Appendix 1. Definition of indicators.

Table A1. Definition of indicators.

Indicators	Description	Measurement scale		Data sources
		primary data	truth table	
Socio-economic impacts				
Access to land lost	% of households affected (land taken by an agribusiness)	%	0%, 1-33%, 34-66%, 67-100%	1, 2
Employment generation	% of households have at least one employee at LAI agribusiness	%	0%, 1-33%, 34-66%, 67-100%	2
Attitude towards LAI	% of households wishing the LAI would leave	%	0%, 1-33%, 34-66%, 67-100%	1
Conflict incidence	% of households who perceived conflict (violent or non-violent) between LAI and community	%	0%, 1-33%, 34-66%, 67-100%	1
Infrastructure improvements	% of households who perceived benefits from infrastructure development through LAI	%	0%, 1-33%, 34-66%, 67-100%	1
Environmental impacts				
Perceived chemical exposure	% of households report chemical exposure from LAI	%	0%, 1-33%, 34-66%, 67-100%	1
Perceived deforestation	% of households report deforestation through LAI	%	0%, 1-33%, 34-66%, 67-100%	1
Perceived over-abstraction of water	% of households report water over-abstraction through LAI	%	0%, 1-33%, 34-66%, 67-100%	1
Perceived water pollution with chemicals and effluents	% of households report water pollution through LAI	%	0%, 1-33%, 34-66%, 67-100%	1
Perceived air pollution with chemicals	% of households report air pollution through LAI	%	0%, 1-33%, 34-66%, 67-100%	1
Perceived increase in pests	% of households report pest increase through LAI	%	0%, 1-33%, 34-66%, 67-100%	1
Perceived occupation of water source	% of households report occupation of water source through LAI	%	0%, 1-33%, 34-66%, 67-100%	1
Pesticide use	g AI.ha-1 per annum (in life-cycle assessment), converted into scale 1..4 in expert assessment	1..4	1..4 (see Appendix B)	3
Eutrophication potential	g PO4-e.ha-1 per annum (in life-cycle assessment), converted into scale 1..4 in expert assessment	1..4	1..4 (see Appendix B)	3
Acidification potential	g SO2-e.ha-1 per annum (in life-cycle assessment), converted into scale 1..4 in expert assessment	1..4	1..4 (see Appendix B)	3
Global warming potential	kg CO2-e.ha-1per annum (in life-cycle assessment), converted into scale 1..4 in expert assessment	1..4	1..4 (see Appendix B)	3
Non-renewable energy consumption	MJ.ha-1 per annum (in life-cycle assessment), converted into scale 1..4 in expert assessment	1..4	1..4 (see Appendix B)	3
Water consumption (blue and green water)	m3.ha-1 per annum (in life-cycle assessment), converted into scale 1..4 in expert assessment	1..4	1..4 (see Appendix B)	3
Soil degradation	%N and %OC change (in life-cycle assessment), converted into scale 1..4 in expert assessment	1..4	1..4 (see Appendix B)	3

Indicators	Description	Measurement scale		Data sources
		primary data	truth table	
Food security impacts				
Food consumption score	a composite score, measuring food frequency and dietary diversity	numerical	Scale of 1..4 with: Comparison of engaged households (EN), non-engaged households (NE) and households in counterfactual areas (CF): 4: EN>NE and EN>CF 3: equal (~) 2: spreading (↕) 1: EN<NE and EN<CF	2
Household dietary diversity score	household dietary diversity as a proxy measure of household food access	numerical		2
Women's dietary diversity score	women's dietary diversity as a proxy measure of household food access	numerical		2
Assets	simply sum of household assets used as a proxy of household resilience	numerical		2
Months of adequate household food provision	sum of the months of adequate provision	numerical		2
Coping strategies	the frequency and severity of behaviours that household engaged in to mitigate food shortages	numerical		2
Food security index	indicator of current status and coping capacity	numerical		2
On-site land use change				
LUC on-site_agricultural expansion through LAI	yes if cropland replaces vegetation	0/1	0/1	5
LUC on-site_agricultural intensification through LAI	yes if SSF cropland --> Irrigated cropland and/or --> greenhouses	0/1	0/1	5
Net change small-scale farming cropland	gain minus losses of land use category within LAI area between 2000 and 2015	ha, % of area	aggregated into agricultural expansion/intensification indicator	5
Net change surface water				5
Net change irrigated cropland				5
Net change grassland				5
Net change forest				5
Net change greenhouses				5
Net change bushland-shrubland				5
Net change LAI cropland (soya, macadamia, tea, banana, vegetables, sisal)				5
Net change LAI mechanized irrigated cropland (pivot irrigation)				5
Net change cultivated wetlands				5
Net change natural wetlands				5

Indicators	Description	Measurement scale		Data sources
		primary data	truth table	
Off-site land use change				
LAI is “agricultural intensification enclave” in its doughnut	yes if LAI intensification occurs despite doughnut reduced agricultural intensity	0/1	0/1	5
LAI is part of agricultural intensification/expansion boom in its doughnut	yes if LAI intensification occurs parallel to doughnut intensification	0/1	0/1	5
Net change small-scale farming cropland	gain minus losses of land use category in 5 km buffer around LAI area between 2000 and 2015	ha and % of area	aggregated into indicators "agricultural intensification encave/boom"	5
Net change surface water				5
Net change irrigated cropland				5
Net change grassland				5
Net change forest				5
Net change greenhouses				5
Net change bushland-shrubland				5
Net change LAI cropland (soya, macadamia, tea, banana, vegetables, sisal)				5
Net change LAI mechanized irrigated cropland (pivot irrigation)				5
Net change cultivated wetlands				5
Net change natural wetlands				5
Indirect land use change				
Small-scale farming driven deforestation_none	% of households reporting small-scale farming driven deforestation	%	0/1	1
Land management change on small-scale farming fields due to LAI	% of households reporting land management change on small-scale farming fields due to LAI	%	0/1	1
LAI mechanization	expert assessment of degree of mechanization	low, medium, high	low, medium, high	3
LAI input intensity	expert assessment of degree of input intensity	low, medium, high	low, medium, high	3

Indicators	Description	Measurement scale		Data sources
		primary data	truth table	
Business models				
Crop	type of crop (cashew nuts, cereals, flowers, forestry, fruits, jatropha, livestock, macadamia, maize, rice, sisal, soybean, vegetables, tea, other)	type	type	4
Farm size (acquired land)	size of acquired land	ha	<100 ha, 100-1000 ha, >1000 ha	4
Farm size (land in operation)	size of land in operation	ha	<100 ha, 100-1000 ha, >1000 ha	4
Utilization of land leased	share of farm size (land in operation) in relation to farm size (acquired land)	%	0-33%, 34-66%, 67-100%	4
Number of jobs	number of jobs	numerical	<100, 100-1000, >1000	4
Share permanent	share (semi-)permanent jobs (>8 months) of total jobs	%	0-33%, 34-66%, 67-100%	4
Labour intensity	total jobs per ha	numerical	<1, 1-10, >10	4
Prior land use	type of prior land use: small-scale farming; pastoralist; large-scale farm (defunct); large-scale farm (operational); communal forestry; nature reserve; other (if mixed, use dominant)	type	type	4
Age of investment	age of investment (at time of fieldwork in 2017)	numerical	<2, 2-5, 6-10, >10 years	4
In-country experience in agriculture	type: investor with long-term experience in “local” agriculture; newcomer to agriculture; newcomer to country	type	type	4
Nationality of investors	domestic; international; settlers’ descendants; prior colonial country; joint venture	type	type	4
Nationality of managers	domestic; international; settlers’ descendants; prior colonial country	type	type	4
Juridical structure	Individual entrepreneur (1); private with shareholding (2); private without shareholding (3); investment fund (4); public (5)	type	type	4
Degree of corporate dependence	Independent (1); affiliates of large company (2)	type	type	4
Degree of vertical integration	scale: 1-4 with: 1 (only independent production); 4 (high vertical integration, incl. production; in-house production of inputs; packaging; marketing etc.).	type	type	4
Organization of production model	own production + own management; outgrowers; contract farming	type	type	4
Main market	local (1); national (2); international (3)	type	type	4
Irrigation technique	drip (1); overhead (2); none (3)	type	type	4
Investor land access	purchase; inheritance; lease with state; lease with private; rent	type	type	4
Status of operations	full operation; struggling; (failed)	type	type	4
CSR activities	existence (1) or not (0)	type	type	4
Sustainability standards	none/GlobalGAP/GlobalGAP and others	type	type	4

Indicators	Description	Measurement scale		Data sources
		primary data	truth table	
Governance system				
Experience of policymakers with LAIs	past experience of policymakers with LSAIs: strong (1) or weak (0)	binary	binary	6
Agricultural and food security policy discourse	favourable for LAI development: -2: not at all favourable policy framework (agricultural and food security policy); 0: neutral; +2: strongly favourable for LAI	-2..0..+2	5-point scale	6
Country-specific pro-LAI policy reforms (recent)	general policy reform favours LAI; land policy reform favours LAI; no LAI-favouring policy reforms: existence (1) or no existence (0)	binary	binary	6
Level of extraversion	weight of international aid in national budget: low (0), medium (1), high (2) level of extraversion of policies	0..2	3-point scale	6
Degree of “development brokering”	numbers of intermediaries to be "contacted" by investors: a lot (2)/ few (1)/ none(0)	0..2	3-point scale	6
Level of fragmentation of policymaking process	coordinated or not (existence of effective coordination institutions etc)	binary	binary	6
Level of fragmentation of policymaking process	low or significant impact of fragmentation on LAIs devlpt	binary	binary	6
Civil society mobilization capacity	high (1) or low (0): number of CS organizations, convergence of positions (the more convergence, the more the capacity to influence policymaking process), political resources available	binary	binary	6
Degree of financial independence/autonomy of NGOs (level of extraversion)	high (1) or low (0): funding model based on donors’ subsidies favours more standardized position (position de principe)	binary	binary	6
Legal compensation systems with moderate compensation levels present but mixed implementation		binary	binary	6
Legal compensation systems for using community land	existence (1) or not (0)	binary	binary	6
Legal compensation systems for using community land	concrete implementation (1) or not (0)	binary	binary	6
Type of compensation of people losing access to land	none; legal minimum; company’s compensation	binary	binary	6
Actual compensation	money / land / infrastructures / services / none	type	type	6
Land property rights: legal status of land on the company’s plots	type	type	type	6
Land property rights: local/customary status of land (on the company's plots before company arrival)	type	type	type	6
Actual land tenure security for large-scale farms	high, low	binary	binary	6
Actual land tenure security (smallholders/families) on the company’s plots before company arrival	high, low	binary	binary	6
Actual land tenure security (smallholders/families) on neighbouring plots	high, low	binary	binary	6

Indicators	Description	Measurement scale		Data sources
		primary data	truth table	
Governance system (continued)				
Consultation in land deal	strong voice - no voice or absent consultation (or if available: type)	binary	binary	6
Accountability of community leaders to land users	strong - weak	binary	binary	6
Accountability of government to land users	strong - weak	binary	binary	6
State authority in land governance	centralized / fragmented	binary	binary	6
Access of smallholders to state authority	rating on scale 1-4 with 1: very weak; 4: very strong	1..4	1..4	6
Social-ecological context				
Yield potential	high - medium - low	1..3	1..3	3
Actual yields	high - medium - low	1..3	1..3	3
No. of growing days in the region	days	ordinal	180-209; 240-269; 300-329	3
Employment elsewhere	% of households having at least one member in wage labour in other firm than LAI	%	0%, 1-33%, 34-66%, 67-100%	1
Water source for irrigation	predom. below ground, predom. above ground	binary	binary	1
Fertilizer use by small-scale farmers	% of small-scale farmer households using fertilizer	%	0-33%, 34-66%, 67-100%	1

Notation: Data sources: (1) Household interviews of work package 3. (2) Household survey of work package 4 (n=504-601 per country). (3) Household interviews, life-cycle assessment, and expert assessment. (4) Semi-structured interviews with company managers (n=68). (5) Remote-sensing analyses. (6) Key-informant interviews and document analysis for data on governance systems. (references see in the methodology section of the main text).