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New Knowledge for Sustainable Bioenergy

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Biofuels and Sustainability: A Case Study from Tanzania

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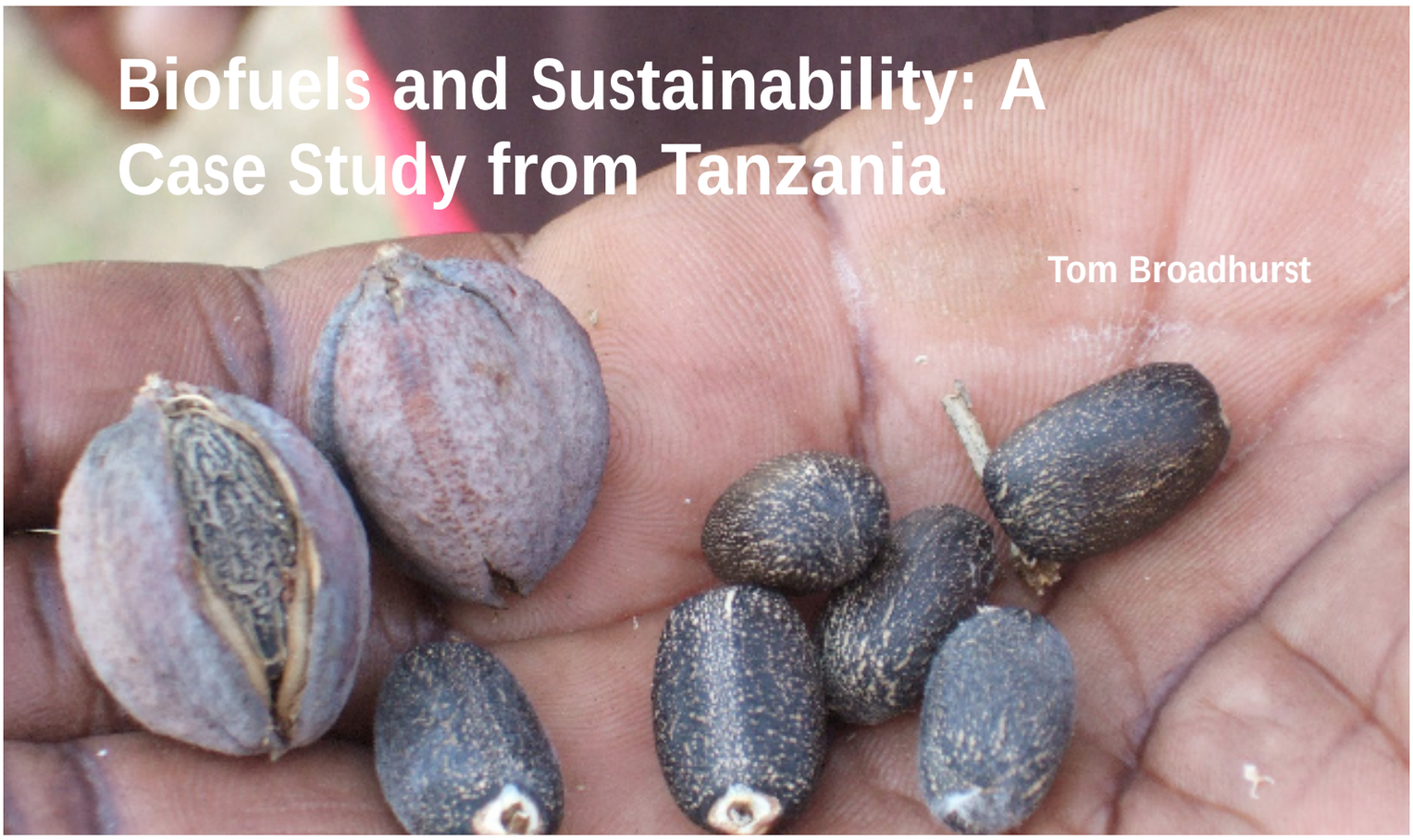

Executive Summary

Tanzania is one of many African countries seeking to benefit from global interest in first-generation liquid biofuels for transportation. Several domestic and international organisations have identified jatropha *(Jatropha Curcas* L.*)* as a potential bioenergy crop, and are initiating biofuels programmes throughout the country using varied production methods and business models, each with different social, economic, and environmental implications.

With biofuels attracting criticism worldwide from environmental and development organisations (e.g., GRAIN, 2007; ActionAid, 2008), a key challenge facing the government of Tanzania is how to capitalise on investor interest in support of sustainable development. Using semi-structured interviews and field observation, this study performed an appraisal of three different models of jatropha biofuels production - plantation, outgrower-led and community-focused - to determine the extent to which each can be considered as sustainable according to the Roundtable on Sustainable Biofuels' (RSB) sustainability standard. The results were then compared and contrasted, leading to the conclusion that biofuels production that supports outgrower or small-scale initiatives, and minimises land-use change, is most beneficial to sustainable rural development in Tanzania.

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List of key Acronyms

ABN	African Biodiversity Network
ESIA	Environmental and Social Impact Assessment
EU	European Union
CDM	Clean Development Mechanism
GHG	Greenhouse gas
HCV	High Conservation Value
MFP	Multi-functional Energy Service Platforms
NGO	Non Governmental Organisation
RSB	Roundtable on Sustainable Biofuels
TaTEDO	Tanzania Traditional Energy and Environment Development Organisation
TIC	Tanzania Investment Centre
URT	United Republic of Tanzania
WWF	Worldwide Fund for Nature

Introduction

Background and rationale:

Biofuels are emerging as a valuable part of many governments' renewable energy policies, driven by motives to decelerate human-induced climate change through reduced greenhouse gas (GHG) emissions (UNFCCC, 2010), improve the energy security of net oil-importing countries (Lee et al, 2008), and stimulate economic development (European Commission, 2008). The EU and USA are leading the charge, creating policy frameworks and economic incentives to encourage the production and consumption of liquid biofuels. The EU, for example, seeks to increase biofuels use in the transport sector from 2% in 2006 to 10% in EU member states by 2020 (European Commission, 2008) through its Renewable Energy Policy Directive, and provided $6.2 billion worth of subsidies to its biofuels industry in 2007 (ActionAid, 2008).

It is estimated that to meet EU targets under the Renewable Energy Directive, 20% of biofuels would have to be imported (European Commission, 2007), requiring an estimated 17.5 million hectares of land in developing countries (Rice, 2010), and stimulating a 'new scramble for Africa' (GRAIN, 2007). Whilst this investment potentially fosters socio-economic development, creates jobs and increases export earnings (Lindlein, 2007), critics have identified issues of land ownership, water scarcity, deforestation, and food insecurity, associated with the replacement of traditional farming systems with biofuels by, frequently, Western-owned agri-businesses (FOE, 2008; GRAIN, 2007). Several studies have also questioned whether biofuels actually reduce GHGs compared to fossil fuels, due to the effects of land use changes during production (Searchinger et al, 2008; Romijn, 2009).

In Tanzania, the focus of this study, several national and international organisations have initiated biofuels programmes. One biofuels 'feedstock' being widely promoted is jatropha (*Jatropha curcas* L.); once heralded as a 'miracle' bioenergy crop due to its apparent drought resistance and ability to grow in marginal soils (Openshaw, 2000; Jones and Miller, 1992; Renner, 2007). However, jatropha cultivation in Sub-Saharan Africa has been attacked for displacing indigenous people, competing with food crops, and causing deforestation (Nyari, 2008; ABN, 2007; Luoma, 2009), undermining its 'green' credentials.

Mindful of biofuels critiques (ABN, 2007; GRAIN, 2007), the government of Tanzania has established guidelines for biofuels investors in an attempt to capitalise on the global biofuels boom in support of local sustainable development (URT, 2008). This mirrors dialogue internationally, where policy instruments and sustainability standards for biofuels are being developed to encourage production in line with the principles of sustainable development.

Biofuels and sustainability:

Sustainability standards and certification schemes aim to give organisations recognition for producing sustainable biofuels, and reassure goverments and consumers that their purchases are economically, socially and environmentally responsible. Several sustainability frameworks for biofuels are now being introduced (e.g., Cramer Commission, 2006; RFA, 2010), many adopting a 'principles and criteria' approach to assessment, whereby a series of pre-defined expectations and objectives must be satisfied to ensure compliance. The Roundtable on Sustainable Biofuels, hosted by the Ecolé Polytecnique Fédérale de Lausanne, has been established to introduce a voluntary, worldwide certification scheme to encourage the sustainable production of biofuels, including criteria such as GHG emissions, land rights and food security.

This study uses Version Zero of the RSB's draft sustainability framework for biofuels, revised in March 2009 following international consultation, which consists of 12 core principles and 38 criteria (available from http://rsb.epfl.ch/page-51763-en.html). The RSB principles cover the following areas (RSB, 2009):

1. Legality	7. Human and labour rights
2. Conservation	8. Air
3. Planning, monitoring and continuous improvement	9. Local socio-economic development
4. Soil	10. Use of technologies, inputs and management of waste
5. Greenhouse gas emissions	11. Local food security
6. Water	12. Land rights

Study aim:

This study seeks to determine the extent to which three different models of jatropha-derived biofuels production in Tanzania can be considered as sustainable, by undertaking a sustainability appraisal of each in accordance with the RSB framework.

Biofuels in Tanzania

A 2005 feasibility study into biofuels as a transportation fuel estimated that Tanzania had the potential to produce up to 22 times its annual energy consumption in bioenergy (GTZ, 2005). In response, and with encouragement from European embassies, the government of Tanzania established a National Biofuels Task Force in 2006, charged with managing the biofuels sector and developing a policy framework. Guidelines for the Sustainable Development of Biofuels were produced in 2008 (URT, 2008), outlining the government's objectives:

1. Enhancing energy security
2. Employment and diversification of rural economy
3. Market-development for agricultural energy crops
4. Saving foreign exchange
5. Reduction of GHGs and vehicle emissions
6. Halting deforestation and desertification by using drought-resistant crops such as jatropha
7. Renewability
8. Replacing fossil-fuels in vehicles
9. Technology transfer
10. Octane enhancement in petrol, replacing lead through use of bioethanol
11. Enhancing food security

However, the implementation of these guidelines has been criticised, with some current biofuels investments at odds with objectives to enhance local energy security, promote food security and reduce deforestation (WWF, 2009; Mwakaje, 2010).

Seeking to capitalise on foreign investment, the government is promoting Tanzania to international biofuels investors, publicising the availability of 'suitable land for energy crops', favourable climatic conditions, attractive export opportunities, local expertise, and the possibility of accessing Clean Development Mechanism (CDM) grants (URT, 2008; GTZ, 2005). This has attracted national and international investors, the majority seeking to export their raw materials to meet demand for biofuels in Europe or North America.

Jatropha features prominently in investors' plans and, in general, three different models of jatropha bioenergy production have emerged:

1. Commercial plantations - grow jatropha as a monoculture on large estates
2. Commercial outgrower schemes – obtain jatropha from contracted smallholder farmers
3. Community-focused schemes – smallholders grow jatropha for local energy projects.

This Working Brief aims to assess and contrast the sustainability of these different approaches to producing jatropha as a bioenergy crop, using a case study of each of the three models.

Case studies:

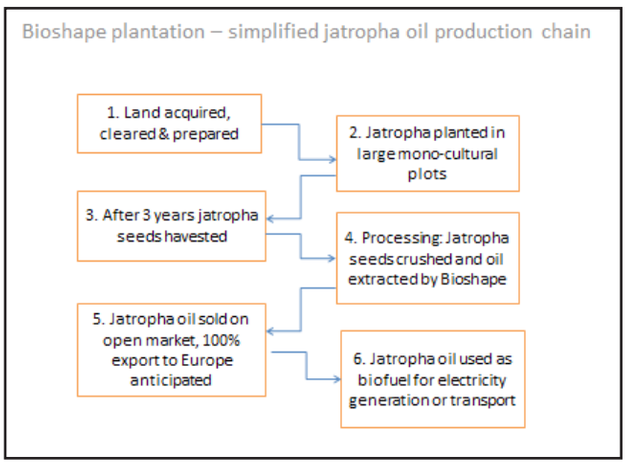
Fig 1: Political Map of Tanzania, showing study sites marked ***X****. Diligent and TaTEDO are in the north, near Arusha, whilst Bioshape is located in the south, near Kilwa.* ***(Source: http://en.wikipedia.org/wiki/Outline_of_Tanzania).***

Plantation model case study - Bioshape:

In 2005, Bioshape Netherlands proposed to establish a 92,000 hectare jatropha plantation in Kilwa district to supply Europe with pure vegetable oil for biofuels production. Bioshape estimates that it would employ 10,000 people, of which 3,000 would be from outside the district, making it the biggest private-sector employer in Tanzania (AidEnvironment, 2007).

Kilwa district (population 171,000), is regarded as one of the poorest in Tanzania, with over 80% of houses built of mud and less than 50% enrolment in primary education (Kilwa District Council, 2007). Agriculture employs 81% of the population, the majority growing sorghum, cassava, rice, and sweet potatoes for subsistence consumption. The natural vegetation is *miombo* woodland interspersed with coastal cloud forest, with average rainfall of 1034mm (AIDEnvironment, 2007).

Bioshape acquired land from four villages, including the case study locations of Mavuji and Migeregere.

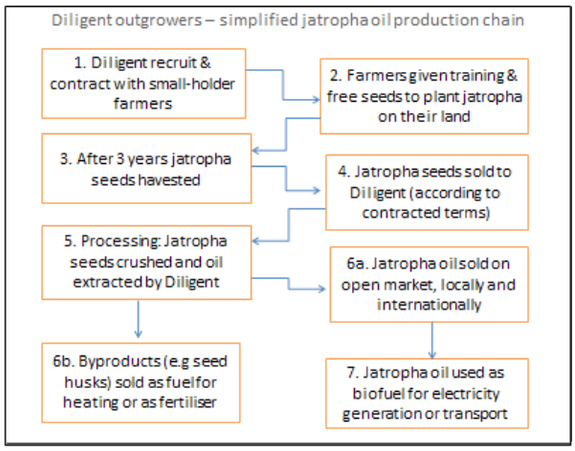


By September 2009 only 200 ha had been cultivated on a pilot farm near Mavuji, although extensive areas of *miombo* had been cleared in preparation for the plantation.

Outgrower model case study - Diligent:

Diligent Energy Systems, another Dutch company, has been engaged with jatropha biofuels in Tanzania since 2004. Located in Arusha, Diligent works with a network of 6,000 outgrowers nationwide, occupying an estimated 3,000 ha that produced 100,000 litres of jatropha-oil in 2008/9. Initially Diligent produced jatropha oil for local consumption as a cooking or transportation fuel, but exports of both 'pure' vegetable oil and biodiesel now account for 90%, with international clients including Boeing and Bayer.

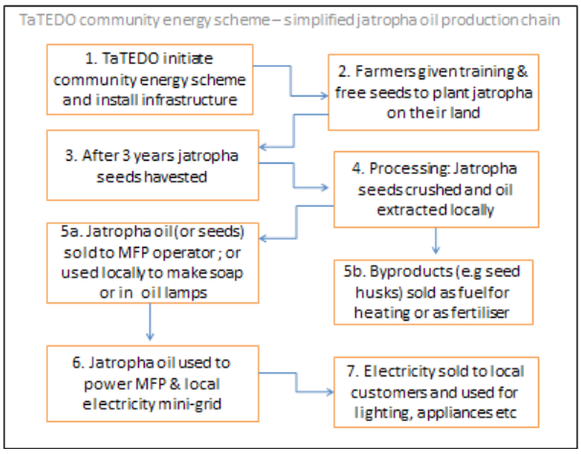
The Diligent outgrowers covered in this case study are in Themi ya Simba and Likamba villages in Arusha region. Arusha is one of Tanzania's driest regions, with an average annual rainfall of 875 mm



in 2002 (Messemaker, 2008). As elsewhere, a large proportion of the population is employed in smallholder agriculture, the main crops being maize and beans, although tourism is a significant employer due to the proximity of Mount Kilimanjaro and Arusha national park. The region is also popular with export-orientated agriculture, producing vegetables and flowers for the international market.

Community-focused model case study - TaTEDO:

Tanzania Traditional Energy and Environment Development Organisation (TaTEDO) promotes sustainable energy technologies for rural development. Since 2006 TaTEDO has piloted Multi-Functional Energy Service Platforms (MFPs), fuelled by jatropha-oil, for the production of electricity. MFPs are used to



power a number of agricultural machines – for grain milling, de-husking and seed-pressing – and supply a local electricity mini-grid. TaTEDO train villagers to operate and maintain the machines, manage the business and cultivate jatropha, aiming for local self-sufficiency.

This case study focuses on the community-energy programme in Leguruki village, also in Arusha region. In keeping with other study sites, Leguruki is predominantly agricultural, with subsistence farming and coffee cash-cropping yielding monthly earnings of TSh35,000 (US$28).

Methods

Data was gathered in September 2009 via field observation and a series of semi-structured interviews with relevant local stakeholders, including local citizens, contracted farmers, plantation workers, village and district government, and representatives of the companies themselves. Sampling varied according to the scale of each model, local preferences and availability of key individuals. For the plantation case study, group interviews with village leaders were locally preferred. In both Mavuji and Migeregere 27 participants (both men and women, of all ages) took part in 2-hour group interviews, supplemented by individual interviews with local government, NGO and company representatives. For the outgrower and community-based case studies individual semi-structured interviews took place with jatropha farmers, village council representatives, biofuels company employees and key local stakeholders, each interview lasting approximately 30-45 minutes. A total of eight people participated in interviews for the outgrower scheme (of which three were female); whilst nine people were interviewed for the community-based scheme in Leguruki (three of whom were female). Information derived from the interviews enabled completion of an assessment scorecard (designed by the researcher) for each biofuels operator, in accordance with the RSB's 44 draft indicators for jatropha (Brinkmann and van Marwijk, 2009).

Results

Plantation model case study - Bioshape:

From the information available, Bioshape's operations in Kilwa were assessed as compliant with 17 of the 44 RSB indicators for jatropha. They were not compliant with 8 of the indicators, and for the remainder they were partially compliant or more information was needed to verify compliance. Strengths were seen in the potential for socio-economic development, use of modern agricultural techniques, and systems and procedures for human resources management, including contracts for workers that defined terms and conditions of service. However, non-compliances were

recorded related to consultation and land acquisition since - whilst legal procedures for consultation were apparently followed during the land acquisition process - there was a lack of transparency from the company and local government regarding the compensation paid, and reported dissatisfaction from local communities with the outcome. This was linked to misunderstanding within communities about their legal rights regarding village land ownership, and their entitlement to compensation and development assistance.

Compensation was agreed between Bioshape, the Tanzania Investment Centre, and district and village governments in return for long-term leaseholds on 16,460 ha of land in Mavuji and 13,600 ha in Migeregere, for which Bioshape reportedly paid US$165,500 and US$297,400 respectively. In accordance with Tanzanian land laws, villages are entitled to 40% of compensation monies, with the remainder split equally between district and national government. However, villagers participating in the group interviews admitted that at the start of negotiations they thought they were entitled to 100% of the compensation package, plus several local-development interventions allegedly promised by Bioshape during consultation, such as jobs and improvements to health, education, water and commercial infrastructure. As such it could not be confirmed that consultation between Bioshape and the villages involved "free, prior and informed consent" as demanded by the RSB criteria.

A non-compliance was also recorded for food security due to concerns within communities of a negative impact on local communities' ability to access or produce food, in particular the implications of employing local subsistence farmers on the plantation and the lower domestic food production that may result. More investigation into the affect that hundreds of migrant workers and their families may have on the local food economy is required.

The plantation's impact on wildlife and biodiversity was deemed to have been inadequately assessed prior to project initiation (WWF, 2009), raising questions about the quality control of environmental impact assessments. The region contains *miombo* woodland and coastal cloud forest, both of which provide habitats for diverse flora and fauna, the latter in particular accommodating numerous endangered and endemic species, such as the southern banded snake eagle (*Circaetus fasciolatus*) and African wild-dog (*Lycaon pictus*) (WWF, 2009). Detailed high conservation value (HCV) and biodiversity assessments are recommended before further land is cleared or cultivated.

Outgrower model case study - Diligent:

Diligent's outgrower model was assessed as compliant with 23 of the 44 indicators of the RSB framework, and non-compliant with 4 of the indicators. Strengths of Diligent's operations were seen as the contribution to local socio-economic development (through the creation of income generation, technology transfer, and new business opportunities), commitment to continual improvement and innovation, and minimal impact on indigenous land rights through use of outgrower farmers.

Weaknesses observed included the unavailability of an environmental and social impact assessment (ESIA), and little evidence that biodiversity and conservation issues had been properly considered during project implementation. Additionally, more evidence is required to demonstrate Diligent's commitment to labour standards and rights, in particular proactive attempts to recognise workers' or farmers' rights to collectively associate. A representational organi-

sation for farmers could promote greater equity in decision making,

as at present farmers' individual bargaining power with Diligent is low.

Community-focused model case study - TaTEDO:

TaTEDO's operations in Leguruki were deemed to be compliant with 18 of the 44 indicators in the RSB framework, and non-compliant for 4 indicators. Strengths were seen in the contribution to local socio-economic development through the creation of job and income generating opportunities, improvements to local energy security, and the minimal impact on indigenous land rights.

Weaknesses were found in relation to the management of the MFP and community energy scheme which hinder its success, including ineffective management structures, technical unreliability, some dissatisfaction with the costs of the project, and relatively low levels of participation - with some local farmers producing jatropha for outgrower schemes rather than the MFP, and the MFP often using fossil fuel instead of jatropha oil. Other areas requiring improvement include conservation, where there is a lack of evidence that appropriate measures are in place to identify and protect areas of high conservation value, and a need for strategies for soil, water and waste management. Further clarification is needed over labour rights and conditions. Additionally, special provisions for small-scale producers are required in the RSB framework, for whom formal systems, processes and documentation are not always available.

Discussion

So as to compare the sustainability of the different bioenergy systems, each producer's perceived impact according to each of the 12 RSB principles was ranked relative to the others. The main findings are outlined below.

Land rights and consultation:

The plantation caused greater conflict over land than smallholder-based schemes.

Smallholders involved in Diligent and TaTEDO's schemes were found to have a low impact on land rights for the simple reason that farmers were using land to which they already had legal entitlement. The plantation, however, required huge tracts of land, and although correct channels for land acquisition were seemingly followed, the majority of participants in group interviews in Mavuji and Migeregere reportedly felt misinformed about the compensation arrangements. This corroborates with other examples of land conflict associated with biofuels in Sub-Saharan Africa (e.g., GRAIN, 2007; ABN, 2007).

Food security:

The plantation model arguably poses a greater threat to food security in the short term than outgrower and smallholder schemes where jatropha is grown as a hedge.

This conclusion is reached following a rapid analysis of the risk factors associated with food security. In the short term, and in the absence of adequate planning, the scale of the proposed plantation and associated socio-economic changes may enhance the vulnerability of the food-insecure population of nearby villages, in all like-

lihood reducing subsistence food production, causing local dependence on purchased food, and increasing pressure on resources due to an influx of migrant workers.

Small-scale farmers contributing to TaTEDO and Diligent's schemes were thought to be at lower risk of jatropha-related food insecurity because they prioritised food production, primarily used jatropha as a hedge, and usually favoured low labour-intensity cultivation. Whilst this undoubtedly affects jatropha yield (Brittaine and Lutaladio, 2010), it results in less competition with food - either through occupying farmer's time (Wiskerke, 2008), or displacing food crops. Other studies in Tanzania have shown that jatropha does not compete with food crops on smallholder farms (Loos, 2009), and can have modest but positive impacts on farmers' incomes (Wiskerke, 2008) - factors that potentially decrease the threat to food availability and access.

Biodiversity and environment:

The plantation model has the largest potential impact on biodiversity, conservation, water, soils and air.

Due to its sheer size, Bioshape's plantation has the greatest potential impact on the environment, requiring the clearing of tens of thousands of hectares of *miombo* woodland to make way for monocropped jatropha. Despite attempts by Bioshape to preserve wildlife corridors and set-aside areas of natural vegetation, applying the precautionary principle would suggest that a lack of biodiversity and HCV mapping may lead to unforeseen habitat loss (WWF, 2009). Elsewhere, plantations have been shown to present significant environmental challenges, including soil erosion, habitat destruction and water resource depletion (Hartemink, 2005).

Smallholder production does not concentrate production into one large area, and thus arguably has less potential to destroy habitats; previous studies of smallholder jatropha cultivation in Tanzania report minimal environmental impact (WWF, 2009; Loos, 2009).

Greenhouse gas emissions:

In the absence of a consistent RSB-approved methodology for calculating GHG emissions, no firm conclusions can be reached about the relative performance of each producer.

In theory, jatropha plantations should have greater GHG reductions in comparison with small-scale schemes due to their greater seed/oil yield per hectare, although yield varies considerably depending on local conditions (Jongschaap et al, 2007). However, Walker and Desanker (2004) and Romjin (2009) propose that carbon depletion from soils is the main variable impacting upon GHG emissions during land-use changes in East African *miombo* habitats. Romjin (2009) added that this was likely to be greater for large plantations where heavy machinery causes significant soil disruption, compared to lower-intensity cultivation techniques, and estimated a carbon-payback time of 30 years for Bioshape's jatropha plantation – equivalent to the productive life of jatropha. Accordingly, direct land use changes associated with Bioshape's plantation model potentially have higher GHG emissions than production via outgrowers or smallholders using jatropha as a hedge on existing farmland. This presumption demands to be tested by thorough quantitative analysis of real data derived from each production chain, using the same methodology.

Socio-economic development:

Small-scale and outgrower initiatives appear to hold greatest potential for pro-poor development.

All three biofuels models have strong potential for socio-economic development but use different approaches. Bioshape's plantation model appears to favour an economic-growth approach to development, driven by a global value-chain (Gereffi et al, 2001) whereby the developing world provide raw-materials and cheap labour, whilst the developed world perform the more value-adding or

technical functions and consume the product. The host community develops economically through increasing income, job creation and infrastructure improvements, but exporting raw materials does little to improve local energy security. In some respects this mirrors the petroleum oil industry in Nigeria, where the country's vast oil reserves have attracted extensive foreign investment for oil extraction, yet the majority of crude oil is exported and the more-profitable refining processes take place overseas (Okonta and Douglas, 2003). This subservient relationship between developed and developing countries arguably maintains historic politico-economic structures and may restrict pro-poor (OECD, 2006) development. Bioshape's plantation model ultimately presents similar opportunities and threats to other forms of plantation agriculture in developing countries, which employs thousands of people, increases foreign exchange earnings and is more economically efficient than smallholder production (Hartemink, 2005). However, plantations depend on cheap labour and imported technology, and are susceptible to fluctuating world market prices, presenting economic risks to host communities, as witnessed by the decline of Tanzanian sisal plantations in the 1980s that caused widespread unemployment (Hartemink, 2005).

TaTEDO's community bioenergy scheme, meanwhile, is based on a value-chain underpinned by local raw materials, labour, ownership and consumption – effectively opting out of the global market for biofuels. The potential benefits include diversification of livelihoods, income generation and improved local energy security, which in turn enable a whole range of economic and social development opportunities. TaTEDO's approach is orientated towards human and pro-poor development ideologies (UNDP, 1990; OECD, 2006). Unfortunately, it has so far failed to live up to expectations due to implementation problems, demanding solutions to financing, reliability and governance issues before it becomes a widely replicable and self-contained model.

The outgrower approach used by Diligent can support both global and local value-chains by creating opportunities to diversify local livelihoods and income, whilst fuelling global demand for biofuels and generating expatriate profits. This approach has created an enabling environment for local farmers and entrepreneurs; the dependence on outgrowers for jatropha means that it is in commercial interests to invest in technology and capacity building for rural farmers, lessons which can be translated to food production. This aligns well with Tanzania's poverty reduction strategy, *MKUKUTA*, which seeks to enhance smallholder productivity (URT, 2007). The business has parallels with other forms of contract farming in developing countries, in which typically smallholders benefit through improved access to markets and technology, reduced exposure to market volatility, and empowerment of women. However, contract farming reduces farmers' flexibility by tying them into long contracts (Simmons, 2002), and in the absence of influencial representational bodies, the weak individual bargaining power of contract farmers could result in exploitation and dependency (Harriss White, 2007) - which may be a risk for Diligent's outgrowers. Furthermore, the relatively high costs of jatropha oil or biodiesel compared to other fuels (kerosene, diesel, charcoal) make jatropha economically uncompeti-

tive as a local source of bioenergy at present, hindering pro-poor development potential (Messemaker, 2008).

In Tanzania, where the government's stated development aims include energy security and poverty reduction, the export-orientated plantation model becomes less favourable - being geared towards foreign profits and cheap labour, with little to reduce Tanzania's reliance on imported petroleum. Consequently, if the Tanzanian government intends to incorporate bioenergy into poverty-reduction strategies, measures should be created to prioritise and incentivise small-scale and outgrower-driven initiatives that support local value-chains (Loos, 2009; Harden, 2008).

Observation:

The results of the ranking imply that, according to the RSB's principles for sustainable biofuels, Diligent's outgrower-led model can be considered the most sustainable, followed by TaTEDO's small-scale rural energy programme, and then Bioshape's plantation model.

However, none of the operators met all criteria in the RSB standard, and consequently, none of them can be considered as 'sustainable' according to this assessment.

Limitations of this exercise:

Reaching firm conclusions about the sustainability of different modes of biofuels production based on the rapid assessment of three producers is limited, as each producer adapts to particular circumstances. Broadening this research to include other producers is recommended in future, which may enable stronger conclusions to be reached about the sustainability of different production systems. Furthermore, the sustainability appraisal undertaken here did not include a thorough analysis of issues such as GHG balance, gender equity, food security, or biodiversity, which are avenues for future study.

Effectiveness of the RSB standard:

Some operational issues were encountered when attempting to implement the standard. Many of these concur with GTZ's 2008 field-test of the Cramer criteria for biofuels in Mozambique which identified concerns around the feasibility of smallholder compliance, ensuring auditors are properly qualified, and demanded clearer procedures for verification and certification (Meissner and Schukat, 2009). Additionally, it is recommended that the local relevance of the RSB standard is enhanced through the development of country and feedstock-specific indicators, along with stronger guidelines for assessment, pertaining to GHG calculations, food security and biodiversity. The importance of indicator localisation in emphasised by the absence of energy security from the RSB framework, even though it is prominent in the government of Tanzania's bioenergy guidelines. These modifications, many of which have been addressed in Version Two of the RSB framework (available from http://rsb.epfl.ch/page-24929-en.html), could improve the quality, consistency and reliability of the standard (IFEU, 2008).

Although the RSB standard provides a practical means of reviewing biofuels producers' performance in several key areas, assessing sustainability through compliance with a standard is limited because so much is dependent on specific local conditions. Indeed, IFEU (2008) demand measures that go beyond certification, including national and international regulations, mandatory sustainability reporting, strict enforcement and transparent verification, so as to build trust in the system. Nevertheless, the RSB standard provides an international reference against which the sustainability of biofuels operations can be benchmarked.

Conclusions and Recommendations

The biofuels industry worldwide is at a crucial juncture - with pro-biofuels policy in the EU and USA coming into force, yet attracting widespread criticism from social and environmental NGOs. This conflict is mirrored in Tanzania, with the government pondering how to capitalise on the global biofuels bonanza in support of national objectives. This study contributes to that debate by assessing the sustainability of several jatropha-biofuels operators, concluding that biofuels production which

supports small-scale cultivation and minimises land-use change is most beneficial to sustainable rural development in Tanzania. The key conclusions are as follows:

Interconnectivity:

Expanding global interest in biofuels has been reflected by increasing foreign investment in biofuels in Tanzania (Songela and Gordon-McLean, 2008). These investments directly impact on the Tanzanian economy, people, and environment, implying that in this increasingly inter-connected world, the EU's decision to introduce biofuels targets under its Renewable Energy Directive can directly affect subsistence farming communities in rural Tanzania.

Furthermore, with EU and US subsidies making it more financially attractive for Tanzanian producers to export biofuels, the government will fail to meet its objective for enhanced domestic energy security. Conversely, export-orientated biofuels production would contribute towards the EU's Renewable Energy Directive targets, highlighting the ongoing tensions between global 'green' goals and local development objectives.

The model of production impacts upon sustainability:

Whilst the socio-environmental impacts of biofuels developments vary depending on the scale of operation, production methods, location, and end-use, the most significant factor identified in this study was whether biofuels resulted in changes in land-use or entitlement. According to this assessment, the outgrower scheme promoted by Diligent and the small-scale rural electrification project managed by TaTEDO hold most promise for sustainable rural development in Tanzania; creating opportunities for training, entrepreneurship and income generation, and encouraging diversification of local energy supplies. Importantly these models also minimise conflict over land, competition with food, and environmental impact when compared to Bioshape's plantation model. Overall, market-driven business models that adhere to 'people, profit, and planet' principles and support local innovation and capacity building, as promoted by Diligent, currently appear the most promising.

In the longer term, maximum benefit for Tanzania may be gained by using jatropha bioenergy domestically, and/or undertaking value-adding biofuels processing locally (e.g., biodiesel production) rather than exporting the raw materials to Europe - although this requires investment in both technology and expertise. Using jatropha oil to generate electricity or as a transport fuel potentially enhances energy security by, for example, reducing reliance on petroleum-based products, firewood or charcoal, and provides new socio-economic development opportunities. However, at present jatropha is not widely promoted nor competitively priced when compared with more established fuels, and thus remains underutilised. Concerted efforts from government and biofuels producers in partnership to develop the domestic market and reduce prices may optimise the local benefits of jatropha.

Tanzanian biofuels guidelines need strengthening:

Current Tanzanian government guidelines and policy do not appear to match investment practice (Mwakaje, 2010). At the heart of this is a lack of clarity over the government's objectives for biofuels - their calls for improved domestic energy security is at odds with many investors' ambitions to export to Europe. This has led to the biofuels sector developing in an uncoordinated manner, causing land-rights conflicts and increased risk of exploitation of rural Tanzanians and the environment. Large-scale investors using a plantation model are particularly susceptible to this 'policy vacuum' due to their requirement for land. The Tanzanian government is advised to strengthen its bioenergy policy, to protect the rights of citizens and send clear signals to biofuels investors. Suggestions for how to do this are given below.

Recommendations:

The government of Tanzania should:

- Update its biofuels guidelines to clarify priorities, making a distinction between biofuels for local energy security and those aiming to enhance export revenues
- Develop a coherent policy that integrates biofuels into national development strategies
- Review the land acquisition process to clarify citizens' rights, ensure fair and transparent compensation arrangements, reduce the space for corruption, and facilitate open and informed consultation procedures in line with African Union guidelines on land policy (AU, 2009)
- Support the development of alternative models of biofuels development that minimise land conflict and promote local value-addition, such as joint-ventures between local communities and investors (Mwakaje, 2010)
- Consider incentivising the development of small-scale jatropha outgrower or rural energy projects to stimulate sector development
- Create a multi-disciplinary working group to oversee implementation of the RSB standard in Tanzania, developing crop and country-specific indicators and guidelines.

To encourage the long-term viability of the industry, jatropha biofuels promoters should:

- Use the RSB standard as a benchmark for producing sustainable biofuels, ensuring compliance with all principles
- Work collectively and in partnership with national and district government and local communities to make Tanzania a gold standard sustainable biofuels-producing nation

The EU and the international community should:

- Adopt mandatory sustainability standards, benchmarked against the RSB
- Encourage further research into biofuels' wider impacts before finalising their national and regional bioenergy policies, in particular impacts on GHGs, food security, the environment and land rights
- Revise biofuels policies and incentives in line with the principles of sustainability, paying greater attention to social, economic and environmental issues associated with biofuels production in developing countries
- Consider alternatives to first-generation biofuels as part of sustainable energy and transportation strategies.

Further study:

To provide a more comprehensive audit of each operators' performance against the RSB framework, further study should include detailed assessments of biodiversity, HCV, food security and GHG emissions, which were not possible here given time and resource restrictions.

A participatory, transparent and outcomes-focused analysis of future pathways for the biofuels sector in Tanzania is also required, leading to the development of a biofuels strategy for Tanzania that is consistent, and supports sustainable rural development, domestic energy security and food security.

Conclusion

Globally and in Tanzania there is still a long way to go before the biofuels industry's contribution to sustainability can be assured. There remains doubt about whether first-generation biofuels should be part of global renewable energy strategies to mitigate climate change, with claims that they can reduce GHG emissions still unproven. At the local level, conflicts over land, environment, and food security persist, as demonstrated in this study of jatropha. However, whilst caution is needed, Tanzania can capitalise on the global biofuels boom through carefully planned developments that balance the needs of the global community to reduce GHGs with local requirements to stimulate socio-economic development, diversify rural energy supplies, and protect the country's most valuable asset, its natural environment. On this evidence, the best way to do this using jatropha biofuels is to support small-scale cultivation as part of outgrower or rural energy schemes.

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PISCES

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Policy Working Group (PWG)

The Policy Working Group (PWG) of PISCES is an expert working group whose objective is to develop a consultative and participatory policy methodology to discuss the policy issues and guide policy statements on bioenergy. The group aims to achieve this by bringing together policy makers, stakeholders and experts to develop a combined methodology on participatory policy dialogue and apply the same in developing bioenergy policy with a focus on Kenya and Sri Lanka.

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