



*Supplement of*

## **Mitigation of agricultural emissions in the tropics: comparing forest land-sparing options at the national level**

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Table S1: REDD+ engagement index created for this study

Indicator		Score
Participation in international initiatives	in UN-REDD (United Nations Collaborative initiative on Reducing Emissions from Deforestation and forest Degradation (REDD) in developing countries) – countries receiving support	1
	UN REDD – partner countries	0.5
	FCPF (Forest Carbon Partnership Facility) - a participant (signing a partnership agreement, but yet to submit any documents)	0.33
	FCPF (Forest Carbon Partnership Facility) - submission of the RPIN (Readiness Plan Idea Note)	0.66
	FCPF (Forest Carbon Partnership Facility) - R-PP (Readiness Preparation Proposal) finalization	1
	CIF-FIP (Forest Investment Plan (FIP) within the Climate Investment Funds (CIF))	1
	GEF (The Global Environment Facility)	1
	Governors' Climate and Forests Task Force.	1
Number of projects	0	0
	1-5	0.25
	6-10	0.5
	11-25	0.75
	>25	1
Funding acquisition	0	0
	<6 M USD	0.25
	<11 M USD	0.5
	<100 M USD	0.75
	>100 M USD	1

Table S2: Yield gap ( $t\ ha^{-1}$ ), and standard deviation (s.d.) of maize, rice and wheat

Yield gap ( $t\ ha^{-1}$ )	Wheat		Rice		Maize	
	Mean	s.d.	mean	s.d.	mean	s.d.
Angola					5.29	0.28
United Arab Emirates						
Argentina	1.14	0.37	1.39	0.21	2.93	0.88
Antigua and Barbuda						
Burundi					5.16	0.52
Benin			3.20	0.72	4.37	0.61
Burkina Faso					2.99	0.25
Bangladesh			1.82	0.55		
Bahamas						
Belize						
Bolivia	1.50	0.71			3.88	1.20
Brazil	1.76	0.38	2.24	0.92	3.24	0.99
Brunei Darussalam						
Bhutan			3.07	0.00	5.37	0.07
Botswana						
Central African Republic			4.08	0.00	3.88	0.03
Chile	2.07	0.96			0.97	0.12
China	1.27	0.82	1.51	0.47	2.90	1.22
Côte d'Ivoire			3.07	0.49	3.94	0.29
Cameroon					4.05	0.87
Congo, DR			4.01	0.87	4.61	0.62
Congo						
Colombia			1.98	1.14	3.91	1.18
Comoros						
Cape Verde						
Costa Rica			1.48	0.25		
Cuba			1.70	0.31		
Djibouti						
Dominica						
Dominican Republic			1.36	0.19		
Algeria	1.63	0.48				
Ecuador			2.63	0.73	4.32	0.69
Egypt	0.39	0.13	0.59	0.05	0.75	0.22
Eritrea						
Ethiopia	1.57	0.27			4.61	1.02
Fiji						
Micronesia						
Gabon						
Ghana					3.93	0.40
Guinea			2.58	0.49	3.92	0.25
Gambia			1.59	0.00		
Guinea-Bissau			2.01	0.44		
Equatorial Guinea						

Guatemala				4.21	0.91
Guyana		1.71	0.21		
Honduras				4.43	0.60
Haiti		3.10	0.67	4.90	0.47
Indonesia		1.86	0.61	3.48	0.85
India	1.39	0.93	2.28	1.01	3.52
Jamaica					
Kenya				4.25	0.74
Cambodia		2.18	0.43	3.49	0.47
Kiribati					
Lao PDR		1.72	0.44		
Liberia		3.21	0.72		
Libya	0.96	0.32			
Saint Lucia					
Sri Lanka		1.67	0.48		
Madagascar		2.92	0.47		
Mexico	1.19	0.31	1.86	0.12	3.80
Mali			2.31	1.10	3.91
Myanmar			1.78	0.40	4.23
Mozambique			3.15	0.12	4.17
Mauritania					
Mauritius					
Malawi		3.74	0.14	4.61	0.94
Malaysia		2.42	0.48		
Namibia					
Niger		2.47	0.00		
Nigeria		2.81	0.40	3.97	0.56
Nicaragua		2.34	0.54	4.23	0.49
Nepal	2.12	0.54	2.60	0.52	4.33
Oman					
Pakistan	1.19	0.86	1.37	0.56	4.13
Panama			2.40	0.68	3.19
Peru			1.28	0.31	3.72
Philippines			2.73	0.69	4.46
Palau					
Papua New Guinea					
Paraguay				3.96	0.55
Rwanda				5.42	0.92
Saudi Arabia	1.17	0.25			
Sudan					
Senegal			1.78	0.67	2.61
Singapore					0.26
Solomon Islands					
Sierra Leone			2.75	0.24	
El Salvador					3.66
Somalia					0.61

South Sudan				
Sao Tome and Principe				
Suriname	1.34	0.37		
Seychelles				
Chad			2.69	0.34
Togo	4.07	0.00	4.16	0.36
Thailand	2.45	0.64	2.19	0.35
Tonga				
Trinidad and Tobago				
Tanzania		4.21	0.45	4.16
Uganda		4.08	0.57	4.07
Uruguay	1.51	0.22	1.31	0.15
Saint Vincent and the Grenadines				
Venezuela		1.18	0.27	2.54
Viet Nam		1.86	0.58	3.44
Vanuatu				
Samoa				
South Africa	1.41	0.40		3.63
Zambia				4.39
Zimbabwe				4.82
				0.79

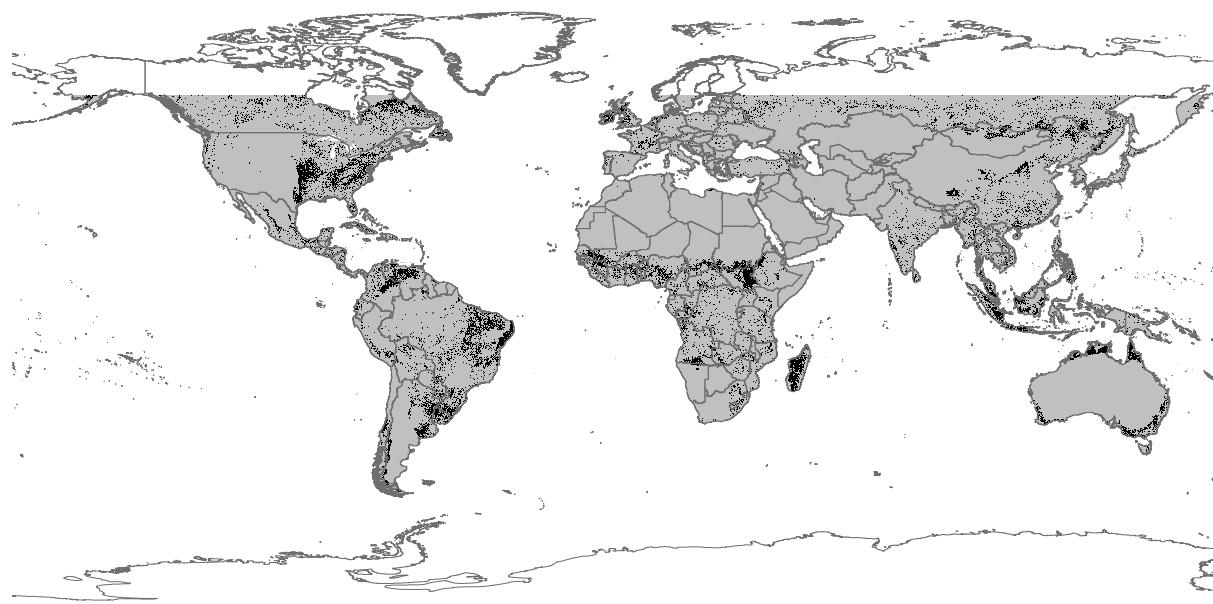


Figure S1. Available land (black) suitable for agricultural production between 60°N and 60°S calculated for this study.

Table S3. Data appendix.

Country	Available land	Yield gap	Emissions gap (on agricultural land)	Forest loss due to agriculture ( $\text{km}^2 \text{y}^{-1}$ )	Source for forest loss calculations	REDD engagement
Angola	Medium	High	Low	254.09	FAO RSS (2000-2005) forest loss	0.14
United Arab Emirates	Low	No data	High	0.00	Hansen (2000-2012) forest loss	0.00
Argentina	High	Low	Low	3123.34	FAO FRA (2000-2010) net & FAO RSS (2000-2005) forest loss	0.39
Antigua and Barbuda	Low	No data	High	No Data	No data	0.00
Burundi	Low	High	Medium	11.07	Hansen (2000-2012) forest loss	0.14
Benin	High	High	Medium	188.33	FAO RSS (2000-2005) forest loss	0.21
Burkina Faso	High	Medium	Medium	50.34	FAO RSS (2000-2005) forest loss	0.54
Bangladesh	High	Low	High	29.48	Hansen (2000-2012) forest loss	0.14
Bahamas	Medium	No data	Medium	4.32	Hansen (2000-2012) forest loss	0.00
Belize	Low	No data	Medium	97.79	FAO FRA (2000-2010) net & Hansen (2000-2012) forest loss	0.18
Bolivia, Plurinational State of	Medium	Medium	Low	3649.01	FAO FRA (2000-2010) net & FAO RSS (2000-2005) forest loss	0.63
Brazil	Medium	Medium	Medium	29470.29	FAO FRA (2000-2010) net & FAO RSS (2000-2005) forest loss	0.54
Brunei Darussalam	Low	No data	High	23.05	FAO FRA (2000-2010) net & Hansen (2000-2012) forest loss	0.00
Bhutan	Low	High	Medium	4.13	Hansen (2000-2012) forest loss	0.36
Botswana	Low	No data	Low	985.68	FAO FRA (2000-2010) net & Hansen (2000-2012) forest loss	0.14
Central African Republic	Medium	High	Medium	720.89	FAO RSS (2000-2005) forest loss	0.43
Chile	Medium	Low	Medium	37.18	FAO FRA (2000-2010) net & FAO RSS (2000-2005) forest loss	0.50
China	Medium	Low	Medium	6887.30	FAO FRA (2000-2010) net & FAO RSS (2000-2005) forest loss	0.25
Côte d'Ivoire	High	High	Low	1321.29	FAO RSS (2000-2005) forest loss	0.46
Cameroon	Medium	High	Medium	3308.10	FAO FRA (2000-2010) net & FAO RSS (2000-	0.54

					2005) forest loss	
Congo, the Democratic Republic of the	Low	High	Low	2138.78	FAO FRA (2000-2010) net & FAO RSS (2000-2005) forest loss	0.68
Congo	Medium	No data	Low	237.57	FAO FRA (2000-2010) net & FAO RSS (2000-2005) forest loss	0.43
Colombia	Medium	Medium	Medium	795.99	FAO FRA (2000-2010) net & FAO RSS (2000-2005) forest loss	0.64
Comoros	High	No data	Medium	0.55	Hansen (2000-2012) forest loss	0.00
Cape Verde	Low	No data	High	0.07	Hansen (2000-2012) forest loss	0.00
Costa Rica	Medium	Low	Medium	135.33	Hansen (2000-2012) forest loss	0.32
Cuba	High	Low	Medium	114.45	Hansen (2000-2012) forest loss	0.14
Djibouti	Low	No data	Low	0.00	Hansen (2000-2012) forest loss	0.00
Dominica	Low	No data	Medium	No Data	No data	0.00
Dominican Republic	Medium	Low	High	126.96	Hansen (2000-2012) forest loss	0.29
Algeria	Low	Low	Low	76.84	FAO RSS (2000-2005) forest loss	0.00
Ecuador	Medium	High	High	1231.85	FAO FRA (2000-2010) net & Hansen (2000-2012) forest loss	0.43
Egypt	Low	Low	High	1.05	Hansen (2000-2012) forest loss	0.00
Eritrea	Low	No data	Low	0.00	Hansen (2000-2012) forest loss	0.00
Ethiopia	High	High	High	1892.59	FAO FRA (2000-2010) net & Hansen (2000-2012) forest loss	0.36
Fiji	Low	No data	High	10.05	Hansen (2000-2012) forest loss	0.32
Micronesia, Federated States of	Low	No data	High	No Data	No data	0.00
Gabon	Low	No data	Low	108.36	FAO RSS (2000-2005) forest loss	0.46
Ghana	High	High	Low	877.04	FAO FRA (2000-2010) net & FAO RSS (2000-2005) forest loss	0.64
Guinea	High	Medium	Low	543.84	FAO RSS (2000-2005) forest loss	0.00
Gambia	Medium	Low	High	0.77	Hansen (2000-2012) forest loss	0.00
Guinea-Bissau	Medium	Medium	Medium	119.35	FAO FRA (2000-2010) net & FAO RSS (2000-2005) forest loss	0.14

Equatorial Guinea	Medium	No data	Low	44.73	FAO FRA (2000-2010) net & Hansen (2000-2012) forest loss	0.25
Guatemala	Medium	High	Medium	551.90	FAO FRA (2000-2010) net & FAO RSS (2000-2005) forest loss	0.46
Guyana	Low	Low	Medium	65.06	FAO RSS (2000-2005) forest loss	0.32
Honduras	Medium	High	Medium	477.53	FAO RSS (2000-2005) forest loss	0.25
Haiti	High	High	High	18.18	Hansen (2000-2012) forest loss	0.14
Indonesia	High	Medium	High	3490.95	FAO FRA (2000-2010) net & FAO RSS (2000-2005) forest loss	0.96
India	Medium	Medium	High	885.89	FAO RSS (2000-2005) forest loss	0.25
Jamaica	Medium	No data	Medium	4.61	FAO FRA (2000-2010) net & Hansen (2000-2012) forest loss	0.00
Kenya	High	High	Medium	750.36	FAO RSS (2000-2005) forest loss	0.57
Cambodia	Medium	Medium	High	892.78	FAO FRA (2000-2010) net & FAO RSS (2000-2005) forest loss	0.54
Kiribati	Low	No data	Low	No Data	No data	0.00
Lao People's Democratic Republic	Medium	Medium	High	462.13	FAO FRA (2000-2010) net & FAO RSS (2000-2005) forest loss	0.64
Liberia	Medium	High	Low	240.00	FAO FRA (2000-2010) net & FAO RSS (2000-2005) forest loss	0.36
Libya	High	Low	Low	0.07	Hansen (2000-2012) forest loss	0.00
Saint Lucia	Medium	No data	High	No Data	No data	0.00
Sri Lanka	High	Medium	High	144.30	FAO FRA (2000-2010) net & FAO RSS (2000-2005) forest loss	0.29
Madagascar	High	High	Low	673.03	FAO FRA (2000-2010) net & FAO RSS (2000-2005) forest loss	0.43
Mexico	Medium	High	Medium	5780.33	FAO FRA (2000-2010) net & FAO RSS (2000-2005) forest loss	0.71
Mali	High	High	Low	124.22	FAO RSS (2000-2005) forest loss	0.00
Myanmar	Medium	Medium	High	3347.05	FAO FRA (2000-2010) net & FAO RSS (2000-2005) forest loss	0.07
Mozambique	Medium	High	Low	1285.02	FAO RSS (2000-2005) forest loss	0.39
Mauritania	High	No	Low	0.00	Hansen (2000-2012)	0.00

		data			forest loss	
Mauritius	High	No data	Medium	1.48	Hansen (2000-2012) forest loss	0.14
Malawi	Low	High	Low	102.38	FAO RSS (2000-2005) forest loss	0.29
Malaysia	High	Medium	High	925.89	FAO FRA (2000-2010) net & FAO RSS (2000-2005) forest loss	0.25
Namibia	Medium	No data	Low	154.76	FAO RSS (2000-2005) forest loss	0.14
Niger	High	Medium	Low	0.00	Hansen (2000-2012) forest loss	0.00
Nigeria	High	High	Low	739.41	FAO RSS (2000-2005) forest loss	0.54
Nicaragua	High	High	Medium	700.00	FAO FRA (2000-2010) net & FAO RSS (2000-2005) forest loss	0.36
Nepal	Low	High	High	208.24	FAO FRA (2000-2010) net & Hansen (2000-2012) forest loss	0.43
Oman	Low	No data	Low	0.00	FAO FRA (2000-2010) net & Hansen (2000-2012) forest loss	0.00
Pakistan	Low	Medium	High	5.14	Hansen (2000-2012) forest loss	0.36
Panama	Medium	High	Medium	59.00	FAO FRA (2000-2010) net & FAO RSS (2000-2005) forest loss	0.54
Peru	Low	High	Medium	3652.49	FAO FRA (2000-2010) net & FAO RSS (2000-2005) forest loss	0.86
Philippines	High	High	High	287.38	FAO RSS (2000-2005) forest loss	0.36
Palau	Medium	No data	Low	No Data	No data	0.00
Papua New Guinea	Medium	No data	High	2174.46	FAO FRA (2000-2010) net & Hansen (2000-2012) forest loss	0.50
Paraguay	Medium	High	Medium	1796.45	FAO FRA (2000-2010) net & FAO RSS (2000-2005) forest loss	0.52
Rwanda	Low	High	Medium	10.85	Hansen (2000-2012) forest loss	0.04
Saudi Arabia	Low	Medium	Low	0.00	FAO FRA (2000-2010) net & Hansen (2000-2012) forest loss	0.00
Sudan	Low	No data	No data	0.58	Hansen (2000-2012) forest loss	0.21
Senegal	High	Medium	Medium	265.57	FAO RSS (2000-2005) forest loss	0.21
Singapore	High	No data	High	No Data	No data	0.14
Solomon Islands	Low	No data	Medium	33.96	Hansen (2000-2012) forest loss	0.14

Sierra Leone	High	High	Low	95.80	FAO RSS (2000-2005) forest loss	0.14
El Salvador	High	High	High	32.09	FAO FRA (2000-2010) net & Hansen (2000-2012) forest loss	0.29
Somalia	Low	No data	Low	2.19	Hansen (2000-2012) forest loss	0.00
South Sudan	High	No data	No data	81.17	FAO RSS (2000-2005) forest loss	0.07
Sao Tome and Principe	Medium	No data	Low	No Data	No data	0.00
Suriname	Low	Mediu m	High	8.31	FAO RSS (2000-2005) forest loss	0.36
Seychelles	Low	No data	High	No Data	No data	0.14
Chad	High	High	Low	246.91	FAO RSS (2000-2005) forest loss	0.00
Togo	High	High	Low	180.10	FAO RSS (2000-2005) forest loss	0.14
Thailand	High	High	High	28.30	FAO FRA (2000-2010) net & FAO RSS (2000-2005) forest loss	0.32
Tonga	Low	No data	High	No Data	No data	0.00
Trinidad and Tobago	Low	No data	High	8.14	FAO FRA (2000-2010) net & Hansen (2000-2012) forest loss	0.04
Tanzania, United Republic of	Medium	High	Medium	4145.80	FAO FRA (2000-2010) net & FAO RSS (2000-2005) forest loss	0.50
Uganda	High	High	Medium	676.22	FAO FRA (2000-2010) net & FAO RSS (2000-2005) forest loss	0.39
Uruguay	High	Mediu m	Medium	57.03	FAO FRA (2000-2010) net & FAO RSS (2000-2005) forest loss	0.18
Saint Vincent and the Grenadines	Low	No data	High	No Data	No data	0.00
Venezuela, Bolivarian Republic of	High	High	Medium	2416.33	FAO RSS (2000-2005) forest loss	0.18
Viet Nam	Medium	High	High	1303.22	FAO RSS (2000-2005) forest loss	0.50
Vanuatu	Low	No data	High	1.67	Hansen (2000-2012) forest loss	0.32
Samoa	Low	No data	High	No Data	No data	0.25
South Africa	High	High	Low	588.59	FAO RSS (2000-2005) forest loss	0.00
Zambia	Low	High	Low	2987.68	FAO RSS (2000-2005) forest loss	0.32
Zimbabwe	Medium	High	Low	2547.88	FAO FRA (2000-2010) net & FAO RSS (2000-	0.07

				2005) forest loss	
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