

Supplementary Material

Supplementary Table 1. Overlaying analysis

		% of Overlaying		
Class	Class	2010	2014	2018
Secondary forest	Degradation	0.6	0.5	0.3
Degradation	Deforestation	0.9	1.0	1.8
Secondary forest loss	Deforestation	1.0	1.1	1.6
Secondary forest	Deforestation	0.5	0.4	0.9

Supplementary Table 2. Land use and cover change (LUCC) areas in the Brazilian Amazon and in TAB, TEF, RBA, SAN and ALF influence regions (presented in Figure 4).

Influence region	Year	Forest	Secondary forest	Other non-forest natural formation	Planted forest	Degradation	Secondary forest loss	Deforestation	Pasture	Agriculture	Others	Water Bodies	Non-Observed
							Area (km ²)						
Brazilian Amazon	2010	3,363,034	109,498	137,252	364	11,301	6,772	8,961	441,584	29,547	2,648	98,227	6,601
	2011	3,359,433	114,223	138,408	411	4,240	6,690	10,067	443,504	30,662	2,782	98,765	6,605
	2012	3,354,258	120,692	138,177	405	3,243	7,260	8,316	439,858	34,568	2,894	99,523	6,595
	2013	3,344,903	126,138	137,684	414	4,722	7,825	8,932	435,139	39,723	2,997	100,719	6,593
	2014	3,331,854	129,264	138,785	479	6,286	8,403	9,360	433,576	45,759	3,034	102,411	6,578
	2015	3,311,776	132,221	138,051	576	18,921	8,503	10,399	434,819	48,214	3,063	102,665	6,582
	2016	3,292,129	133,141	137,440	622	27,546	9,674	13,209	442,469	49,894	3,208	99,877	6,580
	2017	3,286,172	133,058	138,288	685	9,953	13,394	16,981	454,991	51,530	3,281	100,881	6,574
	2018	3,265,968	141,908	139,878	708	5,050	22,854	21,532	452,039	55,517	3,293	100,477	6,565
TAB	2010	2,852,349	85,552	97,273	353	7,260	5,061	7,017	308,942	1,123	2,136	93,902	3,792
	2011	2,849,296	89,475	98,349	399	2,727	4,903	7,314	310,713	1,117	2,224	94,446	3,794
	2012	2,845,917	95,171	98,093	391	1,868	5,325	6,109	308,930	1,510	2,353	95,301	3,789
TEF	2013	1,863,400	90,004	85,670	400	2,736	5,719	4,645	215,223	1,659	2,144	88,315	1,928
	2014	1,856,267	92,160	86,711	452	3,301	5,964	4,634	215,936	2,530	2,200	89,762	1,926
	2015	1,843,256	94,288	86,247	546	14,039	5,970	4,993	216,340	2,755	2,199	89,283	1,926
	2016	1,831,040	94,415	85,957	588	19,579	7,243	7,868	220,646	3,304	2,297	86,977	1,928
	2017	1,831,935	93,830	87,299	647	3,959	9,930	9,500	228,620	3,820	2,339	88,038	1,924
	2018	1,820,161	98,732	88,325	672	2,359	16,438	11,785	226,998	4,721	2,275	87,459	1,918
RBA	2010	3,201,774	107,096	108,021	361	11,129	6,660	8,817	439,011	29,463	2,585	97,336	3,903
	2011	3,198,078	111,747	109,161	407	4,193	6,592	9,918	440,883	30,600	2,720	97,948	3,906
	2012	3,193,102	118,136	108,910	399	3,159	7,142	8,168	437,210	34,511	2,829	98,688	3,900
	2013	3,183,974	123,558	108,368	407	4,600	7,693	8,778	432,410	39,671	2,930	99,867	3,898
	2014	3,171,324	126,690	109,456	471	6,119	8,236	9,165	430,657	45,675	2,966	101,511	3,884
	2015	3,151,911	129,674	108,725	566	18,387	8,336	10,127	431,692	48,128	2,995	101,727	3,887
	2016	3,133,089	130,537	108,170	612	26,272	9,539	12,953	439,215	49,763	3,136	98,977	3,889
	2017	3,126,410	130,264	109,161	674	9,846	13,254	16,640	451,555	51,373	3,210	99,884	3,882
	2018	3,106,853	139,044	110,748	697	4,930	22,453	21,083	448,372	55,318	3,221	99,562	3,875

Influence region	Year	Forest	Secondary forest	Other non-forest natural formation	Planted forest	Degradation	Secondary forest loss	Deforestation	Pasture	Agriculture	Others	Water Bodies	Non-Observed
		Area (km ²)											
SAN	2010	396,406	48,879	36,239	365	1,379	3,770	3,470	146,794	731	1,266	34,542	887
	2011	395,420	52,178	36,739	407	447	3,469	2,580	146,345	713	1,298	34,243	890
	2012	393,046	56,285	36,565	392	448	3,732	2,686	143,601	979	1,429	34,678	887
	2013	389,292	57,226	36,412	391	1,382	4,448	2,958	144,200	1,425	1,515	34,591	886
	2014	386,952	59,015	36,800	433	1,055	4,207	2,688	144,290	2,200	1,551	34,652	886
	2015	382,570	60,632	36,222	489	4,083	4,241	2,896	143,868	2,378	1,530	34,933	884
	2016	374,891	60,032	36,057	514	7,980	5,345	4,036	145,697	2,802	1,612	34,880	882
	2017	374,824	58,880	35,840	565	1,174	7,073	5,193	150,110	3,321	1,643	35,224	880
	2018	367,370	59,215	36,482	581	1,022	12,202	6,678	149,891	4,076	1,575	34,754	880
ALF	2010	1,031,356	67,221	35,358	277	4,956	4,749	5,617	268,893	2,436	1,375	45,983	879
	2011	1,029,142	70,631	35,834	321	2,363	4,533	5,391	269,637	2,661	1,397	46,307	882
	2012	1,026,501	75,767	35,721	310	1,170	4,885	4,768	266,837	3,851	1,549	46,864	878
	2013	1,021,422	78,908	35,119	310	2,350	5,523	5,076	265,296	5,612	1,603	47,004	878
	2014	1,016,680	81,429	35,243	329	2,458	5,546	4,831	264,137	8,249	1,662	47,662	874
	2015	1,008,097	83,633	35,043	399	7,462	5,793	5,164	263,918	9,186	1,666	47,868	873
	2016	997,248	82,103	35,217	446	12,562	7,098	6,905	267,816	10,276	1,773	46,787	872
	2017	990,415	82,719	34,898	478	6,256	9,700	9,276	274,250	11,018	1,803	47,420	869
	2018	981,325	84,242	35,730	513	2,888	16,115	12,495	273,645	12,727	1,773	46,780	868

In green LUC classes: in green absorption, in orange emissions, in yellow not account in the CO₂ estimates, in gray not included in the Figure 4

Supplementary Table 3. Bottom-up CO₂ fluxes by influence region (presented in Figure 7).

Influence region	Year	Forest	Secondary forest	Other non-forest natural formation	Planted forest	Degradation	Secondary forest loss	Deforestation	Net BU	Forest	Secondary forest	Other non-forest natural formation	Planted forest	Degradation	Secondary forest loss	Deforestation
		CO ₂ estimates (Tg CO ₂ yr ⁻¹)								% respect total removals				% respect total emissions		
Brazilian Amazon	2010	-662	-125	-26	-7	339	30	371	-80	81	15	3	1	46	4	50
	2011	-662	-129	-26	-8	127	31	389	-278	80	16	3	1	23	6	71
	2012	-661	-135	-26	-8	97	31	328	-373	80	16	3	1	21	7	72
	2013	-659	-149	-26	-8	142	34	360	-307	78	18	3	1	27	6	67
	2014	-657	-141	-26	-9	189	38	379	-229	79	17	3	1	31	6	63
	2015	-653	-143	-26	-11	568	40	426	201	78	17	3	1	55	4	41
	2016	-650	-133	-26	-12	827	46	524	577	79	16	3	1	59	3	38
	2017	-650	-139	-26	-13	299	70	667	207	78	17	3	2	29	7	64
	2018	-648	-150	-27	-13	152	99	840	253	77	18	3	2	14	9	77
Mean		-656	-138	-26	-10	304	46	476		79	17	3	1	34	6	60
Total (Tg CO ₂)		-5,901	-1,243	-237	-88	2,740	417	4,283		79	17	3	1	37	6	58
TAB_TEF	2010	-601	-65	-19	-7	181	13	183	-314	87	9	3	1	48	3	49
	2011	-601	-65	-19	-7	61	13	183	-435	87	9	3	1	24	5	71
	2012	-601	-68	-19	-7	52	13	149	-481	86	10	3	1	24	6	70
	2013	-390	-79	-16	-8	119	17	142	-216	79	16	3	2	43	6	51
	2014	-388	-81	-17	-8	143	19	154	-178	79	16	3	2	45	6	49
	2015	-386	-82	-16	-10	620	18	159	303	78	17	3	2	78	2	20
	2016	-385	-81	-16	-11	642	23	278	450	78	16	3	2	68	2	29
	2017	-385	-78	-17	-12	113	36	320	-23	78	16	3	2	24	8	68
	2018	-384	-80	-17	-13	72	48	450	76	78	16	3	3	13	8	79
Mean		-458	-75	-17	-9	223	22	224		81	14	3	2	41	5	54
Total (Tg CO ₂)		-4,121	-679	-155	-84	2,004	200	2,018		82	13	3	2	47	5	48
RBA	2010	-650	-104	-21	-7	342	22	343	-75	83	13	3	1	48	3	48
	2011	-649	-101	-21	-8	123	23	404	-229	83	13	3	1	22	4	73
	2012	-649	-107	-21	-7	94	22	307	-360	83	14	3	1	22	5	73
	2013	-648	-114	-21	-8	146	31	329	-285	82	14	3	1	29	6	65
	2014	-645	-113	-21	-9	223	28	384	-153	82	14	3	1	35	4	60
	2015	-642	-117	-21	-11	583	30	429	253	81	15	3	1	56	3	41
	2016	-639	-124	-21	-11	677	36	554	471	80	16	3	1	53	3	44
	2017	-638	-114	-21	-13	257	55	662	188	81	14	3	2	26	6	68
	2018	-635	-124	-21	-13	154	93	848	302	80	16	3	2	14	9	77
Mean		-644	-113	-21	-10	289	38	473		82	14	3	1	34	5	61
Total (Tg CO ₂)		-5,795	-1,018	-187	-86	2,598	340	4,260		82	14	3	1	36	5	59

Influence region	Year	Forest	Secondary forest	Other non-forest natural formation	Planted forest	Degradation	Secondary forest loss	Deforestation	Net BU	Forest	Secondary forest	Other non-forest natural formation	Planted forest	Degradation	Secondary forest loss	Deforestation
CO ₂ estimates (Tg CO ₂ yr ⁻¹)										% respect total removals				% respect total emissions		
SAN	2010	-70	-66	-7	-7	46	13	130	40	47	44	5	4	24	7	69
	2011	-72	-61	-7	-7	15	14	106	-13	49	42	5	5	11	10	79
	2012	-71	-64	-7	-7	18	13	101	-17	48	43	5	5	13	10	77
	2013	-71	-63	-7	-7	46	15	115	27	48	43	5	5	26	9	65
	2014	-70	-65	-7	-7	40	15	113	19	47	43	5	5	24	9	67
	2015	-70	-66	-7	-9	132	15	118	113	46	44	5	6	50	6	45
	2016	-68	-65	-7	-10	283	18	167	319	46	43	5	6	60	4	36
	2017	-69	-64	-7	-10	47	27	156	81	46	43	5	7	20	12	68
	2018	-67	-67	-7	-11	42	42	406	338	44	44	5	7	9	9	83
Mean		-70	-65	-7	-8	74	19	157		47	43	5	6	26	8	65
Total (Tg CO2)		-629	-582	-62	-75	669	173	1,412		47	43	5	6	30	8	63
ALF	2010	-176	-58	-7	-5	142	15	225	136	72	24	3	2	37	4	59
	2011	-175	-60	-7	-6	72	15	225	65	71	24	3	2	23	5	72
	2012	-175	-66	-7	-6	29	14	193	-18	69	26	3	2	12	6	82
	2013	-174	-71	-7	-6	59	22	215	38	68	28	3	2	20	7	73
	2014	-174	-75	-7	-6	69	17	216	41	66	29	3	2	23	5	72
	2015	-172	-71	-7	-7	177	19	218	156	67	28	3	3	43	4	53
	2016	-171	-71	-7	-8	272	23	254	292	66	28	3	3	50	4	46
	2017	-169	-68	-7	-9	220	36	354	357	67	27	3	4	36	6	58
	2018	-168	-85	-7	-10	101	59	470	362	62	31	3	4	16	9	75
Mean		-173	-69	-7	-7	127	24	263		68	27	3	3	29	6	65
Total (Tg CO2)		-1,554	-625	-61	-63	1,141	220	2,371		67	27	3	3	31	6	64

Supplementary Table 4. Top-down CO₂ fluxes by influence region (presented in Figure 7) Gatti et al. (2021). NBE: Net Biome Exchange

Influence region	Year	Total	NBE	FIRE
		CO ₂ estimates (Tg CO ₂ yr ⁻¹)		
Brazilian Amazon	2010	1,041	-279	1,320
	2011	138	-636	774
	2012	1,215	235	980
	2013	901	96	805
	2014	491	-469	960
	2015	1,475	40	1,435
	2016	1,639	373	1,266
	2017	503	-802	1,305
	2018	411	-281	691
Mean		868	-191	1,060
ALF	2010	368	-188	556
	2011	386	49	337
	2012	635	182	453
	2013	700	419	281
	2014	226	-136	362
	2015	728	276	452
	2016	950	650	300
	2017	799	226	573
	2018	807	538	269
Mean		622	224	398
SAN	2010	420	-136	555
	2011	234	-158	392
	2012	817	320	497
	2013	377	-46	422
	2014	221	-279	501
	2015	605	-64	669
	2016	651	-16	668
	2017	73	-309	382
	2018	-22	-235	213
Mean		375	-103	478
RBA	2010	717	-145	862
	2011	-58	-517	459
	2012	14	-546	560
	2013	395	-98	493
	2014	64	-401	465
	2015	651	-494	1,145
	2016	1,086	97	989
	2017	-516	-1,684	1,169
	2018	-180	-764	584
Mean		241	-506	747
TAB_TEF	2010	589	32	557
	2011	-854	-1,066	212
	2012	394	158	235
	2013	-138	-337	199
	2014	326	7	319
	2015	540	210	330
	2016	23	-327	349
	2017	171	-116	287
	2018	-231	-460	229
Mean		91	-211	302

Reference:

Gatti, L. V., Basso, L. S., Miller, J. B., Gloor, M., Domingues, L. G., Cassol, H. L. G., et al. (2021). Amazonia as a carbon source linked to deforestation and climate change. *Nat.* 2021 5957867 595, 388–393. doi: 10.1038/s41586-021-03629-6.

Data set:

Gatti, Luciana V; Correa, Caio C S; Domingues, Lucas G; Miller, John B; Gloor, Manuel; Martinewski, Alexandre; Basso, Luana Santamaria; Santana, Ricardo; Crispim, Stephane P; Marani, Luciano; Neves, Raiane Lopes (2021): CO2 Vertical Profiles on Four Sites over Amazon from 2010 to 2018. PANGAEA, <https://doi.org/10.1594/PANGAEA.926834>