Perry, KI, KF Wallin, JW Wenzel, and DA Herms. Forest disturbance and arthropods: Small-scale canopy gaps drive invertebrate community structure and composition, *Ecosphere*

Supporting Information

Appendix S1

Figure S1.
Gaps were created by girdling 8-12 canopy trees in the 30 × 30 m experimental quadrats using a chainsaw on 5-6 June 2014. A 2 cm wide ring (6-12 cm deep) was cut around the entire circumference of the trunk about 1.5 m above the ground and a second ring was cut approximately 20-30 cm below the first.

Figure S2.
Herbaceous plants, woody shrubs, seedlings, and saplings (≤ 2 cm stem diameter) in the understory were removed using mechanical weed trimmers (KM 110 R KombiMotor, Stihl, Inc.; Virginia Beach, VA) and loppers within the 30 × 30 m experimental quadrats on 5-7 June 2014 (Left: before understory removal; Right: after understory removal). Herbaceous vegetation residue remained on the forest floor in the quadrats, while all woody shrubs and saplings were removed and deposited in the surrounding forest away from the treatments.

Figure S3. Main effects for canopy decline of girdled trees by species (A) and vasculature structure (B) in the canopy gap treatment at Powdermill Nature Reserve, Rector, Pennsylvania, USA. A 1-5 health rating scale was used to assess canopy dieback over the three-year study. A rating of 1 on the scale corresponds to a full healthy canopy; a rating of 5 corresponds to a dead tree; ratings 2-4 corresponds to increasing stages of canopy thinning. A pre-treatment canopy rating was collected on 28 May 2014. Trees were girdled on 5-6 June 2014. Girdled tree species (number of individuals girdled) were American beech (*Fagus grandifolia* Ehrh.) (1), American basswood (*Tilia americana* L.) (2), yellow birch (*Betula alleghaniensis* Britton) (1), black cherry (*Prunus serotine* Ehrh) (2), slippery elm (*Ulmus rubra* Muhl.) (3), red maple (*Acer rebrum* L.) (16), silver maple (*Acer saccharinum* L.) (2), sugar maple (*Acer saccharum* Marsh.) (27), northern red oak (*Quercus rubra* L.) (7), white oak (*Quercus alba* L.) (5), cherrybark oak (*Quercus falcata* var. *pagodifolia* Ell.) (1), white ash (*Fraxinus americana* L.) (3), tulip poplar (*Liriodendron tulipifera* L.) (43), and shellbark hickory (*Carya laciniosa* (Michx. F.) Loud.) (4). Post-treatment canopy ratings were collected five times in 2014 (17 June, 1 July, 15 July, 12 August, and 9 September), and monthly in 2015 (10 June, 8 July, and 5 Aug). Tree taxa included in the 'Other' category were beech, birch, cherry, elm, and ash, and only 1-3 trees of each species were girdled.

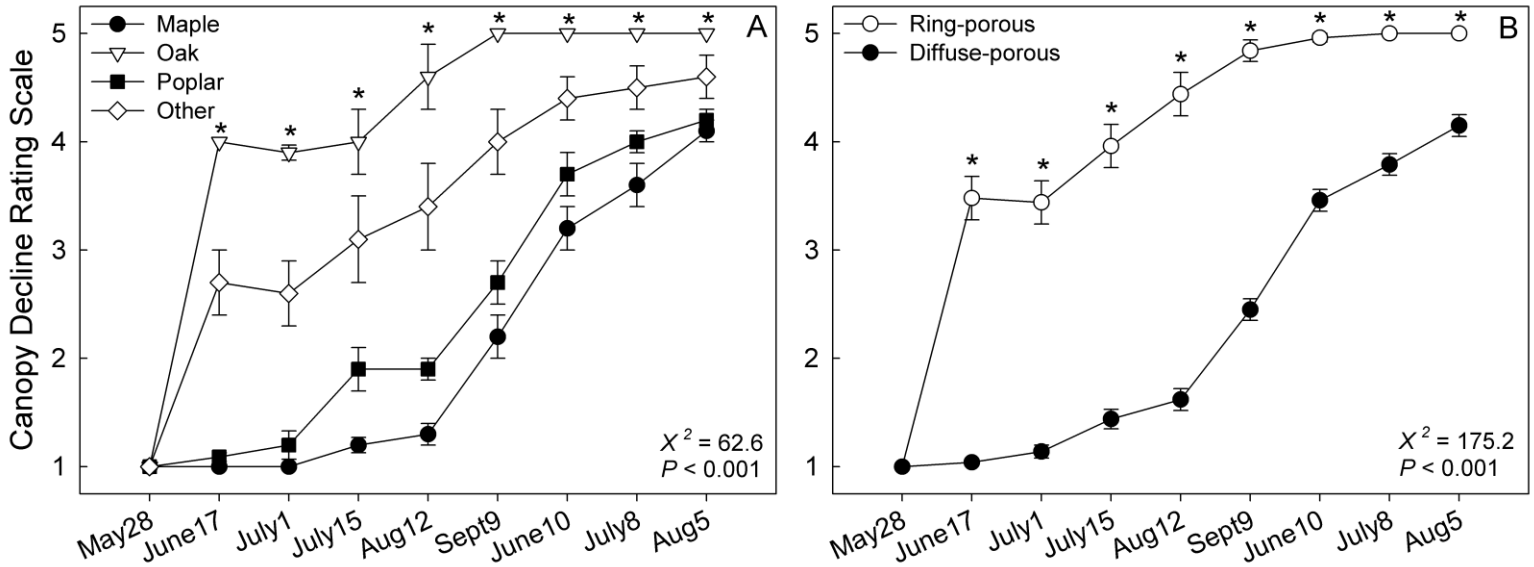

Figure S4. Percentage cover of ground-level vegetation in understory removed and understory undisturbed treatments at Powdermill Nature Reserve, Rector, Pennsylvania, USA. Measurements were collected once in July 2013 before the treatments were implemented. The understory was removed on 5-7 June 2014, and measurements were collected once per month in 2014 and 2015. Repeated measures ANOVA with Tukey's pairwise comparisons, asterisks denote significant differences ($\alpha = 0.05$).

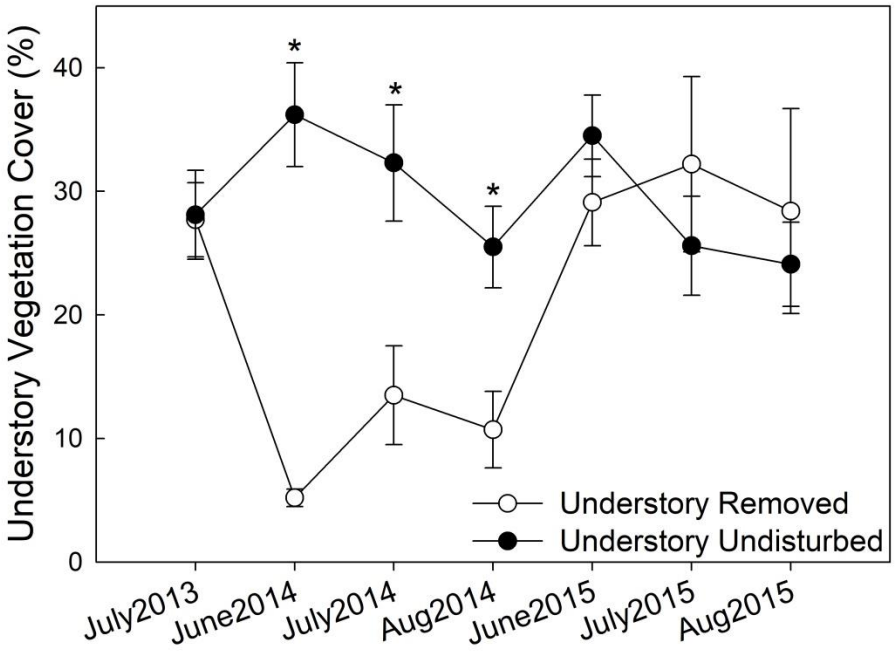

Table S1. Catches of insect species in the families Formicidae, Carabidae, Nitidulidae, Geotrupidae, Scarabaeidae, Trogidae, and Silphidae sampled with unbaited barrier pitfall traps in 2013-2015 at Powdermill Nature Reserve in Rector, Westmoreland County, Pennsylvania, USA. Vouchers for insect families identified to species were deposited at the Museum of Biological Diversity, The Ohio State University, Columbus, OH where each specimen was given a unique identifier label.

Order	Family	Subfamily	Species	2013	2014	2015	Total	Identifier Labels
Hymenoptera	Formicidae		*Aphaenogaster picea* (Wheeler)	2618	2494	2180	7292	OSUC 660352-495
			Amblyopone pallipes (Haldeman)	7	6	13	26	OSUC 661039-58
			Camponotus chromaiodes Bolton	0	0	1	1	OSUC 660846
			Camponotus pennsylvanicus (DeGeer)	258	184	185	627	OSUC 667472-607
			Formica dakotensis Emery	0	2	0	2	OSUC 667470-1
			Formica neogagates Viereck	0	1	0	1	OSUC 660843
			Formica pallidefulva Latreille	1	0	6	6	OSUC 660853-8
			Formica subintegra Wheeler	0	1	0	1	OSUC 660845
			Formica subsericea Say	63	51	71	185	OSUC 667608-62; 667963-96
			Lasius alienus (Foerster)	137	115	524	776	OSUC 660517-620
			Lasius nearcticus Wheeler	19	8	19	46	OSUC 660965-99
			Lasius umbratus (Nylander)	80	1000	35	1115	OSUC 660681-734
			Lasius subumbratus Viereck	0	0	1	1	OSUC 660842
			Leptothorax curvispinosus Mayr	0	2	1	3	OSUC 661059-62
			Leptothorax longispinosus Roger	8	16	10	34	OSUC 660735-66
			Leptothorax schaumii Roger	0	0	1	1	OSUC 660767
			Myrmecina americana Emery	181	115	205	501	OSUC 667997-8116
			Myrmica punctiventris Roger	172	57	97	326	OSUC 667863-955
			Ponera pennsylvanica Buckley	10	10	46	66	OSUC 661000-38
			Prenolepsis imparis (Say)	12	46	0	58	OSUC 660496-516
			Stenamma diecki-schmitti Emery, Wheeler	49	28	75	152	OSUC 660621-61; 660662-80
			Stenamma impar Forel	120	86	174	380	OSUC 660863-964
			Tapinoma sessile (Say)	7	0	0	7	OSUC 660848-52
Coleoptera	Carabidae		*Notiophilus aeneus* (Herbst)	4	11	10	25	OSUC 678043-58
			Sphaeroderus canadensis canadensis Chaudoir	1	3	8	12	OSUC 672270-311; 672316-20
			Sphaeroderus stenostomus lecontei Dejean	56	97	74	227	OSUC 677469-569
			Scaphinotus viduus (Dejean)	1	1	4	6	OSUC 671902-9
			Maronetus imperfectus (Horn)	0	5	2	7	OSUC 672852-9
			Scaphinotus andrewsii mutabilis (Casey)	0	0	1	1	OSUC 671898-901
			Carabus goryi Dejean	160	233	302	695	OSUC 671911-2031
			Trechus quadristriatus (Schrank)	1	0	0	1	OSUC 668394
			Bembidion graciliforme Hayward	0	0	2	2	OSUC 671691-2
			Patrobus longicornis (Say)	0	2	0	2	OSUC 671668
			Loxandrus spp.	0	1	3	4	OSUC 671687-90
			Poecilus lucublandus (Say)	28	1	3	32	OSUC 672434-48
			Lophoglossus scrutator (LeConte)	0	3	1	4	OSUC 671717-21
			Gastrellarius honestus (Say)	3	0	3	6	OSUC 668446-52
			Myas coracinus (Say)	10	6	0	16	OSUC 672618-32
			Myas cyanescens Dejean	7	4	1	12	OSUC 671722-30
			Pterostichus mutus (Say)	0	1	3	4	OSUC 671801-5
			Pterostichus trinarius (Casey)	0	2	9	11	OSUC 668397-405
			Pterostichus sayanus Csiki	0	3	4	7	OSUC 667852-62

	Pterostichus coracinus (Newman)	1	7	1	9	OSUC 672590-614
	Pterostichus lachrymosus (Newman)	49	77	52	178	OSUC 677787-880
	Pterostichus stygicus (Say)	75	210	89	374	OSUC 672036-110
	Pterostichus atratus (Newman)	33	6	1	40	OSUC 668428-43
	Pterostichus hamiltoni Horn	41	45	7	93	OSUC 677965-97
	Pterostichus moestus (Say)	46	41	60	147	OSUC 677574-694
	Pterostichus diligendus (Chaudoir)	8	22	5	35	OSUC 672410-29
	Pterostichus rostratus (Newman)	15	3	9	27	OSUC 677885-942
	Pterostichus adoxus (Say)	93	90	76	259	OSUC 671812-91
	Pterostichus tristis (Dejean)	34	19	7	60	OSUC 672117-63
	Cyclotrachelus fucatus (Freitag)	127	141	103	371	OSUC 672668-746
	Cyclotrachelus sigillatus (Say)	113	139	81	333	OSUC 672468-581
	Cyclotrachelus sodalis sodalis (LeConte)	37	37	14	88	OSUC 678000-10; 678013-40
	Chlaenius emarginatus Say	97	125	143	365	OSUC 672169-263
	Dicaelus politus Dejean	4	11	25	40	OSUC 671338-84
	Dicaelus sculptilis intricatus LeConte	6	11	18	35	OSUC 672829-49; 672451-7
	Dicaelus teter Bonelli	40	79	77	196	OSUC 677699-782
	Notiobia nitidipennis (LeConte)	2	2	4	8	OSUC 672651-65
	Notiobia terminata (Say)	1	2	0	3	OSUC 668408-12
	Xestonotus lugubris (Dejean)	1	0	0	1	OSUC 671670
	Anisodactylus agricola (Say)	0	0	1	1	OSUC 671681
	Amphasia interstitialis (Say)	15	2	26	43	OSUC 671046-86
	Harpalus spadiceus Dejean	0	0	1	1	OSUC 671685-6
	Selenophorus opalinus (LeConte)	0	0	1	1	OSUC 671684
	Trichotichnus vulpeculus (Say)	1	2	0	3	OSUC 671676-8
	Trichotichnus autumnalis (Say)	7	22	77	106	OSUC 671091-144
	Calathus gregarius (Say)	2	0	0	2	OSUC 671669
	Synuchus impunctatus (Say)	1	10	2	13	OSUC 671710-6
	Olisthopus parmatus (Say)	2	5	5	12	OSUC 672754-65
	Agonum retractum LeConte	0	0	2	2	OSUC 671696-8
	Agonum excavatum Dejean	1	0	0	1	NA[b]
	Agonum ferreum Haldeman	6	3	1	10	OSUC 671700-5
	Agonum fidele Casey	9	67	21	97	OSUC 671389-427
	Platynus decentis (Say)	4	3	6	13	OSUC 668453-62
	Platynus tenuicollis (LeConte)	39	20	7	66	OSUC 671747-83
	Platynus angustatus Dejean	176	270	17	463	OSUC 672323-401
	Platynus hypolithos (Say)	11	36	1	48	OSUC 672768-97
	Cymindis americana Dejean	0	1	0	1	OSUC 671667
	Cymindis limbata Dejean	1	1	0	2	OSUC 671665-6
	Apenes lucidula (Dejean)	6	12	1	19	OSUC 668413-26
Nitidulidae[a]	*Amphicrossus ciliatus* (Olivier)	0	1	-	1	OSUC 671709
	Carpophilus antiquus Melsheimer	2	0	-	2	NA[b]
	Carpophilus corticinus Erichson	44	9	-	53	OSUC 681265-83
	Carpophilus lugubris Murray	0	2	-	2	OSUC 681284-9
	Colopterus unicolor Erichson	0	1	-	1	OSUC 671708
	Epuraea aestiva (Illiger)	0	1	-	1	OSUC 671707
	Epuraea rufida (Melsheimer)	4	0	-	4	OSUC 671673-5
	Epuraea rufomarginata (Stephens)	2	0	-	2	OSUC 671706
	Glischrochilus fasciatus (Olivier)	20	2	-	22	OSUC 681290-6
	Glischrochilus sanguinolentus (Olivier)	227	138	-	365	OSUC 681318-71
	Glischrochilus quadrisignatus (Say)	30	10	-	40	OSUC 681297-317
	Pallodes pallidus (Palisot de Beauvois)	98	35	-	133	OSUC 681373-406
	Phenolia grossa (Fabricius)	50	2	-	52	OSUC 681407-13

		Stelidota geminata (Say)	628	569	-	1197	OSUC 681414-62; 681665-82
		Stelidota octomaculata (Say)	31	11	-	42	OSUC 681683-704
Geotrupidae		*Geotrupes balyi* Jekel	156	256	99	511	OSUC 671149-337
		Geotrupes semiopacus Jekel	516	387	1537	2440	OSUC 670863-1045
		Geotrupes splendidus (Fabricius)	137	152	313	602	OSUC 671432-646
		Geotrupes blackburnii Melsheimer	0	0	1	1	OSUC 671778
		Odonteus spp.	4	2	2	8	OSUC 668181-92
		Odonteus liebeckii (Wallis)	0	0	3	3	OSUC 668177-80
Scarabaeidae	Aphodiinae	*Dialytellus dialytoides* (Fall)	29	44	7	80	OSUC 668296-328
		Dialytes striatulus (Say)	9	17	6	32	OSUC 668331-90
		Dialytes truncates (Melsheimer)	2	0	0	2	OSUC 668395
	Dynastinae	*Xyloryctes jamaicensis* (Drury)	1	0	0	1	OSUC 667962
	Melolonthinae	*Dichelonyx diluta* (Fall)	1	0	0	1	OSUC 668193
		Phyllophaga longispina (Smith)	1	0	0	1	OSUC 667960-1
		Phyllophaga vilifrons (LeConte)	1	1	1	2	OSUC 667957-9
		Serica spp.	4	5	3	12	OSUC 668171-6
	Scarabaeinae	*Canthon chalcites* (Haldeman)	1	2	3	6	OSUC 667782-806
		Copris minutus (Drury)	13	36	13	62	OSUC 668117-70
		Onthophagus hecate (Panzer)	2	18	6	26	OSUC 668195-246
		Onthophagus orpheus (Fabricius)	3	24	11	38	OSUC 668249-92
		Onthophagus striatulus (Beauvois)	9	23	7	39	OSUC 667809-49
Trogidae		*Trox variolatus* Melsheimer	30	49	44	123	OSUC 667663-779
Silphidae		*Nicrophorus defodiens* Mannerheim	20	7	12	39	OSUC 660063-93
		Nicrophorus orbicollis Say	146	105	77	328	OSUC 660094-250
		Nicrophorus tomentosus Weber	37	33	9	79	OSUC 660768-841
		Nicrophorus sayi Castelnau	2	0	1	3	OSUC 660859-62
		Necrophila americana (Linnaeus)	18	9	24	51	OSUC 660256-351
		Oiceoptoma noveboracensis (Forster)	1	2	0	3	OSUC 660251-5
Number of Species			96	97	103	125	

[a]Nitidulidae were not identified to species in 2015
[b]No vouchers deposited

Table S2. Main effects of canopy and understory disturbance treatments on the forest floor microenvironment (mean ± SE) in forests at Powdermill Nature Reserve, Rector, Pennsylvania, USA. Repeated measures ANOVA, significant ($\alpha \leq 0.05$) *P* values in bold.

		Canopy Disturbance					Understory Vegetation Disturbance					C × U	
Microclimate Factor	Year	Canopy Gap	Closed Canopy	*df*	*F*	*P*	Understory Removed	Understory Present	*df*	*F*	*P*	*F*	*P*
Canopy Openness (%)	2013	8.2 ± 0.7	7.9 ± 0.6	1,21	0.75	0.396	8.3 ± 0.7	7.8 ± 0.6	1,21	0.82	0.375	0.56	0.460
	2014	10.2 ± 0.5	7.7 ± 0.2	1,21	16.8	**<0.001**	9.3 ± 0.6	8.2 ± 0.2	1,21	0.63	0.435	0.05	0.824
	2015	16.2 ± 0.7	8.8 ± 0.2	1,21	50.8	**<0.001**	13.8 ± 0.9	10.2 ± 0.4	1,21	1.80	0.194	1.48	0.238
Understory Vegetation Cover (%)	2013	30.3 ± 3.3	27.6 ± 3.5	1,21	0.57	0.459	27.7 ± 3.0	28.1 ± 3.6	1,21	1.72	0.203	0.01	0.937
	2014	21.8 ± 3.0	24.1 ± 2.6	1,21	1.78	0.249	9.8 ± 1.7	31.3 ± 2.4	1,21	12.2	**0.002**	6.01	**0.023**
	2015	39.7 ± 3.7	22.2 ± 1.6	1,21	16.9	**<0.001**	29.9 ± 3.7	28.1 ± 2.1	1,21	0.01	0.921	2.40	0.135
Understory Vegetation Height (m)	2013	0.17 ± 0.03	0.21 ± 0.02	1,21	0.00	0.982	0.18 ± 0.03	0.20 ± 0.03	1,21	0.18	0.672	0.24	0.630
	2014	0.23 ± 0.03	0.14 ± 0.01	1,21	9.31	**0.006**	0.15 ± 0.02	0.20 ± 0.01	1,21	4.24	**0.050**	0.00	0.967
	2015	0.33 ± 0.03	0.27 ± 0.02	1,21	8.31	**0.008**	0.24 ± 0.02	0.32 ± 0.02	1,21	1.34	0.259	0.05	0.819
Soil Temperature (°C)	2013	18.8 ± 0.2	19.2 ± 0.2	1,24	0.98	0.331	18.7 ± 0.3	19.2 ± 0.2	1,24	0.02	0.878	0.30	0.586
	2014	19.6 ± 0.2	19.4 ± 0.2	1,24	1.91	0.183	19.9 ± 0.2	19.2 ± 0.2	1,24	8.01	**0.011**	3.38	0.082
	2015	19.8 ± 0.2	19.3 ± 0.2	1,24	2.80	0.104	20.1 ± 0.2	19.2 ± 0.1	1,24	5.19	**0.032**	3.71	0.066
Soil Moisture (%)	2013	0.714 ± 0.03	0.674 ± 0.02	1,24	0.95	0.340	0.695 ± 0.03	0.683 ± 0.2	1,24	1.68	0.207	3.08	0.091
	2014	0.692 ± 0.02	0.545 ± 0.02	1,24	11.3	**0.002**	0.596 ± 0.02	0.593 ± 0.02	1,24	1.67	0.205	0.24	0.626
	2015	0.734 ± 0.02	0.637 ± 0.01	1,24	5.16	**0.042**	0.654 ± 0.02	0.677 ± 0.02	1,24	2.27	0.145	3.93	0.059
Leaf Litter Cover (%)	2013	44.5 ± 4.9	54.0 ± 3.6	1,21	2.11	0.161	47.7 ± 5.0	50.8 ± 3.8	1,21	0.32	0.575	0.64	0.431
	2014	50.1 ± 2.5	60.5 ± 2.8	1,21	7.30	**0.013**	73.1 ± 2.2	51.6 ± 2.1	1,21	9.55	**0.005**	3.02	0.096
	2015	43.6 ± 3.5	60.6 ± 1.8	1,21	12.2	**0.002**	53.9 ± 3.6	54.4 ± 2.2	1,21	0.09	0.765	0.51	0.482
Leaf Litter Depth (mm)	2013	-	-	-	-	-	-	-	-	-	-	-	-
	2014	0.5 ± 0.1	1.0 ± 0.1	1,27	4.82	**0.046**	0.6 ± 0.1	0.8 ± 0.1	1,21	0.18	0.676	0.14	0.716
	2015	-	-	-	-	-	-	-	-	-	-	-	-
Bare Ground Cover (%)	2013	4.5 ± 2.0	6.1 ± 1.5	1,21	0.29	0.595	4.1 ± 2.0	6.5 ± 1.5	1,21	0.46	0.506	3.17	0.089
	2014	5.1 ± 1.1	4.3 ± 0.7	1,21	0.26	0.618	6.4 ± 1.3	3.5 ± 0.5	1,21	4.44	**0.047**	0.84	0.370
	2015	6.1 ± 1.1	3.9 ± 0.7	1,21	1.02	0.323	5.2 ± 1.0	4.4 ± 0.7	1,21	0.04	0.844	0.37	0.552
Fine Woody Debris (%)	2013	7.9 ± 0.8	7.4 ± 0.6	1,21	0.33	0.570	6.6 ± 0.8	8.7 ± 0.6	1,21	3.62	0.070	0.10	0.760
	2014	6.8 ± 0.5	6.2 ± 0.3	1,21	0.17	0.683	6.7 ± 0.3	6.2 ± 0.3	1,21	0.00	0.970	3.71	0.067
	2015	6.5 ± 1.1	6.7 ± 0.4	1,21	1.11	0.304	7.7 ± 1.1	6.0 ± 0.4	1,21	0.42	0.525	1.54	0.228
Coarse Woody Debris (CWD) (%)	2013	6.2 ± 1.5	5.1 ± 1.1	1,21	0.15	0.705	7.5 ± 1.5	3.8 ± 1.2	1,21	3.28	0.084	0.01	0.918
	2014	3.5 ± 0.7	2.8 ± 0.7	1,21	2.42	0.134	2.1 ± 0.5	3.7 ± 0.7	1,21	0.01	0.937	0.15	0.698
	2015	3.9 ± 0.9	3.5 ± 0.7	1,21	0.44	0.513	1.1 ± 0.3	5.2 ± 0.8	1,21	3.03	0.096	0.06	0.813
Rock Cover (%)	2013	2.4 ± 1.4	2.2 ± 1.0	1,21	0.02	0.880	1.7 ± 1.4	2.9 ± 1.0	1,21	0.28	0.599	0.78	0.387
	2014	1.9 ± 0.6	2.4 ± 0.6	1,21	0.06	0.813	1.6 ± 0.5	2.6 ± 0.6	1,21	0.11	0.744	0.11	0.739
	2015	1.0 ± 0.2	1.8 ± 0.3	1,21	0.93	0.344	1.7 ± 0.4	1.4 ± 0.2	1,21	0.12	0.728	0.54	0.471
CWD Volume ($m^3\ m^{-2}$)	2014	45.0 ± 15.2	28.24 ± 7.4	1,28	1.04	0.315	31.7 ± 10.3	36.2 ± 10.2	1,28	0.42	0.521	0.65	0.428

Table S3. Main effects of canopy and understory disturbance treatments on activity-abundances (mean ± SE) of ground-dwelling invertebrate taxa collected in forests at Powdermill Nature Reserve, Rector, Pennsylvania, USA in 2013-2015. Repeated measures ANOVA, significant ($\alpha \leq 0.05$) *P* values in bold. Analyses were conducted for taxa with ≥ 20 individuals collected per year.

			Canopy Disturbance				Understory Vegetation Disturbance				Gap × Veg	
Taxon	Year	*df*	Canopy Gap	Closed Canopy	*F*	*P*	Understory Removed	Understory Present	*F*	*P*	*F*	*P*
Annelida	2013	1,18	0.2 ± 0.06	0.2 ± 0.05	0.80	0.382	0.1 ± 0.04	0.3 ± 0.06	1.63	0.217	0.82	0.375
	2014	1,20	0.2 ± 0.04	0.2 ± 0.04	0.00	0.990	0.2 ± 0.06	0.2 ± 0.04	0.53	0.474	0.17	0.682
	2015	1,20	0.3 ± 0.1	0.3 ± 0.05	2.65	0.122	0.3 ± 0.06	0.3 ± 0.07	0.00	0.979	0.40	0.537
Snail	2013	1,18	1.3 ± 0.1	1.4 ± 0.1	0.02	0.901	1.4 ± 0.1	1.4 ± 0.1	0.04	0.843	0.35	0.562
	2014	1,20	1.4 ± 0.1	1.0 ± 0.1	0.86	0.364	1.4 ± 0.1	1.1 ± 0.1	0.00	0.946	1.69	0.207
	2015	1,20	3.3 ± 0.3	2.4 ± 0.2	0.03	0.871	2.8 ± 0.3	2.6 ± 0.2	0.21	0.649	4.74	**0.040**
Slug	2013	1,18	0.1 ± 0.02	0.1 ± 0.03	0.90	0.356	0.1 ± 0.03	0.1 ± 0.03	0.32	0.579	0.47	0.502
	2014	1,20	0.2 ± 0.1	0.3 ± 0.1	0.12	0.727	0.1 ± 0.04	0.4 ± 0.1	1.41	0.248	0.95	0.341
	2015	1,20	0.1 ± 0.08	0.2 ± 0.04	0.05	0.822	0.1 ± 0.06	0.2 ± 0.05	0.00	0.971	5.74	**0.025**
Geophilomorpha	2013	1,18	0.2 ± 0.07	0.1 ± 0.04	0.00	0.950	0.2 ± 0.04	0.2 ± 0.04	0.17	0.685	0.23	0.640
	2014	1,20	0.2 ± 0.06	0.2 ± 0.03	0.01	0.914	0.2 ± 0.05	0.2 ± 0.04	0.48	0.495	0.34	0.568
	2015		-	-	-	-	-	-	-	-	-	-
Lithobiomorpha	2013	1,18	0.7 ± 0.5	0.3 ± 0.07	0.02	0.878	0.3 ± 0.07	0.6 ± 0.3	0.00	0.964	0.01	0.934
	2014	1,20	0.3 ± 0.09	0.3 ± 0.1	1.21	0.284	0.5 ± 0.1	0.3 ± 0.09	5.09	**0.034**	2.14	0.157
	2015	1,20	0.4 ± 0.1	0.5 ± 0.07	0.03	0.859	0.6 ± 0.1	0.5 ± 0.06	0.70	0.413	0.00	0.968
Scolopendromorpha	2013	1,18	0.1 ± 0.05	0.2 ± 0.04	1.64	0.216	0.2 ± 0.05	0.2 ± 0.04	0.49	0.493	1.05	0.319
	2014	1,20	0.1 ± 0.06	0.1 ± 0.09	1.23	0.280	0.1 ± 0.04	0.2 ± 0.09	3.06	0.094	1.99	0.173
	2015	1,20	0.2 ± 0.1	0.06 ± 0.02	0.02	0.899	0.2 ± 0.1	0.1 ± 0.02	1.41	0.252	0.18	0.680
Abacionidae	2013		-	-	-	-	-	-	-	-	-	-
	2014	1,20	0.4 ± 0.02	0.3 ± 0.2	0.08	0.778	0.4 ± 0.3	0.1 ± 0.001	1.35	0.258	2.26	0.147
	2015		-	-	-	-	-	-	-	-	-	-
Caseyidae	2013	1,18	0.5 ± 0.1	0.6 ± 0.1	0.49	0.494	0.5 ± 0.1	0.6 ± 0.1	0.29	0.597	1.08	0.312
	2014	1,20	3.5 ± 0.5	1.6 ± 0.02	4.99	**0.034**	3.6 ± 0.5	1.4 ± 0.1	4.55	**0.042**	6.74	**0.016**
	2015	1,20	1.3 ± 0.3	0.4 ± 0.1	7.51	**0.011**	0.6 ± 0.1	0.8 ± 0.1	0.14	0.710	0.04	0.850
Julidae	2013	1,18	0.1 ± 0.08	0.1 ± 0.03	0.01	0.911	0.1 ± 0.07	0.1 ± 0.04	1.86	0.189	0.26	0.614
	2014	1,20	1.8 ± 0.4	1.6 ± 0.2	0.11	0.747	1.7 ± 0.5	1.6 ± 0.3	0.12	0.731	6.29	**0.018**
	2015	1,20	2.1 ± 0.1	1.9 ± 0.2	0.05	0.830	1.4 ± 0.2	1.7 ± 0.3	0.10	0.754	1.36	0.259
Parajulidae	2013	1,18	1.5 ± 0.2	2.9 ± 0.5	1.44	0.246	1.9 ± 0.4	2.6 ± 0.4	0.64	0.434	0.21	0.649
	2014	1,20	3.7 ± 0.6	5.2 ± 0.7	0.50	0.486	4.2 ± 0.7	4.9 ± 0.7	0.02	0.880	6.04	**0.022**
	2015	1,20	4.5 ± 0.6	5.4 ± 0.7	0.09	0.762	4.3 ± 0.5	5.6 ± 0.8	0.39	0.540	0.23	0.636
Spirobolidae	2013	1,18	2.6 ± 0.3	3.8 ± 0.4	0.08	0.776	2.8 ± 0.4	3.8 ± 0.4	0.51	0.484	0.02	0.903
	2014	1,20	0.5 ± 0.1	0.4 ± 0.07	0.79	0.384	0.3 ± 0.08	0.4 ± 0.08	2.39	0.137	7.67	**0.010**
	2015	1,20	0.6 ± 0.1	0.5 ± 0.1	0.00	0.981	0.7 ± 0.1	0.4 ± 0.09	0.32	0.580	2.99	0.101
Paradoxosomatidae	2013	1,18	10.9 ± 4.4	8.7 ± 2.0	1.28	0.272	5.1 ± 1.2	12.2 ± 3.2	2.37	0.141	1.75	0.117

	2014	1,20	29.0 ± 5.4	19.4 ± 2.6	0.94	0.343	24.3 ± 3.5	22.3 ± 3.6	0.23	0.639	3.54	0.073
	2015	1,20	12.1 ± 3.3	6.7 ± 1.9	4.84	**0.038**	7.4 ± 2.2	9.1 ± 2.3	0.01	0.927	0.07	0.789
Polydesmidae	2013	1,18	1.5 ± 0.2	1.6 ± 0.3	2.66	0.120	1.2 ± 0.2	1.8 ± 0.3	0.63	0.436	0.37	0.548
	2014	1,20	17.8 ± 3.7	13.0 ± 2.3	0.78	0.386	15.3 ± 2.9	14.5 ± 2.7	0.06	0.805	4.65	**0.042**
	2015	1,20	15.4 ± 2.7	14.7 ± 1.8	2.73	0.117	16.8 ± 1.1	15.7 ± 2.5	0.09	0.766	0.02	0.894
Xystomatidae	2013	1,18	0.1 ± 0.03	0.1 ± 0.03	0.44	0.513	0.1 ± 0.04	0.1 ± 0.02	1.24	0.292	1.66	0.213
	2014		-	-	-	-	-	-	-	-	-	-
	2015		-	-	-	-	-	-	-	-	-	-
Choctellidae	2013	1,18	0.2 ± 0.01	0.16 ± 0.06	1.33	0.263	0.1 ± 0.05	0.1 ± 0.05	0.12	0.734	0.82	0.765
	2014		-	-	-	-	-	-	-	-	-	-
	2015		-	-	-	-	-	-	-	-	-	-
Isopoda	2013	1,18	1.1 ± 0.2	0.6 ± 0.1	1.39	0.254	0.3 ± 0.1	1.1 ± 0.2	0.60	0.449	1.83	0.193
	2014	1,20	1.4 ± 0.6	1.4 ± 0.4	0.00	0.982	0.3 ± 0.1	2.1 ± 0.6	0.07	0.787	1.37	0.255
	2015	1,20	1.2 ± 0.3	0.4 ± 0.1	5.34	**0.033**	0.2 ± 0.07	0.9 ± 0.2	2.00	0.175	3.10	0.096
Araneae	2013	1,18	10.1 ± 0.8	12.0 ± 1.1	0.01	0.943	10.8 ± 1.0	11.5 ± 1.0	0.01	0.928	1.01	0.328
	2014	1,20	12.7 ± 1.9	9.3 ± 0.9	0.30	0.592	11.4 ± 1.5	10.1 ± 1.2	2.09	0.162	0.49	0.491
	2015	1,20	15.4 ± 1.4	10.5 ± 0.6	4.04	**0.050**	15.4 ± 1.5	10.5 ± 0.6	0.76	0.396	0.29	0.597
Opiliones	2013	1,18	0.4 ± 0.09	0.3 ± 0.07	0.58	0.457	0.4 ± 0.1	0.3 ± 0.1	0.83	0.375	0.01	0.912
	2014	1,20	1.7 ± 0.3	0.8 ± 0.1	0.00	0.973	2.0 ± 0.4	0.6 ± 0.1	0.64	0.431	2.47	0.130
	2015	1,20	3.4 ± 0.7	1.8 ± 0.2	2.87	0.108	4.1 ± 0.8	1.4 ± 0.2	2.39	0.140	0.95	0.342
Pseudoscorpiones	2013		-	-	-	-	-	-	-	-	-	-
	2014		-	-	-	-	-	-	-	-	-	-
	2015	1,20	0.7 ± 0.2	0.4 ± 0.1	0.41	0.531	0.6 ± 0.2	0.4 ± 0.1	0.00	0.990	1.76	0.201
Neanuridae	2013	1,18	14.2 ± 1.8	12.6 ± 1.1	0.01	0.907	12.9 ± 1.7	13.4 ± 1.2	0.44	0.516	1.42	0.213
	2014	1,20	5.7 ± 0.9	6.1 ± 1.1	1.75	0.200	7.6 ± 1.4	5.0 ± 0.8	3.95	0.057	2.73	0.113
	2015	1,20	6.1 ± 1.1	6.4 ± 0.7	0.21	0.650	8.1 ± 1.2	5.4 ± 0.6	1.07	0.315	1.20	0.288
Hypogastruridae	2013	1,18	143 ± 24.9	100 ± 12.7	0.01	0.937	112.3 ± 21.8	118.5 ± 14.7	0.01	0.929	1.48	0.240
	2014	1,20	53.7 ± 11.1	45.4 ± 9.5	0.53	0.472	60.6 ± 11.7	41.3 ± 9.2	0.26	0.616	5.38	**0.035**
	2015	1,20	34.9 ± 7.7	29.5 ± 4.2	0.35	0.563	50.3 ± 9.5	21.8 ± 2.9	5.53	**0.033**	0.00	0.954
Isotomidae	2013	1,18	26.6 ± 7.4	19.7 ± 1.9	0.62	0.441	16.3 ± 2.2	25.8 ± 4.6	0.01	0.906	0.03	0.869
	2014	1,20	93.7 ± 33	48.3 ± 16.6	0.88	0.359	72.2 ± 29.1	61.2 ± 19.2	0.28	0.605	4.04	**0.050**
	2015	1,20	34.0 ± 5.3	20.3 ± 5.3	5.34	**0.033**	33.4 ± 9.5	20.6 ± 3.5	2.00	0.175	3.10	0.096
Tomoceridae	2013	1,18	29.6 ± 2.5	32.2 ± 1.9	0.10	0.750	33.1 ± 2.8	30.1 ± 1.7	0.24	0.627	0.01	0.931
	2014	1,20	81.7 ± 12.2	44.1 ± 3.2	0.24	0.630	82.8 ± 12.1	43.5 ± 3.3	0.24	0.628	1.27	0.272
	2015	1,20	136 ± 15.1	64.7 ± 5.7	12.6	**0.002**	99.7 ± 12.0	83.1 ± 8.1	0.04	0.847	0.03	0.871
Entomobryidae	2013	1,18	3.3 ± 0.5	2.4 ± 0.4	0.68	0.420	4.4 ± 0.7	2.7 ± 0.3	2.50	0.131	0.19	0.664
	2014	1,20	7.6 ± 2.1	5.1 ± 0.9	0.58	0.454	10.7 ± 2.3	3.2 ± 0.7	6.94	**0.013**	0.46	0.506
	2015	1,20	18.0 ± 3.0	18.7 ± 3.0	0.20	0.661	18.1 ± 2.9	18.7 ± 3.1	0.00	0.985	0.51	0.486
Dicyrtomidae	2013	1,18	24.9 ± 2.6	22.0 ± 1.6	0.57	0.460	28.4 ± 2.7	19.9 ± 6.5	1.91	0.086	1.62	0.219

	2014	1,20	34.7 ± 3.5	21.5 ± 1.5	8.62	**0.007**	30.9 ± 2.8	23.8 ± 2.1	2.60	0.121	3.52	0.074
	2015	1,20	24.1 ± 2.7	32.2 ± 2.6	0.09	0.771	24.2 ± 2.7	32.1 ± 2.6	0.52	0.481	0.00	0.949
Katiannidae	2013	1,18	1.1 ± 0.3	1.2 ± 0.1	1.94	0.180	1.4 ± 0.2	1.1 ± 0.2	0.05	0.826	1.21	0.285
	2014	1,20	0.7 ± 0.1	0.4 ± 0.09	5.93	**0.023**	0.7 ± 0.1	0.4 ± 0.08	2.09	0.162	0.80	0.381
	2015	1,20	2.3 ± 0.5	2.0 ± 0.4	0.84	0.372	2.4 ± 0.6	1.9 ± 0.4	0.54	0.471	0.44	0.517
Formicidae	2013	1,18	13.3 ± 1.2	13.1 ± 1.1	2.75	0.114	13.4 ± 1.3	13.1 ± 1.0	0.20	0.661	0.02	0.898
	2014	1,20	27.5 ± 11.7	14.3 ± 1.1	0.67	0.420	29.9 ± 11.7	12.9 ± 1.1	0.23	0.640	1.27	0.271
	2015	1,20	17.2 ± 1.4	16.5 ± 1.0	0.45	0.512	19.7 ± 1.4	15.3 ± 0.9	2.12	0.163	0.26	0.618
Gryllidae	2013	1,18	0.5 ± 0.1	0.2 ± 0.06	1.17	0.293	0.5 ± 0.1	0.2 ± 0.05	1.87	0.188	2.02	0.172
	2014	1,20	3.9 ± 1.0	0.6 ± 0.1	5.37	**0.028**	3.4 ± 0.9	0.9 ± 0.2	0.10	0.755	1.57	0.223
	2015	1,20	3.1 ± 0.5	0.2 ± 0.06	5.88	**0.026**	2.6 ± 0.5	0.5 ± 0.1	0.03	0.857	1.53	0.232
Rhaphidophoridae	2013	1,18	0.6 ± 0.1	0.8 ± 0.1	0.24	0.631	0.7 ± 0.1	0.8 ± 0.1	1.44	0.245	0.10	0.750
	2014	1,20	0.9 ± 0.1	0.6 ± 0.1	2.29	0.145	0.6 ± 0.1	0.7 ± 0.1	0.94	0.342	1.16	0.293
	2015	1,20	0.5 ± 0.1	0.6 ± 0.08	0.97	0.338	0.6 ± 0.1	0.5 ± 0.07	7.36	**0.014**	1.43	0.248
Carabidae	2013	1,18	6.3 ± 0.7	6.4 ± 0.6	0.01	0.935	7.0 ± 0.9	6.0 ± 0.5	0.00	0.964	0.08	0.777
	2014	1,20	10.8 ± 1.2	8.6 ± 0.7	3.21	0.087	9.9 ± 1.1	9.1 ± 0.8	0.25	0.625	0.35	0.559
	2015	1,20	7.2 ± 0.9	6.6 ± 0.6	5.33	**0.033**	7.8 ± 1.0	6.3 ± 0.6	1.56	0.228	0.54	0.472
Curculionidae	2013	1,18	1.5 ± 0.2	2.0 ± 0.2	0.02	0.897	1.5 ± 0.2	2.0 ± 0.2	0.25	0.622	3.57	0.075
	2014	1,20	0.4 ± 0.08	1.7 ± 0.2	5.29	**0.031**	1.1 ± 0.2	1.3 ± 0.1	0.32	0.578	0.03	0.868
	2015	1,20	0.8 ± 0.2	1.3 ± 0.2	0.00	0.966	1.0 ± 0.2	1.2 ± 0.2	0.49	0.493	0.06	0.812
Scolytinae	2013	1,18	4.7 ± 0.8	3.9 ± 0.6	1.43	0.247	3.5 ± 0.8	4.6 ± 0.6	4.08	0.068	0.06	0.815
	2014	1,20	1.4 ± 0.2	1.0 ± 0.1	1.23	0.280	1.7 ± 0.3	0.8 ± 0.1	3.06	0.094	1.99	0.173
	2015	1,20	4.2 ± 0.8	3.3 ± 0.5	3.78	0.068	3.8 ± 0.7	1.2 ± 0.2	0.03	0.862	3.17	0.093
Elateridae	2013	1,18	0.1 ± 0.04	0.1 ± 0.02	1.21	0.285	0.1 ± 0.04	0.1 ± 0.02	0.51	0.485	0.18	0.675
	2014		-	-	-	-	-	-	-	-	-	-
	2015		-	-	-	-	-	-	-	-	-	-
Histeridae	2013	1,18	0.1 ± 0.03	0.1 ± 0.04	0.59	0.452	0.1 ± 0.04	0.1 ± 0.03	2.73	0.115	2.23	0.152
	2014	1,20	0.2 ± 0.07	0.1 ± 0.04	0.09	0.765	0.2 ± 0.07	0.1 ± 0.03	1.40	0.249	5.75	**0.023**
	2015	1,20	0.3 ± 0.07	0.1 ± 0.05	4.19	0.056	0.3 ± 0.1	0.1 ± 0.02	9.78	**0.006**	13.7	**0.001**
Phalacrididae	2013	1,18	0.3 ± 0.1	0.6 ± 0.1	1.63	0.217	0.5 ± 0.1	0.2 ± 0.1	1.82	0.193	0.20	0.657
	2014	1,20	0.5 ± 0.1	0.6 ± 0.1	2.43	0.134	0.3 ± 0.08	0.6 ± 0.1	0.07	0.798	1.69	0.208
	2015		-	-	-	-	-	-	-	-	-	-
Ptiliidae	2013	1,18	0.1 ± 0.04	0.1 ± 0.06	0.00	0.958	0.2 ± 0.1	0.1 ± 0.03	1.76	0.201	1.37	0.257
	2014	1,20	2.6 ± 1.8	0.3 ± 0.09	4.06	0.054	0.9 ± 0.3	1.3 ± 1.0	0.03	0.865	3.06	0.094
	2015	1,20	0.2 ± 0.08	0.2 ± 0.09	1.77	0.201	0.3 ± 0.1	0.2 ± 0.05	0.01	0.906	0.11	0.749
Nitidulidae	2013	1,18	4.1 ± 0.6	4.5 ± 0.5	0.10	0.751	4.5 ± 0.8	4.3 ± 0.4	0.40	0.536	0.02	0.889
	2014	1,20	2.3 ± 0.5	4.2 ± 0.5	5.65	**0.024**	2.7 ± 0.5	3.9 ± 0.5	0.10	0.760	0.02	0.884
	2015	1,20	9.5 ± 1.4	8.7 ± 1.7	0.23	0.640	7.9 ± 1.0	9.5 ± 1.8	1.04	0.321	1.27	0.276
Geotrupidae	2013	1,18	2.4 ± 0.5	3.7 ± 1.0	0.62	0.439	2.5 ± 0.4	3.6 ± 1.0	0.77	0.392	0.38	0.544
	2014	1,20	4.0 ± 0.7	3.9 ± 0.8	0.08	0.777	6.2 ± 1.4	2.6 ± 0.4	4.54	**0.042**	0.11	0.738

	2015	1,20	10.7 ± 3.7	7.2 ± 1.9	0.13	0.727	13.4 ± 3.9	5.9 ± 1.8	0.02	0.880	0.20	0.659
Scarabaeidae	2013	1,18	0.3 ± 0.06	0.3 ± 0.06	1.41	0.251	0.2 ± 0.05	0.3 ± 0.07	0.05	0.822	2.05	0.169
	2014	1,20	1.0 ± 0.2	0.6 ± 0.1	0.00	0.991	1.2 ± 0.2	0.4 ± 0.09	4.79	**0.040**	2.79	0.109
	2015	1,20	0.4 ± 0.09	0.1 ± 0.04	4.51	**0.048**	0.4 ± 0.1	0.1 ± 0.03	4.77	**0.043**	2.57	0.127
Aphodinae	2013	1,18	0.1 ± 0.04	0.1 ± 0.04	2.45	0.134	0.04 ± 0.02	0.1 ± 0.05	0.04	0.845	0.00	0.960
	2014	1,20	0.2 ± 0.06	0.3 ± 0.07	1.97	0.175	0.4 ± 0.1	0.1 ± 0.03	2.87	0.105	0.16	0.693
	2015		-	-	-	-	-	-	-	-	-	-
Scarabaeinae	2013	1,18	0.08 ± 0.03	0.1 ± 0.03	0.29	0.594	0.1 ± 0.03	0.1 ± 0.03	0.02	0.887	0.73	0.798
	2014	1,20	0.8 ± 0.1	0.3 ± 0.08	0.49	0.490	0.8 ± 0.1	0.3 ± 0.08	4.48	**0.046**	5.51	**0.028**
	2015	1,20	0.3 ± 0.08	0.1 ± 0.04	5.99	**0.025**	0.4 ± 0.08	0.08 ± 0.02	7.11	**0.016**	4.79	**0.042**
Trogidae	2013	1,18	0.1 ± 0.03	0.1 ± 0.03	0.10	0.753	0.1 ± 0.03	0.1 ± 0.03	0.98	0.334	0.45	0.510
	2014	1,20	0.3 ± 0.09	0.2 ± 0.05	0.21	0.651	0.3 ± 0.09	0.2 ± 0.05	1.16	0.292	0.56	0.462
	2015	1,20	0.1 ± 0.04	0.2 ± 0.07	0.03	0.873	0.2 ± 0.06	0.2 ± 0.07	1.42	0.249	0.01	0.919
Silphidae	2013	1,18	0.6 ± 0.1	0.7 ± 0.1	0.01	0.940	0.6 ± 0.1	0.7 ± 0.1	0.24	0.630	3.09	0.095
	2014	1,20	1.1 ± 0.2	0.6 ± 0.1	0.49	0.492	0.9 ± 0.2	0.7 ± 0.1	0.03	0.873	0.00	0.975
	2015	1,20	0.8 ± 0.2	0.4 ± 0.09	1.02	0.326	0.8 ± 0.2	0.4 ± 0.09	0.41	0.531	0.00	0.986
Staphylinidae	2013	1,18	16.9 ± 1.8	15.3 ± 1.1	1.11	0.306	15.2 ± 1.2	16.3 ± 1.4	0.62	0.442	0.91	0.352
	2014	1,20	36.3 ± 3.8	21.0 ± 1.8	4.52	**0.042**	38.9 ± 3.7	19.4 ± 1.7	6.69	**0.017**	1.56	0.225
	2015	1,20	23.2 ± 3.3	16.2 ± 2.0	3.49	0.074	23.1 ± 3.5	16.3 ± 2.0	0.12	0.736	0.78	0.389

Table S4. Main effects of canopy and understory disturbance treatments on activity-abundances (mean ± SE) of insect species in the families Formicidae, Carabidae, Nitidulidae, Geotrupidae, and Silphidae collected in forests at Powdermill Nature Reserve, Rector, Pennsylvania, USA in 2013-2015. Repeated measures ANOVA, significant ($\alpha \leq 0.05$) *P* values in bold. Analyses were conducted for species with ≥ 150 total individuals collected.

			Canopy Disturbance				Understory Vegetation Disturbance				Gap × Veg	
FAMILY, Species	Year	df	Canopy Gap	Closed Canopy	F	*P*	Understory Removed	Understory Present	F	*P*	F	*P*
FORMICIDAE												
Aphaenogaster picea	2013	1,18	9.6 ± 0.9	9.3 ± 0.8	2.10	0.164	9.2 ± 1.0	9.4 ± 0.8	0.00	0.999	0.24	0.628
	2014	1,20	10.8 ± 2.2	11.3 ± 1.0	2.91	0.102	13.5 ± 2.2	9.7 ± 1.0	0.24	0.629	1.91	0.181
	2015	1,20	9.8 ± 0.9	10.6 ± 0.6	0.33	0.573	12.5 ± 1.0	9.3 ± 0.5	0.69	0.418	0.91	0.353
Camponotus pennsylvanicus	2013	1,18	0.2 ± 0.09	0.4 ± 0.1	0.50	0.490	0.2 ± 0.1	0.4 ± 0.1	0.00	0.954	0.00	0.995
	2014	1,20	1.3 ± 0.2	0.7 ± 0.2	0.08	0.780	0.9 ± 0.3	0.9 ± 0.3	0.01	0.924	0.72	0.405
	2015	1,20	0.6 ± 0.1	1.0 ± 0.2	0.36	0.558	0.6 ± 0.1	0.9 ± 0.2	0.29	0.598	0.04	0.853
Formica subsericea	2013	1,18	0.2 ± 0.9	0.1 ± 0.03	3.94	0.062	0.1 ± 0.09	0.5 ± 0.02	1.20	0.287	3.09	0.095
	2014	1,20	0.3 ± 0.2	0.1 ± 0.1	0.73	0.401	0.4 ± 0.2	0.1 ± 0.06	1.77	0.197	0.38	0.544
	2015	1,20	0.4 ± 0.01	0.3 ± 0.01	4.79	**0.042**	0.7 ± 0.3	0.1 ± 0.04	2.16	0.159	0.01	0.939
Lasius alienus	2013	1,18	0.4 ± 0.2	0.7 ± 0.2	0.05	0.820	0.6 ± 0.2	0.5 ± 0.1	0.28	0.600	0.47	0.502
	2014	1,20	0.9 ± 0.3	0.4 ± 0.08	0.40	0.535	0.9 ± 0.3	0.4 ± 0.09	1.72	0.204	3.46	0.076
	2015	1,20	3.3 ± 1.1	2.0 ± 0.5	1.55	0.230	2.7 ± 0.8	2.3 ± 0.6	0.63	0.439	1.03	0.323
Lasius umbratus	2013	1,18	0.8 ± 0.4	0.8 ± 0.1	0.17	0.681	0.3 ± 0.2	0.3 ± 0.2	0.94	0.344	1.28	0.316
	2014	1,20	1.5 ± 1.3	0.3 ± 0.2	0.64	0.434	1.5 ± 1.3	0.4 ± 0.2	0.02	0.890	0.98	0.334
	2015	1,20	0.1 ± 0.06	0.2 ± 0.1	0.17	0.686	0.08 ± 0.05	0.2 ± 0.1	0.26	0.619	0.65	0.431
Myrmecina americana	2013	1,18	0.8 ± 0.1	0.7 ± 0.1	0.00	0.977	1.0 ± 0.4	0.6 ± 0.1	0.01	0.917	0.01	0.926
	2014	1,20	0.7 ± 0.2	0.4 ± 0.1	0.25	0.623	0.6 ± 0.2	0.5 ± 0.1	1.03	0.321	0.10	0.753
	2015	1,20	1.4 ± 0.2	0.7 ± 0.1	1.24	0.281	1.2 ± 0.2	0.8 ± 0.1	0.00	0.986	0.09	0.764
Myrmica punctiventris	2013	1,18	0.4 ± 0.2	0.7 ± 0.2	2.09	0.165	0.4 ± 0.1	0.7 ± 0.2	1.51	0.235	1.70	0.208
	2014	1,20	0.2 ± 0.07	0.3 ± 0.06	1.45	0.242	0.4 ± 0.1	0.2 ± 0.04	0.16	0.695	3.38	0.080
	2015	1,20	0.2 ± 0.06	0.5 ± 0.1	0.05	0.826	0.4 ± 0.09	0.5 ± 0.1	0.40	0.536	1.48	0.240
Stenamma diecki-schmitti	2013	1,18	0.3 ± 0.1	0.1 ± 0.2	0.40	0.536	0.1 ± 0.07	0.2 ± 0.06	0.96	0.339	0.74	0.402
	2014	1,20	0.1 ± 0.04	0.1 ± 0.03	0.17	0.683	0.2 ± 0.04	0.1 ± 0.03	1.44	0.244	0.04	0.850
	2015	1,20	0.3 ± 0.08	0.4 ± 0.08	0.00	0.968	0.4 ± 0.1	0.3 ± 0.07	1.52	0.234	0.92	0.350
Stenamma impar	2013	1,18	0.3 ± 0.08	0.4 ± 0.09	0.14	0.715	0.4 ± 0.08	0.4 ± 0.09	0.84	0.370	1.67	0.212
	2014	1,20	0.2 ± 0.04	0.1 ± 0.03	1.28	0.271	0.3 ± 0.08	0.3 ± 0.06	0.57	0.458	0.25	0.619
	2015	1,20	0.8 ± 0.1	0.8 ± 0.09	0.14	0.708	0.8 ± 0.1	0.8 ± 0.1	0.18	0.676	2.93	0.105
CARABIDAE												
Carabus goryi	2013	1,18	0.7 ± 0.2	0.8 ± 0.1	0.73	0.404	0.9 ± 0.2	0.6 ± 0.1	0.05	0.820	1.32	0.267
	2014	1,20	1.0 ± 0.2	1.2 ± 0.2	0.09	0.762	2.1 ± 0.3	0.7 ± 0.1	4.39	**0.045**	1.17	0.292
	2015	1,20	1.2 ± 0.2	1.6 ± 0.3	0.01	0.943	2.1 ± 0.4	1.0 ± 0.2	7.33	**0.013**	0.00	0.958
Chlaenius emarginatus	2013	1,18	0.7 ± 0.2	0.3 ± 0.2	2.28	0.082	0.3 ± 0.1	0.5 ± 0.1	0.00	0.958	1.61	0.222

	2014	1,20	0.8 ± 0.2	0.4 ± 0.1	0.76	0.395	0.8 ± 0.2	0.4 ± 0.1	3.08	0.091	0.28	0.603
	2015	1,20	1.1 ± 0.3	0.5 ± 0.1	7.36	**0.013**	1.0 ± 0.3	0.6 ± 0.1	3.08	0.093	0.92	0.347
Cyclotrachelus fucatus	2013	1,18	0.3 ± 0.2	0.7 ± 0.2	0.88	0.363	0.5 ± 0.2	0.6 ± 0.1	0.21	0.652	0.00	0.967
	2014	1,20	0.3 ± 0.1	0.7 ± 0.2	0.48	0.496	0.2 ± 0.1	0.7 ± 0.2	1.20	0.284	2.82	0.105
	2015	1,20	0.3 ± 0.1	0.6 ± 0.1	0.63	0.434	0.4 ± 0.1	0.6 ± 0.1	0.38	0.545	2.84	0.103
Cyclotrachelus sigillatus	2013	1,18	0.3 ± 0.1	0.6 ± 0.2	1.44	0.247	0.2 ± 0.1	0.7 ± 0.2	0.01	0.912	0.40	0.537
	2014	1,20	0.5 ± 0.1	0.8 ± 0.3	0.69	0.414	0.4 ± 0.1	0.9 ± 0.3	0.08	0.783	6.22	**0.019**
	2015	1,20	0.6 ± 0.1	0.3 ± 0.1	4.19	**0.050**	0.4 ± 0.1	0.4 ± 0.1	0.43	0.521	2.30	0.144
Dicaelus teter	2013	1,18	0.2 ± 0.1	0.2 ± 0.04	2.00	0.176	0.1 ± 0.04	0.2 ± 0.1	0.01	0.920	2.27	0.151
	2014	1,20	0.4 ± 0.1	0.4 ± 0.1	0.20	0.661	0.4 ± 0.1	0.4 ± 0.1	0.40	0.535	4.10	0.053
	2015	1,20	0.2 ± 0.1	0.4 ± 0.1	5.38	**0.028**	0.5 ± 0.1	0.3 ± 0.1	4.41	**0.048**	2.78	0.107
Platynus angustatus	2013	1,18	0.7 ± 0.2	0.9 ± 0.2	0.00	0.994	0.9 ± 0.2	0.7 ± 0.1	0.00	0.955	0.15	0.699
	2014	1,20	2.1 ± 0.4	1.0 ± 0.2	10.85	**0.003**	2.1 ± 0.4	1.0 ± 0.2	3.08	0.088	5.44	**0.029**
	2015	1,20	0.1 ± 0.05	0.1 ± 0.02	1.39	0.252	0.1 ± 0.04	0.1 ± 0.03	0.26	0.616	11.9	**0.001**
Pterostichus adoxus	2013	1,18	0.4 ± 0.1	0.4 ± 0.1	0.02	0.900	0.4 ± 0.1	0.4 ± 0.1	0.63	0.438	1.46	0.199
	2014	1,20	0.6 ± 0.2	0.4 ± 0.1	0.30	0.589	0.7 ± 0.2	0.3 ± 0.1	0.14	0.710	0.26	0.614
	2015	1,20	0.3 ± 0.1	0.4 ± 0.1	0.08	0.786	0.4 ± 0.1	0.3 ± 0.1	0.01	0.932	0.14	0.711
Pterostichus lachrymosus	2013	1,18	0.1 ± 0.1	0.3 ± 0.1	0.43	0.522	0.1 ± 0.1	0.3 ± 0.1	0.42	0.523	1.18	0.253
	2014	1,20	0.3 ± 0.1	0.5 ± 0.1	3.20	0.088	0.3 ± 0.1	0.5 ± 0.1	2.55	0.125	6.01	**0.021**
	2015	1,20	0.1 ± 0.03	0.2 ± 0.1	0.30	0.591	0.1 ± 0.03	0.2 ± 0.1	1.09	0.308	1.66	0.211
Pterostichus stygicus	2013	1,18	0.4 ± 0.1	0.3 ± 0.1	0.04	0.846	0.4 ± 0.1	0.3 ± 0.1	0.61	0.444	0.70	0.413
	2014	1,20	1.9 ± 0.5	0.6 ± 0.2	8.84	**0.006**	0.9 ± 0.3	1.2 ± 0.3	1.99	0.173	1.79	0.196
	2015	1,20	0.9 ± 0.4	0.3 ± 0.1	1.74	0.198	0.4 ± 0.1	0.6 ± 0.2	1.62	0.217	7.96	**0.009**
Sphaeroderus lecontei	2013	1,18	0.3 ± 0.1	0.3 ± 0.1	0.31	0.585	0.2 ± 0.1	0.3 ± 0.1	0.04	0.840	0.08	0.784
	2014	1,20	0.5 ± 0.2	0.4 ± 0.1	0.05	0.824	0.4 ± 0.1	0.5 ± 0.1	0.71	0.409	2.54	0.126
	2015	1,20	0.2 ± 0.04	0.5 ± 0.1	3.65	0.067	0.3 ± 0.1	0.4 ± 0.1	0.03	0.872	0.01	0.915
NITIDULIDAE												
Glischrochilus sanguinolentus	2013	1,18	0.8 ± 0.3	0.4 ± 0.1	0.81	0.379	0.6 ± 0.2	1.1 ± 0.5	0.65	0.431	1.11	0.325
	2014	1,20	0.3 ± 0.06	0.3 ± 0.09	0.39	0.537	0.3 ± 0.07	0.3 ± 0.09	0.01	0.909	0.09	0.768
	2015	1,20	-	-	-	-	-	-	-	-	-	-
Stelidota geminata	2013	1,18	1.1 ± 0.3	1.3 ± 0.1	1.94	0.180	1.5 ± 0.4	1.1 ± 0.2	0.13	0.724	2.34	0.143
	2014	1,20	1.6 ± 0.04	3.3 ± 0.04	3.65	0.069	2.0 ± 0.4	3.1 ± 0.5	0.46	0.504	2.10	0.162
	2015	1,20	-	-	-	-	-	-	-	-	-	-
GEOTRUPIDAE												
Geotrupes balyi	2013	1,18	0.5 ± 0.1	0.6 ± 0.1	0.88	0.360	0.7 ± 0.2	0.4 ± 0.1	3.13	0.093	0.21	0.652
	2014	1,20	1.0 ± 0.2	1.3 ± 0.3	1.79	0.194	1.9 ± 0.4	0.8 ± 0.1	1.20	0.285	2.18	0.154
	2015	1,20	0.5 ± 0.1	0.5 ± 0.1	1.40	0.252	0.7 ± 0.2	0.3 ± 0.1	1.60	0.223	0.64	0.434
Geotrupes semiopacus	2013	1,18	1.4 ± 0.5	2.3 ± 0.9	0.27	0.607	1.9 ± 0.2	2.7 ± 0.8	0.59	0.453	0.02	0.893
	2014	1,20	1.9 ± 0.5	1.9 ± 0.5	0.01	0.906	2.9 ± 0.9	1.3 ± 0.3	2.27	0.147	1.04	0.319
	2015	1,20	8.4 ± 3.2	6.0 ± 1.7	0.10	0.753	10.5 ± 3.4	4.9 ± 1.7	0.04	0.841	0.49	0.492
Geotrupes splendidus	2013	1,18	0.6 ± 0.2	0.6 ± 0.2	0.58	0.457	0.8 ± 0.2	0.5 ± 0.1	1.07	0.315	0.58	0.458

	2014	1,20	0.9 ± 0.2	0.6 ± 0.2	0.16	0.689	1.2 ± 0.2	0.5 ± 0.1	2.81	0.108	0.46	0.504
	2015	1,20	2.1 ± 0.6	1.0 ± 0.2	2.07	0.168	2.4 ± 0.7	0.8 ± 0.2	1.51	0.236	0.00	0.987
SILPHIDAE												
Nicrophorus orbicollis	2013	1,18	0.5 ± 0.2	0.6 ± 0.1	0.01	0.911	0.5 ± 0.1	0.6 ± 0.1	2.41	0.138	3.77	0.068
	2014	1,20	0.5 ± 0.1	0.4 ± 0.1	0.00	0.974	0.5 ± 0.1	0.4 ± 0.08	0.01	0.904	0.22	0.644
	2015	1,20	0.4 ± 0.1	0.3 ± 0.08	1.47	0.242	0.4 ± 0.1	0.3 ± 0.07	0.03	0.876	0.06	0.806