

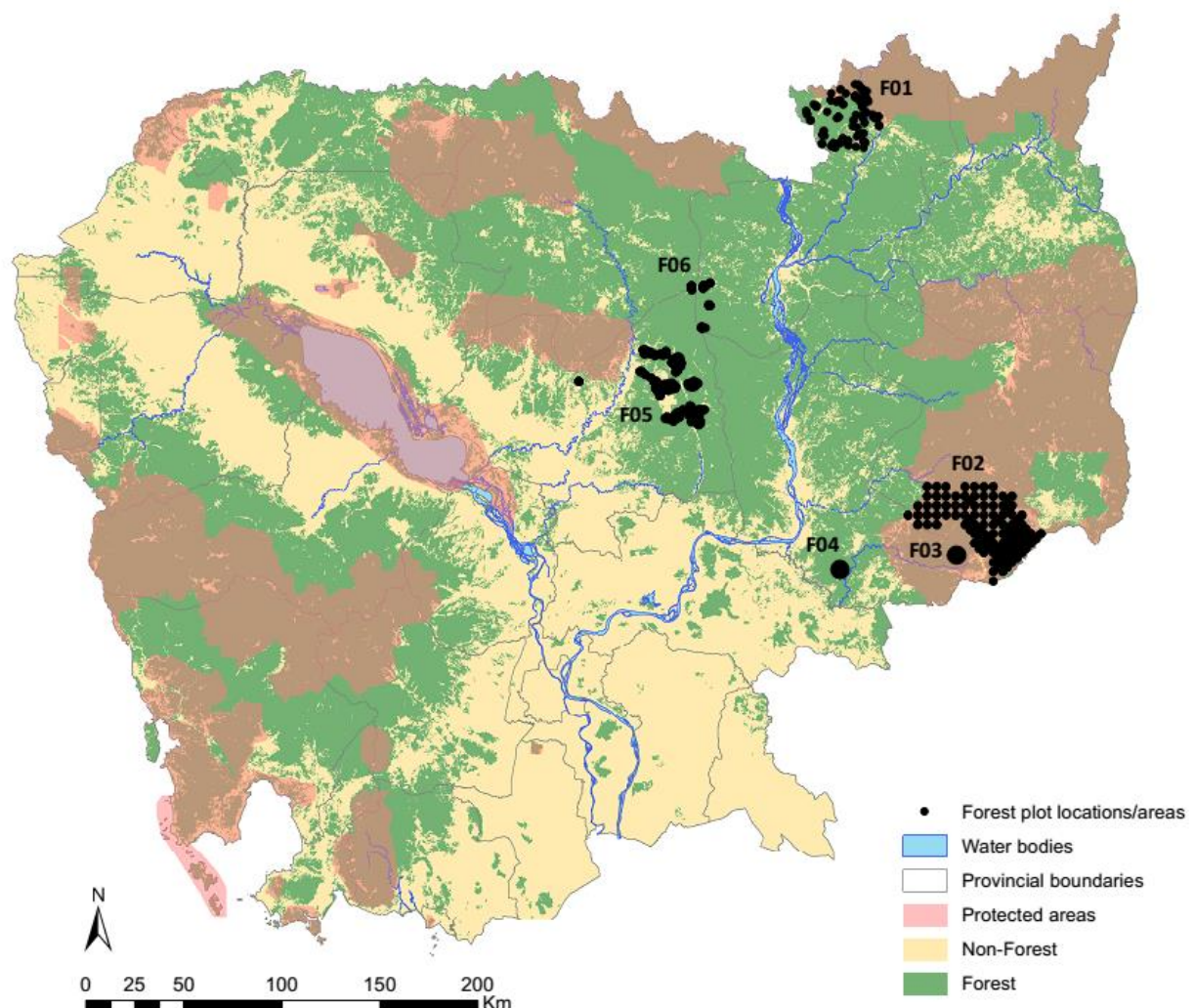
Supplementary Figure 1

Producer price comparison among data sources. Panels show comparison of producer prices from different data sources for: a) rubber, b) sugar, c) cassava and d) cashew. Prices shown are nominal dollars adjusted to US\$ 2013 dollars using a consumer price index (CPI) averaged across Thailand, Vietnam and Cambodia.



Supplementary Figure 2

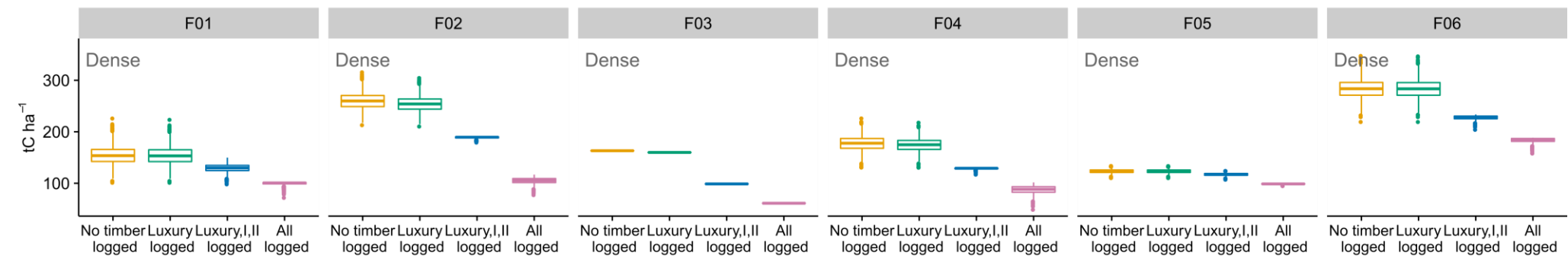
Map of forest inventory locations. Forest inventories were obtained from six landscapes (F01 – F06) in Cambodia (Supplementary Table 1); dense forest was sampled in each landscape, and open forest in three landscapes. Two landscapes are managed for biodiversity conservation (F01 and F02), two are partly managed by communities (F04 and F05) and two are not under formal management (F03 and F06). Some selective logging had taken place in all landscapes prior to data collection, as has occurred across most of the region (Supplementary Note 1). F03 is represented by a single marker as the inventory comprised a single 60 ha plot, and F04 is represented by a single marker as individual plot locations were not available. Dense forest was sampled at all locations, and open forest at F01, F02 and F04. Data sources: F01 (Permian Global in collaboration with Ecometrica and Birdlife Cambodia, unpublished data, 2009); F02 & F03 (Wildlife Conservation Society/Forestry Administration, unpublished data, 2011); F04 (CDRI, unpublished data, 2006¹); F05²; F06³ (with the late J.F. Maxwell). Forest cover, protected areas and water bodies extent obtained from Open Development Cambodia (<https://opendevelopmentcambodia.net>), licensed under CC-BY-SA (<https://creativecommons.org/licenses/by-sa/3.0>).



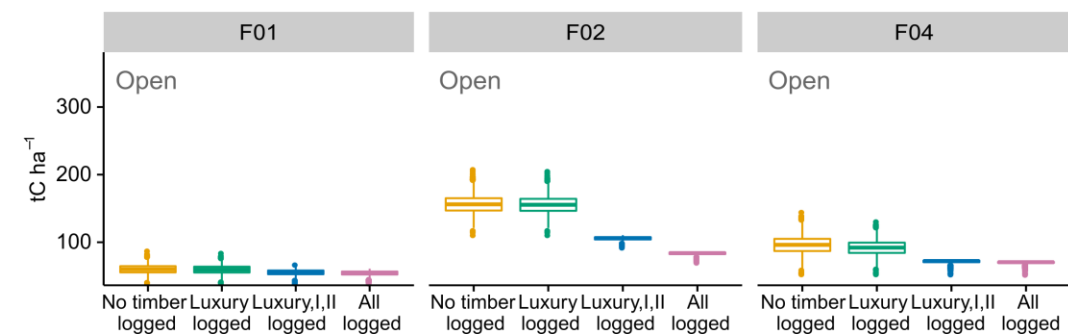
Supplementary Figure 3

Forest carbon stock of dense and open forest in each of six Cambodian forest landscapes. The between-landscape variation in carbon stock (tC ha^{-1}), shown for a) dense forest and b) open forest, reflects differences in annual rainfall, dry season length, and species composition and structure^{4,5}, but may also reflect exploitation history.

a

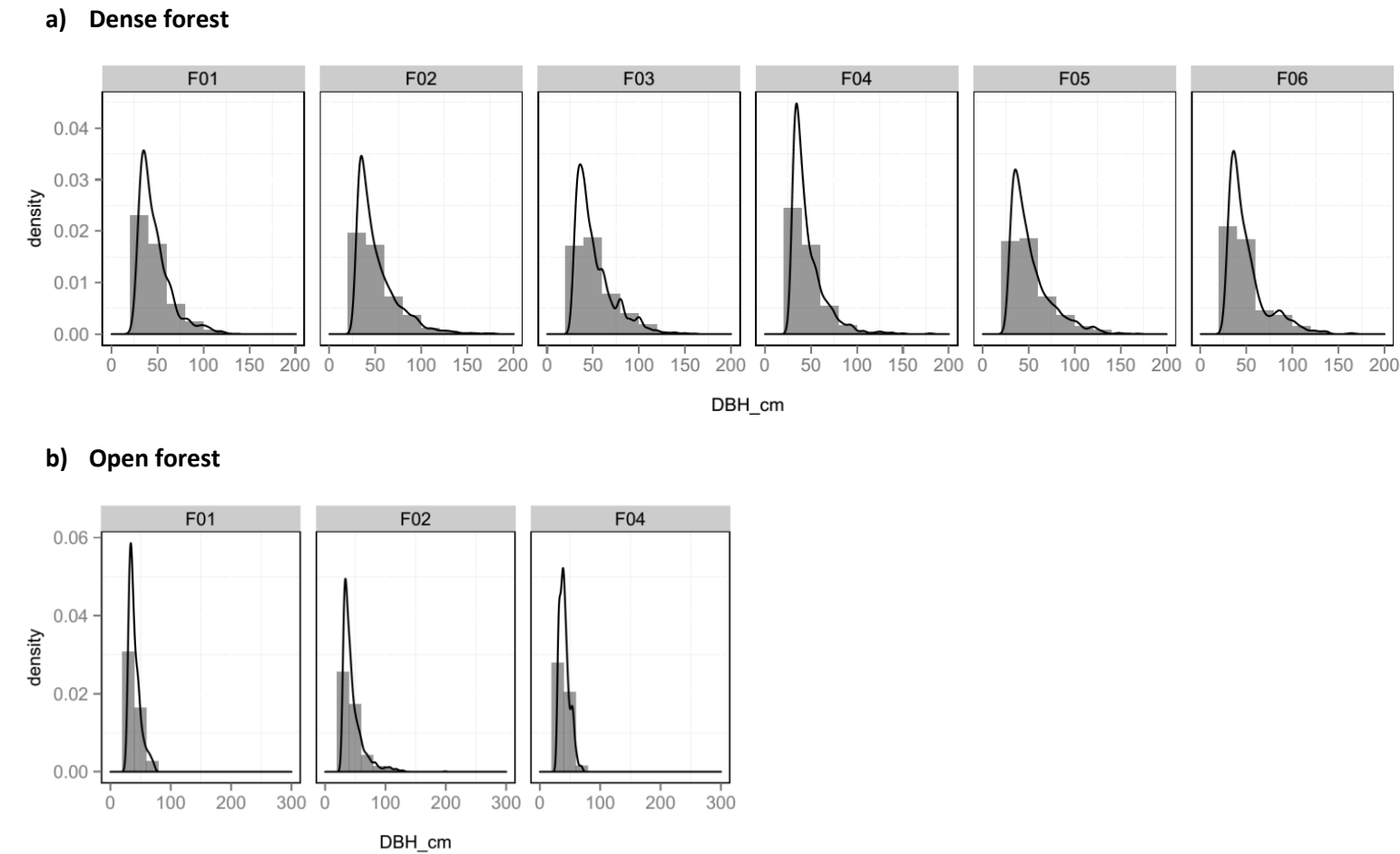


b



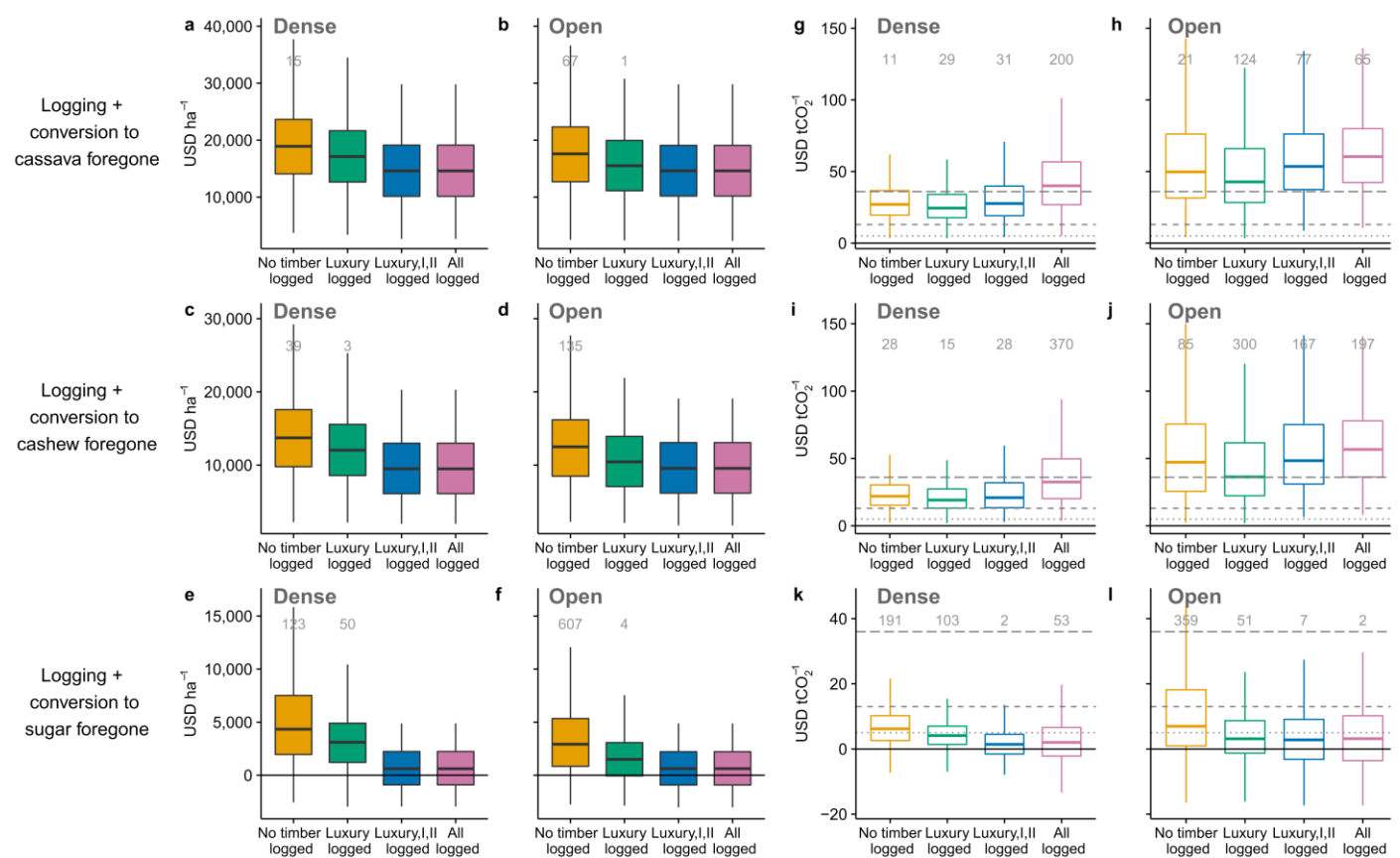
Supplementary Figure 4

Frequency distribution of stem diameters for each forest inventory. Data only includes stems ≥ 30 cm in a) dense forest and b) open forest. Bars show the relative frequency of trees within DBH size categories, while curves represent a smoothed density distribution. Frequency distribution of tree sizes is similar across dense forest landscapes, while in open forest landscapes. Although open forest in landscapes F02 and F01, and dense forest in landscape F02 appeared to have a greater proportion of larger luxury class stems (≥ 60 cm DBH) than other landscapes, the differences were not significant (Supplementary Figure 9; Supplementary Table 11).



Supplementary Figure 5

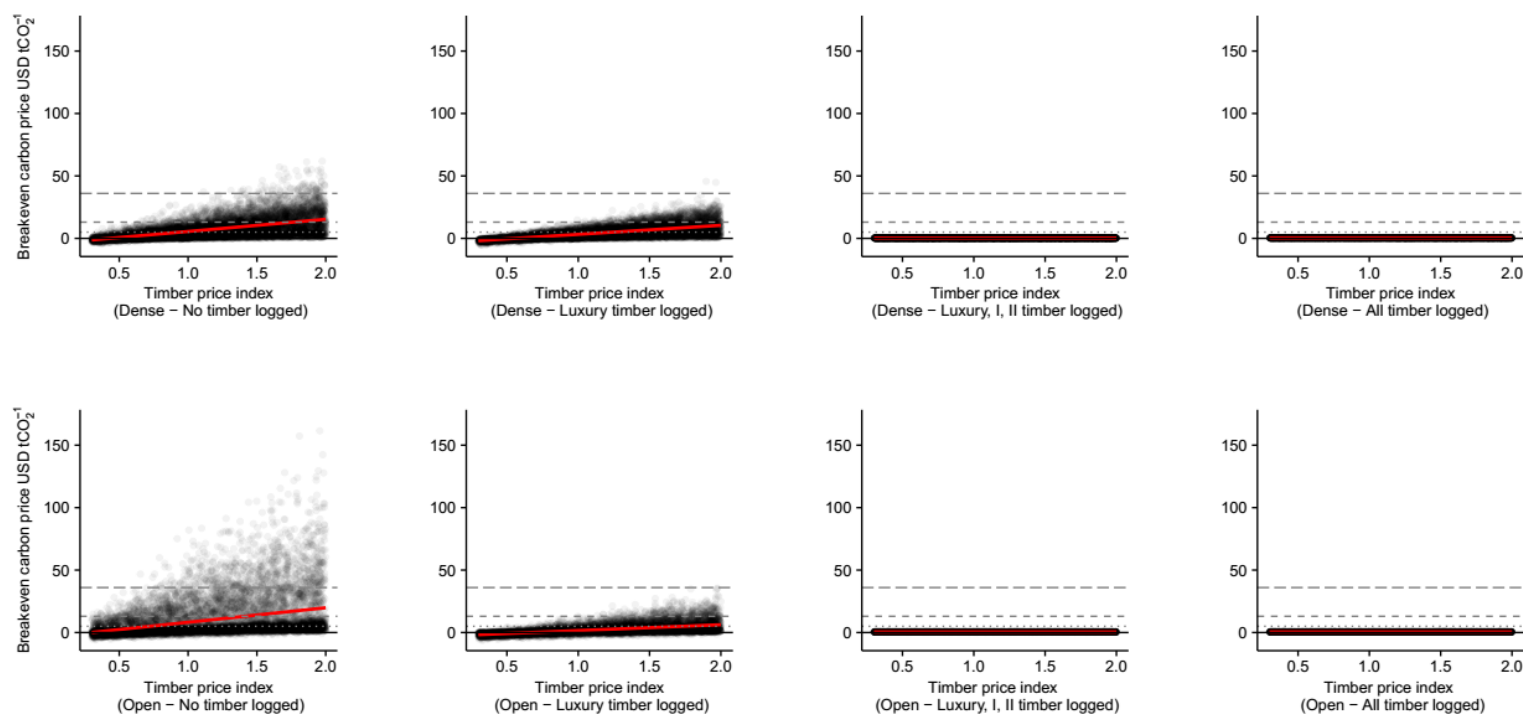
Opportunity costs and breakeven carbon prices needed to protect forests from logging and conversion to cassava, cashew and sugar. Opportunity costs (a – f) are based on the forgone profits from logging (for luxury class timber, trees ≥ 10 cm DBH, other classes of timber, trees ≥ 40 cm DBH) and agriculture (cassava, cashew or sugar, 25 year NPV, 10% discount rate), offset by lost revenue from resin collection with the logging of resin trees (timber royalty class II), which are logged in the “Luxury, I, II logged” and “All logged” scenarios. Breakeven carbon prices (g – l) are the prices needed to offset opportunity costs, REDD+ setup costs and implementation costs. Costs are shown separately for dense and open forests. Time-averaged post-deforestation land use carbon stocks partially offset forest carbon losses. Grey lines in the BCP panels represent real world carbon prices (Supplementary Table 10): dotted = $\$5 \text{ tCO}_2^{-1}$ (indicative of voluntary market forest carbon sales and non-market carbon fund prices), short dash = $\$13 \text{ tCO}_2^{-1}$ (indicative of compliance market prices) and long dash = $\$36 \text{ tCO}_2^{-1}$ (indicative of the social cost of carbon). Outliers (more than 1.5x the interquartile range) are not displayed to improve the clarity of the figure; the value shown above each box-whisker gives the n outliers excluded out of 10,000 modelled results.



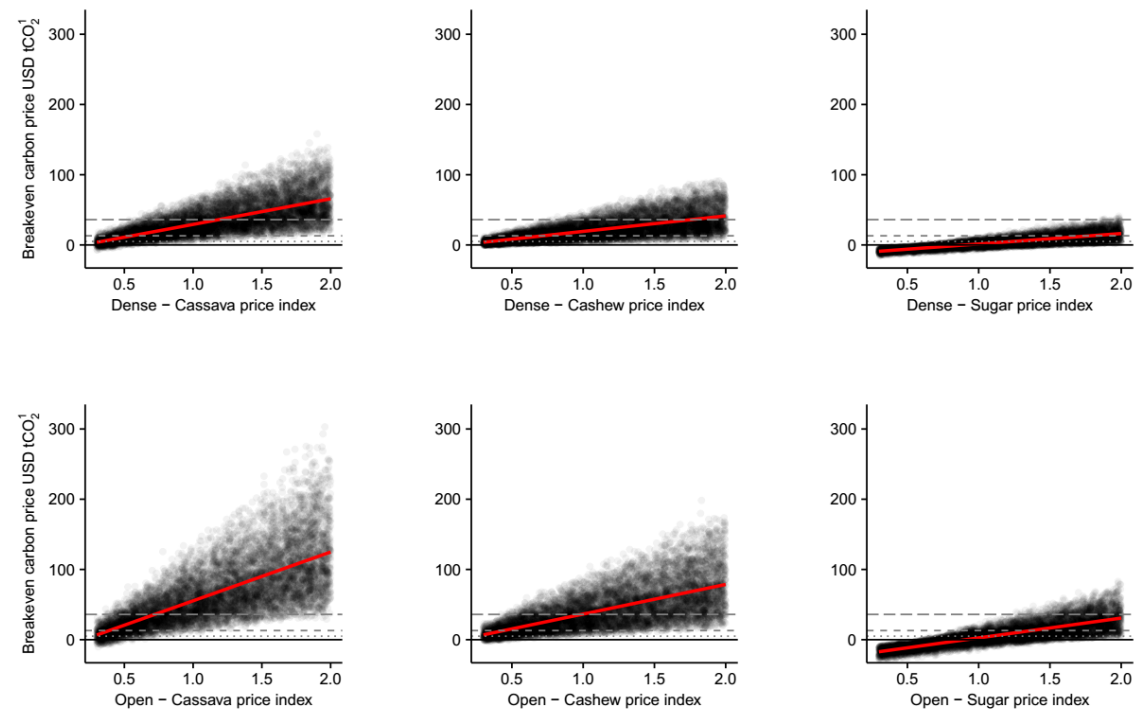
Supplementary Figure 6

Sensitivity analysis assessing the effect of commodity prices on breakeven carbon prices. Sensitivity analyses explored the impacts of increasing and decreasing a) timber, b) agricultural and c) resin prices on carbon breakeven price, using a price index randomly drawn from a uniform distribution between 0.3 and 2 (i.e. from less than a third, to two times the mean price), following Gilroy et al⁶. This index range encompassed all annual producer farm gate price fluctuations for natural rubber 2000 – 2014 inclusive. For each input variable examined (timber, agricultural or resin price), carbon equilibrium prices are shown in relation to the price index. For agricultural price sensitivity analysis, we only show sensitivity of carbon breakeven prices under the “No timber logged” scenario for each crop. Increases in timber and agricultural prices could have a strong effect on the opportunity costs of conservation. In contrast, resin prices would need to increase by more than two times their current value in order to reduce carbon equilibrium prices. Grey lines on the panels represent real world carbon prices (Supplementary Table 10): dotted = \$5 tCO₂⁻¹ (indicative of voluntary market forest carbon sales and non-market carbon fund prices), short dash = \$13 tCO₂⁻¹ (indicative of compliance market prices) and long dash = \$36 tCO₂⁻¹ (indicative of the social cost of carbon).

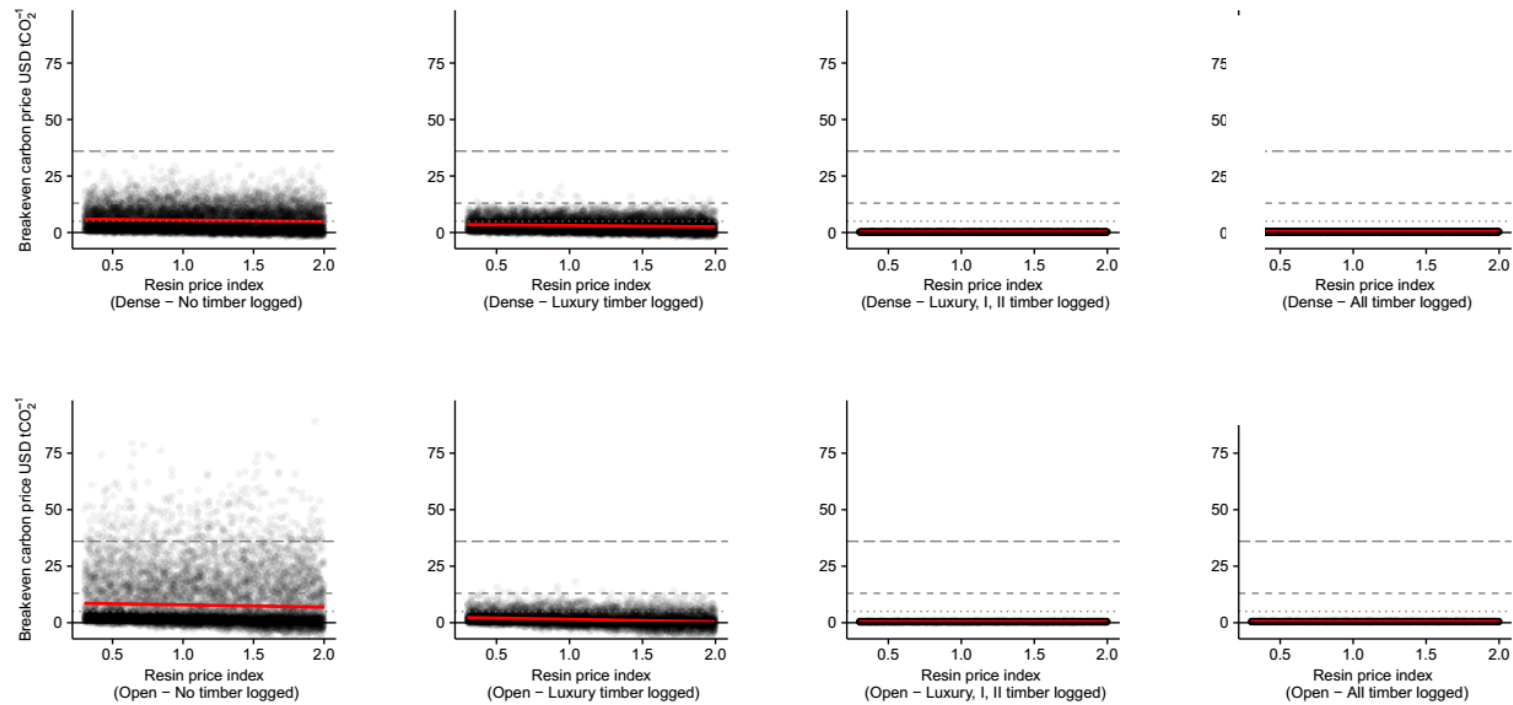
a) Timber prices – “Logging only”



b) Agricultural prices – “No timber logged”

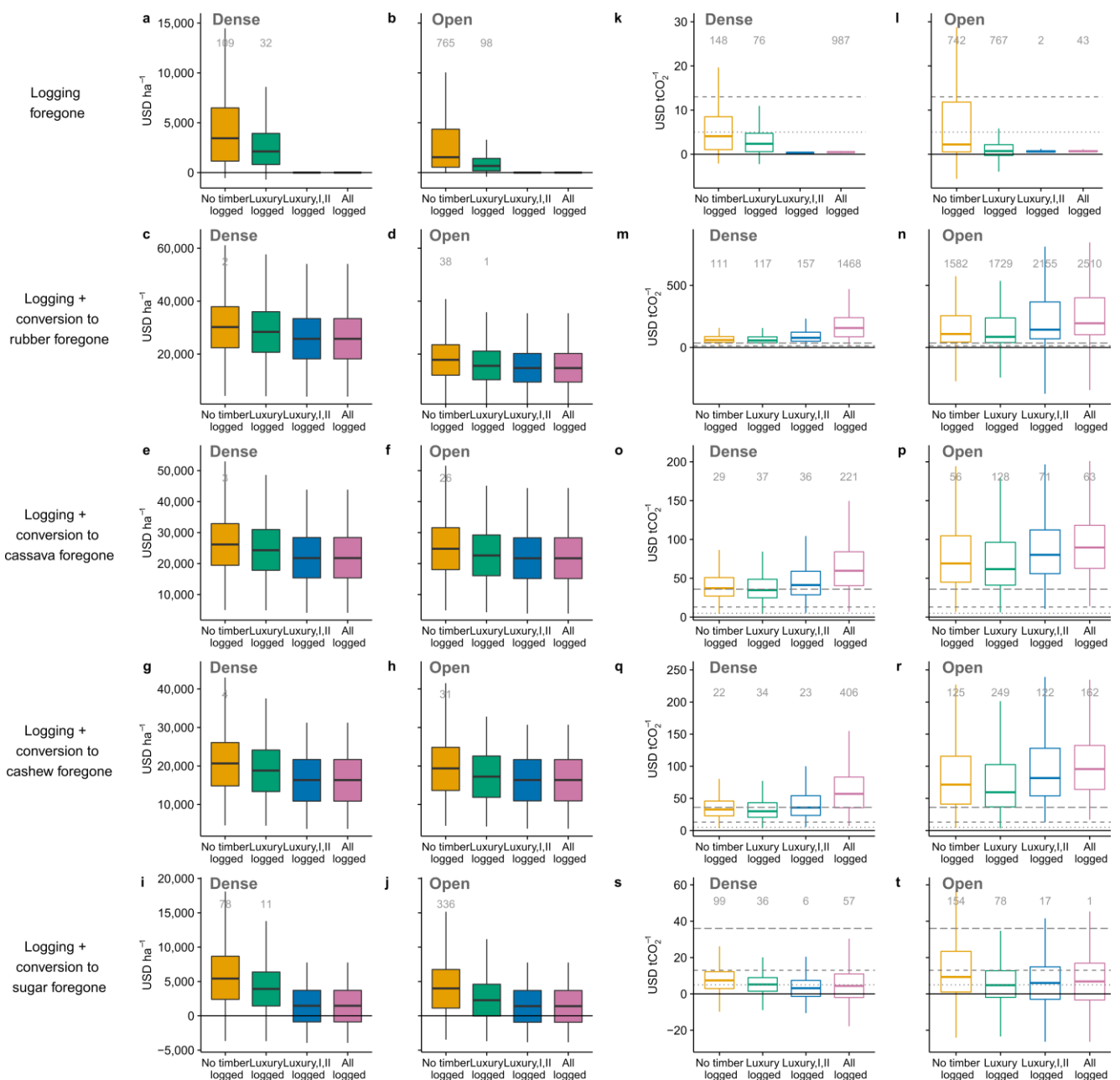


c) Resin prices - “Logging only”



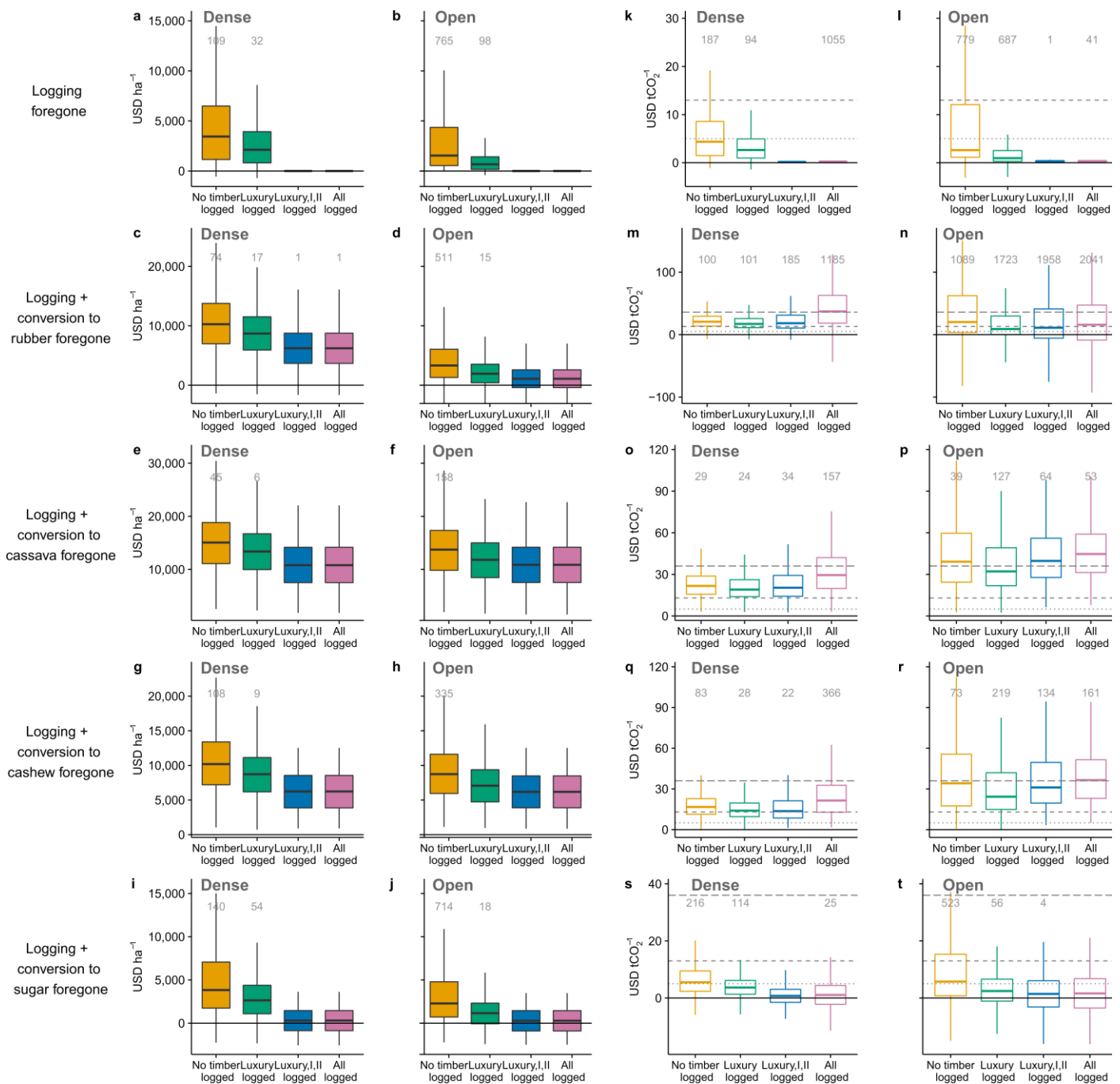
Supplementary Figure 7

Consequence of an alternative 5% discount rate on opportunity costs and breakeven carbon prices needed to protect forests from logging and conversion to rubber and other cash crops. Opportunity costs (OC; a – j) include forgone profits from logging (for luxury class timber, trees ≥ 10 cm DBH, other classes of timber, trees ≥ 40 cm DBH), and/or conversion to agriculture, offset by resin revenue, except where resin trees (class II) are logged out (in the “luxury, I, II logged” and “all timber logged” scenarios). Breakeven carbon prices (BCP; k – t) are the prices needed to offset opportunity costs, REDD+ setup costs and implementation costs. Costs are shown separately for dense and open forests. Time-averaged post-deforestation land use carbon stocks partially offset forest carbon losses. Grey lines on BCP panels represent real world carbon prices: dotted = $\$5 \text{ tCO}_2^{-1}$ (indicative of voluntary market forest carbon sales and non-market carbon fund prices), short dash = $\$13 \text{ tCO}_2^{-1}$ (indicative of compliance market prices) and long dash = $\$36 \text{ tCO}_2^{-1}$ (indicative of the social cost of carbon). Outliers (more than 1.5x the interquartile range) are not displayed to improve the clarity of the figure; the value shown above each box-whisker gives the n outliers excluded out of 10,000 modelled results.



Supplementary Figure 8

Consequence of an alternative 15% discount rate on opportunity costs and breakeven carbon prices needed to protect forests from logging and conversion to rubber and other cash crops. Opportunity costs (OC; a – j) include forgone profits from logging (for luxury class timber, trees ≥ 10 cm DBH, other classes of timber, trees ≥ 40 cm DBH), and/or conversion to agriculture, offset by resin revenue, except where resin trees (class II) are logged out (in the “luxury, I, II logged” and “all timber logged” scenarios). Breakeven carbon prices (BCP; k – t) are the prices needed to offset opportunity costs, REDD+ setup costs and implementation costs. Costs are shown separately for dense and open forests. Time-averaged post-deforestation land use carbon stocks partially offset forest carbon losses. Grey lines on BCP panels represent real world carbon prices: dotted = $\$5 \text{ tCO}_2^{-1}$ (indicative of voluntary market forest carbon sales and non-market carbon fund prices), short dash = $\$13 \text{ tCO}_2^{-1}$ (indicative of compliance market prices) and long dash = $\$36 \text{ tCO}_2^{-1}$ (indicative of the social cost of carbon). Outliers (more than 1.5x the interquartile range) are not displayed to improve the clarity of the figure; the value shown above each box-whisker gives the n outliers excluded out of 10,000 modelled results.

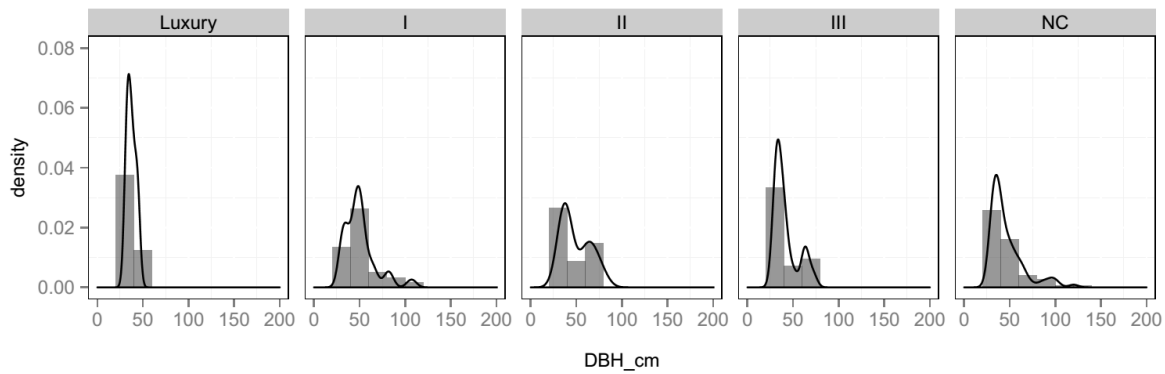


Supplementary Figure 9

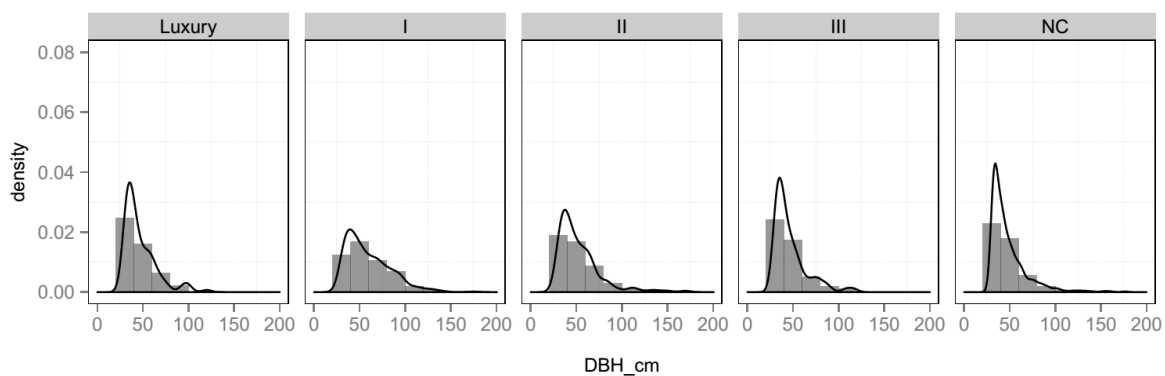
Frequency distribution of stem diameters for each timber royalty class within each forest inventory. Data only includes stems $\geq 30\text{cm}$ in dense forest (a, i – vi) and open forest (b, i – iii). Bars show the relative frequency of trees within DBH size categories, while curves represent a smoothed density distribution. Frequency distribution of tree sizes is remarkably similar across all forest landscapes.

a) Dense forest

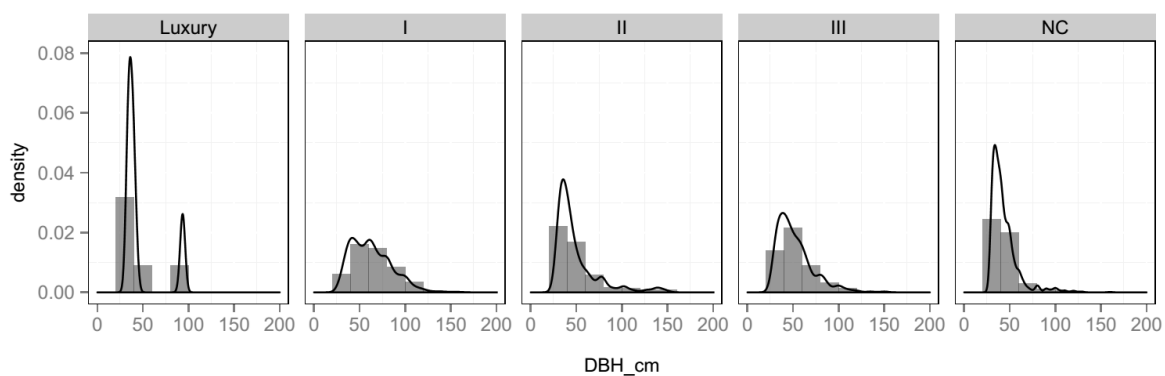
i. F01



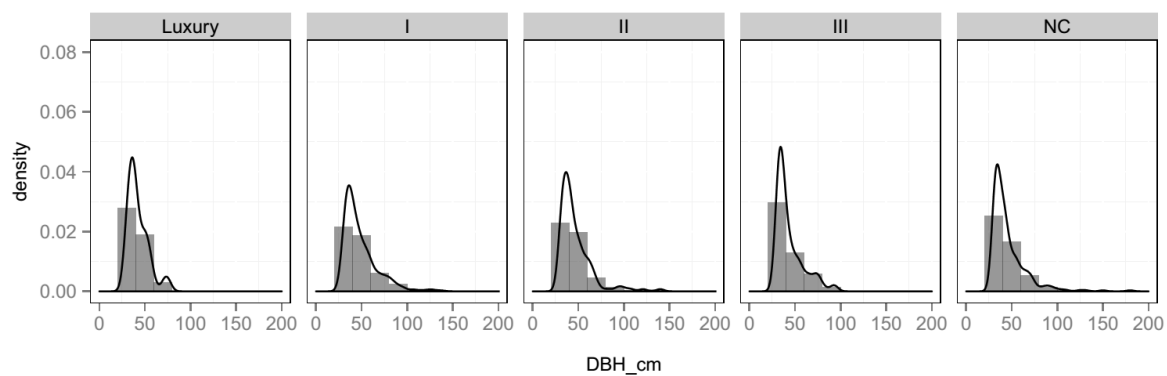
ii. F02



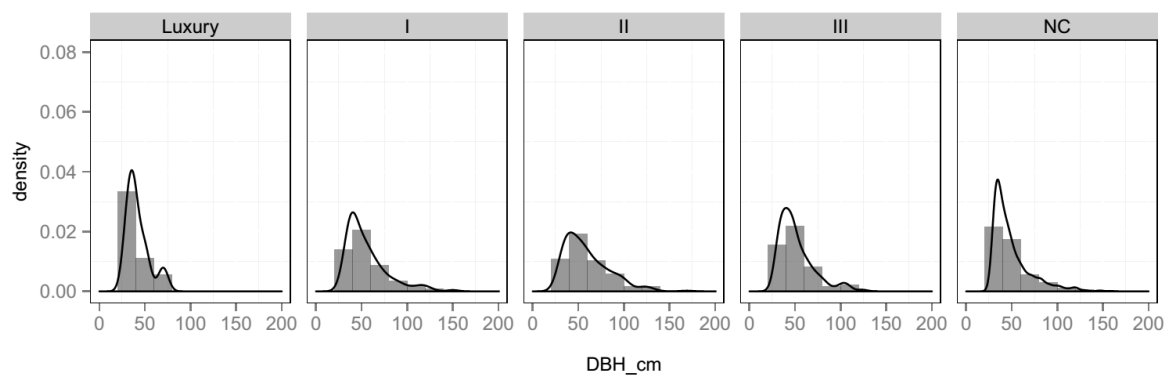
iii. F03



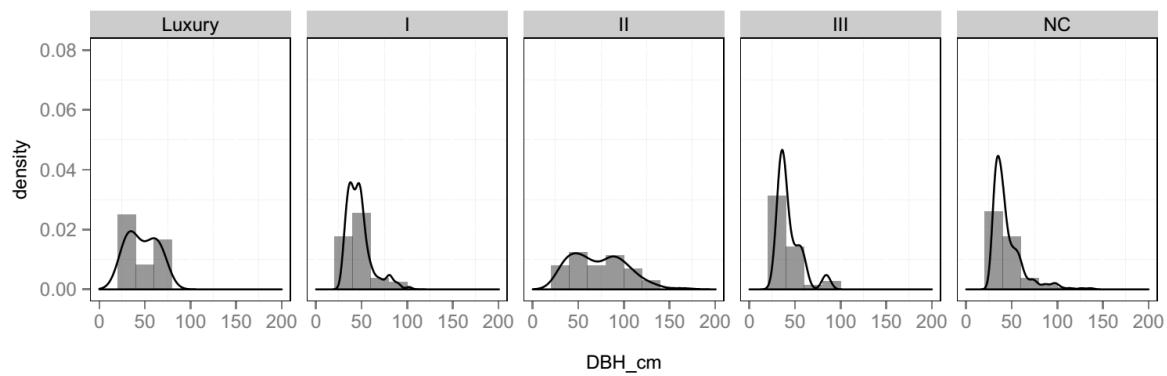
iv. F04



v. F05

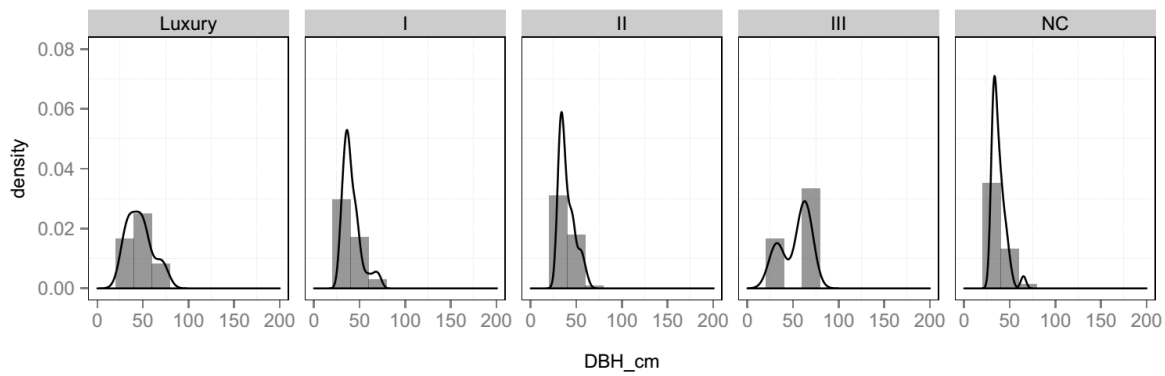


vi. F06

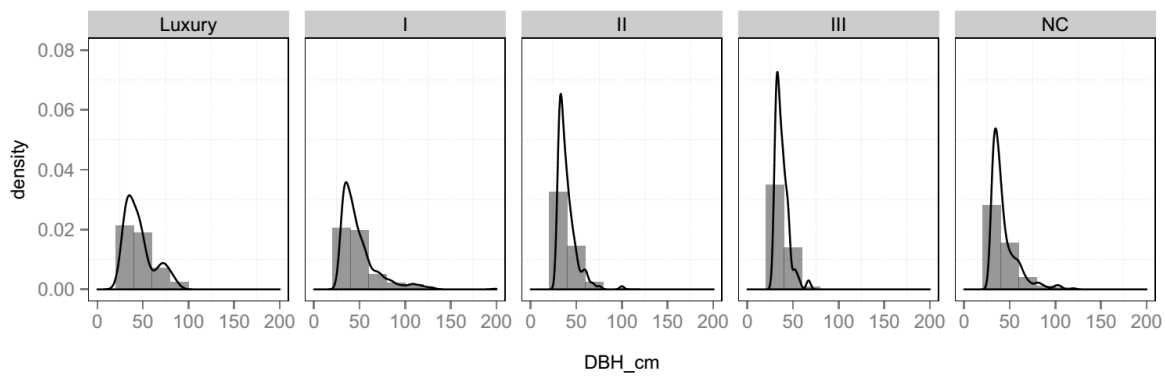


b) Open forest

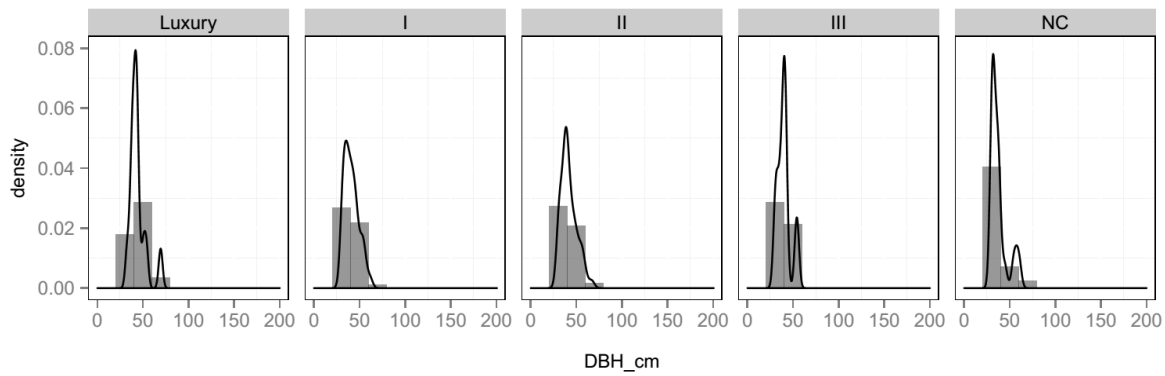
i. F01



ii. F02

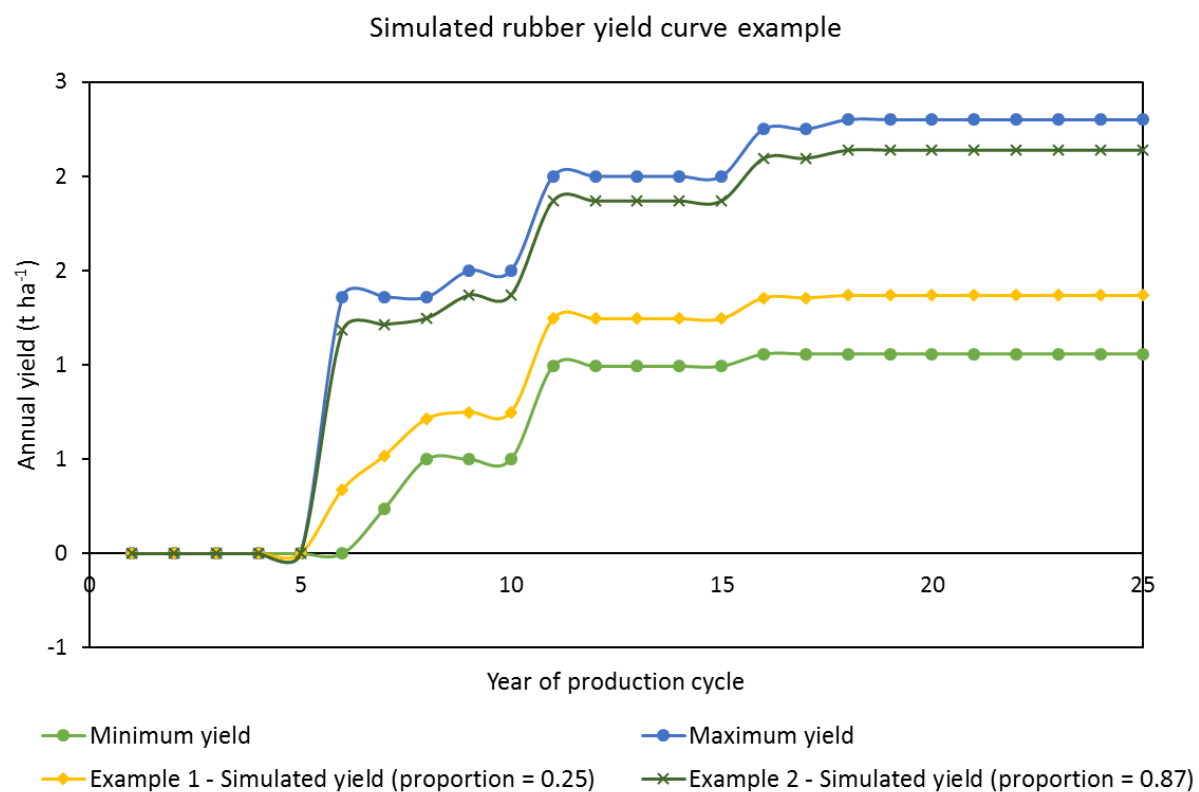


iii. F04



Supplementary Figure 10

Rubber yield curve simulation example. For explanation of simulation, see Supplementary Table 5.



Supplementary Table 1

Tree inventories used to parameterise carbon and timber models. Inventories were originally collected for forest structure, carbon stock measurement and forest composition studies. Five inventories used a fixed sampling area (3.1 - 60 ha total per landscape) while F05 used variable radius plots. Where data were available for trees $5 \leq 10$ cm DBH, these were omitted from analysis, standardising to a minimum DBH of 10cm across all datasets. Data sources: F01 (Permian Global in collaboration with Ecometrica and Birdlife Cambodia), F02 and F03 (Wildlife Conservation Society/Forestry Administration, unpublished data, 2011), F04 (CDRI, unpublished data, 2006¹), F05², F06³ (with the late J.F. Maxwell).

Forest category	Source	Forest type	n trees >10 cm DBH	n trees >30 cm DBH	Tree size (DBH, cm)	n plots	Plot dimensions (m)	Plot area (ha)	Total area sampled (ha)	Approx. coverage (max. distance between plots, km)
Dense	F01	Semi-Evergreen	457	188	5 - 20	31	Radius = 5.64	0.01	0.31	38
					>20	31	Radius = 17.84	0.1	3.10	
	F02	Evergreen/Semi-Evergreen	4594	2289	5 – 15	63	3x subplots; radius = 5	0.024	1.48	60
					15 – 30	63	3x subplots; radius = 15	0.212	13.36	
					>30	63	3x subplots; radius = 20	0.377	23.75	
	F03	Evergreen	3246	2784	5 - 15	24 (pooled to 1)	10 X 25	0.025	0.60	
					15 - 30	24 (pooled to 1)	10 X 50	0.05	1.20	
					>30	1	1000 x 600	60	60.00	
	F04	Evergreen/Semi-Evergreen	3038	894	5 – 10	24	25 x 50	0.125	3.00	n/a
					10 – 30	24	50 x 50	0.25	6.00	
					>30	24	50 x 100	0.5	12.00	
	F05	Evergreen, Semi-Evergreen + Deciduous	3013	1349	>10	361	n/a - variable radius	n/a	n/a	48
	F06	Evergreen, Riverine, Lagostroemia	2512	576	>10	100	10 x 50	0.05	5	83
Total			16860	8080		585			129.80	260
Open	F01	Deciduous	373	128	5 – 20	36	Radius = 5.64	0.01	0.36	29
					>20	36	Radius = 17.84	0.1	3.60	
	F02	Deciduous/Semi-Evergreen matrix	2366	1193	5 – 15	41	Radius = 5	0.024	0.97	60
					15 - 30	41	Radius = 15	0.212	8.69	
					>30	41	Radius = 20	0.377	15.46	
	F04	Deciduous	682	195	5 – 10	15	25 x 25	0.0625	0.94	n/a
					10 – 30	15	25 x 50	0.125	1.88	
					>30	15	50 x 50	0.25	3.75	
Total			3421	1516		92			35.65	260
Grand Total			20281	9596		667			165.45	260

Supplementary Table 2

Median and interquartile range of timber profits for each scenario.

	Opportunity cost of protection (median, \$ ha ⁻¹)	Opportunity cost of protection (lower 25% quartile, \$ ha ⁻¹)	Opportunity cost of protection (upper 25% quartile, \$ ha ⁻¹)	% timber value removed	Remaining % timber profit
<i>Minimum harvestable DBH: 10cm for luxury, other classes 40cm</i>					
Dense					
No timber logged	3,443	1,151	6,490	0	100.0
Luxury timber logged	2,123	810	3,931	38.3	61.7
Luxury, I, II timber logged	0	-	-	100.0	0
All timber logged	0	-	-	100.0	0
Open					
No timber logged	1,543	543	4,356	0	100.0
Luxury timber logged	671	165	1,422	56.5	43.4
Luxury, I, II timber logged	0	-	-	100.0	0
All timber logged	0	-	-	100.0	0
<i>Minimum harvestable DBH: 10cm for luxury, other classes 30cm</i>					
Dense					
No timber logged	4,308	1,637	7,537	0	100.0
Luxury timber logged	2,881	1,227	4,967	33.1	66.9
Luxury, I, II timber logged	0	0	0	100.0	0
All timber logged	0	0	0	100.0	0
Open					
No timber logged	3,373	1,214	6,346	0	100.0
Luxury timber logged	1,961	710	3,494	41.9	58.1
Luxury, I, II timber logged	0	0	0	100.0	0
All timber logged	0	0	0	100.0	0

Supplementary Table 3

Median and interquartile range of agricultural 25-year net present value (NPV), with input costs and prices in \$US adjusted to 2013. NPV is shown for large, monocultural plantations of rubber and sugar, and smallholder farms of cashew and cassava

Forest type	Discount rate (%)	Crop type	25-year NPV (median, \$ ha ⁻¹)	Lower 25% quartile (\$ ha ⁻¹)	Upper 25% quartile (\$ ha ⁻¹)
Dense	5	Rubber	25,774	18,191	33,423
		Cassava	21,782	15,373	28,414
		Cashew	16,328	10,847	21,680
		Sugar	1,463	-886	3,707
	8	Rubber	16,533	11,403	21,733
		Cassava	16,980	12,000	22,041
		Cashew	11,762	7,490	15,838
		Sugar	919	-856	2,784
	10	Rubber	12,571	8,436	16,698
		Cassava	14,597	10,133	19,124
		Cashew	9,491	6,099	12,989
		Sugar	619	-905	2,238
	15	Rubber	6,224	3,676	8,763
		Cassava	10,800	7,511	14,167
		Cashew	6,236	3,862	8,549
		Sugar	306	-860	1,461
Open	5	Rubber	14,697	9,414	20,219
	8		7,909	4,463	11,464
	10		5,089	2,532	7,764
	15		1,088	-403	2,591

Supplementary Table 4

Real world carbon prices. Indicative carbon prices were sought from the literature for comparison with estimated breakeven carbon prices. Three prices were selected, chosen to represent voluntary markets and carbon funds, compliance markets, and the estimated social cost of carbon, respectively.

Mean price (\$ tCO ₂ ⁻¹)	Price type	Source	Indicative price used (\$ tCO ₂ ⁻¹)
1.70	All forest carbon offsets sold on the voluntary market in 2014	7	5.00
3.70	Avoided deforestation (REDD) credits sold globally in 2014	7	
5.00	Non-market forest carbon payments (e.g. bilateral agreements between Norway/Guyana)	7	
5.40	All voluntary market carbon sales	7	
12.70	All compliance market carbon sales (e.g. California's cap and trade policy)	7	13.00
18.00	Corporate internal carbon prices	8	
36.00	US government social cost of carbon	9	36.00
40.00	World Bank social cost of carbon	8	

Supplementary Table 5

Data sources for agricultural net present value calculation. For each parameter, price and cost estimates from different sources were adjusted to US\$ 2013 using an averaged CPI for Thailand, Cambodia and Vietnam¹⁰ before calculation of means, variance or range. FAO producer prices are compared to price estimates from other sources, including GEM commodity prices, in Supplementary Figure 1. For each parameter an explanation of data treatment and value selection is given; resulting crop-specific parameter values are provided in Supplementary Table 8.

Parameter	Reference	Country	Method
<i>Rubber – large scale monocultural plantation crop</i>			
Rubber producer price (see also Supp. Fig. 1)	¹¹	Thailand/ Vietnam	Producer prices are not published for Cambodia on FAOSTAT ¹¹ , so the mean and standard error of the mean (SE) of annual producer prices across Thailand and Vietnam (2003 – 2012 inclusive) were used to account for price volatility and regional variation in rubber prices. Compared to prices reported from ground surveys in Cambodia (\$530 – 1878 t ⁻¹ ; data from 2005 adjusted to US\$ 2013; ^{1,12–14} these values (\$1355 - \$4046, data from 2002 – 2012, \$2333 in 2005) are relatively high; farmers, especially smallholders, may receive lower prices in Cambodia. The most recent data from 2014 gives a producer price of \$1,644 t ⁻¹ . We do not include returns from felling the rubber trees and selling the timber at the end of the 25 year cycle as this is often used to cover the costs of replanting the next cycle ¹⁵ .
Rubber yield	^{1,12,13}	Cambodia	Yield data for each production year of the 25-year management cycle of a large plantation were extracted from each study. Minimum and maximum yields for each year, across all studies, were used as minimum and maximum input parameters for the simulation model (n = 3). Yield estimates that appeared to use unclear units which could correspond to wet latex yield rather than dry rubber yield, were excluded from analysis. For each model iteration an annual dry rubber yield curve (t ha ⁻¹ yr ⁻¹) over 25 years was generated as a proportion of the maximum attainable yield. For each iteration (<i>i</i>), a proportion (<i>prop_i</i> range 0 to 1) was selected randomly from a uniform distribution. Then for each production year (<i>t</i> , range 0-24) the run-specific yield (<i>Y_{i,t}</i>) was calculated applying this proportion to the interval between reported minimum (<i>Ymin_t</i>) and maximum (<i>Ymax_t</i>) yields, following the equation: $Y_{i,t} = Ymin_t + (Ymax_t - Ymin_t) * Yprop_i$. The run-specific proportion used to create the yield curve was generated independently for each crop, for each iteration. Two examples, for <i>prop_i</i> = 0.25 and 0.87, are shown in Supplementary Figure 10. For open forests, a yield penalty was applied to account for predicted slower tree growth in dry conditions by delaying the onset of tapping until 10 years after planting, rather than the usual 6 years ¹⁶ .
Rubber production cost	^{1,12–14}	Cambodia	Production cost data for each year of the 25-year management cycle for large monocultural plantations were extracted from each study (n = 2 referring to large plantations), standardised to USD ha ⁻¹ yr ⁻¹ in US\$ 2013. Costs included: land clearance (using bulldozer or tractor, year 1 only, n = 1), land preparation (annual), planting material, annual inputs, annual labour costs. We do not include the costs of felling rubber trees at the end of the 25-year management cycle as this cost is associated with replanting and the start of the next yield production cycle. For each model iteration an annual cost curve (\$ ha ⁻¹ yr ⁻¹) over 25 years was generated as a proportion of the maximum cost. For each iteration (<i>i</i>), a proportion (<i>Cprop_i</i> range 0 to 1) was selected randomly from a uniform distribution. Then for each production year (<i>t</i> , range 1-25) the run-specific cost (<i>C_{i,t}</i>) was calculated applying this proportion to the interval between reported minimum (<i>Cmin_t</i>) and maximum (<i>Cmax_t</i>) costs, following the equation: $C_{i,t} = Cmin_t + (Cmax_t - Cmin_t) * Cprop_i$. The run-specific proportion used to create the cost curve was generated independently for each crop, for each iteration.

Cashew – smallholder monocultural plantation crop

Cashew producer price	¹¹	Thailand/ Vietnam	Producer prices are not published for Cambodia on FAOSTAT¹¹, so the mean and standard error of the mean (SE) of annual producer prices across Thailand and Vietnam for 2003 - 2012 inclusive (\$861 - \$1197, data from 2002 - 2012, US\$ 2013) were used to account for price volatility and regional variation in cashew prices Compared to prices reported from ground surveys in Cambodia (\$789 - \$1047, 2003 – 2005, in US\$ 2013^{1,12,13}), Cambodian farm gate prices are similar to producer prices in Thailand and Vietnam. Farmers are therefore likely to receive prices similar to these in Cambodia.
(see also Supp. Fig. 1)			
Cashew yield	¹²	Cambodia	Six sets of yield data, for different management cycle lengths, were extracted from ACI (2005¹²) for small farms, covering four provinces. Some yields seemed surprisingly high (up to 5.5 t ha⁻¹), given that average yields from a large scale plantation in Cambodia were reported to be 0.8 t ha⁻¹, and a report on the cashew industry in Cambodia states that the maximum known yields from Cambodia are 2.0 t ha⁻¹, with exceptional yields of 2.5 t ha⁻¹ reported from Vietnam ¹⁷. We therefore excluded any datasets reporting average yields >2.5 t ha⁻¹ over a 25-year plantation cycle. Yield curves reported for management cycles of less than 25 years (e.g. 10 or 15 years) were extrapolated according to the proportional yield declines reported for 25-year management cycles. Minimum and maximum yields for each production year, across all six yield curves, were used as minimum and maximum input parameters for the simulation model and an iteration-specific yield curve was simulated, as for rubber. The run-specific proportion used to create yield curve was generated independently for each crop, for each iteration.
Cashew production cost	¹²	Cambodia	Production cost data for each year of the 25-year management cycle were extracted from each of the six datasets in ACI (2005¹²), standardised to USD ha⁻¹ yr⁻¹ (adjusted to 2013). Costs included: land clearance (using manual labour, year 1 only), land preparation (year 1 only), planting material, annual inputs and labour costs (including imputed family labour costs). Where management cycles reported were for less than 25 years, costs were extended to year 25 based on final year costs in each dataset. Variation in reported labour requirements among the six datasets was high (total annual labour days ranged from 25 to 267 days ha⁻¹). On inspection of the budgets, this was accounted for by a ten-fold greater number of annual labour days reported for harvesting in one smallholder budget (220 – 300 days ha⁻¹). In three other smallholder datasets, annual harvesting labour days ranged from 16 – 30 days ha⁻¹, while a maximum of 35 days ha⁻¹ were reported from a survey of 140 smallholder cashew farmers in Ghana. We therefore considered this large estimate of labour input to be an error, and limited the maximum annual harvesting days to 35 days ha⁻¹. Minimum and maximum costs for each production year, across all six datasets, were used as minimum and maximum input parameters for the simulation model, and an iteration-specific cost curve was simulated, as for rubber. The run-specific proportion used to create the cost curve was generated independently for each crop, for each iteration.

Cassava – smallholder monocultural annual crop

Cassava producer price	¹¹	Thailand/ Vietnam	Producer prices for raw cassava are published for Cambodia on FAOSTAT¹¹, but they are much higher than any of the following price estimates for raw cassava, and therefore appear to be incorrect: producer prices for Thailand and Vietnam; farm gate prices for Cambodia reported in ACI¹² or Hing & Thun¹⁴; farm gate prices provided by The Cambodian Ministry of Agriculture, Forestry and Fisheries (MAFF) to
(see also			

Supp. Figure 1)			the ASEAN Food Security Information System¹⁸; or local prices reported from up to 11 local markets across Cambodia (¹⁹; see Supplementary Figure 1). Farm gate prices provided by MAFF were not available for all years of interest¹⁸, so we used the mean and standard error of the mean (SE) of annual producer prices across Thailand and Vietnam for years 2003 – 2012, adjusted to US\$ 2013 (\$90.51 t⁻¹). This estimate is within the range of farm gate prices reported by MAFF to ASEAN (\$42 – 96 t⁻¹ 2001 – 2011, in US\$ 2013¹⁸, and prices reported by farmers in Cambodia in 2013 (n = 15, \$75.00 – \$90.00 t⁻¹;²⁰) As for rubber, we suggest that small farmers may receive lower prices where access to markets is limited. There is also variation in price among provinces depending on the degree of harvesting, drying and transportation costs paid by the farmer versus middlemen; we base our NPV estimates on the most commonly used system in Cambodia, in which farmers sell raw cassava to traders, and traders pay harvesting, drying and transport costs ¹⁴
Cassava yield	12,14,21	Cambodia	Annual yield data (raw cassava, t ha⁻¹ yr⁻¹) were extracted from each dataset. ACI¹² provided a number of estimates for different farm sizes, while Hing & Thun¹⁴ and Sopheap et al²² reported yields for smallholder farms only. Minimum (10.5 t ha⁻¹ yr⁻¹) and maximum (30.0 t ha⁻¹ yr⁻¹) yields were extracted for each year across all datasets, specific to smallholder farms. The mean of these values (23.8 t ha⁻¹) is close to the mean yield reported at the national scale in Cambodia (20.49 t ha⁻¹ in 2007²²), suggesting that these bounds are appropriate. Yields were assumed to remain constant over 25 years of repeated annual planting. This assumption is supported by data from Cambodia, that show no difference in yield between plots continuously cropped with cassava for 25 years without fertilisation and soils that had been cropped for <10 years²¹. Supporting this, yields of 13.3 t ha⁻¹ yr⁻¹ are reported from fully exhausted soils in Colombia²³. However, cassava is potassium limited, and potassium-depleted soils can produce yields as low as 5 t ha⁻¹ yr⁻¹ in India, but if soils contain potassium-producing minerals, depletion does not occur even in absence of fertiliser application²³. Cassava is tolerant to low soil fertility conditions^{21,23,24}. Evidence from Cambodia suggests that soil type does not affect cassava yield, although farmers self-identified areas of higher soil quality where cassava yields were increased within individual farms²¹. We thus do not modify our yield estimates for open and dense forest areas, despite predicting that soil types may differ under each forest type. Yield curves were created for 25 consecutive years of cultivation, as for rubber and cashew, using the same proportion of maximum yield for each year. The run-specific proportion used to create yield curve was generated independently for each crop, for each iteration.
Cassava production cost	12,14	Cambodia	Annual production cost data for raw cassava were extracted from each of six datasets and standardised to USD ha⁻¹ yr⁻¹ units, adjusted to US\$ 2013. Costs in all studies included: land clearance (using manual labour, year 1 only), land preparation (annual), planting material, annual inputs, annual labour costs (including imputed family labour costs), but did not include drying or transportation costs. Cost curves were created for 25 consecutive years, as for rubber and cashew, using the same proportion of maximum cost for each year. The run-specific proportion used to create the cost curve was generated independently for each crop, for each iteration.
<i>Sugar – large scale monocultural annual crop</i>			
Sugar producer price (see also Supp. Figure 1)	11	Thailand / Vietnam	Producer prices are published for Cambodia on FAOSTAT¹¹, but are much higher than FAOSTAT prices for Thailand and Vietnam and much higher also than Cambodian farm gate prices reported in ACI¹². Prices were checked against global prices, and EU minimum prices, as Cambodia receives preferential pricing to export sugar to the EU through the "Everything but Arms Treaty"²⁵. However, Cambodia's Producer Prices were substantially lower than either of these indicators. We therefore used the mean and standard error of the mean (SE) of annual producer prices across Thailand and Vietnam for years 2003 – 2012 (\$34.34 t⁻¹), but as for rubber and cassava, suggest that small farmers may often receive lower prices where access to markets is limited.

Sugar yield	¹²	Cambodia	Annual yield data for large scale plantations from two regions of Cambodia were extracted from ACI ¹² . Minimum and maximum reported yields were used as input parameters for the simulation model and were assumed to remain constant over 25 years of repeated annual planting. Yield curves were created for 25 consecutive years of cultivation, as for rubber and cashew, using the same proportion of maximum yield for each year. The run-specific proportion used to create yield curve was generated independently for each crop, for each iteration.
Sugar production cost	¹²	Cambodia	Annual production cost data were extracted, standardised to USD ha ⁻¹ yr ⁻¹ , adjusted to US\$ 2013 prices. Costs included: land clearance (using tractor or bulldozer, year 1 only), land preparation costs (annual), planting material, annual inputs, annual labour costs. Cost curves were created for 25 consecutive years, as for rubber, using the same proportion of maximum cost for each year. The run-specific proportion used to create the cost curve was generated independently for each crop, for each iteration.
<i>Inflating US\$ to 2013</i>			
Consumer price index (CPI)	¹⁰	Cambodia/ Thailand/ Vietnam	The World Bank Consumer Price Index (CPI) is available at the country level. For parameters obtained from multi-country studies, CPIs for Cambodia, Thailand and Vietnam were averaged and used to deflate all input costs and prices to 2013.

Supplementary Table 6

Post-deforestation land-use carbon stock estimates. Time-averaged carbon stocks (taCs) of above-ground biomass (AGB) and below-ground biomass (BGB) were estimated as either 50% of the carbon stock of a crop/plantation at the maximum rotation length²⁶, or for rubber, as the carbon stock as calculated by a regression equation at the median rotation length²⁷.

Land-use	taCs (tC ha ⁻¹)	Note
Rubber	52.5	Multiple estimates of taCs were generated by Blagodatsky <i>et al</i> in a review of studies on rubber plantation carbon dynamics ²⁷ . These estimates were either based on a division of the maximum carbon stock (at the time of clearing) by two, which assumes a linear increase in biomass during the growing cycle, or by fitting a regression model where more detailed data are available, and taking the carbon stock of the plantation as calculated by the equation at the median time in the rotation. Estimates of taCs (AGB + BGB) for 20 – 30 year monoculture rubber plantation cycles in South and Southeast Asia ranged from 40 to 65 tC ha ⁻¹ ²⁷ ; the mean of these values (52.5 tC ha ⁻¹) was used in analysis.
Cashew	22.32	Out estimate of taCs for a cashew plantation on a 10-year plantation cycle (22.32 tC ha ⁻¹) were generated based on field data from Cambodia ²⁸ . AGB of cashew plantations for each year of a 10-year plantation cycle were extracted from the data; BGB was assumed to be 24% of AGB ²⁹ , and AGB + BGB carbon stock was assumed to be 50% of biomass. We calculated taCs to be 50% of this value ²⁷ . Where field data were not provided for a given year, the value for the next oldest year was used, generating a conservative estimate.
Cassava	2.5	Carbon stock for “annual cropland” in dry and seasonal areas of Asia reported as 5 tC ha ⁻¹ ; time-averaged carbon stock is 50% of this value ²⁶ .
Sugarcane	6.75	Carbon stock for sugarcane in dry and seasonal areas of Asia reported as 13.5 tC ha ⁻¹ ; time-averaged carbon stock is 50% of this value ²⁶ .

Supplementary Table 7

Value of dipterocarp resin collection and influence on breakeven carbon prices

Forest type	Median 25-year resin revenue	Median carbon breakeven price: “No timber logged + rubber”	Median carbon breakeven price: “No timber logged + rubber”
	(\$ ha ⁻¹)	including resin revenue (\$ tCO ₂ ⁻¹)	excluding resin revenue (\$ tCO ₂ ⁻¹)
Dense	357.38	33.43	34.20
Open	234.49	51.12	52.65

Supplementary Table 8

Price estimates for timber royalty classes at various selling points in Cambodia. Minimum and maximum prices for each royalty class for the roadside/village were used as input parameters for simulations; other price points (i.e. forest, domestic or international market) were not used in the final analysis. In the absence of species-specific records from formal timber markets, all timber species in each royalty class were assumed to fetch the same price as those species from that royalty class that were explicitly named in source of prices (Supplementary Table 14). Prices shown are mean of all available data from 2007 - 2014 inclusive, except for Non-Classified timber, for which we use the price of fuelwood reported from field study in Cambodia³⁰. All prices were inflated to \$US 2013 using a CPI specific to Cambodia. All price data were based on interviews with villagers or market traders.

Price point	Royalty Class	Price (\$ m ⁻³)						References
		Min	Max	Mean Price	SD	SE	n*	
Forest	Luxury	-	-	-	-	-	-	30,31
	I	115.4	202.0	152.6	33.1	14.8	5	
	II	116.5	116.5	116.5	-	-	1	
	III	77.7	77.7	77.7	-	-	1	
	NC	17.3	17.3	17.3	-	-	1	
Roadside/ Village	Luxury	500.0	3,129.4	1,300.5	657.4	150.8	19	5,32,33, Hugh Wright (2010), unpublished data
	I	90.8 [#]	290.5	151.7 [#]	79.7	28.2	8	
	II	139.7 [#]	290.5	251.5	58.6	26.2	5	
	III	77.7*	77.7*	77.7*	-	-	1	
	NC	17.3	17.3	17.3	-	-	1	
Domestic (national) market	Luxury	400.0	1154.6	739.3	330.2	147.7	5	30,31,34–36
	I	346.3	692.7	517.3	122.8	46.4	7	
	II	461.8	577.3	510.6	40.3	13.4	9	
	III	77.7*	77.7*	77.7*	-	-	1	
	NC	17.3	17.3	17.3	-	-	1	
International market	Luxury	3,850.0	50,000.0	18,185.0	16,899.6	5,344.1	10	36–39
	I	346.3 [~]	692.7 [~]	517.3 [~]	122.8 [~]	46.4 [~]	7	
	II	461.8 [~]	577.3 [~]	510.6 [~]	40.3 [~]	13.4 [~]	9	
	III	77.7*	77.7*	77.7*	-	-	1	
	NC	17.3	17.3	17.3	-	-	1	

*n price estimates within and across all studies

[#]Royalty class I timber is classed as more valuable than class II⁴⁰; we thus assume the same minimum price for class I and II timber in simulation models (\$90.81)

*As for forest price

[~]As for domestic market price

Supplementary Table 9

Resampling input parameters. For each sampling iteration, values for each parameter were sampled from either a uniform distribution between the minimum and maximum bounds, or where the shape of the distribution was known to be normal, from a normal distribution defined by the mean and standard error (SE) of the mean.

	Input parameter	Units	Bounds
Agricultural NPV	Crop input costs (annual)	USD ha ⁻¹ yr ⁻¹	Min – Max
	Farm gate price	USD t ⁻¹	Mean – SE
	Crop yield (annual)	t ha ⁻¹ yr ⁻¹	Min – Max
Carbon stock	Forest carbon stock (square root transformed)	tC or tCO ₂ ha ⁻¹	Mean – SE
Timber profit	Timber volume (square root transformed)	m ³ ha ⁻¹	Mean – SE
	Timber price	USD m ⁻³	Min – Max
	Extraction costs	USD m ⁻³	Min – Max

Supplementary Table 10

Proportion of luxury stems $\geq 60\text{cm}$ DBH compared between pairs of landscapes by Chi-squared two-sampled proportions test; there were no significant differences.

				F02		F03		F04		F05		F06	
Forest type		n Luxury stems $\geq 30\text{cm}$ DBH	n Luxury stems $\geq 60\text{cm}$ DBH	χ^2	p	χ^2	p	χ^2	p	χ^2	p	χ^2	p
F01	Dense	4	0	0.0690	0.79	0.0033	0.95	0.0000	1.00	0.0000	1.00	0.2344	0.63
F02	Dense	111	20	-	-	0.0000	1.00	2.1100	0.15	0.0047	0.95	0.1591	0.69
F03	Dense	11	2	-	-	-	-	0.4052	0.52	0.0000	1.00	0.0111	0.92
F04	Dense	34	2	-	-	-	-	-	-	0.0000	1.00	1.7647	0.18
F05	Dense	9	1	-	-	-	-	-	-	-	-	0.1563	0.69
F06	Dense	6	2	-	-	-	-	-	-	-	-	-	-

				F02		F04	
Forest type		n Luxury stems $\geq 30\text{cm}$ DBH	n Luxury stems $\geq 60\text{cm}$ DBH	χ^2	p	χ^2	p
F01	Open	6	1	0.0000	1.00	0.0000	1.00
F02	Open	21	4	-	-	0.2431	0.62
F04	Open	14	1	-	-	-	-

Supplementary Table 11

Input parameters for agricultural net present value calculation. Year 1 includes land clearance costs entailed in preparing logged-over land for agriculture; \$450 for large plantations (mechanised, bulldozer) or \$250 for smallholders (manual labour; ¹²). See Supplementary Table 5 for data sources. All values in 2013 USD.

Crop	Size	Year	Annual cost (\$ ha ⁻¹ yr ⁻¹): minimum	Annual cost (\$ ha ⁻¹ yr ⁻¹): maximum	Farmgate price (\$ t ⁻¹) mean	Farmgate price (\$ t ⁻¹) SE	Annual yield – closed forest (t ha ⁻¹ yr ⁻¹): minimum	Annual yield – closed forest (t ha ⁻¹ yr ⁻¹): maximum	Annual yield – open forest (t ha ⁻¹ yr ⁻¹): minimum	Annual yield – open forest (t ha ⁻¹ yr ⁻¹): maximum
Cashew	Smallholder	0	514.06	764.61	963.48	43.75	0.00	0.00	0.00	0.00
		1	31.42	125.69	963.48	43.75	0.00	0.00	0.00	0.00
		2	27.23	173.88	963.48	43.75	0.00	1.90	0.00	1.90
		3	27.23	173.88	963.48	43.75	0.30	1.90	0.30	1.90
		4	27.23	173.88	963.48	43.75	0.30	1.90	0.30	1.90
		5	54.47	167.59	963.48	43.75	0.60	2.30	0.60	2.30
		6	54.47	167.59	963.48	43.75	0.70	2.30	0.70	2.30
		7	54.47	167.59	963.48	43.75	0.77	2.30	0.77	2.30
		8	54.47	167.59	963.48	43.75	0.77	2.30	0.77	2.30
		9	54.47	167.59	963.48	43.75	0.77	2.30	0.77	2.30
		10	54.47	173.88	963.48	43.75	0.77	3.00	0.77	3.00
		11	54.47	173.88	963.48	43.75	0.77	3.00	0.77	3.00
		12	54.47	173.88	963.48	43.75	0.77	3.00	0.77	3.00
		13	54.47	173.88	963.48	43.75	0.77	3.00	0.77	3.00
		14	54.47	173.88	963.48	43.75	0.77	3.00	0.77	3.00
		15	54.47	173.88	963.48	43.75	0.60	2.31	0.60	2.31
		16	54.47	173.88	963.48	43.75	0.60	2.31	0.60	2.31
		17	54.47	173.88	963.48	43.75	0.60	2.31	0.60	2.31
		18	54.47	173.88	963.48	43.75	0.60	2.31	0.60	2.31
		19	54.47	173.88	963.48	43.75	0.60	2.31	0.60	2.31
		20	54.47	173.88	963.48	43.75	0.60	2.31	0.60	2.31
		21	54.47	173.88	963.48	43.75	0.60	2.31	0.60	2.31
		22	54.47	173.88	963.48	43.75	0.60	2.31	0.60	2.31
		23	54.47	173.88	963.48	43.75	0.60	2.31	0.60	2.31
		24	54.47	173.88	963.48	43.75	0.60	2.31	0.60	2.31
Cassava	Smallholder	0	412.25	860.90	90.51	6.22	10.50	30.10	10.50	30.10
		1	110.29	560.00	90.51	6.22	10.50	30.10	10.50	30.10
		2	110.29	560.00	90.51	6.22	10.50	30.10	10.50	30.10
		3	110.29	560.00	90.51	6.22	10.50	30.10	10.50	30.10
		4	110.29	560.00	90.51	6.22	10.50	30.10	10.50	30.10
		5	110.29	560.00	90.51	6.22	10.50	30.10	10.50	30.10
		6	110.29	560.00	90.51	6.22	10.50	30.10	10.50	30.10
		7	110.29	560.00	90.51	6.22	10.50	30.10	10.50	30.10
		8	110.29	560.00	90.51	6.22	10.50	30.10	10.50	30.10
		9	110.29	560.00	90.51	6.22	10.50	30.10	10.50	30.10
		10	110.29	560.00	90.51	6.22	10.50	30.10	10.50	30.10
		11	110.29	560.00	90.51	6.22	10.50	30.10	10.50	30.10
		12	110.29	560.00	90.51	6.22	10.50	30.10	10.50	30.10
		13	110.29	560.00	90.51	6.22	10.50	30.10	10.50	30.10
		14	110.29	560.00	90.51	6.22	10.50	30.10	10.50	30.10
		15	110.29	560.00	90.51	6.22	10.50	30.10	10.50	30.10
		16	110.29	560.00	90.51	6.22	10.50	30.10	10.50	30.10
		17	110.29	560.00	90.51	6.22	10.50	30.10	10.50	30.10
		18	110.29	560.00	90.51	6.22	10.50	30.10	10.50	30.10
		19	110.29	560.00	90.51	6.22	10.50	30.10	10.50	30.10
		20	110.29	560.00	90.51	6.22	10.50	30.10	10.50	30.10
		21	110.29	560.00	90.51	6.22	10.50	30.10	10.50	30.10
		22	110.29	560.00	90.51	6.22	10.50	30.10	10.50	30.10
		23	110.29	560.00	90.51	6.22	10.50	30.10	10.50	30.10
		24	110.29	560.00	90.51	6.22	10.50	30.10	10.50	30.10

Sugar	Large plantation	0	1168.20	1749.82	35.74	1.30	12.00	29.50	12.00	29.50
		1	586.58	586.58	35.74	1.30	12.00	29.50	12.00	29.50
		2	586.58	586.58	35.74	1.30	12.00	29.50	12.00	29.50
		3	586.58	586.58	35.74	1.30	12.00	29.50	12.00	29.50
		4	586.58	586.58	35.74	1.30	12.00	29.50	12.00	29.50
		5	586.58	586.58	35.74	1.30	12.00	29.50	12.00	29.50
		6	586.58	586.58	35.74	1.30	12.00	29.50	12.00	29.50
		7	586.58	586.58	35.74	1.30	12.00	29.50	12.00	29.50
		8	586.58	586.58	35.74	1.30	12.00	29.50	12.00	29.50
		9	586.58	586.58	35.74	1.30	12.00	29.50	12.00	29.50
		10	586.58	586.58	35.74	1.30	12.00	29.50	12.00	29.50
		11	586.58	586.58	35.74	1.30	12.00	29.50	12.00	29.50
		12	586.58	586.58	35.74	1.30	12.00	29.50	12.00	29.50
		13	586.58	586.58	35.74	1.30	12.00	29.50	12.00	29.50
		14	586.58	586.58	35.74	1.30	12.00	29.50	12.00	29.50
		15	586.58	586.58	35.74	1.30	12.00	29.50	12.00	29.50
		16	586.58	586.58	35.74	1.30	12.00	29.50	12.00	29.50
		17	586.58	586.58	35.74	1.30	12.00	29.50	12.00	29.50
		18	586.58	586.58	35.74	1.30	12.00	29.50	12.00	29.50
		19	586.58	586.58	35.74	1.30	12.00	29.50	12.00	29.50
		20	586.58	586.58	35.74	1.30	12.00	29.50	12.00	29.50
		21	586.58	586.58	35.74	1.30	12.00	29.50	12.00	29.50
		22	586.58	586.58	35.74	1.30	12.00	29.50	12.00	29.50
		23	586.58	586.58	35.74	1.30	12.00	29.50	12.00	29.50
		24	586.58	586.58	35.74	1.30	12.00	29.50	12.00	29.50
Rubber	Large plantation	0	1141.38	1902.64	2595.56	200.27	0.00	0.00	0.00	0.00
		1	174.40	289.94	2595.56	200.27	0.00	0.00	0.00	0.00
		2	79.61	424.01	2595.56	200.27	0.00	0.00	0.00	0.00
		3	79.61	447.47	2595.56	200.27	0.00	0.00	0.00	0.00
		4	79.61	447.47	2595.56	200.27	0.00	0.00	0.00	0.00
		5	349.20	447.47	2595.56	200.27	0.00	1.36	0.00	0.00
		6	349.20	1169.80	2595.56	200.27	0.24	1.36	0.00	0.00
		7	349.20	1178.18	2595.56	200.27	0.50	1.36	0.00	0.00
		8	349.20	1178.18	2595.56	200.27	0.50	1.50	0.00	0.00
		9	349.20	1178.18	2595.56	200.27	0.50	1.50	0.00	1.36
		10	333.35	1178.18	2595.56	200.27	0.99	2.00	0.24	1.36
		11	333.35	1178.18	2595.56	200.27	0.99	2.00	0.50	1.36
		12	333.35	1178.18	2595.56	200.27	0.99	2.00	0.50	1.50
		13	333.35	1178.18	2595.56	200.27	0.99	2.00	0.50	1.50
		14	333.35	1178.18	2595.56	200.27	0.99	2.00	0.99	2.00
		15	322.30	1178.18	2595.56	200.27	1.06	2.25	0.99	2.00
		16	322.30	1178.18	2595.56	200.27	1.06	2.25	0.99	2.00
		17	322.30	1178.18	2595.56	200.27	1.06	2.30	0.99	2.00
		18	322.30	1178.18	2595.56	200.27	1.06	2.30	0.99	2.00
		19	322.30	1178.18	2595.56	200.27	1.06	2.30	1.06	2.25
		20	322.30	1178.18	2595.56	200.27	1.06	2.30	1.06	2.25
		21	322.30	1178.18	2595.56	200.27	1.06	2.30	1.06	2.30
		22	322.30	1178.18	2595.56	200.27	1.06	2.30	1.06	2.30
		23	322.30	1178.18	2595.56	200.27	1.06	2.30	1.06	2.30
		24	322.30	1178.18	2595.56	200.27	1.06	2.30	1.06	2.30

Supplementary Table 12

Harvestable timber volume equations for evergreen, mixed and deciduous forests. Timber volume equations, that estimate harvestable volume rather than tree volume, were obtained from the Forestry Administration of the Royal Government of Cambodia⁴¹. For each tree, timber volume was calculated from diameter at breast height (*DBH*, in m) using the equation appropriate to size class, tree type (dipterocarp or non-dipterocarp; unknown species assumed to be non-dipterocarp) and forest type. The deciduous forest equation was used for all open forest plots; for dense forest plots the evergreen equation was used as it gave consistently lower volume estimates than mixed forest equations, thereby making estimated timber volumes conservative. Although additional equations were available that incorporate tree height (*H*, in m), forest inventories did not provide height estimates and region-specific form factors (required to estimate height from *DBH* data⁴²) were not available for Cambodia; therefore, *DBH*-only equations were used. Tree volumes (m³) were summed per plot and per royalty class and standardised to m³ ha⁻¹. Final harvestable timber volume was reduced by 20% to account for wastage⁴³.

Forest type	Tree type	DBH	Equation
Evergreen	Dipterocarp	<15cm	Volume (m ³) = 0.022 + 3.4*DBH ²
	Dipterocarp	≥15 cm	Volume (m ³) = -0.0971 + 9.503*DBH ²
	Non-Dipterocarp	<30 cm	Volume (m ³) = 0.03 + 2.8*DBH ²
	Non-Dipterocarp	≥30 cm	Volume (m ³) = -0.331 + 6.694*DBH ²
Mixed	Dipterocarp	<15cm	Volume (m ³) = 0.03 + 4.8 * DBH ²
	Dipterocarp	≥15 cm	Volume (m ³) = 0.00126 +6.167 DBH ²
	Non-Dipterocarp	<15 cm	Volume (m ³) = 0.0083 + 4.3 DBH ²
	Non-Dipterocarp	15-30 cm	Volume (m ³) = 0.0083 + 5.3 DBH ²
	Non-Dipterocarp	≥30 cm	Volume (m ³) = 0.0083 + 6.081 DBH ²
Deciduous	Dipterocarp	<15cm	Volume (m ³) = 0.00849 + 4.097 * DBH ²
	Dipterocarp	≥15 cm	Volume (m ³) = -0.051 + 5.864 * DBH ²
	Non-Dipterocarp	<15 cm	Volume (m ³) = 0.03 + 3.3 DBH ²
	Non-Dipterocarp	15-30 cm	Volume (m ³) = 0.03 + 3.55 DBH ²
	Non-Dipterocarp	≥30 cm	Volume (m ³) = -0.413 + 7.819 DBH ²

Supplementary Table 13

Timber species named in roadside/village price estimates. These prices were applied to all species in the same royalty class as the named species i.e. all Class I species were given the same price, based on price estimates for *Lagerstroemia sp*, *Hopea odorata*, *Sindora siamensis*, *Xylia dolabriformis* and *Tarrietia javanica*.

Royalty Class	Species
I	<i>Lagerstroemia sp</i>
	<i>Hopea odorata</i>
	<i>Sindora siamensis</i>
	<i>Xylia dolabriformis</i>
	<i>Tarrietia javanica</i>
II	<i>Anisoptera sp</i>
	<i>Dipterocarpus sp</i>
	<i>Dipterocarpus alatus</i>
	<i>Dipterocarpus tuberculatus</i>
	<i>Dipterocarpus obtusifolius</i>
III	Unknown*
Luxury	<i>Azelia cochinchinensis</i>
	<i>Dalbergia oliveri/bariensis</i> [#]
	<i>Pterocarpus pedatus</i>
	<i>Dalbergia cochinchinensis/D. bariensis</i> [#]
NC	Unknown [‡]

[‡]one price given for fuelwood, applied to all NC timbers¹

[#]*Dalbergia bariensis* is a synonym of *D. oliveri* but is commonly referred to as *D. bariensis* in Cambodia⁴⁴; *D. cochinchinensis* is listed on CITES Appendix II

*one price given for all class III timbers, at forest price point³¹

Supplementary Table 14

Timber extraction cost estimates. The minimum and maximum timber extraction costs from this table were used as input parameters for simulating timber costs. These costings assume selective logging activity by local people in Cambodia in a 'business-as-usual' scenario with no formal logging concessions, inventories, management plan, or demarcation of logging areas. Costs include: wage labour, food, motorbike fuel, ox-cart transportation to the roadside/village and chainsaw maintenance but exclude the capital cost of the chainsaw (around US\$350³⁰). Costs in table are inflated to US\$2013 using a CPI specific to Cambodia.

Reference	Extraction Cost USD m ⁻³ processed wood	Notes
³⁰	116.01	Cost of cutting wood in forest and ox-cart transport to village. Labour, food, fuel, chainsaw oil, 2-stroke oil, chain, chainsaw maintenance, excludes capital cost of chainsaw (\$350 dollars, last 10 years), ox cart to village.
³¹	75.77	Cost of cutting wood in forest and ox-cart transport to village. Hired labour to cut tree, chainsaw fuel, ox cart to village.
¹	82.36	Cost of partial cut and transport (to village).

Supplementary Table 15

Dipterocarpus spp. resin revenue estimation parameters.

Parameter	Reference	Notes
Resin yield per tree per year	^{45–47}	23 – 40 litres yr ⁻¹ reported as maximum and minimum yields, across all three studies, across tree species
Tree sizes tapped for resin	⁴⁵	Trees 40 – 50cm DBH and upwards are preferred, but trees as small as 30cm DBH can be tapped
Non yielding trees (non-starter or exhausted)	⁴⁵	Of 2,555 trees surveyed, 62 (2.4%) were non-starters and 146 (5.7%) were exhausted; thus only 208 (8.1%) were non-yielding
Resin price	^{45,46,48} and WCS, unpublished data.	Price in US\$ litre ⁻¹ ; mean of estimates (adjusted to 2013 US\$) from 2003 – 2014 was \$0.37 per litre

Supplementary Note 1

Forest degradation through logging has a complex history in Cambodia. Forest governance institutions were lost during the political turmoil of the Khmer Rouge era (1975 – 1980). Subsequently, nearly 70% of forested land was allocated for logging concessions in the 1990s, followed by widespread over-harvesting both within and outside concessions⁴⁹. All formal logging concessions were halted in 2002, and many have since been designated as protected areas. Forested land is owned by the state and some annual logging coupes have been allocated; however, large tracts of forest have no clear management plan and illegal logging remains pervasive^{36,38,49–51}. Allocation of forested areas for Economic Land Concessions (ELCs), which allow conversion to plantation crops, is a key driver of forest clearance in Cambodia; much of Cambodia's current timber harvest is extracted within and around ELCs⁵². Much focus has been placed on the extraction of the highest-value Luxury class timber⁵⁰, which can generate high levels of short-term income³³. However, logging of other species (of lower royalty classes, especially classes I & II) is also pervasive⁵ and forms the bulk of timber harvested when forested land is cleared from ELCs⁵³.

The Forestry Administration grants transport licenses for logs ≥ 30 cm DBH harvested from within ELCs, except for luxury timber⁵³. Minimum harvestable limits for all commercial tree species range from 30 – 60cm DBH (as defined by the Ministry of Agriculture, Forestry and Fisheries in Prakas 089 (2005) – a ministerial or inter-ministerial proclamation in Cambodian law), however the level of enforcement of these limits is not clear. According to a Ministerial Declaration, Prakas 089, harvest of all luxury class timber is illegal, as is harvest of resin trees (some *Dipterocarpus* spp, all royalty class II, Supplementary Table 2) utilised by local people, unless they have given consent and been compensated. This latter group includes some of the most commercially valuable dipterocarp species. However, there is evidence for routine and widespread harvest of both luxury and resin trees⁵⁴. In the 1990s commercial logging focussed on trees ≥ 45 cm DBH^{55,56}, while minimum commercial harvestable DBH elsewhere in Southeast Asia is ≥ 40 cm DBH⁵⁷, and an assessment of logging in Cambodia that modelled unsustainable extraction rates assumed trees ≥ 40 cm would be harvested⁵⁸. For class I and II species, we therefore assumed a minimum harvestable DBH of 40 cm. Luxury species are exceptionally valuable and even small amounts are harvested⁵⁹; we therefore assumed all luxury class trees ≥ 10 cm DBH would be harvested. Class III trees are used for local construction purposes (i.e. as timber) or as fuelwood. Non-classified trees are assumed to be only useful as fuelwood; non-classified and class III trees ≥ 40 cm DBH were therefore assumed to have market value as fuelwood.

Supplementary Note 2

Cassava (163% area increase 2009 – 2013, to 421,000 ha⁶⁰), sugarcane (76% area increase 2009 – 2013, to 23,810 ha⁶⁰) and cashew (16,000 ha in 2000, 60,000 ha in 2005, no recent data available¹³) are also rapidly expanding cash crops. In Cambodia, cash-crops may be grown by smallholders (typically cassava, cashew and some rubber in farms of approximately 1-50 ha in size) or by concessionaires in large agro-industrial plantations (typically rubber or sugar).

Dipterocarp resin collection is a traditional livelihood activity that generates important cash income, which directly conflicts with logging, as resin-producing species have valuable timber^{1,45,61}. Other local benefits derived from forests, including fuelwood and bushmeat^{1,56,62}, could not be estimated on a per hectare basis, as they depend on household density, extraction rates and the cost of substitute resources in local markets. However, non-market environmental income can contribute 32 – 35% of household income, of which 70% comes from forest products, excluding resin revenues⁶². As resin collection contributes only a portion of forest product income¹, a substantial proportion of the value of standing forests to local people is not captured in our analysis.

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