Supporting Information. Finzi, A.C., M.-A. Giasson, A.A. Barker Plotkin, J.D. Aber, E.R. Boose, E.A. Davidson, M.C. Dietze, A.M. Ellison, S.D. Frey, E. Goldman, T.F. Keenan, J.M. Melillo, J.W. Munger, K.J. Nadelhoffer, S.V. Ollinger, D.A. Orwig, N. Pederson, A.D. Richardson, K. Savage, J. Tang, J.R. Thompson, C.A. Williams, S.C. Wofsy, Z. Zhou, and D.R. Foster. 2020. Carbon budget of the Harvard Forest Long-Term Ecological Research site: pattern, process, and response to global change. Ecological Monographs.

Appendix S1. Supporting Information.

Table S1. List of the sites and data sets used in this C synthesis activity. The table also includes information on location, land-use history, and present vegetation composition. Published data sets are referenced in Table S2.

Site	HF Tract[1]	Land use history	Current forest type	Stand age in 2015 (years)	Live trees	Litterfall	Dead wood	Soil respiration[2]	Soil C	Root C	Eddy flux	Other
Barre Woods Warming	SC	Pasture	Oak–maple	~75 (>90% damage from 1938 hurricane)	-	19	-	18	Unpublished	Unpublished	-	-
Chronic N	PH	Pasture; tilled	Maple–birch; red pine	72 (hardwood); 89 (red pine)	15	14	-	Unpublished	Unpublished	58, Magill et al. (2004)	-	-
Clearcut	PH	Pasture, tilled	mixed hardwood–softwood	7	-	-	-	66, 67	68	-	69, Unpublished	LAI: Williams et al. (2013), Khomik et al. (2014), unpublished
CRUI	PH	Various	Oak–maple	100-125	-	-	-	-	45	-	-	-
DIRT Experiment	TS	Pasture	Oak–maple	~100	-	-	-	11	13, Unpublished	12	-	-
EMS	PH	Pasture; tilled; woodlot	Various; mostly oak–maple	120	32, 35	30	33, 34	31	Unpublished	-	6, 7	LAI: 28, 29
EMS transect	PH	Pasture; tilled; woodlot	Various; mostly oak–maple	120	-	10	-	9	-	-	-	-
Hemlock History	PH, SC	Woodlot	Hemlock	>100	25	-	-	-	-	-	-	-
Hemlock Removal	Simes	Pasture; woodlot	Hemlock; pine–oak; oak–maple	50–135 (hemlock); 50–65 (hardwood)	43	53	40, 41, 42	44, 52	26	-	-	-
Hemlock Woodlot	PH	Woodlot	Hemlock	135–150, plus a few trees >200	20, 48	50	-	46	-	-	37, 38, 39	LAI: 49
Hydrological gradient	PH	Woodlot	Oak–maple	120	-	-	-	27	-	-	-	-
Impact of Hemlock Woolly Adelgid	PH, Simes	Woodlot	Various; mostly hemlock	50–150	-	72	-	-	73	74	-	-
Infested hemlock	PH	Woodlot	Hemlock	135–150, plus a few trees >200	-	-	-	-	85	84	-	-
Little Prospect Hill Tower	PH	Pasture	Oak–maple	58 (1957 fire)	-	51	-	47	-	-	-	-

Lyford Plot	PH	Pasture	Oak–maple	115	21	-	-	-	-	-	-	-
Mapped Tree Plots	TS	Woodlot	Oak–maple	Up to ~150	22	-	-	-	-	-	-	-
Meteorological tower	PH	Pasture	Open field	NA	-	-	-	-	-	-	-	Air temperature, precipitation: 1, 2, 3
Microbial exoenzyme activity	PH	Various	Hemlock, white ash	Various	-	63	-	-	62	61, Brzostek et al. (2013)	-	Root exudates: Brzostek et al. (2013)
Nitrate mobility in forest ecosystems	PH	Pasture; tilled	Oak–maple, red pine	80 (oak-maple); 53 (red pine)	-	-	-	-	Vitousek et al. (1982)	-	-	-
PHOREST	PH	Pasture; tilled; woodlot	various	~ 60–150	16, 23, 75	-	76, 77, 78	-	17, 79	-	-	-
Phenology and carbon allocation of roots	PH	Various	Red oak, hemlock, white ash	120 (oak); 50–150 (hemlock); NA (ash)	-	-	-	-	-	80, 81, 83	-	Root exudates: 82
Plantation Biodiversity	PH, TS	Pasture; tilled	Red pine; spruce	78–95	54, 55	-	56, 57	-	-	-	-	-
Plantation Regeneration	PH	pasture	Red pine	90	59	-	60	-	-	-	-	-
Prospect Hill Warming	PH	Pasture	Oak–maple	75	-	-	-	8	Unpublished	-	-	-
Radiocarbon	PH	Pasture; woodlot	Various; mostly oak–maple	120	-	-	-	-	Gaudinski et al. (2000)	-	-	-
Role of fine roots	PH	Pasture	Oak–maple; red pine	80 (oak-maple); 53 (red pine)	-	-	-	-	-	McClaugherty et al. (1982)	-	-
Simulated Hurricane	TS	Pasture	Oak–maple	100	4, 5	36	64, 65	-	-	-	-	-
Snowpack manipulation	PH	Tilled	Oak–maple	75	-	-	-	-	Unpublished	-	-	
Temperature sensitivity of microbial activity	PH	Various	Red oak, hemlock, white ash	120 (oak); 50–150 (hemlock); NA (ash)	-	-	-	-	71	-	-	-
WarmN	PH	Pasture	Oak–maple	90	-	-	-	24	Unpublished	-	-	-
Water chemistry	PH	Pasture	Hemlock	50–150	-	-	-	-	-	-	-	DOC: 70

Data sets can be found on-line in the Harvard Forest Data Archive [http://harvardforest.fas.harvard.edu/harvard-forest-data-archive].

[1] Harvard Forest tracts are Prospect Hill (PH), Slab City (SC), Simes (Simes), and Tom Swamp (TS).

[2] The soil respiration data sets listed have been used to generate data set HF194 (Giasson et al. 2013) which has been used and expanded to cover 2010–2015 for this analysis.

Table S2. Harvard Forest, DOI, and KNB numbers of the previously published datasets used in this C synthesis activity.

Reference in Table S1	Harvard Forest archive	DOI	KNB
1	HF000-01	doi:10.6073/pasta/84cf303ea3331fb47e8791aa61aa91b2	knb-lter-hfr.0.15
2	HF001-08	doi:10.6073/pasta/04076dfd30b286c6c29301b6345a63f5	knb-lter-hfr.1.23
3	HF001-10	doi:10.6073/pasta/04076dfd30b286c6c29301b6345a63f5	knb-lter-hfr.1.23
4	HF002-01	doi:10.6073/pasta/c0088d9174c77d6b38437708af3bf4a0	knb-lter-hfr.2.22
5	HF002-02	doi:10.6073/pasta/c0088d9174c77d6b38437708af3bf4a0	knb-lter-hfr.2.22
6	HF004-01	doi:10.6073/pasta/dd9351a3ab5316c844848c3505a8149d	knb-lter-hfr.4.28
7	HF004-02	doi:10.6073/pasta/dd9351a3ab5316c844848c3505a8149d	knb-lter-hfr.4.28
8	HF005-05	doi:10.6073/pasta/cea45e7fb060024359907b2da691b55a	knb-lter-hfr.5.27
9	HF006-01	doi:10.6073/pasta/33ba3432103297fe0644de6e0898f91f	knb-lter-hfr.6.27
10	HF006-04	doi:10.6073/pasta/33ba3432103297fe0644de6e0898f91f	knb-lter-hfr.6.27
11	HF007-06	doi:10.6073/pasta/40d4b9f3f99692ca01a8c6aeab29983d	knb-lter-hfr.7.23
12	HF007-07	doi:10.6073/pasta/40d4b9f3f99692ca01a8c6aeab29983d	knb-lter-hfr.7.23
13	HF007-09	doi:10.6073/pasta/40d4b9f3f99692ca01a8c6aeab29983d	knb-lter-hfr.7.23
14	HF008-03	doi:10.6073/pasta/91b1f285a44d385cc84242b52653396d	knb-lter-hfr.8.24
15	HF008-04	doi:10.6073/pasta/91b1f285a44d385cc84242b52653396d	knb-lter-hfr.8.24
16	HF015-02	doi:10.6073/pasta/095e33510e18dbbd5e8016b72b5c9c3a	knb-lter-hfr.15.20
17	HF015-05	doi:10.6073/pasta/095e33510e18dbbd5e8016b72b5c9c3a	knb-lter-hfr.15.20
18	HF018-07	doi:10.6073/pasta/7eeed0965e7a60ce0443e505e7c767f5	knb-lter-hfr.18.28
19	HF018-09	doi:10.6073/pasta/7eeed0965e7a60ce0443e505e7c767f5	knb-lter-hfr.18.28
20	HF031-01	doi:10.6073/pasta/a8e2baf899319b9846fc287ee9479bb1	knb-lter-hfr.31.22
21	HF032-01	doi:10.6073/pasta/a84fc8e297fb8e5f8adf8ff98e208f8d	knb-lter-hfr.32.18
22	HF036-01	doi:10.6073/pasta/b00a65d64888f175997a315b6f06f062	knb-lter-hfr.36.19
23	HF039-02	doi:10.6073/pasta/49559cfbe9870ddbc30ab7a566038738	knb-lter-hfr.39.17
24	HF045-01	doi:10.6073/pasta/191c82bf4d949362e118138a01a42781	knb-lter-hfr.45.28
25	HF053-01	doi:10.6073/pasta/0f29b09d3075b5b3afc783177c21cb5f	knb-lter-hfr.53.18

26	HF054-05	doi:10.6073/pasta/a461a4d9630f48c821712a6cd9d7465a	knb-lter-hfr.54.23
27	HF068-01	doi:10.6073/pasta/29aae9def8e977d8ee67f1ca2f54b632	knb-lter-hfr.68.22
28	HF069-01	doi:10.6073/pasta/37ff12d47894a73ddd9d86c1225e2dc8	knb-lter-hfr.69.30
29	HF069-02	doi:10.6073/pasta/37ff12d47894a73ddd9d86c1225e2dc8	knb-lter-hfr.69.30
30	HF069-05	doi:10.6073/pasta/37ff12d47894a73ddd9d86c1225e2dc8	knb-lter-hfr.69.30
31	HF069-08	doi:10.6073/pasta/37ff12d47894a73ddd9d86c1225e2dc8	knb-lter-hfr.69.30
32	HF069-09	doi:10.6073/pasta/37ff12d47894a73ddd9d86c1225e2dc8	knb-lter-hfr.69.30
33	HF069-10	doi:10.6073/pasta/37ff12d47894a73ddd9d86c1225e2dc8	knb-lter-hfr.69.30
34	HF069-11	doi:10.6073/pasta/37ff12d47894a73ddd9d86c1225e2dc8	knb-lter-hfr.69.30
35	HF069-12	doi:10.6073/pasta/37ff12d47894a73ddd9d86c1225e2dc8	knb-lter-hfr.69.30
36	HF101-01	doi:10.6073/pasta/12b4ea2f42162f0d5eb5e618880e564f	knb-lter-hfr.101.21
37	HF103-01	doi:10.6073/pasta/eae9d5adcea3afc30e94c20e6b710a22	knb-lter-hfr.103.32
38	HF103-03	doi:10.6073/pasta/eae9d5adcea3afc30e94c20e6b710a22	knb-lter-hfr.103.32
39	HF103-04	doi:10.6073/pasta/eae9d5adcea3afc30e94c20e6b710a22	knb-lter-hfr.103.32
40	HF125-01	doi:10.6073/pasta/183b36060c7f692b77b24e8160110c63	knb-lter-hfr.125.19
41	HF125-02	doi:10.6073/pasta/183b36060c7f692b77b24e8160110c63	knb-lter-hfr.125.19
42	HF125-03	doi:10.6073/pasta/183b36060c7f692b77b24e8160110c63	knb-lter-hfr.125.19
43	HF126-02	doi:10.6073/pasta/c2db383d264c1d7fea6fddaba65bb555	knb-lter-hfr.126.14
44	HF130-01	doi:10.6073/pasta/182895973c0b2464ce0bdd5c01442566	knb-lter-hfr.130.16
45	HF143-01	doi:10.6073/pasta/4f11a16db52752c10bfec649dedf90b0	knb-lter-hfr.143.10
46	HF148-01	doi:10.6073/pasta/4aa53377a2bf156a637784dfc9a79e7c	knb-lter-hfr.148.12
47	HF148-02	doi:10.6073/pasta/4aa53377a2bf156a637784dfc9a79e7c	knb-lter-hfr.148.12
48	HF149-01	doi:10.6073/pasta/9f6086909a3c7f801d45c3878d265651	knb-lter-hfr.149.18
49	HF150-01	doi:10.6073/pasta/5c18fda0e51764dd359a022a455886ba	knb-lter-hfr.150.18
50	HF151-01	doi:10.6073/pasta/f46cee9f532042efae5ffb4e74f347b9	knb-lter-hfr.151.17
51	HF151-02	doi:10.6073/pasta/f46cee9f532042efae5ffb4e74f347b9	knb-lter-hfr.151.17
52	HF160-05	doi:10.6073/pasta/3711d8c542c50afb43a45302a9691c7a	knb-lter-hfr.160.20
53	HF161-01	doi:10.6073/pasta/86e1bab7fc897720360f54fdbe046f9a	knb-lter-hfr.161.15
54	HF162-02	doi:10.6073/pasta/a8be8f5f024b2a0aaef00404528181ec	knb-lter-hfr.162.14

55	HF162-03	doi:10.6073/pasta/a8be8f5f024b2a0aaef00404528181ec	knb-lter-hfr.162.14
56	HF162-06	doi:10.6073/pasta/a8be8f5f024b2a0aaef00404528181ec	knb-lter-hfr.162.14
57	HF162-07	doi:10.6073/pasta/a8be8f5f024b2a0aaef00404528181ec	knb-lter-hfr.162.14
58	HF166-01	doi:10.6073/pasta/92bef2e39303102ccd1ad38f377d466b	knb-lter-hfr.166.8
59	HF175-01	doi:10.6073/pasta/746ffc4112a7701b58df8ec87ddc09cf	knb-lter-hfr.175.10
60	HF175-02	doi:10.6073/pasta/746ffc4112a7701b58df8ec87ddc09cf	knb-lter-hfr.175.10
61	HF180-06	doi:10.6073/pasta/f361d879405d9f73551243091bf019d6	knb-lter-hfr.180.8
62	HF180-07	doi:10.6073/pasta/f361d879405d9f73551243091bf019d6	knb-lter-hfr.180.8
63	HF180-08	doi:10.6073/pasta/f361d879405d9f73551243091bf019d6	knb-lter-hfr.180.8
64	HF207-01	doi:10.6073/pasta/bc21358fb98bda26d9d4f5fa2fd86174	knb-lter-hfr.207.8
65	HF207-02	doi:10.6073/pasta/bc21358fb98bda26d9d4f5fa2fd86174	knb-lter-hfr.207.8
66	HF223-01	doi:10.6073/pasta/8cd3b777f4e8d0dabcccdb4548d8fb36	knb-lter-hfr.223.4
67	HF223-02	doi:10.6073/pasta/8cd3b777f4e8d0dabcccdb4548d8fb36	knb-lter-hfr.223.4
68	HF227-01	doi:10.6073/pasta/d9e05c1f411688a7b46874f63245d01c	knb-lter-hfr.227.2
69	HF233-01	doi:10.6073/pasta/23a12b614ee4b80e8c6139549bfc2178	knb-lter-hfr.233.3
70	HF240-01	doi:10.6073/pasta/8517404340a6cc26c180d22cd9e168a4	knb-lter-hfr.240.3
71	HF256-03	doi:10.6073/pasta/42a6724c330604d3524acb71bb02c60e	knb-lter-hfr.256.2
72	HF257-11	doi:10.6073/pasta/3592ddc3ee246f4e6d583e527e764e2f	knb-lter-hfr.257.4
73	HF257-20	doi:10.6073/pasta/3592ddc3ee246f4e6d583e527e764e2f	knb-lter-hfr.257.4
74	HF257-21	doi:10.6073/pasta/3592ddc3ee246f4e6d583e527e764e2f	knb-lter-hfr.257.4
75	HF271-02	doi:10.6073/pasta/40d9bc27f42ec255464c2de6d0aa37b0	knb-lter-hfr.271.2
76	HF271-03	doi:10.6073/pasta/40d9bc27f42ec255464c2de6d0aa37b0	knb-lter-hfr.271.2
77	HF271-04	doi:10.6073/pasta/40d9bc27f42ec255464c2de6d0aa37b0	knb-lter-hfr.271.2
78	HF271-05	doi:10.6073/pasta/40d9bc27f42ec255464c2de6d0aa37b0	knb-lter-hfr.271.2
79	HF271-07	doi:10.6073/pasta/40d9bc27f42ec255464c2de6d0aa37b0	knb-lter-hfr.271.2
80	HF278-01	doi:10.6073/pasta/e79cbe8a834a50f52c18c41ba040dfe4	knb-lter-hfr.278.2
81	HF278-02	doi:10.6073/pasta/e79cbe8a834a50f52c18c41ba040dfe4	knb-lter-hfr.278.2
82	HF278-03	doi:10.6073/pasta/e79cbe8a834a50f52c18c41ba040dfe4	knb-lter-hfr.278.2
83	HF278-04	doi:10.6073/pasta/e79cbe8a834a50f52c18c41ba040dfe4	knb-lter-hfr.278.2

84	HF293-03	doi:10.6073/pasta/40937403f8c954365c09bfa94fd88cc5	knb-lter-hfr.293.2
85	HF293-05	doi:10.6073/pasta/40937403f8c954365c09bfa94fd88cc5	knb-lter-hfr.293.2

Table S3. Live aboveground and coarse root C stocks and accumulation rates for trees in permanent plots and unmanipulated controls. Live coarse root stocks are based on ratios of aboveground biomass that vary by tree size and type (Jenkins et al. 2004). The summaries by forest type are based on the mean change in C stocks at a plot level, with forest type determined by a cluster analysis of the forest type in its most recent measurement year.

Project	Forest type	Time span (First − most recent census)	Aboveground g C m^{-2} first census mean (SD)	Aboveground g C m^{-2} most recent census mean (SD)	Coarse root g C m^{-2} first census mean (SD)	Coarse root g C m^{-2} most recent census mean (SD)	No. years (# censuses)	Hectares sampled (# plots)	Annual aboveground C accrual rate by difference g C m^{-2} yr^{-1} (SD)[b]
Chronic N (Control)	Hardwood	1988–2008	4,845 (NA)	8,210 (NA)	948 (NA)	1,577 (NA)	20 (8)	0.09 (1)	168.2 (NA)
EMS (Unmanipulated)	Primarily hardwood	1993–2014	9,930 (3,198)	12,920 (4,040)	1,932 (632)	2,503 (789)	21 (18)	1.07 (34)	142.3 (67.9)
Hemlock History	Hemlock	1995–2012	15,092 (2,088)	15,016 (1,599)	3,022 (487)	3,114 (390)	17 (3)	0.36 (4)	−4.5 (136.0)
Hemlock Removal (Control)	Hardwood	2004–2014	9,407 (474)	10,804 (437)	1,840 (139)	2,105 (143)	10 (3)	1.51 (2)	139.7 (3.7)
Hemlock Removal (Control)	Hemlock	2004–2014	12,871 (1,765)	14,139 (1,681)	2,637 (356)	2,895 (343)	10 (3)	1.58 (2)	126.8 (8.4)
Hemlock Woodlot	Hemlock	1990–2014	10,886 (NA)	13,679 (NA)	2,300 (NA)	2,874 (NA)	24 (4)	0.72 (1)	116.4 (NA)
HEM tower plots	Hemlock	2002–2015	13965 (2970)	13933 (5347)	2953 (641)	2944 (1135)	13 (14)	0.12 (11)	−2 (328.7)
HEM tower plots, pre-adelgid	Hemlock	2002–2012	13965 (2970)	15312 (3457)	2953 (641)	3234 (745)	10 (11)	0.12 (11)	134.6 (89.7)
Lyford Grid	Hardwood	1969–2011	7,444 (NA)	13,195 (NA)	1,427 (NA)	2,498 (NA)	42 (5)	2.88 (1)	136.9 (NA)
Simulated Hurricane (Control)	Hardwood	1990–2015	9,801 (NA)	14,592 (NA)	1,864 (NA)	2,752 (NA)	25 (6)	0.6 (1)	191.6 (NA)
Mapped Overstory	Hardwood	1990–2013	11,800 (1,523)	14,776 (1,797)	2,235 (295)	2,787 (350)	23 (3)	1.0 (4)	129.4 (32.3)
PHOREST	Hardwood & pine–oak	1992–2013[a]	8,098 (2,671)	11,491 (3,024)	1,596 (526)	2,243 (586)	21 (2)	2.33 (46)	161.6 (81.1)
PHOREST	Hemlock	1992–2013[a]	11,278 (4,013)	14,175 (3,839)	2,330 (825)	2,920 (786)	21 (2)	0.71 (14)	138.0 (107.7)
Overall, hardwood (oak–maple & maple–birch–ash)								(76)	149.5 (125.4)
Overall, hemlock								(32)	19.4 (259.2)

[a] PHOREST first census in 1937, but there was a major hurricane in 1938 so C accrual was assessed for 1992–2013.

[b] SD calculated from the change in aboveground C per plot.

Table S4. Supporting material for biomass calculations: allometric equations for tree species at the Harvard Forest. The column "N data points" are out of 126,757 total tree × time measurements, from 14 projects. BM: biomass (kg); D: DBH (cm); Range: diameters of trees used to develop equation; Number: number of trees used to develop equation. Exp is e; log is ln.

Species	Equation	Source, Location, Range, Number,	Component	N data points
Abies balsamea (Balsam fir)	BM = exp(−2.5356 + 2.4349*log(D))	Young et al. (1980) *in* Ter-Mikaelian and Korzukhin (1997), ME, 2.54–50.8 cm, *n* = 95	Total aboveground above 6" stump	13
Acer pensylvanicum (Striped maple)	BM = (exp(0.5958 + 2.4017*log(D/2.54)))/2.2	Hocker and Early (1983), NH, 0.6–7.5 cm, n = 8	Stem + live branches	876
Acer rubrum (Red maple, plus one *Acer* spp.)	BM = exp(−2.2202 + 2.3922*log(D))	Dietze (2015)	Total aboveground above stump	37,849
Acer saccharum (Sugar maple)	BM = exp(−1.291 + 2.219*log(D))	Dietze (2015)	Total aboveground above stump	1,728
Acer spicatum (Mountain maple)	BM= 0.2040 * D^2.2524	Whittaker et al. (1974) *in* Ter-Mikaelian and Korzukhin (1997), NH, 1–20 cm, *n* = 15	Total aboveground	2
Alnus incana (Alder sp.)	BM = exp(−2.4800 + 2.4835*log(D))	Jenkins et al. (2004), General equation for mixed hardwoods, 0–56 cm, n = 289	Total aboveground	3

Betula alleghaniensis (Yellow birch)	BM = exp(−1.542 + 2.260*log(D))	Dietze (2015)	Total aboveground above stump	5.535
Betula lenta (Black birch, plus *Betula* spp.)	BM = (1.6542 * (D/2.54)^2.6606)/2.2	Brenneman et al. (1978), WV, 5–51 cm, n = 8	Total aboveground (excludes foliage)	9,569
Betula papyrifera (Paper birch)	BM = exp(−3.082 + 2.683*log(D))	Dietze (2015)	Total aboveground above stump	2,476
Betula populifolia (Gray birch)	BM = exp(−1.835 + 2.309*log(D))}	Dietze (2015)	Total aboveground above stump	1,123
Carpinus caroliniana (Hornbeam)	BM = exp(−2.4800 + 2.4835*log(D))	Jenkins et al. (2004), General equation for mixed hardwoods, 0–56 cm, n = 289	Total aboveground	23
Castanea dentata (American chestnut)	BM = exp(−1.881 + 2.386*log(D))	Dietze (2015) (Equation for *Quercus rubra*)	Total aboveground above stump	548
Carya sp. (hickory), includes *C. glabra* and *C. ovata*	BM = 0.0763 * D^2.6209	Wiant et al. (1977) *in* Ter-Mikaelian and Korzukhin (1997), WV, 5–40 cm, *n* = 19	Total aboveground excluding foliage	430
Fagus grandifolia (American beech)	BM = exp(−1.342 + 2.231*log(D))	Dietze (2015)	Total aboveground above stump	4,162

Fraxinus americana (White ash)	BM = exp(−1.381 + 2.208*log(D))	Dietze (2015)	Total aboveground above stump	2,358
Fraxinus nigra (Black ash)	BM = 0.1634 * D^2.3480	Perala and Alban (1993) *in* Ter-Mikaelian and Korzukhin (1997), Upper Great Lakes, 4–32 cm, *n* = 18	Total aboveground	62
Hamamelis virginiana (Witch hazel)	BM = (38.111 * D^2.900)/1000	Smith and Brand (1983) *after* Telfer (1969), Canada, 0–4 cm, n = 21	Total aboveground	620
Juniperus virginiana (Eastern redcedar)	BM = exp(−0.7152 + 1.7029*log(D))	Jenkins et al. (2004), General equation for woodland, 0–78 cm, n = 61	Total aboveground	1
Larix spp. (includes *L. decidua*)	BM = exp(0.8162 + 2.2453*log(D/2.54)))/2.2	Young et al. (1980) *in* Ter-Mikaelian and Korzukhin (1997), ME, 2.54–50.8 cm, *n* = 23	Total aboveground above stump	5
Nyssa sylvatica (Black gum)	BM = exp(−2.4800 + 2.4835*log(D))	Jenkins et al. (2004), General equation for mixed hardwoods, 0–56 cm, n = 289	Total aboveground	146
Ostrya virginiana (Hophornbeam)	BM = exp(−2.4800 + 2.4835*log(D))	Jenkins et al. (2004), General equation for mixed hardwoods, 0–56 cm, n = 289	Total aboveground	506
Picea rubens (Red spruce). Use this also for Picea spp., P. abies, P. glauca	BM = exp(−2.621 + 2.456*log(D))	Dietze (2015)	Total aboveground above stump	1700 (729 *P. rubens*)

Pinus resinosa (Red pine)	BM = exp(−2.076 + 2.317*log(D))	Dietze (2015)	Total aboveground above stump	4,542
Pinus rigida (Pitch pine)	BM = 0.1040 * D^2.3373	Whittaker and Woodwell (1968) *in* Ter- Mikaelian and Korzukhin (1997), NY, 0–31 cm, *n* = 15	Total aboveground	1
Pinus strobus (Eastern white pine)	BM = exp(−3.293 + 2.603*log(D))	Dietze (2015)	Total aboveground above stump	8,612
Pinus sylvestris (Scotch pine)	BM = exp(−2.5356 + 2.4349*log(D))	Jenkins et al. (2004), General equation for pine, 0–180 cm, n = 331	Total aboveground	63
Populus grandidentata (Largetooth aspen), includes *Populus* spp.	BM = 0.0785 * D^2.4981	Perala and Alban (1993) *in* Ter-Mikaelian and Korzukhin (1997), MI, 3–45 cm, *n* = 57	Total aboveground	93
Prunus pensylvanica (Pin cherry)	BM = exp(0.9758 + 2.1948*log(D/2.54)))/2.2	Young et al. (1980) *in* Ter-Mikaelian and Korzukhin (1997), ME, 2.5–22.9 cm, *n* = 30	Total aboveground above stump	63
Prunus serotina (Black cherry)	BM = (1.8082 * (D/2.54)^2.6174)/2.2	Brenneman et al. (1978), WV, 5–51 cm, n = 26	Total aboveground (excludes foliage)	1,730
Prunus virginiana (Chokecherry)	BM = 0.2643 * D^1.7102	Young et al. (1980) in Ter-Mikaelian and Korzukhin (1997), ME, 3–15 cm, *n* = 16	Total aboveground	6

Quercus alba (White oak), includes 6 *Q. bicolor* (Swamp white oak)	BM = exp(−2.520 + 2.590*log(D))	Dietze (2015)	Total aboveground above stump	761
Quercus coccinea (Scarlet oak)	BM = 0.2482 * D^2.19	Whittaker and Woodwell (1968) *in* Ter-Mikaelian and Korzukhin (1997), NY, 8–28 cm, *n* = 15	Total aboveground	2
Quercus rubra (Red oak)	BM = exp(−1.881 + 2.386*log(D))	Dietze (2015)	Total aboveground above stump	12,697
Quercus velutina (Black oak)	BM = exp(−2.821 + 2.659*log(D))	Dietze (2015)	Total aboveground above stump	3,188
Robinia pseudoacacia (Black locust)	BM = exp(−2.4800 + 2.4835*log(D))	Jenkins et al. (2004), General equation for mixed hardwoods, 0–56 cm, n = 289	Total aboveground	32
Sorbus americana (American mountain ash)	BM = exp(−2.4800 + 2.4835*log(D))	Jenkins et al. (2004), General equation for mixed hardwoods, 0–56 cm, n = 289	Total aboveground	8
Tilia americana (Basswood)	BM = (1.4416 * (D/2.54)^2.7324)/2.2	Brenneman et al. (1978), WV, 5.1–50.8 cm, n = 13	Total aboveground (excludes foliage)	54
Tsuga canadensis (Eastern hemlock)	BM = exp(−2.2712 + 2.3444*log(D))	Dietze (2015)	Total aboveground above stump	25,107

Ulmus sp. (Elm), includes *U. americana*	BM = 0.0825 * D^ 2.468	Perala and Alban (1993) *in* Ter-Mikaelian and Korzukhin (1997), Upper Great Lakes, 4–29 cm, *n* = 14	Total aboveground above stump	45
Unknown species	BM = exp(−2.4800 + 2.4835*log(D))	Jenkins et al. (2004), General equation for mixed hardwoods, 0–56 cm, n = 289	Total aboveground	12

Table S5. Mean ± SD (*n*) litterfall for permanent plots and unmanipulated controls.

Project	Forest type	Litterfall (g C m^{-2} yr^{-1})		
		Foliar	Non-foliar	Total
Barre Woods warming	Hardwood	162 ± 23 (8)	-	-
Chronic N	Hardwood	176 ± 33 (24)	-	-
EMS	Hemlock	136 ± 30 (60)	58 ± 34 (60)	194 ± 47 (60)
	Hardwood	152 ± 34 (356)	39 ± 25 (356)	190 ± 43 (356)
EMS transect	Hardwood	191 ± 33 (60)	-	-
Hemlock removal	Hemlock	150 ± 9 (16)	62 ± 16 (16)	212 ± 12 (16)
	Hardwood	179 ± 15 (16)	48 ± 29 (16)	226 ± 32 (16)
Hemlock woodlot	Hemlock	173 ± 56 (108)	85 ± 88 (108)	258 ± 114 (108)
Impact of hemlock woolly adelgid	Hemlock	129 ± 21 (8)	-	-
Little Prospect Hill tower	Hardwood	159 ± 37 (179)	42 ± 43 (179)	200 ± 64 (179)
Microbial exoenzyme activity	Hemlock	150 ± 55 (12)	-	-
	Hardwood	198 ± 26 (12)	-	-
Simulated hurricane	Hardwood	-	-	208 ± 22 (26)

Table S6. Mean ± SD (*n*) fine, coarse, and standing woody debris carbon content for permanent plots and unmanipulated controls.

Project	Forest type	Woody debris (g C m^{-2})			
		Fine (0.6–7.5 cm)	Coarse (>7.5 cm)	Standing dead	Total
EMS	Hemlock	-	968 ± 765 (14)	690 ± 336 (14)	-
	Hardwood	172 ± 105 (121)[1]	1,288 ± 1,041 (100)	918 ± 852 (98)	2,378 ± 1,346
Hemlock removal	Hemlock	429 ± 164 (10)	500 ± 132 (10)	1,699 ± 474 (10)	2,628 ± 519
	Hardwood	208 ± 70 (10)	619 ± 188 (10)	988 ± 404 (10)	1,815 ± 451
Prospect Hill inventory	Hemlock	309 ± 181 (25)	420 ± 345 (14)	972 ± 1,020 (14)	1,701 ± 1,092
	Hardwood	296 ± 191 (35)	477 ± 540 (46)	797 ± 725 (46)	1,570 ± 924
Simulated hurricane	Hardwood	323 ± 91 (4)	271 ± 69 (4)	-	-

[1] 2–7.5 cm diameter.

Table S7. Mean ± SD (*n*) soil carbon content for permanent plots and unmanipulated controls.

Project	Forest type	Soil C content (g C m^{-2})			
		OH	0–15 cm	15–30 cm	30–45 cm
Barre Woods warming	Hardwood	1,771 ± 1,241 (4)	2,760 ± 195 (4)	1,960 ± 228 (4)	1,145 ± NA (1)
Chronic N	Hardwood	2,532 ± 624 (6)	5,435 ± 914 (6)	2,861 ± 581 (6)	1,596 ± 715 (4)
CRUI	Hardwood	1,516 ± 428 (18)	4,392 ± 1,017 (18)	-	-
DIRT	Hardwood	3,629 ± 1,769 (18)	4,260 ± 826 (17)	2,996 ± 318 (3)	1,169 ± 1 (2)
EMS	Hemlock	5,472 ± 2,491 (5)	-	-	-
	Hardwood	3,434 ± 1,264 (28)	-	-	-
Hemlock removal	Hemlock	913 ± 129 (4)	2,007 ± 631 (4)	-	-
	Hardwood	1,133 ± 204 (7)	1,844 ± 504 (8)	-	-
Impact of hemlock woolly adelgid	Hemlock	3,075 ± 1,851 (8)	5,205 ± 312 (8)	3,990 ± 1,071 (8)	2,532 ± 464 (8)
Infested hemlock	Hemlock	6,184 ± 2,206 (3)	3,895 ± 498 (3)	2,600 ± 1,032 (3)	-
Microbial exoenzyme activity	Hemlock	2,387 ± 290 (6)	6,529 ± 3,502 (12)	-	-
	Hardwood	-	7,099 ± 2,587 (18)	-	-
Nitrate mobility in forest ecosystems	Hardwood	1,895 ± NA (13)	6,753 ± NA (13)	4,107 ± NA (3)	4,528 ± NA (3)
PHOREST[1]	Hemlock/pine	-	5,861 ± 1,404 (38)	-	-
	Hardwood	-	5,564 ± 1,191 (143)	-	-
PHOREST[2]	Hemlock/pine	3,942 ± 1,457 (13)	4,856 ± 1,114 (13)	-	-
	Hardwood	2,897 ± 1,050 (31)	4,880 ± 967 (32)	-	-
Prospect Hill warming	Hardwood	2,565 ± 605 (6)	4,313 ± 1,175 (6)	3,368 ± 1,054 (6)	1,953 ± 1,395 (3)
Radiocarbon	Hardwood	2,020 ± 536 (2)	5,759 ± 749 (2)	594 ± 56 (2)	277 ± 42 (2)
Snowpack manipulation	Hardwood	3,128 ± 466 (6)	3,148 ± 2,738 (6)	-	-
Temperature sensitivity of microbial activity	Hemlock	-	4,531 ± 677 (6)	-	-
	Hardwood	-	7,139 ± 1,458 (12)	-	-
WarmN	Hardwood	3,314 ± 990 (6)	5,054 ± 725 (6)	3,250 ± 1,241 (6)	1,743 ± 398 (6)

[1] Data set HF015

[2] Data set HF271

Table S8. Mean ± SD (*n*) fine root biomass (g C m^{-2}) for permanent plots and unmanipulated controls.

Data set	Forest type	Fine roots (< 2 mm)			
		OH	0–15 cm	15–30 cm	30–45 cm
Barre Woods warming[1]	Hardwood	27 ± 25 (48)	239 ± 184 (48)	-	-
Chronic N	Hardwood	80 ± 30 (6)	-	-	-
Chronic N[2]	Hardwood	174 ± 76 (10)	140 ± 48 (10)	-	-
DIRT	Hardwood	60 ± 23 (6)	39 ± 25 (6)	-	-
DIRT[3]	Hardwood	69 ± 33 (6)	-	-	-
Impact of hemlock woolly adelgid	Hemlock	120 ± 78 (8)	131 ± 35 (8)	85 ± 18 (8)	105 ± 40 (8)
Infested hemlock	Hemlock	245 ± 140 (18)	177 ± 58 (18)	134 ± 102 (15)	-
Microbial exoenzyme activity	Hemlock	-	190 ± 113 (30)	-	-
	Hardwood	-	157 ± 87 (30)	-	-
Phenology and carbon allocation of roots	Hemlock	115 ± 53 (47)	176 ± 65 (46)	-	-
	Hardwood	139 ± 58 (48)	198 ± 70 (96)	-	-
Role of fine roots[4]	Hardwood	245 ± 22 (10)	140 ± 11 (10)	70 ± 8 (4)	55 ± 6 (4)

[1] Data used by Zhou et al. (2011), provided by author. Fine roots are defined as diameter ≤ 1 mm.

[2] Data from Magill et al. (2004).

[3] Data used by Lajtha et al. (2014), provided by author.

[4] Data from McClaugherty et al. (1982). Fine roots are defined as diameter < 3 mm.

Table S9. Annual (1 Nov–31 Oct) gross primary production and ecosystem and soil respiration (g C m^{-2}) measured and modeled up to 24 years at the EMS site, 11 years at the HEM site, and 6 years at the CC site.

Year	Hemlock tower			EMS tower			Clearcut tower		
	GPP	R_e	R_s	GPP	R_e	R_s	GPP	R_e	R_s
1992	-	-	-	1,176	962	876	-	-	-
1993	-	-	-	1,354	1,200	652	-	-	-
1994	-	-	-	1,233	1,061	799	-	-	-
1995	-	-	-	1,260	987	763	-	-	-
1996	-	-	-	1,328	1,123	725	-	-	-
1997	-	-	-	1,401	1,185	628	-	-	-
1998	-	-	-	1,207	1,104	717	-	-	-
1999	-	-	-	1,405	1,175	778	-	-	-
2000	-	-	-	1,451	1,233	691	-	-	-
2001	-	-	-	1,629	1,161	634	-	-	-
2002	-	-	-	1,523	1,257	727	-	-	-
2003	-	-	-	1,525	1,272	738	-	-	-
2004	-	-	-	1,711	1,294	711	-	-	-
2005	1,378	967	701	1,387	879	745	-	-	-
2006	1,543	1,029	674	1,638	1,164	715	-	-	-
2007	1,341	843	654	1,636	1,148	695	-	-	-
2008	1,446	968	649	1,602	961	689	-	-	-
2009	1,389	869	666	1,791	1,380	707	-	-	-
2010	1,614	1,053	726	2,133	2,013	771	1,171	1,912	-
2011	1,352	1,068	673	1,885	1,878	715	1,310	1,948	1,143
2012	1,465	1,010	709	1,679	1,326	753	1,801	2,078	1,299
2013	1,236	990	664	1,496	1,220	706	1,949	1,631	1,776
2014	1,218	1,228	668	1,562	1,132	710	1,846	1,421	-
2015	1,083	1,212	739	1,605	1,346	786	2,339	1,569	-

Table S10. Correlation coefficients (*p* value) of radial growth versus monthly climate data from 1920–2012 collected at Amherst, MA. “p” or “c” before the abbreviation for a month stands for year prior to ring formation or current year of ring formation, respectively. Bold correlation coefficients denote relationships significant at $p < 0.05$. Asterisks indicate relationships significant at $p < 0.01$.

Month	Red oak (*Quercus rubra*)			Red maple (*Acer rubrum*)		
	Mean minimum temperature	Mean maximum temperature	Total precipitation	Mean minimum temperature	Mean maximum temperature	Total precipitation
pMar	-0.097 (0.642)	-0.080 (0.547)	0.066 (0.540)	0.073 (0.504)	0.136 (0.189)	-0.058 (0.588)
pApr	-0.099 (0.654)	0.042 (0.694)	**-0.205** (0.046)	0.106 (0.314)	**0.232** (0.024)	-0.065 (0.541)
pMay	-0.106 (0.313)	-0.180 (0.081)	0.071 (0.506)	0.089 (0.597)	0.043 (0.684)	0.109 (0.301)
pJun	0.032 (0.758)	0.081 (0.556)	**-0.279*** (0.007)	-0.002 (0.980)	0.065 (0.545)	-0.108 (0.304)
pJul	-0.089 (0.601)	-0.100 (0.659)	0.076 (0.524)	-0.005 (0.958)	-0.140 (0.177)	0.141 (0.174)
pAug	-0.073 (0.504)	**-0.277*** (0.007)	0.066 (0.539)	-0.126 (0.226)	**-0.220** (0.032)	0.108 (0.306)
pSep	-0.121 (0.248)	-0.141 (0.173)	-0.004 (0.969)	0.045 (0.671)	-0.041 (0.695)	-0.042 (0.691)
pOct	0.113 (0.282)	0.126 (0.228)	-0.051 (0.633)	0.157 (0.129)	0.159 (0.124)	-0.108 (0.305)
pNov	-0.046 (0.668)	0.002 (0.980)	0.117 (0.262)	**0.213** (0.039)	0.082 (0.560)	0.023 (0.822)
pDec	-0.025 (0.804)	-0.011 (0.913)	0.024 (0.811)	0.089 (0.598)	0.053 (0.618)	0.140 (0.178)
cJan	0.100 (0.659)	0.109 (0.297)	-0.062 (0.559)	0.117 (0.262)	0.134 (0.198)	-0.035 (0.739)
cFeb	-0.094 (0.625)	-0.129 (0.215)	-0.069 (0.520)	-0.023 (0.821)	-0.110 (0.296)	0.015 (0.883)
cMar	-0.173 (0.093)	-0.146 (0.159)	0.163 (0.115)	0.068 (0.524)	0.057 (0.594)	**0.213** (0.038)
cApr	-0.159 (0.124)	-0.044 (0.681)	-0.073 (0.504)	0.119 (0.254)	0.103 (0.673)	0.009 (0.929)
cMay	0.027 (0.791)	0.069 (0.517)	-0.110 (0.295)	0.100 (0.659)	0.101 (0.665)	-0.054 (0.614)
cJun	0.007 (0.945)	-0.094 (0.629)	-0.012 (0.901)	-0.171 (0.098)	-0.114 (0.274)	-0.076 (0.525)
cJul	0.145 (0.163)	0.151 (0.145)	0.036 (0.733)	0.008 (0.934)	-0.082 (0.557)	0.054 (0.612)
cAug	0.137 (0.186)	0.028 (0.784)	**0.202** (0.049)	0.053 (0.619)	-0.086 (0.585)	0.098 (0.646)

Table S11. Mean bulk density (g cm^{-3}), carbon content (%), and total soil carbon (g C m^{-2}) in the top 15 cm of the mineral soil of the hardwood- and conifer-dominated plots of the PHOREST study measured in both 1992 and 2013 (SD).

	1992	2013
Hardwoods (*n* = 31)		
Bulk density	0.78 (0.08)	0.75 (0.10)
C content	5.36 (1.29)	5.62 (1.24)
Total soil C	6,072 (1,509)	6,021 (1,238)
Conifers (*n* = 11)		
Bulk density	0.78 (0.12)	0.69 (0.15)
C content	5.43 (1.40)	6.62 (2.11)
Total soil C	6,269 (2,119)	6,321 (1,201)

Table S12. Day of year when the sites turned into a net C sink on a calendar year basis.

Year	HEM	EMS	CC
1992	-	175	-
1993	-	197	-
1994	-	189	-
1995	-	179	-
1996	-	191	-
1997	-	193	-
1998	-	180	-
1999	-	170	-
2000	-	189	-
2001	-	174	-
2002	-	190	-
2003	-	187	-
2004	-	179	-
2005	89†	164	-
2006	21†	173	-
2007	99†	174	-
2008	101†	162	-
2009	92	187	-
2010	83	172	NA¶
2011	100	217	NA¶
2012	84†	176	NA¶
2013	105	174	166
2014	110‡	177	125
2015	135§	206	102
Mean (SD)	93 (28)	182 (13)	131 (32)

† During winter, the site turned repeatedly from a net C source to a net C sink and vice versa but became a consistent net C sink on the day of year listed.

‡ The site reverted back to a net C source on day 274 and was a net C source on a calendar year basis.

§ The site reverted back to a net C source on day 205 and was a net C source on a calendar year basis.

¶ The site never turned into a net C sink.

Table S13. Light-response curve parameters estimates (95% confidence interval) for July GPP as a function of photosynthetic photon flux density. α is the apparent quantum yield (mol mol^{-1}) and $A_{\max}$ is the ecosystem photosynthetic capacity (µmol C m^{-2} s^{-1}). Light-response curves were fitted using Eq. 3. Data were averaged within 50 µmol photon m^{-2} s^{-1} bins of PPFD.

Year	Hemlock tower		EMS tower		Clearcut tower	
	α	$A_{\max}$	α	$A_{\max}$	α	$A_{\max}$
1992	-	-	0.043 (0.030–0.056)	33.29 (26.36–40.42)	-	-
1993	-	-	0.052 (0.041–0.062)	32.02 (28.30–35.75)	-	-
1994	-	-	0.034 (0.023–0.045)	58.28 (31.46–85.11)	-	-
1995	-	-	0.059 (0.046–0.072)	39.21 (33.93–44.48)	-	-
1996	-	-	0.064 (0.049–0.080)	37.83 (32.68–42.98)	-	-
1997	-	-	0.051 (0.033–0.069)	40.63 (30.53–50.73)	-	-
1998	-	-	0.040 (0.033–0.048)	33.91 (28.94–38.89)	-	-
1999	-	-	0.055 (0.041–0.068)	35.77 (30.62–40.92)	-	-
2000	-	-	0.065 (0.053–0.078)	38.15 (34.02–42.27)	-	-
2001	-	-	0.067 (0.049–0.085)	39.95 (33.95–45.94)	-	-
2002	-	-	0.051 (0.040–0.062)	47.41 (39.16–55.66)	-	-
2003	-	-	0.069 (0.056–0.081)	44.77 (40.06–49.47)	-	-
2004	0.044 (0.029–0.058)	22.14 (18.50–25.79)	0.051 (0.032–0.069)	66.55 (35.94–97.16)	-	-
2005	0.071 (0.044–0.097)	26.36 (22.48–30.23)	0.079 (0.045–0.113)	42.89 (33.00–52.79)	-	-
2006	0.060 (0.047–0.072)	26.76 (24.41–29.11)	0.078 (0.053–0.104)	61.93 (47.97–75.90)	-	-
2007	0.051 (0.034–0.068)	27.05 (22.70–31.40)	0.064 (0.048–0.080)	42.36 (36.01–48.71)	-	-
2008	0.085 (0.043–0.127)	19.17 (16.54–21.81)	0.065 (0.048–0.083)	49.71 (39.95–59.47)	-	-
2009	0.090 (0.030–0.151)	23.95 (17.89–30.01)	0.061 (0.045–0.077)	45.98 (37.98–53.97)	0.014 (0.012–0.016)	25.27 (20.24–30.31)
2010	0.089 (0.051–0.127)	24.29 (21.00–27.58)	0.071 (0.054–0.088)	50.77 (42.80–58.74)	0.044 (0.034–0.053)	19.21 (17.45–20.97)
2011	0.039 (0.018–0.060)	20.32 (15.06–25.58)	0.052 (0.035–0.070)	56.19 (39.77–72.61)	0.037 (0.034–0.041)	30.59 (28.60–32.59)
2012	0.042 (0.026–0.058)	23.51 (18.79–28.24)	0.067 (0.045–0.090)	37.75 (31.56–43.94)	0.045 (0.040–0.050)	35.90 (33.42–38.38)
2013	0.054 (0.024–0.083)†	18.69 (14.96–22.41)†	0.074 (0.057–0.092)	39.46 (34.81–44.11)	0.041 (0.036–0.046)	44.34 (39.96–48.72)
2014	0.064 (0.039–0.089)†	26.57 (22.43–30.70)†	0.039 (0.018–0.060)	61.58 (27.66–95.50)	0.040 (0.036–0.043)	52.50 (48.33–56.68)
2015	0.044 (0.011–0.076)†	17.87 (12.28–23.46)†	0.053 (0.042–0.063)	45.38 (38.81–51.95)	0.044 (0.037–0.050)	64.68 (54.60–74.75)

†Clear visual signs of HWA-associated decline. Data not shown on Fig. 8a.

Figure S1. Diameter distribution of trees in all plots/years with individual tree growth measurements, showing that surviving trees tended to be larger than trees that died.

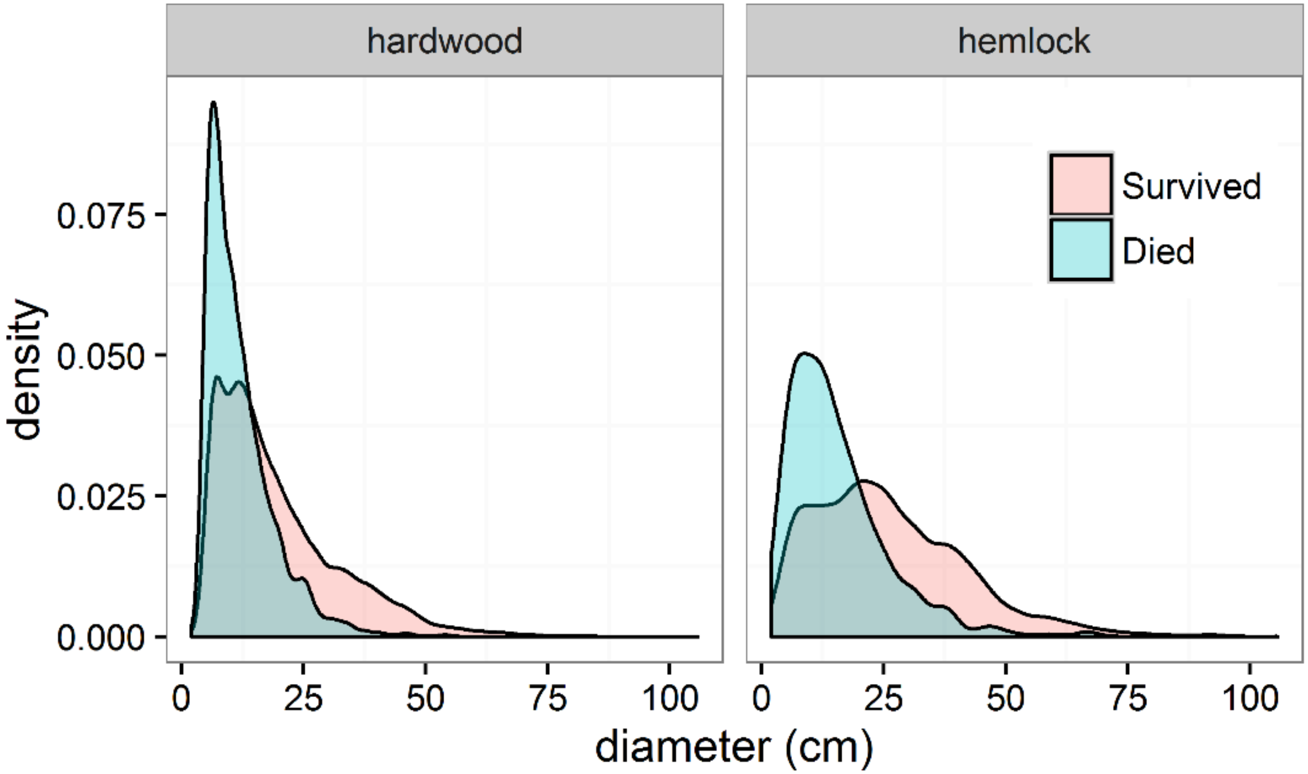


Figure S2. Annual net ecosystem production (a,d,g) and its component fluxes R_e (b,e,h) and GPP (c,f,i) estimated after filling gaps using the PI-preferred, the Fluxnet-Canada, and the Reichstein et al. (2005) methods for the EMS (a–c), HEM (d–f), and CC (g–i) flux towers. The PI-preferred for the EMS site is non-linear regression of temperature and light dependence. At the HEM site, multiple regression models using temperature, PPFD, and other variables were preferred in 2004–2007 and the Fluxnet-Canada method using a fixed *u** threshold in 2008–2015. The PI at the CC site preferred using a marginal distribution sampling method. Flux partitioning in both the Fluxnet-Canada and the Reichstein et al. (2005) methods is based on the estimation of R_e using a temperature function, which is then used to estimate GPP such as GPP = NEP + R_e. The uncertainty shown is caused by the *u** threshold selection. Star symbols represent years during which hemlocks were in decline.

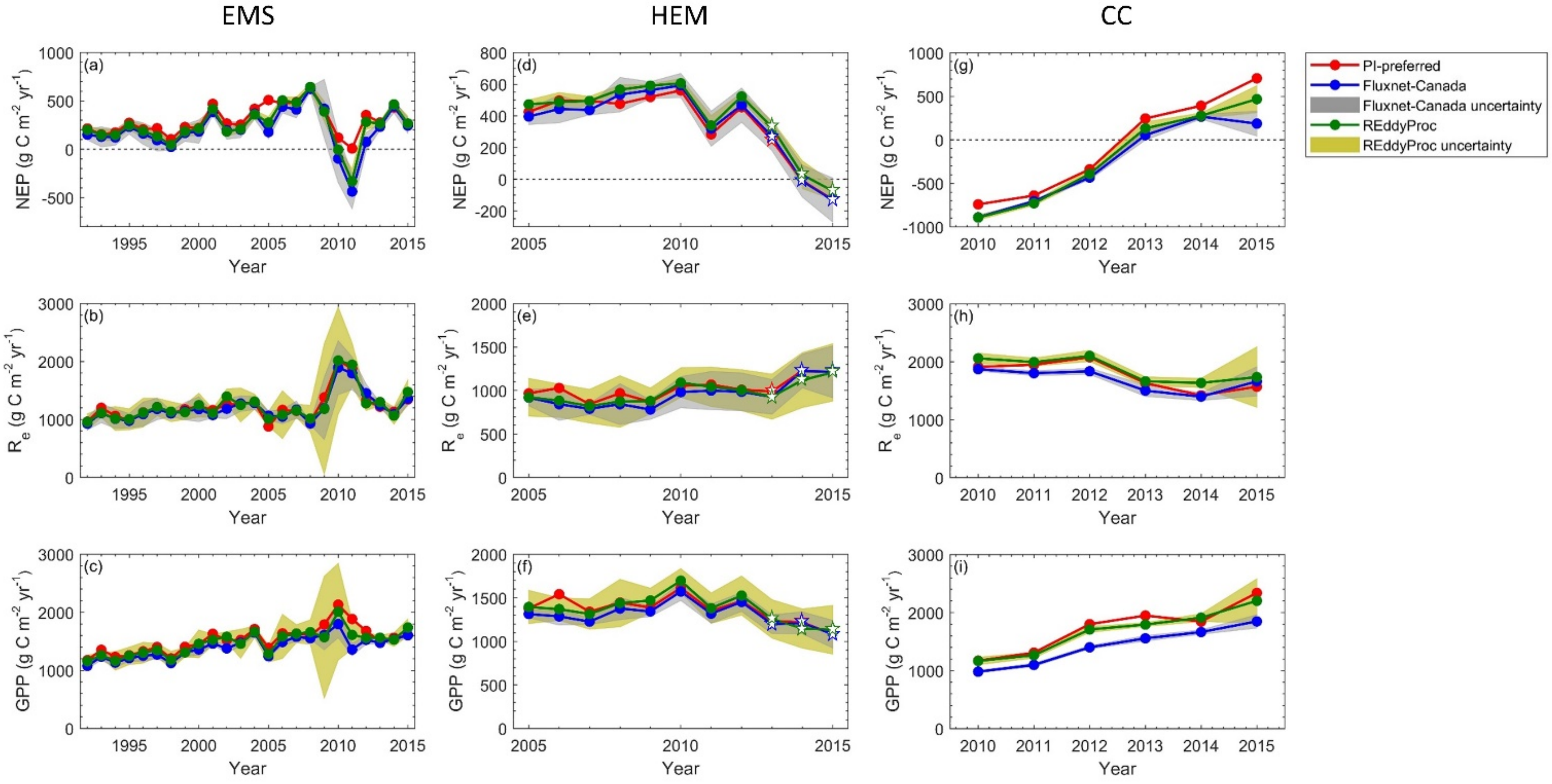


Figure S3. Light-response curve parameters estimates with 95% confidence intervals for July GPP as a function of photosynthetic photon flux density: (a) apparent quantum yield (α) and (b) ecosystem photosynthetic capacity (A_{max}). Light-responses curves were fitted using Eq. 3. Data were averaged within 50 μmol photon m^{-2} s^{-1} bins of PPFD.

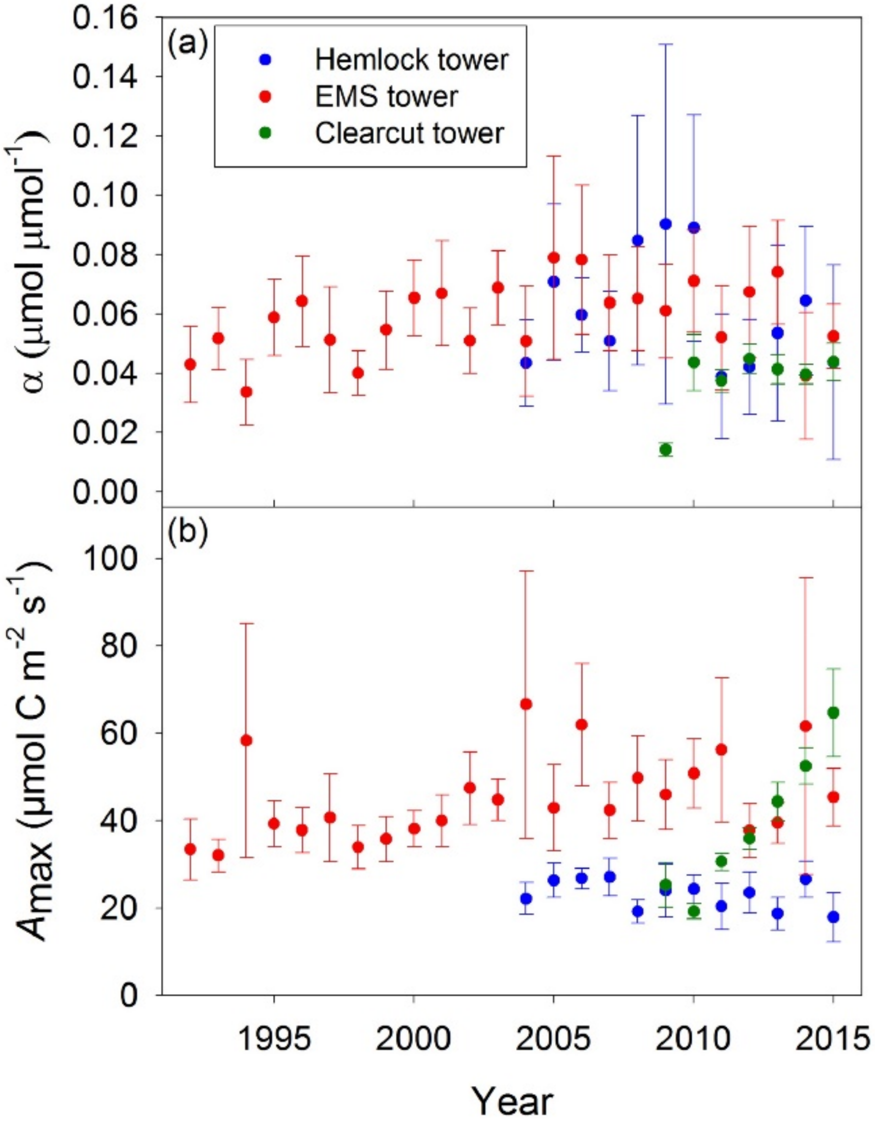


Figure S4. Average annual carbon loss to mortality for hardwood (top) and hemlock (bottom) plots, summarized by plot. Violin plots show variation in mortality among plots, and points indicate mean mortality per year. In many years, only one hemlock plot was measured, thus there is no variation to show.

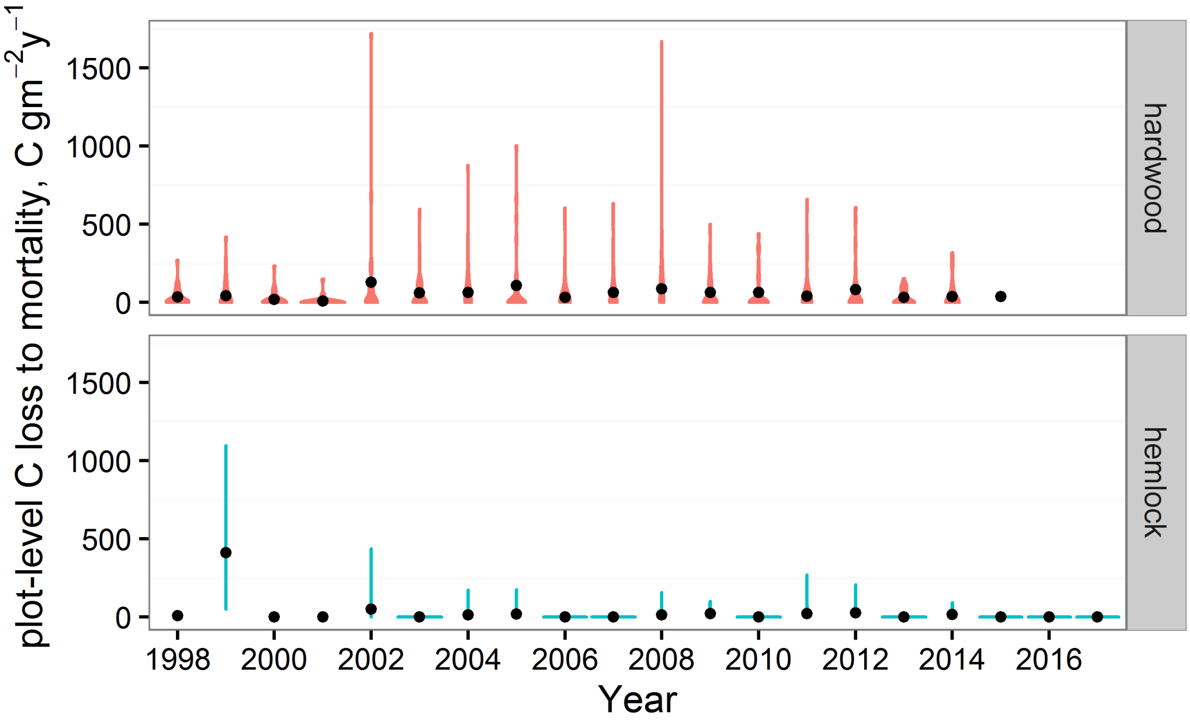


Figure S5. Dead wood pools for hardwood plots over time: (top), standing dead wood stocks; (middle), coarse woody debris (CWD, >7.5 cm diameter) stocks; (bottom), fine woody debris (FWD, <7.5 cm diameter). There was no trend over time in standing dead wood stocks. For CWD, the intercept 1411 ± 241 ($p < 0.001$), and slope −31.2 ± 15.7 ($p = 0.049$) were significant. For FWD, the intercept 112 ± 38 and slope 7.2 ± 2.5 were significant. For the EMS tower plots, CWD had a significantly positive slope (69 ± 30) in contrast to the overall hardwood trend, and no change over time in standing dead or FWD. There were insufficient hemlock-dominated sites to examine trends over time.

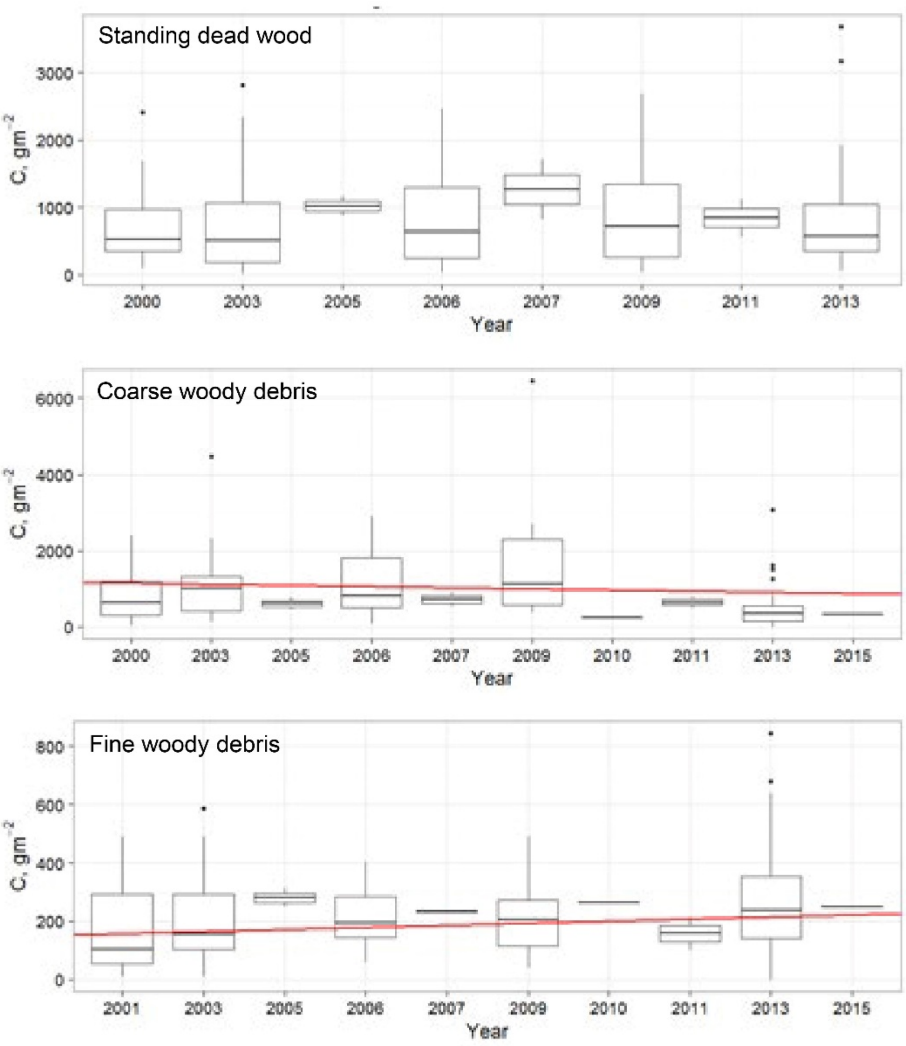
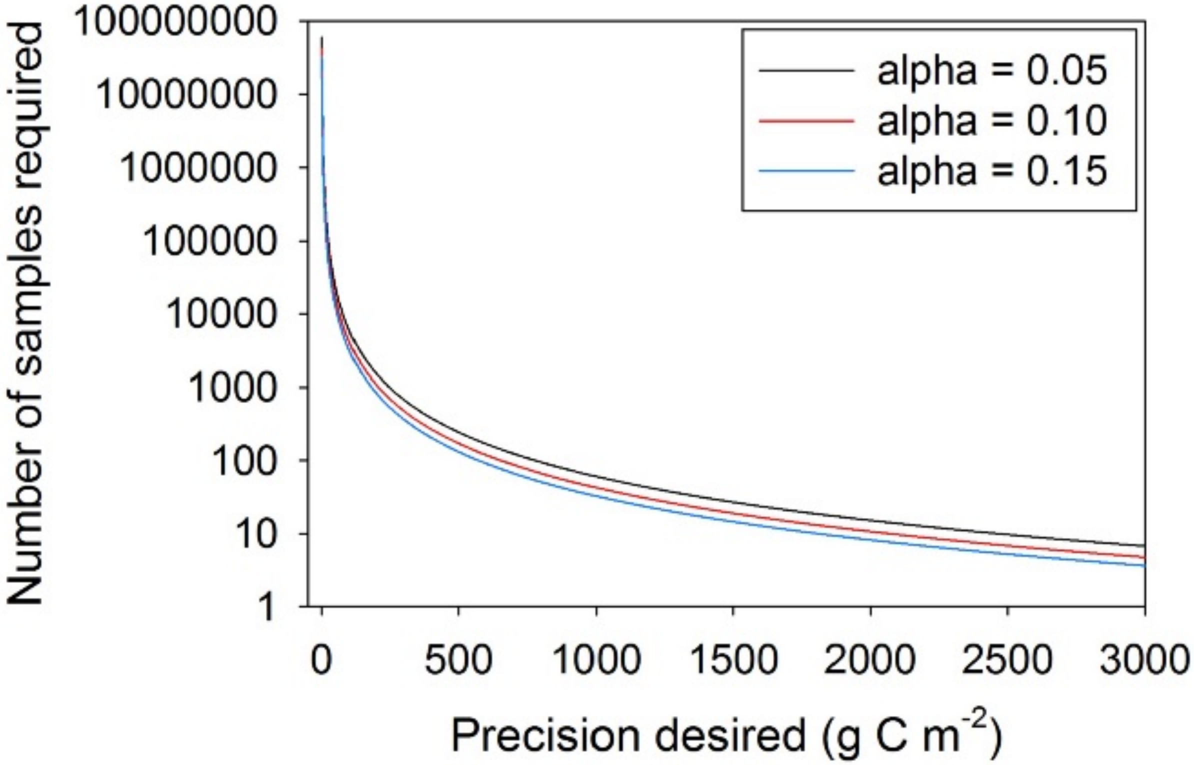


Figure S6. Number of samples required to detect a statistically significant given change in total soil organic C content.



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