APPENDIX TWO

Tables

Table A2.1 Land Sizes and Origin of Projects in Country Inventories

	All projects			Domestic			Foreign		
Country	Projects (number)	Total area (thousand ha)	Median (ha)	Projects (number)	Total area (thousand ha)	Median (ha)	Projects (number)	Total area (thousand ha)	Median (ha)
Ethiopia	406	1,190	700	383	582	616	23	607	4,000
Liberia	17	1,602	59,374	2	117	58,323	15	1,485	98,179
Mozambique	405	2,670	2,225	274	1,402	2,000	131	1,268	3,800
Nigeria	115	793	1,500	110	769	1,500	5	24	4,000
Sudan	132	3,965	7,980	90	3,086	6,930	42	879	8,400
Cambodia	61	958	8,985	35	670	9,400	26	288	8,608

Source: Relevant ministries, national and regional investment promotion agencies.

Note: For Ethiopia, only the region of the investor was available and all investors from Africa were considered domestic. The inventory for Ethiopia covers only the five regions of Amhara, Benishangul-Gumuz, Gambela, Oromia, and the SNNPR (Southern Nations, Nationalities, and People's Region). The Sudanese inventory only covers 9 of Sudan's 25 states, predominantly in the north and central regions of the country (Blue Nile, River Nile, North Kordofan, Northern, Gedarif, Gazira, Khartoum, Kasala, and White Nile). The data was collected for application made during the five years prior to December 2009. Thresholds defining "large scale" were 500 hectares for Ethiopia, Liberia, Nigeria, and Sudan and 1,000 for Mozambique. Cambodia does not mention a threshold for its official inventory.

Table A2.2 Reasons for Country Selection and Key Insights from Case Studies

Reasons for country selection	Reasons for enterprise selection and key insights
Congo, Dem. Rep. ■ Postconflict (displacement, potential elite capture) ■ High agro-ecological potential/investor interest ■ Ecosystem vulnerable to land use change ■ New forestry law introduced social safeguards	**Maize:** (10,000 ha obtained, 2,000 ha under operation). Designed to meet provincial demand to achieve self-sufficiency (that is, may be more strategic than economic). Investor originally planned to focus on sugarcane, but chose maize because of liquidity problems. Investment displaced local cultivators, pushing them into a national park where farmers now pay guards to let them cultivate within the reserve; other farmers forced to relocate 50 km away where they rent land from local people. Mineral poor soils highly susceptible to erosion following biomass clearance. No EIA required by law; only projects supported by outside agencies (for example, World Bank) conduct EIA. **Rubber, coffee, cacao** (24,000 ha obtained, planted approximately 4,000 ha rubber, 150 ha coffee, 95 ha cacao): Colonial plantation in Équateur province recently acquired by a new investor. Currently employs all previous workers (1,282) and provides them with housing, a 230-bed hospital, clean water and electricity, primary and secondary schools, and other social infrastructure. Workers receive variable wages of some US$35 per week. No pollution was observed though there was some forest clearance for new rubber plantings, which could have negative impacts.
Liberia ■ Renegotiating concessions postconflict ■ Legislated concession process ■ Community-negotiated social contracts for forestry ■ Extractive Industries Transparency Initiative (EITI) now includes timber in Liberia	**Rice** (14,999 ha): Chosen because of role as a major food crop; picked largest rice concession on the border with Sierra Leone and Guinea to study migration effects. Economic problems caused investor to encroach on fertile wetlands, in contravention of agreements reached with the community (which cannot be enforced), displacing 30 percent of the local population. Compensation is not offered to all who lost rights. 400 full-time jobs have been created for unskilled workers (mostly ex-combatants) but there is concern about hiring foreigners who are willing to work for lower wages. As a result of deforestation, more than 50 ha of swamp have been silted from the first year of operations.

(continued)

Table A2.2 (Continued)

Reasons for country selection	Reasons for enterprise selection and key insights
	Timber (119,240 ha): After UN ban was lifted, Liberia adopted very progressive legislation requiring social agreements and could become a major player in tropical timber markets. The country's second largest timber concession was chosen because it is only concession that has implemented a social agreement so far. Social agreement clearly specifies rental payments and benefit sharing with government, but prohibition of investors' interference with good faith exercise of customary uses of timber and other forest products is not adhered to. Investment has thus restricted community access to forest products in context of increasing population and decreasing farmland. **Rubber** (32,540 ha): Rubber is Liberia's most important cash crop (20 percent of GDP) and the second largest rubber concession; the largest one (Firestone) has been extensively studied. Employees negotiated for safe water in all camps, increased number of approved dependents entitled to health care and education from four to seven. Still, despite this, productive use of the concession is made difficult by a long-standing dispute about the concessionaire's right to expand beyond the area brought under cultivation in the 2 years after award of the concession, createing great uncertainly for local communities. Situation is made worse by lack of community consultation and limited compensation.
Mexico ■ *Ejido* reform allocated community land rights ■ Communities negotiate with investor directly ■ Government services (attorney, register of projects)	**Maize:** Investments in Chiapas (3,066 ha) and Jalisco (2,070 ha). Foundation (Fundación Mexicana para el desarrollo rural, FUNDAR) engages smallholders to improve their access to markets in the food processing industry and so secure industry supplies. Land belongs to *ejido* members and peasants with scant resources who receive technical assistance and financing from suppliers. Key private sector companies support project by guaranteeing harvest sales. 300 jobs created at Chiapas site. Both public and private sector actors involved in project: government programs boost productivity. Sale agreements and production support from private sector enterprises with strong corporate social responsibility mentality. **Rubber** (2,970 ha): Company cultivates most land but *ejido* members act as small-scale suppliers and workers, derive clear benefits from plantation.

Mozambique ■ Government solicited private investment ■ Unanticipated rush of applications (especially biofuels) ■ New land law (1997); community consultation mandatory ■ In contrast to biofuels investments, most of which are very recent, forestry concessions have been operating for years, allowing detection of impacts	**Sugarcane for ethanol** (30,000 ha): Authorities awarded use rights (DUAT) to a multi-national investor based on promise of employing 2,650 workers. At time of study only 35–40 were employed full-time plus some 30 on a seasonal basis (some of them migrants from Zimbabwe). Although few benefits materialized, local people lost access to forest for fuel wood, game meat, fish. Investor uses local water supply and roads without compensation; thus negatively affecting women who gather the water. EIA noted potential negative impacts of agro-chemicals on soil, air, water and recommended mitigation measures. Also negative impact of forest clearance for sugarcane production. Project is the first that has been cancelled by government due to noncompliance with contract. **Forestry** (26,000 ha): DUAT awarded to foreign investor. Unique social and ecological goals of the project benefit from private sector contributions and outside assistance. Company employed 280 people (mostly local people) at time of study, including 56 women. Work is intensive but contracts are short term; monthly salary not sufficient to compensate for lost livelihoods. Although community land delimitation was conducted, local authorities did not issue communities certificates; some of the land was then awarded to the investor. Lack of agreed boundaries led to displacement from agricultural lands. **Sugarcane for ethanol** (20,000 ha): One of very few large-scale agricultural investments actually operating. Lack of information on project boundaries led to community concerns over access to grazing lands; company may have encroached on fertile lands that the communities had not wished to concede. Consultations did not include itinerant charcoal makers who were negatively impacted by the transfer of community forest lands to the investor.
Tanzania ■ Recent investor interest in developing biofuels supported by government investment promotion on coast ■ Agricultural encroachment on pastoral lands ■ No social impact assessment required for approval ■ Impacts on vulnerable groups (including those dependent on natural resources) often overlooked in planning	**Teak** (28,132 ha awarded, of which 7,800 planted): Sustainable teak plantation and processing facilities. Company provides direct employment to 120 people in the plantations and 110 at the wood processing facility. Since 2005, company's Social Fund has contributed US$150,000 to social infrastructure projects (for example, schools, dispensaries, teachers' houses, and village halls). Village contracted (US$25,000 annually) to prevent wildfires and poaching via patrols and boundary maintenance. Company supports teak outgrower and beekeeping programs in some neighboring communities. Land conflicts with local agriculturalists, beekeepers, other investors have damaged public relations. **Livestock and jatropha** (4,455 ha at present but investor targets 18,211 ha): Joint venture between Dutch and Tanzanian companies; land belongs to four villages, who still must approve

(continued)

Table A2.2 (Continued)

Reasons for country selection	Reasons for enterprise selection and key insights
■ Only nonbiofuel projects were selected for case studies given that biofuel investments are already well documented.	transfers to the investor; only one village has so far granted land rights. Investor wants to lease land directly from the local villages, in violation of the Village Land Act. Potentially negative impacts on pastoralist communities' access to grazing land, firewood, and water. Expected employment benefits not quantified. New charcoal production method consumes 1/4 the biomass of traditional methods and uses only wood obtained through pruning/thinning, which could have significantly positive impacts on local woodlands. Planned organic honey production should have limited negative environmental impacts (no chemicals used) but could increase pollination and create additional income for smallholders through honey and beeswax production. Through eradication and control of tsetse fly in this area, there will be not only a large tsetse fly–free pastureland for grazing wild and domestic animals (livestock), but also the community in this area will be free from sleeping sickness disease. Possible negative impacts include chemical pollution and exotic alien plant species introduction. Significant number of EIAs (1 per enterprise) already completed. **Multiuse** (5,000 ha): For eco-charcoal production, cattle production, beekeeping/honey processing, aloe vera and jatropha production/processing. Investor (Dutch joint venture) bought derivative right of occupancy held by two farms. Expected to employ 250 people full-time; 150 people thus far during start-up phase (over half women). Company provides water and other social services (for example, electricity, a dispensary, and primary school) for local communities. High benefits generate concern about possible in-migration. **Rice** (5,818 ha): Investor acquired derivative right of occupancy from previous investor; got into land conflict with local users who claim rights. Public-private partnership between Rufiji Basin Development Authority (Tanzania) and British company. Investor provides roughly US$38,500/year annually for community development in surrounding villages. Employs 262 workers, of which 85 percent are local.
Ukraine ■ Unfinished land reform; no agricultural land sales ■ Local government supports community-investor negotiations	**Multiple crops and pigs** (9,477 ha): EU investor leases land from local peasants; employs 5,000 workers, almost all local people, at competitive rates (50 percent higher than average). Uses modern production methods; trains workers to properly operate and maintain expensive equipment.

	Multiple crops (150,000 ha): Domestic investor built excellent community relations through regular communication with and training of local people (for example, regarding use of pesticides) and social infrastructure investments (for example, repairs roads, and so on). Employs modern no-till technologies; plans to increase yields to EU average (three times current levels) in three years. **Multiple crops** (300,000 ha): Largest portfolio investor in Ukraine. Bad community relations due to economic difficulties that led to leaving most of the land fallow and closing down of the more labor-intensive livestock operation, apparently in breach of its agreement with the local rayon administration. This, and payment of low land rental (1.5 percent compared to national norm of 3 percent of normative land value) leads to limited community benefits.
Zambia ■ Government farm bloc model: mixed large- and small-scale ■ Biofuels rush; also large Zimbabwean farmers ■ 2 percent of land rental proceeds to community	**Export-oriented crops** (155,000 ha): Government has created a farm bloc after converting customary into statutory land. However, after the investor that was initially identified lost interest, no progress has been made. Local fears about potential displacement. Potential population displacement, loss of access to forest products, including edible caterpillars. Intact miombo woodlands on site would be negatively impacted by clearing for cultivation; current environmental impacts limited to land-clearing for road and dam construction and related soil erosion. **Sugar:** 17,838 ha estate + 13,860 ha outgrowers (smallholder + commercial). Investor (multinational, mostly South African and British) leases state land (formerly crown land) from Government on 99-year lease, pays rental fee of US$5/ha (soon to increase to US$20/ha) + taxes (US$1.1 million/yr cane levy, US$590,000/yr personal levy, + 35 percent corporate income tax). Roughly 300 smallholders engaged in sugar cultivation on plots of average 6.5 ha, earning roughly US$1,643/ha/year. Smallholders participate either as independent producers on their own land or as labor tenants who lease a total of 1,100 ha from the nucleus estate. Pricing mechanism works against smallholders and there allegations of the company trying to gain access to land and water rights by requiring smallholders to pledge their land as collateral in exchange for loans for input. Environmental concerns include eutrophication from agricultural chemical runoff and sedimentation in the floodplain, an important fishing area which currently produces US$23.3 million/year in fishing off-take; pollution and resulting health impacts from cane burning (roughly 1.35 g TEQ/ha and 45 g TEQ/ha of emissions to air and land, respectively); indirect impacts from loss of land to sugar plantation, including population displacement to marshlands with a heightened risk of malaria and former pastures, which leads to increased grazing pressure and human-wildlife conflicts. Nonparticipating smallholders have wider range of farm enterprises, many of higher value than sugarcane (for example, cabbage US$19,000/ha, or rainfed maize, irrigated beans and wheat US$4,464/ha).

(continued)

Table A2.2 (Continued)

Reasons for country selection	Reasons for enterprise selection and key insights
	Jatropha on 250 ha nucleus, only 65 ha planted, + outgrowers: British investor; 40 percent germination rate on nucleus; no production yet. 35 locals employed on short-term basis (US$2.56/d), lack of interest from local farmers perhaps due to poor germination rate on nucleus and the fact that their holdings are located within a Game Management area, which limits land use options and introduces oversight from environmental authority. Only 27 farmers from a nearby Resettlement Scheme (each has 25–35 ha under 14-year lease) joined outgrower scheme, with 0.251 ha each under jatropha. Investor provides inputs and buys seeds subject to a floor price and quality standards. However, insufficient technical advice given to farmers due to lack of sufficient testing of the different varieties in the area and no farmers have yet been paid for their seeds. Farmers find the crop is more labor intensive than advertized, especially because lately aphid attacks have increased production costs. Long-term contracts lock in land use, which prevents farmers from switching to higher value crops. No EIA because individual holdings are small, but collective impacts include forest clearance for outgrower jatropha production.

Source: Country case studies undertaken for this report.

Table A2.3 Projections of Global Land Use for Food, Feed, Biofuels

Source	Biofuels included?	Area cultivated	Forest cover
FAO	No	1.8	n.a.
IIASA I	No	4.5	–2.7
IIASA II	Yes	6.0	–3.3
IFPRI	Yes	10.2	–8.7
Eickhout and others (2009)	Yes	12.3	—

Source: Authors' compilation. Figures are in million ha per year.
Note: The relevant time horizon for all projections is until 2030, with the exception of IFPRI, which is until 2020. — = not available.

Table A2.4 Estimated Costs of Sorghum Production in Sudan

Technology	Size (ha)	Yield (t/ha)	Cost (US$/t)	Price (US$/t)	Net profit
Actual	400	0.4	495	215	–280
Potential	400	4.0	125	215	90
Actual	20	0.5	204	215	11
Actual	8000	0.5	277	215	–62

Source: Government of Sudan 2009.
Note: Potential yields possible using zero tillage and fertilizer.

Table A2.5 Summary of Analysis of Farm Incomes for Smallholders Relative to Wage Employment on Large-Scale Farms

	Ratio of smallholder to large scale for			Smallholder farm		Comparison		
	Yields	Labor/ha	Cost/ton	Family labor (days/year)[a]	Farm income (US$/year)[b]	Wages for equivalent large farm area (US$/year)	Farm income–to–wage ratio	Break even land rental
Sugarcane								
Zambia 1 ha irrigated	.78	4.80	0.86	598	2,118	348	6.09	1407
Oil palm								
Indonesia 2 ha outgrower	.89	.92	1.04	322	2,067	990	2.09	422
Indonesia 2 ha low input	.47	.48	1.00	192	873	990	0.88	–93
Cameroon 2 ha independent	.62	.90	.36	200	1,770	580	3.05	535
Rubber								
Malaysia 1 ha independent	.60	1.22	1.63	72	810	624	1.30	186
Grains								
Nigeria 5 ha independent maize	.50	.53	1.18	100	1,563	500	3.13	213
Zambia 5 ha independent maize	.67	5.06	.91	260	1,316	290	4.54	108
Cameroon 5 ha independent maize	.74	.84	.93	490	1,526	154	9.91	246
Sudan 20 ha sorghum	1.0	2.0	.74	200	1,994	319	6.10	81

Sources: Sugarcane and maize for Nigeria and Zambia using emerging farmer category where possible (World Bank 2009); oil palm and maize for Cameroon using high input smallholder (World Bank 2008); oil palm for Indonesia (Zen, Barlow, and Gondowarsito 2006); rubber for Malaysia (Barlow 1997); sorghum for Sudan (Government of Sudan 2009).

Note: To allow comparison, we make a number of assumptions. First, we hold constant the farm size managed by a commercially oriented smallholder for any commodity and assume that all labor employed on the farm is family labor. Second, we combine returns to capital and land. Doing so is justifiable because for most commodities, capital investments focus on land improvements, such as trees or irrigation, whereas machinery is usually hired. Third, we consider payments to land as the residual and ignore taxes.

a. Not corrected.

b. Corrected.

Table A2.6 Potential Land Availability by Country (all areas are in thousands of ha)

				Suitable noncropped, nonprotected			
					Nonforest with population density of		
	Total area	Forest area	Cultivated area	Forest < 25/km²	< 25/km²	< 10/km²	< 5/km²
Sub-Saharan Africa	**2,408,224**	**509,386**	**210,149**	**163,377**	**201,540**	**127,927**	**68,118**
Angola	124,294	57,941	2,930	11,502	9,684	6,625	4,561
Burkina Faso	27,342	2,072	4,817	452	3,713	1,040	256
Cameroon	46,468	23,581	6,832	8,973	4,655	3,205	1,166
Central African Republic	62,021	23,496	1,879	4,358	7,940	6,890	5,573
Chad	127,057	2,280	7,707	680	14,816	10,531	7,061
Congo, Dem. Rep.	232,810	147,864	14,739	75,760	22,498	14,757	8,412
Congo, Rep.	34,068	23,132	512	12,351	3,476	3,185	2,661
Ethiopia	112,829	8,039	13,906	534	4,726	1,385	376
Gabon	26,269	21,563	438	6,469	954	927	839
Kenya	58,511	3,284	4,658	655	4,615	2,041	935
Madagascar	58,749	12,657	3,511	2,380	16,244	11,265	6,572
Mali	125,254	3,312	8,338	582	3,908	776	28
Mozambique	78,373	24,447	5,714	8,247	16,256	9,160	4,428
South Africa	121,204	8,840	15,178	918	3,555	1,754	649

(continued)

Table A2.6 (Continued)

				Suitable noncropped, nonprotected			
					Nonforest with population density of		
	Total area	Forest area	Cultivated area	Forest < 25/km²	< 25/km²	< 10/km²	< 5/km²
Sudan	249,872	9,909	16,311	3,881	46,025	36,400	18,547
Tanzania	93,786	29,388	9,244	4,010	8,659	4,600	1,234
Zambia	75,143	30,708	4,598	13,311	13,020	8,367	3,083
Latin America and the Caribbean	**2,032,437**	**933,990**	**162,289**	**290,631**	**123,342**	**91,576**	**64,320**
Argentina	277,400	33,626	28,154	16,228	29,500	23,835	16,856
Bolivia	108,532	54,325	2,850	21,051	8,317	7,761	6,985
Brazil	847,097	485,406	62,293	130,848	45,472	27,654	15,247
Colombia	113,112	64,543	7,339	31,313	4,971	3,776	2,838
Ecuador	25,152	11,631	3,384	3,663	638	415	313
French Guiana	8,034	7,809	6	3,554	27	27	27
Guyana	20,845	17,737	464	8,501	210	189	156
Mexico	194,218	64,447	25,845	7,206	4,360	2,857	1,719
Paraguay	39,904	19,112	5,419	10,269	7,269	6,035	5,133
Peru	128,972	68,312	3,799	39,951	496	476	438
Suriname	14,460	13,847	86	5,318	6	5	5

Uruguay	17,772	1,323	2,030	731	9,269	8,681	7,340
Venezuela, R.B.	90,531	48,345	3,912	6,167	8,966	7,725	5,891
Eastern Europe and Central Asia	**2,469,520**	**885,527**	**251,811**	**140,026**	**52,387**	**29,965**	**18,210**
Belarus	20,784	7,784	6,019	4,853	3,691	868	204
Russian Federation	1,684,767	807,895	119,985	128,966	38,434	24,923	15,358
Ukraine	59,608	9,265	32,988	2,594	3,442	394	74
East and South Asia	**1,932,941**	**493,762**	**445,048**	**46,250**	**14,341**	**9,496**	**5,933**
China	935,611	167,202	136,945	10,514	2,176	1,383	843
Indonesia	183,897	95,700	32,920	24,778	10,486	7,291	4,666
Malaysia	32,243	21,171	7,184	4,597	186	119	50
Middle East and North Africa	**1,166,118**	**18,339**	**74,189**	**209**	**3,043**	**843**	**236**
Rest of world	**3,318,962**	**863,221**	**358,876**	**134,700**	**50,971**	**45,687**	**41,102**
Australia	765,074	88,086	45,688	17,045	26,167	25,894	25,593
Canada	969,331	308,065	50,272	30,100	8,684	8,289	7,598
Papua New Guinea	44,926	29,387	636	9,746	3,771	3,193	1,917
United States	930,303	298,723	174,515	74,350	8,756	6,818	5,058
World Total	**13,333,053**	**3,706,457**	**1,503,354**	**775,211**	**445,624**	**305,711**	**198,064**

Source: Fischer and Shah 2010.

Note: "Suitable" means that at least 60 percent of possible yield can be attained for any of the five rainfed crops considered here (wheat, oil palm, sugarcane, soybean, maize). Countries are included if they have a total of at least 3 million ha of forested or nonforested suitable area for areas with population density $< 25/km^2$. Suitable ha per cultivated ha area based on nonprotected, nonforest suitable area where the population density of the grid cell is $< 25/km^2$, $< 10/km^2$, or $< 5/km^2$.

Table A2.7 Land Availability by Region for Different Crops (< 25 persons/km^2 and < 6 hours to major market)

	Total	Maize	Soybean	Wheat	Sugarcane	Oil palm
Sub-Saharan Africa	**94,919**	**44,868**	**38,993**	**3,840**	**6,023**	**1,194**
East Africa	57,833	29,980	22,432	2,873	2,506	42
Central Africa	20,838	6,620	9,706	253	3,270	988
South Africa	3,252	977	1,558	715	2	0
West Africa	12,996	7,291	5,296	0	244	164
Latin America and the Caribbean	**93,957**	**28,385**	**37,716**	**11,043**	**15,021**	**1,793**
Central America and the Caribbean	5,079	1,980	1,476	845	521	257
South America	88,878	26,405	36,240	10,198	14,500	1,535
Eastern Europe and Central Asia	**43,734**	**3,851**	**419**	**39,464**	**0**	**0**
Eastern Europe	40,031	3,788	321	35,922	0	0
Central Asia	3,703	63	98	3,542	0	0
East and South Asia	**3,320**	**465**	**443**	**1,045**	**500**	**867**
Southeast Asia	2,918	425	415	712	499	866
South Asia	402	39	28	333	1	1
Middle East and North Africa	**2,647**	**0**	**10**	**2,637**	**0**	**0**
North Africa	651	0	0	651	0	0
West Asia	1,996	0	10	1,986	0	0
Rest of world	**24,554**	**5,741**	**5,289**	**12,747**	**722**	**55**
North America	12,321	1,583	2,386	7,800	552	0
Oceania	8,920	3,804	2,838	2,053	170	55
Western Europe	3,313	354	65	2,894	0	0
Total	**263,131**	**83,310**	**82,870**	**70,776**	**22,266**	**3,909**

Source: Fischer and Shah 2010.
Note: All areas in thousands of ha.

Table A2.8 Wheat—Potential for Land/Yield Expansion for Key Producers and Countries with Uncultivated Land

	2008 production		Land availability (thousand ha)						
	Area	Yield	Population < 25/km²			Population < 10/km²		Population < 5/km²	
	1,000 ha	t/ha	Total	< 6 h	> 6 h	< 6 h	> 6 h	< 6 h	> 6 h
Countries with land available									
Russian Federation	26,070	2.45	35,722	29,510	6,218	17,219	5,991	8,610	5,593
China	23,617	4.76	1,622	533	1,120	268	925	125	667
United States	22,542	3.02	3,877	3,586	284	2,852	269	2,162	250
Australia	13,552	1.58	1,402	1,005	121	937	128	855	135
Kazakhstan	12,906	0.97	2,948	2,376	574	1,963	525	1,491	498
Canada	10,032	2.85	8,639	4,214	4,425	3,844	4,419	3,182	4,407
Turkey	7,583	2.35	1,626	1,585	41	408	9	64	4
Ukraine	7,054	3.67	2,430	2,418	12	296	1	50	0
Argentina	4,284	1.97	6,472	5,472	979	4,072	965	2,550	902
Brazil	2,374	2.48	1,345	1,329	16	905	16	431	14
Belarus	514	3.98	3,219	3,202	15	703	7	163	2
Uruguay	460	2.80	2,736	2,225	510	2,047	503	1,679	480
New Zealand	42	8.11	1,064	1,047	17	876	15	638	15

(continued)

Table A2.8 (Continued)

	2008 production		Land availability (thousand ha)						
	Area	Yield	Population < 25/km²			Population < 10/km²		Population < 5/km²	
	1,000 ha	t/ha	Total	< 6 h	> 6 h	< 6 h	> 6 h	< 6 h	> 6 h
Madagascar	5	2.44	1,069	959	63	549	50	231	39
Subtotal	131,035		74,171	59,461	14,395	36,939	13,823	22,231	13,006
Current producers									
India	28,039	2.80	0	0	0	0	0	0	0
Pakistan	8,550	2.45	1	1	0	0	0	0	0
France	5,492	7.10	850	848	2	33	0	5	0
Iran, Islamic Rep.	4,750	2.11	333	275	58	98	47	30	25
Germany	3,214	8.09	55	55	0	1	0	0	0
Morocco	2,858	1.32	515	499	16	163	4	42	0
Italy	2,289	3.87	6	5	1	0	0	0	0
Poland	2,278	4.07	266	266	0	36	0	3	0
Iraq	2,203	1.01	275	269	6	23	2	4	2

Afghanistan	2,139	1.23	85	57	28	12	5	0	2
Romania	2,098	3.42	157	154	3	40	3	17	2
United Kingdom	2,080	8.28	39	39	0	3	0	0	0
Spain	2,067	3.25	291	286	5	91	3	27	1
Algeria	1,800	1.28	93	87	6	4	7	1	4
Syrian Arab Republic	1,668	2.42	96	96	0	6	0	0	0
Ethiopia	1,425	1.73	180	30	150	0	28	0	0
Uzbekistan	1,377	4.46	277	243	34	96	15	29	9
Egypt, Arab Rep.	1,227	6.50	0	0	0	0	0	0	0
Hungary	1,126	5.02	37	37	0	3	0	1	0
Bulgaria	1,112	4.17	295	295	0	22	0	3	0
Subtotal	77,792		3,851	3,542	309	631	114	162	45
World Total	**223,564**		**88,149**	**70,776**	**17,373**	**40,553**	**15,424**	**23,577**	**13,786**

Source: Fischer and Shah 2010.

Note: Countries with land available in the table are those with 1 million ha or more of nonforested noncultivated suitable area (< 25 persons/km^2) while producers are included if they produced more than 1 million ha of the commodity in 2008.

Table A2.9 Maize—Potential for Land/Yield Expansion for Key Producers and Countries with Uncultivated Land

	2008 production		Land availability (thousand ha)						
	Area	Yield	Population < 25/km²			Population < 10/km²		Population < 5/km²	
	1,000 ha	t/ha	Total	< 6 h	> 6 h	< 6 h	> 6 h	< 6 h	> 6 h
Countries with land available									
United States	31,826	9.66	1,647	1,538	109	1,120	85	793	61
Brazil	14,445	4.09	11,388	10,406	982	5,314	917	2,533	795
Mexico	7,354	3.31	2,029	1,732	297	1,084	269	575	226
Nigeria	3,845	1.96	1,301	876	426	40	80	0	3
Argentina	3,412	6.45	9,469	7,704	1,765	6,015	1,761	4,051	1,642
Tanzania	3,100	1.18	3,715	2,271	1,444	950	917	303	112
South Africa	2,799	4.14	1,063	911	152	452	87	174	35
Ukraine	2,440	4.69	1,011	1,008	3	96	1	24	0
Ethiopia	1,767	2.14	2,395	114	2,281	9	707	3	196
Russian Federation	1,732	3.86	2,458	2,170	288	1,338	280	856	266
Zimbabwe	1,730	0.29	1,002	851	151	145	53	28	22
Kenya	1,700	1.39	2,568	1,009	1,559	395	885	270	325
Congo, Dem. Rep.	1,484	0.78	2,657	1,185	1,472	790	1,102	447	621
Mozambique	1,400	0.92	7,592	4,206	3,386	2,004	2,322	705	1,409
Angola	1,115	0.51	4,109	1,030	3,079	522	2,489	293	1,935
Paraguay	850	2.24	3,098	749	2,348	506	2,314	337	2,214
Venezuela, R.B.	740	3.47	4,640	3,919	720	3,299	695	2,418	638
Zambia	664	2.18	5,716	2,383	3,333	1,029	2,657	329	1,039
Burkina Faso	608	1.67	2,306	1,376	930	299	332	62	80
Guinea	484	1.97	1,458	1,198	261	293	76	64	11

Bolivia	364	2.12	2,530	920	1,610	758	1,549	598	1,428
Madagascar	250	1.48	6,753	4,654	2,100	3,075	2,020	1,573	1,597
Chad	235	0.96	9,131	3,736	5,395	1,896	4,550	738	3,452
Central African Republic	130	1.09	2,405	84	2,322	38	2,194	14	1,941
Uruguay	81	4.15	2,735	2,225	510	2,047	503	1,679	480
Australia	68	5.69	18,870	2,890	15,980	3,611	15,944	3,528	15,907
Sudan	31	2.02	31,889	14,390	17,499	9,753	15,529	3,994	7,911
Mali	0		2,358	1,580	778	152	323	4	15
Subtotal	84,654		148,293	77,115	71,180	47,030	60,641	26,393	44,361
Current producers									
China	29,883	5.56	463	279	184	82	79	21	25
India	8,300	2.32	25	24	0	4	0	3	0
Indonesia	4,003	4.08	204	5	200	1	163	0	107
Philippines	2,661	2.60	1	0	1	0	0	0	0
Romania	2,432	3.23	70	69	1	19	1	7	1
France	1,702	9.29	286	286	1	2	0	0	0
Malawi	1,597	1.65	12	8	4	0	0	0	0
Hungary	1,200	7.47	12	12	0	2	0	1	0
Canada	1,169	9.06	45	44	0	25	0	8	0
Vietnam	1,126	4.02	0	0	0	0	0	0	0
Pakistan	1,118	3.61	0	0	0	0	0	0	0
Italy	1,053	9.01	0	0	0	0	0	0	0
Subtotal	56,244		1,118	727	391	135	243	40	133
World total	**161,017**		**156,828**	**83,310**	**74,419**	**48,773**	**62,690**	**26,984**	**45,516**

Source: Fischer and Shah 2010.

Note: Countries with land available in the table are those with 1 million ha or more of nonforested noncultivated suitable area (< 25 persons/km^2), while producers are included if they produced more than 1 million ha of the commodity in 2008.

Table A2.10 Soybeans—Potential for Land/Yield Expansion for Key Producers and Countries with Uncultivated Land

	2008 production		Land availability (thousand ha)						
	Area	Yield	Population < 25/km²			Population < 10/km²		Population < 5/km²	
	1,000 ha	t/ha	Total	< 6 h	> 6 h	< 6 h	> 6 h	< 6 h	> 6 h
Countries with land available									
United States	30,206	2.67	2,582	2,386	196	1,781	173	1,248	127
Brazil	21,272	2.82	22,124	20,057	2,067	11,471	1,975	5,571	1,746
Argentina	16,380	2.82	9,752	8,142	1,610	6,379	1,572	4,211	1,451
Paraguay	2,645	2.57	2,245	763	1,481	486	1,325	303	1,209
Bolivia	958	1.67	3,676	1,337	2,339	1,191	2,301	1,032	2,174
Uruguay	462	1.67	2,743	2,231	512	2,053	505	1,683	482
South Africa	174	1.85	1,669	1,449	220	691	112	257	45
Mexico	76	2.02	1,272	1,121	151	774	136	486	103
Zimbabwe	65	1.62	1,467	1,312	155	218	60	24	29
Venezuela, R.B.	37	1.62	3,693	3,076	617	2,541	597	1,765	538
Congo, Dem. Rep.	35	0.48	8,700	3,600	5,101	1,903	3,678	959	2,206
Australia	18	2.00	5,778	2,775	3,003	2,689	2,520	2,574	2,547
Cameroon	12	0.58	2,346	1,406	940	723	867	123	380
Zambia	10	1.20	6,372	2,702	3,670	1,195	2,940	361	1,139
Ethiopia	8	1.08	2,142	119	2,024	13	625	6	169
Burkina Faso	5	1.13	1,407	934	473	224	185	52	62

Tanzania	5	0.38	3,832	2,399	1,433	1,097	941	378	174
Kenya	3	0.84	1,391	612	779	252	427	159	175
Madagascar	0	1.00	6,243	4,425	1,818	2,832	1,667	1,393	1,340
Mali	0		1,550	1,021	529	91	210	2	7
Central African Republic	0		4,311	765	3,546	455	3,301	159	2,904
Angola	0		5,259	1,326	3,932	558	2,964	273	2,029
Chad	0		5,685	2,467	3,218	1,332	2,752	584	2,286
Sudan	0		13,698	6,694	7,004	4,839	6,038	2,478	4,057
Mozambique	0		7,340	4,040	3,300	1,935	2,273	691	1,380
Guinea	0		1,345	1,138	208	278	62	62	11
Subtotal	72,371		128,622	78,297	50,326	48,001	40,206	26,834	28,770
Current producers									
India	9,600	0.94	14	13	1	1	0	0	0
China	9,127	1.70	83	44	39	11	18	5	1
Canada	1,195	2.79	0	0	0	0	0	0	0
Subtotal	19,922		97	57	40	12	18	5	1
World total	**96,870**		**137,711**	**82,870**	**54,841**	**49,379**	**43,575**	**27,401**	**31,125**

Source: Fischer and Shah 2010.

Note: Countries with land available in the table are those with 1 million ha or more of nonforested noncultivated suitable area (< 25 persons/km^2), while producers are included if they produced more than 1 million ha of the commodity in 2008.

Table A2.11 Sugarcane—Potential for Land/Yield Expansion for Producers and Countries with Uncultivated Land

	2008 production		Land availability (thousand ha)						
	Area	Yield	Population < 25/km²			Population < 10/km²		Population < 5/km²	
	1,000 ha	t/ha	Total	< 6 h	> 6 h	< 6 h	> 6 h	< 6 h	> 6 h
Countries with land available									
Brazil	8,141	79.71	9,431	8,757	674	5,440	655	2,803	596
Indonesia	416	62.56	3,169	330	2,839	136	1,991	46	1,333
Argentina	355	84.37	3,808	3,018	789	2,298	773	1,368	681
Cameroon	145	10.00	1,297	665	632	337	607	63	363
Bolivia	128	50.31	1,522	588	934	567	934	528	906
Paraguay	90	50.00	1,812	818	993	537	764	347	634
Madagascar	82	31.71	2,108	1,766	342	890	164	312	82
Congo, Dem. Rep.	40	38.75	6,531	1,958	4,573	756	3,208	276	1,935
Congo, Rep.	18	36.11	1,453	117	1,336	46	1,280	12	1,092
Central African Republic	13	7.20	1,210	446	763	257	639	77	476
Papua New Guinea	9	52.94	1,035	45	990	10	835	1	443
Uruguay	6	55.33	1,055	843	213	809	213	648	209
Subtotal	9,433		34,431	19,351	15,078	12,083	12,063	6,481	8,750
Current producers									
India	5,055	68.88	1	0	1	0	0	0	0
China	1,709	73.11	8	6	2	2	0	0	0
Pakistan	1,241	51.49	0	0	0	0	0	0	0
Thailand	1,054	69.71	3	3	0	0	0	0	0
Subtotal	9,059		12	9	3	2	0	0	0
World total	**24,375**		**41,176**	**22,266**	**18,910**	**13,706**	**15,039**	**7,469**	**10,909**

Source: Fischer and Shah 2010.

Note: Countries with land available in the table are those with 1 million ha or more of nonforested noncultivated suitable area (< 25 persons/km²), while producers are included if they produced more than 1 million ha of the commodity in 2008.

Table A2.12 Oil Palm—Potential for Land/Yield Expansion for Key Producers and Countries with Uncultivated Land

	2008 production		Land availability (thousand ha)						
	Area	Yield	Population < 25/km²			Population < 10/km²		Population < 5/km²	
	1,000 ha	t/ha	Total	< 6 h	> 6 h	< 6 h	> 6 h	< 6 h	> 6 h
Countries with land available									
Indonesia	5,000	17.00	6,576	771	5,805	283	4,265	75	2,756
Congo, Dem. Rep.	175	6.48	4,546	849	3,697	451	2,822	223	1,731
Colombia	165	19.39	2,811	687	2,124	475	1,893	272	1,618
Ecuador	135	15.56	214	24	191	22	151	17	116
Papua New Guinea	96	14.58	2,069	53	2,016	11	1,721	0	985
Brazil	66	10.00	1,185	570	615	360	599	198	561
Venezuela, R.B.	27	12.27	286	171	115	147	113	116	113
Liberia	17	10.76	397	88	309	22	190	4	88
Peru	13	18.93	220	33	187	30	184	21	171
Congo, Rep.	7	12.50	1,222	2	1,219	1	1,186	0	1,040
Gabon	4	7.98	319	14	304	7	303	4	283
Nicaragua	3	24.00	431	105	326	71	281	42	210
Bolivia	0	0.00	287	37	250	35	249	25	235

(continued)

Table A2.12 (Continued)

	2008 production		Land availability (thousand ha)						
	Area	Yield	Population < 25/km²			Population < 10/km²		Population < 5/km²	
	1,000 ha	t/ha	Total	< 6 h	> 6 h	< 6 h	> 6 h	< 6 h	> 6 h
Subtotal	5,708		20,563	3,404	17,158	1,915	13,957	997	9,907
Current producers									
Malaysia	3,900	21.28	145	36	109	17	78	5	32
Nigeria	3,200	2.66	1	0	0	0	0	0	0
Thailand	450	17.49	20	15	5	0	1	0	0
Guinea	310	2.68	1	1	0	0	0	0	0
Ghana	300	6.33	6	5	0	0	0	0	0
Côte d'Ivoire	215	5.58	122	70	52	11	22	1	4
Subtotal	8,375		295	127	166	28	101	6	36
World total	**14,586**		**21,760**	**3,909**	**17,851**	**2,100**	**14,474**	**1,059**	**10,235**

Source: Fischer and Shah 2010.

Note: Countries with land available in the table are those with 1 million ha or more of nonforested noncultivated suitable area (< 25 persons/km²), while producers are included if they produced more than 1 million ha of the commodity in 2008.

REFERENCES

Barlow, C. 1997. "Growth, Structural Change, and Plantation Tree Crops: The Case of Rubber." *World Development* 25 (10): 1589–1607.

Eickhout, B., H. van Meijl, A. Tabeau, and E. Stehfest. 2009. "The Impact of Environmental and Climate Constraints on Global Food Supply." In *Economic Analysis of Land Use in Global Climate Change Policy*, ed. T. W. Hertel, S. Rose, and R. S. J. Tol. London: Routledge.

Fischer, G., and M. Shah. 2010. "Farmland Investments and Food Security: Statistical Annex." Report prepared under a World Bank and International Institute for Applied Systems Analysis contract, Luxembourg.

Government of Sudan. 2009. "Study of the Sustainable Development of Semi-Mechanized Rainfed Farming." Ministry of Agriculture and Forestry, Khartoum.

World Bank. 2008. "Cameroon Agricultural Value Chain Competitiveness Study." World Bank, Washington, DC.

World Bank. 2009. *Awakening Africa's Sleeping Giant: Prospects for Competitive Commercial Agriculture in the Guinea Savannah Zone and Beyond*. Washington, DC: World Bank.

Zen, Z., C. Barlow, and R. Gondowarsito. 2006. "Oil Palm in Indonesian Socio-Economic Improvement: A Review of Options." *Oil Palm Industry Economic Journal* 6 (1): 18–29.