

Supplementary Materials S1. Expert group-consensus workshop

An expert workshop was conducted involving eight local experts (two team coordinators/ecologists, three ecologists, two social scientists, and one policy analyst) to analyze which land cover changes occurred in the West Kutai and Mahakam Ulu districts between 2000 and 2009.

We used semi-structured questions and a group-consensus approach instead of individual knowledge-elicitation, as this is an open procedure, allowing new ideas to arise (see Perera et al. 2011). The experts were asked open and closed questions about the main land uses and the main land cover change processes that occurred in the study area between 2000 and 2009. At the start of the workshop, all workshop participants agreed that it was impossible to discuss the land cover change processes in the period 1990 and 2000, since this was perceived as too long ago: in that period, the experts did not work in this field of expertise or in the region, or could not remember which specific land cover changes occurred. The experts did indicate that during the periods 1990–2000 and 2000–2009, land cover changed from more small-scale activities and agriculture (such as mixed cropland and smallholder rubber plantations in 1990–2000) to more large-scale activities (such as rubber plantations and oil palm plantations in 2000–2009). Before the interview, the definitions of land cover types and land cover change processes (as defined in Supplementary Materials S2) were explained.

The main open questions and answers:

Q1. Did the existing land cover types and the type of land cover change processes in the landscape change between the periods 1990–2000 and 2000–2009?

A1. Yes, between 1990–2000 and 2000–2009, land cover change became much more dynamic in the region with land cover types rapidly succeeding each other. In the period 1990–2000, there were mostly small-scale land cover types, such as smallholder rubber gardens and mixed croplands (consisting of shifting cultivation systems and/or dryland fields). In 2000–2009, smallholders increasingly converted their rubber gardens to monoculture rubber plantations (i.e., intensification) and to oil palm plantations. Also, more commercial oil palm plantations were being developed. In 2000–2009 there was more intensification of agricultural lands.

Q2. What were the main land cover types and processes existing in the landscape between 2000 and 2009?

A2. Mixed croplands, smallholder rubber gardens and oil palm plantations were the main land cover types visible in the landscape. Large-scale deforestation and conversion by concession holders, and small-scale conversion of forest lands, shrublands or grasslands to mixed cropland and/or smallholder rubber were the main land cover change processes identified. On a much smaller scale, regeneration also occurred from grassland to shrubland and different forest types.

Q3. What were the main initial subsequent land cover types for the conversion of forest land, shrubland or

grassland (meaning: to what land cover type did farmers change the 'natural' land cover type, being grassland or shrubland or after forest clearing)?

A3. The main subsequent land cover types were mixed croplands, oil palm plantations and (less frequently) also rubber gardens.

Q4. Did the first subsequent land cover type after conversion in a certain area remain permanent after its establishment, or was it, in certain cases, changed into other land cover types?

A4. The initial land cover type was not necessarily permanent: mixed cropland was increasingly being converted to smallholder rubber gardens and also further to intensified rubber or oil palm plantations.

Q5. If so, which subsequent land cover types occurred after conversion to the first land cover type?

A5. The subsequent land cover types were smallholder rubber gardens, intensified rubber plantations and oil palm plantations.

Q6. According to the previous questions and answers, one can conclude that land cover trajectories existed in the landscape during the given time frame. Which were these? (land cover change trajectories: a sequence of land cover changes within a certain time frame)

A6. Yes, multiple land cover change trajectories existed, consisting of the following steps:

A. One-step trajectories of forest degradation and/or deforestation to grasslands or shrublands.

B. Multiple-step trajectories of (i) deforestation to grasslands, and (ii) conversion from grasslands to large-scale plantations.

C. Multiple-step trajectories of (i) forest degradation and/or deforestation and conversion to small-scale mixed cropland, (ii) conversion after 1-2 years to smallholder rubber, and (iii) in certain cases, further to monocultures, mostly oil palm. The time period to conversion of smallholder rubber to oil palm varied locally.

When small-scale rubber fields were converted into oil palm plantations, some smallholders established new mixed cropland areas in newly obtained forested lands, and land cover change trajectory C was initiated again in another area.

Q7. Could you identify so-called permanent land cover types (meaning land cover types that were not converted into other land cover types in the landscape during the given time frame)?

A7. Yes: oil palm plantations, pulpwood plantations and (coal) mining were perceived as permanent land uses between 2000 and 2009.

Q8. What is the reason/motivation for farmers to choose certain land cover types and to subsequently convert to other land cover types?

A8. Smallholders converted from mixed cropland or smallholder rubber gardens to monoculture plantations to increase their income. The choice of the smallholders between maintaining their mixed croplands or small-scale rubber garden into oil palm plantations (trajectory C in Figure S4) depended on the price competitiveness of their produce, including rubber, versus palm oil and on the presence of success stories in the village regarding oil palm cultivation.

During the workshop, the land cover types and the land cover changes from one land cover type to another were drawn on a white board in an interactive and iterative way, meaning that land cover types and the arrows in between were drawn and adapted according to the perceptions of the workshop participants. This interactive group-consensus discussion resulted in a basic drawing of the main land cover change trajectories on which the participants agreed by consensus.

Supplementary Materials S2. Land cover change processes and trajectories

Land cover incorporates all biophysical attributes of the earth's surface. *Land use* indicates the human-induced utilisation of this land cover (Lambin *et al.*, 2001). For example, forest is a certain land cover type, however, the utilisation of forests can be different; for example, forest is a land cover type that can be used as a conservation or production forest. In this paper, land cover change is the process of change or changes of one land cover type to another. In Figure S 1, a conceptual framework of land cover change processes is shown, in which the left box shows the naturally-occurring land cover types, such as grasslands, shrublands and forest types. Forest types are classified according to canopy cover; closed canopy forest (>70% canopy cover), medium open canopy forest (40–70% canopy cover) and open forest (10–40% canopy cover) (Budiman *et al.*, 2014). The right box shows the land use types which are human-induced, e.g., agricultural lands, plantations, settlements and mining sites. The arrows show the land cover change processes that occur if one land cover type changes into another.

In this study, we define *land cover degradation* as the process of decreasing canopy cover within the forest category, for example from closed to medium canopy forest, or a decreasing biomass density within non-forest types, such as from shrublands to grasslands. Figure S 1 shows that forest can degrade into another forest type and can be subject to deforestation to shrubland or grassland. We define *deforestation* as a decrease in tree canopy cover to below a 10% threshold (Food and Agriculture Organization of the United Nations, 2014) or, more clearly, a change from forest to either shrubland or grassland. Regrowth or *regeneration* of degraded or deforested vegetation cover can occur, for instance, from grassland to shrubland or forest type. Land cover *conversion* is defined in this study as the change from any land cover type to a land cover type that is used for the production of commodities or extraction of natural resources, as shown in Figure S 1. Such land uses can subsequently be *abandoned and regenerated* into natural land cover types. All non-forest types, including shrublands and agricultural lands can be cleared through the process named *land clearance*.

Land cover change trajectories are different from land cover change processes in that these indicate the 'exact' sequence of land cover changes in a certain area over a specific period of time (Mertens & Lambin, 2000; Petit *et al.*, 2001), and consequently provide information about the changes from one land cover type to another. Trajectories can involve one or more steps or transitions; can be part of land cover change processes; or can be a combination of different land cover change processes (Figure S 1). For example, a trajectory can include the land cover change processes 'forest degradation' and 'conversion' in one sequence within a specific time period.

Additionally, forest degradation can follow the land cover change trajectory of a closed canopy forest to a medium open canopy forest, and further to an open canopy forest type.

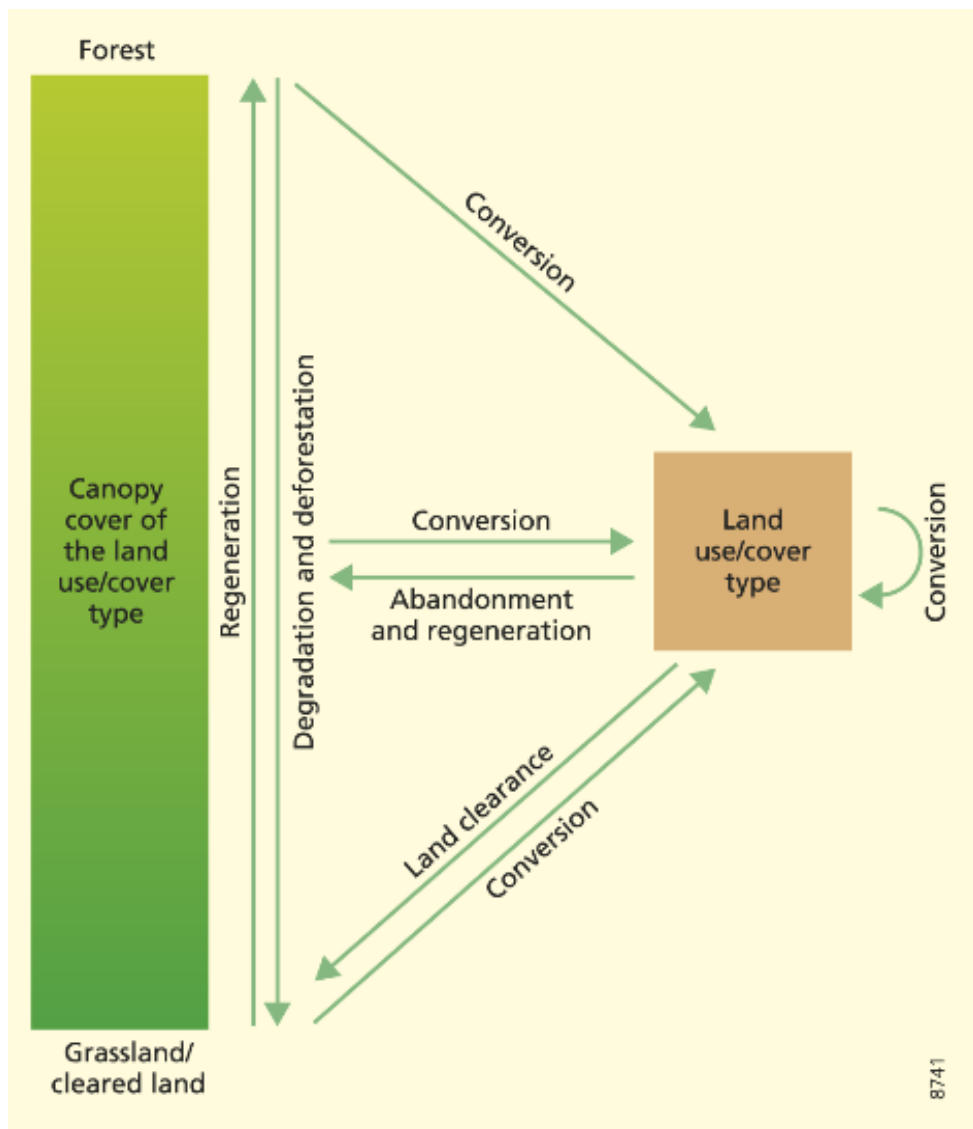


Figure S1. Conceptual model of the land cover changes and land cover change processes in a disturbed tropical forest landscape. (Processes are indicated by a single arrow; trajectories can involve one or multiple arrows)

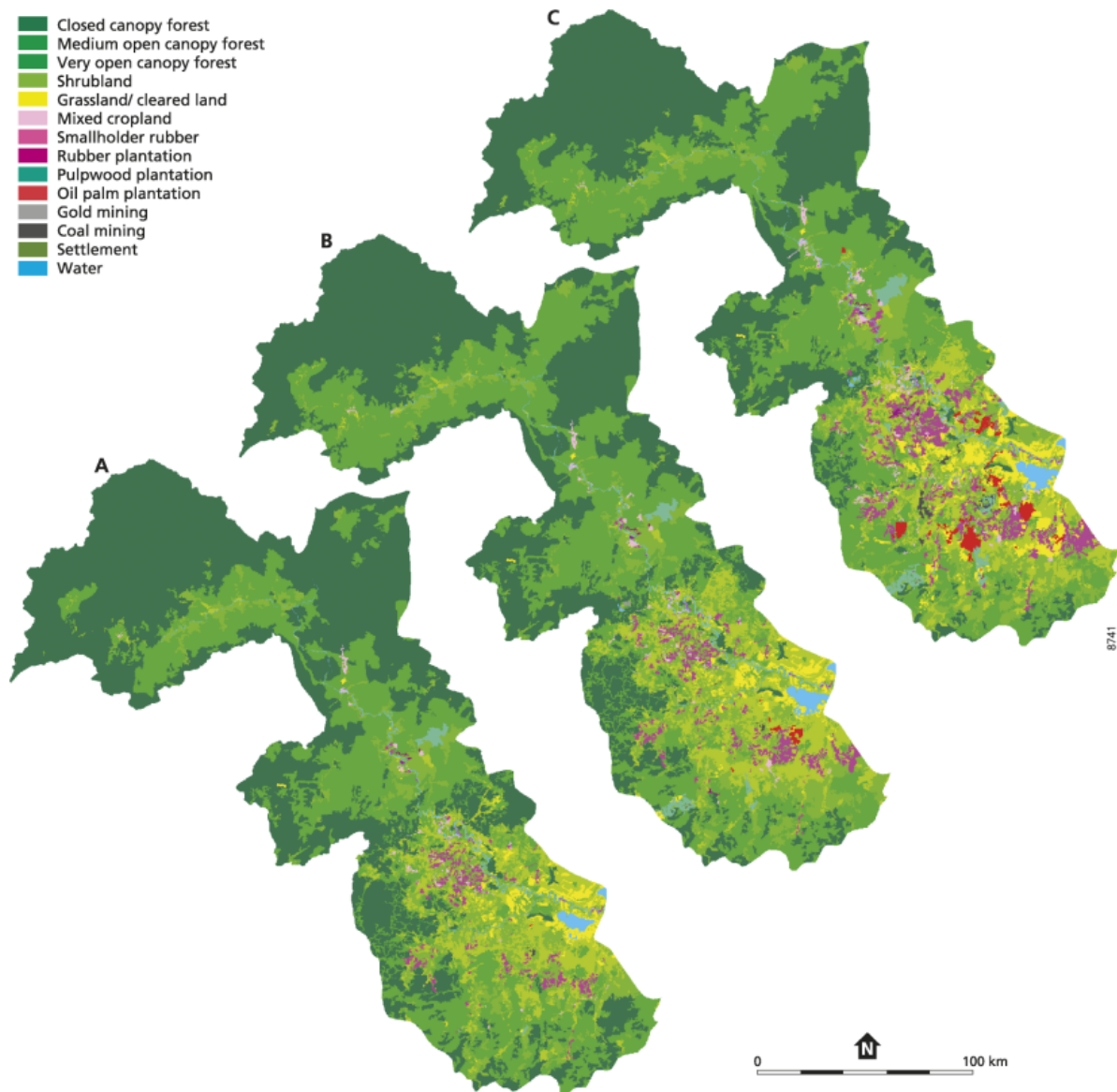


Figure S2. Land cover maps of the West Kutai and Mahakam Ulu Districts for 1990 (A), 2000 (B) and 2009 (C) (following Budiman et al. 2014) (1 raster cell is 100 x 100 m).

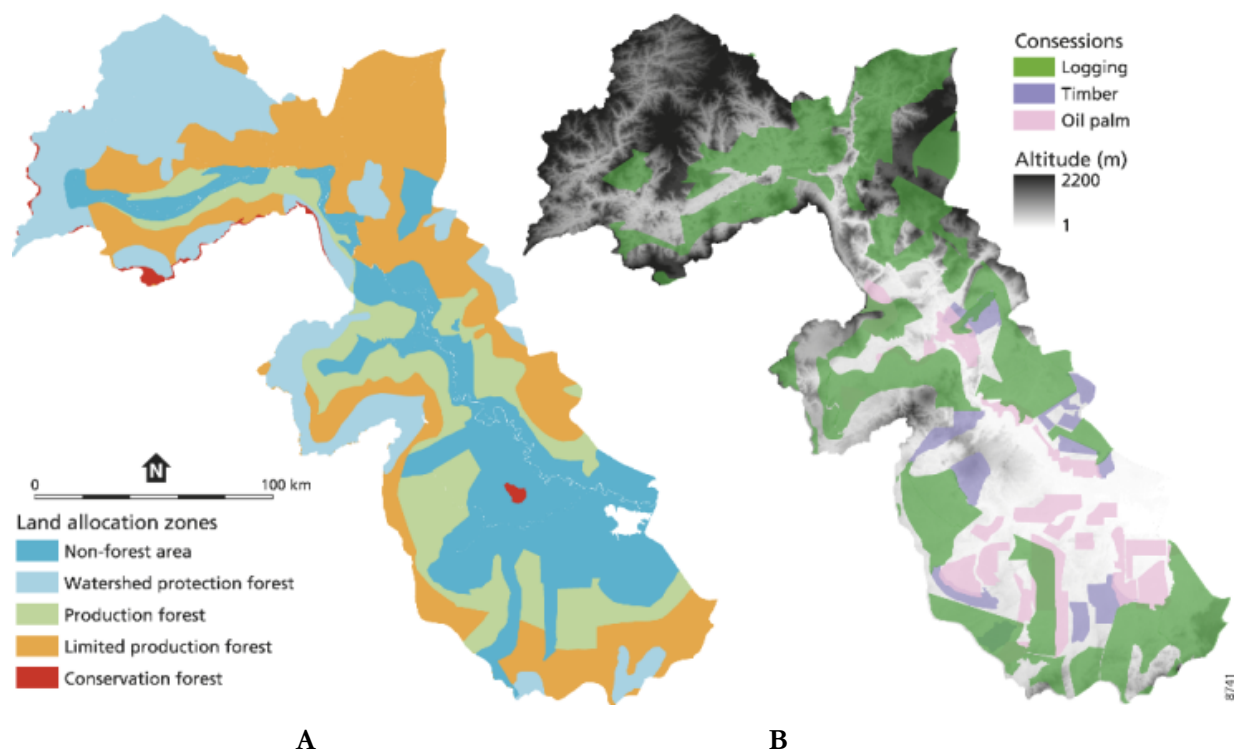


Figure S3. A) Land allocation zones; B) altitude (m) overlaid with concession maps for the West Kutai and Mahakam Ulu Districts (source: World Resources Institute 2014).

Table S1. Specification of the selected land cover types (following Budiman et al. 2014).

Land cover type	Subclasses in land cover types	Soil type	Canopy - Crown cover
1. Closed canopy forest (>70% canopy cover)	Dry Lowland Forest rather closed canopy	Dry	Closed - >70%
	Forest on Sandstone rock rather closed canopy	Sandstone rock	Closed - >70%
	Fresh Water Swamp Forest rather closed canopy	Fresh water swamp	Closed - >70%
	Peat Swamp Forest rather closed canopy	Peat swamp	Closed - >70%
2. Medium open canopy forest (40–70% canopy cover)	Dry Lowland Forest medium open canopy	Dry	Medium open - 40–70%
	Forest on Sandstone rock medium open canopy	Sandstone rock	Medium open - 40–70%
	Fresh Water Swamp Forest medium open canopy	Fresh water swamp	Medium open - 40–70%
	Peat Swamp Forest medium open canopy	Peat swamp	Medium open - 40–70%
3. Open canopy forest (10–40% canopy cover)	Dry Lowland Forest very open canopy	Dry	Very open - 10–40%
	Forest on Sandstone rock very open canopy	Sandstone rock	Very open - 10–40%
	Fresh Water Swamp Forest very open canopy	Fresh water swamp	Very open - 10–40%
	Peat Swamp Forest very open canopy	Peat swamp	Very open - 10–40%
	Forest Re-growth (Belukar)		Re-growth (Belukar)
	Forest Re-growth on Swampy	Swampy	Re-growth
4. Shrubland	Shrubland (Semak/Belukar Muda)		Semak/Belukar Muda
	Shrubland on Sandstone Forest	Sandstone rock	
	Shrubland on Swampy	Swampy	
	Overgrowing Clear cut-Shrubland		clear cut, overgrowing
5. Grassland/cleared land	Swamp Grasses/Fernland	Swampy	
	Grassland		
	Burnt		
	Cleared		
	Cleared for Industrial Pulpwood plantation		
	Cleared for Oil palm Plantation		
6. Mixed cropland	Mixed Cropland		
	Mixed Garden		
7. Smallholder Rubber	Small Holder Rubber		
8. Rubber plantation	Rubber Plantation		
9. Pulpwood plantation	Acacia Plantation		
	<i>Paraserianthes falcataria</i>		
	Industrial Pulpwood plantation		
10. Oil palm plantation	Oil palm Plantation		
	Young Oil palm Plantation		
	Young Oil Palm Plantation		
11. Gold mining	Gold Mining		
12. Coal mining	Coal Mining		
13. Settlement	Settlement		
14. Water	Water Body		

Table S2. Absolute land area (ha) per land cover type and relative land cover changes (%) between 1990, 2000 and 2009.

	1990 (ha)	2000 (ha)	2009 (ha)	% of total land in 1990	% of total land in 2000	% of total land in 2009	Net loss or gain (%) between 1990 and 2000	Net loss or gain (%) between 2000 and 2009	Net loss or gain (%) between 1990 and 2009
Natural land cover types							%	%	%
Total forested land	2,902,255	2,797,588	2,651,877	88	85	81	-4	-5	-9
1. Closed canopy forest	1,579,037	1,264,373	1,114,442	48	38	34	-20	-12	-29
2. Medium open canopy forest	957,173	1,114,282	1,094,593	29	34	33	16	-2	14
3. Open canopy forest	366,045	418,933	442,842	11	13	13	14	6	21
4. Shrubland	248,882	309,529	278,631	8	9	8	24	-10	12
5. Grassland/cleared land	49,219	48,425	102,955	1	1	3	-2	113	109
Agriculture and mining									
6. Mixed cropland	11,640	15,590	26,151	0	0	1	34	68	125
7. Smallholder Rubber	44,009	66,086	122,489	1	2	4	50	85	178
8. Rubber plantation	954	1,365	2,970	0	0	0	43	118	211
9. Pulpwood plantation	8,060	16,376	31,698	0	0	1	103	94	293
10. Oil palm plantation	135	4,238	31,160	0	0	1	3,039	635	22,981
11. Gold mining	53	644	133	0	0	0	1,115	-79	151
12. Coal mining	566	842	7,752	0	0	0	49	821	1,270
13. Settlement	3,077	3,162	6,741	0	0	0	3	113	119
14. Water	24,768	29,773	31,061	1	1	1	20	4	25
Total	3,293,618	3,293,618	3,293,618						

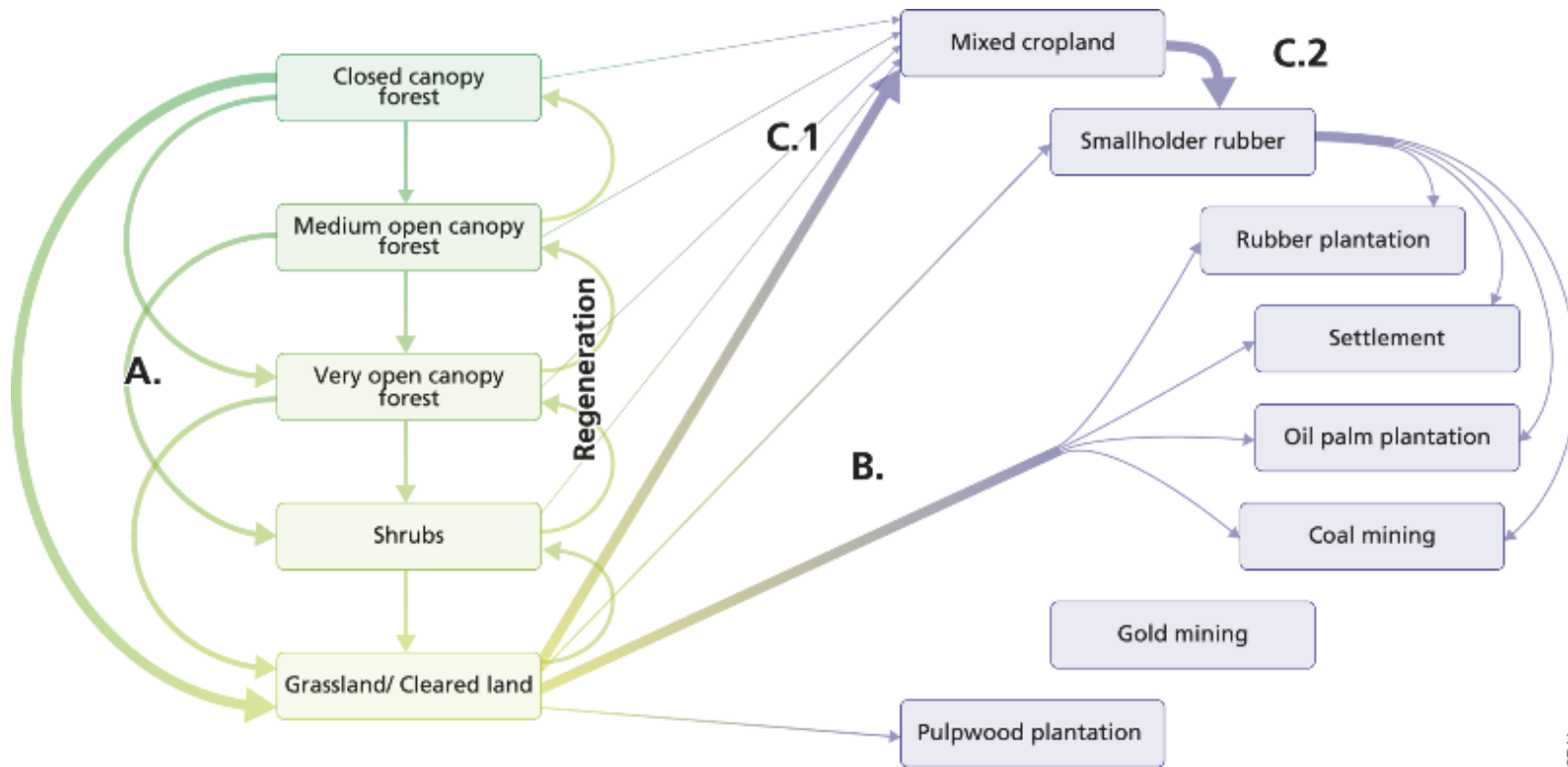


Figure S4. The main land cover change processes and trajectories identified for West Kutai and Mahakam Ulu based on expert knowledge. The trajectories are either dominant (thick arrows) or less dominant (thin arrows): A) degradation and/or deforestation to grasslands or shrublands; B) deforestation to grasslands, and conversion from grasslands to large-scale plantations; C1) degradation and/or deforestation to grasslands, conversion from grasslands to mixed cropland (which the experts referred to as shifting cultivation areas and/or dryland rice fields), after a few years, conversion from mixed cropland to smallholder rubber, and in certain cases; C2) further conversion from smallholder rubber to permanent land cover types, such as oil palm.

Table S3. Land cover change matrix (in ha) 1990–2000 for the West Kutai and Mahakam Ulu districts. These matrices indicate the number of pixels (and thus the hectares) change from one land cover type (vertical axis) to another (horizontal axis) within the selected time period.

	Closed forest	Medium open forest	Very open forest	Shrubs	Grassland/Cleared	Mixed cropland	Smallholder Rubber	Rubber plantation	Pulpwood plantation	Oil palm plantation	Gold mining	Coal mining	Settlement	Water	Total 1990
Closed forest	1,261,735	275,564	29,218	9,850	280	853	900				338			299	1,579,037
Medium open forest	2,638	833,974	59,830	45,882	3,165	1,629	1,267	411	8,117		154			106	957,173
Very open forest		4,744	311,257	31,166	1,565	2,591	14,535		52	36	99				366,045
Shrubs			18,582	218,749	1,596	716	4,811			4,067		276	85		248,882
Grassland/Cleared			25	2,428	41,809		210		147					4,600	49,219
Mixed cropland			21	1,454	10	9,801	354								11,640
Smallholder Rubber							44,009								44,009
Rubber plantation								954							954
Pulpwood plantation									8,060						8,060
Oil palm plantation										135					135
Gold mining											53				53
Coal mining												566			566
Settlement													3,077		3,077
Water														24,768	24,768
Total 2000	1,264,373	1,114,282	418,933	309,529	48,425	15,590	66,086	1,365	16,376	4,238	644	842	3,162	29,773	3,293,618

Table S4. Land cover change matrix (in %) 1990–2000 for the West Kutai and Mahakam Ulu districts. These matrices indicate the percentage of pixels change from one land cover type (vertical axis) to another (horizontal axis) within the selected time period.

	Closed forest	Medium open forest	Very open forest	Shrubs	Grassland / Cleared	Mixed cropland	Smallholder Rubber	Rubber plantation	Pulpwood plantation	Oil palm plantation	Gold mining	Coal mining	Settlement	Water	Total 1990
Closed forest	38.31	8.37	0.89	0.30	0.01	0.03	0.03				0.01			0.01	47.94
Medium open forest	0.08	25.32	1.82	1.39	0.10	0.05	0.04	0.01	0.25		0.00			0.00	29.06
Very open forest		0.14	9.45	0.95	0.05	0.08	0.44		0.00	0.00	0.00				11.11
Shrubs			0.56	6.64	0.05	0.02	0.15		-	0.12		0.01	0.00		7.56
Grassland / Cleared			0.00	0.07	1.27	-	0.01		0.00					0.14	1.49
Mixed cropland			0.00	0.04	0.00	0.30	0.01								0.35
Smallholder Rubber							1.34								1.34
Rubber plantation								0.03							0.03
Pulpwood plantation									0.24						0.24
Oil palm plantation										0.00					0.00
Gold mining											0.00				0.00
Coal mining												0.02			0.02
Settlement													0.09		0.09
Water														0.75	0.75
Total 2000	38.39	33.83	12.72	9.40	1.47	0.47	2.01	0.04	0.50	0.13	0.02	0.03	0.10	0.90	100.00

Table S5. Land cover change matrix (in ha) 2000–2009 for the West Kutai and Mahakam Ulu districts. These matrices indicate the number of pixels (and thus the hectares) change from one land cover type (vertical axis) to another (horizontal axis) within the selected time period.

	Closed forest	Medium open forest	Very open forest	Shrubs	Grassland/Cleared	Mixed cropland	Smallholder Rubber	Rubber plantation	Pulpwood plantation	Oil palm plantation	Gold mining	Coal mining	Settlement	Water	Total 2000
Closed forest	1,102,673	142,241	8,954	4,119	1,650	1,413	701			2,435		182		5	1,264,373
Medium open forest	10,790	948,713	108,182	26,722	5,253	4,373	6,967		1,288	1,663		285	13	33	1,114,282
Very open forest	979	3,052	286,742	63,180	13,222	4,282	36,261		3,992	2,966		3,106	1,139	12	418,933
Shrubs		438	36,779	176,113	45,781	5,581	13,644	746	7,609	17,623		3,447	1,040	728	309,529
Grassland/Cleared			1,913	6,287	36,548	233	76		1,446	1,428		93	160	241	48,425
Mixed cropland		149	239	2,202	336	9,902	1,817		158	33		39	715		15,590
Smallholder Rubber					48	367	62,496	1,307	282	834		192	560		66,086
Rubber plantation							448	917							1,365
Pulpwood plantation									16,376						16,376
Oil palm plantation					60					4,178					4,238
Gold mining									157		133			354	644
Coal mining				3					390			408	41		842
Settlement			24				79						3,059		3,162
Water			9	5	57								14	29,688	29,773
Total 2009	1,114,442	1,094,593	442,842	278,631	102,955	26,151	122,489	2,970	31,698	31,160	133	7,752	6,741	31,061	3,293,618

Table S6. Land cover change matrix (in %) 2000–2009 for the West Kutai and Mahakam Ulu districts. These matrices indicate the number of pixels change from one land cover type (vertical axis) to another (horizontal axis) within the selected time period.

	Closed forest	Medium open forest	Very open forest	Shrubs	Grassland/Cleared	Mixed cropland	Smallholder Rubber	Rubber plantation	Pulpwood plantation	Oil palm plantation	Gold mining	Coal mining	Settlement	Water	Total 2000
Closed forest	33.48	4.32	0.27	0.13	0.05	0.04	0.02			0.07		0.01		0.00	38.39
Medium open forest	0.33	28.80	3.28	0.81	0.16	0.13	0.21		0.04	0.05		0.01	0.00	0.00	33.83
Very open forest	0.03	0.09	8.71	1.92	0.40	0.13	1.10		0.12	0.09		0.09	0.03	0.00	12.72
Shrubs		0.01	1.12	5.35	1.39	0.17	0.41	0.02	0.23	0.54		0.10	0.03	0.02	9.40
Grassland/Cleared			0.06	0.19	1.11	0.01	0.00		0.04	0.04		0.00	0.00	0.01	1.47
Mixed cropland		0.00	0.01	0.07	0.01	0.30	0.06		0.00	0.00		0.00	0.02		0.47
Smallholder Rubber					0.00	0.01	1.90	0.04	0.01	0.03		0.01	0.02		2.01
Rubber plantation							0.01	0.03							0.04
Pulpwood plantation									0.50						0.50
Oil palm plantation					0.00					0.13					0.13
Gold mining									0.00		0.00			0.01	0.02
Coal mining				0.00					0.01			0.01	0.00		0.03
Settlement			0.00				0.00						0.09		0.10
Water			0.00	0.00	0.00								0.00	0.90	0.90
Total 2009	33.84	33.23	13.45	8.46	3.13	0.79	3.72	0.09	0.96	0.95	0.00	0.24	0.20	0.94	100.00

Table S7. Land cover change processes defined, i.e., the conversions from land cover types in the left columns to land cover types in the top rows.

	1. Closed canopy forest	2. Medium open canopy forest	3. Open canopy forest	4. Shrubland	5. Grassland/ cleared land	6. Mixed cropland	7. Smallholder Rubber	8. Rubber plantation	9. Pulpwood plantation	10. Oil palm plantation	11. Gold mining	12. Coal mining	13. Settlement		
1. Closed canopy forest		Degradation		Deforestation		Conversion to agricultural land									
2. Medium open canopy forest															
3. Open canopy forest															
4. Shrubland	Regeneration														
5. Grassland/ cleared land															
6. Mixed cropland	Abandonment and regeneration					Land clearance		Conversion to agricultural land							
7. Smallholder Rubber															
8. Rubber plantation															
9. Pulpwood plantation															
10. Oil palm plantation															
11. Gold mining															
12. Coal mining															
13. Settlement															

Table S8. Overview of net area lost in 1990 and net area gained in 2009 per land cover type (in hectares)

	Total area lost between 1990 and 2009 (ha)	Total area gained between 1990 and 2009 (ha)	Net loss or gain between 1990 and 2009 (ha)
<i>Total forested land</i>			
1. Closed canopy forest	478,318	13,723	-464,595
2. Medium open canopy forest	260,522	397,942	137,420
3. Open canopy forest	140,279	217,076	76,797
4. Shrubland	118,833	148,582	29,749
5. Grassland/ cleared land	16,264	70,000	53,736
<i>Land use types</i>			
6. Mixed cropland	5,145	19,656	14,511
7. Smallholder Rubber	3,320	81,800	78,480
8. Rubber plantation	37	2,053	2,016
9. Pulpwood plantation	-	23,638	23,638
10. Oil palm plantation	-	31,025	31,025
11. Gold mining	-	80	80
12. Coal mining	429	7,615	7,186
13. Settlement	103	3,767	3,664
14. Water	85	6,378	6,293
Total ha changed			1,023,335
Total ha no change			2,270,283

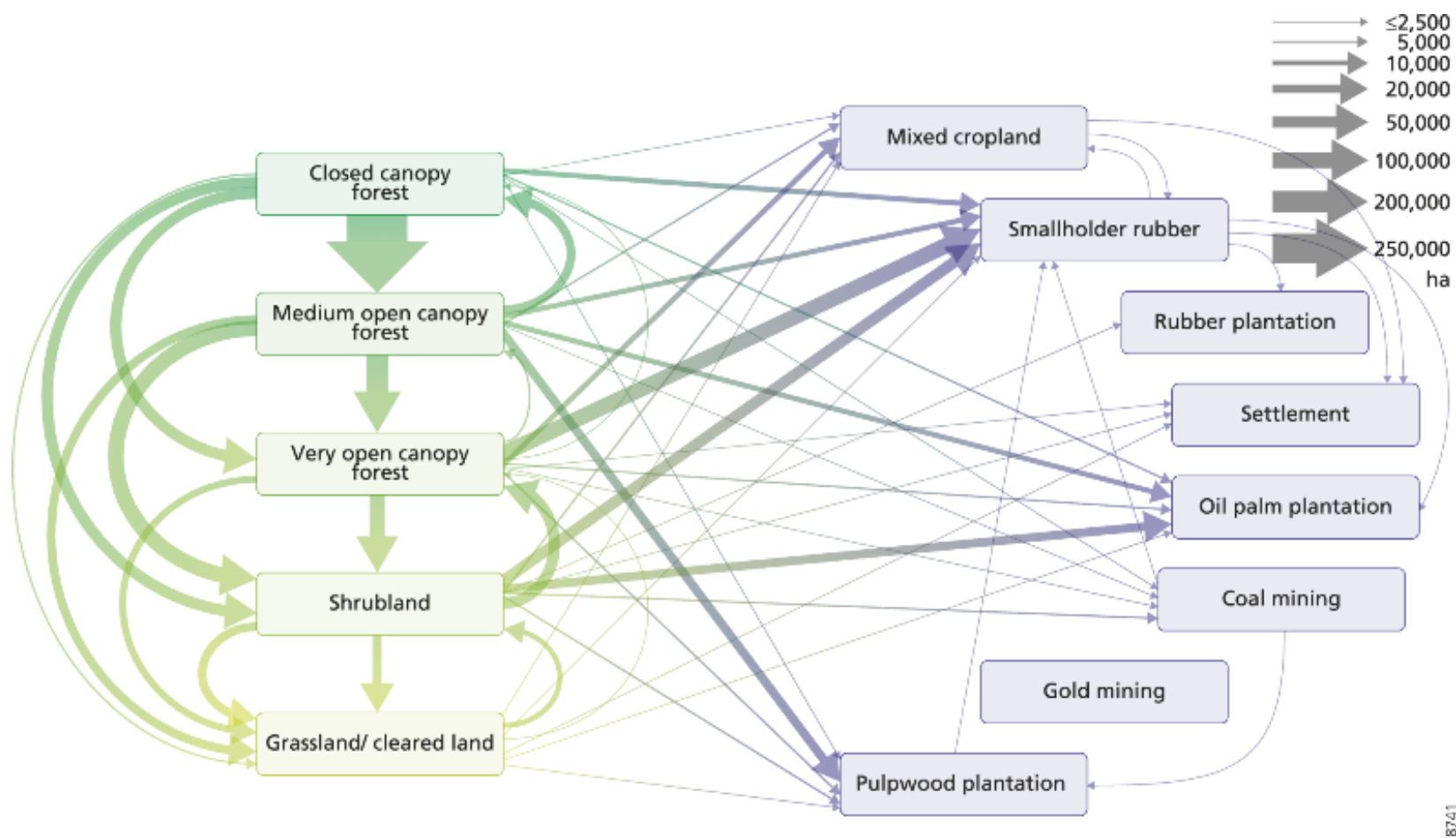


Figure S5. The land cover change trajectories (single arrows) as identified in the West Kutai and Mahakam Ulu districts between 1990 and 2009.

Table S9. Land area (hectares) of land cover types in concessions in 2009.

	Total land area in 2009	Land area outside concessions*	Land area in concessions			
			Total	Logging concession	Oil palm concession	Timber concession
Total forested land	2,651,900	1,348,200	1,303,700	1,073,600	144,700	85,300
1. Closed canopy forest	1,114,400	801,200	313,200	289,900	17,200	6,100
2. Medium open canopy forest	1,094,600	368,500	726,100	619,700	61,300	45,000
3. Open canopy forest	442,800	178,400	264,400	164,000	66,200	34,200
4. Shrubland	278,600	94,300	184,300	84,500	63,900	35,900
5. Grassland/cleared land	103,000	50,500	52,500	9,700	35,300	7,600
Land use types	229,200	91,200	138,000	46,600	54,200	37,400
6. Mixed cropland	26,200	13,200	13,000	4,900	5,000	3,100
7. Smallholder Rubber	122,500	61,600	60,900	24,000	27,800	9,200
8. Rubber plantation	3,000	2,000	1,000	100	600	200
9. Pulpwood plantation	31,700	-6,300*	38,000	13,000	1,700	23,300
10. Oil palm plantation	31,200	11,300	19,900	2,200	16,600	1,200
11. Gold mining	100	100				
12. Coal mining	7,800	4,500	3,300	1,800	1,500	-
13. Settlement	6,700	4,800	1,900	600	1,000	400
14. Water	31,100	28,300	2,800	200	2,600	-
Total land area	3,300,000	1,618,700	1,681,300	1,214,600	300,700	166,200
Total share of land in study area		49%	51%	37%	9%	5%

* The land area outside concessions was estimated by subtracting the total land area in 2009 with the land area in concessions.

* There is a discrepancy between the total land area in 2009 and the land area in concessions, as there is overlap between the concession types.

Table S10. Occurrence (%) of land cover change processes in the period 2000–2009 in concession types.

land cover change processes	Land area outside concessions	Land area in concessions			
		Total	Logging concession	Oil palm concession	Timber concession
Abandonment and regeneration	49%	51%	6%	14%	31%
Clearance	35%	65%	8%	45%	11%
Conversion	44%	56%	18%	26%	12%
Deforestation	29%	71%	38%	20%	12%
Degradation	29%	71%	51%	11%	9%
Regeneration	60%	40%	24%	13%	3%

Table S11. Occurrence of land cover types (in 2009) in land allocation zones (World Resources Institute, 2014) (in hectares, figures are rounded).

	Non-forest area	Conservation forest	Limited production forest	Production forest	Watershed protection forest	Other (boundary issue)
1. Closed canopy forest	60,100	12,500	344,100	77,900	616,400	3,400
2. Medium open canopy forest	194,300	2,200	518,400	271,100	106,200	2,400
3. Open canopy forest	204,500	900	118,400	104,200	13,300	1,500
4. Shrubland	148,200	1,700	60,000	66,100	2,000	600
5. Grassland/cleared land	84,000	2,400	600	5,800	100	10,100
6. Mixed cropland	18,100	-	2,400	5,300	100	300
7. Smallholder Rubber	89,700	50	6,100	25,100	900	650
8. Rubber plantation	2,600	-	-	300	-	100
9. Pulpwood plantation	5,100	-	7,700	18,700	-	200
10. Oil palm plantation	25,500	-	-	5,600	-	100
11. Gold mining	-	-	100	-	-	0
12. Coal mining	7,100	-	-	700	-	0
13. Settlement	5,800	-	200	400	100	200
14. Water	5,400	-	600	50	50	25,000
Total	850,400	19,750	1,058,600	581,250	739,150	50,850

Table S12. Occurrence of timber, logging and oil palm concessions in land allocation zones (World Resources Institute, 2014) (in hectares).

	Logging concession (ha)	Oil palm concession (ha)	Timber concession (ha)
Overlapping pixels with other concessions*	900	2,300	100
Non-forest area	77,100	224,900	8,600
Conservation forest	3,600	-	-
Limited production forest	741,300	8,800	37,500
Production forest	364,300	63,900	119,700
Watershed protection forest	27,400	500	300
Total	1,214,600	300,400	166,200

*Concession areas are sometimes overlapping with one another.