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# Constraints to biofuel feedstock production expansion in Zambia

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**Abstract:** World biofuel production has been increasing to improve energy security and mitigate global warming. Southern Africa's bioenergy demand could increase with South Africa's planned fuel blending mandates, triggering increased demand for feedstocks and agricultural land. Ensuring sustained production will require a full understanding of the constraints to production expansion, considering the tradeoffs that may be generated in rural areas, as has been observed for large-scale land acquisitions. We analyse the social and biophysical constraints to biofuel production expansion in Zambia. Previously social constraints have received limited attention even though they may prove more problematic. Results indicate that Zambia is at least moderately suitable for bioenergy investments with biophysically suitable areas largely coinciding with the socially suitable areas. However, existing gaps in compensatory procedures may inhibit large-scale projects' access to development finance if not aligned with internationally acceptable practices, and generate negative outcomes if safeguards are not in place.

**Keywords:** biofuels, social constraints, biophysical constraints, Zambia, Southern Africa
**JEL classification:** N77, O13, Q15, Q16

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# 1 Introduction

Increasing biofuel blending mandates across the globe have potential to contribute to reduced greenhouse gas emissions, while promoting energy security and generating economic gains. In Southern Africa, South Africa's planned blending could significantly increase regional demand, given the relative size of its transport sector (REN21 2015; Wenberg 2013). Land-abundant developing countries will become attractive biofuel investment destinations, given that South Africa is more land-constrained and meeting bioethanol mandates may require at least 174,000 ha of arable land by 2035 (Stone et al. 2015). Typically, these have been preferred destinations for land acquisitions relating to biofuels and other large-scale agricultural investments (Deininger and Byerlee 2011, 2012; Vermeulen and Cotula 2010).

However, there are tradeoffs that may come with pursuing development of biofuel investments in these countries. And the extent of expansion may be limited or threatened by existing or future constraints. Hence, a full understanding of the local constraints to production expansion is crucial for establishing viable industry—previously, projects failed because of a lack of this understanding (see Locke and Henley 2013). Reaching a scale of production that can sustain an industry requires a set of basic conditions to be in place. On the physical side, there needs to be sufficient arable land, and optimal growing conditions. Production must also be economic, yielding (or promising future) positive financial returns which equal or exceed what producers could hope to get from producing alternative crops. And for reasons explored further below, production also needs to be socially beneficial and not negatively impact the rural communities that engage in—or are affected by—the feedstock production expansion. While in the past the emphasis for making decisions on the siting and scale of feedstocks has focused on the physical-economic feasibility, it is becoming increasingly obvious that there is need to understand the constraints social factors place on aspirations to expand biofuel feedstocks production.

## 1.1 Why might social constraints impact on biofuel investments?

Both large- and small-scale biofuel feedstock projects have faced substantial challenges since the boom in the early 2000s. Small-scale-led projects faced feedstock-related challenges, with the preferred feedstock proving financially unsustainable. On the other hand, large-scale projects have been more contentious and faced challenges related to the process of land acquisition; a number of high-profile cases have received attention due to the negative impacts they have had on the livelihoods of neighbouring communities that have lost land and livelihood resources, without seeing the benefits of biofuel projects.

There are several examples of negative impacts from biofuel-related investments, and large-scale land acquisitions in general. Observed impacts on the rural population so far include worsening food insecurity, loss of water rights, and poverty, particularly among vulnerable groups. This has been through negative impacts on availability of land, water, and forest resources, given conversion to agriculture use. In other cases, there have been have increased conflicts among rural households and between rural households and the projects (Azadi et al. 2012; Deininger and Byerlee 2011; Hunt 2014; Nolte and Subakanya 2016; Schoneveld et al. 2011; von Braun and Meinzen-Dick 2009; Williams et al. 2012). In other cases, large-scale land acquisitions have inefficiently utilized land (Jayne et al. 2014; Locke and Henley 2013). All this is despite anticipated positive spillovers such as employment, markets, knowledge, and technology from the large-scale agricultural projects (or farms) to their hinterlands.

An important question, then, would be what constraints does this evidence place on the viability of bioenergy expansion projects? Clearly, as the potential negative social impacts of biofuel projects have become recognized, so too have they become important determinants of projects' economic viability.

First, we consider issues that may possibly impede a project from moving beyond the design phase and into the implementation phase because of the existence of local opposition or outstanding unresolved issues that prevent it from moving forward. These may be hard or soft constraints—financial institutions may refuse to release funds if projects face unresolved 'ticking time bomb' issues, or projects may also face local opposition from local groups or powerbrokers who refuse to grant a licence. Project viability may be threatened as it has become increasingly clear that the local legitimacy of projects may be questioned further down the line, and pursuing a project in the face of brewing opposition in the hope that this will dissipate over time is often overly optimistic. Many such examples exist across the globe (such as Infinito Gold (Public Citizen 2012) and land conflicts between agribusinesses and locals (Lambin et al. 2013)). It is therefore also useful to consider future social constraints where these can be imagined with a reasonable degree of confidence.

Second, we think of social constraints in terms of the impacts that rural transformation projects may have on households. It is expected, and increasingly demanded, that rural development activities—especially those funded by donors and international financial institutions (IFIs)—leave communities in a better position, or at least no worse off, than they were before the intervention.

Social issues can thus constrain production expansion through two channels:

1. Non-acquiescence of local households and decision makers to efforts to either encourage them to grow feedstocks (through smallholder/outgrower approaches), or to transfer land to a consolidated land-holding by an investor seeking to control production on a large area of land.
2. Where public finance—and increasingly other types—is involved, funding is conditional upon project implementers designing and having in place policies to ensure community consent of planned project activities, and where involuntary resettlement is involved they must have in place a resettlement policy that meets international best practices.

Thus, the projected social impacts of any biofuel expansion bear close upfront examination. Against this backdrop, the purpose of this paper is to explore the possible severity of social constraints to producing biofuel feedstocks in different areas of rural Zambia under different production models, and identify areas that are likely least constrained by either physical or social factors. It discusses the impact of these constraints for expansion under both smallholder and large-scale models.

The remainder of the paper is structured as follows: Section 2 presents the research methods and data sources; Section 3 discusses the study's key findings; and Section 4 concludes and presents the main policy implications.

## 2 Methods and data sources

### 2.1 Research methods

To answer the research questions, we employ a mixed-methods approach consisting of literature review and qualitative and descriptive analyses.

### 2.2 Data and sources

Data for the descriptive analysis is based on nationally representative surveys, namely the Crop Forecast Survey (CFS) and the Rural Agricultural Livelihoods Survey (RALS).

The CFS is collected every year by the Zambia Central Statistical Office (CSO) and the Ministry of Agriculture (MoA), with support from the Indaba Agricultural Policy Institute. The CFS collects information on crop production, sales, and land. The dataset is nationally representative of all smallholder and large-scale farmers. It is also representative at the district level, rendering it attractive for identification of socioeconomic constraints at the subnational level.

The RALS is a nationally representative panel dataset collected every three years; it covers 442 standard enumeration areas and 8,840 households. It is the most comprehensive dataset with regards to information on rural livelihoods, crop/livestock production, and sales. Using these data, we identify areas suitable for expansion of biofuels at the subnational level. Specifically, we used data on land-holdings, food availability, and income poverty among rural households. Detailed information on RALS sampling and coverage is given by Chapoto and Zulu-Mbata (2015a).

To assess the willingness and ability of farmers to engage in feedstock production, focus-group discussions were conducted with farmers in areas identified as suitable for feedstock production expansion. A total of 11 districts across four provinces were selected. In each district, two groups of eight farmers were interviewed, with participants drawn from various agricultural camps.

For the analysis of large-scale land acquisitions we looked at different sources of data, including the analysis of government data by Sipangule and Lay (2015)[1] and the Land Matrix's database of large-scale land acquisitions. For information on compensation we consulted data from International Finance Corporation client projects in Zambia.

## 3 Study findings

### 3.1 Biophysical constraints to biofuel production expansion

Zambia has sufficient arable land per capita on paper to meet biofuel production requirements for both the local and South African market. In 2011, this was estimated at 3.1 ha, halving by 2035 due to population growth (Table 1). This will still be higher than most industrialized countries. However, there is a caveat to this: inadequate infrastructure limits the extent to which this can be utilized and

[1] This includes the Zambian Development Agency's list of expressions of interest in land acquisition.

this is one reason why rural people say there is inadequate land in Zambia (Sitko et al. 2015). This is confirmed by the preference for brownfield sites among investors seeking agricultural land in Zambia, indicating that these are more accessible than greenfield sites (Sipangule and Lay 2015). Nevertheless, efforts to ease this constraint are underway through the government's farm-block development programme. Zambia has low population densities, even by regional standards, with 8 per cent of its land having only eight persons per square kilometre; 69 per cent of this land is located at least 8 km from an urban centre (Sitko et al. 2015).

Table 1: Estimates of land availability in Zambia up to 2035

| Year | Population | Arable land (ha) | Surface area (ha) | Arable land to person ratio | Land to person ratio |
|---|---|---|---|---|---|
| 2011 | 13,100,000 | 40,000,000 | 75,261,400 | 3.1 | 5.7 |
| 2020 | 17,885,422 | 40,000,000 | 75,261,400 | 2.2 | 4.2 |
| 2025 | 19,900,000 | 40,000,000 | 75,261,400 | 2.0 | 3.8 |
| 2035 | 26,923,658 | 40,000,000 | 75,261,400 | 1.5 | 2.8 |

Source: authors, based on data from CSO 2010, 2013; Sitko et al. 2015; ZDA 2014.

There are within-country differences in land availability, but the land constraint is highest in Eastern and Southern Provinces, where 73 per cent of the rural smallholders say there is inadequate land (Chapoto and Zulu-Mbata 2015b). The land constraint among smallholder farmers is further discussed under the social constraints of a smallholder-led biofuels industry. The majority of land in Zambia is under customary tenure (86.9 per cent of smallholders have land under customary tenure), with conversion to statutory land often complex and expensive for the smallholders (Sitko et al. 2015). Any conversions by smallholders would require easing this constraint to tenure conversions or be done in groups, as is the case for sugarcane outgrower schemes at Kaleya, where a block title was acquired for farmers operating in the irrigation scheme to aid in accessing finance (Tagliarino 2014). Existing tenure conditions may also hamper on-farm investments that promote sustainable land use.

Comparing the ease of access to land among population groups is crucial, particularly as population forecasts point to a growing youth population (and labour force) (see Losch 2014). These will be important for setting a new set of initial conditions for driving future growth. Findings from focus-group discussions in four provinces of interest for bioenergy investments indicate that there are clear differences in the ease of access to land across space and gender. For the provinces that are likely to be destinations for biofuel investments, we find that finance is the key determinant of whether one will access land or not (through rental markets or sales), irrespective of gender or whether they are local or non-local. This perhaps explains why there has been elite land capture in Zambia. The general narrative, perhaps perpetrated by traditional Zambian culture, has been that land is passed on within families, especially to male children. Females then can use some of it, or end up using land belonging to their husbands when they get married. Previously, it was more difficult for females to acquire land, but more recently traditional leaders are increasingly allocating land to females in their chiefdoms. Various reasons have been advanced to explain why land has been distributed in this way in the past; from interviews with locals the reasons appear to be driven by tradition, with locals offering the following reasons:

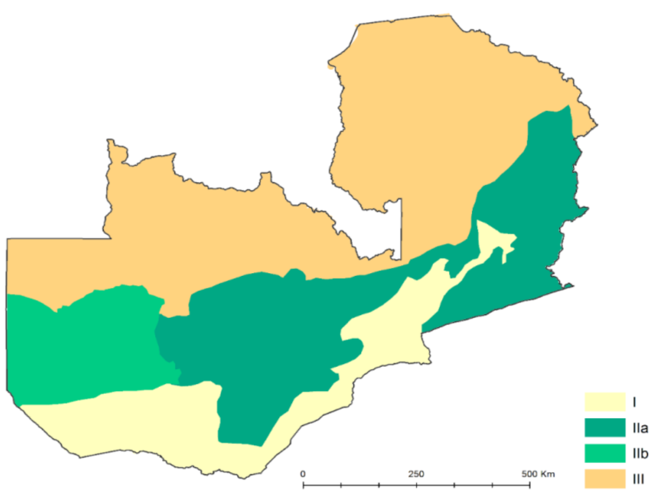
- 'Males are more likely to put land to productive use and that is why it is usually passed on to them.'
- 'Females can easily get married to outsiders who may have criminal records, and thus local authorities try to minimize the occurrence of such.'
- 'In the past, when one's husband dies, land would be grabbed from the widow, and the new system in the traditional set-up is trying to get rid of this practice. Moreover, women have become active participants in agricultural production.'

The ease of access that is driven by finance appears more important in densely populated areas near the metropolitan cities. Among women, access to land other than that within the family is easier for widows and divorcees. In some cases, traditionally, it is unacceptable for women to separately own land for as long as they are married. In one district, one farmer said: 'I can let her go look for land if we have children and doing so for our kids.' Another said: 'For the sake of marriage security, I would rather she didn't look for land because she may be too independent and run away.'

For the youth, access is through land owned by their parents, or where possible through the rental and sales markets.

Climatic and soil conditions may limit what feedstocks can be grown in an area. From our analysis, we find most of Zambia receives sufficient rainwater (800–1,200 mm per annum) that can be used to produce feedstocks under rain-fed conditions. This is mostly in agroecological zones (AEZs) II and III, the majority of which is of high agroecological potential (except for AEZ IIb) and generally has low population densities and growth, even by regional standards (Figures 1 and 2; Sitko et al. 2015). Zambia has three main AEZs, which are classified based on soil type, temperature, and rainfall (Figure 1). AEZ I receives less than 800 mm of rain per annum, AEZs IIa and IIb receive 800–1,000 mm per annum, and AEZ III receives 1,000–1,500 mm of rain per annum (Chapoto and Zulu-Mbata 2015b).

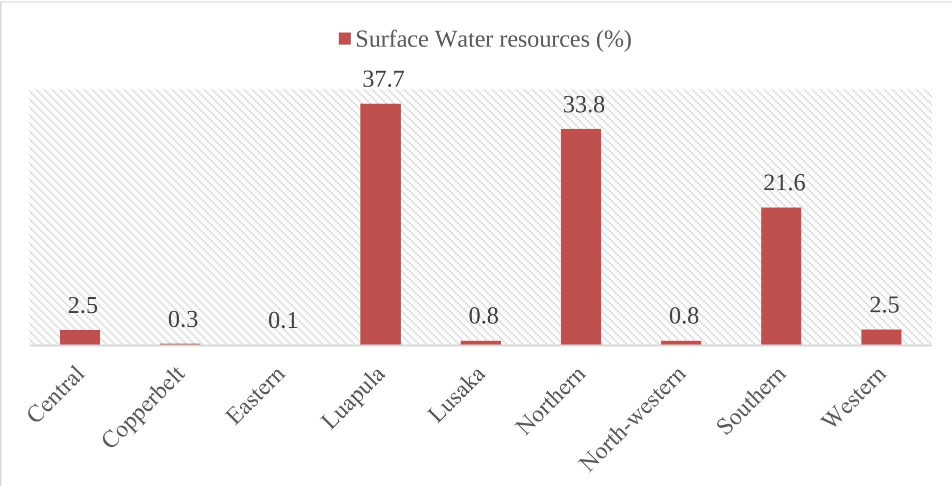
Figure 1: Zambia's agroecological zones




Source: Chapoto and Zulu-Mbata 2015b.

Available data estimates renewable annual surface water potential at 100 $km^2$. Most surface water is located in Luapula, Northern, and Southern Provinces, accounting for 93.1 per cent of the 12,621 $km^2$ available surface water (Figure 2). However, Southern Province is likely to be surface water-constrained, given sugarcane production activities by Zambia Sugar Plc and Kafue Sugar.

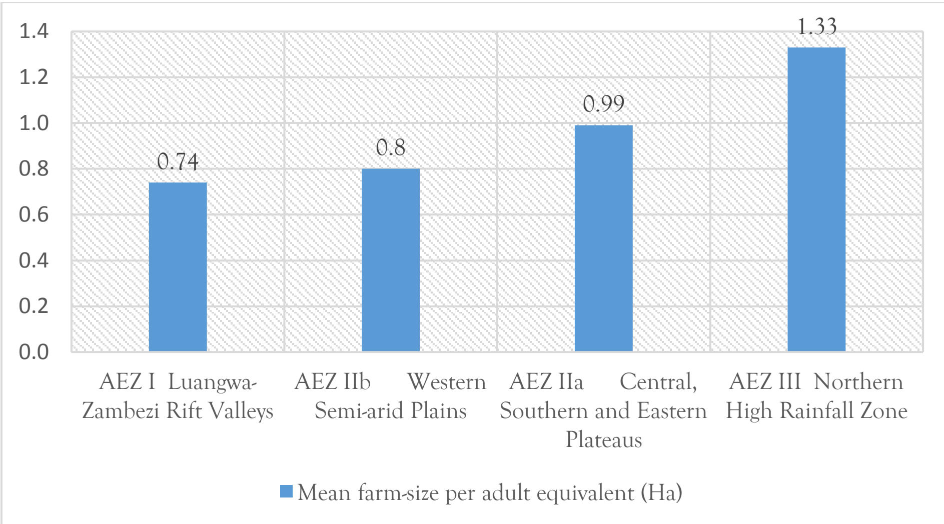
Figure 2: Distribution of surface water resources by province




Source: authors' calculations based on data from Nyambe and Feilberg 2009.

We find that most areas with adequate rain and surface water also have large farm sizes per capita (Figure 3). Renewable groundwater potential is estimated at 49.6 $km^3$, but little is known about the spatial distribution of groundwater resources. A complete understanding is crucial, especially in the southern-most parts of the country, where irrigation using groundwater would significantly contribute to feedstock production expansion under poor rainfall and high rainfall variability. Moreover, locating projects in this area would cut down transport costs to South Africa. Irrigation potential is estimated at 2.75 million hectares, of which only 156,000 ha of land is presently under irrigation on commercial farms of irrigated cash crops (MoA 2016; ZDA 2014); irrigated crop production by smallholders is almost inexistent. However, at the household level, the 2015 RALS shows that most rural households in Zambia are within 4 km of piped or borehole water, with the lowest distances observed in Eastern Province. However, extremes are observed for Serenje District in Central Province at 8.1 km and Mpika in Muchinga Province at 13 km.

Figure 3: Distribution of mean land-holding size by AEZ




Source: authors' calculations based on RALS 2015.

## 3.2 Constraints to smallholder-led production expansion

From a social perspective, three indicators are used to determine suitability for a smallholder-led biofuel expansion programme. First, in areas where people are food insecure, expanding feedstock production may worsen their food insecurity via increases in food prices. It may also worsen their nutrition status, given the likelihood that they would also have reduced crop diversity as they expand feedstock production. Small median plot sizes likely indicate a general lack of available land for large-scale feedstock production, and limited ability of smallholders to engage in outgrower schemes. As such, areas with small median land sizes may not be appropriate for expanding feedstock production. A high share of poor households indicates inability to engage in production expansion due to a general lack of capital or equipment, and also indicates a lack of capacity among households to survive external shocks.

We compute land, number of months without food, and poverty terciles across regions within Zambia. Land-constrained regions fall within the bottom tercile; similarly, areas least constrained by poverty fall within the bottom tercile of the share of poor households. Income poverty is used as it is the next best alternative to consumption-based poverty estimates.[2] For these data, we use the US$1.25 poverty line based on 2005 purchasing power parity. Food-insecure areas fall within the top tercile of months without food. Areas satisfying all three constraints are classified as unconstrained; those satisfying two constraints as moderately constrained; and those satisfying one condition or fewer are constrained. Summary statistics for each of these constraints are provided in Table 2.

[2] http://web.worldbank.org/WBSITE/EXTERNAL/TOPICS/EXTPOVERTY/EXTPA/0,,contentMDK:20242876~menuPK:435055~pagePK:148956~piPK:216618~theSitePK:430367,00.html.

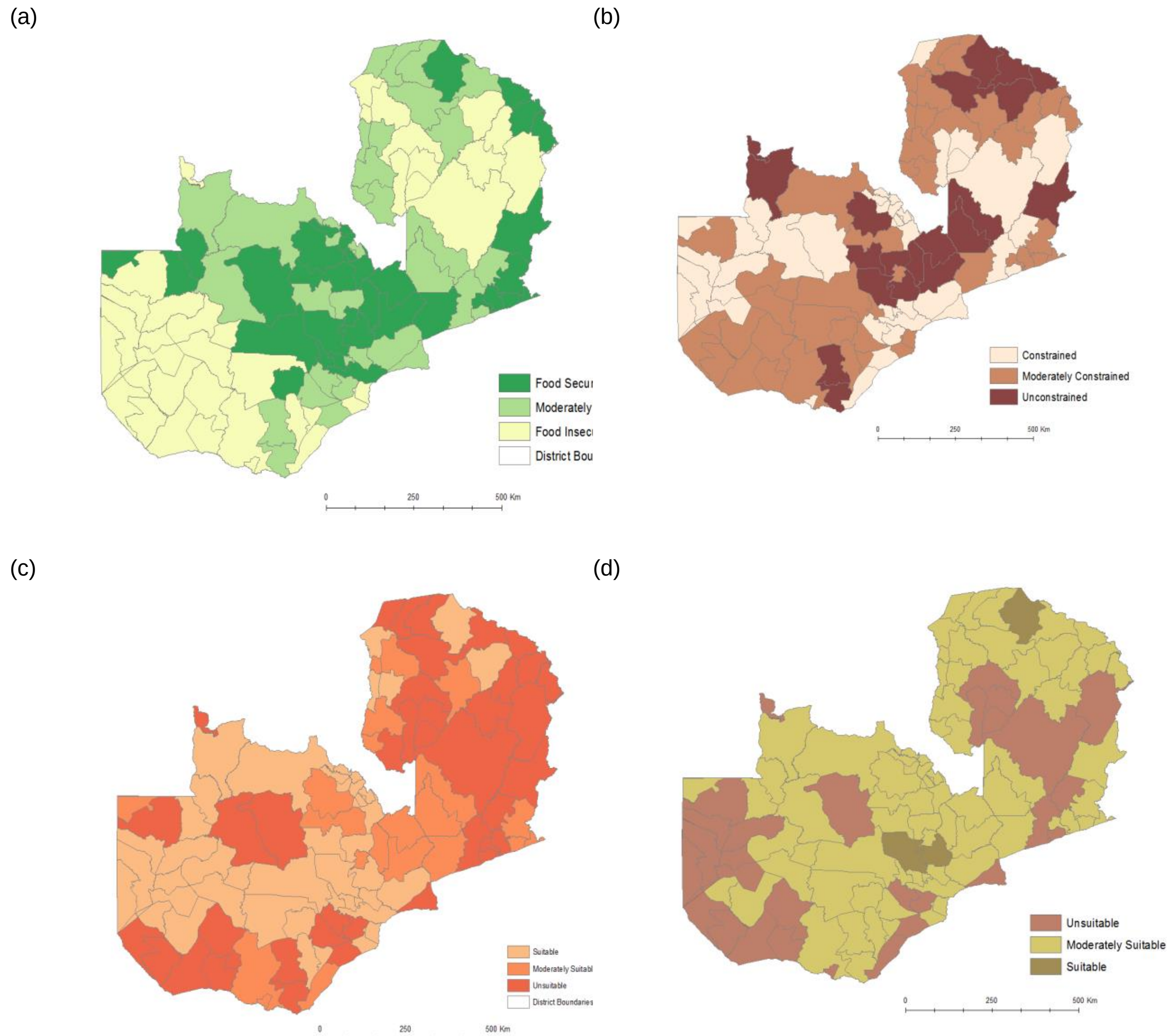
Table 2: Summary statistics for social constraint variables

| Social constraint | Constraint terciles | | |
|---|---|---|---|
| | 1 | 2 | 3 |
| Share of poor households (percentage) | 36 | 51 | 65 |
| Median farm size (hectares) | 0.25 | 0.45 | 1 |
| Number of months without food | 3 | 3.6 | 5 |

Source: authors' calculations based on RALS 2015.

Based on this classification we find that Western Province is largely unsuitable for feedstock expansion; it has a large number of districts that are socially constrained. This is followed by Muchinga and Eastern Provinces. In Southern Province, the southern-most areas are unsuitable—an expected result given the marginal agroclimatic conditions for agricultural production. There are some parts of Eastern Province that are unsuitable, mostly close to Muchinga Province (Figure 4).

Figure 4: Social constraints to biofuel investments: (a) suitability based on food security; (b) suitability based on land-holding sizes; (c) distribution of the share of poor households; (d) Overall suitability based on all social constraints

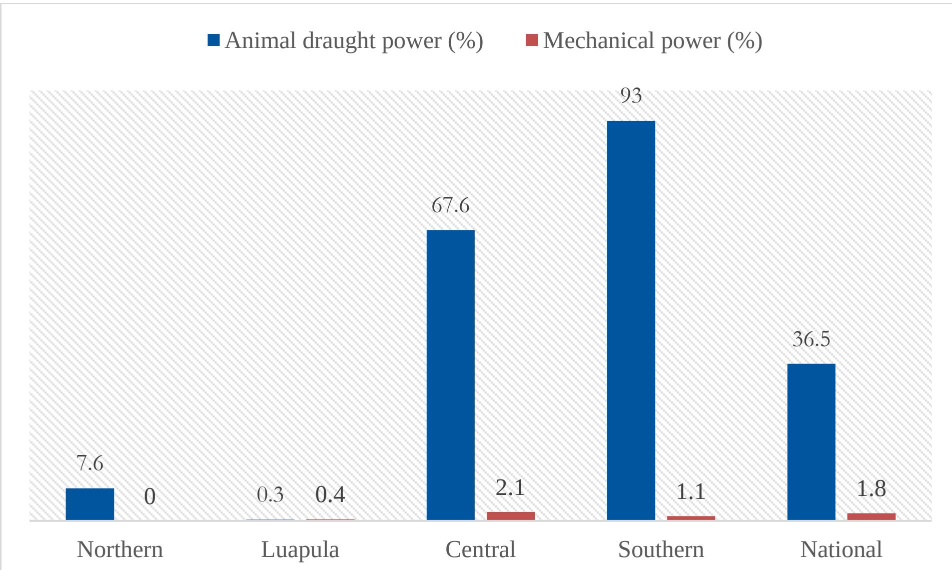



Source: (a) RALS 2015; (b) CSO/MAL CFS 2014–15; (c) RALS 2015; (d) compiled based on (a)–(c).

Out-migration patterns indicate the general availability for labour for agricultural production in an area and thus a key constraint to expanding production (Lambin et al. 2013). As such, areas with high rural–urban migration may indicate a general lack of labour for agricultural activities both presently and in the future. Rural to urban migration is highest in Luapula and Northern Provinces (44 per cent and 34 per cent, respectively) (Nyambe and Feilberg 2009). Most districts in these areas are also moderately suitable (Figure 4). The highly-urbanized Provinces (Lusaka and Copperbelt) experience very limited rural–urban migrations (<10 per cent). In the remaining provinces, rural to urban migration is estimated as 18–30 per cent. However, while there is rural to urban migration in some areas, RALS 2015 shows that, on average, most migration in rural Zambia occurs within rural areas, perhaps because urban areas do not have the employment opportunities that the rural people seek—implying that availability of unskilled labour may not be a problem.

Results from focus-group discussions indicate a general willingness among farmers to participate in biofuel projects; however, most did indicate that there are limitations to how much production expansion can take place among smallholders on their own. Doing so would require increasing their access to inputs, and mechanization. Presently, household labour is the major source of tillage power, with animal draught and mechanical power used by very few households (Figure 5).

Figure 5: Distribution of households using technology




Source: authors' calculations based on RALS 2015.

There are limits to how much one can cultivate using manual labour, which is the major power source. Similarly, low intensification levels limit productivity and production levels. However, farmers in areas of interest (Luapula, Southern, Central, Northern, and Copperbelt Provinces) did highlight the need for safeguards to be in place, especially given the experiences with past firms, where contracted *Jatropha* was not bought, leaving farmers without a market. Further improvements to the contractual relations between farmers and firms will be critical to the industry's success.

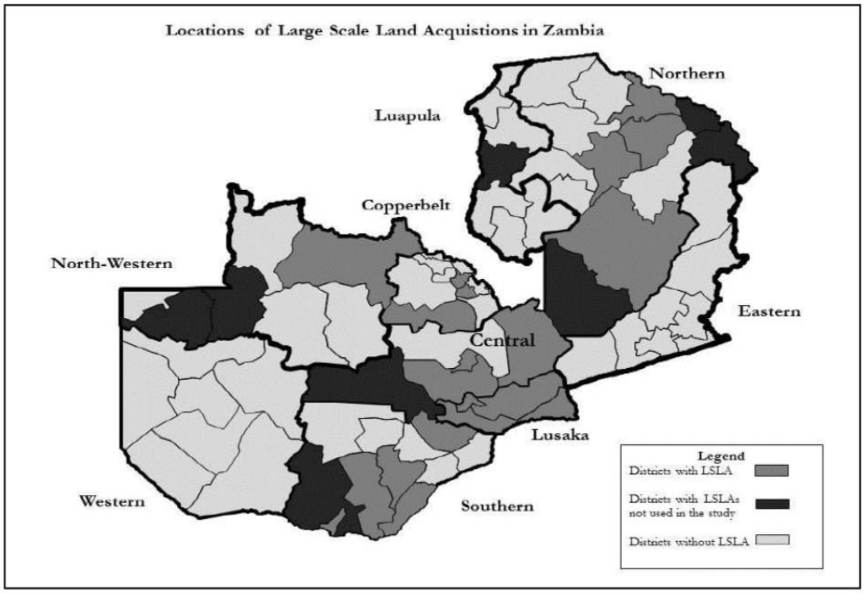
### 3.3 Constraints to a large-scale-led biofuels industry

Zambia is one of the countries that has attracted most interest from investors seeking large tracts of land to develop agriculture projects (Deininger and Byerlee 2011; Oakland Institute 2011).

Using several sources of data,[3] Sipangule and Lay (2015) detail the number, size, and location of large-scale land investments (LSLIs) across Zambia's districts. They enumerate 95 foreign LSLIs in 26 districts, covering around 562,312 ha of land. All of these districts are in the Central, Copperbelt, Northern, North-western, Luapula, and Southern Provinces. Their analysis suggests that most investments are clustered along the railway line and major roads, and that investors prefer to take on existing farms rather than invest in greenfield sites (Figure 6).

[3] This includes data from the Zambian Development Agency and the Land Matrix.

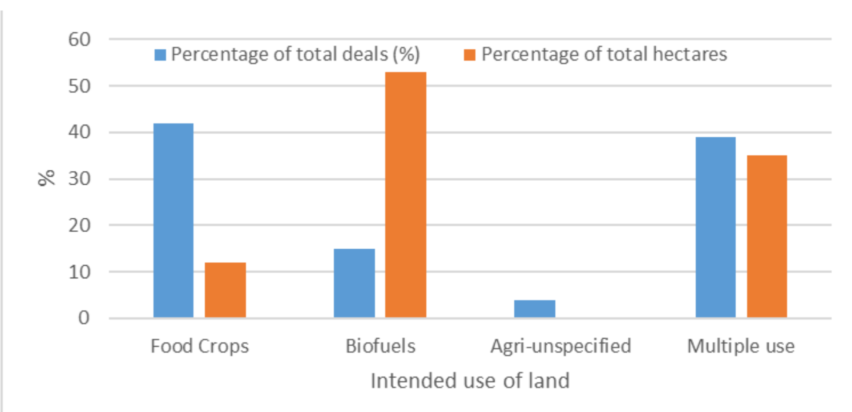
Figure 6: Districts of Zambia targeted by large-scale land acquisitions




Source: Sipangule and Lay 2015.

Recent analysis by the Land Matrix (Land Matrix 2016) covers a smaller number of deals (34)[4] comprising 390,074 ha. Looking at the intended use of the land, they find that most projects aim to produce food crops (42 per cent), followed by multiple uses, including food and livestock production. Although only making up 15 per cent of deals, investments that target production of biofuel feedstocks cover 53 per cent of the land under contract (Figure 7).

Figure 7: Intended use of land under concluded land deals in Zambia




Source: authors' illustration based on Land Matrix 2016.

[4] The Land Matrix limits its analysis to deals for agricultural purposes (excluding forestry and mining) that entail a transfer of rights to use, control, or ownership of land, cover an area of at least 200 ha, and were initiated after 2000. Data were valid as of 1 February 2016.

Unlike in some other countries where the number of deals fell following an initial wave of acquisitions in 2008–10, in Zambia the pace at which deals have been signed has quickened since 2011, with significant deals covering a large area of land (*c.*200,000 ha) signed in 2012.

A large share of intended deals have progressed to an operational stage. Analysis of their data by the Land Matrix suggests 65 per cent of those deals that have been concluded have progressed to an operational phase; similarly, Sipangule and Lay (2015) find that of the 95 cases they examine, 75 have progressed to an operational phase. However, as is the case elsewhere, the majority of these investments are not farming the full area they have leased: Land Matrix analysis suggests that, on average, ventures farm less than 5 per cent of the area they have under contract. Biofuel feedstock projects, in particular, have faced challenges reaching the production stage: only two of the seven biofuel feedstock projects have reached and remain in production, and it is unclear how much of this land is actually cultivated.

Part of the reason for Zambia's attractiveness is its legal framework, which provides relatively easy access to land for investors. The 1995 Land Act allows investors who meet a set of conditions[5] to acquire land. Importantly, the Land Act provides a mechanism for the conversion of customary land to leasehold state land, which removes land from the jurisdiction of chiefs. It also allows traditional owners and existing leaseholders to identify outside investors and recommend them to the Commissioner in the Ministry of Lands (Sipangule and Lay 2015). This mechanism allowing the conversion of customary land to statutory land has been frequently used by Zambia's growing middle class who, together with central and local government, have led a process of land conversion that has reduced the area of customary land from as much as 94 per cent in the middle of the twentieth century to 54 per cent in 2015 (Sitko et al. 2015).

In addition, in an attempt to stimulate the agricultural sector, the government played an active role in promoting Zambia as a destination for foreign investment in agriculture. The cornerstone of this drive was the establishment in 2008 of a farm-block development programme. Through this programme, the government identified large tracts of land in nine provinces which it has plans to survey, convert from customary to state land, and provided titles for. As of 2014, one of the farm-blocks (Nansanga) was most advanced; as well as providing electricity and dams, the government had conducted a cadastral survey and surveyed and titled the land (GRZ 2014). To attract investment in these locations, the government has made its own investments in key infrastructure, including roads, irrigation, and power (Oakland Institute 2011).

*The process of land acquisition for investment*

In spite of the shift of land from customary to leasehold, a sizeable proportion of land remains under the custody of chiefs. For large projects, the Lands Acquisition Act of 1996 gives the president the right to acquire any piece of land in the national interest; however, to acquire customary land, three authorities—the district council chair, executive secretary, and the chief—must provide approval for conversion of customary land to leasehold title. The commissioner of lands is also meant to provide consent unless the process causes injustice, or is contrary to national interest or policy. The 1999 Lands Act is not clear regarding what rights the chiefs retains over land following conversion, what

[5] These conditions include that the company must adhere to conditions of the Investment Act, including that 75 per cent of shareholders are Zambian and are registered in Zambia.

other customary rights to use land (other than occupation, which is prohibited) remain, and whether customary laws continue to apply, but Tagliarino (2014) notes that in practice customary claims to land are extinguished, and the chief's ability to influence actions by the investor are diminished as only the commissioner of lands is party to lease agreements, and leases are only subject to statute and regulations passed by the Ministry of Lands. Chiefs are not given any responsibilities to ensure terms of the contract are enforced.

*Legal issues surrounding the processes of acquisition, consultation, resettlement, and compensation*

Global experience points to a close association between large-scale land acquisitions and social risks, especially when households are displaced and resettled. In Zambia, there is a mix of evidence of displacement resulting from land investment. Studies from around 2010 found that households were unable to access food as easily after displacement compared to before displacement. Milimo et al. (2011), cited by van der Werf (2015), found that the households forced to relocate following the transfer of church land to an investor suffered from increased hunger as they were unable to farm the new areas as successfully as they could their former land. Similarly, a study by the Zambian Land Alliance of a displaced community, cited by the Oakland Institute (2011), found that following relocation households were only able to produce 25–50 per cent of the crop volume they previously could.

This report also documented cases of households becoming physically disconnected from public services, including schools, and losing access to both food and fuel from forests. Nolte's (2014) qualitative study found anecdotal evidence of displacement occurring, and notes that only in those cases where forced expropriation occurred is compensation mandatory; in other cases, the amount of compensation that affected households receive depends on the generosity of investors, the bargaining power of the community, or discretionary interventions by local or national government officials. As a result, it is not uncommon for households to receive no or low compensation for lost land. In addition to questions regarding compensation for foregone land, affected households complained that they did not receive compensation for destroyed trees and crops. However, interviews also revealed that a substantial number of households were positive about the impact of LSLIs, especially the employment opportunities they generated and, in a small number of cases, providing infrastructure, access to farm equipment and information on farming techniques.

Key processes to ensure that social issues are minimized are those included in processes of consultation, resettlement, and compensation. There are different approaches to mitigating these risks. In Zambia, Environmental and Social Impact Assessments are the legal mechanism used to determine potential adverse impacts and selection of suitable mitigation mechanisms before resettling people affected by projects or disasters.

However, there are weaknesses associated with each of these processes in Zambia. The 1995 Lands Act contains only weak provisions on consultation: it requires the president to take into consideration customary law and consult those whose interests may be affected. It provides no guidance on how consultation should take place, or whether (and how) affected persons are to be compensated in the event of physical or economic displacement (Tagliarino 2014). Guidance from the ZDA presented above suggests that the lowest level of consultation is with chiefs and village headmen, so consultation with villagers is not always formally required.

There does not appear to be a clear division of responsibilities for leading on issues related to displacement and resettlement between different government departments. Chu et al. (2015) note that while the Zambia Environmental Management Agency is responsible for auditing Environmental Impact Assessments (EIAs) and Resettlement Action Plans, the process of resettlement is overseen by the Department of Resettlement (DoR) and the Disaster Management and Mitigation Unit (DMMU), which sit under the Office of the Vice President. Experiences suggest there is inadequate communication between these offices (Chu et al. 2015). During our research, participants in focus-group discussion suggested compensation was organized through the Ministry of Local Government and Housing, but the valuation exercise was carried out by the MoA.

In addition, while all projects requiring resettlement need to submit an EIA, producing a Resettlement Action Plan does not appear to be a legal requirement for either government agencies or companies whose internal policies do not mandate one. Instead, government agencies often rely on the DMMU and DoR to carry out these tasks; neither department appears to have adequate capacity to monitor and enforce the regulation as they stand.

## 4 Conclusions and policy implications

Increasing biofuel mandates in Southern Africa offer promise for improving energy security and mitigating global warming, while generating benefits for locals. South Africa's planned blending creates a large market for produced biofuels in Southern Africa. Given that it is land-constrained, production will have to be from land-abundant countries. This paper sought to understand the constraints to biofuel production expansion in Zambia as a land-abundant country. In addition to biophysical suitability, we also analyse social constraints to a small- and large-scale-led biofuels industry expansion. Inclusion of social constraints underscores the importance these have for ensuring a sustainable industry that will not face local opposition or generate negative social costs, and ensuring projects have access to international finance.

From a biophysical perspective, we note that Zambia has 3.1 ha of arable land per person; with population growth this will reduce to 1.5 ha—a large enough land-size to accommodate feedstock production when compared to other countries. About 70 per cent of the land-mass lies in areas suitable for production of biofuel feedstocks (AEZ II and III). There is adequate rainfall in these areas to support feedstock production, except for sugarcane, which is typically grown under irrigation. Surface water is also largely available. Most of this is concentrated in areas that are highly suitable for feedstock expansion (Luapula, Northern, and Southern Provinces have the surface water resources, covering over 93 per cent of the country's surface water).

We analysed social constraints to small-scale-led production expansion (i.e. small median plot sizes, high incidences of poverty, and food insecurity), coupled with an analysis of biophysical suitability. Using the extent of food insecurity, poverty, and the size of median land-holdings as indicators for social suitability for a smallholder-led biofuel production expansion programme, we find that the biophysically suitable areas largely coincide with the socially suitable areas. Except for Western Province, and the southern-most parts of Southern Province, the rest of Zambia is at least moderately suitable for feedstock production expansion from both a social and physical point of view. A number of districts in Muchinga Province fail the social constraint despite being physically suitable. Districts in Northern, Luapula, Copperbelt, Central, and Southern Provinces would be ideal for expanded production of biofuel feedstocks.

However, while Zambia is biophysically suitable for biofuel investments, social constraints and costs may limit the extent of a large-scale led production expansion. These include (1) social costs that may constrain access to finance from international donors and financiers; and (2) factors that may increase the likelihood of projects facing local opposition as land and water shortages increase.

Overall, there is a considerable risk that rural households may be left worse off if large-scale-led investments proceed, as evidenced by studies involving previous large-scale land acquisitions. This emanates from inadequacies in the consultation, displacement, and compensation procedures and practices related to land acquisitions for large-scale investments. Specifically, the 1995 Lands Act provides no guidelines on compensation, or consultation relating to displacement. Consultation is only with chiefs, excluding villagers. There is no clear division of responsibilities regarding displacements and resettlement between government agencies. There is no legal mandate to provide a Resettlement Action Plan among projects, despite firms being mandated to provide an EIA plan.

There is neither a comprehensive legal framework nor the public institutions with a clear mandate to guide the process of resettlement and compensation; key decisions regarding these issues fall to the individual. Identification of suitable land for agricultural investments occurs without consultation with the locals directly affected. Resettlement plans and compensation guidelines are drawn-up without the involvement of affected individuals.

A review of existing procedures and its implementation is thus crucial. Otherwise, any investments must be in areas with low population densities in order that risks are minimized. State land should be prioritized for bioenergy investments where it is available. For example, the farm-blocks that lie largely in the biophysically and socially suitable areas across the country, covering an estimated 850,000 ha.

However, findings from earlier studies including on farm-block sites suggest that these are not necessarily always free from encumbrances and undertaking proper consultation on this land and following best practices for resettlement and compensation is necessary.

**References**


Azadi, H.H., E. Houshyar, K. Zarafshani, G. Hosseininia, and F. Witlox (2012). 'Agricultural Outsourcing: A Two-headed Coin?' *Global and Planetary Change*, 100: 20–27. Available at: https://biblio.ugent.be/publication/3238891/file/6790608.pdf (accessed April 2016).

Central Statistical Office (CSO). (2010). *2010 Census of Population and Housing: Population Summary Report.* Lusaka: Central Statistical Office. Available at: www.zamstats.gov.zm/report/Census/2010/National/2010%20Census%20of%20Population%20Summary%20Report.pdf (accessed April 2016).

Central Statistical Office (CSO). (2013). *Population and Demographics Projections 2011–2035*. Lusaka: Central Statistical Office. Available at: www.zamstats.gov.zm/report/Census/2010/National/Zambia%20Census%20Projection%202011%20-%202035.pdf (accessed April 2016).

Chapoto, A., and O.N. Zulu-Mbata (2015a). *2015 Rural Agricultural Livelihoods Survey Report*. Lusaka: Indaba Agricultural Policy Research Institute. Available at: www.iapri.org.zm/images/Articles/RALS_Report.pdf (accessed February 2016)

Chapoto, A., and O.N. Zulu-Mbata (2015b). *Atlas of Zambian Agriculture*. Lusaka: Indaba Agricultural Policy Research Institute.

Chu, J., K. Young, and D. Phiri (2015). 'Large-Scale Land Acquisitions, Displacement, and Resettlement in Zambia'. Cape Town: University of Western Cape, Institute of Land Poverty and Agrarian Studies (PLAAS). Available at: www.plaas.org.za/sites/default/files/publications-pdf/PLAAS_ADC%20policy%20brief_Zambia_Web.pdf (accessed November 2016).

Deininger, K., and D. Byerlee (2011). *Rising Global Interest in Farmland: Can It Yield Sustainable and Equitable Benefits?* Washington, DC: World Bank. Available at: https://siteresources.worldbank.org/DEC/Resources/Rising-Global-Interest-in-Farmland.pdf (accessed October 2016).

Deininger, K., and D. Byerlee (2012). 'The Rise of Large Farms in Land Abundant Countries: Do They Have a Future?'. *World Development*, 40(4): 701–14.

Government of the Republic of Zambia (GRZ). (2014). 'Farmblock Development Programme'. Lusaka: Government of the Republic of Zambia. Available at: http://photos.state.gov/libraries/zambia/231771/PDFs/FarmBlocksPresentation.pdf (accessed October 2016).

Hunt, A., A. Collard-Wexler, and S.D. O'Connell (2014). 'How do Electricity Shortages Affect Productivity? Evidence from India'. NBER Working Paper 19977. Cambridge, MA: National Bureau of Economic Research. Available at: www.nber.org/papers/w19977 (accessed October 2016).

Jayne, T.S., A. Chapoto, N. Sitko, J. Chamberlin, and M. Muyanga (2014). 'Is the Scramble for Land in Africa Foreclosing a Smallholder Agricultural Expansion Strategy'. *Journal of International Affairs*, 67(2): 35.

Lambin, E.F., H.K. Gibbs, L. Ferreira, R. Grau, P. Mayaux, P. Meyfroidt, and J. Munger (2013). 'Estimating the World's Potentially Available Cropland Using a Bottom-Up Approach'. *Global Environmental Change*, 23: 892–901. Available at: www.gibbs-lab.com/wp-content/uploads/2015/09/Gibbs_Estimating_the-worlds_potentially_available_cropland_using_a_bottom-up_approach_2013.pdf (accessed April 2016).

Land Matrix (2016). 'Large Scale Land Acquisitions Profile: Zambia'. Available at: http://www.landmatrix.org/en/get-the-detail/by-target-country/zambia/?order_by=&starts_with=Z (accessed 26 January 2017).

Locke, A., and G. Henley (2013). 'Scoping Report on Biofuels Projects in Five Developing Countries'. London: Overseas Development Institute. Available at: www.odi.org/sites/odi.org.uk/files/odi-assets/publications-opinion-files/8394.pdf (accessed February 2016).

Losch, B. (2014). 'African Youth in Agriculture and Rural Development'. Background paper for the FAO Regional Conference for Africa (ARC 2014). Available at: https://agritrop.cirad.fr/573011/1/document_573011.pdf (accessed January 2017).

MoA (Ministry of Agriculture) (2016). 'Investment Opportunities in the Zambian Agricultural Sector: Focus on the Farm Block Development Program'. Presented in Saudi Arabia at the King Abdullah Initiative for Saudi Agricultural Investments Abroad by Hon. Given Lubinda (Minister of Agriculture), Zambia Ministry of Agriculture.

Nolte, K. (2014). 'Large-Scale Agricultural Investments Under Poor Land Governance in Zambia'. *Land Use Policy*, 38: 698–706.

Nolte, K., and M. Subakanya (2016). 'Relationship Between Large-Scale Agricultural Investors and Local Communities: Lessons from Two Investments in Zambia'. Policy Brief 79. Lusaka: Indaba Agricultural Policy Research Institute. Available at: http://fsg.afre.msu.edu/zambia/ps_79.pdf (accessed April 2016).

Nyambe, I.A., and M. Feilberg (2009). 'Zambia: National Water Resources Report for WWDR3'. Lusaka: Ministry of Energy and Water Development. Available at: http://webworld.unesco.org/water/wwap/wwdr/wwdr3/case_studies/pdf/Zambia_National_Water_Resources_Report.pdf (accessed October 2016).

Oakland Institute. (2011). 'Understanding Land Deals in Africa: Country Report—Zambia'. Oakland, CA: Oakland Institute. Available at: www.oaklandinstitute.org/sites/oaklandinstitute.org/files/OI_country_report_zambia.pdf (accessed April 2016).

Public Citizen. (2012). 'Case Studies: Investor–State Attacks on Public Interest Policies'. Washington, DC: Public Citizen. Available at: Public Citizen: www.citizen.org/documents/egregious-investor-state-attacks-case-studies.pdf (accessed October 2016).

Renewable Energy for the 21st century (REN21). (2015). *Renewables 2015: Global Status Report*. Paris: REN21. Available at: www.ren21.net/wp-content/uploads/2015/07/GSR2015_KeyFindings_lowres.pdf (accessed February 2016).

Schoneveld, G.C., L.A. German, and E. Nutakor (2011). 'Land-based Investments for Rural Development? A Grounded Analysis of the Local Impacts of Biofuel Feedstock Plantations in Ghana'. *Ecology and Society*, 16(4): 10. Available at: www.ecologyandsociety.org/vol16/iss4/art10 (accessed April 2016).

Sipangule, K., and J. Lay (2015). *The Impact of Foreign Large-Scale Land Acquisitions on Smallholder Productivity in Zambia*. Dakar-Almadies: African Growth and Development Policy Modelling

Consortium. Available at: www.agrodep.org/sites/default/files/AGRODEPWP0011_1_0.pdf (accessed April 2016).

Sitko, N., J. Chamberlain, and M. Hichaambwa (2015). *The Geography of Customary Land in Zambia: Is Development Strategy Engaging With the Facts?* Lusaka: Indaba Agricultural Policy Research Institute.

Stone, A., G. Henley, and T. Maseela (2015). *Modelling Growth Scenarios for Biofuels in South Africa's Transport Sector*. Helsinki: UNU-WIDER. Available at: www.wider.unu.edu/sites/default/files/wp2015-148.pdf (accessed January 2016).

Tagliarino, N. (2014). 'Zambia: Conversions of Customary Land to Leasehold'. Focus on Land in Africa Brief. Available at: https://agriknowledge.org/downloads/xk81jk45p (accessed October 2016).

van der Werf. (2015). 'Large-Scale Foreign Land Investments in Africa with Particular Attention to the Case of Zambia'. MA thesis, University of the Witwatersrand.

Vermeulen, S., and L. Cotula (2010). 'Over the Heads of Local People: Consultation, Consent, and Recompense in Large-scale Land Deals for Biofuels Projects in Africa'. *The Journal of Peasant Studies*, 37(4): DOI: http://dx.doi.org/10.1080/03066150.2010.512463.

von Braun, J., and R. Meinzen-Dick (2009). '"Land Grabbing" by Foreign Investors in Developing Countries: Risks and Opportunities'. IFPRI Policy Brief 13. Washington, DC: International Food Policy Research Institute. Available at: http://ebrary.ifpri.org/cdm/ref/collection/p15738coll2/id/14853#img_view_container (accessed April 2016).

Wenberg, E. (2013). 'South Africa Looks to Develop Domestic Biofuels Production'. Global Agriculture Information Network Report. Pretoria: Global Agriculture Information Network. Available at: http://gain.fas.usda.gov/Recent%20GAIN%20Publications/South%20Africa%20Looks%20to%20Develop%20Domestic%20Biofuels%20Production_Pretoria_South%20Africa%20-%20Republic%20of_10-23-2013.pdf (accessed February 2016).

Williams, T.O., B. Gyampoh, F. Kizito, and R. Namara (2012). 'Water Implications of Large-Scale Land Acquisitions in Ghana'. Water Alternatives. Available at: www.water-alternatives.org (accessed February 2016).

Zambia Development Agency (ZDA). (2014). 'Agricultural Sector Leaflet'. Lusaka: Zambia Development Agency. Available at: www.zda.org.zm/?q=download/file/fid/51 (accessed April 2016).