Appendix. Supplementary tables.

Table S1. Variables and metrics used at SCBI as part of the annual mortality census.

Table S2. Allometric equations used to estimate aboveground biomass for woody species at the SCBI CTFS-ForestGEO plot.

Table S3. Net biomass change and components thereof at the SCBI CTFS-ForestGEO plot for the 5-year census period 2008-2013.

Table S4. Fitted Parameters for Size-Related Variation in Mortality (m) and Biomass Mortality (M).

Table S5. Species abundance and mortality rates for stems $\geq$ 10 cm at the SCBI CTFS-ForestGEO plot for each study census period.

Table S6. Fitted Parameters for Variation in Growth Rate between Live and Dead Trees.

Table S1. Variables and metrics used at SCBI as part of the annual mortality census.

Variable	Code	Condition
Stem condition	**A**	Tree alive
	DS	Tree dead, still standing
	DC	Tree dead, fallen
	DN	Tree presumed dead, not found
	PD	Tree dead in previous, most recent census
Crown position classes*	**D**	Canopy dominant
	C	Canopy codominant
	I	Intermediate
	S	Suppressed
	OG	Open grown
Crown condition	**1**	0-25% of the crown is intact (most of the crown is gone)
	2	26-50% of the crown is intact
	3	51-75% of the crown is intact
	4	76-100% of the crown is intact (none or few branches lost)
Liana load	**0**	lianas absent
	1	up to 25% of the tree crown covered by lianas
	2	26–50% liana cover
	3	51–75% liana cover
	4	76–100% liana cover
Factors associated with death (FADs)	**U**	Cause of death not evident
		Physical damage
	B	Broken (snapped trunk, bole breakage)
	UP	Uprooted tree (root bole exposed)
	S	Slope failure
	CR	Crushed by other tree or tree parts
	L	Lightning
	Fi	Fire
		Biological damage (pathogens/insects/plant diseases)
	F	Fungi
	K	Canker or swelling present.
	I	Insect infestation (e.g., bark beetles, beetles galleries).
	V	Vertebrate damage.

*DBH was used as a predictor of crown position for fallen dead trees.

Table S2. Allometric equations used to estimate aboveground biomass for woody species at the SCBI CTFS-ForestGEO plot.

Family	*Species*	Species code[1]	Equation[2]	a	b	Taxa[3]	Region[4]	Reference
Aceraceae	*Acer negundo*	acne	1	-2.0470	2.3852	F	NA	Chojnacky et al. 2014
Aceraceae	*Acer platanoides*	acpl	1	-2.0470	2.3852	F	NA	Chojnacky et al. 2014
Aceraceae	*Acer rubrum*	acru	2	2.0772	2.5080	Sp	WV	Jenkins et al. 2004
Simaroubaceae	*Ailanthus altissima*	aial	1	-2.4800	2.4835	mh	NA	Jenkins et al. 2004
Rosaceae	*Amelanchier arborea*	amar	1	7.217	1.514	Sp	TN	Jenkins et al. 2004
Annonaceae	*Asimina triloba*	astr	1	-2.4800	2.4835	mh	NA	Jenkins et al. 2004
Berberidaceae	*Berberis thunbergii*	beth	1	-2.4800	2.4835	mh	NA	Jenkins et al. 2004
Betulaceae	*Carpinus caroliniana*	caca	1	4.97	2.34	Sp	NH	Jenkins et al. 2004
Juglandaceae	*Carya cordiformis*	caco	2	1.9338	2.6209	G	WV	Jenkins et al. 2004
Juglandaceae	*Carya glabra*	cagl	2	1.9338	2.6209	G	WV	Jenkins et al. 2004
Juglandaceae	*Carya ovalis*	caovl	2	1.9338	2.6209	G	WV	Jenkins et al. 2004
Juglandaceae	*Carya tomentosa*	cato	2	1.9338	2.6209	G	WV	Jenkins et al. 2004
Fagaceae	*Castanea dentata*	cade	1	-2.0705	2.4410	F	NA	Chojnacky et al. 2014
Cannabaceae	*Celtis occidentalis*	ceoc	1	-2.4800	2.4835	mh	NA	Jenkins et al. 2004
Fabaceae	*Cercis canadensis*	ceca	1	-2.5095	2.5437	F	NA	Chojnacky et al. 2014
Oleaceae	*Chionanthus virginicus*	chvi	1	-2.4800	2.4835	mh	NA	Jenkins et al. 2004
Cornaceae	*Cornus alternifolia*	coal	1	-1.384	2.76	Sp	NC	Jenkins et al. 2004
Cornaceae	*Cornus florida*	cofl	1	-1.384	2.76	Sp	NC	Jenkins et al. 2004
Betulaceae	*Corylus americana*	coam	1	-2.4800	2.4835	mh	NA	Jenkins et al. 2004
Rosaceae	*Crataegus pruinosa*	crpr	1	*-2.2118*	2.4133	F	NA	Chojnacky et al. 2014
Ebenaceae	*Diospyros virginiana*	divi	1	-2.4800	2.4835	mh	NA	Jenkins et al. 2004
Elaeagnaceae	*Elaeagnus umbellata*	elum	1	-2.4800	2.4835	mh	NA	Jenkins et al. 2004
Celastraceae	*Euonymus alatus*	eual	1	-2.4800	2.4835	mh	NA	Jenkins et al. 2004
Fagaceae	*Fagus grandifolia*	fagr	2	2.0394	2.5715	Sp	WV	Jenkins et al. 2004
Oleaceae	*Fraxinus americana*	fram	2	2.3626	2.4798	Sp	WV	Jenkins et al. 2004
Oleaceae	*Fraxinus nigra*	frni	2	0.1634	2.3480	Sp	UGL	Ter-Mikaelian 1997
Oleaceae	*Fraxinus pennsylvanica*	frpe	2	0.1634	2.348	Sp	GAtCP	Ter-Mikaelian 1997
Hamamelidaceae	*Hamamelis virginiana*	havi	2	38.1110	2.9000	Sp	CAN	Smith et al. 1983
Aquifoliaceae	*Ilex verticillata*	ilve	2	53.4970	3.3400	Sp	CAN	Smith et al. 1983
Juglandaceae	*Juglans cinerea*	juci	1	-2.5095	2.5437	F	NA	Chojnacky et al. 2014
Juglandaceae	*Juglans nigra*	juni	1	-2.5095	2.5437	F	NA	Chojnacky et al. 2014
Lauraceae	*Lindera benzoin*	libe	1	*-2.2118*	2.4133	F	NA	Chojnacky et al. 2014
Magnoliaceae	*Liriodendron tulipifera*	litu	2	1.0259	2.7324	Sp	WV	Jenkins et al. 2004
Caprifoliaceae	*Lonicera maackii*	loma	2	51.9960	2.7700	Sp	CAN	Smith et al. 1983
Nyssaceae	*Nyssa sylvatica*	nysy	3	1.5416	1.2759	Sp	NC	Jenkins et al. 2004
Paulowniaceae	*Paulownia tomentosa*	pato	1	-2.4800	2.4835	mh	NA	Jenkins et al. 2004
Pinaceae	*Pinus pungens*	pipu	1	5.2831	2.0369	Sp	EUS	Jenkins et al. 2004
Pinaceae	*Pinus strobus*	pist	1	5.2831	2.0369	Sp	EUS	Jenkins et al. 2004
Pinaceae	*Pinus virginiana*	pivi	2	9.9340	2.9200	Sp	ID/MT	Smith et al. 1983
Platanaceae	*Platanus occidentalis*	ploc	3	2.49193	1.18881	Sp	P	Jenkins et al. 2004

Family	*Species*	Species code[1]	Equation[2]	a	b	Taxa[3]	Region[4]	Reference
Rosaceae	*Prunus avium*	prav	2	1.8082	2.6174	Sp	WV	Jenkins et al. 2004
Rosaceae	*Prunus persica*	prpe	2	1.8082	2.6174	Sp	WV	Jenkins et al. 2004
Rosaceae	*Prunus serotina*	prse	2	1.8082	2.6174	Sp	WV	Jenkins et al. 2004
Fagaceae	*Quercus alba*	qual	2	1.5647	2.6887	Sp	WV	Jenkins et al. 2004
Fagaceae	*Quercus coccinea*	quco	2	2.65743	2.43948	Sp	WV	Jenkins et al. 2004
Fagaceae	*Quercus falcata*	qufa	2	2.4601	2.4572	Sp	WV	Jenkins et al. 2004
Fagaceae	*Quercus michauxii*	qumi	2	1.5509	2.7276	Sp	WV	Jenkins et al. 2004
Fagaceae	*Quercus muehlenbergii*	qumu	2	1.5509	2.7276	Sp	WV	Jenkins et al. 2004
Fagaceae	*Quercus prinus*	qupr	2	1.5509	2.7276	Sp	WV	Jenkins et al. 2004
Fagaceae	*Quercus rubra*	quru	2	2.4601	2.4572	Sp	WV	Jenkins et al. 2004
Fagaceae	*Quercus velutina*	quve	2	2.1457	2.5030	Sp	WV	Jenkins et al. 2004
Fabaceae	*Robinia pseudoacacia*	rops	3	1.04649	1.37539	Sp	NC	Jenkins et al. 2004
Rosaceae	*Rosa multiflora*	romu	2	37.637	2.779	G	ID/MT	Smith et al. 1983
Rosaceae	*Rubus allegheniensis*	rual	2	43.9920	2.8600	Sp	ID/MT	Smith et al. 1983
Rosaceae	*Rubus pensilvanicus*	rupe	2	43.9920	2.8600	Sp	ID/MT	Smith et al. 1983
Rosaceae	*Rubus phoenicolasius*	ruph	2	43.9920	2.8600	Sp	ID/MT	Smith et al. 1983
Adoxaceae	*Sambucus canadensis*	saca	1	-2.4800	2.4835	mh	NA	Jenkins et al. 2004
Lauraceae	*Sassafras albidum*	saal	1	1.3539	1.3412	Sp	OH	Jenkins et al. 2004
Tiliaceae	*Tilia americana*	tiam	2	1.4416	2.7324	Sp	WV	Jenkins et al. 2004
Ulmaceae	*Ulmus americana*	ulam	2	0.0825	2.4680	Sp	UGL	Ter-Mikaelian 1997
Ulmaceae	*Ulmus rubra*	ulru	3	2.04282	1.25462	G	P	Jenkins et al. 2004
Adoxaceae	*Viburnum acerifolium*	viac	2	29.6150	3.2430	Sp	CAN	Smith et al. 1983
Adoxaceae	*Viburnum prunifolium*	vipr	2	29.6150	3.2430	Sp	CAN	Smith et al. 1983
Adoxaceae	*Viburnum recognitum*	vire	2	29.6150	3.2430	Sp	CAN	Smith et al. 1983

1. Species code used throughout this manuscript.
2. Aboveground biomass (bm) equation forms: (1) bm=exp(a+b*lnDBH), (2) bm=aD^b, and (3) bm=a(D^2)^b.
3. Species or species group for which allometry was developed. F: Family; G: Genus; Sp: Species; mh: mixed hardwood.
4. Location for which allometry was developed. CAN: Canada; EUS: Eastern U.S.; GAtCP: Gulf and Atlantic Coastal Plains; ID/MT: Idaho/Montana; NA: North America; NC: North Carolina; NH: New Hampshire; OH: Ohio; P: Piedmont Southeastern U.S.; TN: Tennessee; UGL: Upper Great Lakes; WV: West Virginia.

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Ter-Mikaelian M, Korzukhin M (1997) Biomass equations for sixty-five North American tree species. Forest Ecology and Management, 1–24.

Table S3. Net biomass change and components thereof at the SCBI CTFS-ForestGEO plot for the 5-year census period 2008-2013. Shown are data for all species and for three taxa with anomalously high mortality rates.

Taxa	Diameter class (cm)	Biomass 2008 (Mg ha^{-1})	Biomass 2013 (Mg ha^{-1})	Δ Biomass (Mg ha^{-1} yr^{-1})	$ANPP_{stem}$ (Mg ha^{-1} yr^{-1})	Biomass mortality (Mg ha^{-1} yr^{-1})	Recruitment (Mg ha^{-1} yr^{-1})
All	All	307	321	2.88	6.42	3.62	0.0835
All	1-10	4.29	4.49	0.0431	0.218	0.212	0.0371
All	10-30	28.2	28.4	0.0444	0.710	0.687	0.0210
All	30-50	70.6	75.0	0.938	1.73	0.793	0.00537
All	≥50	204	213	1.86	3.77	1.93	0.0200
Cercis canadensis	All	0.547	0.492	-0.0116	0.0201	0.0322	$4.57x10^{-4}$
Cercis canadensis	1-10	0.251	0.229	-0.00476	0.0104	0.0156	$4.57x10^{-4}$
Cercis canadensis	10-30	0.277	0.241	-0.00766	0.00893	0.0166	0
Cercis canadensis	30-50	0.0189	0.0226	$8.29x10^{-4}$	$8.29x10^{-4}$	0	0
Cercis canadensis	≥50	0	0	0	0	0	0
Ulmus rubra	All	1.74	0.608	-0.244	0.0151	0.262	0.00242
Ulmus rubra	1-10	0.150	0.103	-0.0102	0.00423	0.0146	$1.66x10^{-4}$
Ulmus rubra	10-30	1.21	0.474	-0.160	0.0105	0.173	0.00225
Ulmus rubra	30-50	0.299	0.0319	-0.0578	$3.63x10^{-4}$	0.0582	0
Ulmus rubra	≥50	0.0758	0	-0.0161	0	0.0161	0
Quercus spp.	All	109.5	110.4	0.173	2.16	1.99	0.00400
Quercus spp.	1-10	0.0838	0.151	0.0138	0.0178	0.00398	$2.52x10^{-5}$
Quercus spp.	10-30	3.41	3.44	0.00473	0.123	0.122	0.00397
Quercus spp.	30-50	20.0	21.2	0.246	0.585	0.339	0
Quercus spp.	≥50	86.1	85.7	-0.0913	1.43	1.52	0

Table S4. Fitted Parameters for Size-Related Variation in Mortality (*m*) and Biomass Mortality (*M*).

						ln (*a*)		*b*		*c*	
Equation	Census	min *D* (cm)	AICc	R^2	Adj. R^2	est. (95%CI)	p	est. (95%CI)	p	est. (95%CI)	p
Mortality rate (m)											
Eq. 2*	2008-13	1	16.4	0.83	0.82	2.24 (1.95, 2.52)	<0.001	-0.491 (-0.598, -0.383)	<0.001	-	-
		10	18.0	0.61	0.56	2.71 (1.37, 4.05)	0.001	-0.632 (-1.02, -0.247)	0.005	-	-
	2013-14	10	20.7	0.40	0.33	1.83 (0.123, 3.54)	0.04	-0.505 (-1.01, -0.002)	0.05	-	-
	2014-15	10	26.3	0.34	0.27	1.96 (-0.0154,3.93)	0.05	-0.544 (-1.11, 0.023)	0.06	-	-
Eq. S1**	2008-13	1	19.0	0.83	0.81	2.18 (1.83, 2.53)	<0.001	-0.433 (-0.656, -0.209)	<0.001	-0.003 (-0.015, 0.008)	0.54
		10	19.9	0.71	0.64	4.66 (1.72, 7.60)	0.006	-1.47 (-2.67, -0.269)	0.02	0.024 (-0.009, 0.056)	0.13
	2013-14	10	23.0	0.59	0.47	4.21 (0.655, 7.77)	0.03	-1.53 (-2.98, -0.080)	0.04	0.029 (-0.010, 0.068)	0.12
	2014-15	10	29.6	0.45	0.31	4.27 (-0.451, 8.99)	0.07	-1.53 (-3.45, 0.390)	0.10	0.028 (-0.024, 0.079)	0.25
Biomass mortality rate (M)											
Eq. 2*	2008-13	1	15.1	0.78	0.77	-4.76 (-5.05, -4.47)	<0.001	0.441 (0.326, 0.555)	<0.001	-	-
		10	-4.2	0.54	0.48	-4.00 (-4.52, -3.48)	<0.001	0.203 (0.0492, 0.358)	0.02	-	-
	2013-14	10	14.3	0.63	0.58	-6.18 (-7.72, -4.64)	<0.001	0.694 (0.219, 1.17)	0.01	-	-
	2014-15	10	25.0	0.36	0.28	-5.82 (-8.04, -3.60)	<0.001	0.610 (-0.0491, 1.27)	0.07	-	-

*Parameters correspond to relationships plotted in Fig. 3.

**Equation S1: $m = a\overline{D_0}^{b} exp^{c\overline{D_0}}$. Here, a, b, and c are fitted parameters, where a relatively high value for c gives a pronounced U-shaped fit and c=0 gives a power function.

Table S5. Species abundance and mortality rates for stems ≥ 10 cm at the SCBI CTFS-ForestGEO plot for each study census period.

	N live stems				Stem mortality rate (*m;* % yr^{-1}) (95% CI)			Biomass mortality (*M*; Mg ha^{-1} yr^{-1})*			Proportion of dead biomass (%)		
Species acronym	2008	2013	2014	2015	2008-13	2013-14	2014-15	2008 -13	2013 -14	2014-15	2008 -13	2013 -14	2014 -15
ulru	299	133	119	108	18.64 (16.21,21.21)	8.96 (5.41,14.46)	11.36 (6.47,19.25)	0.25	0.08	0.06	72.3	17.4	10.6
ceca	136	128	119	114	6.52 (4.74,8.81)	5.98 (3.18,11.0)	5.21 (1.71,11.73)	0.02	0.01	0.01	26.2	4.2	2.8
caca	231	255	250	250	3.09 (2.18,4.33)	1.44 (0.47,3.33)	0.00	0.01	0.01	0.00	10.3	2.2	0
quru	414	368	361	356	2.86 (2.19,3.72)	1.54 (0.75,3.15)	1.75 (0.57,4.04)	0.66	0.13	0.56	10.8	0.5	1.5
quve	328	290	282	277	2.71 (1.99,3.66)	2.24 (1.14,4.35)	2.24 (0.73,5.15)	0.52	0.53	0.88	8.4	2.3	2.5
qupr	264	236	231	226	2.63 (1.85,3.70)	1.70 (0.55,3.92)	2.74 (0.90,6.28)	0.27	0.03	0.30	8.4	0.3	1.6
fram	435	415	402	396	1.94 (1.41,2.64)	2.54 (1.49,4.30)	1.87 (0.86,4.01)	0.21	0.45	0.05	6.1	3.4	0.3
acru	186	190	186	184	1.65 (0.98,2.74)	1.65 (0.45,4.18)	1.35 (0.16,4.80)	0.03	0.02	0.03	5.6	1.2	1.1
juni	130	121	119	118	1.53 (0.80,2.86)	1.31 (0.16,4.65)	1.05 (0.03,5.70)	0.03	0.01	0.09	2.6	0.3	1.1
qual	421	396	394	390	1.49 (1.04,2.13)	0.41 (0.05,1.48)	1.28 (0.35,3.25)	0.47	0.02	0.44	6.1	0.1	0.9
tiam	139	131	128	128	1.26 (0.64,2.45)	1.70 (0.35,4.90)	0.00	0.03	0.05	0.00	5.1	2.4	0
cato	626	630	623	619	0.86 (0.58,1.26)	0.87 (0.42,1.79)	0.82 (0.22,2.08)	0.10	0.13	0.04	6.1	2.0	0.4
nysy	505	495	488	486	0.85 (0.55,1.30)	1.14 (0.55,2.34)	0.52 (.06,1.86)	0.04	0.03	0.02	5.9	1.1	0.4
cagl	769	773	765	759	0.81 (0.56,1.16)	0.84 (0.42,1.64)	0.99 (0.46,2.15)	0.08	0.15	0.06	2.8	1.4	0.3
litu	2278	2220	2203	2190	0.72 (0.57,0.90)	0.62 (0.38,0.98)	0.75 (0.44,1.27)	0.14	0.12	0.07	0.5	0.1	0.04
caovl	302	304	303	302	0.71 (0.39,1.30)	0.26 (0.01,1.45)	0.42 (0.01,2.31)	0.04	0.02	0.01	3.8	0.4	0.1
caco	218	231	228	226	0.60 (0.27,1.29)	1.04 (0.22,3.02)	1.10 (0.13,3.93)	0.02	0.02	0.09	2.2	0.4	1.4
fagr	279	308	308	308	0.16 (0.02,0.56)	0.00	0.00	0.04	0.00	0.00	7.0	0	0

*Biomass calculations based on *D* values measured in 2013 core census.

Table S6. Fitted Parameters for Variation in Growth Rate between Live and Dead Trees (Eq. 4, Fig 5).

		k			$\overline{g_{ref}}$ at D_{ref}=50		
Status	**R^2**	**est.**	**95% CI**	**P**	**est.**	**95% CI**	**P**
Live until 2015	0.94	0.207	0.169, 0.245	<0.001	0.397	0.365, 0.430	<0.001
Dead non-physical damages in 2014 or 2015	0.57	0.102	0.035, 0.169	0.007	0.166	0.109, 0.223	<0.001
Dead physical damage in 2014 or 2015	0.63	0.168	0.072, 0.265	0.003	0.268	0.185, 0.351	<0.001
All Dead in 2014 or 2015	0.76	0.126	0.073, 0.180	<0.001	0.208	0.163, 0.254	<0.001