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FLEX CROPS: A PRIMER

Julie de los Reyes and Katie Sandwell (editors)

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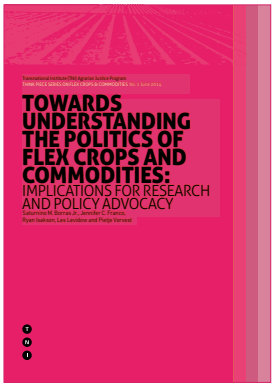
This report compiles, in a concise and accessible form, the key findings from a series of papers on flex crops published by TNI. It is intended to bring the findings of the series to a broader audience of activists and social movements, and contribute to a continuing exchange on the topic.

The original series of papers includes:



The Politics of Flex Crops and Commodities: Implications for research and policy advocacy

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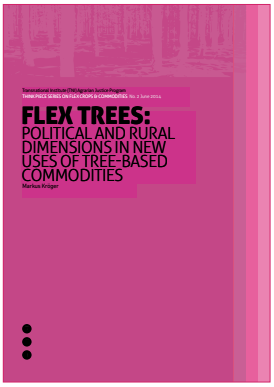
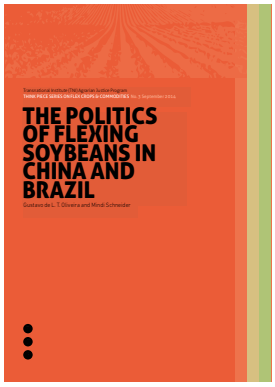


Flex trees: Political and rural dimensions in new uses of tree-based commodities

Markus Kröger

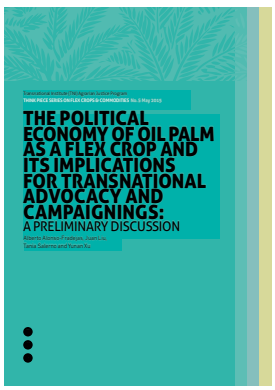


The Politics of Flexing Soybeans in China and Brazil

Gustavo de L. T. Oliveira and Mindi Schneider

The Politics of Sugarcane Flexing in Brazil and Beyond

Ben McKay, Sérgio Sauer, Ben Richardson and Roman Herre



The Political Economy of Oil Palm as a Flex Crop. And its implications for Transnational Advocacy and Campaignings: A Preliminary Discussion

Alberto Alonso-Fradejas, Juan Liu, Tania Salerno and Yunan Xu

The papers are available for download at https://www.tni.org/en/topic/flex-crops

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INTRODUCTION

Many crops have several uses, some have dozens. Crops like corn and oil palm have for centuries been used as the basis for feed, fiber, alcohol, and energy production, as well as serving as a staple source of food for cultures growing them. However, new uses for crops, and new economies around these uses, are emerging today. Mediated by concerns around food and energy security; climate change; rising demand for natural resources and commodities from emerging economies; and the search for alternative financial investments, classic crops like corn, sugarcane, and soy, among others, and their by-products are now being produced, circulated and consumed differently—a difference that needs to be better understood and accounted for more fully. Understanding this transformation is important for combating the new social and environmental harms that arise from this mode of production.

The emergence of flex crops and commodities

Using plants in multiple ways is a practice as old as humanity and many crops have come to occupy a central place in society precisely because of their multiple uses. Sugar cane, for example, has been cultivated for centuries to produce sugar, and its by-product, bagasse, as a source of steam energy. Trees, likewise, as an invaluable source of timber and wood pulp, have provided contemporary building material, paper products and fuel.

An important feature of the current era, however, is the drive to expand these uses in fundamentally new ways. Crops and commodities are being accorded new, multiple and interchangeable uses as food, feed, fuel, and industrial material in a process we refer to as *flexing*. Flexing entails the creation of entirely new products, or the transformation of by-products and residues previously considered 'waste' into new commodities. This process is taking place largely as a result of the converging food, energy, financial and climate crises, and of the changing resource needs of emerging economies, to which flex crops and commodities are positioned as a (potential) solution.

Food, energy and environmental crises

The convergent and interlinked food, energy and environmental crises are a major source of emerging markets for flex crops and commodities. As international concern builds about "feeding the nine billion" (the projected population in 2050) and about global climate change, flex crops are presented as key to achieving food security and effecting the transition to a low-carbon future. Under the rubric of the so-called green or bio-economy, new uses of crops as food, feed, and fuel are developed and marketed as more efficient, sustainable and renewable alternatives to traditional production, and especially to fossil fuels. The search for 'renewable' and 'clean' energy sources, in particular, has intensified the demand for biomass— fuel derived from the burning of organic materials, such as wood, plant residues, and animal waste. With international and regional environmental policy frameworks (e.g. The European Union Renewable Energy Directive) seeking to increase reliance on these sources, crops like oil palm, sugarcane, corn and soybeans have increasingly taken on non-food functions as sources of biodiesel or ethanol fuel.

Further, the cultivation of trees is being adapted to demands from carbon markets, as part of climate change mitigation strategies. Instead of cutting trees for other purposes (e.g. for wood products or fuel), companies can "flex" their use by selling the carbon-sequestration potential of a tree plantation to other companies that seek to 'offset' their carbon emissions.

Shifting demand from emerging economies

Middle-income countries are consuming more energy and food, and shifting to a more meat-based diet. As countries like Brazil, Russia, India, China and South Africa (also known as the 'BRICS') adopt consumption patterns similar to those which have been in place in Western Europe, Japan and North America for a century, demand for many products is growing. This includes plastics, medicines, bio-economy products, and especially, fuel and meat, which pushes demand for agro-fuels and animal feed respectively. Pressure is especially intense for fuel and feed made from soy, corn, sugarcane and oil palm. Alongside this, new geographies of production have emerged to respond to this demand. Countries like Cambodia and Zambia have experienced the highest global percentage expansion in sugarcane area harvested in recent years, while Brazil has transformed itself into a major soybean producer and exporter. New trade relationships are being established between countries that have not typically been centres of trade and capital.

> ***"Biofuels and biomass today constitute two-thirds of the so-called 'renewable energy' consumed in the European Union (EU), with the remainder accounted for by solar, wind and hydroelectric power. The target of the European Commission is to generate, by 2020, 14% of all of the EU's energy from biomass, and to fuel 10% of all road transport with plant products. Most of the raw material needed to meet these targets will not come from waste – as is frequently claimed – but rather wood, crops and animals."***
>
> Winfridus Overbeek, Markus Kröger and Julien-François Gerber[1]

Financialisation

The emergence of flex crops is also importantly linked with the process of "financialisation,"[2] a term used to refer to the increasing penetration of finance capital into all aspects of life. The instability in global financial markets following the 2008 crisis has made investors eager to find new and stable investment opportunities. The food and agricultural sector has been one such outlet. Besides traditional speculation in financial futures markets for agricultural commodities, large financial investors such as pension funds and hedge funds (called 'institutional investors'), have increasingly bought farmland and shares in corporate flex crop plantations and processing facilities, motivated by expectations of high future food prices and growing demand for renewable energy.

Flex crops function as a flex-investment: a single crop sector can, in effect, stand in for a diversified product portfolio. This corresponds neatly with the preferred investment strategy of these types of investors (i.e. portfolio diversification) and allows them to speculate and gain leverage on the different uses of a crop (e.g. as biodiesel, detergent, or pharmaceutical). If, for example, turning soy into animal feed is expected to fetch a higher market value than its other potential uses, then production can be flexibly switched to the end-product that can bring in higher returns. Thus, as a growing amount of land switches hands and crops are targeted as investment opportunities; financial motives become increasingly significant in determining what crops are grown where, by whom and under what conditions.

Multiple-ness meets flexible-ness

Flex crops and commodities—which include but are not limited to oil palm, sugar cane, corn, fast-growing trees and soya—are characterised by their *multiple-ness* and *flexible-ness*. While most of these crops have actual multiple uses, new uses have emerged that were previously considered unfeasible due to lack of technological capacity or commercial viability. The multiple-ness of present-day crops builds on (or alters) their old uses, and creates new ones that respond to the dramatically increasing demand for alternative sources of energy and shifting consumption patterns. For example, soy traditionally has multiple food uses, but has seen an expansion in its use as animal feed: the feed market is now one of the largest sources of demand for the crop.

In other cases, product residues or by-products have acquired new value and new uses: bagasse, the fibre waste from the extraction of sugar is now used as animal feed and feedstock for bioethanol production.

Flexible-ness refers to the ease with which a crop can be transformed from one particular purpose to another feasible yet competing use. While this is, to an extent, dependent on the material attributes of the crop, flexible-ness also depends on the economic incentives and technological capabilities that exist to support crop use switching. To illustrate, the flexing of sugar cane from sugar to ethanol production in Brazil has been facilitated by the creation of a market that guarantees ethanol consumption and ensures the profitability of the sector (i.e. legal mandates to blend ethanol in petrol). Technologically, the development of agro-ethanol refineries has made it possible and increasingly cost-effective to produce ethanol from crops like sugar cane and corn.

Flexing as an accumulation strategy

For the capitalist firms that largely dominate the production and trade of flex crops, flexing represents a new accumulation strategy. It opens up new markets for expanded production, and offers the possibility to switch product lines (through crop use change) in favour of the commodity that can deliver the most profit. Cultivation of oil palm, for example, gives access to the markets for food, cosmetics, animal feed as well as the biodiesel market all at once. The diversity of possible markets in which the same crop can be sold helps companies to manage price fluctuations, since a flex crop can be turned, with relative

THE MAKING OF A FLEX CROP

Crops *become* flex crops where the material, social and economic basis exists to support this development. Firstly, a crop must possess biophysical attributes that allow it to be broken down and processed in multiple ways so as to expand its use. For instance, certain characteristics of palm oil as a raw material make it particularly amenable to blending and processing. This versatility is partly responsible for the extension of its use beyond food products, to include animal feed and most recently, biofuel and energy.

Secondly, the technology to convert a crop, or its by-products, into another form must be available or, at least, feasible—that is, there must be a market lucrative enough as to make it financially viable to invest in the necessary technology. The development of new technologies makes industrial-scale production possible or, in some cases, creates entirely new products. Agro-diesel refineries have made it possible to convert vegetable oils into agro-diesel fuel which can be used by cars and other vehicles. Meanwhile, other new technological developments are advancing, allowing, for example, for the creation of new kinds of plastics from wood and other plant biomass (e.g. sugarcane leaves and stalks, oil palm fronds, etc.) in complex and expensive bio-refineries, as well as the creation of high-density wood pellets from sawdust and other wood waste products.

Thirdly, a market that would afford a strong possibility of profitability must exist in order to nurture the development of flex crops and commodities. Flexing can be curtailed in commodities where the required technology is expensive, or where the risk on investment is high. As such, private sector involvement often depends on economic incentives in market pricing or in the form of grants, taxes, loans or subsidies.

ease, into the end-product that guarantees the highest profit. Flexing, in this sense, helps mitigate the risk associated with investing in a single crop.

It is perhaps not surprising that the emergence of flex crops is leading to industrial restructuring and dramatic reconfigurations in the production process: what is being produced, how, where, and by whom, and what happens to it after it is produced, is changing significantly. Since flexing expands the potential uses and markets of commodities, an even broader array of actors are implicated in the process, including bio-tech companies, car, food and energy industries, livestock companies, investment banks and institutional investors. Consolidation is occurring and new partnerships emerging in some of these industries as companies seek to corner an even bigger part of the flex economy. Mergers and acquisitions bring with them new business lines, new geographies of operations, and new configurations in the ownership of capital. Importantly, these lead to the concentration of economic power, leaving crucial decisions regarding the production and circulation of key crops and commodities in the hands of fewer firms.

In all of this, the state has been a critical partner. Trade and environmental policy, government support for research and development, and specific subsidy regimes helped create and stabilise the market for flex crops and commodities. The state is especially important in the expansion of the market for alternative energy. Through strategic interventions in the market for biofuels (e.g. mandatory blending laws), the state facilitates flexing and legitimises it as a strategy in the development of a low-carbon economy.

FLEX TREES

While historically trees have been used for a variety of purposes, flexing in the forest industry has increased both in intensity and scope. As with other flex crops, the emergence of flex trees must be understood in light of key changes in world energy demand and how this has evolved over time. While trees have been the first and primary fuel for humankind, the introduction of coal and hydro-carbons (i.e. oil and gas) in early industrialisation and during the industrial revolution has replaced wood as the dominant source of energy globally. Oil, gas and nuclear energy, for example, have in turns shifted society's reliance away from timber for fuel. This started to change at the turn of the current millennium, as growing concerns over resource depletion and fossil fuels' effects on the climate intensified the search for renewable resources and energy.

Flexing in trees occurs through the creation of *new uses* for traditional wood materials as well as through the cultivation of *new species* of trees that are more flexible. The significance of flexing is apparent in the growing role of wood in the construction and durable material sectors, as part of a bid to expand its industrial use. New uses have also been found for by-products or residues of the production process, giving them a secondary function. Pulping by-products, for instance, are now being turned into biodiesel for the transport industry instead of being burned off in pulp mills. In addition, facilitated by advances in technology (i.e. genetic engineering), tree species with flexible use are being increasingly favoured for cultivation, a break from previous industry practice of specialising in species best suited for pulp usage. Multi-use, flexible species allow for swift rotation, which has implications for the turnover of invested capital.

Opening up new uses gives access to new markets where timber products can be sold. Nowadays, aside from servicing the paper pulp industry, flex trees are increasingly finding their way into energy, biomass and carbon credit markets. As part of efforts to replace petroleum-based products with bio-based alternatives, wood is being re-positioned as a raw material for bio-refineries to produce biomass, following efforts by the oil and paper industry to develop new methods to turn wood residue into second-generation fuels[3]. However, as researchers have pointed out, "[r]eplacing fossil fuels with biomass would require taking over continent-sized land masses",[4] as significant amounts of wood, and land, are needed for this purpose.

Flex trees are also being cultivated as part of putative climate change mitigation strategies. With the development of the carbon market, owners of flex trees can opt to sell so-called carbon credits (i.e. pollution rights for other companies, offseting their emissions) instead of selling wood. However, this has mainly incentivised the further expansion of industrial tree plantations, rather than encouraging the use of natural forests as carbon sinks.

The role of the state

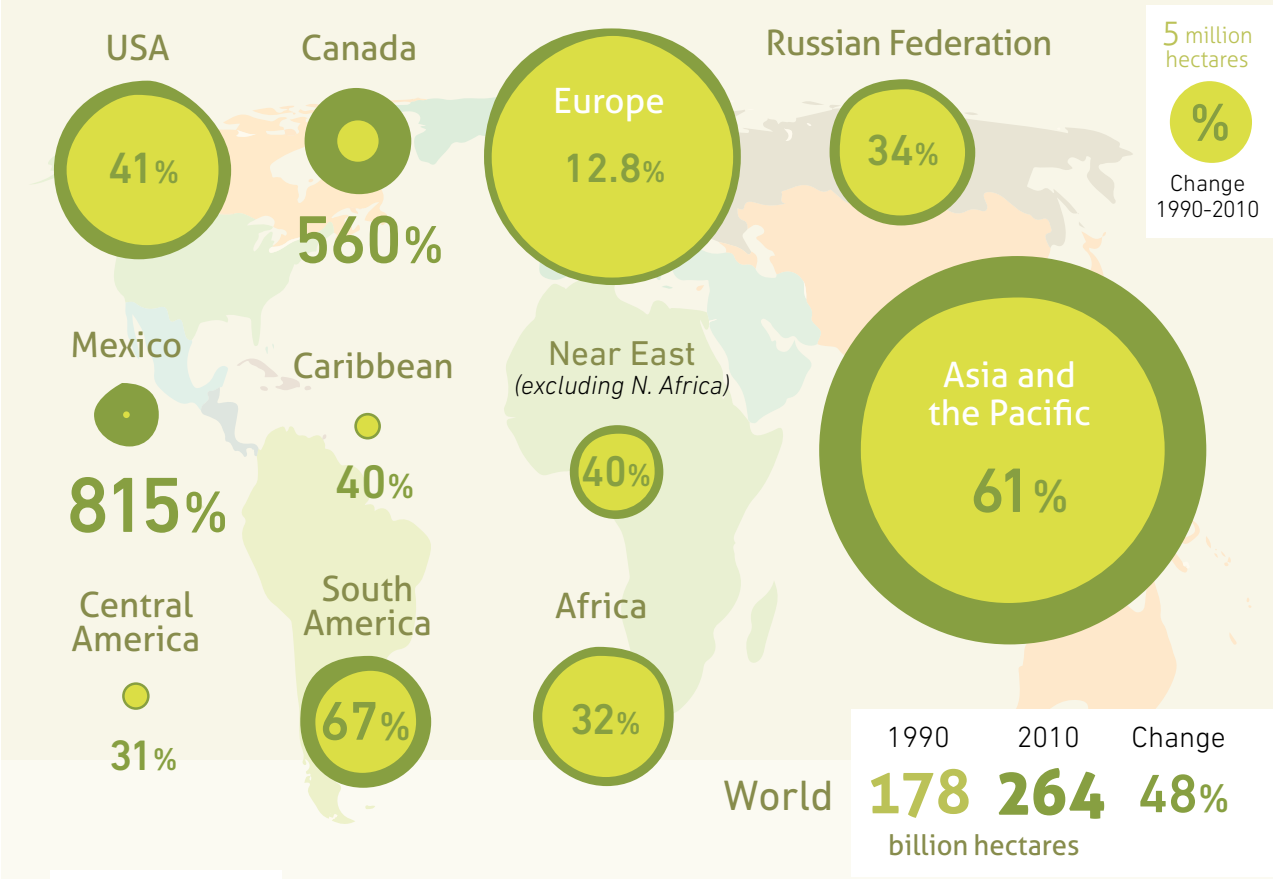
State support for flex trees takes the form of direct financing and state/regulatory policy measures. The EU's Renewable Energy Directive, which mandates member states to draw a percentage of their energy consumption from sources officially defined as renewable, has galvanised efforts to develop industrial-scale bioenergy. In line with this directive, supranational bodies like the European Commission have also mobilised funds to finance private sector involvement in wood-based energy. An example is the 170-million euro grant to UPM, the third largest paper producer globally, to build a bio-refinery in France. International climate policy has also effectively created the market for carbon offsets, and enabled tree plantations to enter this market. In countries like India and Brazil, this is being translated into policies that support the expansion of tree plantation area, putting pressure on land use. For example, the Green India Mission, which aims to increase India's tree plantation cover by 5 million hectares and improve existing cover in another 5 million hectares,[5] could potentially lead to the cutting of 'secondary' or 'degraded' forests to make way for tree plantations.

Corporate control over flexing

Flex trees are mainly cultivated in large-scale monocultural estates owned by large corporations. While timber is still mainly sourced from natural forests, the share drawn from plantations is rapidly increasing. This process is mostly corporate-driven.

The emerging market for flex trees is also incentivising cooperation between different industries that hope to profit from it. For instance, the paper and energy industries are embarking on biodiesel pilot projects to develop second-generation fuels from wood. This grouping includes companies like UPM (paper company), Fortum (energy company), Green Fuel Nordic (wood bio-oil company), Metso (world-leading producer of pulping machinery), Envergent Technologies (oil technology), and Billerudkorsnäs (world-leading packaging company).

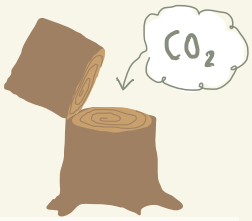
Infographic 1 'PLANTED FOREST' EXPANSION BETWEEN 1990 AND 2010 BY REGIONS



Source: Kröger 2012.[6]

Infographic 2

OVERVIEW OF TREE-FLEXING AND MULTIPLE-USE PATHWAYS, ACTORS AND DYNAMICS

Main pathways of flexing and multiple-use increase	Key products	Examples of some key forestry companies	Inter-industry merging with (and examples of companies linking up), and new players
Wood-based Energy  Biofuels	Second-generation wood-based **Biodiesel** **Ethanol** **Gas**	Fibria, UPM, MetsäFibre UPM, Fibria (wood-fuels) Metsä-Fibre (wood-gas)	**Energy** Chevron, Shell, Fortum **Machinery** Metso **Oil technology** Envergent Technologies **Detergent technology** UOP Honeywell **Energy and chemicals** Ensyn **Packaging** BillerudKorsnäs
⚠ Too large amount of wood ends up used as transport diesel, ethanol or gas, rather than more value-adding uses (e.g. bio-plastics, paint production)			
 Electricity and heating	**Wood-chips and pellets**	SUZANO PAPEL E CELULOSE Suzano (pellets)	**Coal and other power plants**
⚠ Stumps and other harvest residuals stripped from forests; intensifying wood collection leads to loss of biodiversity and carbon sinks			
 **"Carbon sinks"**	**Carbon credits** **Carbon storage** e.g. REDD, CDM schemes	PLANTAR Plantar (CDM)	**Steel industry** TP emission-compensation schemes, charcoal production
⚠ Fires, wood carbon ending in non-durable products, soil and water balance damaged, land taken from food production and other uses, biodiversity losses, increased harvesting, calculation errors			
 **Flexing tree species** GM trees etc.	**More adaptable, productive or flexible-use tree species**	SUZANO PAPEL E CELULOSE Suzano (GM and hybrid trees)	**Glyphosate and fertiliser-producers** **GM companies**
⚠ Ends up supporting monoculture tree plantation or problematic GM-tree expansion; flex tree may be engineered to use more water and nutrients, grow faster, and expand to areas where they displace food production or native biomes			
 **Paper, cardboard and other timber products replacing fossil fuels**	**New construction materials** e.g. wood-plastic composites **Industrial materials** e.g. cross-laminated timber **Pulp-based textiles replacing polyester** **Biochemicals in medicines, paints, foods** **Bio-plastics**	UPM, storaenso UPM, Stora Enso	**Construction industry** **Automobile industry** **Textile producers**
⚠ Risks, possible problems and conflicts Source: Kröger 2012.[7]	⚠ Conflict with non-renewable industries (cement, chemical, oil, plastic and metal producers); conflict with those wanting to use trees for energy, carbon storage and conventional paper products		

SOYBEANS

While soy remains an important food item in China (its main market) e.g. as tofu and soy sauce, the consumption of soy has shifted from food to feed: China's livestock industry, where imported soybeans are used as animal feed, is now its largest source of demand. This shift has its roots in the reform era, post-1978, that pushed to modernise diets through increased meat intake, especially by wealthier urban residents. A mix of market reforms and government subsidies during this period led to a boom in the country's livestock feed industry, of which soybean is a critical component.

Soy's co-products, soybean meal (mainly used in livestock feed) and soybean oil (mainly edible oil) are presently the key drivers of the soybean complex boom (see Infographic 3). Given soy's success as animal feed, new potential uses are also being pursued. Agribusiness giants like Monsanto and Cargill are pushing to extend (genetically-modified) soy's use as fish feed, a move that raises concerns regarding its potential environmental and health impacts.[8]

Soy's key geographies

China and Brazil are two key locations in the global soy complex. While soy has a long history of use in food and farming systems in China, spanning millennia, Brazil's emergence as a major soy producer and exporter is far more recent. Soy was initially used as a non-food cover crop in Brazil and later expanded to serve the vegetable oil and livestock feed industries. With the boom in soy production in the 1990s, the soybean crushing industry moved to expand the uses of soy, notably as biodiesel and as a food additive. Soy-based biodiesel production in Brazil absorbed about 10 per cent of Brazil's soybean production in 2013. While still incipient, biodiesel is quickly becoming one of soy's most significant markets after livestock feed.

China's large-scale demand for soybeans is a key driver of the global soy market: China stands as the largest consumer and importer of soy. Domestic consumption is also higher than at any other point in history. To cater to this demand, new geographies of production have emerged resulting in a dramatic increase in soybean production globally. Over the past 60 years, global production grew by almost 1000 per cent, while the land area dedicated to soy cultivation has quadrupled.[9] As of 2007, South America's Southern Cone accounts for 57 per cent of the total world soybean exports.[10]

Corporate control over flexing

The control of soy production and trade is highly concentrated in the hands of large agro-industrial processing and commodity trading companies. This includes companies like ADM, Bunge, Cargill and Louis Dreyfus. Within China, foreign companies control a large share of the production and trade of soy beans, particularly US-based companies that already dominate the global soy trade. The penetration of foreign firms in China's soy market came about when many Chinese firms were forced into bankruptcy in 2004. However, domestic agribusiness firms like the Beidahuang Group, a state-owned enterprise, remain some of the most powerful flexors within China. Through increasing state support for domestic and state-owned enterprises, Chinese firms are seeking to capture a bigger part of the market both at home and abroad.

In Brazil, major companies like Sadia, Perdigão and Ceval were the key domestic players in the soybean market until the 1990s. These companies also dominated the poultry and pork markets, which drove the demand for soybean crushing (for livestock feed) domestically. From the 1990s onwards, with the opening up of markets in Latin America's Southern Cone, and the entry of large players like ADM (Archer Daniels Midland), Bunge, Cargill and Dreyfus (collectively called ABCD), Brazil's leading agro-food industries were quickly acquired.[11] The acquisition of Ceval, Santista, Incobrasa, Gessy Lever and Sadia transferred control of a significant part of the domestic market to transnational firms.[12]

The role of the state

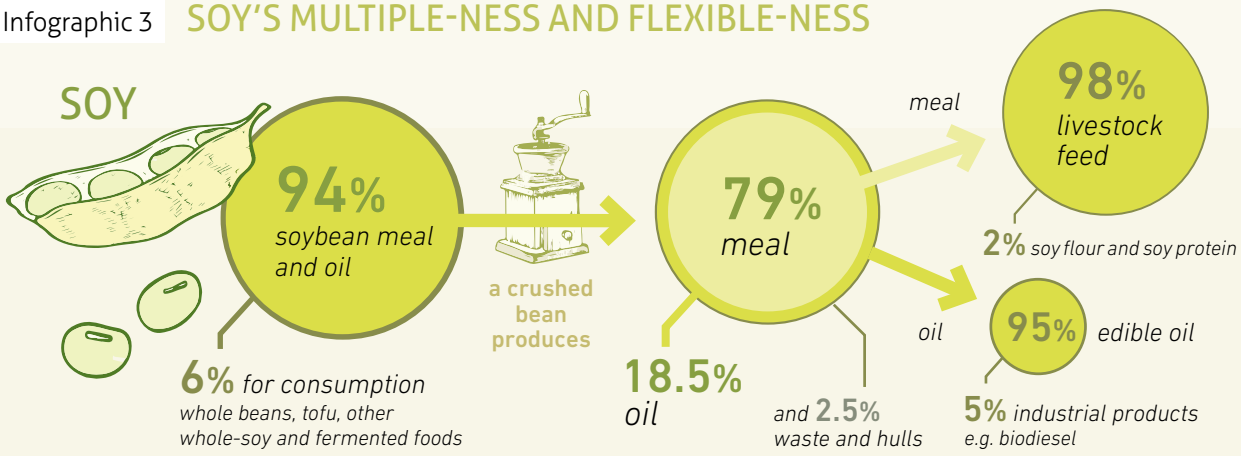
The Chinese government's support for domestic and state-owned firms is apparent in its import strategy which focuses on whole, unprocessed soybeans in order to leave the crushing and processing to the local industry. Following the bankruptcy of a number of local companies in 2004, the state has had a strong role in the local industry's recovery through a number of interventions including: i) a ban on foreign ownership in the soy sector; ii) financial support for domestic firms; iii) price-setting for soy produced locally; and iv) the creation of a soybean futures market.[13]

In Brazil, the state has assumed a central role in the biodiesel market. With the establishment of the National Program for the Production and Use

of Biodiesel (PNPB) in 2004, the government controls the mixing mandate for biodiesel and guarantees the consumption of 80 per cent of what is produced.

Moreover, through state-owned Petrobras, the state is also directly involved in biodiesel production - a market that Petrobras dominates.

Infographic 3 SOY'S MULTIPLE-NESS AND FLEXIBLE-NESS



Source: Oliviera and Schneider 2014.[14]

SUGAR CANE

"Sugar"cane is a crop with multiple uses, including food and non-food purposes. It is used mainly in sugar production through the extraction of sucrose as raw material. Products that can derive from the process of sugar cane refining include molasses and rum, as well as steam energy from burning the fibrous residue of cane stalks (bagasse).

More recently however, there have been intensified efforts to further expand and flex its use in fuel generation and as animal feed. Ethanol, one of the most complex derivatives produced from the fermentation of sugar, is increasingly used as a liquid fuel. The use of bagasse as solid fuel for both electricity and gas generation has also accelerated. Other parts of the cane stalk previously considered 'waste' are now put to use as fuel, fertiliser, or feed. Thus, as with other crops, flexing in the sugar cane industry involves the creation of new and flexible uses to maximise profits from every stick of cane produced. Flexing allows sugarcane mills to switch product mixes (see Infographic 4), depending on the expected revenue from different end products.

Geography of sugar cane flexing

Sugar cane is the world's largest crop, amounting to 2.16 billion tonnes in production weight in 2013.[15] It is indigenous to tropical regions and is widely cultivated in over 90 countries.[16] In recent years, the total area of sugarcane harvested globally has increased at an

Infographic 4 BRAZIL'S BLEND RATIO AND THE 'FLEXING' PROCESS

For 2013/14, the ex ratio was 48 per cent sugar and 52 per cent ethanol. In the production process, sugarcane is first crushed into a sugar-rich juice – this is the most expensive part of the operation. Next, sugar is produced through crystallizing and centrifuging the juice, with the leftover molasses then being fermented and distilled to produce ethanol.

Flexing is made possible by extracting less sucrose from the juice and thereby leaving more available in the molasses. One important consequence from co-producing sugar and ethanol is that it extends the milling season and thereby allows for greater use of their fixed capital. This is because the total sugar content of cane remains relatively high at the beginning and end of the season, despite a decline in sucrose content.

Source: McCay et. al. 2014.[17]

unprecedented rate: from 2005 to 2013, it grew from 19.7 million hectares to 26.5 million hectares, an increase of 26 per cent.[18] The largest expansion took place in Brazil, the top sugarcane producer, as the country embarked on an aggressive drive to 'flex' its production processes. Southern Africa and Southern Asia, similarly, have been important zones of expansion, as transnational companies, with the support of states, sought to flex their activities into ethanol and energy production in these regions.

As multiple uses are created for sugar cane, larger swathes of land are needed to carve out an even greater share for its production. In Brazil, this has led to land use change, replacing land previously dedicated to livestock and agriculture production. But the consequences of flexing are not restricted to sugar cane producing territories. A concrete example is the drop in Brazil's sugar exports in 2007 and 2008 as it shifted its sugar cane harvest to production of ethanol. This export gap resulted in a price increase in sugar, creating a powerful incentive for other producers in other countries to step in. Geographically, therefore, the effects of flexing can spill-over into new spaces, especially given the global market dynamics in which crops like sugar cane are embedded.

The role of the state

The state has been pivotal in both creating and managing the market for sugar cane flexing. Through a combination of subsidies, credit extension and tax exemptions, the Brazilian state actively promoted an ethanol-based fuel economy in Brazil. State credit, funneled through the state-owned Brazilian Social and Economic Development Bank, provided financing for the sugar-ethanol industry, among other credit lines to promote its growth. Despite the now deregulated fuel pricing, ethanol-use mandates by the government that alter the blend ratio for fuel are an important mechanism by which sugar cane prices are stabilised. In terms of taxation policy, flex-fuel vehicles — those that utilise gasoline, ethanol or a combination of both — have benefitted from favourable tax rates over their gasoline-powered counterparts. State policy and a conducive regulatory environment have effectively guaranteed the success of sugarcane flexing in Brazil.

In Africa and Asia, the expansion of sugar cane flexing is also state-backed, if not state-orchestrated. In South Africa, for example, the country's 'Bio-Economy Strategy' created demand for second generation biofuels (e.g. from sugarcane bagasse), a market that large corporations are expected to dominate due to the required scale of investment. In Southeast Asia, regional giants like Mitr Phol and KSL Sugar are expanding operations in Cambodia through state-backed land concessions. Estimates suggest that over 100,000 hectares have already been allotted for sugarcane cultivation.

Corporate control over flexing

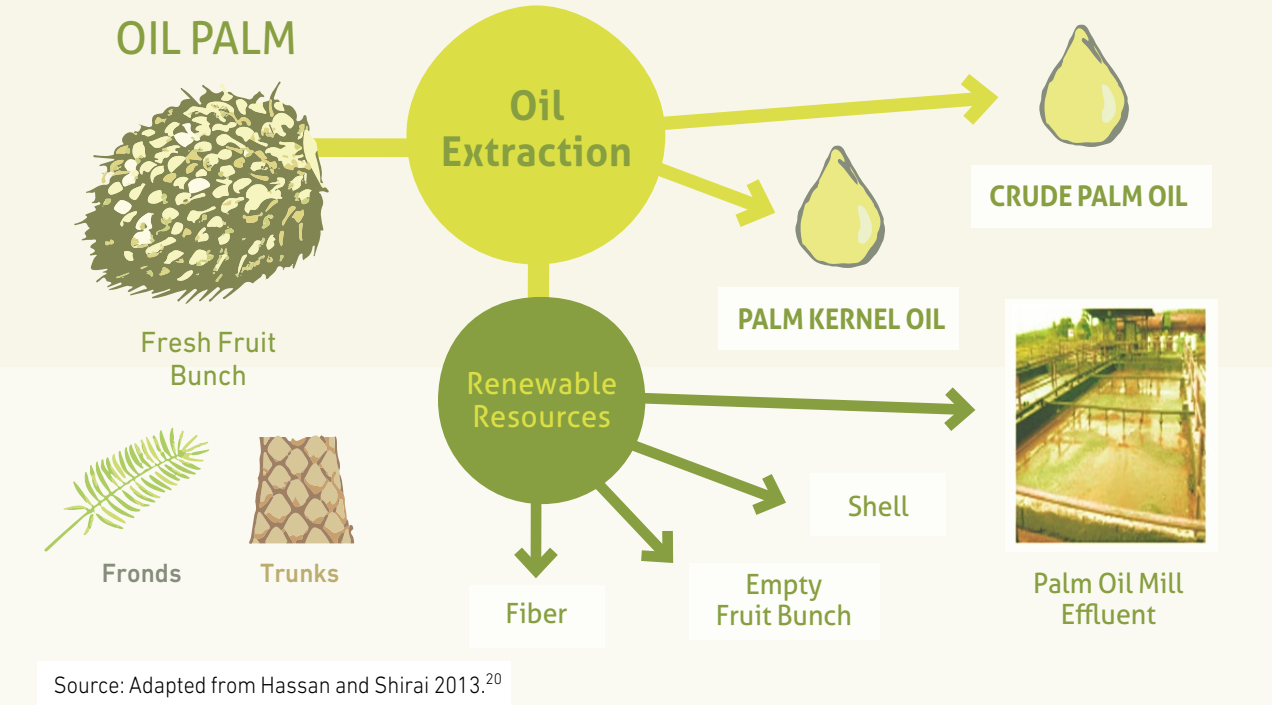
Brazilian sugarcane is primarily in the hands of large and predominantly foreign corporations. From a mere 3 per cent in 2006, foreign capital's share of the sugarcane market shot up to 33 per cent by 2012.[19] In terms of market share, just seven milling groups are responsible for 55 per cent of all sugar cane production. Since larger capital investment is required to produce multiple products, milling groups have turned to mergers and acquisitions. These boost companies' capacities to flex as they bring in expertise and further a process of vertical integration that guarantees access to fuel distribution infrastructure. In the process, competing firms, including family-run businesses and cooperatives, have been dissolved or taken over, concentrating market power and flexing decisions in the hands of a few highly capitalised firms.

OIL PALM

While oil palm is a crop that has multiple uses, flexing in the sector is still in the 'anecdotal phase'. Oil palm is mainly used as oil seed, although new uses are being developed to increase the possible uses of biomass in the future. It is also being positioned as a crop with lucrative flexing possibilities, especially in the area of renewable energy.

Oil palm's multiple uses rely mainly on the extraction of crude palm oil and palm kernel oil from its oil seed. Palm oil, produced from crushing the pulp, is extensively used and consumed in processed foods, cleaning products, cosmetics and fuel. Palm kernel oil and its by-product, palm kernel cake (the pulp residue after the oil is extracted from the kernel), on the other hand, are used mainly in soap, detergents and animal feed (see Infographic 4). Aside from this wide range of palm-based products, new uses are being developed for the biomass from the oil palm, which includes oil palm fronds, fruit husks, palm kernel shells, and liquid waste from palm oil

Infographic 5 MULTIPLE USES OF OIL PALM AS AN OILSEED AND AS BIOMASS



Source: Adapted from Hassan and Shirai 2013.[20]

mill effluent (POME). Through advancing technologies, new pathways for flexing are made possible, potentially turning oil palm and its by-products/co-products into sources of bioenergy, biofuel and biomaterials.

The role of the state

State actors and agencies play a vital role in the flexing of oil palm and in facilitating further flexing. Initiatives like Colombia's 2008 National Biofuel Policy and Malaysia's National Biomass Strategy provide some clear examples of how state policy can create the conditions for private enterprises to flex by creating demand for food, biodiesel and other non-food uses of palm oil. Aside from domestic policy, international trade policy is also an important tool through which countries like China, which is a major consumer of palm oil products and by-products, has driven the cultivation of oil palm in countries like Indonesia and Malaysia. Moreover, states help to promote the multiple uses of oil palm by emphasizing their alleged importance in addressing food and energy security and climate change.

Corporate control

A wide range of corporate actors are involved in oil palm's production, processing and trading. Some of the largest corporations that sell or trade consumer goods and agricultural produce, such as Unilever and Cargill, are well positioned to control flexing. Cargill, for instance, is deeply involved in the oil palm value web: it owns plantations, crushing mills, and shipping lines (via subsidiaries); is a major player in the production, transformation and circulation of oil palm; and is able to flex its intermediate and end-products. Companies from China (e.g. Julong Group) and other emerging economies are also some of the competing firms that are seeking to gain a greater share in oil palm's value web, although it remains to be seen whether these companies will move into further diversifying oil palm's multiple uses i.e. into biomass production. One means through which oil palm companies have begun to 'upgrade' into flexing is by financialising their activities, leveraging financial tools like land securitisation.

IMPLICATIONS OF FLEXING

Food (in)security

Despite its purported objective of contributing to food security, flexing could in fact have the opposite effect. Since flexing frees companies from having to pre-determine the type of product to be produced and the market where the product will be sold, they are able to flexibly switch depending on price signals. This implies that crops can be shifted from the food to the fuel market if the price favours selling to the latter, which could undermine the reliability of the food supply. Moreover,

with the ongoing trend towards centralisation of production through mergers and acquisitions, an even narrower band of companies are positioned to dominate the flex economy and with it, the supply of key food crops.

False climate solutions

The emerging green economy is determining new sites of profiteering that are not necessarily compatible with 'greening'. Carbon sequestration programmes and wood-based energy alternatives are, if anything, encouraging the expansion of plantations rather than using (and conserving) natural forests. The expansion of (industrial) tree plantations has been shown to have led to new forms of enclosures and dispossession, as well as having negatively impacted soil/water quality and biodiversity.[21] Similarly, in the case of soy-based biodiesel, its purported benefit as a renewable energy source is belied by the total carbon emissions generated in its production and the environmental degradation that arises from production operations. Indeed, the production of flex crops (such as sugar cane, oil palm, corn and soy) and trees relies on increased use of agro-chemicals and water.

Competing interests over land/resource use

For industries implicated in flexing, competing interests in land and resources are emerging. For instance, the forest and energy industries' interests in using forest trees as sources of alternative energy and building material stand in conflict with agribusiness' interest in clearing forests. For these industries, the utility of land, trees or forests are assessed in terms of their best use as food, feed, fuel, or industrial material, overriding some of their other functions (e.g. as sources of non-wood products, forest-based foods) and other potential uses. As demand for prominent flex crops like sugar cane, maize, and oil palm surges, new frontiers are sought to respond to this demand. In Brazil, the demand for sugarcane has resulted in an appreciation in land prices, undermining efforts to buy back land for the resettlement of indigenous people and landless peasants, and squeezing out traditional agrarian livelihoods. Flexing could thus foment or intensify struggles over land and other resources.

Genetic modification

Flexing relies on the development of technologies that could expand crop use, including modifying a crop's genetic make-up to suit the requirements of flexing operations. This is being undertaken in trees, seeds and in industrial fermentation, raising issues of food quality and safety.

IMPLICATIONS FOR SOCIAL MOVEMENTS AND POLICY ADVOCACY CAMPAIGNS

New research agenda

Research on the emergence of flex crops and commodities is still in its early stages and the process (flexing) itself is still unfolding, leaving much room for further empirical study. Much still needs to be done to unpack how flexing happens in a range of different crops, the key players involved, and the new emerging geographies of production, among others. Future studies are also needed to investigate the role of flexing in land and resource grabs, its effects on farmers and plantation and industrial workers, and its socio-ecological consequences. This may also entail employing new concepts, methodologies and analytical lenses that are attuned to these dynamics.

VALUE CHAIN VERSUS VALUE WEB

Value chain approaches capture the organization of commodity production, often conceptualized as linear arrangements of material transformation and product flow. Under the flex economy, production resembles a value 'web', with a cluster of industries, suppliers and collaborators that correspond to the multiple product lines pursued in a single crop sector.

Recalibrating advocacies and campaigns

The flex economy can be complex in its operations, especially with transnational companies increasingly operating beyond their conventional sectors and drawing in a broader range of actors, from smallholder producers to traders and investment banks. For activists and researchers, this presents new challenges, requiring new ways of thinking that transcend conventional sectoral framing and campaigning.

The narrative surrounding flex crops rests on the idea that food and energy security is best achieved through an agro-industrial system of production. With its claims of efficiency, economies of scale, and innovation, this system is put forward as superior to alternatives. Part of the task of activists and researchers

is to challenge these myths (e.g. by highlighting the tenuous links between flexing and meeting the world's food needs) while advancing alternative solutions (e.g. smaller-scale, diversified farming systems as opposed to large-scale industrial production).

Addressing dominant narratives about flex crops also implies coming to terms with the limitations of certain research approaches (e.g. commodity supply chains/ value chains) and actions (e.g. boycotts of particular products). Given the breadth and fluidity of flexors' operations a single field of oil palm in Indonesia becomes, for example, linked with the fate of a dozen industries and commodities (cosmetics, food additives, animal feed, fuel markets, plastics manufacturing, etc.), undermining the impact of single-issue campaigns (such as those targeting biofuels). This makes the case for strengthening links and building coalitions between organisations that work in diverse but increasingly interlinked issues; and for re-scaling/re-framing campaigns so as to reach out to broader constituencies. 'Multi-frame, transnational, multi-constituent coalitions' could be explored as a potentially more effective way of organizing in the face of the increasingly multiple and flexible dynamics driving and shaping the development of flex crop economies around the world.

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The views expressed herein are those of the authors and the Hands on the Land network and not necessarily those of the EC.

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Agroecology by the Filipino painter ***Boy Dominguez****, 2013*

TNI Think Piece Series on Flex Crops & Commodities

The convergence of multiple crises (food, energy and fuel, climate and financial) in the midst of the rise of newer hubs of global capital (BRICS countries and some middle income countries) – and the various responses to these by states and corporations – have paved the way for the emergence of 'flex crops and commodities'. Flex crops and commodities are those that have multiple and/or flexible uses: food, animal feed, fuel, and other commercial-industrial uses. In fact the contemporary global land rush is intertwined with the rise of flex crops and commodities: sites of large-scale land deals tend to be sites of expansion of production of these crops and commodities, e.g. soya, sugarcane, palm oil, corn, cassava, industrial trees. What are the implications of this phenomenon for how scholars, civil society and grassroots social movements undertake 'engaged research', public actions and policy advocacy around agrarian justice issues? The issues are compelling and urgent, yet still largely under-researched. TNI is launching the TNI Think Piece Series on Flex Crops & Commodities to jump-start collaborative action and a critical dialogue between engaged academics, civil society and grassroots movement activists on this issue.

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Many crops have several uses, some have dozens. Crops like corn and oil palm have for centuries been used as the basis for feed, fiber, alcohol, and energy production, as well as serving as a staple source of food for cultures growing them. However, new uses for crops, and new economies around these uses, are emerging today. Mediated by concerns around food and energy security; climate change; rising demand for natural resources and commodities from emerging economies; and the search for alternative financial investments, classic crops like corn, sugarcane, and soy, among others, and their by-products are now being produced, circulated and consumed differently—a difference that needs to be better understood and accounted for more fully. Understanding this transformation is important for combating the new social and environmental harms that arise from this mode of production.

Keywords: flex crops | flex commodities | oil palm | soy | flex trees | sugarcane