days. The following inferences can be made from the table:

- Land requirements are lower when feedstock productivity is high. This largely explains why jatropha requires more land than sugarcane and sweet sorghum; and,
- Sweet sorghum requires less land than sugarcane. This is because bio-ethanol from the former crop is produced by direct conversion whilst that from the latter comes through an indirect process (viz. via molasses).

Table 4: Land required to grow feedstock that runs a 60 000 litres/day capacity plant under low and high productivity environments (ha)

Feedstock	Low potential		High Potential	
	1 day	*200 days*	*1 day*	*200 days*
Sugarcane	-	-	52	10 400
Sweet sorghum	31	6 234	22	4 400
Jatropha	200	40 000	67	13 400

Notes: Average yields used: sugarcane=115t/ha; sweet sorghum=35 & 50t/ha and jatropha=1 & 3t/ha under low and high potential environments respectively. Bio-fuel conversion figures are given in Table 3.
Source: Based on Tables 2 & 3.

It is clear from the foregoing that bio-fuel production requires substantial amounts of land for feedstock production. The land will come from two scenarios. Scenario I involves opening up substantial amounts of virgin land. This is already taking place or planned in Botswana, Mozambique, Zambia and Zimbabwe. Possible impacts of this are the altering of landscapes, loss of biological diversity, displacement of local communities and tying up land that could be used for food production. Scenario II consists of switching from an existing crop to a bio-fuel feedstock. For example, a switch from tobacco to jatropha is planned in Manica province of Mozambique. In parts of Malawi, smallholder farmers are being encouraged to switch from tobacco to jatropha production (Mughogho, *per com)*. This scenario might impact less on landscape alteration, biodiversity loss and human displacement as it uses existing land. It could, however, affect food security if farmers switch from a staple food crop.

Figure 4: An example of a commercial stand of Jatropha

Scenarios I and II raise questions on the sustainability of bio-fuel production in the study countries and elsewhere. It is against this background that the Roundtable on Sustainable Bio-fuels, a grouping of farmers, businesses, governments and non governmental organizations based in Switzerland has produced draft principles and criteria for sustainable bio-fuels production (Annex III). The draft will lead to the development of global environmental/social standards that will be administered by the International Social and Environmental Accreditation and Labelling Alliance (Bomford, 2008). The region's response to environmental and social sustainability legislation on bio-fuels production proposed by the European Union has been mixed (Box 4).

Box 4: Response to proposed international environmental/social standards on bio-fuels by Malawi

Malawi has teamed up with seven other developing countries (Argentine, Brazil, Colombia, Mozambique, Sierra Leone, Indonesia and Malaysia) to warn the European Union (EU) that they will complain to the World Trade Organization if it passes proposed legislation designed to improve the environmental sustainability of bio-fuels by restricting the types of fuels the block imports.

According to international media reports, the EU is considering pushing forward legislation intended to ban the purchase of bio-fuels from energy crop plantations that are believed to harm the environment and lead to food shortages by displacing land used for food crops and contributing to rainforest deforestation. Energy Minister Ted Kalebe could neither deny nor confirm the warning on behalf of the Malawi government.

Environmentalists have largely welcomed the proposals, which would ensure that only plantations that have been independently certified as meeting various environmental criteria would be able to sell resulting bio-fuels into the EU.

Source: The Nation, 2008.

The following recommendations are made on bio-fuels, livelihoods, food security and the environment:

- A detailed study on the financial and economic viability of smallholder farmer out-grower schemes should be undertaken. This will provide guidelines on how to improve the effectiveness of current schemes and inform policy/strategy development on bio-fuel investment and smallholder farmer participation;
- Out-growers should be capacitated to negotiate favourable terms with large companies. This includes demanding that they be paid for feedstock by-products such as molasses and bagasse in the case of sugarcane;
- Study country governments should encourage bio-fuel producers to ensure that a certain percentage of feedstock fed into their processing plants comes from smallholder growers;
- Study countries should be encouraged to opt for non staple food crops for bio-fuel production;
- Strategies that promote the co-existence of bio-fuel feedstocks and food crops should be promoted. For example, investors could be encouraged to plant a certain percentage of land allocated to bio-fuels to food crops;
- Study countries should undertake national land assessment and zoning exercises to identify and map out potential areas for bio-fuel investments and potential "no go" areas;
- Study countries should develop market links that promote sustainable bio-fuel production. In this regard, they should recognize market opportunities that will develop if they are able to export bio-

fuels produced in an environmentally and socially sound manner. This will have to be complimented by strategies that encourage consumers in developed countries to insist on bio-fuel products made from certified feedstock plantations and to demand that their companies exercise responsible corporate social responsibility in the countries they operate;

- Study country governments should provide incentives to investors who implement environmentally friendly practices in feedstock and bio-fuel production and support smallholder farmers; and,
- The region and study countries should review and adopt relevant elements of the draft global principles and criteria on sustainable bio-fuels production.

Bio-fuels policies

Experiences from Brazil, the United States of America and Europe show that mandatory blend targets, tax incentives and other supportive policy measures can catalyze the development of a bio-fuels sector. In fact, there is no country in the world where the sector has grown to commercial scale without a clear policy and legislative framework. However, the formulation of relevant bio-fuels policies in the study countries is still in its infancy. Annex IV shows that:

- Bio-fuels policies are still evolving and their provisions are general statements on biomass energy, renewable energy or bio-fuels. They are not specific on strategies, institutional frameworks and supporting legislation for implementation; and,
- The policies are not yet harmonized with relevant sectoral policies (Box 5).

Box 5: Lack of harmonization between bio-fuels policy pronouncements, related sectoral policies and practice

Mozambique

The huge push for bio-fuel investments in Mozambique has been partly due to the preferential treatment enjoyed by the country in some international markets. This has led to conflicts over land use between local communities and large scale bio-fuel investors as government transfers land from communities to the latter in contravention of existing land, forestry, wildlife, water and environmental policies and legislation. Such dilemmas and conflicts between existing community land rights and "superior" rights of investors for bio-fuel production and other economic activities reflect some of the inefficiencies and gaps in policy formulation. It is against this background that the government has adopted a cautionary approach to bio-fuel investment. In this regard, land allocation for feedstock production was suspended pending the finalization and approval of a bio-fuels policy and a land zoning exercise.

Malawi

Malawi's land policy clarifies and strengthens customary land rights and formalizes the role of traditional authorities in the administration of customary land that covers 80% of the country. The policy provides for customary land to be registered and protected against arbitrary conversion to public land; and encourages customary landholders to register their holdings as private customary estates. In practice, government can still lease out such land to private investors regarded as strategic and good for the country.

Source: Nhanthumbo, 2008; Sibanda, 2008; and Shumba, et al, 2009

Figure 5: A Zimbabwe motor vehicle powered by Jatropha bio-diesel

Given the foregoing, there is need for study countries to urgently formulate specific policies and strategies that guide bio-fuels development and investment. It is therefore recommended that a regional bio-fuels policy and strategy framework/model be developed to inform focused national policy/strategy development processes. The regional framework should have the following elements:

- Articulate specific strategies that support and synchronize various parts of the bio-fuels value chain. They include feedstock choice, production, processing, marketing and investment;
- Address issues of bio-fuels product quality and environmental/social sustainability standards in line with global ones;
- Set bio-fuel and fossil fuel blending targets and time frames in order to create national demand/ markets;
- Ensure that local communities benefit from bio-fuel investments and that their land rights are recognized and respected;
- Ensure that a balance between bio-fuels and food production in maintained within the participating communities;
- Prioritize capacity building of institutions involved in bio-fuel initiatives across the value chain;
- Ensure that related sectoral policies are complementary to and supportive of bio-fuels in order to attract new investment and provide guidance on where such investments should take place; and,
- Articulate incentives for investors. They should include tax rebates for environmentally friendly operations and for demonstrating responsible corporate social responsibility; and clear and user friendly regulatory guidelines that include licensing and registration.

WAY FORWARD

The following priority actions are proposed in order to take recommendations of the two studies forward:

- Developing a regional bio-fuels policy and strategy framework/model that informs focused national policy and strategy development processes;
- Speeding up and concluding the development, fine tuning and elaboration of national bio-fuels policies and strategies guided by the regional policy and strategy framework;
- Assessing national bio-fuel demand; current and potential feedstock production levels; and bio-fuel processing capacities in order to rationalize and streamline the bio-fuels value chain;
- Undertaking national land assessment and zoning exercises to identify and map out potential areas for bio-fuel investments and potential "no go' areas in study countries;
- Drawing up bio-fuel product and environmental and social sustainability standards to facilitate trade and promote "good environmental stewardship";
- Setting up criteria for selecting potential bio-fuel feedstocks;
- Developing national frameworks that ensure that communities benefit from bio-fuel investments;
- Carrying out a human skills audit for the bio-fuel industry in study countries;
- Putting in place mechanisms that facilitate the involvement of all key sectors in the bio-fuels discourse, project design and implementation;
- Managing and sharing information on bio-fuels for awareness raising and project design and implementation. Information generated by the two studies provides a useful basis for formulating and implementing national and regional communication strategies; and,
- Drawing up comprehensive and practical national and regional bio-fuels implementation strategies and action plans.

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ANNEX II: STATUS OF JATROPHA, SWEET SORGHUM AND SUGARCANE PROJECTS IN THE STUDY COUNTRIES

Country	Existing/On-going projects	Planned projects
Botswana	A feasibility study on bio-fuel production and use was commissioned in 2007. It identified jatropha & sweet sorghum as suitable feedstocks.	There are plans to establish 100 000 ha of jatropha & sweet sorghum through out-grower schemes in the Central district.
Malawi	Has been involved in sugarcane cultivation for sugar & ethanol production for a long time through large scale plantations & smallholder out-grower schemes. Toleza Farm Ltd has planted 250 ha of jatropha for bio-diesel in Balaka district.	Energen Resources Inc. plans to etablish 10 000 ha of jatropha through large plantations & out-growers.
Mozambique	Is involved in sugarcane plantations for sugar production. The resultant molasses is exported. Renewable Alternative Energies Ltd is producing biodiesel from coconut & has a plant capacity of 40 000 litres per annum.	Energen Resources Inc. was allocated 60 000 ha of land for jatropha. The ESV Group plans to establish the largest single plantation of jatropha in Africa in Inhambane province. Sun Biofuels has purchased five former tobacco farms for jatropha production in Manica. Investments in sweet sorghum cultivation are planned.
Zambia	A few sugar companies are involved in sugarcane production through plantations & out-growers. The molasses is used a livestock feed. Conservation Agriculture project is promoting the production of jatropha as hedges for bio-diesel production by 2 500 farmers.	DI Oils-UK plans to establish 189 000 ha of jatropha through out-growers.
Zimbabwe	Has a well established sugar industry supported by large estates and smallholder out-growers. Produces ethanol that was blended with petrol but is now exported as alcohol. Has established processing capacity of 10 000 & 60 000 litres per day at the Mutoko & Mt Hampden Bio-diesel plants respectively.	Finealt Bio-diesel & Noczim (Govt. companies) are promoting jatropha cultivation throughout the country under the out-grower arrangement. ZBE, a private company plans to develop and plant 100 000 ha to sugarcane for sugar and bio-ethanol production in Masvingo province.

Source: Chundama, 2008; Nhantumbo, 2008; Sibanda, 2008; Ramaano, 2009; Mughogho, et al, 2009; Shumba, et al, 2009.

ANNEX III: DRAFT PRINCIPLES AND PRACTICES ON SUSTAINABLE BIO-FUELS RELEASED BY THE ROUNDTABLE ON SUSTAINABLE BIO-FUELS

Principle	Practice
1. National laws-legality	Follow all applicable laws of the country and international treaties.
2. Stakeholder consultation	Design and operate projects under appropriate, comprehensive, transparent, consultative and participatory processes that involve all relevant stakeholders.
3. Green House Gas (GHG) reduction	Mitigate climate change by significantly reducing GHG emissions as compared to fossil fuels.
4. Human rights	Do not violate human rights or labour rights & ensure decent work & the well-being of workers.
5. Development	Contribute to the social and economic development of local, rural and indigenous peoples and communities.
6. Food security	Do not impair food security.
7. Eco-system conservation	Avoid negative impacts on biodiversity, eco-systems and areas of high conservation value.
8. Soil conservation	Improve soil health and minimize degradation.
9. Water conservation	Optimize surface and groundwater resource use, including minimizing contamination or depletion of these resources, and respecting existing formal and customary water rights.
10. Air conservation	Minimize pollution from production and processing throughout the supply chain.
11. Technology and efficiency	Use cost effective production technology and improve efficiency and social and environmental performance through the use of emerging technologies.
12. Land rights	Do not violate land rights.

Source: Bomford, 2008.

ANNEX IV: SUMMARY OF BIO-FUELS POLICIES

Country	Bio-fuels policy
Botswana	Government has initiated the following: inclusion of bio-fuels into the Botswana Energy Master Plan of 2004 and the National Energy Policy of 2000; and the development of Biomass Energy Strategy
Malawi	Malawi's Growth and Development Strategy of 2006-2011 and the Agriculture Development Programme of 2007-2011 have no provisions or strategies for the bio-fuels sector. However, a bio-fuels policy is being developed.
Mozambique	One of the objectives of the National Strategy on Energy of 2000 is "to promote sources of renewable energy products". In addition, a sectoral policy document on "Mozambique position and experience on bio-fuels" describes approaches, policies and strategies for the development of a bio-fuels industry. Two main provisions in the document are the cultivation of bio-fuel feedstocks on currently idle land and a gradual introduction of the blending of petrol with bio-ethanol and of fossil diesel with bio-diesel at 5-10%.
Zambia	The revised National Energy Policy of 2008 recognizes the potential role of renewable energy sources in the energy balance of Zambia. It also identifies sugarcane, sweet sorghum and jatropha as priority feedstocks for bio-fuel production and the need to support smallholder farmers to cultivate them.
Zimbabwe	A document on principles for bio-fuels development and use in Zimbabwe was adopted as a national policy document for bio-fuels in 2007. Areas covered by the document include: choice of feedstock (jatropha and sugarcane), its production and processing; pricing of feedstock and bio-fuels; bio-fuels standards, distribution & markets; investment incentives; capacity building; and research and development.

Source: Jumbe, et al, 2007; Chundama, 2008; Nhantumbo, 2008; Sibanda, 2008; Ramaano, 2009; Shumba, et al. 2009; Mughogho, et al 2009