



Competitive or complementary? Industrial crops and food security in sub-Saharan Africa

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Key messages

- Growing industrial crops arouses fears of less food and nutrition security for those engaged in their farming and processing.
- Such fears may be exaggerated. Growing industrial crops is often likely to improve food security, owing to higher incomes and complementarities between industrial and food crops.
- Several qualifications apply however. When farmers lack land, labour and capital, it will take more than a change of crop to alleviate their poverty. Farmers need to get a reasonable price for their produce. They have to be able to mitigate price fluctuations. Women face particular disadvantages as farmers, processors and marketers of industrial crops.
- Most evidence concerns smallholders, not plantations and estates where more serious concerns over land and labour may apply.

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Table of contents

| | |
|---|-----------|
| 1 Summary | 1 |
| 1.1 Background | 1 |
| 1.2 Question and approach | 1 |
| 1.3 Stakeholder perceptions of industrial crops | 2 |
| 1.4 Policies for industrial crops | 3 |
| 1.5 Impacts of industrial crops on food and nutrition security | 3 |
| 2 Introduction | 5 |
| 2.1 Background: previous and current interests in industrial crops | 5 |
| 2.2 Industrial crops in Africa | 6 |
| 2.3 Relating industrial crops to food and nutrition security | 8 |
| 3 Questions and methods | 10 |
| 3.1 Literature review | 10 |
| 3.2 Stakeholder views | 11 |
| 3.3 Policies for industrial crops | 11 |
| 4 Stakeholder perceptions of industrial crops | 13 |
| 5 Policies for industrial crops in four countries of sub-Saharan Africa | 17 |
| 5.1 Policies on investment | 17 |
| 5.2 Policies, laws, regulations and practice | 17 |
| 5.3 Crop-specific policies and their implications for food security | 19 |
| 5.4 Discussion | 20 |
| 6 Reported impacts of industrial crops on food and nutrition security | 21 |
| 6.1 Availability of food | 21 |
| 6.2 Access to food | 23 |
| 6.3 Stability of food access | 24 |
| 6.4 Utilisation of food | 25 |
| 6.5 Direct observations of FNS | 26 |
| 6.6 Other significant changes | 27 |
| 7 Conclusions | 29 |
| References | 32 |
| Figures | |
| Figure 1: Area of industrial crops harvested worldwide, 2013 | 7 |
| Figure 2: Area of industrial crops harvested in Africa, 2011-13 | 7 |
| Tables | |
| Table 1: Recording of observations seen in existing studies | 10 |
| Table 2: Stakeholders' views on benefits and concerns associated with industrial crop expansion | 16 |
| Table 3: Crops for which specific legislation exists | 19 |

1 Summary

1.1 Background

Using arable land to grow crops that do not contribute to food supplies has long prompted concern. In the 1980s it was feared that growing cash crops in Africa would displace food production. Reliance on the market would leave farmers exposed to market risks and dependent on supply chains dominated by powerful firms, and would encourage mono-cropping and over-use of fertilisers and chemicals. These concerns have resurfaced since the mid-2000s owing to higher agricultural prices on world markets and a boom in biofuels that has led to an explosion of planned investments for large-scale production of food and biofuel feedstock in sub-Saharan Africa.

These concerns are strongest for *industrial crops*, defined as those not grown for food and whose production potentially competes with food crops for land, water, labour and capital. A wider definition might also include crops that undergo considerable processing even if the end product is a food; included since the end product may not be readily available locally, or may be a specialised food that cannot contribute substantially to local diets even if locally available, such as cocoa. The main crops that fall under this broad definition are: sugar crops such as cane, beets and sweet sorghum; fibres, including cotton, sisal, flax, jute, manila and coir; rubber; oil crops produced in large part for industrial processing such as palm oil, castor and jatropha; tobacco; beverages of cocoa, coffee, tea and mate; and others such as pyrethrum and shea butter (karité).

Worldwide, 119 million hectares¹ (ha) are planted to industrial crops, broadly defined; less than one tenth of the more than 1,900 million ha under crops in 2013. Within industrial crops, just a few dominate. Cotton, sugar cane, oil palm, rubber, cocoa and coffee make up 108 out of the 119 million ha planted to industrial crops. For Africa, just 21 million ha were planted to industrial crops in 2011–13 out of 347 million ha under crops. Again, a few crops dominate: almost 19 of the 21 million ha were planted to cocoa, coffee, oil palm, cotton and sugar cane.

Areas planted to industrial crops have not been growing rapidly either. Between 1961–63 and 2011–13 the area cultivated in Africa increased by more than 3.8 times: the area to industrial crops rose by just 43% over the same period. This is not to imply that industrial crops are insignificant. Locally, they may occupy much of the land. But it does help set some recent concerns in proportion. The farmlands of Africa are not undergoing mass conversion from food to industrial crops, nor in the rest of the world either.

1.2 Question and approach

The central question this study addresses is *‘what is the impact of industrial crop production on food and nutrition security?’* Four pathways potentially link industrial crops to food and nutrition security, the paths derived from the four dimensions of food security of availability, access, utilisation of food and stability, as follows:

Food availability: growing industrial crops may reduce the area planted to food crops and the labour and capital applied, and hence reduce production. Industrial tree crops may also compete for nutrients in the root zone with food crops in adjacent fields or shade those crops.

There can, however, be complementarities as when fertiliser applied to an industrial crop in rotation provides some residual nutrients to subsequent food crops. In addition, when industrial crops are grown at scale, then systems, both public and private, to supply farm inputs and to buy crops may develop that also benefit food crops. Technologies and know-how for industrial crops may spill over to improve food crop yields. Processors of

¹ Not including biofuel feedstock from relatively minor crops such as jatropha and sweet sorghum. Only very small areas are planted to these.

industrial crops may build or help maintain rural roads to ensure supplies, roads that equally benefit food crop farmers.

Food access: incomes from growing industrial crops can allow households to buy in more food, and more diverse food. Jobs created on estates or in processing plants similarly generate incomes (and stable incomes); as too do additional activities in the local economy that serve the industrial crops sector, or respond to demand from farmers and labourers spending extra income locally.

When land has been acquired from farmers to form estates, the compensation paid may improve access to food directly, or indirectly – as when compensation allows the farmers to invest on any remaining land or to open a non-farm business. Conversely, where land is transferred and compensation is not paid or is inadequate, this can lead to a reduction in households' disposable income, reducing spending on food. Women may be particularly affected if either their claims to land or their reliance on the commons (rangelands and forests) are not recognised.

Utilisation of food: industrial crops may create jobs for women on fields or in processing plants. While welcome for income, they may however deprive women of time, leaving them less time to prepare food for infants and to care for them, worsening nutrition.

Growing industrial crops may expose field workers to new health risks, for example from handling crop chemicals, or from disease vectors in irrigation canals. Increased illness is likely to impair nutrition.

Stability and reliability: industrial crops may expose growers to new risks, either from weather, pests and diseases that may lead to variable harvests, or from volatile prices in the market. In both cases incomes would become more variable, with the risk of food insecurity when incomes fall. On the other hand, industrial crops may also raise farmers' disposable incomes allowing consumption at traditionally lean times of the year.

Two ancillary questions were also asked. One concerned the perspectives on industrial crops held by different actors. The other was to see what policies selected countries in Africa have for the development of industrial crops.

To answer these three questions, the literature was reviewed; open interviews were carried out with stakeholders from industry, non-governmental organisations and roundtables interested in industrial crops; and policies governing industrial crops in Ghana, Malawi, Mozambique and Swaziland were reviewed.

1.3 Stakeholder perceptions of industrial crops

Stakeholders recognise that engaging with industrial crop markets can benefit farmers, because improving access to markets raises their earnings and improves welfare. Many rural areas chronically lack investment, so the additional capital that industrial crops introduce often has important benefits, both to physical infrastructure and human capital. Industrial crop production is often able to extract more value from land than existing land uses, which can increase earnings and overcome credit constraints.

That said, several concerns were voiced, above all when industrial crops are grown on estates and plantations. On existing estates, labour conditions often fall short of decent work standards, with precarious employment, low pay and poor conditions, and sometimes with employee association discouraged. On outgrower schemes concerns arise over producers having to sell to a single buyer at a disadvantage.

Some of the most serious concerns arise in the establishment of new estates, where land acquisition may lead to the dispossession of vulnerable users, to the appropriation of water, and to loss of forest cleared to make way for crops. Costs are most likely to fall on poor and vulnerable people whose livelihoods depend on forest, land and water.

A broader concern of industrial crop expansion concerns the increasing influence of investors in industrial crops over agricultural policy priorities. Better organised and resourced, industrial crop producers and processors may be more able to secure changes in fiscal policies and public spending plans in their favour.

Most concerns arise from large-scale production of industrial crops. Although data to confirm the areas under production of different scales are not readily available, it is far from clear that most production takes place on estates and plantations. Indeed, some of the literature suggests that historically large-scale production has been

comparatively rare, although sugar cane may be an exception. The bulk of academic research on industrial crops deals with smallholders, not estates.

1.4 Policies for industrial crops

Policies in the four countries aim to balance openness to investment in industrial crops and a light-touch to regulation with the need to safeguard access to land and water for existing and future citizens, provide for decent treatment of labour and to protect the environment. This is easier said than done, for two reasons.

First, producing a legal framework that reflects policy aims, and has feasible measures to implement it, is no simple matter. In some cases, laws have been revised several times within living memory thereby creating some ambiguity among both government officers and citizens who may not realise that previous legislation has been superseded. In other cases, it is not clear that a comprehensive regime exists – that is, a national policy supported by formal laws and regulations, with a clearly designated, legally empowered and resourced agency to implement policy. To align all elements is not necessarily straightforward: in practice gaps are frequent, especially when it comes to legislation that is desirable but is not backed by the authority and resources to implement it. Moreover, overlaps may arise where different agencies apparently have competences over the same or similar matters.

Second, it is one thing to legislate; another to implement, especially when dealing with agricultural investments spread over large areas, sometimes in remote places.

For both reasons, some of the legislation reflects good intentions that cannot be applied, especially for environmental laws. Where, however, the laws deal with strongly felt matters, such as land, then interpretation of the law may be contested. Land regulations can be ambiguous when current users have acquired informal rights that are seen, at least locally, as legitimate. In such cases, investors looking for lands find themselves dealing with agencies implementing national laws, customary authorities entrusted with local lands, local communities and existing land users — all of whom may have differing interpretations of land rights.

1.5 Impacts of industrial crops on food and nutrition security

Most studies address effects on local *food availability*. Contrary to fears that devoting land and labour to industrial crops would mean less production of food crops, reports often indicate that food production has been sustained even as industrial crop output has risen. That counter-intuitive result stems from situations where land has been sufficient to accommodate industrial crops with no loss of land to food crops, or where it has been possible to intensify food crop production at the same time as planting industrial crops. In some cases both of these processes have been assisted by complementarities in the production of industrial and food crops. For example, input delivery and marketing systems for industrial crops have benefitted production of food crops, earnings from industrial crops have financed inputs and labour to grow food, skills learned in cultivating industrial crops have transferred to food plots, and roads and other infrastructure for industrial crops have served food crops equally well.

Two qualifications apply to the reassuring finding that farmers maintain food production while they grow more industrial crops. One, in some cases, smallholders willingly give up production of food crops because the returns to industrial crops are high. Reports of gross margins are infrequent, but those seen often show very large differences between industrial and food crops: for example, tobacco in Malawi in the 1990s generated returns per hectare ten times as large as hybrid maize.

Two, in most of the cases where food crop production has fallen on account of industrial crops, an estate has taken over fields previously farmed by smallholders for food. Almost all such reports, however, concern the early stages of plantation development, prompting questions about possible compensating changes in the medium term.

Studies that illuminate *access to food* often report higher incomes from industrial crops. Qualifications again apply. Households producing industrial crops may still be on (very) low incomes, although that is often not so much the result of growing a crop that does not yield well per hectare, but more because households lack the land, labour and capital to produce more. Women farmers are often at a disadvantage in access to land and labour, to technical knowledge, and in selling their crops. Again, whether they are worse off than when growing food crops is not clear. From the very few reports of wages on estates, accounts can be found of workers paid so little that

they cannot even feed themselves adequately. Owing to the paucity of studies, however, it is hard to judge whether this is a general outcome, or the result of reports concentrating understandably on cases of public concern.

Studies of access rarely if at all observe the other side of access: the price of food in local markets.

On *stability*, prices of some industrial crops can vary considerably, leaving producers vulnerable when prices fall. In some cases, and particularly when the rural economy is both developed and diversified, smallholders can buffer the impacts by switching their labour to other activities. Tree crops in particular can be semi-abandoned when prices fall, to be revived when prices recover. On the other hand, workers on estates may benefit from stable wages.

The few studies that deal with dimensions of *utilisation* report women producing, processing and marketing industrial crops as being increasingly pressed for time. This might imply that they had less time for child care, but observations are not explicit. A single study did establish, however, that the children of women engaged with rural businesses, some associated with industrial crops, were better nourished than those of comparable women. If any time was lost to child care, the gains in nutrition from higher incomes may have outweighed any such effect.

Direct observations of food security and nutrition of households growing industrial crops rarely show them as having worse outcomes than control groups. Again, however, the few observations of workers on plantations can provide some counter-examples, but the significance of so few observations is not clear.

Overall, it seems that growing industrial crops is often likely to improve food and nutrition security, owing to higher incomes earned and the complementarities that can apply between growing industrial and food crops. The few studies that directly observe outcomes confirm this, while those that report reduced poverty and inequality support it.

That said, many qualifications apply that indicate where policy-makers need to address their efforts. They include:

- When people on low incomes have little land, labour and capital, it will take more than a change of crop to alleviate their poverty.
- Prices of industrial crops matter. Farmers are more likely to get a fair return if supply chains work effectively and they are not unduly taxed on their produce.
- Commodity prices vary. Protecting growers against fluctuations in market prices may be desirable, but it is not always straightforward or economical to do so. An alternative is to assist them to adapt and react to price variations.
- As with agricultural and rural development in general, a priority is to work to correct the disadvantages that women face as farmers, processors and marketers of industrial crops.

Finally, there is nothing much unusual or remarkable about industrial crops and their impacts on food security. The issues they raise over food and nutrition security are similar to those that apply to most forms of agriculture. More needs to be understood, however, about plantations and estates where more serious and specific concerns may apply in some cases.

As ever, gaps exist in the literature. A mismatch seems apparent between public concerns over industrial crops in sub-Saharan Africa that centre around large-scale production, especially when the firm is a foreign investor, and research studies which overwhelmingly report experiences with smallholders. Two other gaps are of particular interest. One concerns systematically comparing the different impacts of large and small-scale production of industrial crops on food security. The other is to establish who benefits from industrial crops grown at different scales. In particular, to what extent are the smallholders growing such crops the better-off smallholders, and to what extent does larger-scale production and processing provide jobs for people who are landless or nearly landless?

2 Introduction

2.1 Background: previous and current interests in industrial crops

Using arable land to grow crops that do not contribute to food supplies has long prompted concern. Soon after the 1984 famine in Ethiopia had drawn attention to food production in Africa, cash crops came under the spotlight, especially those grown for export. Surely, argued the critics, cultivation of cash crops, using land, water, labour, fertiliser and other inputs must detract from food production, thereby undermining food security. That led to lively debate about the merits of food and cash crops in Africa. Summarising a review of the evidence, however, Maxwell and Fernando (1989) reported that, contrary to some expectations, cash and food crop production tended to correlate both at national and household levels, and that complementarities in their production could potentially more than offset any competition for resources.

Sceptics were not just concerned about cash crops displacing food production. They feared that specialising in cash crops would expose farmers to risks from volatile market prices. Smallholders might come to depend on commodity chains and large firms with market power would use this to reduce prices paid or to increase the cost of inputs. Cash cropping could lead to mono-cropping and overuse of fertilisers and chemicals, thereby mining soils, increasing the risk of pests and diseases, and polluting soils and water.

Of these potential drawbacks, declining food security and deteriorating nutrition caught the most attention. Consequently in the late 1980s and early 1990s, International Food Policy Research Institute (IFPRI) researchers carried out one of the most thorough investigations of the relation between growing crops for cash and nutrition. Primary research in Gambia, Guatemala, Kenya, the Philippines and Rwanda was complemented by reviews from India, Malawi, Papua New Guinea, Sierra Leone and Zambia. They found that growing commercial crops led to increased production of staples, either because additional land was brought into cultivation, or yields of food crops rose (von Braun, 1995). Incomes increased both for those farmers growing commercial crops, as well as for others in the local economy since the demand for hired labour rose. In almost all cases higher income was associated with improved child nutrition, although the relation was quite weak. Except for Sierra Leone, little evidence was seen of nutrition deteriorating under commercialisation.

A more qualified judgment came from DeWalt (1993), who reviewed these cases and others. She stressed the importance of the prices paid for cash crops since these were critical to higher earnings. Where subsistence food production was protected or maintained, nutrition outcomes were better. Most important for DeWalt, the link from income to nutrition depended on how much control mothers had over increased incomes, and whether growing commercial crops reduced the time they had to care for their children.

Interest in this debate declined in the 1990s, but returned after the mid-2000s, stimulated by two related developments: rising interest in biofuels and the 2007-08 food price spike.

A combination of rising oil prices from the early 2000s onwards and policies (mainly in the European Union and the US) to replace fossil fuels with renewable fuels prompted a rapid expansion of biofuel production. In the US, ethanol production grew from 6.1 billion litres in 2000 to 49.5 billion litres in 2010, while US biodiesel output rose from almost nothing to 2.1 billion litres between 2000 and 2010. In the EU, the equivalent increases were ethanol from 1.5 to 6.4 billion litres, and biodiesel from 0.8 to 10.3 billion litres. Large increases in ethanol production were also registered in Brazil from 2000 to 2010 (Langeveld et al., 2014).

Although all three of these producers mainly produce biofuel from their own agriculture, there is considerable scope to import biofuels from the developing world, where biofuel yields per hectare are often higher. As the EU

in particular brought in its mandates for renewable liquid fuels, so interest mounted in cultivating apparently underused lands in Africa to produce biofuels both for local consumption and export to the EU market.

In 2007-08 the prices of cereals spiked on world markets, with increases of between two and three times seen in less than a year – the largest such shock seen since 1973-74. Prices of other agricultural commodities also rose. This led to an almost unprecedented interest in investing in production of biofuels, staple foods and other agricultural commodities in Africa and other parts of the world where land was abundant. Those interested were large private firms from high-income countries, state-owned corporations from the Middle East and Asia, and domestic investors, both local firms and individuals. In many cases the plans were to acquire land for large-scale production – seen as ‘land grabbing’ by some (von Braun and Meinzen-Dick, 2009, Deininger and Byerlee, 2011). Not only did this prompt much concern over land being expropriated from smallholders, but also when non-food crops were planned — as in the case of some biofuel feedstock, jatropha being the most frequent example — old concerns that this would endanger food security once again came to the fore. So too did concerns over potential poor treatment of farm labour and of environmental damage from converting forest, bush and grasslands to cultivated land.

This research stems from the recent revival interest in this topic. Specifically, the interest here is the impact of growing industrial crops in sub-Saharan Africa on food and nutrition security.

2.2 Industrial crops in Africa

Industrial crops may be defined as those which are not grown for food and whose production potentially competes with food crops for land, water, labour and capital. A wider definition might also include crops that undergo considerable processing, even if the end product is a food. These are included since the end product may not be readily available in local food systems, or may be a specialised food that cannot be seen as contributing substantially to local diets even if locally available, such as cocoa.

The main crops that fall under this broad definition are:

- sugar crops such as sugar cane, sugar beets and sweet sorghum
- fibrous crops, including: cotton, sisal, flax, jute, manila and coir
- rubber
- oils crops produced in large part for industrial processing such as palm oil, castor and jatropha
- tobacco
- beverages: cocoa, coffee, tea and mate
- others such as pyrethrum and shea butter (karite).

Crops such as sugarcane and oil palm play a major role in the food industry globally as they are inputs to the production of a large variety of processed foods. Sugarcane has also been included on the grounds that most cane is industrially processed, and when the end product is refined sugar this is hardly a satisfactory substitute for other foods in diets beyond a small quantity.

Crops such as castor, jatropha, oil palm, sugarcane and other sugar crops can be processed to produce liquid fuels of ethanol, biodiesel and straight vegetable oil.

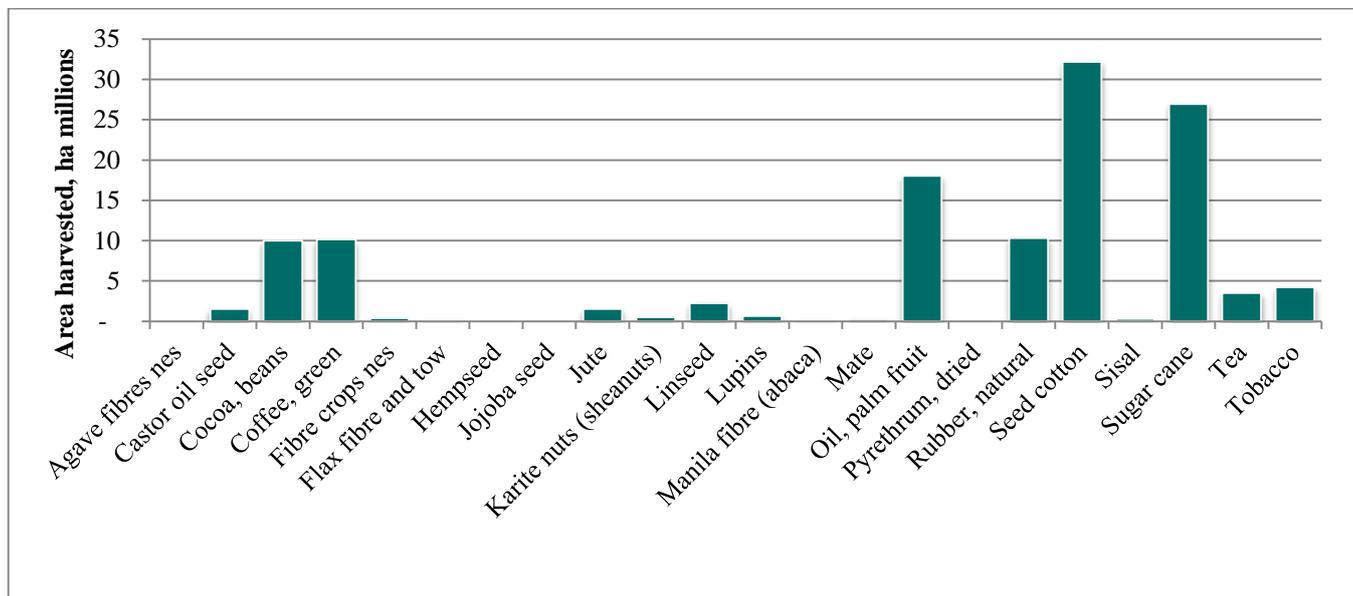
Industrial crops may be grown by small-scale family farms, or at larger scale on estates and plantations. For some crops a processing plant needs to be readily accessible, some of which benefit from economies of scale – such as sugar mills – so that even if the crop is produced on a small-scale the processing may be done by a much larger concern, be it a private firm, parastatal or co-operative.

Worldwide, 119 million hectares (ha) are planted to industrial crops, broadly defined.² That is a small share (less than one-tenth) of the more than 1,900 million ha under crops in 2013. Moreover, within the category of industrial

² This figure does not include biofuel feedstock from relatively minor crops such as jatropha and sweet sorghum. The areas planted to these, however, would be very small.

crops, just a few dominate (see Figure 1). Cotton, sugar cane, oil palm, rubber, cocoa and coffee make up 108 out of the 119 million ha planted to industrial crops.

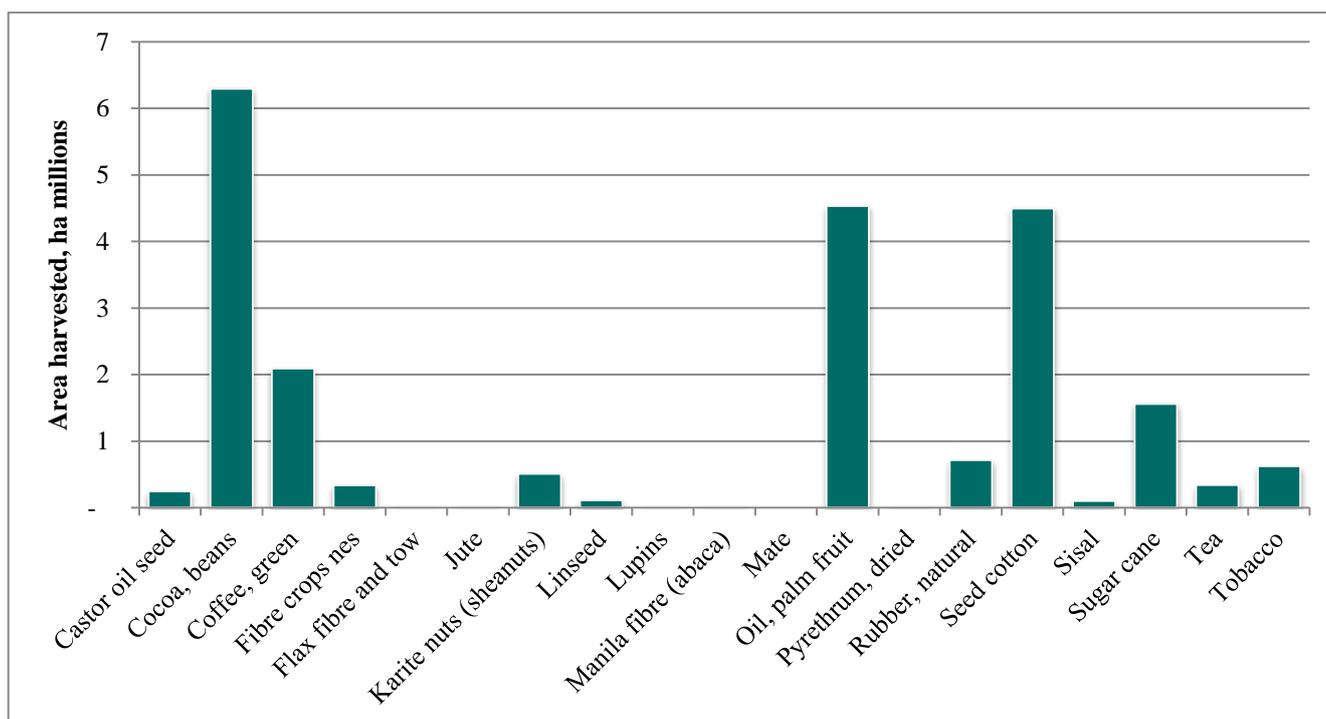
Figure 1: Area of industrial crops harvested worldwide, 2013



Source: FAOSTAT

For Africa, just 21 million ha were planted to industrial crops in 2011-13 out of 347 million ha under crops. Again, a few crops dominate (see Figure 2). Almost 19 of the 21 million ha were planted to cocoa, coffee, oil palm, cotton and sugar cane.

Figure 2: Area of industrial crops harvested in Africa, 2011-13



Source: FAOSTAT

Industrial crops are thus not a major category of crop: not compared, for example, to cereals, pulses, oil crops and roots and tubers. Perhaps somewhat surprisingly, the area planted to them has not been growing rapidly either. Between 1961-63 and 2011-13 the area cultivated in Africa increased by more than 3.8 times: the area to industrial crops rose by just 43% over the same period.

This is not to imply that industrial crops are insignificant. Locally, they may occupy much of the land. But it does help set some recent concerns in proportion. Neither the farmlands of the world nor of Africa are undergoing mass conversion from food to industrial crops.

It is too early to say if the recent rush to acquire land will substantially alter this picture. While research suggests that some countries such as Liberia and Sierra Leone have effectively signed away large areas mainly for industrial crops, and most of this land is subject to competing claims (Nolte, 2014; Schoneveld, 2014), whether or not these deals will end up breaking ground and permanently replacing existing crop cover is unclear. Recent analysis of land deals since the mid-2000s suggests that only around half of formally concluded projects are operating, and the land they operate on accounts for only 11% of the total area under contract (Locke and Henley, 2015).

2.3 Relating industrial crops to food and nutrition security

One of the most common definitions of food security is that adopted by the World Food Summit of 1996: ‘Food security exists when all people at all times have physical and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life’ (FAO, 2008). From this definition four dimensions of food security can be drawn out. People will be food secure when:

- sufficient food is available
- people have access to it (largely a matter of incomes and food prices)
- food is well utilised (largely a matter of people being in good health to make use of nutrients), and
- availability and access to food are stable and reliable.

Nutrition is the outcome of diet and health, in turn depending on intake of food, health services and sanitary environment, and for children, the way they are fed. Behind these lie the political, economic and social reasons that govern how food and public services are produced and provided and how they are distributed. Nutrition thus results from multiple factors (Pelletier, 2002).

Following the dimensions of food security outlined, industrial crops can affect food and nutrition security through the following paths:

Food availability: growing industrial crops may reduce the area planted to food crops and the labour and capital applied, and hence reduce production. Industrial tree crops may also compete for nutrients in the root zone with food crops in adjacent fields, or shade those crops. There can, however, be complementarities, as when fertiliser applied to an industrial crop in rotation provides some residual nutrients to subsequent food crops.

In addition, when industrial crops are grown at scale, public and private systems to supply farm inputs and to buy crops may develop that can also apply to food crops. Technologies and know-how for industrial crops may spill over to improve food crop yields. Processors of industrial crops may build or help maintain rural roads to ensure supplies, roads that equally benefit food crop farmers.

Food access: incomes from growing industrial crops can allow households to buy in more food, and more diverse food. Jobs created on estates or in processing plants similarly generate incomes (and stable ones), as too do additional activities in the local economy that serve the industrial crops sector or respond to demand from farmers and labourers spending extra income locally.

When land has been acquired from farmers to form estates, the compensation paid may improve access to food directly – or indirectly, as when compensation allows the farmers to invest on any remaining land or to open a non-farm business. Conversely, where land is transferred and compensation is not paid or is inadequate, this can lead to a reduction in households’ disposable income, reducing spending on food. Women may be particularly affected if either their claims to land or the extent of their reliance on the commons (rangelands and forests) are not recognised.

Utilisation of food: industrial crop production can affect this largely through its effects on women. Jobs may be created for women on fields or in processing plants. Growing industrial crops may change women's access to land, their incomes from farming, and their social status. These in turn have two potential effects on nutrition. One, when women have control over more income, it is likely that they will spend on food for their children, improving nutrition. Two, jobs may deprive women of time, leaving them less time to prepare food for infants and to care for them, worsening nutrition.

It is also possible that growing industrial crops may expose field workers to new health risks, for example from handling crop chemicals, or from disease vectors in irrigation canals. Increased illness is likely to impair nutrition.

Stability and reliability: industrial crops may expose growers to new risks, either from weather, pests and diseases that may lead to variable harvests, or from volatile prices in the market. In both cases incomes would become more variable, with the risk of food insecurity when incomes fall. On the other hand, industrial crops may also generate revenues and raise farmers' disposable incomes, allowing consumption at traditionally lean times of the year.

Evidence on these four paths will be reviewed. Industrial crops are the focus here, although the way in which they are produced is often the motivation for their study. Differences in scale of production have implications for the paths set out. When smallholders grow industrial crops, incomes become critical to their access to food: incomes that depend on production and prices in markets, both subject to some risks. When crops are grown on estates, workers derive their food from wages that may or may not reflect the value of production, but which may be less affected by risks.

Current interests in the development of industrial crops in Africa are of general interest to development policy and practice. They are also the subject of a research project, 'Food security impacts of industrial crop expansion in Sub-Saharan Africa', (FICESSA) that began in 2015 and runs until 2017. This aims to examine the food security outcomes of industrial crop expansion in sub-Saharan Africa. The research brings together scholars from the Universities of Oxford, Tokyo, and the United Nations; the Council for Scientific and Industrial Research (CSIR) South Africa; the Royal Botanical Gardens at Kew; and the Overseas Development Institute, London. The programme will collect evidence of local food security outcomes and institutional settings related to industrial crops in Ghana and Sierra Leone in West Africa, and from Malawi, Mozambique and Swaziland in Southern Africa.

This report is both a contribution to general understanding as well as an initial FICESSA study.

3 Questions and methods

The central question this study addresses is ‘what is the impact of industrial crop production on food and nutrition security?’ Detailed questions can be derived from the paths set out in the previous section by looking at the impact of industrial crops on food availability, access, utilisation and stability.

Two ancillary questions were also asked. One concerned the perspectives on industrial crops held by different actors. The other was to see what policies selected countries in Africa have for the development of industrial crops.

Three exercises were conducted to answer these questions.

3.1 Literature review

The literature was reviewed to identify studies of the effects of industrial crops. The ScienceDirect database was used to identify articles, searching the title, abstracts and keywords for studies that mentioned key industrial crops (cocoa, cotton, coffee, oil palm, rubber, sugar, tea and tobacco) and other key terms (food, employment, jobs, land and income). The literature was searched back to 1985. The initial search generated more than 600 publications. On inspection of abstracts, just over 100 of these proved to have evidence of the impact of industrial crops on food security outcomes. Those with the more promising abstracts were read. References to other promising publications not captured by the initial search were also followed up.

The search was not restricted to Africa, although in the selection of studies for detailed consideration, priority was given to studies of industrial crops in Africa. Significant studies from other parts of the world have been included to ensure that understandings from those are not ignored.

Observations from the studies considered were then recorded, with changes organised largely by the four paths set out in the last section (see Table 1 for details). In addition to observations of changes in elements in the four paths, some studies recorded direct observations of food security or nutrition. Many studies also registered impacts on poverty, equality, social relations and the environment. These were also noted.

Table 1: Recording of observations seen in existing studies

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|---|---|
| <p>The following relations and changes were recorded:</p> <p><i>Food Security</i></p> <p>A Availability of food:</p> <p>A1 Area under food crops</p> <p>A2 Labour or capital to food crops</p> <p>A3 Roads, local access</p> <p>A4 Access to inputs</p> <p>A5 Access to buyers</p> <p>A6 Technology</p> | <p>C Utilisation</p> <p>C1 Time for child care, feeding</p> <p>C2 Jobs for women</p> <p>C3 Women’s access to land, income, status</p> <p>D Stability</p> <p>D1 Exposure to risk from weather, pests, diseases</p> <p>D2 Exposure to risk from market</p> <p>D3 Imported food</p> <p>E Direct observations of food and nutrition security</p> |
|---|---|

| | |
|---|---|
| A8 Local food production B Access to food | E1 Food security and hunger, seasonal hunger E2 Nutrition |
| B1 Incomes from industrial crops (SF, outgrowers) | Other significant changes |
| B2 Jobs on estates, processing plant, linked local activity | O1 Environment: land cover, soil quality, water quality, water resources, biodiversity, other |
| B3 Compensation for land | O2 Social relations, political power |
| | O3 Income equality, poverty |

Although the classification used has 22 categories of observations, most studies focused on no more than three or four of these. The resulting matrix of observations includes many blank cells. As will be seen, some categories were rarely observed at all.

3.2 Stakeholder views

To gauge the issues that most concern investors in industrial crops and those concerned by their activities, a range of stakeholders were interviewed to elicit their views on the socio-economic and environmental impacts of industrial crops in the developing world. They were asked open-ended questions, as follows:

What concerns and opportunities do you see when industrial crops — that is, not for food — are grown in the developing world? Which do you see the most important?

Can you give examples of where these concerns or opportunities apply most?

If private sector,

- Which of these directly affects your business?
- What precautions do you undertake to avoid socio-economic or environmental harm, or to maximise social benefits?
- Does government policy oblige you to avoid harm or provide social benefits?

If public sector,

- What should be done to avoid socio-economic or environmental harm, or to maximise social benefits?
- What should governments, donors, international organisations do?

Interviews were carried out over the telephone, and in one case in person, with representatives from: an international agricultural corporation involved in crop production, processing and marketing; an international non-governmental organisation that runs development programmes and advocates for better policy; two crop roundtables that provide a forum for those concerned with the crop and which encourage high standards; and a think tank concerned with agriculture and food.

3.3 Policies for industrial crops

To better understand the policy context in four of the FICESSA study countries, short papers were commissioned from informed local observers on policy and practice for industrial crop investments in Ghana, Malawi, Mozambique and Swaziland. The papers addressed the following questions

What laws, regulations and policies apply to investors who want to develop industrial crops?

What assessments are investors, or public agencies that supervise them, obliged to carry out?

What provisions, if any, govern the following issues?

-
- Acquisition of land and water
 - Hiring and treatment of labour on fields or in processing plants (and are there specific provisions for women and children?)
 - Management of land and water, prevention of pollution, safe use of chemicals
 - Maintenance of food production in the district where the industrial crops are grown
 - Contracting of outgrowers.

Which agencies are expected to supervise these regulations? Is there a single agency that deals with all or most of these issues, or are responsibilities spread across agencies? How are industrial crop developments supervised?

They were also asked to comment on the application of the laws, regulations and policies.

4 Stakeholder perceptions of industrial crops

The stakeholders interviewed presented a range of perceptions on the benefits and harm associated with industrial crops, and the relative importance of different impact pathways. Given the small sample no attempt was made to analyse views by type of stakeholder. Instead, the views expressed have been combined and sorted by concern. Their views, summarised in Table 2, were as follows.

Benefits of industrial crop expansion

Stakeholders recognise that engaging with industrial crop markets can benefit farmers because improving access to markets raises their earnings and improves welfare. Many rural areas chronically lack investment, so the additional capital that industrial crops introduce often has important benefits, both to physical infrastructure and human capital. Industrial crop production is often able to extract more value from land than existing land uses, which can increase earnings and overcome credit constraints.

Concerns about industrial crop expansion

Much industrial crop production occurs on large-scale estates, and conditions on existing estates as well as the impacts of establishing new estates raise various problems.

Existing estates: labour issues

On existing estates, labour conditions often fall short of decent work standards. Much labour is short-term and these workers do not receive benefits available to full employees. In many cases, those formally employed are from other parts of the country and not from surrounding communities – communities whose benefits from the estate's presence are therefore limited. It is common for pay to be below a 'living wage': workers do not earn enough to afford food and basic needs for their households. Women workers are often paid less and also face sexual harassment from other employees.

A major obstacle to improving wages and working conditions is poor representation of employees' interests in unions or workers' associations. This stems partly from poor representation by existing unions and organisations who fail to secure better conditions, either on purpose or due to incompetence. But in other cases union members face discrimination from employers, while non-unionised workers are threatened with sanctions if they join.

Certification schemes are promoted by some as a means of improving labour conditions, because they require employers to demonstrate that conditions comply with national laws or higher standards. To gain and retain certification accreditation, employers improve conditions for workers, bringing them into line with national standards; sometimes they go further by building community infrastructure, subsidising food and providing health and education facilities. Some stakeholders recognise the good intentions behind these efforts, but argue that only a relatively small amount of estate production is certified, and poor work conditions continue to exist in spite of certification.

Existing outgrower schemes: contracts and payment terms

Outgrower schemes are often promoted as an alternative to estate production because when farmers retain land rights and control over production decisions, they have more agency to improve their livelihoods. However, whether outgrowers are in a stronger position than estate employees depends on the nature of their relationship with buyers. In cases of palm oil outgrower schemes, where most outgrowers can sell only to a single buyer who

they depend on for inputs and non-farm items, their financial situation is often precarious as their earnings may only just exceed spending, and in some years may fall short, leading them into debt.

Expanding estates: concerns around land, water and environment

Stakeholders express concern over processes of establishing industrial crops, especially in the formation of large estates. Land acquisition processes often bear huge risks for local communities if land they rely on is transferred without their consent and they face shocks to their livelihoods as a result. Principles of Free Prior and Informed Consent – where communities have an ultimate say over conditions associated with land transfers – are rarely followed by investors, who engage only with representatives from government or traditional authorities. Often land is acquired by investors who do not question if the government officials or traditional leaders they consult and negotiate land deals with are appropriate representatives of communities. Nor do they establish if their activities will cause shocks to the livelihoods of affected communities or seek to mitigate these.

While the conversion of farmland has most obvious impacts on livelihoods, in many cases forests are frequently important sources of food and materials for communities; when they are converted to industrial crops households have to buy these goods instead, which they may not be able to afford to do.

Water

During establishment, some industrial crops (especially oil palm) are also associated with creating local water shortages. In extreme cases, estates may divert rivers to their areas; more commonly there are concerns of over-extraction of water by industrial crop growers (estates and outgrowers) leading to shortages for other users, which affects their agricultural and household use.

Forest loss

Deforestation and loss of natural habitat more generally are areas of concern as there is little scope to expand industrial crops without forest loss. Large-scale expansion of oil palm in Southeast Asia is major driver of high-carbon forest loss, and there are fears this process could be replicated in tropical Africa. There are also concerns that some certification-based efforts to prevent deforestation are not robust.

Incomes and poverty

The major concern of industrial crop expansion is that local communities who lose land and are not compensated with other land, jobs or alternative livelihoods experience net losses to their welfare. These include worsened food security – less food availability, lower disposable incomes, worse stability and nutrition – as well as worsened access to health care and education.

These losses are not acknowledged partly because the frameworks governments use to assess benefits and losses do not consider the value of the resources that households rely on.

Distorting agricultural policy

A broader concern of industrial crop expansion concerns the increasing influence of industrial crop investors over agricultural policy priorities. Well organised and well resourced, industrial crop producers and processors may be more able to secure changes in fiscal policies and public spending plans in their favour. For example, they may be able to secure tax breaks or secure subsidies that reduce their overall tax burden. Alternatively, they may convince governments to increase spending on infrastructure in those regions where they operate, reducing their costs. Other groups – smaller-scale farmers living nearby and elsewhere – miss out on these benefits. There are concerns that these reconfigured patterns of spending are not effective for overall development and poverty reduction.

While stakeholders acknowledge the benefits of industrial crops, a wider range of serious concerns emerges. Most of these concerns refer to cases where large-scale cultivation takes place on estates and plantations. It is far from clear, despite what some stakeholders say, that the majority of industrial crops come from such large-scale holdings. Data on areas to industrial crops broken down into scale of production are not readily available to test this proposition.

Two things are clear, however. First, there is a longstanding literature that explains why estates and plantations have been the exceptions for most industrial crops (Byerlee, 2014; Hayami, 1996, 2000; Overseas Development Institute, 1989; Smalley, 2013). Generally, large-scale production has only been established in cases where virgin land has been converted to crops, with only a sparse local population and few if any established farmers, and where it has been necessary to invest considerably in roads, water sources and processing plant. Exceptions exist – mostly sugar cane estates. For cane, production is often large-scale owing to the need to assure tightly-scheduled deliveries of cane to the mill to keep it operating to capacity while ensuring cane is milled promptly before sucrose content is lost.

The surge of recent large-scale land deals – many in well-populated areas – may challenge this picture, although, as discussed above, failure among these is common. This is in keeping with longer-standing experience which suggests poor performance in plantation agriculture (Tyler and Dixie, 2013). In other circumstances, industrial crops are most commonly grown by smallholders. On occasion, industrial crop production that began on large-scale estates has given way to smallholder production as local populations have built up. Rubber in Southeast Asia is an example.

Second, as will be seen, the great bulk of academic research on industrial crops deals with smallholders, not estates. Formal research assessments of estates are surprisingly uncommon.

Table 2: Stakeholders' views on benefits and concerns associated with industrial crop expansion

| Land and water acquisition | Labour | Incomes and poverty | Environment | Other |
|--|--|--|---|---|
| <p>Land tenure is one of the hardest areas for investors to address – perhaps more so for investors who want to act responsibly.</p> <p>Land acquisition has often taken place with little consultation with local communities, and almost always without a process to gain consent in line with principles of Free Prior and Informed Consent (FPIC).</p> <p>Where existing land claims are not recognised, investors may be acting legally even as communities are dispossessed of their land.</p> <p>Land acquisitions for industrial crops are often accompanied by over-abstraction of water. Rights to water, and resulting compensation for loss, is rarely in place.</p> <p>Investments in industrial crops however may mean land (esp. degraded land) is put to more effective use, and creates extra value that can be shared.</p> | <p>Jobs provided on large cash crop estates are usually fewer than companies suggest, with much seasonal and piecemeal work. These workers do not benefit from labour rights.</p> <p>Jobs on estates are often low-paid, and fail to cover costs of feeding a family.</p> <p>The right to association remains weak in many industrial crop estates, maintaining a situation of low pay.</p> <p>Women face frequent discrimination. They receive systematically lower pay. There are frequent cases of sexual harassment which companies fail to mitigate or prevent.</p> | <p>Households engaging in cash crop production have often prospered.</p> <p>The contents of contracts are very important for contract farming; these are sometimes weak or contain unfair terms.</p> <p>The full economic costs and benefits of replacing food crops with industrial crops are rarely recognised. The economic and nutritional value of mixed cropping to farmers, and the loss of this with monoculture expansion, is not considered.</p> | <p>Industrial crop expansion in the tropics (especially oil palm, livestock, pulp and paper) is a massive driver of deforestation.</p> <p>Some environmental safeguards introduced (e.g. identifying and prioritising high conservation value forests) effectively doom other forests/ecosystems which are cleared instead.</p> | <p>Loss of agency: Industrial crop expansion under palm oil led to communities losing control over their livelihoods. Communities became totally dependent on companies for their earnings and purchases and are unable to take up alternative opportunities.</p> <p>Cash crop growers become more exposed to price change risks.</p> <p>Social relations: Jobs on estates are often given to outsiders rather than local community members, leading to resentment.</p> <p>Policy capture: Industrial crops interests capture agricultural policy. Narratives, regulations and investment shift towards prioritising large industrial crops above smallholders and food crops.</p> |

Source: Stakeholder interviews

5 Policies for industrial crops in four countries of sub-Saharan Africa

This section examines policies and regulations to guide significant investments in industrial crops in Ghana, Malawi, Mozambique and Swaziland. Based on a review of policies in each country, it describes the regulatory environment governing start-up and operations for large projects producing industrial crops.

This regulatory environment is important insofar as it sets out the responsibilities and duties of investors when establishing and running their projects. These have potentially important impacts on the food security of surrounding communities and households who depend on land, may seek jobs on agricultural plantations, or grow and sell produce to estates. Also, as set out in the conceptual framework in Section 1.3, changes to local infrastructure and the economy as a result of the investment may also affect households' access to markets and jobs.

Policy frameworks in each country consist of policies, laws and regulations in four major areas: land, water, labour and the environment. In addition, all countries have policies specific to key crops, which set out the specific policies and governance arrangements, including the role of organisations mandated to oversee the sector.

5.1 Policies on investment

Overarching support for foreign investment is set out in government acts to promote investment and exports, which affirm a country's pro-investment orientation, equal treatment of local and foreign firms and eligibility to invest in all sectors of the economy. For example, Ghana's Investment Centre Promotion Act (2013) seeks to provide an attractive incentive framework and a transparent predictable investment environment. Similarly, Malawi's 2012 Investment and Promotion Act states that neither foreign nor domestic investors will face restrictions related to their size, the source of their funds, or their domestic or international orientation. In some cases, investment policies go further to attract investors by offering investors tax holidays in early years, allowing considerable repatriation of profits. For example, Mozambique's 2009 Code for Fiscal Benefits provides investors with exemptions on VAT and customs duties for imports, and provides for reduced rates of corporation tax for up to 15 years. Many of these policies are relatively recent and are in contrast to previous decades' policies that restricted involvement in certain sectors to public agencies or domestic firms.

5.2 Policies, laws, regulations and practice

5.2.1 Land

Each country has laws governing how investors can acquire land. In general, these set out channels that investors can use to acquire long-term leasehold rights to land held under different systems of tenure. However, given the limited amount of land that is free from competing claims, opportunities to acquire land may be restricted.

- Foreign investors can currently acquire leases for up to 50 years, but the conditions attached to the land acquisition process are unclear and the policy framework remains in a state of transition. Although Malawi has had a National Land Policy (NLP) in place since 2002, the land laws associated with it have been delayed subject to further consultation. In the absence of a new land law, the existing land law of 1965 remains in force, although some of the recommendations from the NLP are

followed. Up-to-date regulations have yet to be introduced pending the entry into law of the new land law. There is a lack of guidance due to a transition from the (outdated) legal regime which potentially allows for land acquisitions to ignore other land users.

- Mozambique allows foreign investors to acquire a leasehold user right for up to 50 years once it has been confirmed with local authorities and communities that the land is unoccupied. For larger projects that are likely to have environmental, social or economic impacts, an impact assessment is needed and only provisional user right (*direito de uso e aproveitamento dos terrenos* – DUAT), valid for two years with renewal subject to performance against criteria, is granted. Mozambique’s laws are generally seen to be strong, although there are gaps in enforcement, including monitoring of conditions of DUAT fulfilment.
- Land in Swaziland is categorised into private and crown-owned land. Chiefs have the authority to disburse crown-owned land. For private land, the Title Deeds Office is responsible for overseeing and registering land transfers. As land zoning and granting permission to develop both crown-owned and private land is the responsibility of the Land Management Board, it is not always clear which institution makes key decisions on land acquisition and development.
- Much of Ghana’s rural land is held under customary tenure controlled by traditional chiefs. For investors to acquire land, they must both gain consent from these chiefs and follow statutory laws on land zoning and use. In reality, access to much communal land is constrained by conflicting claims over ownership that are costly to resolve. Investors often choose to rely on outgrowers instead of attempting to acquire land for plantations.

Practice suggests that obtaining land is not simple. No country, for example, has an open land market where an investor might readily acquire a sizeable area to farm. Indeed, in land-scarce Malawi it seems that acquiring more than a nucleus estate of, say, 100-500 ha, would be very difficult. Some countries thus explicitly encourage investors to consider contracting smallholders as outgrowers to supply processors. Even when land formally held by the state is leased to investors, difficulties can arise when the land is effectively occupied by informal users. In these four countries as in much of the rest of sub-Saharan Africa, longstanding customary norms for land use arranged locally may conflict with decisions made by government according to national statutes governing land tenure.

5.2.2 Water use

All countries have water policies or laws but these differ in their reach and in their level of implementation. As with other environmental laws (see below) enforcement is under-resourced and usually weak.

- Mozambique’s water policy clarifies that communities have priority withdrawal rights for any local water source for use on farms up to one hectare. Water concessions, granted through the National Water Cadastre, are issued for up to 50 years once fees and taxes have been paid.
- Swaziland’s Water Act of 2003 states that large-scale users must apply for a withdrawal permit and sets out the conditions of water use including the volume and times when water can be withdrawn, requiring the user to keep records of water withdrawals.
- Malawi has a National Water Policy (2002, revised in 2005) which sets out the main aims of water management for the country. To govern large-scale water abstraction the policy recommended setting up a National Water Resources Authority to discharge and control licences but this has not been done yet.
- Ghana has a national water policy (2007) but this makes no mention of water for large-scale land investments.

Monitoring water use by, and applying policy and regulations to, agricultural users dispersed across rural areas is an administrative challenge for which few countries have adequate resources.

5.2.3 Labour

All countries have wide-coverage labour laws, which cover minimum standards of employment, working hours and dismissal, and protect the freedom to associate.

It is unclear, however, how well labour legislation is enforced. For example in Swaziland some companies reportedly dissuade their employees from joining unions.

5.2.4 Environment

All countries have environmental legislation governing uses of forest, soils and water and limiting pollution. Legislation also sets out the situations in which projects are required to undertake environmental impact assessments. They consider impacts on overall resource availability (for water, forests, land) as well as local community dependence on these resources. Environmental impact assessments usually entail detailed consultation with communities.

In most cases environmental impact assessments are required if projects exceed a certain land size, result in the displacement of people, or use substantial amounts of pesticides or fertiliser. For example, projects in Malawi that are larger than 10 hectares, involve resettlement of 20 households, or use more than one tonne of fertiliser per hectare require an environmental impact assessment. Mozambique and Swaziland categorise projects into three size groups, and the projects that fall in the medium or large categories require environmental impact assessments, specialist studies and public consultation.

However, environmental laws are often ignored and assessments are not consistently carried out. For example, some environmental impact assessments in Malawi are carried out at a late stage of project development and involve minimal public participation.

5.3 Crop-specific policies and their implications for food security

Table 3 presents policies for specific industrial crops in the four countries. Some are longstanding: Malawi's Tobacco Act and Swaziland's Sugar Act date back over 40 years. Others, including Mozambique's Tobacco Act and Malawi's Cotton Act, are more recent. The main aims of these policies are to promote growth and stability in the sector by introducing specific governance and regulating production and prices.

For the most part, policies and regulations do not consider food security issues and provide no guidance on how to mitigate conflicts that may arise from industrial crop expansion. The one exception is in Mozambique, where biofuels legislation requires companies growing biofuel feedstock to monitor and maintain food production in the region at a similar level to before the project became operational.

Table 3: Crops for which specific legislation exists

| Country | Crops | Details |
|------------|---------------------------|--|
| Malawi | Tobacco; cotton | The Tobacco Act (1970) has provisions on production, manufacture and marketing of tobacco. The Cotton Act (2014) provides for establishment of a Cotton Council as a licencing body, set to start in 2015, but currently lacks resources. For sugar, the National Export Strategy (2012) set a trade goal for Malawi to become a regular and reliable sugar supplier, encourages diversification into Fair Trade and promotes creating a brand for Malawi sugar. |
| Ghana | Tree crops; cocoa | The Cocoa Development Strategy I (1999) and II seek to increase production by adopting modern production technologies, including fertiliser and disease/ pest control. |
| Mozambique | Cotton; tobacco; biofuels | Cotton. The 1994 Regulation for Cotton Growing (<i>Regulamento para a cultura do Algodão</i> , 91/1994) governs the structure, rules and regulations that apply to operators in the cotton sector regarding <i>inter alia</i> contracts, production plans, and technical norms. Tobacco. The 2011 Regulation on Promotion, Production and Marketing of Tobacco (<i>Regulamento sobre Fomento, Produção e Comercialização do Tabaco</i> , 176/2011). |

The biofuels policy and strategy (Resolution No. 22/2009) states that biofuel crops must be planned according to agro-ecological mapping to avoid displacing basic food crops. It discourages use of staple foods such as cassava and maize as biofuel feedstock.

The Biofuels Sustainability Criteria Framework (2014). Section 5 of the document specifies that investments should not reduce local food security. Operators must provide evidence that they are following a plan to maintain basic food production in the region comparable to the situation before operations. No mandatory percentage of land allocated for food production is mentioned in the strategy or sustainability criteria.

| | | |
|-----------|-------|---|
| Swaziland | Sugar | The Sugar Act of 1967 governs activities of the industry. The sector is regulated by the Swaziland Sugar Association and the Quota Board. The Sugar Act has restrictions on cultivating, manufacturing, refining and importing and exporting sugar. Production is regulated through production quotas and milling licences. |
|-----------|-------|---|

No country has formal regulations on forms of contracts between processors and outgrowers other than overall contract law, which is probably unwieldy when applied to multiple small contracts between processors and growers.

5.4 Discussion

Overall, policies in the four countries aim to balance openness to investment and light-touch regulation with a need to safeguard access to land and water by existing and future citizens, to provide for decent treatment of labour and to protect the environment. This is easier said than done, for two reasons.

First, producing a legal framework that reflects policy aims, and has feasible measures to implement it, is no simple matter. In some cases, the legislation is quite dense in that laws have been revised several times within living memory, thereby creating some ambiguity among both government officers and citizens who may not realise that previous legislation has been superseded.

In other cases, it is not clear that a comprehensive regime exists. That is, ideally a country would have:

- a national policy that sets out (broadly) goals and the means to achieve them
- a formal law supported by sets of specific regulations that establishes the detail behind the overall policy, including designating...
- ...an agency(ies) to implement the policy and law, sufficiently legally empowered and provided with budget and staff to carry out its functions.

To align all three elements is not necessarily a straightforward task: in practice gaps are frequent, especially when it comes to legislation that is desirable but which may not have political priority and hence is not backed by the authority and resources to implement it. Moreover, overlaps where different agencies apparently have competences over the same or similar matters may arise. Responsibility for regulating irrigation, for example, may be fragmented between agricultural and water ministries.

Second, it is one thing to legislate, another to implement – especially when dealing with agricultural investments spread over large areas, sometimes in remote places.

For both reasons, some of the legislation reflects good intentions that cannot be applied: as would be the case for some environmental laws including those governing water. Where, however, the laws deal with strongly felt matters, such as land, then interpretation of the law may be contested. Land regulations can be ambiguous when current users have acquired informal rights that are seen, at least locally, as legitimate. In such cases, investors looking for lands find themselves dealing with agencies implementing national laws, customary authorities entrusted with local lands, local communities and existing land users – all of whom may have differing interpretations of land rights, sometimes based on their different interests.

6 Reported impacts of industrial crops on food and nutrition security

This chapter is mainly organised around the four dimensions of food security, a section for studies that directly observe changes in food security and nutrition, plus a section that records other significant changes reported in the studies surveyed.

It is apparent that not all aspects of food security are well covered: some aspects of industrial crops have received surprisingly little attention – above all production on a large scale, especially in Africa. Hence scarcely anything can be said about the terms and conditions of jobs on plantations. To some extent this reflects the extent to which industrial crops are grown on a small scale, but this hardly justifies the apparent research gap.

6.1 Availability of food

The expectation is that industrial crops may have two very different effects on food production: either they compete for land and other resources and reduce food production; or production is complementary so that farmers with industrial crops also harvest more food crops. A third position also exists: that food crop production is maintained, even if complementarities do not arise. Evidence exists for all three positions.

6.1.1 Competition for land and labour

In some cases land for food crops has been lost to estates. For example, in Liberia access to land to grow food decreased significantly in Grand Cape Mount when Sime Darby set up an oil palm plantation, as did access to forests which provide an important source of food (Balachandaran et al., 2012). In Sierra Leone households affected by plantations established for oil palm and sugar cane complained they had lost land to grow food (Baxter and Schaefer, 2013). In Ghana, access to good quality land was reduced for households as a result of a company acquiring land for jatropha (Schoneveld et al., 2011). In Mozambique, households had also been displaced from land to make way for jatropha (Peters, 2009).

Where smallholders (whether independent producers or outgrowers) were concerned, some had converted land from food crops to the industrial crop, but often this was very much a free choice. For example, in Chinja, Peru, in the 1990s, small farmers gave up growing maize to produce cotton, a crop that gave much larger margins (Escobar et al., 2000). In Mozambique, outgrowers of sugar cane were reluctant to follow company guidelines to plant food crops as well as cane: they wanted to convert all their land to cane given the high returns (Jelsma et al., 2010).

Studies that model the likely effects of expansion of cash crops report reduced production of food crops. McMahon (1989) reports this for Kenya when considering what might have happened had coffee planting been liberalised from the 1960s to the 1980s; as does Sahn (1994) for Malawi when considering what would have happened if smallholder tobacco farmers had not been heavily taxed. Models depend of course on the assumptions they incorporate: it is much easier to model competition for resources than to model economies of scope and complementarities. When Orr (2000) observed what did happen in Malawi in the 1990s, expanded production of burley tobacco did not lead to less maize being produced.

6.1.2 No loss of food crops

In several cases, smallholders have planted industrial crops but have been able to maintain food crop production too. One way to do this is by intercropping food crops with trees and bushes such as cocoa and jatropha. In Cameroon cocoa farmers intercropped groundnuts, cassava, maize, cocoyam and plantain with cocoa (Kaziangi and Masters, 2006). For jatropha, intercropping was seen in Mali (Favretto et al., 2013), Ethiopia (Teman, 2010), Zambia (German et al., 2011) and Michoacán, Mexico (Skutch, 2011). In Nigeria, almost a quarter of households growing rubber grew food crops among the rubber plants (Agwu, 2006). On the other hand, cocoa farmers in Nigeria reported that they could not grow food crops during the establishment of their cocoa groves (Oyulole et al., 2009).

The other way to maintain local food production is by expanding the cropped area to accommodate both industrial and food crops, as seen in Tanzania (Loos, 2008) and Zambia (German et al., 2011) for jatropha outgrowers. Other examples of land expansion come from complementarities.

6.1.3 Complementarities in cropping

At least three ways in which food and industrial crops complement one another have been identified. The first is a direct channel seen at household level when firms that contract growers provide them with inputs, machinery services, and training specifically for food crops. The motivation for the firm is to attract growers and to make it easier for outgrowers to dedicate some of their land to growing the industrial crop – although the offer may not be entirely free, since costs may be deducted from the price paid for output delivered. This has been seen for cotton schemes in francophone West Africa, where a state monopoly organises production: being a monopoly the firm can be sure that farmers cannot sell their crop on the side (Theriault and Tschirley, 2014).

A second channel is indirect, at household level. Farmers may use earnings from industrial crops to finance inputs for food crops, thereby overcoming any credit limits they face. Differing seasonal demand for labour may present opportunities to grow an industrial crop without detracting from labour for food crops. Outgrowers may also divert inputs provided for the industrial crop to food. They may benefit from either specific training or more general experience acquired from growing the industrial crop (skills that can be applied to food crops). Lastly there may be residual effects of fertiliser applied to annual industrial crops for subsequent food crops grown in rotation.

For example, in the 1980s and 1990s southern Mali saw considerable expansion of cotton cultivation, organised by a state monopoly. Yet in the heart of the cotton zone, Koutiala Circle (Cercle), cereals cultivation expanded faster than cotton from 1980 to 1997: so much so that cereals were exported out of the zone. Animal draught became more common to create the cotton fields, but the same power source could also open new fields for millet, sorghum and maize (Benjaminsen, 2001). The effects, however, may not be even between men and women: in the same cotton zone of Mali, women found that they had to give up some of their private plots to cope with the demands of the expanding cotton fields. Those plots had produced lucrative harvests of higher value food crops and rice that were mostly sold (Lilja and Sanders, 1998).

In Malawi in the 1990s, smallholders who had been permitted to grow burley tobacco maintained their food output. One channel was using earnings from tobacco to pay for additional labour on the maize plots (Orr 2000). In Papua New Guinea farms that combined coffee growing with subsistence food production benefitted from economies of scope (Coelli and Fleming, 2004).

A third channel applies not at household level, but at village or district level. When sufficient numbers of farmers grow an industrial crop, it may stimulate private provision of inputs and farm services and private marketing. Once these dealers have established their business, they can expand them readily to supply inputs for food crops or to buy in surpluses of food crops. Similarly, sufficient concentration of commercial farming in an area may encourage government to invest in local roads and infrastructure.

In Gokwe, Zimbabwe, newly settled land in the 1970s and 1980s proved ideal for growing cotton. As inputs dealers set up their businesses, cotton farmers were able to intensify their maize production: higher yields for grain were associated with areas where cotton growing had been established longest (Govereh and Jayne 2003).

Three things can be seen in these reports:

-
- Complementarities seem to be more often reported than competition, so that often food production has been sustained even as industrial crop output has risen. Two qualifications apply, however:
 - Where smallholders see much higher earnings from industrial crops, they may abandon food production, not because they have to, but simply because it makes financial sense to devote all their resources to the cash crop. Only occasionally does the literature reviewed report gross margins, but when they do, the difference between food and industrial crops can be very large indeed: for Malawi, for example, Orr (2000) estimates gross margins to tobacco as more than ten times those to hybrid maize.
 - Where it seems that food crop production has fallen on account of industrial crops, in most cases it is where an estate has taken over fields previously farmed by smallholders for food. Almost all those studies, however, concern the early stages of plantation development, prompting questions about what the displaced farmers do in the medium term.

6.2 Access to food

Access to food results from a combination of incomes, prices of food, and entitlement to transfers, gifts and exchanges. The literature search only revealed one of these dimensions: that of returns to industrial crops. No studies reported on changes in costs of food, or other entitlements to food.

Industrial crops should command higher prices and lead to higher margins than basic food crops. Most³ goods manufactured from them are not necessities but rather purchased once basic needs are met, and since many industrial crops are exported to developed countries where consumers have higher purchasing power, one could expect margins to be larger for industrial crops than for food crops consumed domestically (Grosh, 1994, cited in Smalley, 2013). Earnings from crop sales should allow households to purchase at least the same quantity of food that they could produce themselves – if not more – and pay for other goods and services.⁴

A first, obvious indication that growing industrial crops is attractive is found in the large numbers of farmers who take up production of industrial crops, enter into purchase contracts and renew these for consecutive years. Almost all studies find large numbers of farmers engaged in industrial crop production, and large numbers of applicants for participation in outgrower schemes. Figures from Ghana show that around five times as much land is under smallholder oil palm production as is under outgrowers or estates (Ofosu-Budu and Sarpong, 2013). Sugarcane growers in the sugar belt of western Kenya also rapidly expanded production (Wegulo and Obilnji, 1999).

Households growing cash crops regularly earn higher incomes than peer groups growing food crops. The cotton literature provides most examples, with studies from Peru (Escobal et al., 2000), Zimbabwe (Govere and Jayne, 2003), Cote d'Ivoire (Sahn, 1990) and Sudan (Hassan et al., 2000) reporting that cotton produces higher gross margins than alternative crops, and farmers have higher incomes than peers growing food crops. The evidence from oil palm studies is similar where, once production is established, farmers see higher returns than from other crops. This is especially strong in Southeast Asia where many farmers were able to take advantage of high prices and growing markets during the late 1990s-2000s (Rist, 2009; Feintrenie et al., 2010; Bunidarsono et al., 2013); but findings from sub-Saharan Africa also provide evidence for higher incomes from oil palm in Cameroon (Hoyle and Levang, 2012) and Nigeria (Adebo et al., 2015). Tobacco from Malawi in the 1990s generated attractive returns, with gross margins that were ten times higher than maize (Orr, 2000).

For sugar farmers, Wegulo and Obilnji's (1999) study in western Kenya found that sugar made up 79% of all agricultural income, with incomes from sugar being much higher than from other crops. Shumba et al. (2011) similarly found that average net incomes of sugarcane outgrowers in Zambia were higher than alternative livelihood opportunities both in agriculture and other sectors. The 161 sugarcane producers in the Kaleya Smallholder Company attached to the Nakambala estate in Zambia earned very high incomes from producing

³ Possible exceptions are cotton, sugar, tea and palm oil and which may be necessities for households around the world.

⁴ However, the relationship between food expenditure and food security is not straightforward: looking at households of all levels of food security, those who tend to spend more on food tend to be less food insecure, but towards the bottom end of the food security spectrum, the relationship is less clear (Bertelli and Macours, 2014).

sugar cane, with an average net income per outgrower of \$11,700 per year. This was well above Zambia's minimum wage, and comparable with management positions in other sectors.

These positive findings require several qualifications because earnings are not equal across regions, crops, or between sexes. First, Shumba et al.'s (2011) findings on the high absolute profitability of sugar in Zambia is by no means universal across industrial crops in different regions. For example, incomes in the cocoa sector in West Africa have long been flagged as area of concern, as many farmers remain in poverty despite years of engagement in the sector. In Ghana, Asamoah et al. (2013) found that only 18% of cocoa farmers were either extremely poor or poor⁵ as defined by national poverty standards. Their households spent around 55% of their incomes on food, higher than the national average. Similarly, Fountain and Hutz-Adams (2015) reported that earnings of cocoa growers to be around \$0.84 a day in Ghana, and \$0.5 a day in Cote d'Ivoire, placing many in absolute poverty. This difference is partly explained by the differences in cocoa prices: Cote d'Ivoire's national marketing board pays 25% less to farmers than the Ghana Cocoa Board.

In Central America and Mexico, many households growing coffee were on low incomes (Bacon et al., 2014; Beuchelt and Zeller, 2011; Barham et al., 2011; Donovan and Poole, 2014; Kilian et al., 2006; Valkila, 2009), largely because they had too little land or could not raise the productivity of their crops owing to lack of labour and capital. Household endowments clearly matter.

While generally industrial crops grown in suitable conditions can produce much better returns to land and labour than staple food crops, jatropha seems an exception. Promoted and adopted on the belief that yields would be higher to generate good incomes, productivity has consistently been lower than expected, leading to growers abandoning crops (Ariza-Montobbio and Lele, 2010; Hunsberger, 2010), or even letting other households pick the seeds for free (Grimsby et al., 2012). In most cases, household incomes from jatropha were very low. In some cases households effectively forewent incomes as they had diverted labour to jatropha production (German et al., 2011).

Only a few studies report wages to labourers on estates and plantations, sometimes recording surprisingly poor wages. Reviewing the literature on plantation employees producing industrial crops, Smalley (2013) notes that wages are often at or below minimum wages, and as a result, employees cannot afford to cover their 'calorific expenditure'. The same was seen on sugar plantations in Tanzania (Mblinyi and Semakafu, 1995). On tea plantations in Malawi and India, wages alone did not secure workers' households access to basic needs, and only once other benefits the estate provided were accounted for did households' incomes surpass minimum wage levels, which in Malawi's case is below the international extreme poverty line (Oxfam and ETP, 2013). Given how few observations were seen,⁶ it is not clear how generalised this may be for workers on large-scale farms.

Gender is another important qualification (see Section 5.6). Women often have fewer assets for farming than men, may participate less in farmers associations and get fewer benefits from them, and sometimes have less access to technical information for growing industrial crops – partly because such crops are commonly seen to be 'men's crops' (Waswa et al., 2009).

6.3 Stability of food access

While the above studies suggest that industrial crops are usually more profitable than staple food crops, a common concern is that returns are less stable owing to *increased exposure to risks in markets*. Not only does cultivation of industrial crops typically involve purchasing inputs from the market, most notably seed, fertiliser and crop protection chemicals, but also all of the output is sold. Moreover, as industrial crop production systems often have stronger links to international markets than food crops, changes in exchange rates also matter. For most developing countries the main risk is depreciation of the currency. This would harm growers if they have to pay more for imported inputs such as fertilisers, but they would gain from higher output prices – assuming that prices are set on world markets rather than being domestically administered.

⁵ Measured using national poverty lines for Ghana.

⁶ Moreover, it may be that alarming cases of low pay and poor conditions at work are more likely to be reported than the converse, since they are rightly cases for public concern.

Fluctuations in input prices over time can have important effects on the disposable incomes of industrial crop producers. Onumah et al. (2014) note that cocoa farmers regularly need to borrow money for inputs before their harvests, and depending on the cost of inputs this can amount to as much as 60% of their harvest value. Wafula Netondo et al. (2010) also note that input suppliers in Kenya deducted high and increasing amounts from sugarcane suppliers to cover their costs, not all of which appeared justified, leaving farmers with less income than expected.

Output price falls, however, usually matter more for farmer returns. Falls in prices can be quite sudden, since some world prices such as coffee are highly sensitive to harvest failures in major producers such as Brazil, as well to significant increases in supply as happened in the 1980s and 1990s with the emergence of Vietnam as a major exporter (Eakin et al., 2009). Prices can also fall when administered regimes are changed. Between 1989 and 1993 the state buying agency in Côte d'Ivoire reacted to its increasing deficits and falling world cocoa prices by cutting farm-gate prices to half their previous levels. Households of cocoa growers saw sharp falls in their disposable incomes of almost 40%. This had knock-on effects on children's schooling and nutrition. Around 5% of cocoa-growing households withdrew children aged 6-15 from school, while younger children aged 2-4 saw significant additional stunting. Moreover, given the importance of cocoa to the local economy, non-producers – who were poorer in the first place – also experienced income shocks and saw their consumption levels fall (Coigneau and Jedwab, 2012).

How badly price collapses affect households appears to be affected by how easily they can diversify into other crop production. Annual industrial crops may be replaced by food crops at the next planting. Following a price collapse in tobacco in the early 1990s, Tanzanian tobacco growers stopped producing tobacco and reverted to growing maize (Mbilinyi, 1991 cited in Smaller, 2013). Tree crops, however, represent a standing investment that is not readily cut down. When their prices fall, a common reaction is to reduce effort and save on inputs — sometimes to the point of abandoning the trees and only attending them at harvest time to scavenge whatever fruit has been produced, diverting labour and cash to other activities. For example, in Mexico Rodríguez Padrón and Burger (2015) found that a slump in the coffee price had less of a shock on coffee farmers in less specialised regions who could switch their labour to other activities, while those in more remote and specialised coffee growing regions were locked into coffee production and saw returns to labour fall. In Veracruz, Mexico, slumping prices in the early 2000s have led to labour looking for and finding other jobs, so that even when prices have recovered, coffee growers use less labour than before (Eakin et al., 2009). Studies of cocoa suggest most farmers continue to grow cocoa despite the lower prices.

Food access may become less stable if food prices rise. Since the mid-2000s this has been a concern in cocoa districts in Ghana where imported rice and oil are important staples (Asamoah et al., 2013). Areas of industrial crop production may also see the highest price fluctuation for staples within national borders. Wafulo Netondo et al. (2010) report that the western Kenyan sugar belt regularly sees the highest maize prices in the country, and suggest that this is partly due to the decreasing local maize production as sugar planting has expanded.

Industrial crops, on the other hand, can stabilise food access through some of the complementarities in production described in Section 5.1. In Ethiopia, for example, Negash and Swinnen (2012) found that harvesting castor beans meant households could buy food when cash was traditionally scarce. Castor beans can be harvested twice a year, and since they do not spoil easily in the field, farmers could collect and sell these when they needed cash to purchase food.

In the studies reviewed there were surprisingly few references to farmers of industrial crops becoming more exposed to risks from weather, pests and diseases.

6.4 Utilisation of food

Few studies observed that women had less time for child care as a result of working on industrial crops. Some reports, however, implied that women might come under time pressure. For example, in Michoacán, Mexico it was feared that expansion of jatropha might lead to heavy demands on women's time in processing the crop (Skutsch et al., 2011). Observing women employed in the processing and commercialisation of palm oil, in both Imo State, Nigeria (Ugwoke et al., 2004) and in Guinea (Carrere, 2013), it was implied that women had less time since the demands of the palm oil work was heavy. In both these cases, however, the jobs and incomes created for women were seen as substantial, improving their lives.

Whether that did indeed mean less time for child care or whether children's nutrition suffered was not examined. A Nigerian study (Ibe, 2010) sheds some light on this. It compared the nutrition of 97 children with mothers 'involved in business' – as garri makers/farmers (53%), palm oil harvesters (26%), and makers of soap (12%) and beverages (8%) – with 100 children whose mothers did none of these things. Pre-school children of the business mothers had significantly better body measurements, and much better for stunting, energy and protein intakes, compared to the control group. That suggests that either work did not detract from child care or that additional incomes more than compensated for any reduced child care, or both.

Women were sometimes disadvantaged when growing industrial crops compared to men. For example, in Côte d'Ivoire and Ghana female cocoa farmers were generally worse educated than other farmers. Hired female labour was usually not employed directly, but through their husbands who were paid on their behalf. Moreover, pay for women was worse, their work more menial and paid by the task. Women also faced less favourable access to markets. As a result they produced lower quality cocoa sold on local markets at low prices. (Utz/Solidaridad, 2009). Similarly, observing female cocoa growers in Ghana, Quisumbing et al. (2001) reports that while women were as likely as men to plant trees, they obtained lower yields on their cocoa plots, suggesting they faced gender-specific constraints.

Female disadvantage was also seen in southern Mali where the expansion of cotton meant that women had too little time to cultivate their private plots that generated valued private income (Lilja and Sanders, 1998). In Côte d'Ivoire, Oxfam (2013) found women to be under-represented in cocoa cooperatives, and they did not benefit from the discounted inputs and price premiums associated with membership.

In these cases women had clearly not benefitted as much as they should from industrial crops, although whether they got no benefit or were even harmed was less clear. In some cases, however, disadvantage did harm women's lives. On the sugar cane plantations of Tanzania women received lower wages than men and were hired only on short-term contracts. For the many unmarried female workers with families, incomes were insufficient for family needs. As will be seen in the next section, their nutrition suffered as well (Mblinyi and Semakafu, 1995). In northern Ghana the establishment of a jatropha plantation meant women lost access to trees and crops which provided them with income (Schoneveld et al., 2011).

6.5 Direct observations of FNS

Most studies that compare measures of food security and nutrition between growers of industrial crops and a control group report no differences that can be attributed to choice of crop.

Among coffee farmers in northern Nicaragua, the number of months of seasonal hunger depends on incomes, land and maize output, but not on coffee plantings (Bacon et al., 2014). For Zomba District, Malawi, no difference was seen in the nutrition of children of tobacco farmers compared to those of other farmers, although for those with less than one hectare the children of tobacco growers experienced a drop in energy intake before harvest since the households depended on buying-in maize (Peters and Herrera, 1989, reported in Orr 2000). Also, using data from Zomba from 1986-87, a regression analysis found that the nutrition of children improved with higher total spending (and hence incomes), with female-headed households, and with girls compared to boys; but found that the share of the farm planted to tobacco had no effect (Sahn et al., 1994). In the north of Côte d'Ivoire, regression models of stunting of children using data from household surveys in the mid-1980s showed that higher income improved nutrition, as did their mother's height, birth order, less disease, and closeness to doctors and nurses; but land area and share to export crops had no effects (Sahn, 1990). For western Kenya in the 1980s, households growing sugarcane had slightly better nutrition than non-growers. Among pre-schoolers the difference was explained by better health and sanitation (Kennedy and Cogill, 1987). More subjectively, palm oil outgrowers in Ghana were more confident of their future food security than independent producers of palm oil (Väth and Kirk, 2013).

Contrary reports were less common. For Liberia, communities that had lost land to an oil palm plantation had worse diets, with four months more of inadequate food, than comparable communities that were not affected by the plantation (Balachandaran et al., 2012). In Tanzania, women working on sugar plantations were under-nourished, since neither the food provided by the company was enough to sustain their high levels of activity, nor were their wages sufficient to purchase supplementary food. According to the Mtibwa plantation doctor,

heavy work and poor nutrition contributed to anaemia and fatigue among pregnant workers, possibly resulting in the observed high levels of involuntary abortions, low birth weight and infant deaths (Mbilinyi and Semakafu, 1995).

When cocoa prices in Côte d'Ivoire fell in the early 1990s, young children aged two to four years suffered more stunting, with girls worse affected than boys (Cogneau and Jedwab 2012).

6.6 Other significant changes

6.6.1 Income equality and poverty

A major theme in studies of coffee growing, above all in Central America and Mexico, has been the impact of *certification of coffee* as organic, environmentally friendly or fairly traded, or combinations of these. Almost all such studies see small gains in prices from such schemes, but too small to make much of an impact on poverty: indeed, most studies argue that raising yields and quality would do more for farm incomes.

For Nicaragua, Beuchelt and Zeller (2011) argue that prices for certified coffee could not compensate for low productivity and limited land and labour, conclusions confirmed by Donovan and Poole (2014). For the same country, Valkila (2009) saw that certified production from low intensity plots had higher returns than non-certified coffee from similar plots, but less than could be achieved by higher intensity methods.

For Mexico, Weber (2011) saw certification for both fair trade and organic as yielding an extra \$26 a year for each household member: only a small gain. Not surprisingly Barham et al. (2011) saw that coffee growers in the south of Mexico had better options in migrating and in labour markets than in getting their coffee certified.

For Central America as a whole, Kilian et al. (2006) conclude that fair trade certification helped in the short run, but in the longer run coffee quality and productivity were key to higher incomes.

In Uganda, impacts of coffee certification differed by scheme. The Fairtrade scheme raised incomes by 30% and reduced poverty; another two schemes did neither. The difference was that the Fairtrade scheme did not tie growers to one buyer: they could sell to several buyers (Chiputwa et al., 2015)

Some studies stressed how cultivation of industrial crops could contribute to alleviating the *poverty* of those on low incomes. For coffee in Kenya, McMahon (1989) estimated that restrictions on planting had not limited growth of GDP, but prevented a better distribution of income, particularly as liberalisation would have created jobs for the landless. For growers of cocoa and cotton in Côte d'Ivoire, Sahn (1990) showed that lower taxes on export crops would have reduced poverty. For tobacco in Malawi in the 1980s, taxes on smallholder tobacco probably reduced smallholder incomes and worsened child nutrition (Sahn et al., 1994). In Mexico, jatropha cultivation led to more labour being hired and raised incomes to landless labour (Skutsch et al., 2011).

On the other hand, studies of coffee growers in Central America and Mexico (cited above), of burley tobacco growers in Malawi (Orr, 2000), and of cocoa farmers in Ghana (Asamoah, 2013) all noted how often the farmers lived in poverty. It was not however, the crop that trapped them, but their lack of land, labour and capital.

6.6.2 Social relations: land rights, buying relations, and gender

Several studies reported changes in *land rights*. In Liberia allegations of pressure and intimidation of locals regarding consent to land acquisition for oil palm plantations were reported (Greenpeace, 2014). The legitimacy of land acquisitions for oil palm estates was queried in Cameroon (Greenpeace, 2012). In the highlands of central Vietnam, the expansion of coffee farming in the 1980s and 1990s led to indigenous groups being pushed into the remaining forest to practice shifting cultivation (Meyfroidt et al., 2013). Not all accounts are of industrial crop growers trampling over the rights of existing users. In Malawi, for example, sugar cane cultivated on outgrower schemes generated much higher incomes than other crops, but schemes were not expanded since it was feared that there would be conflict over land (Hermann et al., forthcoming).

In parts of West and Central Africa cultivation tended to confirm use rights over land, so that in-migrants were quick to establish continuous cultivation of their land. This applied to cotton and other fields in Burkina Faso

(Gray and Kevane, 2001), while in Cameroon cocoa growers planted trees to assert tenure (Kaziangi and Masters, 2006). In Ghana, oil palm growers took on contracts with a processing plant which they felt enhanced their claims to the land they farmed (Väth and Kirk, 2013).

Some studies focused on *relations between smallholders producing industrial crops and large-scale buyers of their produce*. Examining the benefits of fair-trade certification for small-scale tea growers in Kenya, Dolan (2010) argues that certification reinforces existing power imbalances between smallholders and large corporations. Worse, it may obscure such imbalances as the certificate becomes an element of patronage. Similarly, Bassett (2010) sees fair-trade schemes for cotton in Burkina Faso and Mali as failing to address ‘fundamental inequities’ between small-scale farmers and buyers, although some positives are clear from fair-trading in higher quality cotton, greater participation by women, and the spread of organic techniques. Cotton growers in Andhra Pradesh, India, who have joined a fair trade scheme have adopted Bt cotton rather than organic production: they are locked into agrarian capitalism, argues Makita (2012).

Some report that co-operation can improve the terms faced by smallholders. Collective marketing through cocoa farmers’ organisations in the Centre Region of Cameroon increased returns to farmers by around 8% (Kamden, 2013). In Burkina Faso, Bassett (2010) saw promise in an agreement between the National Cotton Growers’ Union and Victoria’s Secret clothing in the US that created a new marketing channel.

Impacts of industrial cropping may fall *differently on women and men*, with fewer benefits or disadvantages to women as producers, processors and members of households growing the crop. In southern Mali women were losing income from private plots as cotton cultivation expanded (Lilja and Sanders, 1998). In Ghana, it was feared the small-scale growers and especially women would lose out as government and processors encouraged a switch from traditional Dura varieties of oil palm to hybrid varieties (Oosterveer et al., 2014). For cocoa farmers in Côte d’Ivoire, women were less represented than men in co-operatives, and neither benefitted from the discounted inputs nor the price premiums associated with membership (Fountain and Hutz-Adams, 2015). In the same country and Ghana, women growing cocoa faced greater barriers to entry and had fewer opportunities than men. Moreover, some forms of certification had unwittingly created more work for women, although gender-specific schemes such as Kuapa Kokoo in Ghana did improve women’s positions (Utz/Solidaridad, 2009).

6.6.3 Environment

Although the environment was not a search term, several studies reported environmental losses from developing industrial crops. Most often reported were loss of forests, with accompanying biodiversity and environmental services, when tree crops were planted on cleared forest. This was the case for coffee in central Vietnam (D’haeze et al., 2005; Meyfroidt et al., 2013), for tobacco in the miombo woodlands of Tanzania (Sauer and Abdallah, 2007), for oil palm grown in Cameroon (Hoyle and Levang, 2012), Gabon and Liberia (Greenpeace 2012, 2014), for jatropha grown in Michoacán, Mexico (Skutsch et al., 2011) and in Brong Ahafo, Ghana (Schoneveld et al., 2011), and for cocoa in Cameroon where the returns to clearing forest for new groves were higher than investing in existing cocoa groves (Kaziangi and Masters, 2006).

Other concerns were the impacts of monocropping, combined with excessive tillage, leading to soil degradation, as reported by Chavez et al. (2012, 2014) in northwest Argentina. Poor irrigation management and drainage had led to salination and waterlogging in the Gediz delta of Turkey causing serious losses to cotton growers (Atis, 2006).

Allegations of over-use of soil and its consequent degradation are not always proven. Southern Mali is a case in point where cotton yields declined in the 1990s leading commentators to allege soil mining. But as Benjaminsen (2001) reported, cotton farmers tried to improve their fields by planting or maintaining trees, such as *faidherbia* that help fertilise soil, and applied manure when possible to their plots. He argued that any fall in the yields was the result of calculating average yields through time when cotton was being extended towards the semi-arid margins where the land would not yield as well as in the heartland of cotton cultivation. This was largely confirmed by taking soil samples from plots under different land uses in a sample village, including from sacred groves that had never been tilled: while cultivated plots had less carbon and potassium than long fallows, woodlands and sacred groves; they had no less nitrogen, calcium, magnesium and phosphorus (Benjaminsen et al., 2010).

7 Conclusions

A mismatch seems apparent between public concerns over industrial crops in sub-Saharan Africa that centre around large-scale production, especially when the firm is a foreign investor, and the formal research literature which overwhelmingly reports experiences with smallholders. This may reflect that some industrial crops in Africa, such as cotton and coffee, have largely been grown on a small scale, or it may be that formal studies have yet to catch up with events on the ground. Readily available data cannot illuminate that. Studies that compare the same crop being grown on small and large scale were not found.

Stakeholder interviews conveyed two main messages. One was that industrial crops could benefit countries and local populations, improving welfare. The other was that, in practice, large-scale investments entailed risks to the land rights of existing users, to decent treatment of labour on estates, to the returns to outgrowers, to the environment and even to distorting agricultural policy priorities. Most of these issues, however, relate to large-scale production on estates and plantations.

The policy assessments for the four countries show that the four countries sampled broadly welcome investment in agriculture and do not wish to encumber would-be investors with excessive regulation. Policies, laws and regulations exist to deal with many of the risks noted by the stakeholders interviewed, although in practice the frameworks are not complete, and their implementation is far from straightforward.

The bulk of this study, however, reviews existing studies to answer the question of how industrial crops affect food and nutrition security. Most studies that shed light on this concern the effects on local *food availability*. Contrary to fears that devoting land and labour to industrial crops would mean less production of food crops, reports often indicate that food production has been sustained even as industrial crop output has risen. That counter-intuitive result stems from situations where land has been sufficient to accommodate industrial crops with no loss of land to food crops, or where it has been possible to intensify food crop production at the same time as planting industrial crops. In some cases both of these processes have been assisted by complementarities in the production of industrial and food crops. Input delivery and marketing systems for industrial crops have benefitted production of food crops, earnings from industrial crops have financed inputs and labour to grow food, skills learned in cultivating industrial crops have transferred to food plots, and roads and other infrastructure for industrial crops have served food crops equally well.

Two qualifications apply to the reassuring finding that farmers maintain food production while expanding industrial crops. One, in some cases, smallholders willingly give up production of food crops because the returns to industrial crops are high. Reports of gross margins are infrequent, but those seen often show very large differences between industrial and food crops: for example, tobacco in Malawi in the 1990s generated returns per hectare ten times as large as hybrid maize. Two, in most of the cases where food crop production has fallen on account of industrial crops, an estate has taken over fields previously farmed by smallholders for food. Almost all such reports, however, concern the early stages of plantation development, prompting questions about possible compensating changes in the medium term, such as what displaced farmers do.

Studies that illuminate *access to food* often report higher incomes from industrial crops. Qualifications again apply. Households producing industrial crops may still be on (very) low incomes, although that is often not so much the result of growing a crop that does not yield well per hectare – although *jatropha* is often an exception⁷ – but more because households lack the land, labour and capital to produce more. Their poverty results from general conditions, not their choice of crop. Women farmers are often at a disadvantage in access to land and labour, to technical knowledge, and in selling their crops. Again, whether they are worse off than when growing food crops

⁷ Partly because the plant has not yet been well developed agronomically, and partly because growers lack experience of the crop.

is not clear. A final important qualification is that from the very few reports of wages on estates, accounts can be found of workers paid so little that they cannot even feed themselves adequately. Owing to the paucity of studies, however, it is hard to judge whether this is a general outcome, or the result of reports concentrating understandably on cases of public concern. Studies of access rarely if ever observe the other side of access: the price of food in local markets.

On *stability*, studies record that prices of some industrial crops can be variable, leaving producers vulnerable when prices fall. In some cases, and particularly when the rural economy is both developed and diversified, smallholders are able to buffer the impacts by switching their labour to other activities. Tree crops in particular can be semi-abandoned when prices fall, to be revived when prices recover. On the other hand, workers on estates may benefit from stable wages.

The few studies that deal with dimensions of *utilisation* report women producing, processing and marketing industrial crops as being increasingly pressed for time. This might imply that they had less time for child care, but observations are not explicit. A single study did establish, however, that the children of women engaged with rural businesses, some associated with industrial crops, were better nourished than those of comparable women. If any time was lost to child care, the gains in nutrition from higher incomes may have outweighed any such effect.

Direct observations of food security and nutrition of households growing industrial crops rarely show them as having worse outcomes than control groups. Again, however, the few observations of workers on plantations can provide some counter-examples, but the significance of so few observations is not clear.

Other observations seen in some of the studies reviewed include:

- Industrial crops were associated with reduced poverty and less inequality, since they generate jobs and incomes for those on low incomes, including those who depend on farm work.
- Certification of industrial crops to gain price premiums offer only limited gains. Higher productivity and quality of crops may be a better route to boosting the incomes of poor producers.
- In the few studies of estates, concerns over loss of land rights brought about by land transfers are frequent. For smallholders in West and Central Africa, however, growing industrial crops can be a way to establish and strengthen their rights to land.
- Women are often at a disadvantage as producers of industrial crops. Whether they always become worse off when households switch from food to industrial crops, however, is not clear.
- Most of the environmental concerns registered concern loss of forest, usually to tree crops.

Overall, it seems that most often growing industrial crops is likely to improve food and nutrition security, owing to higher incomes earned and the complementarities that can apply between growing industrial and food crops. The few studies that directly observe outcomes confirm this, while those that report reduced poverty and inequality support this.

That said, many qualifications apply that indicate where policy-makers need to address their efforts. They include:

- When people on low incomes have little land, labour and capital, it will take more than a choice of crop to alleviate their poverty.
- Prices of industrial crops matter. Farmers are more likely to get a fair return if supply chains work effectively and they are not unduly taxed on their produce.
- Commodity prices vary. Protecting growers against fluctuations in market prices may be desirable, but it is not always straightforward or economical to do so. An alternative is to assist them to adapt and react to price variations. The pointers, albeit mainly from studies of coffee growers in Mexico, are that helping farmers to cope – including through cash transfers – may be the more promising approach.
- As with agricultural and rural development in general, a priority is to work to correct the disadvantages that women face as farmers, processors and marketers of industrial crops. How to do that most effectively belongs to wider debates on female empowerment.

Finally, there is nothing much unusual or remarkable about industrial crops and their impacts on food security. The issues they raise over food and nutrition security are similar to those that apply to most forms of agriculture.

More needs to be understood, however, about plantations and estates where there are (unconfirmed) indications that more serious and specific concerns apply.

As ever, gaps exist in the literature. Two are of particular interest. One concerns comparing impacts of large and small-scale production of industrial crops on food security. The other is to establish who benefits from industrial crops grown at different scales. In particular, to what extent are smallholders growing such crops the better-off among them, and to what extent do larger-scale production and processing provides jobs for people who are landless or nearly so. These concerns may be addressed by the studies planned under the forthcoming Belmont Forum-funded FICESSA project.

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