Article:

Brienen, RJW orcid.org/0000-0002-5397-5755, Phillips, OL orcid.org/0000-0002-8993-6168, Feldpausch, TR et al. (89 more authors) (2015) Long-term decline of the Amazon carbon sink. Nature, 519 (7543). pp. 344-348. ISSN 0028-0836

https://doi.org/10.1038/nature14283

Supplementary information, Long term decline of the Amazon carbon sink.

R.J.W. Brienen[1]*, O.L. Phillips[1]*, T.R. Feldpausch[1,2], E. Gloor[1], T.R. Baker[1], J. Lloyd[3,4], G. Lopez-Gonzalez[1], A. Monteagudo-Mendoza[5], Y. Malhi[6], S.L. Lewis[1,7], R. Vásquez Martinez[5], M. Alexiades[8], E. Álvarez Dávila[9], P. Alvarez-Loayza[10], A. Andrade[11], L.E.O.C. Aragão[2,12], A. Araujo-Murakami[13], E.J.M.M. Arets[14], L. Arroyo[13], G.A. Aymard C.[15], O.S. Bánki[16], C. Baraloto[17,18], J. Barroso[19], D. Bonal[20], R.G.A. Boot[21], J.L.C. Camargo[11], C.V. Castilho[22], V. Chama[23], K.J. Chao[1,24], J. Chave[25], J.A. Comiskey[26], F. Cornejo Valverde[27], L. da Costa[28], E.A. de Oliveira[29], A. Di Fiore[30], T.L. Erwin[31], S. Fauset[1], M. Forsthofer[29], D.R. Galbraith[1], E.S. Grahame[1], N. Groot[1], B. Hérault[32], N. Higuchi[11], E. Honorio C.[1,33], H. Keeling[1], T.J. Killeen[34], W.F. Laurance[35], S. Laurance[35], J. Licona[36], W.E. Magnussen[37], B.S. Marimon[29], B.H. Marimon-Junior[29], C. Mendoza[38,39], D.A. Neill[40], E.M. Nogueira[41], P. Núñez[23], N.C. Pallqui Camacho[23], A. Parada[13], G. Pardo-Molina [42], J. Peacock[43], M. Peña-Claros[36,44], G.C. Pickavance[1], N.C.A. Pitman[10,45], L. Poorter[44], A. Prieto[46], C.A. Quesada[41], F. Ramírez[47], H. Ramírez-Angulo[48], Z. Restrepo[49], A. Roopsind[50], A. Rudas[46], R.P. Salomão[51], M. Schwarz[1], N. Silva[52], J.E. Silva-Espejo[23], M. Silveira[53], J. Stropp[54], J Talbot[1], H. ter Steege[55], J. Teran-Aguilar[56], J. Terborgh[10], R. Thomas-Caesar[50], M. Toledo [36], M. Torello-Raventos[57,58], R. K. Umetsu[29], G.M.F. van der Heijden[59,60], P. van der Hout[61], I.C. Guimarães Vieira[51], S.A.Vieira[62], E. Vilanova[63], V.A. Vos[64,42], R.J. Zagt[21]

1 School of Geography, University of Leeds, Leeds, LS2 9JT, UK
2 College of Life and Environmental Sciences, University of Exeter, Rennes Drive, Exeter, EX4 4RJ, UK
3 Department of Life Sciences, Imperial College London, Silwood Park Campus, Buckhurst Road, Ascot, Berkshire SL5 7PY, UK
4 School of Marine and Tropical Biology, James Cook University, Cairns, 4870 Qld, Australia
5 Jardín Botánico de Missouri, Prolongacion Bolognesi Mz.e, Lote 6, Oxapampa, Pasco, Peru
6 Environmental Change Institute, School of Geography and the Environment, University of Oxford, UK
7 Department of Geography, University College London, Pearson Building, Gower Street, WC1E 6BT, UK
8 School of Anthropology and Conservation, Marlowe Building, University of Kent, Canterbury CT1 3EH, UK
9 Servicios Ecosistemicos y Cambio Climático, Jardín Botánico de Medellín, Medellín, Colombia
10 Center for Tropical Conservation, Duke University, Box 90381, Durham, NC 27708, USA
11 Biological Dynamics of Forest Fragment Project (INPA & STRI), C.P. 478, Manaus, AM 69011-970, Brazil
12 National Institute for Space Research (INPE), São José dos Campos, São Paulo, Brazil
13 Museo de Historia Natural Noel Kempff Mercado, Universidad Autonoma Gabriel Rene Moreno, Casilla 2489, Av. Irala 565, Santa Cruz, Bolivia
14 Alterra, Wageningen University and Research Centre, PO box 47, 6700 AA Wageningen, The Netherlands
15 UNELLEZ-Guanare, Programa de Ciencias del Agro y el Mar, Herbario Universitario (PORT), Mesa de Cavacas, Estado Portuguesa, Venezuela 3350
16 Biodiversiteit en Ecosysteem Dynamica, University of Amsterdam, Postbus 94248, 1090 GE Amsterdam, The Netherlands
17 Institut National de la Recherche Agronomique, UMR EcoFoG, Campus Agronomique, 97310 Kourou, French Guiana
18 International Center for Tropical Botany, Department of Biological Sciences, Florida International University, Miami, FL, 33199, USA
19 Universidade Federal do Acre, Campus de Cruzeiro do Sul, Rio Branco, Brazil
20 INRA, UMR 1137 ‘‘Ecologie et Ecophysiologie Forestiere ’’54280 Champenoux, France
21 Tropenbos International , P.O. Box 232, 6700 AE Wageningen, The Netherlands
22 Embrapa Roraima, Caixa Postal 133, Boa Vista, RR, CEP 69301-970, Brazil
23 Universidad Nacional San Antonio Abad del Cusco. Av. de la Cultura N° 733. Cusco, Peru
24 International Master Program of Agriculture, College of Agriculture and Natural Resources, National Chung Hsing University, Taichung 40227, Taiwan
25 Université Paul Sabatier CNRS, UMR 5174 Evolution et Diversité Biologique, bâtiment 4R1, 31062 Toulouse, France
26 Northeast Region Inventory and Monitoring Program, National Park Service, 120 Chatham Lane, Fredericksburg, VA 22405, USA
27 Andes to Amazon Biodiversity Program, Madre de Dios, Perú
28 Universidade Federal do Para, Centro de Geociencias, Belem, CEP 66017-970, Para, Brazil
29 Universidade do Estado de Mato Grosso, Campus de Nova Xavantina, Caixa Postal 08, CEP 78.690-000, Nova Xavantina, MT, Brazil
30 Department of Anthropology, University of Texas at Austin, SAC Room 5.150, 2201 Speedway Stop C3200, Austin, TX 78712, USA
31 Department of Entomology, Smithsonian Institution, PO Box 37012, MRC 187, Washington, DC 20013-7012, USA
32 Cirad, UMR Ecologie des Forêts de Guyane, Campus Agronomique, 97310 Kourou, French Guiana
33 Instituto de Investigaciones de la Amazonía Peruana, Av. A. José Quiñones km 2.5, Iquitos, Perú
34 World Wildlife Fund, 1250 24th St NW, Washington, DC 20037, USA

35 Centre for Tropical Environmental and Sustainability Science (TESS) and School of Marine and Environmental Sciences, James Cook University, Cairns, Queensland 4878, Australia
36 Instituto Boliviano de Investigación Forestal, C.P. 6201, Santa Cruz de la Sierra, Bolivia
37 National Institute for Research in Amazonia (INPA), C.P. 478, Manaus, Amazonas, CEP 69011-970, Brazil
38 FOMABO, Manejo Forestal en las Tierras Tropicales de Bolivia, Sacta, Bolivia
39 Escuela de Ciencias Forestales (ESFOR), Universidad Mayor de San Simón (UMSS), Sacta, Bolivia
40 Universidad Estatal Amazónica, Facultad de Ingeniería Ambiental, Paso lateral km 2 1/2 via Napo, Puyo, Pastaza, Ecuador
41 National Institute for Research in Amazonia (INPA), C.P. 2223, 69080-971, Manaus, Amazonas, Brazil
42 Universidad Autonoma del Beni, Campus Universitario, Av. Ejército Nacional, final, Riberalta, Beni, Bolivia
43 Department of Agriculture, Askham Bryan College, York, UK
44 Forest Ecology and Forest Management Group, Wageningen University, PO Box 47, 6700 AA Wageningen, The Netherlands
45 The Field Museum, 1400 South Lake Shore Drive, Chicago, IL 60605–2496, USA
46 Doctorado Instituto de Ciencias Naturales, Universidad Nacional de Colombia, Colombia
47 Universidad Nacional de la Amazonía Peruana, Iquitos, Loreto, Perú
48 Universidad de Los Andes, Facultad de Ciencias Forestales y Ambientales, Mérida, Venezuela
49 Ecosistemicos y cambio climático (SECC) del Jardín Botánico de Medellin, Medellin, Colopmbia
50 Iwokrama International Centre for Rainforest Conservation and Development, 77 High Street Kingston, Georgetown, Guyana
51 Museu Paraense Emilio Goeldi, Av. Magalhães Barata, 376 - São Braz, CEP: 66040-170, Belém, PA, Brazil
52 UFRA, Av. Presidente Tancredo Neves 2501, Belém, Pará, Brasil
53 Museu Universitário, Universidade Federal do Acre, Rio Branco AC 69910-900, Brazil
54 European Commission – DG Joint Research Centre, Institute for Environment and Sustainability, Via Enrico Fermi 274, 21010 Ispra, Italy
55 Naturalis Biodiversity Center, PO Box, 2300 RA, Leiden, The Netherlands
56 Museo de Historia Natural Alcide D'Orbigny, Av. Potosi no 1458, Cochabamba, Bolivia
57 School of Earth and Environmental Science, James Cook University, Cairns, Qld 4870, Australia
58 Centre for Tropical Environmental and Sustainability Science (TESS) and School of Marine and Tropical Biology, James Cook University, Cairns, Queensland 4878, Australia
59 University of Winsconsin, Milwaukee, WI 53202, USA
60 Smithsonian Tropical Research Institute, Apartado Postal 0843-03092, Panamá, República de Panamá
61 Van der Hout Forestry Consulting, Jan Trooststraat 6, 3078 HP Rotterdam, the Netherlands
62 Universidade Estadual de Campinas, NEPAM, Rua dos Flamboyants, 155- Cidade Universitária Zeferino Vaz, CAMPINAS, CEP 13083-867, Sao Paulo, Brazil
63 Instituto de Investigaciones para el Desarrollo Forestal, Universidad de Los Andes, Mérida, Venezuela
64 Centro de Investigación y Promoción del Campesinado,regional Norte Amazónico, C/ Nicanor Gonzalo Salvatierra N° 362, Casilla 16, Riberalta, Bolivia

* These authors contributed equally to this work

Corresponding author: Roel Brienen, School of Geography, University of Leeds, Woodhouse Lane, Leeds, LS2 9JT, UK, Tel. ++ 44 113 343 3381, e-mail: r.brienen@leeds.ac.uk

Alternative explanations of trends in net biomass increases

We consider alternative, artefactual explanations for the observed trends in biomass change and forest dynamics. Based on literature, we here focus in particular on two views that have been proposed as influencing plot-based inferences of forest dynamics, i.e., the recovery of plots from previous large disturbances, and majestic forest selection bias.

The first explanation proposes that a random, small set of (small) plots could be biased toward sampling forest patches that are recovering from previous, large disturbance(s). Hence, over short time periods, small samples of small plots may by chance be dominated by plots capturing forest patches in which plots are more likely to accumulate carbon and thus, incorrectly, suggest an apparent forest-wide biomass carbon sink (e.g., Korner[1], Fisher et al.[2]). The implications of disturbance-recovery processes for interpreting tropical forest dynamics have been extensively debated in the literature[3,4], and it is clear that they can be extremely important drivers of dynamics in individual plots or some landscapes[5]. We therefore ask, to what degree can this recovery from previous forest disturbances be driving the trends reported from across the network? Analysis presented in the main text suggests that our sites are not dominated by successional maturing stands – for example, there is no evidence of floristic shifts to greater wood density or change in stem numbers (Fig 3b,c), and plots have shown an increase in biomass fluxes of both growth and of mortality (Figs 1, 2), and increases in both stem recruitment and in stem mortality (ED Fig. 6). These trends are all at odds with multiple documented observations of succession and stand development in tropical forests (e.g., Drake et al.[6]; Chambers et al.[7], Van Breugel et al.[8], Chazdon et al.[8]), and of temperate and boreal forest dynamics (e.g. Acker et al.[9] , Ryan et al.[10], Runkle et al.[11], Coomes et al.[12]). They are also inconsistent with theoretical work on self-thinning for mono-specific and multispecies stands (e.g., Binkley et al.[13], Kohyama et al.[14]), and with recent empirical analysis of the effect of age on productivity across ecosystems and with the predicted effects of stand age on productivity from metabolic scaling theory (Michaletz et al.[15]). In addition, analysis of the Amazon forest disturbance spectrum shows that the overwhelming majority (as much as 99%) of biomass losses occur through high-frequency, small disturbances of <0.1-ha (Espirito-Santo et al [5]), which are captured through our monitoring of ≈1-hectare sized plots.

The second explanation is a related but subtly different argument that inadequate sampling and/or an unconscious or conscious bias can mean that initially the best-looking (or "majestic") patches of forests in mature late-successional phase are over-sampled (i.e., "plot selection bias"). While these might gain small amounts of biomass for a few years, after time they are likely to break down (e.g. Condit[16], Phillips et al.[21]). This "mature forest decline/collapse" could occur either by chance (external disturbance) or because of intrinsic processes (e.g., senescence) - in either case the eventual death of large trees accelerates stem mortality, and the resulting increased light levels then accelerate recruitment. Hence, most plots might eventually inevitably undergo a localized large decline in biomass and a sharp acceleration in stem turnover, which could incorrectly be interpreted as an apparent forest-wide increase in turnover[17,18]. Our dataset does indeed show that mortality increases in most plots after establishment, resulting in a positive relation between the time since plot establishment and mortality. The slope for the effect of time since establishment on mortality is 0.052 Mg ha^{-1} yr^{-2}, a similar magnitude as the effect of calendar date (cf. Fig. 1). While such a relationship is consistent with this proposed plot selection bias, if there is in fact a calendar date effect then it of course also follows that there will be a statistical correlation between mortality and time since establishment - since for each individual plot time since establishment is exactly related to calendar date. Statistically it is therefore impossible to separate these two alternative explanations for the observed trend (i.e., plot establishment date and calendar date) due to the inevitable statistical coincidence of any calendar date related trend with the time since establishment. We therefore conducted several additional analyses to explore the likelihood of this potential bias to be affecting our results. All consistently indicate that the observed trends are not driven by plot selection bias. Results of these analyses are detailed here.

Firstly, we revised how plot locations were initially chosen. In those cases where no member of the Leeds senior team was present, the relevant PI was asked to comment on establishment protocol. We reasoned that plots could not be biased with respect to forest structure in their initial set-up if the plot location was either "explicitly randomised independent of forest structure", "randomised or systematically located within a larger grid", or if "the longest axis of the plot was 250 meters or longer". We include long-axis plots in this category, as it is nearly impossible to avoid disturbed forest patches in a tropical forest when establishing such plots, and understory visibility in Amazonia is usually at least one order of magnitude less than this. Of our full set of plots, 50% have at least one axis of 250 meters or longer (median, 500m), 52% are randomly or systematically located within a larger grid, and 42% of plot locations were individually randomised with regard to initial forest structure upon installation. Out of the 321 plots, 76 (24%) did not belong to at least one of these categories and which could therefore have been subject to a plot selection bias. When we re-run our analysis excluding this subset of plots we find very similar or even bigger slopes for net biomass change (-0.041 Mg ha^{-1} yr^{-2}, p< 0.001), for productivity (0.025 Mg ha^{-1} yr^{-2}, p< 0.001) and for mortality (0.061 Mg ha^{-1} yr^{-2}, p< 0.001) compared with the analysis using the full dataset (Fig. 1). This high degree of internal consistency shows that the overall results cannot be driven by plots with possible bias toward initially intact forest patches.

Secondly, the structural signatures of the plot data do not fit with an intact forest plot selection bias. If a (biased) "plot selection effect" predominates, then breakdown of mature phase forest should be evident as disturbances accumulate, and plots would naturally lose biomass as they become progressively more disturbed. Instead what we see is that plots have gained biomass throughout (ED figure 2), so that they are on average substantially more massive at the end of the monitoring (i.e. today) than when they were set-up even while mortality (and productivity, and stem dynamics) accelerated. These biomass increases are observed over the full monitoring period (i.e., Figure 1: AGB change line positive throughout) and are also associated with the average biomass of individual trees increasing throughout (ED Fig 6a). In sum, it is extremely difficult to see how breakdown of mature stands and dominant trees could be the driver of increased mortality when the forests and trees have, in fact, continued to get bigger.

Thirdly, if a plot selection bias were driving our results, then we would expect to find that sites monitored over longer intervals more likely to lose biomass than those monitored over short intervals, as they will have had more time to accumulate more disturbances from their initial intact state. Thus, we expect (a) a negative correlation of total monitoring period with delta AGB (and a positive correlation with mortality), and (b) that the slopes of net AGB change over time of plots increase with total monitoring period of a plot, thus predicting a negative correlation of total interval with change in delta AGB. Instead, the non-significant trends that we observe in the data are generally opposite to the expectations for the plot selection bias (i.e., a weak positive relation between monitoring length and mean AGB change rate, and between monitoring length and the slope of net AGB change (ED Fig. 9a,b), and a weak negative relation between monitoring length and the mean AGB loss rate, and between monitoring length and the slope of mortality (cf. ED Fig. 9b,c)).

Fourthly, in our analyses which explicitly control for site-switching, it is notable the long-term calendar trends (e.g. period 1990-2011 in ED Fig. 3a) are shallower than the recent trends (period 2000-2011 in ED Fig. 3c) both for net AGB change and for mortality. But if a plot selection bias were predominating, then the recent slopes should be progressively shallower than the long-term trends. This is because the more recent trends include the exact same long-term plots as in the 1990-2011 set, but with the addition of a large amount of shorter, recent plots. Hence, new plots were added which should show less disturbance (as they are in the early period since establishment), so that for recent times the relative influence of long-monitored plots becomes diluted. The recent acceleration in mortality cannot therefore be driven by increasing disturbance in the longer-term plots.

Finally, if alternatively, we instead include in our analysis all plots, but now use only their first census interval, the trends that we find (main ms Figs. 1 and 2, and ED Fig. 3) still hold with significant decrease of net biomass change over time (slope= -0.043 Mg ha^{-1} yr^{-2}, p=0.046), significant increase in biomass mortality (slope= -0.076 Mg ha^{-1} yr^{-2}, p=0.013) and increase in biomass productivity (slope=0.027 Mg ha^{-1} yr^{-2}, p=0.080). In this analysis we avoid all subsequent stochastic disturbance that intact plots followed over time would accumulate under the hypothesized bias, and yet we find essentially the same patterns as the whole dataset shows.

From these analyses, we conclude that inadequate or biased sampling of stands that leads to either (1) the over-representation of forest recovering from previous undocumented disturbances, or (2) of mature forest patches becoming progressively more vulnerable to disturbances, are unlikely to be a dominant driver of the changes observed in forest biomass carbon stocks and fluxes in the plot network.

Modelling the lag in necromass decay

Delayed respiration of dead wood is known to have potentially large impacts on the ecosystem carbon balance of individual Amazon landscapes[19], but to our knowledge the possible implications of this for the magnitude and timing of large-scale biosphere-atmosphere carbon fluxes have not previously been explored. The current manuscript reports that biomass mortality has been increasing markedly since at least the 1980s, so here we ask what has been the approximate magnitude of the consequences of this phenomenon on lagging necromass fluxes at the scale of the whole basin? To this end, we created a two-pool model to examine the time lag between a linear increase in tree mortality (M) and eventual carbon release to the atmosphere due to respiration, accounting for the known decomposition rates of Amazon woody necromass (N), and for limited transfer of carbon to the soil. Change in the size of N and soil organic carbon (C) pools were calculated as follows:

$dN/dt = M(t) – N/\tau_N$

$dC/dt = fN/\tau_N - C/\tau_C$,

where f is the fraction (20%) of respiring necromass which enters the soil organic carbon pool, and where τ_N and τ_C are the mean residence times of N and C, respectively. The first and largest of the two pools, necromass carbon, was initialised using the initial mortality rate for 1983 (M), and necromass mean residence time (τ_N) derived from published data from permanent plots across Amazon (see below for calculation). We accounted for the production of both above-ground and below-ground necromass, using the known central Amazon ratio of below-ground: above-ground biomass of 0.37: 1 (Higuchi et al. in Phillips et al.[20]), to account for the additional dead wood production below-ground when a tree dies.

To estimate necromass fluxes into the second pool - that of soil carbon derived from above-ground necromass - data from tropics are largely lacking. It might be expected that this fraction would be substantial due to leaching and the actions of decomposers, principally termites, which are estimated to consume 50% of tropical dead wood production[21]. We applied a relatively low estimate used in the Rothamsted model, which suggests that of necromass carbon lost ≈80% is immediately respired, while a fraction (f) 20% goes first into the soil carbon pool due to fragmentation, leaching, and the action of microbes[22]. This fraction is similar to the estimate of 24% of Malhi et al.[23]. Decomposition of soil carbon is also poorly known; it can be expected to have varying resistance to degradation. Work by Telles et al.[24] implies turnover times of between 10 to 70 years (Table 3 in Telles et al.[24]). Here for simplicity we assumed one pool of soil carbon derived from necromass, with a turnover time (τ_C) of 30 years.

Our variables are thus:

N	woody necromass per unit area (kg C ha^{-1})
C	soil organic carbon sourced from necromass decomposition (kg C ha^{-1})
M	mortality rate (kg C ha^{-1} yr^{-1})
τ_N	mean turnover time necromass (yr)
τ_C	mean turnover time of soil organic carbon (yr)
f	fraction of decaying necromass carbon moving to soil carbon pool

The carbon flux to the atmosphere due to immediate or delayed decay of necromass carbon at time t is then:

$$F(t) = (1\text{-}f)\,N(t)/\tau_N + C(t)/\tau_C$$

Our model is intended to explore the nature of the lagged respiration response of the enhanced necromass production, but clearly the quantity of enhanced mortality necromass-derived carbon that the atmosphere has yet to see is impossible to precisely define because the decomposition and transfer processes have been poorly studied in tropical ecosystems. Thus, for simplicity we have assumed the same decomposition rate ($1/\tau_N$) for below-ground necromass as for above-ground, and assumed the same transfer fraction f for movement of decaying necromass to the soil carbon pool. Alternative scenarios could be constructed with slightly different assumptions.

Estimating the turnover time of necromass in Amazonia, τ_N

We used the values of dry weight above-ground coarse necromass stocks, N, (Mg ha^{-1}) from Amazon terra firme plots published in the review by Chao et al. (2009), with recent coarse necromass input rates ($I_{short\text{-}term}$, in Mg dry biomass ha^{-1} yr^{-1}) also available based on long-term monitoring of the same plots. Turnover times (τ_N) can be estimated as stock/flux, i.e. N/I, assuming that inputs and outputs are in approximate equilibrium. Plot-by-plot values for N, I, and τ_N are presented in Supplementary Info Table 2.

Necromass inputs and stocks vary across the forested neotropical humid lowlands as a function of biomass, mean wood density, and other stand-level properties, as well as soil nutrition (e.g., Chao et al. 2009). To the first order these macroecological features of Amazon forests are governed by large-scale geological and geomorphological features, notably the influence of the ancient Pre-Cambrian Guyana and Brazilian Shields in north-eastern, eastern, and southern Amazonia, and the influence of recent, more fertile Andean-derived sediments in the west[25]. To derive a single best estimate of Amazon mean necromass turnover we therefore accounted for the different areas of these areas of influence (cf. Table 3 in Chao et al.[26]). The ratio of Eastern to Western Amazon forest area is approximately 3.32 : 1, allowing us to compute an area-weighted pan-Amazon mean.

Based on plot-by-plot necromass turnover rates in Supplementary Info Table 2, we estimate the pan-Amazon necromass turnover rate to have mean value of 8 years. Note that for Amazonia we find that the system is in fact in disequilibrium, with mortality rates having tended to increase in secular fashion over time. Since current necromass stocks (N) are somewhat influenced by the legacy of (lower) mortality rates in the past, our estimate of the turnover time from the necromass pool (N/I) may be biased low, and respiration of necromass carbon may in fact take longer than we have estimated.

Estimating change in the necromass pool over time

Extended data Figure 10 shows the estimated change in necromass and soil organic matter since 1983, using the above necromass decay model. The cumulative flux of above- and below-ground mortality is estimated as 85.5 t C ha^{-1}, while the integrated flux of necromass back to the atmosphere is estimated as ≈ 79.5 t C ha^{-1}. Simply scaling the difference (5.99×10^6 g C ha^{-1}) by the area of lowland Amazon old-growth forest (6.29×10^8 ha), implies that the atmosphere has yet to see ≈3.77 Pg of the necromass carbon ($5.99 \times 6.29 \times 10^6 \times 10^8$ g = 3.77 Pg) produced by the long-term mortality increase over the last three decades. Evidently, while the Amazon biomass carbon sink has weakened, the Amazon whole ecosystem carbon sink has become increasingly concentrated [dominated by a net sink] into necromass pools. Any increase in respiration of this enhanced pool of Amazon dead organic matter could substantially weaken the terrestrial carbon sink seen by the atmosphere.

Supplementary Information Table 1. List of all plots included in this analysis with geographic coordinates, plot size, start and end dates, and the main researchers for each plot.

Plot Code	Plot name	Country	Latitude	Longitude	Plot size (ha)	Start census date	End census date	Senior team[1] or data source	Notes
ACL-01	Aguas Calientes, plotMA1, AC	VENEZUELA	8.75	-71.5	0.25	1979.3	1984.4	Jean Veillon, Sandra Brown; RAINFOR	
ACU-01	Acuario, plot 1	BOLIVIA	-15.25	-61.25	1	1996.3	2007.2	Jon Lloyd, Luzmila Arroyo, Oliver Phillips, Ted Feldpausch ; RAINFOR	
AGJ-01	Aguajal	PERU	-11.89	-71.36	2	1993.8	2008.7	John Terborgh ; RAINFOR	
AGP-01	Amacayacu: Agua Pudre E	COLOMBIA	-3.72	-70.31	1	1992.2	2011.9	Adriana Prieto, Agustin Rudas, Eliana Jimenez, Jon Lloyd, Oliver Phillips ; RAINFOR	
AGP-02	Amacayacu: Agua Pudre U	COLOMBIA	-3.72	-70.3	1	1991.9	2011.9	Adriana Prieto, Agustin Rudas, Eliana Jimenez, Jon Lloyd, Oliver Phillips ; RAINFOR	
ALF-01	Alta Floresta plot 1	BRAZIL	-9.6	-55.94	1	2002.4	2011.4	Ricardo Keichi Umetsu, Jon Lloyd, Marcos Silveira, Ted Feldpausch; RAINFOR	
ALM-01	Altos de Maizal	PERU	-11.8	-71.47	2	1994.7	2012.7	Fernando Cornejo, John Terborgh, Oliver Phillips, Roel Brienen ; RAINFOR	
ALP-01	Allpahuayo A	PERU	-3.95	-73.43	0.44	1990.9	2011.2	Abel Monteagudo, Tim Baker, Javier Silva Espejo, Oliver Phillips, Roel Brienen, Yadvinder Malhi; RAINFOR	
ALP-02	Allpahuayo B	PERU	-3.95	-73.44	0.46	1990.9	2011.2	Abel Monteagudo,Tim Baker, Oliver Phillips ,Roel Brienen ; RAINFOR	
ALP-30	Allpahuayo C	PERU	-3.95	-73.43	1	2001.3	2011.2	Abel Monteagudo, Tim Baker, Javier Silva Espejo, Oliver Phillips, Yadvinder Malhi ; RAINFOR	
ALP-40	Allpahuayo D	PERU	-3.94	-73.44	1	2006.9	2011.2	Abel Monteagudo, Freddy Ramirez, Oliver Phillips; RAINFOR	
ANN-03	Anangu, ANN-03	ECUADOR	-0.53	-76.43	1	1986.0	1991.0	data source: Korning & Balsev, 1994[27]	Basal area converted to biomass using country specific relations between basal area and biomass.
BAC-01	BACA-51162, Caparo	VENEZUELA	7.45	-71.01	0.25	1991.3	2012.1	Armando Torres, Emilio Vilanova,Geertje van der Heijden, Hirma Ramirez, Oliver Phillips; RAINFOR	Combined BAC-01, 03 to make 0.5 ha
BAC-02	BACA-51284, Caparo	VENEZUELA	7.45	-71.01	0.25	1991.9	2012.1	Armando Torres, Emilio Vilanova,Geertje van der Heijden, Hirma Ramirez, Oliver Phillips; RAINFOR	Combined BAC-01, 03 to make 0.5 ha
BAC-03	BACA-51294, Caparo	VENEZUELA	7.45	-71.01	0.25	1991.3	2012.1	Armando Torres, Emilio Vilanova,Geertje van der Heijden, Hirma Ramirez, Oliver Phillips; RAINFOR	Combined BAC-02, 04 to make 0.5 ha
BAC-04	BACA-51367, Caparo	VENEZUELA	7.45	-71.01	0.25	1991.9	2012.1	Armando Torres, Emilio Vilanova,Geertje van der Heijden, Hirma Ramirez, Oliver Phillips; RAINFOR	Combined BAC-02, 04 to make 0.5 ha
BAC-05	BACA-52301, Caparo	VENEZUELA	7.45	-71.01	0.25	2001.3	2012.1	Armando Torres, Emilio Vilanova,Geertje van der Heijden, Hirma Ramirez, Oliver Phillips; RAINFOR	Combined BAC-05, 06 to make 0.5 ha
BAC-06	BACA-52312, Caparo	VENEZUELA	7.45	-71.01	0.25	1996.3	2012.1	Armando Torres, Emilio Vilanova,Geertje van der Heijden, Hirma Ramirez, Oliver Phillips; RAINFOR	Combined BAC-05, 06 to make 0.5 ha
BAR-01	Barranco (TEAM VGCOU-2)	PERU	-11.9	-71.42	0.81	1995.9	2012.7	Patricia Alvarez-Loayza, Abel Monteagudo, John Terborgh; RAINFOR	
BDF-01	BDFFP, 2303 Dimona.5-6	BRAZIL	-2.34	-60.1	2	1985.3	2007.5	William Laurance, Susan Laurance, Ana Andrade ; RAINFOR	
BDF-03	BDFFP, 1101 Gaviao	BRAZIL	-2.42	-59.85	1	1981.1	2009.3	William Laurance, Susan Laurance, Ana Andrade ; RAINFOR	

Plot Code	Plot name	Country	Latitude	Longitude	Plot size (ha)	Start census date	End census date	Senior team[1] or data source	Notes
BDF-04	BDFFP, 1102 Gaviao	BRAZIL	-2.43	-59.85	1	1981.1	2009.6	William Laurance, Susan Laurance, Ana Andrade ; RAINFOR	
BDF-05	BDFFP, 1103 Gaviao	BRAZIL	-2.43	-59.85	1	1981.2	2009.3	William Laurance, Susan Laurance, Ana Andrade ; RAINFOR	
BDF-06	BDFFP, 1201 Gaviao	BRAZIL	-2.41	-59.86	3	1981.5	2009.3	William Laurance, Susan Laurance, Ana Andrade ; RAINFOR	
BDF-07	BDFFP, 1105 Gaviao	BRAZIL	-2.4	-59.9	1	1981.6	2009.5	William Laurance, Susan Laurance, Ana Andrade ; RAINFOR	
BDF-08	BDFFP, 1109 Gaviao	BRAZIL	-2.4	-59.9	1	1981.6	2009.5	William Laurance, Susan Laurance, Ana Andrade ; RAINFOR	
BDF-09	BDFFP, 1113 Florestal	BRAZIL	-2.4	-59.85	1	1987.0	2007.0	William Laurance, Susan Laurance, Ana Andrade ; RAINFOR	
BDF-10	BDFFP, 1301 Florestal 1= plot 1301.1 and 1301.3	BRAZIL	-2.39	-59.86	2	1983.5	2007.0	William Laurance, Susan Laurance, Ana Andrade ; RAINFOR	
BDF-11	BDFFP, 1301 Florestal 2= plots 1301.4,5,6	BRAZIL	-2.38	-59.85	3	1983.5	2007.0	William Laurance, Susan Laurance, Ana Andrade ; RAINFOR	
BDF-12	BDFFP, 1301 Florestal 3=plots 1301.7,8	BRAZIL	-2.39	-59.85	2	1983.5	2007.0	William Laurance, Susan Laurance, Ana Andrade ; RAINFOR	
BDF-13	BDFFP, 3402 Cabo Frio	BRAZIL	-2.4	-59.91	9	1985.9	2009.9	William Laurance, Susan Laurance, Ana Andrade ; RAINFOR	
BDF-14	BDFFP, 3304 Porto Alegre	BRAZIL	-2.36	-59.97	1	1984.2	2009.2	William Laurance, Susan Laurance, Ana Andrade ; RAINFOR	
BEE-01	BEEM plot 1	BOLIVIA	-16.53	-64.58	1	2002.0	2010.0	Luzmila Arroyo, Oliver Phillips, Tim Killeen ; RAINFOR	
BEE-05	BEEM plot 5	BOLIVIA	-16.53	-64.58	1	2002.7	2010.0	Luzmila Arroyo, Oliver Phillips, Tim Killeen ; RAINFOR	
BES-01	Besotes-01	COLOMBIA	10.53	-73.29	1	2006.5	2010.6	Oliver Phillips, Tomas Hinojosa; RAINFOR	
BNT-01	Bionte 1	BRAZIL	-2.64	-60.16	1	1986.5	2012.5	Niro Higuchi ; RAINFOR	
BNT-02	Bionte 2	BRAZIL	-2.64	-60.15	1	1986.5	2012.5	Niro Higuchi ; RAINFOR	
BNT-04	Bionte 4	BRAZIL	-2.63	-60.15	1	1986.5	2012.5	Niro Higuchi ; RAINFOR	
BNT-05	Bionte T4 B2 SB1	BRAZIL	-2.63	-60.17	1	1986.5	1993.5	Niro Higuchi ; RAINFOR	
BNT-06	Bionte T4 B1 SB3	BRAZIL	-2.63	-60.17	1	1986.5	1993.5	Niro Higuchi ; RAINFOR	
BNT-07	Bionte T4 B4 SB4	BRAZIL	-2.63	-60.17	1	1986.5	1993.5	Niro Higuchi ; RAINFOR	
BOG-01	Bogi 1	ECUADOR	-0.7	-76.48	1	1995.7	2011.5	Abel Monteagudo, David Neill, Oliver Phillips, Roel Brienen ; RAINFOR	
BOG-02	Bogi 2	ECUADOR	-0.7	-76.47	1	1995.4	2011.5	Abel Monteagudo, David Neill, Oliver Phillips, Roel Brienen ; RAINFOR	
CAR-01	Carajas	BRAZIL	-5.58	-49.72	1	1986.4	1988.9	Rafael Salomao ; RAINFOR	
CAX-01	Caxiuana 1	BRAZIL	-1.74	-51.46	1	1994.5	2010.0	Samuel Almeida, Leoandro Ferreira, Yadvinder Malhi; RAINFOR	
CAX-02	Caxiuana 2	BRAZIL	-1.74	-51.46	1	1995.5	2010.0	Samuel Almeida, Leoandro Ferreira, Yadvinder Malhi; RAINFOR	
CAX-06	TORRE Caxiuana	BRAZIL	-1.72	-51.46	1	2004.6	2010.0	Lola da Costa, Samuel Almeida, Leandro Ferreira, Yadvinder Malhi ; RAINFOR	
CAX-08	Caxiuana Terra Preta	BRAZIL	-1.85	-51.47	1	2003.4	2010.0	Luiz Aragao, Lola da Costa, Samuel Almeida, Yadvinder Malhi ; RAINFOR	
CLA-03	ANCLA-03, Clarines	VENEZUELA	9.95	-65.17	0.25	1979.1	2012.2	Emilio Vilanova, Armando Torres, Geertje van der Heijden; RAINFOR	combined with CLA-03, 04 to make 0.5 ha
CLA-04	Clarines	VENEZUELA	9.95	-65.17	0.25	1979.1	2012.2	Emilio Vilanova, Armando Torres, Geertje van der Heijden; RAINFOR	combined with CLA-03, 04 to make 0.5 ha
CPP-01	Fazenda Santo Amaro 1	BRAZIL	-1.84	-47.1	1	1997.5	2000.5	Ima Vieira ; RAINFOR	
CRP-01	Cerro Pelao 1	BOLIVIA	-14.54	-61.5	1	1994.1	2011.4	Abel Monteagudo, Tim Killeen, Luzmila Arroyo, Oliver Phillips, Roel Brienen; RAINFOR	
CRP-02	Cerro Pelao 2	BOLIVIA	-14.54	-61.5	1	1994.3	2011.4	Abel Monteagudo, Tim Killeen, Luzmila Arroyo, Oliver Phillips, Roel Brienen; RAINFOR	
CUY-01	Cuyabeno	ECUADOR	0	-76.2	1	1988.4	1990.9	Data source: Korning, 1992 [28]	Basal area converted to biomass using country specific relations between basal area and biomass.
CUZ-01	Cuzco Amazonico, CUZAM1E	PERU	-12.5	-68.97	1	1989.4	2011.7	Abel Monteagudo, Oliver Phillips, Rodolfo Vasquez ; RAINFOR	
CUZ-02	Cuzco Amazonico, CUZAM1U	PERU	-12.5	-68.97	1	1989.4	2011.7	Abel Monteagudo, Oliver Phillips, Rodolfo Vasquez ; RAINFOR	

Plot Code	Plot name	Country	Latitude	Longitude	Plot size (ha)	Start census date	End census date	Senior team[1] or data source	Notes
CUZ-03	Cuzco Amazonico, CUZAM2E	PERU	-12.5	-68.96	1	1989.4	2011.7	Abel Monteagudo, Oliver Phillips, Rodolfo Vasquez ; RAINFOR	
CUZ-04	Cuzco Amazonico, CUZAM2U	PERU	-12.5	-68.96	1	1989.4	2011.7	Abel Monteagudo, Oliver Phillips, Rodolfo Vasquez ; RAINFOR	
DOI-01	RESEX Chico Mendes: Seringal Dois Irmaos 1	BRAZIL	-10.57	-68.31	1	1991.3	2011.5	Marcos Silveira, Oliver Phillips, Ted Feldpausch, Tim Baker; RAINFOR	
DOI-02	RESEX Chico Mendes: Seringal Dois Irmaos 2 (with bamboo)	BRAZIL	-10.55	-68.31	1	1999.4	2011.5	Marcos Silveira, Oliver Phillips, Ted Feldpausch, Tim Baker; RAINFOR	
DUK-01 to DUK-72	LO1T0 to LO9T7500 (72 plots)	BRAZIL	-2.92	-59.98	0.5	2001.5	2003.5	data source: de Toledo [29]	
ELD-01	El Dorado, km93, plotG1, ED1	VENEZUELA	6.1	-61.4	0.25	1979.2	2012.2	Emilio Vilanova, Geertje van der Heijden, Hirma Ramirez, Oliver Phillips ; RAINFOR	combined with ELD-01, 02 to make 0.5 ha
ELD-02	El Dorado, km93, plotG2, ED1	VENEZUELA	6.1	-61.4	0.25	1979.2	2012.2	Emilio Vilanova, Geertje van der Heijden, Hirma Ramirez, Oliver Phillips ; RAINFOR	combined with ELD-01, 02 to make 0.5 ha
ELD-03	El Dorado, km98, plotG3, ED2	VENEZUELA	6.08	-61.4	0.25	1979.2	2012.2	Emilio Vilanova, Geertje van der Heijden, Hirma Ramirez, Oliver Phillips ; RAINFOR	combined with ELD-03, 04 to make 0.5 ha
ELD-04	El Dorado, km98, plotG4, ED2	VENEZUELA	6.08	-61.41	0.25	1979.2	2012.2	Emilio Vilanova, Geertje van der Heijden, Hirma Ramirez, Oliver Phillips ; RAINFOR	combined with ELD-03, 04 to make 0.5 ha
ELI-01 to ELI-02	Piste St. Elie, ELI-01 and ELI-02 combined	FRENCH GUIANA	5.5	-53	1.78	1981.2	1991.2	data source : Pellissier and Riera 1993 [30]	Basal area converted to biomass using country specific relations between basal area and biomass.
FEC-01	Fazenda Experimental Catuaba	BRAZIL	-10.07	-67.62	1	2000.9	2013.5	Marcos Silveira, Plinio Camargo, Simone Vieira, Forster Brown, Ted Feldpausch: RAINFOR	
FMH-01	Forest reserve Mabura hill 01, Brown sand-Greenhart plot	GUYANA	5.17	-58.69	1	1993.8	2012.2	Roderick Zagt, Hans ter Steege, James Singh; RAINFOR	
FMH-02	Forest reserve Mabura hill 02, Brown sand-Greenhart plot	GUYANA	5.17	-58.69	1	1993.8	2012.2	Roderick Zagt, Hans ter Steege, James Singh; RAINFOR	
FMH-03	Forest reserve Mabura hill 03, White Sand plot	GUYANA	5.18	-58.7	1	2005.6	2012.2	Hans ter Steege, James Singh, Olaf Banki ; RAINFOR	
GMT-01	Granja Marathon	BRAZIL	-1.11	-47.8	1	1997.4	2002.5	Ima Vieira ; RAINFOR	
HCC-21	Huanchaca Dos, plot1	BOLIVIA	-14.53	-60.74	1	1996.5	2011.4	Luzmila Arroyo, Tim Killeen ,Roel Brienen, Ted Feldpasuch, Jon Lloyd; RAINFOR	
HCC-22	Huanchaca Dos, plot 2	BOLIVIA	-14.53	-60.73	1	1996.5	2011.4	Luzmila Arroyo, Tim Killeen ,Roel Brienen, Ted Feldpasuch, Jon Lloyd; RAINFOR	
HCC-23	Isla Huanchaca, plot 1	BOLIVIA	-14.56	-60.75	1	1999.5	2011.4	Luzmila Arroyo, Tim Killeen ,Roel Brienen; RAINFOR	
HCC-24	Isla Huanchaca, plot 2	BOLIVIA	-14.57	-60.75	1	1999.5	2011.4	Luzmila Arroyo, Tim Killeen ,Roel Brienen; RAINFOR	
IWO-03	Iwokrama 3, mixed forest	GUYANA	4.53	-58.78	1	2008.2	2012.2	Anand Roopsind, Raquel Thomas, Roel Brienen ; RAINFOR	
IWO-09	Iwokrama 9, white sand	GUYANA	4.61	-58.73	1	2008.5	2012.2	Anand Roopsind, Raquel Thomas, Roel Brienen ; RAINFOR	
IWO-11	Iwokrama 11, Brown sand	GUYANA	4.62	-58.72	1	2008.5	2012.2	Anand Roopsind, Raquel Thomas, Roel Brienen ; RAINFOR	
IWO-12	Iwokrama 12, Turtle Mountain	GUYANA	4.73	-58.72	1	2008.5	2012.2	Anand Roopsind, Raquel Thomas, Roel Brienen ; RAINFOR	
IWO-21	Iwokrama 21, white sand	GUYANA	4.63	-58.74	1	2002.9	2012.3	Olaf Banki, Raquel Thomas, Roel Brienen ; RAINFOR	
IWO-22	Iwokrama 22, Brown sand	GUYANA	4.62	-58.72	1	2002.9	2012.2	Olaf Banki, Raquel Thomas, Roel Brienen ; RAINFOR	
JAC-01	Jacaranda, norte-sul (north-south), plots 1-5	BRAZIL	-2.61	-60.21	5	1996.5	2011.5	Adriano Nogueira Lima,Niro, Higuchi ; RAINFOR	
JAC-02	Jacaranda, leste-oeste (east-west), plots 6-10	BRAZIL	-2.62	-60.2	5	1996.5	2011.5	Adriano Nogueira Lima,Niro, Higuchi ; RAINFOR	

Plot Code	Plot name	Country	Latitude	Longitude	Plot size (ha)	Start census date	End census date	Senior team[1] or data source	Notes
JAS-02	Jatun Sacha 2	ECUADOR	-1.07	-77.62	1	1987.6	2011.5	Abel Monteagudo, David Neill, Oliver Phillips, Roel Brienen ; RAINFOR	
JAS-03	Jatun Sacha 3	ECUADOR	-1.08	-77.61	1	1988.9	2011.5	Abel Monteagudo, David Neill, Oliver Phillips, Roel Brienen ; RAINFOR	
JAS-04	Jatun Sacha 4 Full plot	ECUADOR	-1.07	-77.61	0.96	1990.4	2011.5	Abel Monteagudo, David Neill, Oliver Phillips, Roel Brienen ; RAINFOR	
JAS-05	Jatun Sacha 5 Full plot (until 2007)	ECUADOR	-1.06	-77.62	1	1989.4	2002.0	David Neill, Oliver Phillips ; RAINFOR	
JBU-01	Sitio Sto. Antonio- Jambuacu	BRAZIL	-1.14	-47.7	1	1997.4	2002.5	Ima Vieira; RAINFOR	
JEN-11	Jenaro Herrera A Terraza Alta	PERU	-4.88	-73.63	1	2005.2	2011.3	Euridice Honorio, Oliver Phillips, Roel Brienen, Tim Baker ; RAINFOR	
JEN-12	Jenaro Herrera B Varillal	PERU	-4.9	-73.63	1	2005.2	2011.3	Euridice Honorio, Oliver Phillips, Roel Brienen, Tim Baker ; RAINFOR	
JEN-13	Jenaro Herrera C	PERU	-4.92	-73.53	1	2007.3	2011.3	Euridice Honorio, Oliver Phillips, Roel Brienen, Tim Baker ; RAINFOR	
JRI-01	Jari 1	BRAZIL	-0.89	-52.19	1	1985.5	1996.5	Natalino Silva ; RAINFOR	
LAS-02	Jacaratia Los Amigos	PERU	-12.57	-70.09	1	2004.4	2008.6	Oliver Phillips ; RAINFOR	
LCA-13	La Chonta 13	BOLIVIA	-15.68	-62.78	1	2001.3	2011.7	Todd Fredericksen, Marielos Pena-Claros, Marisol Toledo ; RAINFOR	
LCA-16	La Chonta 16	BOLIVIA	-15.68	-62.78	1	2001.4	2011.7	Todd Fredericksen, Marielos Pena-Claros, Marisol Toledo ; RAINFOR	
LCA-29	La Chonta 29	BOLIVIA	-15.68	-62.77	1	2000.8	2011.7	Todd Fredericksen, Marielos Pena-Claros, Marisol Toledo ; RAINFOR	
LCA-30	La Chonta 30	BOLIVIA	-15.68	-62.77	1	2000.8	2011.7	Todd Fredericksen, Marielos Pena-Claros, Marisol Toledo ; RAINFOR	
LFB-01	Los Fierros Bosque I	BOLIVIA	-14.58	-60.83	1	1993.6	2011.4	Tim Killeen Luzmila Arroyo, Oliver Phillips, Roel Brienen, Ted Feldpausch; RAINFOR	
LFB-02	Los Fierros Bosque II	BOLIVIA	-14.58	-60.83	1	1993.6	2011.4	Tim Killeen Luzmila Arroyo, Oliver Phillips, Roel Brienen, Ted Feldpausch; RAINFOR	
LOR-01	Amacayacu: Lorena E	COLOMBIA	-3.06	-69.99	1	1992.5	2011.9	Adriana Prieto, Agustin Rudas,Oliver Phillips ; RAINFOR	
LOR-02	Amacayacu: Lorena U subplot 1-13	COLOMBIA	-3.06	-69.99	0.52	1992.5	2011.8	Adriana Prieto, Agustin Rudas, Jon Lloyd, Oliver Phillips ; RAINFOR	Is one continuous plot with LOR-02, 03 of 1 ha
LOR-03	Amacayacu: Lorena U subplot 14-25	COLOMBIA	-3.06	-69.99	0.48	1992.5	2011.8	Adriana Prieto, Agustin Rudas, Jon Lloyd, Oliver Phillips ; RAINFOR	Is one continuous plot with LOR-02, 03 of 1 ha
LSL-01	Las Londras, plot 1	BOLIVIA	-14.4	-61.14	1	1996.5	2009.5	Tim Killeen Luzmila Arroyo, Oliver Phillips, Roel Brienen; RAINFOR	
LSL-02	Las Londras, plot 2	BOLIVIA	-14.4	-61.14	1	1996.5	2009.5	Tim Killeen Luzmila Arroyo, Oliver Phillips, Roel Brienen; RAINFOR	
MBT-01	Mabet plot 1	BOLIVIA	-10.07	-65.89	1	1999.7	2011.7	Abel Monteagudo, Guido Pardo, Marisol Toledo, Roel Brienen; RAINFOR	
MBT-02	Mabet plot 2	BOLIVIA	-10.05	-65.89	1	1999.8	2011.7	Abel Monteagudo, Guido Pardo, Marisol Toledo, Roel Brienen; RAINFOR	
MBT-04	Mabet Plot 4	BOLIVIA	-10.31	-65.55	1	2003.4	2011.8	Abel Monteagudo, Guido Pardo, Marisol Toledo, Roel Brienen; RAINFOR	
MBT-05	Mabet plot 5	BOLIVIA	-10.03	-65.63	1	2003.5	2011.8	Abel Monteagudo, Guido Pardo, Marisol Toledo, Roel Brienen; RAINFOR	
MBT-06	Mabet plot 6	BOLIVIA	-10.04	-65.64	1	2003.5	2011.8	Abel Monteagudo, Guido Pardo, Marisol Toledo, Roel Brienen; RAINFOR	
MBT-07	Mabet plot 7	BOLIVIA	-9.91	-65.74	1	2004.2	2011.8	Abel Monteagudo, Guido Pardo, Marisol Toledo, Roel Brienen; RAINFOR	
MBT-08	Mabet plot 8	BOLIVIA	-9.94	-65.75	1	2003.9	2011.7	Abel Monteagudo, Guido Pardo, Marisol Toledo, Roel Brienen; RAINFOR	
MIN-01	Rio das Minas, Parque Nacional da Serra do Divisor	BRAZIL	-8.56	-72.88	1	1996.5	2013.5	Marcos Silveira, Oliver Phillips, Ted Feldpausch ; RAINFOR	
MNU-01	Manu, alluvial Cocha Cashu Trail 3, M1	PERU	-11.89	-71.41	1.89	1974.7	2010.7	John Terborgh ; RAINFOR	
MNU-03	Manu, terra firme terrace, M3	PERU	-11.9	-71.4	2	1991.7	2012.6	John Terborgh, Roel Brienen ; RAINFOR	
MNU-04	Manu, terra firme ravine, M4	PERU	-11.91	-71.4	1	1991.7	2012.6	John Terborgh, Roel Brienen ; RAINFOR	
MNU-05	Manu, alluvial Cocha Cashu Trail 12 (TEAM VGCOU-5)	PERU	-11.88	-71.41	2	1989.8	2012.6	John Terborgh, Roel Brienen ; RAINFOR	
MNU-06	Manu, alluvial Cocha Cashu Trail 2 & 31 (TEAM VGCOU-1)	PERU	-11.89	-71.4	2.25	1989.8	2012.6	John Terborgh, Roel Brienen ; RAINFOR	
MNU-08	Cocha Salvador Manu, mature floodplain	PERU	-12	-71.24	2	1991.8	2012.7	Fernando Cornejo, John Terborgh, Oliver Phillips, Roel Brienen; RAINFOR	

Plot Code	Plot name	Country	Latitude	Longitude	Plot size (ha)	Start census date	End census date	Senior team[1] or data source	Notes
MRB-01	Marabà: UA1	BRAZIL	-5.73	-49.05	2	1988.4	1996.0	Rafael Salomao ; RAINFOR	
MRB-02	Marabà: UA2	BRAZIL	-5.72	-49.03	2	1988.5	1996.0	Rafael Salomao ; RAINFOR	
MRB-03	Marabà: UA3	BRAZIL	-5.7	-49	2	1988.5	1996.0	Rafael Salomao ; RAINFOR	
MSH-01	Mishana	PERU	-3.78	-73.5	1	1983	1990.7	Oliver Phillips, Rodolfo Vasquez; RAINFOR	
MTH-01	Marechal Thaumaturgo, Alto Rio Juruà - Parque Nacional da Serra do Divisor	BRAZIL	-8.88	-72.79	1	1996.4	2011.4	Marcos Silveira,Oliver Phillips,Ted Feldpausch, Tim Baker ; RAINFOR	
NOU-01	Nouragues Grand Plateau 10L	FRENCH GUIANA	4.09	-52.67	1	1993.2	2012.9	Jerome Chave, Kyle Dexter, Lilian Blanc, Ted Feldpausch; RAINFOR	Continuous plot Grand plateau of 10 ha with Nou-01 to Nou-10
NOU-02	Nouragues Grand Plateau 11L	FRENCH GUIANA	4.09	-52.67	1	1994.9	2012.9	Jerome Chave, Kyle Dexter, Lilian Blanc, Ted Feldpausch; RAINFOR	Continuous plot Grand plateau of 10 ha with Nou-01 to Nou-10
NOU-03	Nouragues Grand Plateau 12L	FRENCH GUIANA	4.09	-52.68	1	1993.4	2012.9	Jerome Chave, Kyle Dexter, Lilian Blanc, Ted Feldpausch; RAINFOR	Continuous plot Grand plateau of 10 ha with Nou-01 to Nou-10
NOU-04	Nouragues Grand Plateau 13L	FRENCH GUIANA	4.09	-52.68	1	1992.2	2012.9	Jerome Chave, Kyle Dexter, Lilian Blanc, Ted Feldpausch; RAINFOR	Continuous plot Grand plateau of 10 ha with Nou-01 to Nou-10
NOU-05	Nouragues Grand Plateau 14L	FRENCH GUIANA	4.09	-52.68	1	1992.7	2012.9	Jerome Chave, Kyle Dexter, Lilian Blanc, Ted Feldpausch; RAINFOR	Continuous plot Grand plateau of 10 ha with Nou-01 to Nou-10
NOU-06	Nouragues Grand Plateau 15L	FRENCH GUIANA	4.09	-52.68	1	1992.8	2012.9	Jerome Chave, Kyle Dexter, Lilian Blanc, Ted Feldpausch; RAINFOR	Continuous plot Grand plateau of 10 ha with Nou-01 to Nou-10
NOU-07	Nouragues Grand Plateau 16L	FRENCH GUIANA	4.08	-52.68	1	1993.2	2012.9	Jerome Chave, Kyle Dexter, Lilian Blanc, Ted Feldpausch; RAINFOR	Continuous plot Grand plateau of 10 ha with Nou-01 to Nou-10
NOU-08	Nouragues Grand Plateau 17L	FRENCH GUIANA	4.08	-52.68	1	1993.2	2012.9	Jerome Chave, Kyle Dexter, Lilian Blanc, Ted Feldpausch; RAINFOR	Continuous plot Grand plateau of 10 ha with Nou-01 to Nou-10
NOU-09	Nouragues Grand Plateau 18L	FRENCH GUIANA	4.08	-52.68	1	1993.4	2012.9	Jerome Chave, Kyle Dexter, Lilian Blanc, Ted Feldpausch; RAINFOR	Continuous plot Grand plateau of 10 ha with Nou-01 to Nou-10
NOU-10	Nouragues Grand Plateau 19L	FRENCH GUIANA	4.09	-52.68	1	1994.4	2012.9	Jerome Chave, Kyle Dexter, Lilian Blanc, Ted Feldpausch; RAINFOR	Continuous plot Grand plateau of 10 ha with Nou-01 to Nou-10
NOU-11	Nouragues Petit Plateau 20H	FRENCH GUIANA	4.08	-52.68	1	1992.6	2012.9	Jerome Chave, Lilian Blanc, Ted Feldpausch ; RAINFOR	Continuous plot Petit plateau of 12 ha with Nou-11 to Nou-22
NOU-12	Nouragues Petit Plateau 21H	FRENCH GUIANA	4.08	-52.68	1	1992.6	2012.9	Jerome Chave, Lilian Blanc, Ted Feldpausch ; RAINFOR	Continuous plot Petit plateau of 12 ha with Nou-11 to Nou-22
NOU-13	Nouragues Petit Plateau 22H	FRENCH GUIANA	4.08	-52.68	1	1992.6	2012.9	Jerome Chave, Lilian Blanc, Ted Feldpausch ; RAINFOR	Continuous plot Petit plateau of 12 ha with Nou-11 to Nou-22
NOU-14	Nouragues Petit Plateau 20G	FRENCH GUIANA	4.08	-52.68	1	1992.5	2012.9	Jerome Chave, Lilian Blanc, Ted Feldpausch ; RAINFOR	Continuous plot Petit plateau of 12 ha with Nou-11 to Nou-22
NOU-15	Nouragues Petit Plateau 21G	FRENCH GUIANA	4.08	-52.68	1	1992.6	2012.9	Jerome Chave, Lilian Blanc, Ted Feldpausch ; RAINFOR	Continuous plot Petit plateau of 12 ha with Nou-11 to Nou-22
NOU-16	Nouragues Petit Plateau 22G	FRENCH GUIANA	4.08	-52.68	1	1992.6	2012.9	Jerome Chave, Lilian Blanc, Ted Feldpausch ; RAINFOR	Continuous plot Petit plateau of 12 ha with Nou-11 to Nou-22
NOU-17	Nouragues Petit Plateau 20F	FRENCH GUIANA	4.08	-52.68	1	1992.5	2012.9	Jerome Chave, Lilian Blanc, Ted Feldpausch ; RAINFOR	Continuous plot Petit plateau of 12 ha with Nou-11 to Nou-22
NOU-18	Nouragues Petit Plateau 21F	FRENCH GUIANA	4.08	-52.68	1	1992.5	2012.9	Jerome Chave, Lilian Blanc, Ted Feldpausch ; RAINFOR	Continuous plot Petit plateau of 12 ha with Nou-11 to Nou-22
NOU-19	Nouragues Petit Plateau 22F	FRENCH GUIANA	4.08	-52.68	1	1992.6	2012.9	Jerome Chave, Lilian Blanc, Ted Feldpausch ; RAINFOR	Continuous plot Petit plateau of 12 ha with Nou-11 to Nou-22
NOU-20	Nouragues Petit Plateau 20E	FRENCH GUIANA	4.08	-52.68	1	1992.6	2012.9	Jerome Chave, Lilian Blanc, Ted Feldpausch ; RAINFOR	Continuous plot Petit plateau of 12 ha with Nou-11 to Nou-22
NOU-21	Nouragues Petit Plateau 21E	FRENCH GUIANA	4.08	-52.68	1	1992.6	2012.9	Jerome Chave, Lilian Blanc, Ted Feldpausch ; RAINFOR	Continuous plot Petit plateau of 12 ha with Nou-11 to Nou-22
NOU-22	Nouragues Petit Plateau 22E	FRENCH GUIANA	4.08	-52.67	1	1992.6	2012.9	Jerome Chave, Lilian Blanc, Ted Feldpausch ; RAINFOR	Continuous plot Petit plateau of 12 ha with Nou-11 to Nou-22
NXV-06	Floresta de Galeria: Parque Municipal do Bacaba (Alto)	BRAZIL	-14.72	-52.36	0.47	1998.8	2012.1	Beatriz Marimon, Ben Hur, Monica Forsthofer, Edmar A. de Oliveira; RAINFOR	
NXV-07	Floresta de Galeria: Parque Municipal do Bacaba (Meio)	BRAZIL	-14.72	-52.36	0.47	1999.3	2011.1	Beatriz Marimon, Ben Hur, Monica Forsthofer, Edmar A. de Oliveira; RAINFOR	
NXV-08	Floresta de Galeria: Parque Municipal do Bacaba (Baixo)	BRAZIL	-14.72	-52.36	0.47	1999.2	2011.1	Beatriz Marimon, Ben Hur; RAINFOR	
PAK-01	Pakitza, Manu River, dissected alluvial, plot1 (TEAM VGCOU-3)	PERU	-11.92	-71.25	1	1991.7	2012.7	James Comisky, Patricia Alvarez-Loayza; RAINFOR	
PAR-01	Paracou, parcelle 01	FRENCH GUIANA	5.25	-52.92	6.25	1984.7	2007.7	data source: Rutishauser et al. 2010 [31] and Blanc et al. 2006[32]	
PAR-06	Paracou, parcelle 06	FRENCH GUIANA	5.25	-52.92	6.25	1984.7	2007.7	data source: Rutishauser et al. 2010 [31] and Blanc et al. 2006[32]	
PAR-11	Paracou, parcelle 11	FRENCH GUIANA	5.25	-52.92	6.25	1984.7	2007.7	data source: Rutishauser et al. 2010 [31] and Blanc et al. 2006[32]	

Plot Code	Plot name	Country	Latitude	Longitude	Plot size (ha)	Start census date	End census date	Senior team[1] or data source	Notes
PAR-13	Paracou, parcelle 13	FRENCH GUIANA	5.25	-52.92	6.25	1991.7	2007.7	data source: Rutishauser et al. 2010 [31] and Blanc et al. 2006[32]	
PAR-14	Paracou, parcelle 14	FRENCH GUIANA	5.25	-52.92	6.25	1991.7	2007.7	data source: Rutishauser et al. 2010 [31] and Blanc et al. 2006[32]	
PAR-15	Paracou, parcelle 15	FRENCH GUIANA	5.25	-52.92	6.25	1991.7	2007.7	data source: Rutishauser et al. 2010 [31] and Blanc et al. 2006[32]	
PAR-20	Guyaflux 1	FRENCH GUIANA	5.28	-52.92	0.49	2004.4	2010.3	Damien Bonal: RAINFOR	joined together with PAR-20, 28, and 29: Oxisols plot
PAR-21	Guyaflux 2	FRENCH GUIANA	5.28	-52.92	0.49	2004.5	2010.3	Damien Bonal: RAINFOR	joined together with PAR-21, 26; Seasonally waterlogged plot
PAR-22	Guyaflux plot 3	FRENCH GUIANA	5.28	-52.92	0.49	2004.5	2010.3	Damien Bonal: RAINFOR	joined together with PAR-22, 24, and 25: Sandy soils plot; join 3 .49 hectare plots into one
PAR-23	Guyaflux Plot 4	FRENCH GUIANA	5.28	-52.92	0.49	2004.4	2010.3	Damien Bonal: RAINFOR	joined together with PAR-23, 27; transitional habitats
PAR-24	Guyaflux plot 5	FRENCH GUIANA	5.28	-52.92	0.49	2004.4	2010.3	Damien Bonal: RAINFOR	joined together with PAR-22, 24, and 25: Sandy soils plot; join 3 .49 hectare plots into one
PAR-25	Guyaflux plot 6	FRENCH GUIANA	5.28	-52.92	0.49	2004.4	2010.3	Damien Bonal: RAINFOR	joined together with PAR-22, 24, and 25: Sandy soils plot; join 3 .49 hectare plots into one
PAR-26	Guyaflux plot 7	FRENCH GUIANA	5.28	-52.92	0.49	2004.5	2010.3	Damien Bonal: RAINFOR	joined together with PAR-22, 24, and 25: Sandy soils plot; join 3 .49 hectare plots into one
PAR-27	Guyaflux plot 8	FRENCH GUIANA	5.28	-52.92	0.49	2004.4	2010.3	Damien Bonal: RAINFOR	joined together with PAR-23, 27; transitional habitats
PAR-28	Guyaflux plot 9	FRENCH GUIANA	5.28	-52.92	0.49	2004.4	2010.3	Damien Bonal: RAINFOR	joined together with PAR-20, 28, and 29: Oxisols plot
PAR-29	Guyaflux plot 10	FRENCH GUIANA	5.28	-52.92	0.49	2004.5	2010.3	Damien Bonal: RAINFOR	joined together with PAR-20, 28, and 29: Oxisols plot
PIB-05	Pibiri 05	GUYANA	5.02	-58.62	1	1993.7	2012.2	Peter van der Hout, Hans ter Steege, James Singh ; RAINFOR	
PIB-06	Pibiri 06	GUYANA	5.01	-58.62	1	1993.7	2012.2	Peter van der Hout, Hans ter Steege, James Singh ; RAINFOR	
PIB-12	Pibiri 12	GUYANA	5.03	-58.6	1	1993.7	2012.2	Peter van der Hout, Hans ter Steege, James Singh ; RAINFOR	
PNY-03	Paujil-Ozuz Bosque Humedo Tropical	PERU	-10.31	-75.29	1	2004.8	2011.8	Abel Monteagudo, Oliver Phillips, Rodolfo Vasquez ; RAINFOR	
PNY-04	Paujil Bosque Humedo Tropical	PERU	-10.34	-75.25	1	2007.5	2011.8	Abel Monteagudo, Oliver Phillips, Rodolfo Vasquez ; RAINFOR	
PNY-05	Paujil-Venado Bosque Humedo Tropical	PERU	-10.35	-75.25	1	2008.2	2011.8	Abel Monteagudo, Oliver Phillips, Rodolfo Vasquez ; RAINFOR	
PNY-06	Paujil-Venado Bosque Humedo Tropical	PERU	-10.36	-75.25	1	2008.2	2011.8	Abel Monteagudo, Oliver Phillips, Rodolfo Vasquez ; RAINFOR	
PNY-07	Paujil-Venado Bosque Humedo Tropical	PERU	-10.35	-75.26	1	2008.2	2011.8	Abel Monteagudo, Oliver Phillips, Rodolfo Vasquez ; RAINFOR	
POR-01	RESEX Chico Mendes: Seringal Porongaba 1	BRAZIL	-10.82	-68.78	1	1991.4	2011.4	Marcos Silveira, Oliver Phillips, Ted Feldpausch, Tim Baker ; RAINFOR	
POR-02	RESEX Chico Mendes: Seringal Porongaba 2	BRAZIL	-10.8	-68.77	1	1991.4	2011.5	Marcos Silveira, Oliver Phillips, Ted Feldpausch, Tim Baker ; RAINFOR	
PPB-01	Peixe-Boi Parcela 01	BRAZIL	-1.18	-47.32	1	1991.5	1999.5	Rafael Salomao ; RAINFOR	
PPB-02	Peixe-Boi Parcela 02	BRAZIL	-1.18	-47.32	1	1991.5	1999.5	Rafael Salomao ; RAINFOR	
PPB-03	Peixe-Boi Parcela 03	BRAZIL	-1.18	-47.32	1	1991.5	1999.5	Rafael Salomao ; RAINFOR	
PTB-01	Porto Trombetas	BRAZIL	-1.17	-56.41	1	1997.6	2007.1	Rafael Salomao ; RAINFOR	
PTB-02	Porto Trombetas	BRAZIL	-1.48	-56.39	1	1997.6	2007.1	Rafael Salomao ; RAINFOR	
PTN-01	Puerto Nare	COLOMBIA	6.12	-74.67	1	1999.7	2010.1	Esteban Alvarez, Oliver Phillips, Zorayda Restrepo ; RAINFOR	
RET-05	Reserva El Tigre 05	BOLIVIA	-10.97	-65.72	1	1995.2	2011.6	Rene Boot, Lourens Poorter, Abel Monteagudo, Marisol Toledo, Roel Brienen, Vincent Vos; RAINFOR	Continuous plot of 4 ha with RET-05, 06, 08, 09
RET-06	Reserva El Tigre 06	BOLIVIA	-10.97	-65.72	1	1995.2	2011.6	Rene Boot, Lourens Poorter, Abel Monteagudo, Marisol Toledo, Roel Brienen, Vincent Vos; RAINFOR	Continuous plot of 4 ha with RET-05, 06, 08, 09
RET-08	Reserva El Tigre 08	BOLIVIA	-10.97	-65.72	1	1995.2	2011.6	Rene Boot, Lourens Poorter, Abel Monteagudo, Marisol Toledo, Roel Brienen, Vincent Vos; RAINFOR	Continuous plot of 4 ha with RET-05, 06, 08, 09

Plot Code	Plot name	Country	Latitude	Longitude	Plot size (ha)	Start census date	End census date	Senior team[1] or data source	Notes
RET-09	Reserva El Tigre 09	BOLIVIA	-10.97	-65.72	1	1995.2	2011.6	Rene Boot, Lourens Poorter, Abel Monteagudo, Marisol Toledo, Roel Brienen, Vincent Vos; RAINFOR	Continuous plot of 4 ha with RET-05, 06, 08, 09
RFH-01	Reserva Florestal Humaita	BRAZIL	-9.75	-67.67	1	2004.3	2011.5	Jon Lloyd, Marcos Silveira, Oliver Phillips, Ted Feldpausch ; RAINFOR	
RIO-01	Rio Grande, plotDA1, RG	VENEZUELA	8.11	-61.69	0.25	1979.2	2012.2	Emilio Vilanova, Geertje van der Heijden, Hirma Ramirez ; RAINFOR	Combined with RIO-01, 02 to make 0.5 ha
RIO-02	Rio Grande, plotDA2, RG	VENEZUELA	8.11	-61.69	0.25	1979.2	2012.2	Emilio Vilanova, Geertje van der Heijden, Hirma Ramirez ; RAINFOR	Combined with RIO-01, 02 to make 0.5 ha
ROM-01	Roraima, Peltogyne monodominant	BRAZIL	3.42	-61.67	0.75	1991.8	2003.2	data source: Nascimiento et al. 2007 [33]	
RST-01	Base da Restauraçao - Reserva Extrativista do Alto Juruà	BRAZIL	-9.04	-72.27	1	1995.4	2013.4	Jon Lloyd, Marcos Silveira, Tim Baker, Ted Feldpausch; RAINFOR	
SCR-01	SCR-01, Oxisol	VENEZUELA	1.93	-67.02	1	1975.7	1986.0	data Source: Uhl et al. 1998[34]	Basal area converted to biomass using country specific relations between basal area and biomass.
SCR-04	San Carlos de Rio Negro, MAB site, Tall Caatinga, plot A	VENEZUELA	1.93	-67.04	1	1975.5	2012.1	Gerardo Aymard, Jon Lloyd, Oliver Phillips, Tim Baker; RAINFOR	
SCR-05	San Carlos de Rio Negro, MAB site, Yevaro, plot B	VENEZUELA	1.93	-67.04	1	1975.6	2012.1	Gerardo Aymard, Jon Lloyd, Oliver Phillips, Tim Baker, ; RAINFOR	
SCT-01	Sacta plot 1	BOLIVIA	-17.09	-64.77	1	2001.8	2011.7	Casimiro Mendoza, Luzmila Arroyo ; RAINFOR	
SCT-06	Sacta plot 6	BOLIVIA	-17.09	-64.77	1	2002.6	2011.7	Casimiro Mendoza, Luzmila Arroyo ; RAINFOR	
SUC-01	Sucusari A	PERU	-3.25	-72.91	1	1992.1	2011.2	Nestor Jaramillo, Oliver Phillips, Rodolfo Vasquez, Roel Brienen, Tim Baker; RAINFOR	
SUC-02	Sucusari B	PERU	-3.25	-72.9	1	1992.1	2011.2	Nestor Jaramillo, Oliver Phillips, Rodolfo Vasquez, Roel Brienen, Tim Baker; RAINFOR	
SUC-03	Sucusari C	PERU	-3.25	-72.92	1	2001.1	2011.2	Oliver Phillips, Rodolfo Vasquez, Roel Brienen, Tim Baker ; RAINFOR	
SUC-04	Sucusari D	PERU	-3.25	-72.89	1	2001.2	2011.3	Oliver Phillips, Rodolfo Vasquez, Roel Brienen, Tim Baker; RAINFOR	
SUC-05	Sucusari E	PERU	-3.26	-72.89	1	2001.1	2011.3	Nestor Jaramillo, Oliver Phillips, Rodolfo Vasquez, Roel Brienen, Tim Baker; RAINFOR	
SUM-01	Sumaco	ECUADOR	-0.6	-77.63	0.82	1989.4	2002.5	David Neill; RAINFOR	
TAM-01	Tambopata plot zero	PERU	-12.84	-69.29	1	1983.8	2011.7	Oliver Phillips, Rodolfo Vasquez, Ted Feldpausch, Tim Baker ; RAINFOR	
TAM-02	Tambopata plot one	PERU	-12.83	-69.29	1	1979.9	2011.7	Oliver Phillips, Rodolfo Vasquez, Ted Feldpausch, Tim Baker ; RAINFOR	
TAM-03	Tambopata plot two swamp	PERU	-12.84	-69.28	0.58	2003.7	2011.6	Oliver Phillips, Rodolfo Vasquez, Abel Monteagudo; RAINFOR	
TAM-04	Tambopata plot two swamp edge clay	PERU	-12.84	-69.28	0.42	1985.6	2011.6	Oliver Phillips, Rodolfo Vasquez,Ted Feldpausch,Tim Baker ; RAINFOR	
TAM-05	Tambopata plot three	PERU	-12.83	-69.27	1	1983.7	2011.7	Javier Silva Espejo,Oliver Phillips,Rodolfo Vasquez,Tim Baker,Yadvinder Malhi ; RAINFOR	
TAM-06	Tambopata plot four	PERU	-12.84	-69.3	0.96	1983.7	2011.7	Javier Silva Espejo,Oliver Phillips,Rodolfo Vasquez,Tim Baker,Yadvinder Malhi ; RAINFOR	
TAM-07	Tambopata plot six	PERU	-12.83	-69.26	1	1983.8	2011.6	Oliver Phillips,Rodolfo Vasquez,Ted Feldpausch,Tim Baker ; RAINFOR	
TAM-08	Tambopata plot seven	PERU	-12.83	-69.27	1	2001.5	2011.2	Oliver Phillips,Rodolfo Vasquez, Abel Monteagudo; RAINFOR	
TAP-50	Tapajos, RP014, 1	BRAZIL	-3.31	-54.94	0.25	1983.5	1995.5	Natalino Silva ; RAINFOR	combined with adjacent TAP-50, 51, 52, 53 to make one hectare
TAP-51	Tapajos, RP014, 2	BRAZIL	-3.31	-54.94	0.25	1983.5	1995.5	Natalino Silva ; RAINFOR	combined with adjacent TAP-50, 51, 52, 53 to make one hectare
TAP-52	Tapajos, RP014, 3	BRAZIL	-3.31	-54.94	0.25	1983.5	1995.5	Natalino Silva ; RAINFOR	combined with adjacent TAP-50, 51, 52, 53 to make one hectare
TAP-53	Tapajos, RP014, 4	BRAZIL	-3.31	-54.94	0.25	1983.5	1995.5	Natalino Silva ; RAINFOR	combined with adjacent TAP-50, 51, 52, 53 to make one hectare
TAP-54	Tapajos, RP014, 5	BRAZIL	-3.31	-54.95	0.25	1983.5	1995.5	Natalino Silva ; RAINFOR	combined with adjacent TAP-54, 55, 56, 57 to make one hectare

Plot Code	Plot name	Country	Latitude	Longitude	Plot size (ha)	Start census date	End census date	Senior team[1] or data source	Notes
TAP-55	Tapajos, RP014, 6	BRAZIL	-3.31	-54.95	0.25	1983.5	1995.5	Natalino Silva ; RAINFOR	combined with adjacent TAP-54, 55, 56, 57 to make one hectare
TAP-56	Tapajos, RP014, 7	BRAZIL	-3.31	-54.95	0.25	1983.5	1995.5	Natalino Silva ; RAINFOR	combined with adjacent TAP-54, 55, 56, 57 to make one hectare
TAP-57	Tapajos, RP014, 8	BRAZIL	-3.31	-54.95	0.25	1983.5	1995.5	Natalino Silva ; RAINFOR	combined with adjacent TAP-54, 55, 56, 57 to make one hectare
TAP-58	Tapajos, RP014, 9	BRAZIL	-3.31	-54.94	0.25	1983.5	1995.5	Natalino Silva ; RAINFOR	combined with adjacent TAP-58, 59, 60, 61 to make one hectare
TAP-59	Tapajos, RP014, 10	BRAZIL	-3.31	-54.94	0.25	1983.5	1995.5	Natalino Silva ; RAINFOR	combined with adjacent TAP-58, 59, 60, 61 to make one hectare
TAP-60	Tapajos, RP014, 11	BRAZIL	-3.31	-54.94	0.25	1983.5	1995.5	Natalino Silva ; RAINFOR	combined with adjacent TAP-58, 59, 60, 61 to make one hectare
TAP-61	Tapajos, RP014, 12	BRAZIL	-3.31	-54.94	0.25	1983.5	1995.5	Natalino Silva ; RAINFOR	combined with adjacent TAP-58, 59, 60, 61 to make one hectare
TAP-70	Tapajos	BRAZIL	-2.89	-54.95	3.99	1999.5	2001.5	data source: Rice et al. 2004 [35]	
TAP-80	Tapajos (Nepstad et al. 2002 drought control plot)	BRAZIL	-2.9	-54.95	1	2000.0	2006.0	data source: Nepstad et al. 2002 [36]	
TEC-01	TEAM Caxiuana plot 1	BRAZIL	-1.71	-51.46	1	2002.9	2012.8	Maria Aparecida Freitas, Samuel Almeida, Leandro Ferreira; TEAM	
TEC-02	TEAM Caxiuana plot 2	BRAZIL	-1.74	-51.49	1	2003.2	2012.8	Maria Aparecida Freitas, Samuel Almeida, Leandro Ferreira; TEAM	
TEC-03	TEAM Caxiuana plot 3	BRAZIL	-1.73	-51.51	1	2003.2	2012.8	Maria Aparecida Freitas, Samuel Almeida, Leandro Ferreira; TEAM	
TEC-04	TEAM Caxiuana plot 4	BRAZIL	-1.75	-51.52	1	2003.3	2012.8	Maria Aparecida Freitas, Samuel Almeida, Leandro Ferreira; TEAM	
TEC-05	TEAM Caxiuana plot 5	BRAZIL	-1.78	-51.59	1	2003.5	2012.8	Maria Aparecida Freitas, Samuel Almeida, Leandro Ferreira; TEAM	
TEC-06	TEAM Caxiuana plot 6	BRAZIL	-1.73	-51.43	1	2003.3	2012.8	Maria Aparecida Freitas, Samuel Almeida, Leandro Ferreira; TEAM	
TEM-01	TEAM Manaus plot 1: Reserva Ducke, base	BRAZIL	-2.97	-59.9	1	2004.1	2011.6	Atila Alves de Oliveira, Ieda Amaral; TEAM	
TEM-02	TEAM Manaus plot 2: Reserva Ducke, Ipiranga	BRAZIL	-2.93	-59.95	1	2004.3	2011.6	Atila Alves de Oliveira, Ieda Amaral; TEAM	
TEM-03	TEAM Manaus plot 3: Cabo Frio	BRAZIL	-2.41	-59.9	1	2003.9	2011.6	Atila Alves de Oliveira, Ieda Amaral; TEAM	
TEM-04	TEAM Manaus plot 4	BRAZIL	-2.43	-59.79	1	2003.9	2011.7	Atila Alves de Oliveira, Ieda Amaral; TEAM	
TEM-05	TEAM Manaus plot 5	BRAZIL	-2.62	-60.21	1	2004.0	2011.7	Atila Alves de Oliveira, Ieda Amaral; TEAM	
TEM-06	TEAM Manaus plot 6	BRAZIL	-2.6	-60.11	1	2004.2	2011.7	Atila Alves de Oliveira, Ieda Amaral; TEAM	
TIP-01	Tiputini 01	ECUADOR	-0.66	-76.4	1	1997.9	2011.6	Abel Monteagudo,Nigel Pitman,Roel Brienen ; RAINFOR	
TIP-02	Tiputini 2	ECUADOR	-0.63	-76.14	0.8	1997.6	2011.6	Abel Monteagudo,David Neill,Oliver Phillips,Roel Brienen ; RAINFOR	
TIP-03	Tiputini 3	ECUADOR	-0.64	-76.15	1	1998.2	2011.6	Abel Monteagudo,David Neill,Oliver Phillips,Roel Brienen ; RAINFOR	
VCR-01	Fazenda Vera Cruz plot 1 monodominant forest (combined Bia+TROBIT)	BRAZIL	-14.83	-52.16	0.64	1996.3	2011.3	Claudinei Oliveira dos Santos,Beatriz Marimon,Ben Hur, Ted Feldpausch, Jon Lloyd; RAINFOR	
VCR-02	Fazenda Vera Cruz mixed forest adjacent to monodominant (Bia data only)	BRAZIL	-14.83	-52.17	0.6	2003.6	2008.8	Claudinei Oliveira dos Santos,Beatriz Marimon,Ben Hur, Ted Feldpausch, Jon Lloyd; RAINFOR	
YAN-01	Yanamono A	PERU	-3.44	-72.85	1	1983.4	2011.2	Oliver Phillips,Rodolfo Vasquez,Roel Brienen, Tim Baker; RAINFOR	
YAN-02	Yanamono B	PERU	-3.43	-72.84	1	2001.1	2011.2	Oliver Phillips,Rodolfo Vasquez,Roel Brienen, Tim Baker; RAINFOR	
YAS-01	Yasuni	ECUADOR	-0.69	-76.4	24	1995.5	2000.5	data source: Chave et al 2008 [37]	
ZAR-01	Zafire Varillal	COLOMBIA	-4.01	-69.91	1	2004.7	2006.7	Eliana Jimenez, Jon Lloyd, Maria Penuela, Oliver Phillips ; RAINFOR	
ZAR-02	Zafire Rebalse	COLOMBIA	-4	-69.9	1	2004.9	2009.8	Eliana Jimenez, Jon Lloyd, Maria Penuela, Oliver Phillips ; RAINFOR	
ZAR-03	Zafire Terra Firme	COLOMBIA	-3.99	-69.9	1	2004.9	2009.8	Eliana Jimenez, Jon Lloyd, Maria Penuela, Oliver Phillips ; RAINFOR	
ZAR-04	Zafire Altura	COLOMBIA	-3.99	-69.91	1.04	2005.1	2009.8	Eliana Jimenez, Jon Lloyd, Maria Penuela, Oliver Phillips ; RAINFOR	

[1]Defined as current principal investigator, main grant holder, and principal field leaders.

Supplementary Information Table 2. Above-ground necromass (N, Mg biomass ha^{-1}), recent annualised mortality inputs (I, Mg biomass ha^{-1} yr^{-1}), and necromass turnover time (τ_{N}, years) estimated as N/I, for Amazon plots.

Region	**Plot Name**	**Necromass, N**	**Mortality inputs.**	**Turnover time, τ_N**
E	ELD-01/02	74.5	6.7	11.1
E	ELD-03/04	62.8	8.6	7.3
E	RIO-01/02	38.4	6.3	6.1
E	ELD-01/02 and RIO-01/02	33.3	2.6	12.8
E	Juruena, Mato Grosso,	43.2	7.9	5.5
E	TUF1, Tapajós, Pará	52.8	7.9	6.7
E	TUF2 , Tapajós, Pará	51.8	7.9	6.6
E	Tapajós, Pará	52.4	8.5	6.2
E	Tapajós, Pará	86.6	4.8	18.1
E	Manaus	21.0	3.6	5.8
E	BIONTE, Manaus	29.7	2.3	12.9
W	ALP-A	31.4	2.5	12.6
W	ALP-B	41.1	7.9	5.2
W	SUC-01	21.5	5.9	3.6
W	SUC-02	27.4	4.4	6.2
W	SUC-04	25.5	5.5	4.6
W	SUC-05	37.9	4.8	7.9
W	YAN-01	15.4	4.8	3.2
W	YAN-02	18.6	4.1	4.5
W	JEN-11	20.3	4.6	4.4
W	CUZ-01	19.8	4.9	4.0
W	CUZ-02	23.9	5.2	4.6
W	CUZ-03	16.6	4.6	3.6
W	CUZ-04	21.0	7.4	2.8
W	TAM-01	13.5	3.7	3.6
W	TAM-02	33.1	4.8	6.9
W	TAM-05	14.3	4.7	3.0
W	TAM-06	6.3	3.5	1.8
W	TAM-07	14.9	3.9	3.8
W	TAM-08	21.6	3.0	7.2

Supplementary references

1 Korner, C. Slow in, rapid out - Carbon flux studies and Kyoto targets. Science **300**, 1242-1243 (2003).

2 Fisher, J. I., Hurtt, G. C., Thomas, R. Q. & Chambers, J. Q. Clustered disturbances lead to bias in large- scale estimates based on forest sample plots. Ecol. Lett. **11**, 554-563 (2008).

3 Chambers, J. Q. et al. The steady-state mosaic of disturbance and succession across an old-growth Central Amazon forest landscape. Proceedings of the National Academy of Sciences **110**, 3949-3954 (2013).

4 Gloor, M. et al. Does the disturbance hypothesis explain the biomass increase in basin-wide Amazon forest plot data? Global Change Biol. **15**, 2418-2430, doi:10.1111/j.1365-2486.2009.01891.x (2009).

5 Espirito-Santo, F. D. B. et al. Size and Frequency of Natural Forest Disturbances and the Amazon Forest Carbon Balance. Nature communications **5**, doi:doi:10.1038/ncomms4434 (2014).

6 Drake, D. R. & Mueller-Dombois, D. Population development of rain forest trees on a chronosequence of Hawaiian lava flows. Ecology, 1012-1019 (1993).

7 Chambers, J. Q. et al. Response of tree biomass and wood litter to disturbance in a Central Amazon forest. Oecologia **141**, 596-611, doi:10.1007/s00442-004-1676-2 (2004).

8 Chazdon, R. L. et al. Rates of change in tree communities of secondary Neotropical forests following major disturbances. Philosophical Transactions of the Royal Society B-Biological Sciences **362**, 273-289, doi:10.1098/rstb.2006.1990 (2007).

9 Acker, S., Halpern, C., Harmon, M. & Dyrness, C. Trends in bole biomass accumulation, net primary production and tree mortality in Pseudotsuga menziesii forests of contrasting age. Tree Physiology **22**, 213-217 (2002).

10 Ryan, M. G., Binkley, D., Fownes, J. H. & Fitter, M. B. a. A. H. in Adv. Ecol. Res. Vol. Volume 27 213-262 (Academic Press, 1997).

11 Runkle, J. R. Changes in southern Appalachian canopy tree gaps sampled thrice. Ecology **79**, 1768-1780 (1998).

12 Coomes, D. A. & Allen, R. B. Mortality and tree-size distributions in natural mixed-age forests. J. Ecol. **95**, 27-40, doi:10.1111/j.1365-2745.2006.01179.x (2007).

13 Binkley, D., Stape, J. L., Ryan, M. G., Barnard, H. R. & Fownes, J. Age-related decline in forest ecosystem growth: an individual-tree, stand-structure hypothesis. Ecosystems **5**, 58-67 (2002).

14 Kohyama, T. Density-size dynamics of trees simulated by a one-sided competition multispecies model of rainforest stands. Ann. Bot. **70**, 451-460 (1992).

15 Michaletz, S. T., Cheng, D., Kerkhoff, A. J. & Enquist, B. J. Convergence of terrestrial plant production across global climate gradients. Nature **512**, 39-43 (2014).

16 Condit, R. Forest turnover, diversity, and CO_2. Trends Ecol. Evol. **12**, 249-250, doi:http://dx.doi.org/10.1016/S0169-5347(97)01095-1 (1997).

17 Sheil, D. Species richness, tropical forest dynamics and sampling: Questioning cause and effect. Oikos **76**, 587-590 (1996).

18 Phillips, O. L. et al. Changes in growth of tropical forests: Evaluating potential biases. Ecol. Appl. **12**, 576-587 (2002).

19 Saleska, S. R. et al. Carbon in Amazon Forests: Unexpected Seasonal Fluxes and Disturbance-Induced Losses. Science **302**, 1554-1557, doi:10.1126/science.1091165 (2003).
20 Phillips, O. L., Lewis, S. L., Baker, T. R., Chao, K. J. & Higuchi, N. The changing Amazon forest. Philosophical Transactions of the Royal Society B-Biological Sciences **363**, 1819-1827, doi:10.1098/rstb.2007.0033 (2008).
21 Cornwell, W. K. et al. Plant traits and wood fates across the globe: rotted, burned, or consumed? Global Change Biol. **15**, 2431-2449, doi:10.1111/j.1365-2486.2009.01916.x (2009).
22 Jenkinson, D. & Rayner, J. The turnover of soil organic matter in some of the Rothamsted classical experiments. Soil science **123**, 298-305 (1977).
23 Malhi, Y. et al. Comprehensive assessment of carbon productivity, allocation and storage in three Amazonian forests. Global Change Biol. **15**, 1255-1274, doi:10.1111/j.1365-2486.2008.01780.x (2009).
24 Telles, E. d. C. C. et al. Influence of soil texture on carbon dynamics and storage potential in tropical forest soils of Amazonia. Global Biogeochemical Cycles **17** (2003).
25 Quesada, C. et al. Basin-wide variations in Amazon forest structure and function are mediated by both soils and climate. Biogeosciences **9**, 2203-2246 (2012).
26 Chao, K. J. et al. After trees die: quantities and determinants of necromass across Amazonia. Biogeosciences **6**, 1615-1626 (2009).
27 Korning, J. & Balsev, H. Growth rates and mortality patterns of tropical lowland tree species and the relation to forest structure in Amazonian Ecuador. J. Trop. Ecol. **10**, 151-166 (1994).
28 Korning, J. Structure, dynamics, and growth of tropical rain forest tress in Amzonian Ecuador PhD thesis, Aarhus University, (1991).
29 de Toledo, J. J., Magnusson, W. E., Castilho, C. V. & Nascimento, H. E. M. Tree mode of death in Central Amazonia: Effects of soil and topography on tree mortality associated with storm disturbances. For. Ecol. Manage. **263**, 253-261 (2012).
30 Pelissier, R. & Riéra, B. Dix ans de dynamique d'une forêt dense humide de Guyane Française. Revue d'écologie **48**, 21-33 (1993).
31 Rutishauser, E., Wagner, F., Herault, B., Nicolini, E.-A. & Blanc, L. Contrasting above-ground biomass balance in a Neotropical rain forest. Journal of Vegetation Science **21**, 672-682 (2010).
32 Blanc, L., Echard, M. & Gourlet-Fleury, S. Analyse dendrométrique des forêts naturelles et exploitées en forêt tropicale humide de Guyane française. Données issues des dispositifs permanents, 1-26 (2006).
33 Nascimento, M. T., Barbosa, R. I., Villela, D. M. & Proctor, J. Above-ground biomass changes over an 11-year period in an Amazon monodominant forest and two other lowland forests. Plant Ecol. **192**, 181-191, doi:10.1007/s11258-007-9303-z (2007).
34 Uhl, C., Clark, K., Dezzeo, N. & Maquirino, P. Vegetation dynamics in Amazonian treefall gaps. Ecology, 751-763 (1988).
35 Rice, A. H. et al. Carbon balance and vegetation dynamics in an old-growth Amazonian forest. Ecol. Appl. **14**, S55-S71 (2004).
36 Nepstad, D. et al. The effects of partial throughfall exclusion on canopy processes, aboveground production, and biogeochemistry of an Amazon forest. Journal of Geophysical Research: Atmospheres (1984–2012) **107**, LBA 53-51-LBA 53-18 (2002).

37 Chave, J. et al. Assessing evidence for a pervasive alteration in tropical tree communities. PLoS Biol. **6**, 455-462, doi:10.1371/journal.pbio.0060045 (2008).