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Supplementary Materials for

Congo Basin forest loss dominated by increasing smallholder clearing

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Published 7 November 2018, *Sci. Adv.* **4**, eaat2993 (2018)
DOI: 10.1126/sciadv.aat2993

This PDF file includes:

Supplementary Materials

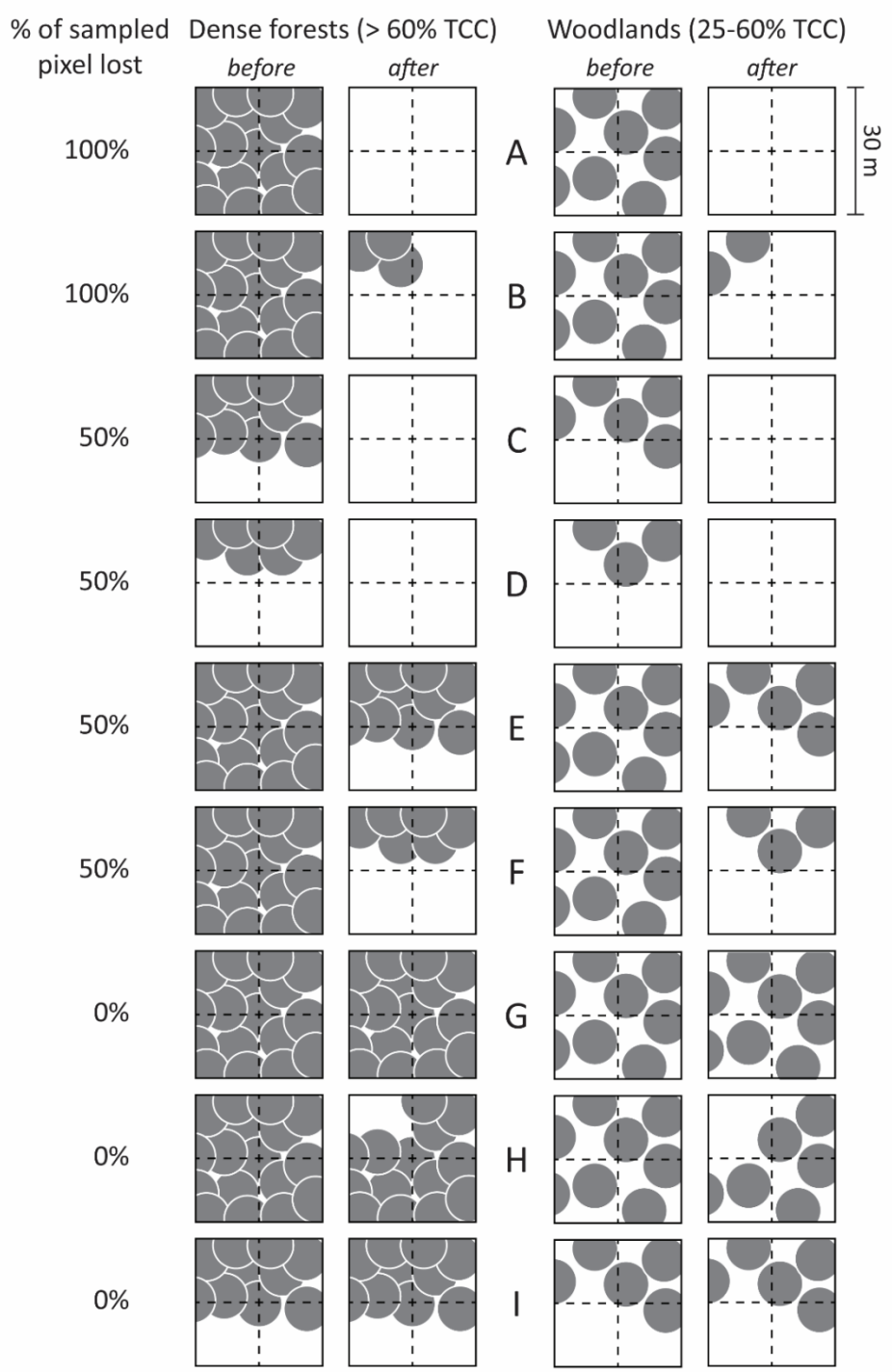

Fig. S1. Conceptual diagram of forest loss cases distinguishable via visual interpretation of a single 30-m Landsat pixel. (**A**) and (**B**) represent pixels interpreted as 100% of a pixel lost in the current analysis, which includes 75-100% pixel loss (B), not visually distinguishable in Landsat data from complete pixel clearing; (**C**–**F**) represent partial canopy loss, interpreted as 50% of pixel lost, which includes anything between 25 and 75% of a pixel lost; (**G**–**I**) represent pixels interpreted as 0% of a pixel lost, which may include clearing of less than a quarter pixel (H), or absence of forest loss (G and I). Note that cases (B) and (H) should cancel each other and not introduce any bias into interpretation. Pixels with tree canopy cover <25% are considered non-forested in the current analysis.

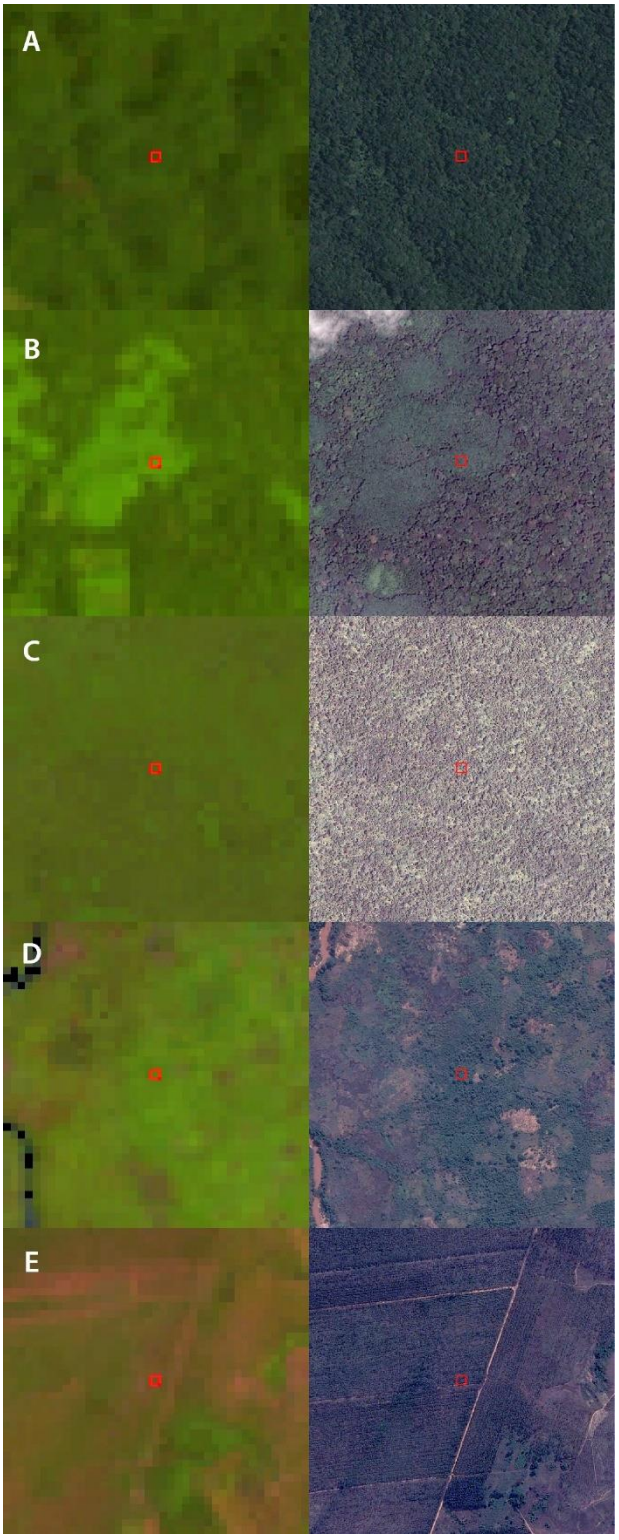

Fig. S2. Examples of predisturbance forest types. (**A**) primary and mature secondary dense humid tropical forests (HTF), (**B**) young secondary dense HTF, (**C**) primary woodlands and dry forests, (**D**) secondary woodlands and sparse secondary HTF, (**E**) plantations. Left: Landsat annual cloud-free composites; right: very high-resolution (<1 m) imagery from Google Earth. Red square corresponds to the sampled pixel.

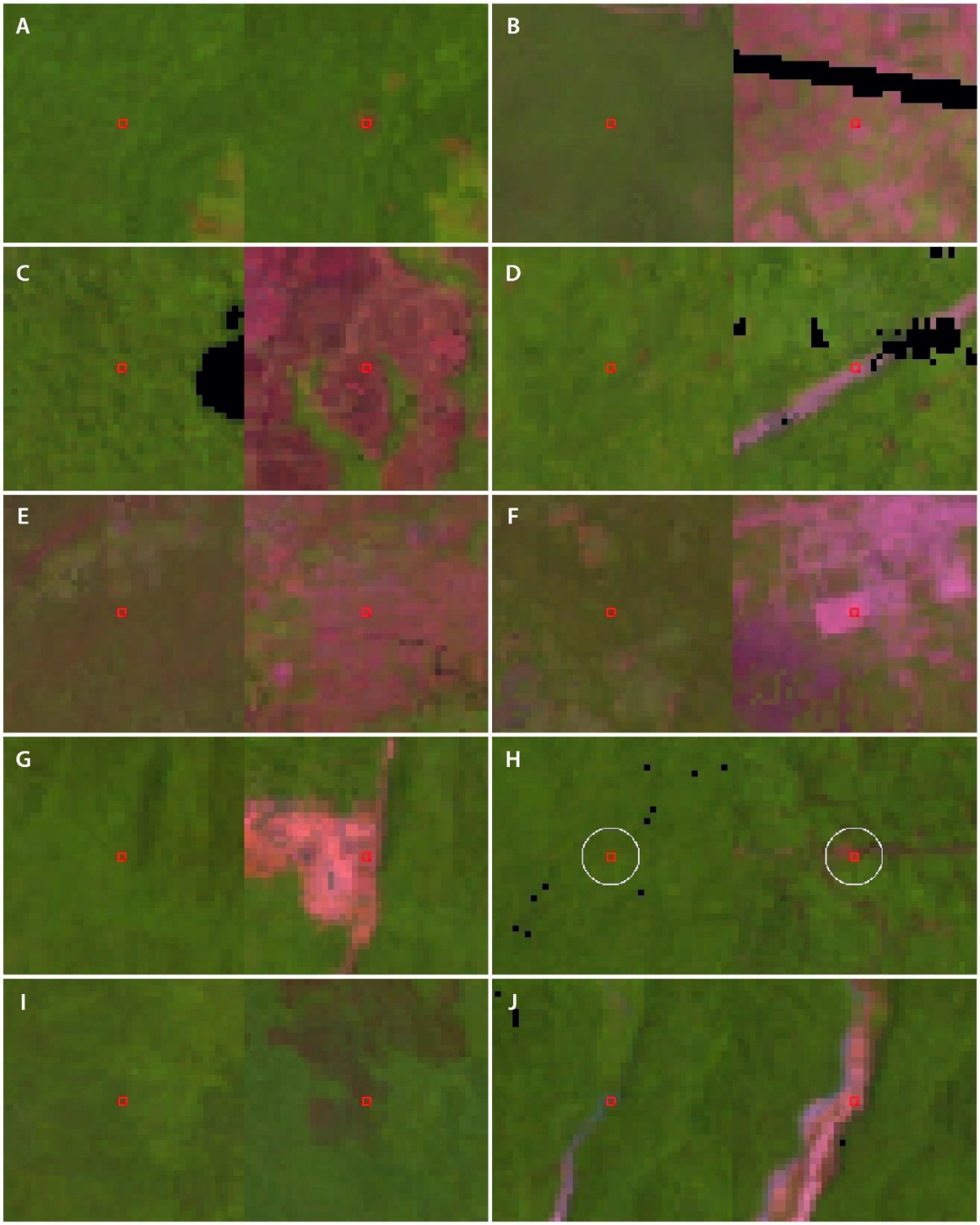

Fig. S3. Examples of forest disturbance drivers. (**A**) small-scale forest clearing for rotational agriculture and charcoal production (contribution of charcoal production does not exceed 10% of the class area (*42*)), (**B**) small-scale clearing for semi-permanent agriculture, (**C**) large-scale agro-industrial clearing, (**D**) road construction, (**E**) residential construction, (**F**) commercial construction, (**G**) mining, (**H**) industrial selective logging, (**I**) fire, (**J**) river meandering. Images are annual cloud-free Landsat composites: left – pre-disturbance, right – post-disturbance. Red square corresponds to the sampled pixel. White circle in (H) is a 120-m buffer used to define the areas affected by selective logging.

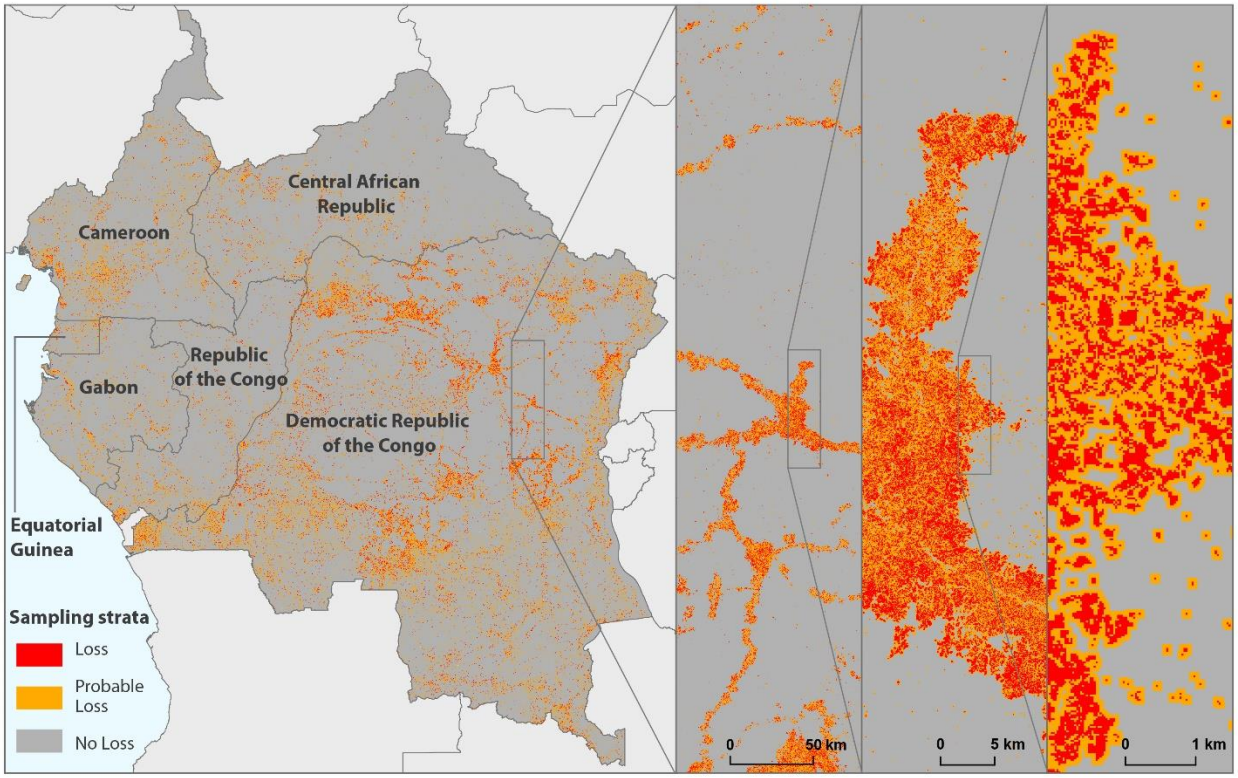

Fig. S4. Study area and sampling strata.

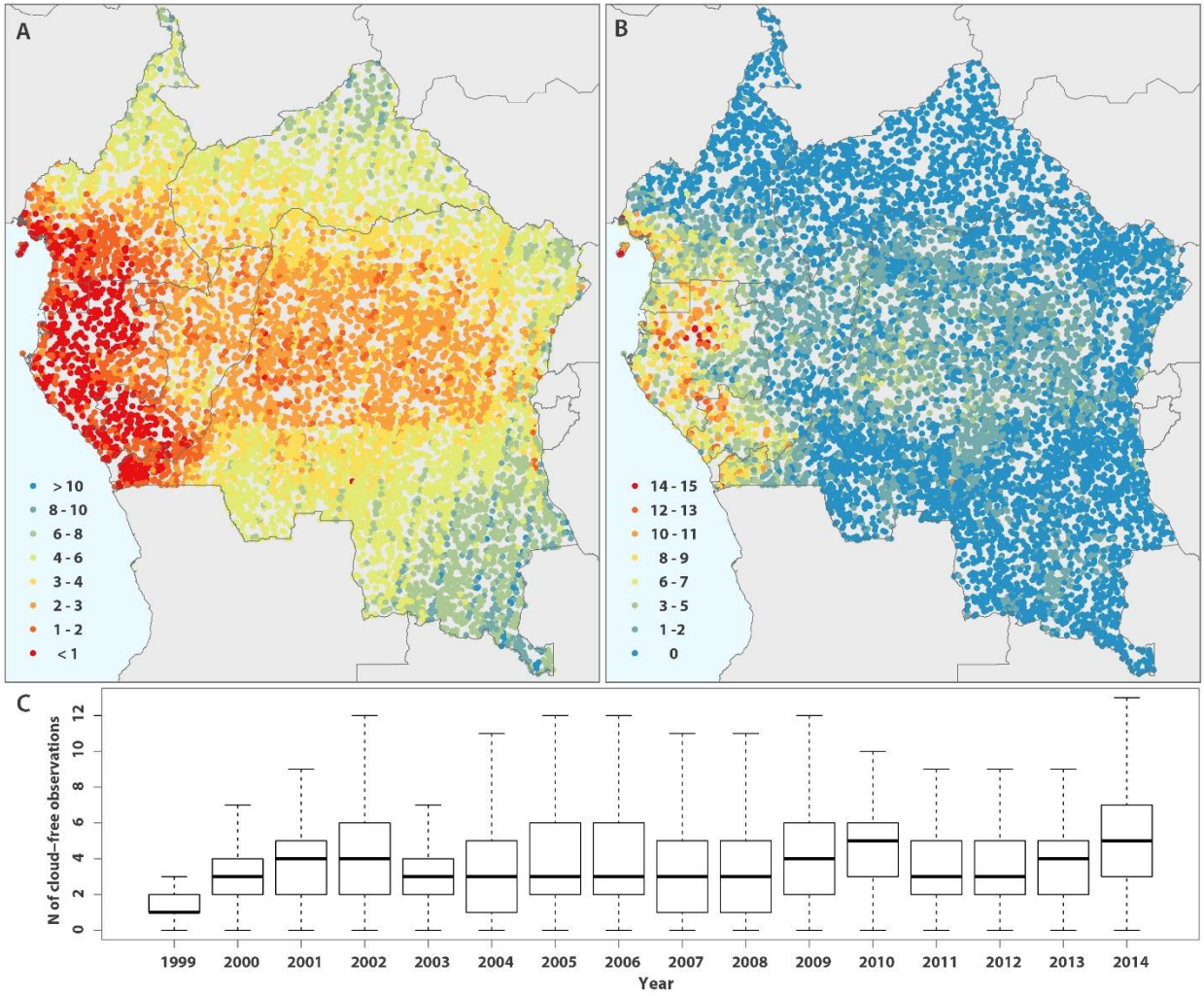

Fig. S5. Availability of cloud-free 16-day Landsat observations for the sampled pixels. (**A**) Average number of cloud-free observations per year. (**B**) Number of years with zero cloud-free observations. (**C**) Box plots of the number of cloud-free observations for each sampled pixel in each year.

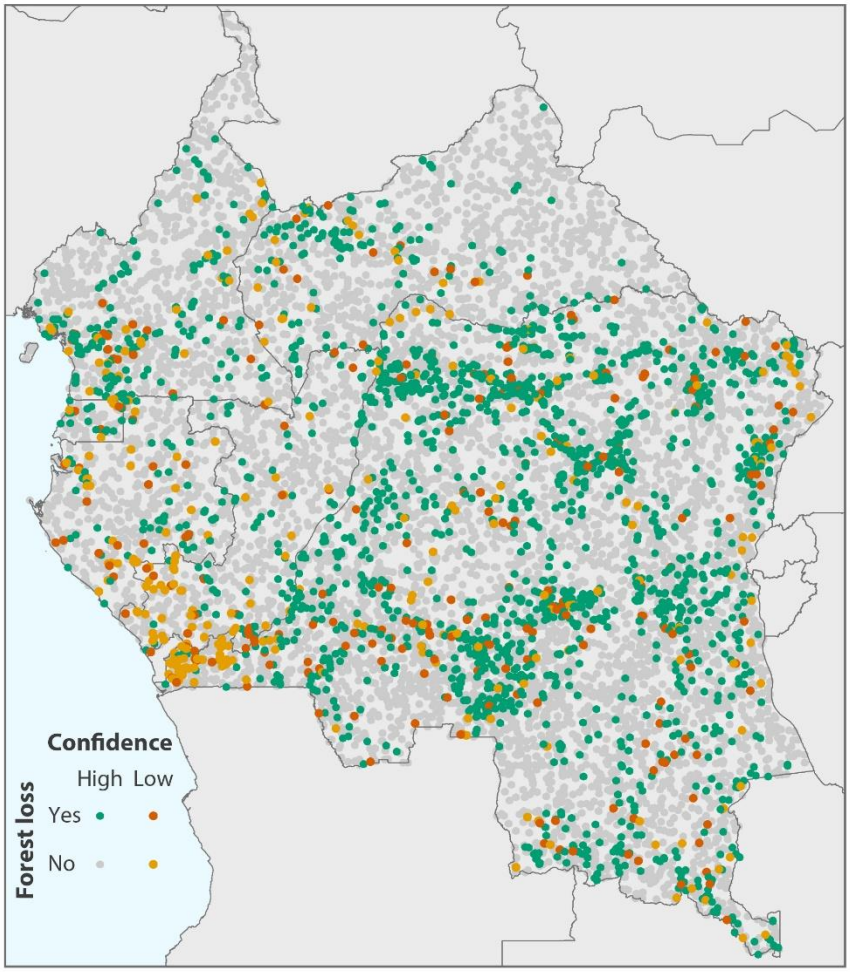

Fig. S6. Sampled pixels with high and low confidence of presence/absence of forest loss.

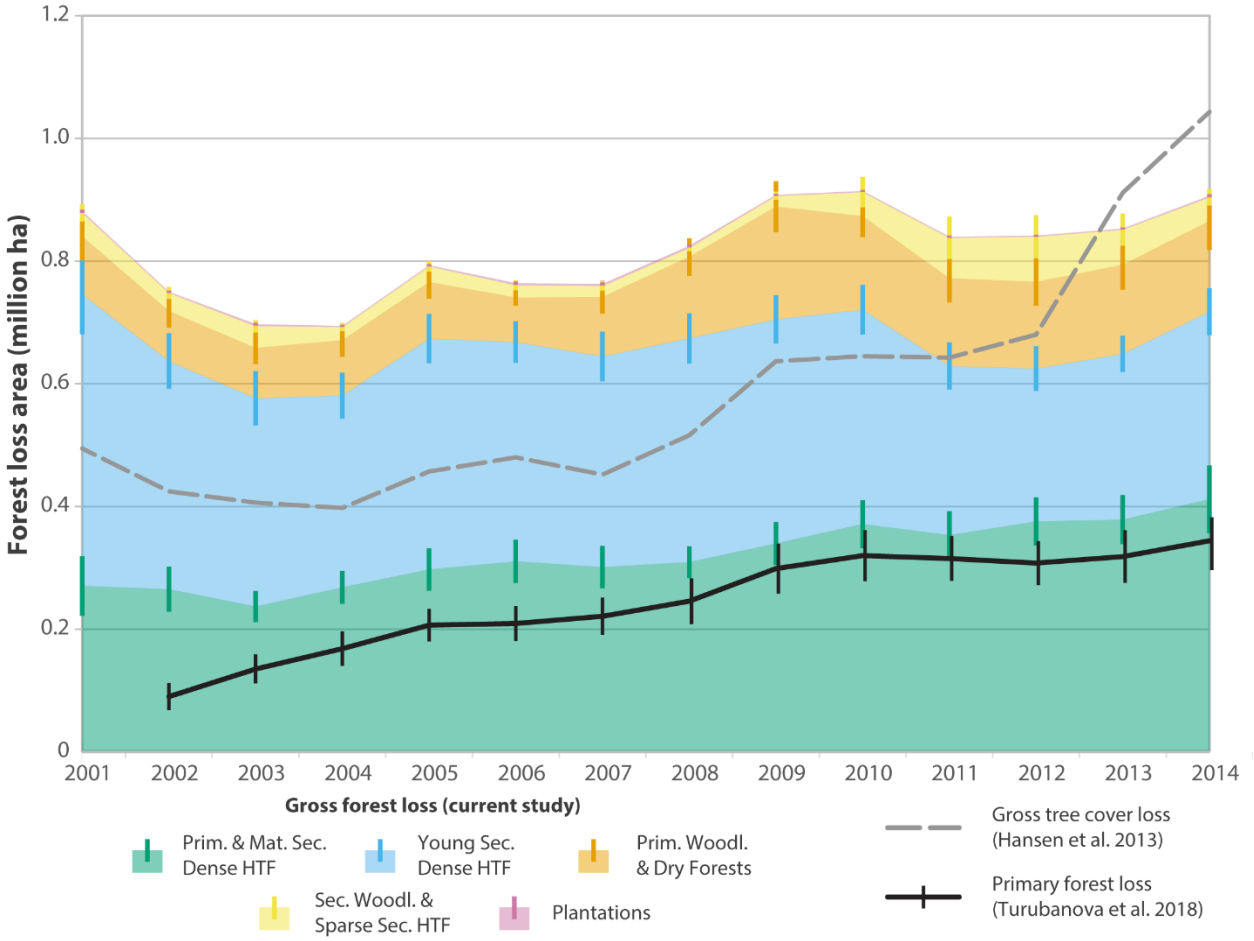

Fig. S7. Comparison of annual forest loss estimates for DRC. Error bars represent ± one standard error.

Table S1. Summary of selected socioeconomic indicators for the study countries. Data sources: Forest cover area – FAO FRA 2015; Population and Gross Domestic Product (GDP) - World Development Indicators, World Bank; Governance rank - World Governance Indicators, Political Stability and Absence of Violence, World Bank; Human Development Index (HDI) - UNDP Human Development Report 2015. Governance percentile rank ranges from 0 to 100, with higher values corresponding to better governance. HDI ranges from 1 to 188 with higher values corresponding to lower HDI. GDP rank is out of 195 countries globally with higher values corresponding to lower GDP. Country acronyms: CAM – Cameroon, CAR – Central African Republic, DRC – Democratic Republic of the Congo, EQG – Equatorial Guinea, GAB – Gabon, RoC – Republic of the Congo.

Country	Forest cover	Population			Governance			Human Development Index			Gross Domestic Product		
	Area (Mha), 2000	(million. people)		% of total ↑*	2000	2014	Δ	Average annual growth (%)		2014 rank	Average annual growth (%)		2014 rank
		2000	2014					2000 - 2010	2010 - 2014		2000 - 2010	2010 - 2014	
CAM	22.1	15.3	22.2	19	28	13	↓	1.07	1.32	153	3.4	5.1	96
CAR	22.4	3.8	4.5	2	13	0.5	↓	1.58	-0.84	187	2.1	-7.1	170
DRC	157.2	47.1	73.7	72	0	5	↑	2.18	1.52	176	3.6	8.0	93
EQG	1.7	0.6	1.1	1	65	53	↓	1.18	-0.18	138	18.5	2.5	105
GAB	22.0	1.2	1.9	2	38	32	↓	0.48	0.76	110	1.2	5.6	110
RoC	22.6	3.2	4.9	4	17	31	↑	1.25	1.61	136	5.0	4.4	120

*Percent contribution of each country to the total 2000-2014 population increase in the region

Table S2A. Total 2001 to 2014 forest disturbance area by disturbance driver and predisturbance forest type (million hectares ± SE). Pre-disturbance (year 2000) forest types: PF – primary and mature secondary dense humid tropical forests (HTF), SF – young secondary dense HTF, PW – primary woodlands and dry forests, SW – secondary woodlands and sparse secondary HTF, PL – plantations. Loss categories contributing >1% to the total forest disturbance area of the study region are highlighted in yellow. Forest clearing for small-scale rotational agriculture includes clearing for charcoal production, the contribution of which does not exceed 10% of the class area (*42*).

Forest type	Forest clearing for						Industrial Selective Logging	Fire	Natural Forest Disturbances	*Total*
	Agriculture			Construction		Mining				
	Small-scale		Large-scale							
	Rotational + Charcoal Production	Semi-permanent		Roads	Residential & Commercial					
	All countries									
PF	5.089 ± 0.193	–	0.094 ± 0.021	0.037 ± 0.017	0.008 ± 0.006	0.006 ± 0.004	1.572 ± 0.290	0.418 ± 0.133	0.017 ± 0.010	7.241 ± 0.372
SF	5.644 ± 0.292	–	0.008 ± 0.006	0.025 ± 0.009	0.056 ± 0.017	–	–	0.039 ± 0.023	–	5.772 ± 0.293
PW	2.163 ± 0.220	0.345 ± 0.085	0.005 ± 0.005	0.006 ± 0.006	0.079 ± 0.041	–	–	0.170 ± 0.103	0.006 ± 0.006	2.774 ± 0.260
SW	0.668 ± 0.138	–	–	–	0.023 ± 0.015	–	–	0.005 ± 0.005	–	0.696 ± 0.139
PL	0.023 ± 0.015	–	0.050 ± 0.019	–	–	–	–	–	–	0.073 ± 0.024
Total	13.587 ± 0.415	0.345 ± 0.085	0.157 ± 0.029	0.068 ± 0.021	0.166 ± 0.047	0.006 ± 0.004	1.572 ± 0.290	0.633 ± 0.170	0.022 ± 0.011	16.556 ± 0.538
	Cameroon									
PF	0.405 ± 0.051	–	0.072 ± 0.019	0.005 ± 0.005	0.005 ± 0.005	–	0.358 ± 0.142	0.023 ± 0.015	–	0.870 ± 0.151
SF	0.462 ± 0.119	–	–	–	–	–	–	–	–	0.462 ± 0.119
PW	0.023 ± 0.015	0.172 ± 0.076	–	0.006 ± 0.006	0.013 ± 0.013	–	–	–	–	0.215 ± 0.079
SW	0.048 ± 0.023	–	–	–	0.018 ± 0.014	–	–	–	–	0.066 ± 0.027
PL	0.013 ± 0.013	–	0.016 ± 0.009	–	–	–	–	–	–	0.029 ± 0.016
Total	0.952 ± 0.131	0.172 ± 0.076	0.089 ± 0.020	0.012 ± 0.008	0.036 ± 0.019	–	0.358 ± 0.142	0.023 ± 0.015	–	1.642 ± 0.206
	Central African Republic									
PF	0.197 ± 0.049	–	–	–	–	0.003 ± 0.003	0.013 ± 0.013	0.017 ± 0.010	–	0.230 ± 0.052
SF	0.011 ± 0.008	–	–	–	–	–	–	–	–	0.011 ± 0.008
PW	0.832 ± 0.132	0.048 ± 0.021	–	–	–	–	–	0.026 ± 0.018	0.006 ± 0.006	0.911 ± 0.134
SW	0.076 ± 0.023	–	–	–	–	–	–	–	–	0.076 ± 0.023
PL	–	–	–	–	–	–	–	–	–	–
Total	1.116 ± 0.139	0.048 ± 0.021	–	–	–	0.003 ± 0.003	0.013 ± 0.013	0.043 ± 0.021	0.006 ± 0.006	1.228 ± 0.141
	Democratic Republic of the Congo									
PF	4.033 ± 0.166	–	0.008 ± 0.006	0.005 ± 0.005	0.003 ± 0.003	–	0.098 ± 0.074	0.337 ± 0.129	0.017 ± 0.01	4.499 ± 0.223
SF	4.722 ± 0.249	–	–	0.005 ± 0.005	0.037 ± 0.014	–	–	0.013 ± 0.013	–	4.777 ± 0.249
PW	1.308 ± 0.176	0.125 ± 0.031	0.005 ± 0.005	–	0.062 ± 0.039	–	–	0.144 ± 0.102	–	1.643 ± 0.209
SW	0.475 ± 0.115	–	–	–	0.005 ± 0.005	–	–	0.005 ± 0.005	–	0.485 ± 0.115
PL	0.010 ± 0.007	–	0.021 ± 0.010	–	–	–	–	–	–	0.031 ± 0.013
Total	10.548 ± 0.344	0.125 ± 0.031	0.033 ± 0.013	0.010 ± 0.007	0.107 ± 0.042	–	0.098 ± 0.074	0.498 ± 0.165	0.017 ± 0.01	11.436 ± 0.389
	Equatorial Guinea									
PF	0.014 ± 0.008	–	–	0.003 ± 0.003	–	0.003 ± 0.003	–	–	–	0.021 ± 0.009
SF	0.068 ± 0.036	–	0.003 ± 0.003	0.010 ± 0.005	0.007 ± 0.005	–	–	–	–	0.088 ± 0.037
PW	–	–	–	–	–	–	–	–	–	–

Forest type	Forest clearing for									
	Agriculture			Construction		Mining	**Industrial Selective Logging**	**Fire**	**Natural Forest Disturbances**	***Total***
	Small-scale		Large-scale							
	Rotational + Charcoal Production	Semi-permanent		Roads	Residential & Commercial					
SW	–	–	–	–	–	–	–	–	–	–
PL	–	–	–	–	–	–	–	–	–	–
Total	0.082 ± 0.037	–	0.003 ± 0.003	0.014 ± 0.006	0.007 ± 0.005	0.003 ± 0.003	–	–	–	0.109 ± 0.037
	Gabon									
PF	0.133 ± 0.028	–	0.014 ± 0.008	0.010 ± 0.008	–	–	0.483 ± 0.157	0.015 ± 0.015	–	0.655 ± 0.160
SF	0.102 ± 0.032	–	0.005 ± 0.005	0.007 ± 0.005	0.012 ± 0.008	–	–	–	–	0.125 ± 0.033
PW	–	–	–	–	0.005 ± 0.005	–	–	–	–	0.005 ± 0.005
SW	–	–	–	–	–	–	–	–	–	–
PL	–	–	–	–	–	–	–	–	–	–
Total	0.234 ± 0.041	–	0.018 ± 0.009	0.017 ± 0.009	0.017 ± 0.009	–	0.483 ± 0.157	0.015 ± 0.015	–	0.784 ± 0.161
	Republic of the Congo									
PF	0.306 ± 0.060	–	–	0.013 ± 0.013	–	–	0.620 ± 0.184	0.027 ± 0.019	–	0.966 ± 0.194
SF	0.280 ± 0.082	–	–	0.003 ± 0.003	–	–	–	0.027 ± 0.019	–	0.310 ± 0.084
PW	–	–	–	–	–	–	–	–	–	–
SW	0.068 ± 0.068	–	–	–	–	–	–	–	–	0.068 ± 0.068
PL	–	–	0.013 ± 0.013	–	–	–	–	–	–	0.013 ± 0.013
Total	0.655 ± 0.121	–	0.013 ± 0.013	0.016 ± 0.014	–	–	0.620 ± 0.184	0.053 ± 0.026	–	1.358 ± 0.219

Table S2B. Annual forest loss area by forest disturbance driver and predisturbance forest type in all countries (million hectares ± SE). Forest clearing for small-scale rotational agriculture includes clearing for charcoal production, the contribution of which does not exceed 10% of the class area (*42*).

Year	Forest clearing for									
	Agriculture			Construction		Mining	**Industrial Selective Logging**	**Fire**	**Natural Forest Disturbances**	***Total***
	Small-scale		Large-scale							
	Rotational + Charcoal Production	Semi-permanent		Roads	Residential & Commercial					
	All forest types									
2001	1.099 ± 0.154	0.008 ± 0.006	0.008 ± 0.006	–	0.002 ± 0.002	–	0.172 ± 0.099	0.149 ± 0.102	–	1.438 ± 0.210
2002	1.082 ± 0.132	0.023 ± 0.015	0.013 ± 0.013	–	–	–	0.198 ± 0.105	–	–	1.316 ± 0.170
2003	0.609 ± 0.076	0.011 ± 0.007	0.005 ± 0.005	0.002 ± 0.002	0.018 ± 0.014	–	0.044 ± 0.023	–	0.005 ± 0.005	0.694 ± 0.081
2004	0.852 ± 0.125	0.013 ± 0.013	0.005 ± 0.005	–	–	–	0.020 ± 0.016	0.033 ± 0.021	–	0.923 ± 0.129
2005	1.028 ± 0.110	0.034 ± 0.017	0.011 ± 0.008	0.003 ± 0.003	0.005 ± 0.005	–	0.161 ± 0.098	0.024 ± 0.015	–	1.265 ± 0.149
2006	0.909 ± 0.108	0.042 ± 0.020	–	0.006 ± 0.006	0.003 ± 0.003	–	0.015 ± 0.015	0.085 ± 0.073	–	1.060 ± 0.133
2007	0.847 ± 0.093	–	0.005 ± 0.005	0.007 ± 0.006	0.014 ± 0.009	–	0.114 ± 0.073	0.031 ± 0.019	–	1.019 ± 0.120
2008	0.947 ± 0.142	0.030 ± 0.019	0.011 ± 0.008	0.019 ± 0.014	0.014 ± 0.008	–	0.030 ± 0.021	–	0.006 ± 0.006	1.056 ± 0.146
2009	1.073 ± 0.096	0.034 ± 0.016	0.019 ± 0.010	0.003 ± 0.003	0.039 ± 0.017	–	0.068 ± 0.068	–	0.006 ± 0.006	1.242 ± 0.121
2010	0.972 ± 0.101	0.029 ± 0.016	0.016 ± 0.009	–	0.036 ± 0.036	–	0.254 ± 0.130	0.085 ± 0.073	–	1.391 ± 0.184
2011	0.998 ± 0.144	0.003 ± 0.003	0.011 ± 0.007	0.005 ± 0.004	0.010 ± 0.007	0.003 ± 0.003	0.013 ± 0.013	0.032 ± 0.019	–	1.073 ± 0.146
2012	0.926 ± 0.131	0.030 ± 0.016	0.025 ± 0.011	–	0.020 ± 0.015	–	0.095 ± 0.071	0.083 ± 0.029	–	1.178 ± 0.154
2013	1.174 ± 0.122	0.090 ± 0.070	0.013 ± 0.008	0.017 ± 0.01	0.002 ± 0.002	0.003 ± 0.003	0.290 ± 0.127	0.093 ± 0.073	0.005 ± 0.005	1.688 ± 0.203
2014	1.072 ± 0.115	–	0.019 ± 0.009	0.005 ± 0.004	0.003 ± 0.003	–	0.100 ± 0.071	0.018 ± 0.014	–	1.214 ± 0.136
Total	13.587 ± 0.415	0.345 ± 0.085	0.157 ± 0.029	0.068 ± 0.021	0.166 ± 0.047	0.006 ± 0.004	1.572 ± 0.290	0.633 ± 0.170	0.022 ± 0.011	16.556 ± 0.538
	Primary and Mature Secondary Dense Humid Tropical Forests									
2001	0.294 ± 0.056	–	0.008 ± 0.006	–	–	–	0.172 ± 0.099	0.077 ± 0.072	–	0.552 ± 0.135
2002	0.287 ± 0.042	–	–	–	–	–	0.198 ± 0.105	–	–	0.485 ± 0.113
2003	0.273 ± 0.054	–	0.005 ± 0.005	–	–	–	0.044 ± 0.023	–	0.005 ± 0.005	0.327 ± 0.059
2004	0.259 ± 0.043	–	–	–	–	–	0.020 ± 0.016	0.033 ± 0.021	–	0.312 ± 0.050
2005	0.381 ± 0.049	–	0.005 ± 0.005	–	–	–	0.161 ± 0.098	0.006 ± 0.006	–	0.552 ± 0.110
2006	0.321 ± 0.048	–	–	–	–	–	0.015 ± 0.015	0.085 ± 0.073	–	0.421 ± 0.089
2007	0.297 ± 0.046	–	–	0.007 ± 0.006	0.005 ± 0.005	–	0.114 ± 0.073	0.005 ± 0.005	–	0.428 ± 0.087
2008	0.322 ± 0.043	–	0.011 ± 0.008	0.019 ± 0.014	–	–	0.030 ± 0.021	–	–	0.382 ± 0.051
2009	0.410 ± 0.051	–	0.013 ± 0.008	0.003 ± 0.003	0.003 ± 0.003	–	0.068 ± 0.068	–	0.006 ± 0.006	0.504 ± 0.086
2010	0.389 ± 0.058	–	0.011 ± 0.008	–	–	–	0.254 ± 0.130	–	–	0.654 ± 0.142
2011	0.492 ± 0.077	–	–	–	–	0.003 ± 0.003	0.013 ± 0.013	0.032 ± 0.019	–	0.539 ± 0.081
2012	0.377 ± 0.055	–	0.020 ± 0.010	–	–	–	0.095 ± 0.071	0.070 ± 0.025	–	0.562 ± 0.094
2013	0.501 ± 0.064	–	0.005 ± 0.005	0.008 ± 0.008	–	0.003 ± 0.003	0.290 ± 0.127	0.093 ± 0.073	0.005 ± 0.005	0.904 ± 0.160
2014	0.486 ± 0.073	–	0.015 ± 0.009	–	–	–	0.100 ± 0.071	0.018± 0.014	–	0.619 ± 0.103
Total	5.089 ± 0.193	–	0.094 ± 0.021	0.037 ± 0.017	0.008 ± 0.006	0.006 ± 0.004	1.572 ± 0.290	0.418 ± 0.133	0.017 ± 0.010	7.241 ± 0.372
	Young Secondary Dense Humid Tropical Forests									
2001	0.640 ± 0.122	–	–	–	0.002 ± 0.002	–	–	–	–	0.642 ± 0.122
2002	0.558 ± 0.098	–	–	–	–	–	–	–	–	0.558 ± 0.098
2003	0.225 ± 0.045	–	–	0.002 ± 0.002	–	–	–	–	–	0.227 ± 0.045
2004	0.419 ± 0.090	–	–	–	–	–	–	–	–	0.419 ± 0.090
2005	0.479 ± 0.091	–	–	0.003 ± 0.003	0.005 ± 0.005	–	–	0.013 ± 0.013	–	0.500 ± 0.092

Year	Forest clearing for									
	Agriculture			Construction		Mining	**Industrial Selective Logging**	**Fire**	**Natural Forest Disturbances**	***Total***
	Small-scale		Large-scale							
	Rotational + Charcoal Production	Semi-permanent		Roads	Residential & Commercial					
2006	0.366 ± 0.058	–	–	–	0.003 ± 0.003	–	–	–	–	0.368 ± 0.058
2007	0.361 ± 0.065	–	–	–	0.006 ± 0.006	–	–	–	–	0.368 ± 0.066
2008	0.423 ± 0.111	–	–	–	0.009 ± 0.006	–	–	–	–	0.431 ± 0.111
2009	0.423 ± 0.061	–	–	–	0.018 ± 0.009	–	–	–	–	0.441 ± 0.061
2010	0.372 ± 0.064	–	–	–	–	–	–	0.013 ± 0.013	–	0.385 ± 0.065
2011	0.333 ± 0.093	–	–	0.005 ± 0.004	–	–	–	–	–	0.339 ± 0.093
2012	0.273 ± 0.052	–	0.005 ± 0.005	–	0.008 ± 0.008	–	–	0.013 ± 0.013	–	0.298 ± 0.055
2013	0.351 ± 0.051	–	0.003 ± 0.003	0.010 ± 0.007	0.002 ± 0.002	–	–	–	–	0.367 ± 0.051
2014	0.419 ± 0.074	–	–	0.005 ± 0.004	0.003 ± 0.003	–	–	–	–	0.428 ± 0.075
Total	5.644 ± 0.292	–	0.008 ± 0.006	0.025 ± 0.009	0.056 ± 0.017	–	–	0.039 ± 0.023	–	5.772 ± 0.293
	Primary Woodlands and Dry Forests									
2001	0.148 ± 0.076	0.008 ± 0.006	–	–	–	–	–	0.072 ± 0.072	–	0.227 ± 0.105
2002	0.087 ± 0.028	0.023 ± 0.015	–	–	–	–	–	–	–	0.111 ± 0.031
2003	0.098 ± 0.028	0.011 ± 0.007	–	–	0.005 ± 0.005	–	–	–	–	0.114 ± 0.030
2004	0.141 ± 0.075	0.013 ± 0.013	–	–	–	–	–	–	–	0.154 ± 0.076
2005	0.137 ± 0.035	0.034 ± 0.017	–	–	–	–	–	–	–	0.171 ± 0.038
2006	0.192 ± 0.077	0.042 ± 0.020	–	0.006 ± 0.006	–	–	–	–	–	0.240 ± 0.079
2007	0.148 ± 0.044	–	–	–	0.003 ± 0.003	–	–	0.026 ± 0.018	–	0.176 ± 0.048
2008	0.184 ± 0.077	0.030 ± 0.019	–	–	–	–	–	–	0.006 ± 0.006	0.220 ± 0.080
2009	0.224 ± 0.055	0.034 ± 0.016	–	–	0.018 ± 0.014	–	–	–	–	0.276 ± 0.059
2010	0.172 ± 0.05	0.029 ± 0.016	–	–	0.036 ± 0.036	–	–	0.072 ± 0.072	–	0.309 ± 0.096
2011	0.088 ± 0.028	0.003 ± 0.003	0.005 ± 0.005	–	0.005 ± 0.005	–	–	–	–	0.101 ± 0.029
2012	0.165 ± 0.077	0.030 ± 0.016	–	–	0.013 ± 0.013	–	–	–	–	0.207 ± 0.080
2013	0.255 ± 0.088	0.090 ± 0.070	–	–	–	–	–	–	–	0.346 ± 0.112
2014	0.123 ± 0.046	–	–	–	–	–	–	–	–	0.123 ± 0.046
Total	2.163 ± 0.220	0.345 ± 0.085	0.005 ± 0.005	0.006 ± 0.006	0.079 ± 0.041	–	–	0.170 ± 0.103	0.006 ± 0.006	2.774 ± 0.260
	Secondary Woodlands and Sparse Secondary Humid Tropical Forests									
2001	0.017 ± 0.010	–	–	–	–	–	–	–	–	0.017 ± 0.010
2002	0.144 ± 0.074	–	–	–	–	–	–	–	–	0.144 ± 0.074
2003	0.013 ± 0.008	–	–	–	0.013 ± 0.013	–	–	–	–	0.025 ± 0.015
2004	0.034 ± 0.013	–	–	–	–	–	–	–	–	0.034 ± 0.013
2005	0.031 ± 0.017	–	–	–	–	–	–	0.005 ± 0.005	–	0.036 ± 0.017
2006	0.031 ± 0.019	–	–	–	–	–	–	–	–	0.031 ± 0.019
2007	0.036 ± 0.020	–	–	–	–	–	–	–	–	0.036 ± 0.020
2008	0.018 ± 0.010	–	–	–	0.005 ± 0.005	–	–	–	–	0.023 ± 0.012
2009	0.015 ± 0.009	–	–	–	–	–	–	–	–	0.015 ± 0.009
2010	0.025 ± 0.015	–	–	–	–	–	–	–	–	0.025 ± 0.015
2011	0.085 ± 0.073	–	–	–	0.005 ± 0.005	–	–	–	–	0.090 ± 0.073
2012	0.110 ± 0.075	–	–	–	–	–	–	–	–	0.110 ± 0.075
2013	0.066 ± 0.025	–	–	–	–	–	–	–	–	0.066 ± 0.025
2014	0.043 ± 0.018	–	–	–	–	–	–	–	–	0.043 ± 0.018
Total	0.668 ± 0.138	–	–	–	0.023 ± 0.015	–	–	0.005 ± 0.005	–	0.696 ± 0.139

Year	Forest clearing for									
	Agriculture			Construction		Mining	**Industrial Selective Logging**	**Fire**	**Natural Forest Disturbances**	***Total***
	Small-scale		Large-scale							
	Rotational + Charcoal Production	Semi-permanent		Roads	Residential & Commercial					
	Plantations									
2001	–	–	–	–	–	–	–	–	–	–
2002	0.005 ± 0.005	–	0.013 ± 0.013	–	–	–	–	–	–	0.018 ± 0.014
2003	–	–	–	–	–	–	–	–	–	–
2004	–	–	0.005 ± 0.005	–	–	–	–	–	–	0.005 ± 0.005
2005	–	–	0.005 ± 0.005	–	–	–	–	–	–	0.005 ± 0.005
2006	–	–	–	–	–	–	–	–	–	–
2007	0.005 ± 0.005	–	0.005 ± 0.005	–	–	–	–	–	–	0.010 ± 0.007
2008	–	–	–	–	–	–	–	–	–	–
2009	–	–	0.005 ± 0.005	–	–	–	–	–	–	0.005 ± 0.005
2010	0.013 ± 0.013	–	0.005 ± 0.005	–	–	–	–	–	–	0.018 ± 0.014
2011	–	–	0.005 ± 0.005	–	–	–	–	–	–	0.005 ± 0.005
2012	–	–	–	–	–	–	–	–	–	–
2013	–	–	0.005 ± 0.005	–	–	–	–	–	–	0.005 ± 0.005
2014	–	–	–	–	–	–	–	–	–	–
Total	0.023 ± 0.015	–	0.050 ± 0.019	–	–	–	–	–	–	0.073 ± 0.024

Table S3. Comparison of forest loss estimates for DRC. All forest loss area estimates except FAO FRA are gross loss estimates. FAO FRA reports net change area, which for primary forests should be equal to gross loss area. Ernst et al. (2013) results were challenging to compare with other studies, since the publication provided only relative measures of forest loss (%/yr) and did not report denominator (national forest area?).

Study	Source		Definition		Study period	Annual forest loss area (1000ha/yr) ± 95% CI				
	Forest loss area	Forest type information	Forest	Forest type		All forests	Primary (natural) HTF	Primary woodlands	Secondary Woodlands	Secondary HTF
FAO FRA 2015 (*41*)	National reporting		>0.5 ha, >10% TCC, >5m, Land use definition	Primary forest: naturally regenerated forest of native species, no clearly visible indications of human activities; Other naturally regenerated forest (with indications of human activities)	1990-2000	311	73		238	
					2000-2010	311	107		205	
					2010-2015	311	140		171	
Potapov et al. 2012 (*16*)	National-scale map (60m resolution, Landsat-based)		>30% TCC, >5m height	Primary and secondary HTF >60% TCC, Woodlands 30-60% TCC	2000-2005	347	73	40		234
					2005-2010	395	140	66		189
Hansen et al. 2013 (*14*)	Global map (30m Landsat-based)	–	>5m height, any TCC	–	2000-2005	426	–	–	–	–
					2005-2010	553	–	–	–	–
					2010-2015	850	–	–	–	–
					2016	1380	–	–	–	–
Tyukavina et al. 2013 (*25*)	Sample (30 m Landsat-based)	Potapov et al. (2012) map	>30% TCC, >5m height	Primary and secondary HTF >60% TCC, Woodlands 30-60% TCC	2000-2010	670 ± 108	179 ± 65	90 ± 44		401 ± 74
Ernst et al. 2013 (*23*)	Sample (20x20 km blocks of 30m Landsat or 15 Aster data)		Tree cover >5m height	Three TCC gradations (>70%, 40-70%, 10-40%), not clear from method description how they are combined into the final estimate for "dense" forests	1990-2000	0.15%/yr ± 0.02%/yr	–	–	–	–
					2000-2005	0.32%/yr ± 0.05%/yr	–	–	–	–
Tyukavina et al. 2015 (*17*)	Sample (30m Landsat-based)		>25% TCC, >5m height	"Natural" forests, including primary and mature secondary forests, and natural woodlands without evidence of prior disturbances; "Managed" forests, including plantations and shifting cultivation.	2000-2012	808 ± 258	358 ± 158		450	
Turubanova et al. 2018 (*33*)	National-scale map (30m Landsat-based)		–	Primary HTF >60% TCC, > 5m height	2002-2014	–	217	–	–	–
	Sample (30m Landsat-based)				2002-2014	–	297 ± 69	–	–	–
Current study	Sample (30m Landsat-based)		>25% TCC, >5m height	Primary and secondary HTF >60% TCC, Woodlands 25-60% TCC (Plantations not reported separately here, but included in "all forests")	2000-2005	769 ± 93	269 ± 49	92 ± 44	28 ± 14	378 ± 67
					2005-2010	841 ± 91	327 ± 55	136 ± 50	18 ± 11	357 ± 56
					2010-2014	847 ± 119	380 ± 53	125 ± 48	64 ± 42	276 ± 49

Table S4. Major sources of uncertainty during sample interpretation and measures to address them.

Interpretation	Source of uncertainty	Measures to address uncertainty
Presence of forest loss	Unsure whether the pixel was forested or covered with shrub (< 5m) in 2000 in case very high-resolution imagery for the sampled pixel is absent	- Look for the nearby areas with the similar spectral signature in Landsat and available very high-resolution imagery; - Check Landsat-modeled year 2000 tree cover height for the pixel
	Unsure whether it is repeated clearing of Young Secondary HTF or re-clearing of non-woody fallows	- Look for the absence of large seasonal variation in the pre-disturbance 16-day Landsat data; - Do not record the second/third re-clearing of vegetation in case of rotation agriculture.
Year of forest loss	Missing cloud-free observations in the years prior to detected forest disturbance	- Use non-cloud-screened 16-day data to maximally employ hazy/cloud-contaminated data; - Report annual loss stats in the form of the 3-year moving averages
Pre-disturbance forest type	Unsure whether it is Primary and Mature Secondary or Young Secondary HTF	- Look at the landscape scale in Landsat and Google Earth to identify the boundaries of active rural complex; - Check Landsat-modeled year 2000 tree cover and height for the pixel; - Check using year 2000 primary forest mask (Turubanova et al. 2017).
	Unsure whether it is Young Secondary HTF or Primary Woodlands and Dry Forests	- Check for seasonality in Landsat 16-day observation graphs; - Check Landsat-modeled year 2000 tree cover for the pixel.
Forest disturbance driver	Unsure whether it is Small- or Large-scale Clearing for Agriculture	- Check if annual clearing size is above or below 10 ha.
	Unsure whether it is Rotational or Semi-permanent Small-scale Clearing for Agriculture	- Check for the indication of forest regrowth in Landsat 16-day graphs (tree cover gain is a sign of rotational agriculture); - If forest clearing happened at the end of study period (2012-2014), look for the presence of forest regrowth in the nearby disturbance patches.
	Unsure whether it is escaped Fire or Rotational Small-scale Clearing for Agriculture	- Check if pixel immediately starts regrowing after disturbance; - Check if the field boundaries are visible within the fire scar in very high-resolution imagery.

Table S5. Distribution of sampled pixels (n_h) among the country poststrata and three sampling design strata (loss, probable loss, and no loss) and strata sizes (N_h).

Country	Sample size, sampled pixels (n_h)				Stratum size, pixels (N_h)			
	Stratum			Total	Stratum			Total
	Loss	Probable Loss	No Loss		Loss	Probable Loss	No Loss	
Democratic Republic of the Congo	1,594	2,157	2,737	6,488	107,066,310	361,126,985	2,570,501,636	3,038,694,931
Central African Republic	109	223	837	1,169	7,899,514	37,899,759	765,814,878	811,614,151
Cameroon	141	317	605	1,063	9,873,930	52,084,816	547,287,848	609,246,594
Republic of the Congo	73	166	461	700	5,667,003	28,752,588	410,092,596	444,512,187
Gabon	63	116	324	503	3,709,753	22,993,150	317,391,039	344,093,942
Equatorial Guinea	20	21	36	77	883,138	3,977,387	30,277,866	35,138,391
Total	2,000	3,000	5,000	10,000	135,099,648	506,834,685	4,641,365,863	5,283,300,196