GIGA Focus
German Institute of Global and Area Studies
Leibniz-Institut für Globale und Regionale Studien

Number 5
2014
ISSN 2196-3940

Food or Fuel – The Role of Agrofuels in the Rush for Land

Kerstin Nolte, Martin Ostermeier and Kim Schultze

The production of agrofuel crops is believed to be playing a decisive role in the so-called "land rush," the international scramble for arable land in developing and emerging countries. Reports of an alarming wave of land acquisitions due to "agrofuels hype" initiated by agrofuel investors have made headlines in recent years. The potential merits and dangers of agrofuel production are the subject of heavy debate, with food-security concerns and environmental impacts fueling the controversy.

Analysis

Based on data from the Land Matrix Global Observatory, our analysis assesses the role of agrofuel production in the "rush for land" and sheds light on the often-nontransparent investment process of agrofuel projects. We find that these projects account for an important share of the global demand for land. However, the "agrofuels hype" is over. Land deals with the intention of cultivating agrofuel crops are particularly prone to failure, especially early on in the projects. We expect that the investors that have survived this first period of investments are here to stay, and that "cowboy investors" have been turned off by difficult investment environments in low- and middle-income countries.

- Agrofuel production is one of the main drivers of the global rush for land. Twenty-three percent of the concluded transnational deals currently recorded in the Land Matrix include plants intended for agrofuel production.
- Sub-Saharan Africa appears to be the most heavily favored region for agrofuel investments.
- European investors top the rankings of investor countries for agrofuel projects.
- Agrofuel crops require huge initial investments and take several years to yield returns. In difficult investment environments, agrofuel projects require experienced and serious investors in order to be successful.
- Jatropha projects have a particularly high record of failure.

Keywords: agrofuels, biofuels, jatropha, Land Matrix, large-scale land acquisitions, land grabbing

INTERNATIONAL EDITION English

open access

Agrofuels and Large-Scale Land Acquisitions

Agrofuel production[1] is a truly global phenomenon. The increase in agrofuel production – from jatropha in Africa, oil palm plantations in Southeast Asia, and soybeans or sugar cane in Latin America to rapeseed or maize in Europe – has affected the livelihoods of people all over the world.

The importance of agrofuel production continues to grow, with worldwide agrofuel output increasing by 70 percent between 2007 and 2011 (from 1.1 million barrels per day (mb/d) to 1.9 mb/d). Global agrofuel consumption has grown even faster, and almost doubled within the same period, from 0.99 mb/d to approximately 1.8 mb/d (EIA 2013). This is not overly surprising, given that national governments and international organizations support and heavily subsidize the agrofuels sector. The European Union member states, for instance, have set an ambitious target of 20 percent of energy coming from renewable resources by 2020 (European Commission 2009).

Agrofuels are seen as an effective measure to reduce carbon dioxide emission and lessen the dependency on fossil fuels. These are produced from grown biomass and are therefore classified as renewable energies. Many of these crops are flexcrops since they are commonly used as both food and fuel. For farmers and investors this flexibility reduces the price volatility risk because they can choose the best commercial channel for their product. The agrofuel industry might also offer great opportunities for developing countries as a whole in terms of increasing trade flows, developing the agricultural and industrial sectors, creating jobs and, consequently, increasing national income.

However, agrofuel production is heavily contested, for several reasons. First, huge areas of land are required, although estimates in this regard vary. The International Energy Agency has calculated that the proportion of total arable land used for energy crops will rise from 2 percent today to 6 percent in 2050 to satisfy the global demand (IEA 2011: 26). In an earlier assessment, the corresponding figure for meeting the predicted demands of the EU was estimated at between 4 and 18 percent of total agricultural land in the EU countries (European Commission 2006: 6). This explains why the rise in agrofuel production is directly linked to the phenomenon of large-scale land acquisitions. In fact, the rising demand for agrofuels has been cited as one of the main determinants of "land grabbing" (Schoneveld 2014; World Bank 2010: 15).

Second, energy crops are in direct competition with food crops. There is concern that by affecting prices, a shift away from food towards fuel crops will have significant impacts on land use and food security beyond the countries in which agrofuels are grown (World Bank 2010). This holds particularly for developing countries. The potential to increase agricultural areas is perceived to be highest in developing countries, particularly in sub-Saharan Africa. It is not only the aggregated land area acquired that matters, but also the quality and location of that land. Despite frequent claims of acquirers that they only target "marginal land" (for example, for planting jatropha, an inedible oilseed-bearing shrub praised for its alleged ability to generate high yields on marginal land), this is rarely the case. Instead, these acquirers often compete with smallholders for the best land with regard to soil fertility, access to water for irrigation, preexisting infrastructure and the proximity to markets (Cotula 2013: 47). This process threatens food security; in particular, the countries that are most vulnerable to famines experience conflict within and between local communities and governments that lose access to land.

Third, the efficiency of agrofuels as a means to reduce greenhouse gas emissions and thereby mitigate climate change remains a highly controversial issue. In fact, when we look at the whole life cycle of agrofuels, the emissions might be even greater than the savings achieved from their use. When assessing the energy balance of agrofuels, researchers have stressed the importance of integrating by-products in the analysis. Especially for ethanol fuels, the by-products (for example, dried distiller grains with solubles, corn gluten feed, and corn oil) might offset energy savings (Farrell et al. 2006). Moreover, large farmland investments could lead to indirect land use change, thereby leading to environmental degradation, with scarce water resources and soils being depleted.

What Do We Know about Agrofuels Deals?

Generally speaking, there is insufficient and imprecise data on the scope and impact of agrofuels

1 The terms biofuels and agrofuels are often used interchangeably. We have opted to use the more neutral term, agrofuels, by which we understand fuels produced from energy crops including agricultural and agro-industrial by-products.

projects. Agrofuels have long been praised as a sustainable solution to meet the growing demands of global energy-consumption. However, following a number of reports about the "agrofuel hype," reports on failed projects have accumulated over the last years. Examples include the African Biodiversity Network 2010 report on Ethiopia, Habib-Mintz (2010) on Tanzania, Wilkinson and Herrera (2010) on Brazil, and Colbran and Eide (2008) on Indonesia. These reports motivate us to take a closer look at the role agrofuel projects play in the "rush for land" and ask whether the agrofuel boom is over.

Our analysis is based on data from the Land Matrix Global Observatory, a global and independent land monitoring initiative with the goal of promoting transparency and accountability in decisions over land and investment in low- and middle-income countries. The database is regularly updated and collected from a variety of sources, such as research papers, policy reports, official government records, company websites, and media reports. Furthermore, the Land Matrix uses its global network and feeds in information from country experts and individual users (crowdsourcing). [2] The data presented here is from 2 June 2014.

The Land Matrix currently contains information on 274 concluded land deals with the stated investment intention of "agrofuels." Of these, 190 involve foreign investors and the remainder concern domestic actors only. Agrofuel projects account for 23 percent of the total area of 956 concluded transnational deals (covering 36 million hectares of land) currently recorded in the Land Matrix. The following analysis considers transnational deals only and focuses on "pure" agrofuel deals. These are cases in which the investor clearly states the project's objective to be the cultivation of crops for further use in fuel or energy production. Only counting such deals may be considered as a lower bound estimate of actual agrofuel crop cultivation, as many crops cultivated for "mixed" intentions (often cases in which crops have multiple uses, such as sugar cane for sugar and ethanol production) may eventually end up being used for energy and agrofuel production.

2 See <www.landmatrix.org>. This initiative is coordinated by five core partners: GIGA German Institute of Global and Area Studies, Centre de Coopération Internationales en Recherche Agronomique pour le Développement (CIRAD), the Centre for Development and Environment at the University of Bern (CDE), Deutsche Gesellschaft für Internationale Zusammenarbeit GmbH (GIZ), and the International Land Coalition (ILC).

Negotiating Agrofuel Projects

A number of insights on the role of agrofuels in the rush for land can be drawn from Table 1, which contrasts pure agrofuel, mixed and other deals according to their negotiation status. The Land Matrix data shows that "pure" concluded agrofuel deals account for an important share of all deals, with 3.8 million hectares under contract (approximately 12 percent of the total area under contract). Including "mixed" deals (4.4 million hectares under contract) increases the share of agrofuels to almost 23 percent. Further, the discrepancy between intended size (that is, the size of deals as typically announced initially by a company or reported by the media) and the size of area under contract becomes clearly visible. This discrepancy is greatest in relative terms for "pure" agrofuel deals: the intended size is more than twice the size under contract. This could imply that (probably overambitious) agrofuel projects turn out to be much smaller once they are confronted with the reality of the agricultural sector.

Most notably, the bottom row of Table 1 shows that "pure" agrofuel deals account for a considerable share of failed deals. More specifically, 25 of 163 agrofuel deals failed, covering an intended investment area of 2.4 million hectare. Hence, pure agrofuel investments are more likely to fail compared to the overall number of deals within each investment intention. Moreover, the majority of agrofuel deals tend to fail at an early stage of the investment process – that is, during the negotiation process. Of the 25 failed "pure" agrofuel deals, 23 never featured a signed contract and two failed after a contract had been concluded. For non-agrofuel deals, the share of those deals that fail during negotiations is much smaller (52 percent).

Who Are the Investors?

The Land Matrix data in Table 2 shows the top-10 investor countries for "pure" agrofuel and "mixed" deals ranked by the amount of land under contract. Agrofuel projects seem to particularly attract foreign investors from industrialized countries. Six of the top-10 investor countries for "pure" agrofuel deals are from high-income countries (according to the World Bank classification): the Netherlands, Great Britain, Canada, France, Italy and Spain. While European countries dominate the list, Ma-

Table 1: Pure, Mixed and Other Deals according to Negotiation Status

	"Pure" Agrofuel Deals			"Mixed" Deals with Agrofuel			Other Deals		
	Number of Cases	Intended Size of Area in million ha	Size of Area under Contract in million ha	Number of Cases	Intended Size of Area in million ha	Size of Area under Contract in million ha	Number of Cases	Intended Size of Area in million ha	Size of Area under Contract in million ha
Concluded Deals	98	7.8	3.8	92	6.0	4.4	766	45.9	27.8
Intended Deals	40	1.6	n.a.	15	2.0	n.a.	136	11.3	n.a.
Failed Deals	25	2.4	0.0	7	0.2	0.1	46	2.7	1.7

Source: <www.landmatrix.org>, data as of 2 June 2014.
Note: For a further 22 pure or mixed agrofuel deals the negotiation status is unclear.

Table 2: Top-10 Investor Countries for Pure and Mixed Deals

	"Pure" agrofuel deal			"Mixed"deals with agrofuel		
	Investor Country	Investor Region	Size under Contract (ha)	Investor Country	Investor Region	Size under Contract (ha)
1	Netherlands	Europe	904,700	United Kingdom	Europe	796,905
2	United Kingdom	Europe	726,419	Singapore	Asia	656,294
3	Malaysia	Asia	479,178	India	Asia	584,332
4	Canada	Americas	276,437	Malaysia	Asia	430,194
5	France	Europe	230,000	Hong Kong	Asia	421,310
6	Republic of Korea	Asia	206,661	Saudi Arabia	Asia	250,000
7	Italy	Europe	176,849	South Africa	Africa	206,103
8	China	Asia	172,789	Portugal	Europe	161,000
9	Romania	Europe	130,000	Zimbabwe	Africa	150,000
10	Spain	Europe	65,273	Switzerland	Europe	126,800

Source: <www.landmatrix.org>, data as of 2 June 2014.

laysia is also an important player in agrofuel cultivation, as are investors from South Korea, China and Romania (also worth mentioning is South Africa, which is ranked 11th). South African investors are involved in several large-scale agrofuel projects in countries such as Zambia and Zimbabwe, with stakes in various agrofuel projects in Mozambique. For "mixed" deals, Great Britain, which also plays a prominent role in the agrofuel sector, tops the list, followed by mostly Asian investors: Singapore and India, Malaysia, Hong Kong and Saudi Arabia.

What Are the Target Countries?

Table 3 sheds light on the target countries. Brazil ranks first due to its bioethanol-promoting policies, strong expertise on refining technologies, incentives for international and national investors, and high local and international demand for agrofuels. Augmented since the start of the global financial crisis in 2008, foreign investment to produce ethanol from sugarcane, also for export, has come from Japan and Europe, but mostly the Americas and the USA and Canada. Sub-Saharan Africa appears to be the most favored region for agrofuel investments, with six countries representing almost half of the total land under contract among the top 10. Following Brazil, Madagascar is the second-largest provider of land to foreign investors for agrofuel production, while Sierra Leone and Ethiopia head the list for "mixed" deals. Among Asian countries, Indonesia – which is well known for its extensive palm oil plantations – stands out as the prime target country for agrofuel deals, ranking third on the "pure" agrofuels and first on the "mixed" deals target-country list.

Table 3: Top-10 Target Countries for Pure and Mixed Deals

	"Pure" agrofuel deal			"Mixed" deals with agrofuel		
	Target Country	**Target Region**	**Size under contract (ha)**	**Target Country**	**Target Region**	**Size under contract (ha)**
1	Brazil	Americas	896,307	Indonesia	Asia	1,066,150
2	Madagascar	Africa	569,558	Sierra Leone	Africa	817,726
3	Indonesia	Asia	400,000	Ethiopia	Africa	444,800
4	Senegal	Africa	207,500	Ghana	Africa	421,808
5	Burkina Faso	Africa	200,000	Papua New Guinea	Oceania	390,286
6	Ethiopia	Africa	175,400	Mozambique	Africa	232,093
7	Kenya	Africa	160,000	Liberia	Africa	220,000
8	Papua New Guinea	Oceania	135,178	Zambia	Africa	206,103
9	Lao People's Democratic Republic	Asia	134,361	Timor-Leste	Asia	100,000
10	Mozambique	Africa	125,335	Ukraine	Europe	80,000

Source: <www.landmatrix.org>, data as of 2 June 2014.

Table 4: Land Acquisitions for Pure and Mixed Agrofuel Deals according to Implementation Status

	"Pure" Agrofuel Deals			"Mixed" Deals with Agrofuels		
	Number of Concluded Deals	**Size of Area under Contract**	**Current Size of Area in Production**	**Number of Concluded Deals**	**Size of Area under Contract**	**Current Size of Area in Production**
	#	(in million ha)		#	(in million ha)	
Project not started	6	0.3	n.a.	7	1.1	n.a.
Startup phase (no production)	14	0.4	n.a.	11	0.5	n.a.
In operation (production)	37	1.4	1.0	51	1.9	0.4
Project abandoned	18	0.9	n.a.	1	0.0	n.a.
No information	23	0.8	n.a.	22	0.9	n.a.
Total (deals or ha)	**98**	**3.8**	**1.0**	**92**	**4.4**	**0.4**

Source: <www.landmatrix.org>, data as of 2 June 2014.

Implementing Agrofuel Projects

Concluded negotiations do not necessarily result in actual project implementation. Table 4 sheds light on the difficulties of realizing agrofuel projects by mapping concluded deals according to their implementation status. Approximately half of the non-agrofuel deals have started production (55 percent for "mixed"). This is only true for approximately 38 percent of the "pure" agrofuel deals. In addition, the data suggest that a large number of "pure" agrofuel projects (18 out of 98) have been abandoned, with the land still under contract.

Although the Land Matrix data does not yet allow for an in-depth impact assessment of operational, failed or abandoned investments – either for land deals in general or for agrofuel deals in particular – we emphasize that land deals can have an important impact on target countries, particularly local communities. This includes immediate impacts such as a loss of access to land, displacements, and compensations, as well as medium- and long-term impacts such as employment creation, environmental impacts, technology spillovers, infrastructure development, and price effects for agricultural produce and inputs. Immediate impacts even apply to the case of failed deals; for example, customary land rights that governments ignored when negotiating the deal are not always returned if a deal fails.

Reasons for Failure

The analysis of Land Matrix data indicates that agrofuel projects are prone to failure, and indeed do fail more often than other land deals. So why do so many agrofuel investments fail?

Agrofuel projects are challenging since making agrofuels from biomass is a newer form of production than agriculture for food. Hence, it is conceivable that investors lack experience with certain crops. Moreover, most agrofuel crops require heavy initial investments until they yield their first return. For instance, most jatropha projects ceased operations before the plant reached maturity (after five to seven years) (Schoneveld 2014). In order to disentangle our findings, Table 5 shows the main agrofuel crops and illustrates the importance of jatropha projects. Relatively established crops such as oil palm and sugar cane also play a huge role. Cassava, corn and soybean only account for a small share of agrofuel deals. Strikingly, investors abandoned 15 percent of all jatropha investments. This is in stark contrast to other crops such as oil palm or sugar cane, which have abandonment rates of 1.8 and 7.7 percent, respecely. In fact, very few had experience with jatropha cultivation when it first aroused investors' interest. Hence, while oil palm and sugarcane attracted large established agribusinesses able to carry the relatively high start-up costs, jatropha projects were usually initiated by inexperienced start-ups (Schoneveld 2014: 6). Jatropha projects failed on a large scale due to weak business capabilities.

Like other forms of land-based investment, agrofuel projects are often carried out in difficult environments in remote areas. Many target countries are marked by low levels of infrastructure, corrupt governments and inefficient agriculture. These difficulties increase the costs of agricultural production. Moreover, agriculture in tropical regions is impeded by poor soil quality and unreliable rainfall patterns.

The promise of quick and easy money through agrofuel projects attracts less-experienced investors. Therefore, when they encounter obstacles in areas such as processing or the lack of machinery, failure and permanent abandonment are likely. Stories of how easy and non-demanding jatropha cultivation and maintenance are have proven to be incorrect. It has become clear that jatropha, like most other plants, yields the best results in rich soils.

Outlook: End of the Agrofuel Boom?

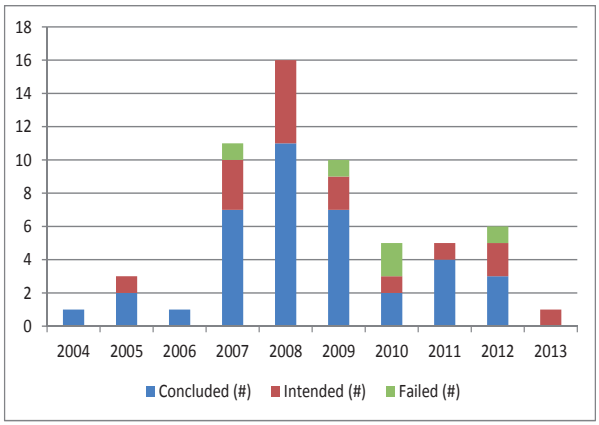
We are now a few years behind the peak of new initiations of agrofuel projects. This is highlighted in Figure 1, which shows the chronological pattern of jatropha projects in the Land Matrix. Between 2007 and 2009, this plant generated a large degree of hype and, within a few years, the number of concluded and intended jatropha deals had multiplied several times. However, this trend has declined again since then. Figure 1 should be read with some caution; deals are only mentioned in reports with a delay and therefore often appear in the Land Matrix a few years after they have been initiated. Accordingly, the decrease might not be as sharp as that shown in the figure.

Table 5: Agrofuel Crops and Implementation Status

Crops	Project not Started	Startup Phase	In Operation	Project Abandoned	No Information	Total
Jatropha	5	12	26	16	45	104
%	4.81	11.54	25	15.38	43.27	100
Oil palm	6	4	24	1	19	54
%	11.11	7.41	44.44	1.85	35.19	100
Sugar cane	7	3	19	4	19	52
%	13.46	5.77	36.54	7.69	36.54	100
Cassava (maniok)	4	1	4	0	3	12
%	33.33	8.33	33.33	0	25	100
Corn (maize)	1	2	4	0	2	9
%	11.11	22.22	44.44	0	22.22	100
Soya bean	0	0	7	0	3	10
%	0	0	70	0	30	100
Sunflower	0	4	3	2	4	13
%	0	30.77	23.08	15.38	30.77	100
Total	23	26	87	23	95	254
%	9.06	10.24	34.25	9.06	37.4	100

Source: <www.landmatrix.org>, data as of 2 June 2014.

Figure 1: Initiation of Jatropha Projects for Pure and Mixed Agrofuel Deals



Source: <www.landmatrix.org>, data as of 2 June 2014.

Despite a clear decrease in the initiation of new jatropha projects according to the Land Matrix data, the demand for agrofuels remains high. Experience with jatropha crops continues to grow, which means it is too early to dismiss jatropha projects entirely (Schoneveld 2014).

We assume that "cowboy investors" have been turned off by difficult investment environments in low- and middle-income countries and that those investors that have survived this first period of investments are here to stay. Since agrofuel policies still rank high on the national agendas of both industrialized and developing countries, there may be continued demand for agrofuels or even a new wave of agrofuel investments. Ongoing discussion in the EU on policy restrictions on food-based biofuels could improve the market prospects for non-edible biofuels such as jatropha (Schoneveld 2014). While these debates are important for remaining and future agrofuel projects, the following issues remain unsolved: (a) Knowledge about the impacts of such projects is currently too limited to state whether they are beneficial for host countries. (b) In low- and middle-income countries, food security needs to be the primary concern of agriculture. (c) While a diversification of energy sources is desirable at the global level, doubts remain about how efficient agrofuels really are.

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The Authors

Kerstin Nolte is a research fellow at the GIGA Institute of African Affairs. She is also a PhD candidate at the GIGA Doctoral Programme and at the University of Göttingen.
Contact: <kerstin.nolte@giga-hamburg.de>, Website: <http://www.giga-hamburg.de/en/team/nolte-kerstin>

Martin Ostermeier is a research fellow at the GIGA Institute of Latin American Studies. He is also a PhD candidate at the GIGA Doctoral Programme and a PhD student at the Department of Economics at the University of Göttingen.
Contact: <martin.ostermeier@giga-hamburg.de>, Website: <http://www.giga-hamburg.de/en/team/ostermeier>

Kim Schultze worked as a short-term consultant for The Land Matrix project at the GIGA Institute of African Affairs from February to June 2014.

Contact: <kimschultze@googlemail.com>

Related GIGA Research

This GIGA Focus is a result of the project "Transparency, Dynamics and Impacts of Large-Scale Land Acquisitions (LSLA): Global and Local Evidence" (BMZ, 2012–2014). Besides this, a number of projects within GIGA's Research Programme 3 are related: Socio-Economic Development in the Context of Globalisation are related to this GIGA Focus: (1) Large-Scale Land Acquisitions and Sustainable Development (BMBF, 2010–2013); and (2) Contributions to CRC 990 "Ecological and Socioeconomic Functions of Tropical Lowland Rainforest Transformation Systems (Sumatra, Indonesia)": Long-Term Land Use, Poverty Dynamics and Emission Trade-Offs (C04) and Landscape-Level Assessment of the Ecological and Socio-Economic Functions of Rainforest Transformation Systems in Sumatra (Indonesia) (B10).

Related GIGA Publications

Anseeuw, Ward, Mathieu Boche, Thomas Breu, Markus Giger, Jann Lay, Peter Messerli, and Kerstin Nolte (2012), *Transnational Land Deals for Agriculture in the Global South: Analytical Report based on the Land Matrix Database*, Bern/Montpellier/Hamburg: CDE/CIRAD/GIGA.

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Contact: <giga-focus@giga-hamburg.de>; GIGA, Neuer Jungfernstieg 21, 20354 Hamburg, Germany

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