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Forest Health

Insect Surveys in Hinesburg Town Forest Following a Wind Event

Department of Forests, Parks, & Recreation
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On December 1, 2010, the Hinesburg Town Forest (837 acres) experienced a windstorm that resulted in damage to about 45 contiguous acres, with a concentrated blowdown that covered approximately 32 acres. Among the trees affected were white and red pine and Norway spruce, along with mixed hardwoods that included black cherry, white ash and other species.

Aerial view of the December 2010 blowdown. Photo: K. Thompson

The situation posed a unique regional opportunity to document woodboring and other insects that might utilize damaged host trees at the site. It was presumed that many different bark and ambrosia beetles (Scolytinae), longhorn beetles (Cerambycidae), metallic woodboring beetles (Buprestidae) and additional families of beetles, as well as other taxa such as the horntails or woodwasps (Family Siricidae), would find this place attractive. Results to date are included in this report.

Trap Deployment

Two types of traps were used to collect insects at the wind-disturbed mixed forest in Hinesburg. On March 12, 2012, five Uni-Traps were deployed, two in mixed spruce stands and three in mixed hardwood stands (Figure 1). The target species for these traps included ambrosia beetles in the genus *Trypodendron*, along with other members of the family Scolytinae. In the spruce stands, traps were baited with lineatin pheromone, alpha-pinene and ethanol. In the hardwood stands, we used a combination of lineatin, ethanol and the "natural lure" of small, cut branches of yellow birch that were bruised and draped with a wire over the traps. Dry cups with vapona killing strips were used for collecting insects lured to the traps. Traps were emptied every two weeks from March 12 to September 8, 2012.

Figure 1. One of five Uni-traps deployed at Hinesburg Town Forest, May 12, 2012. *Photo: T. Hanson*

In addition to the Uni-traps, three Lindgren funnel traps (12-funnel series) were positioned at breast height on re-bar trap holders in three stands (Figure 2). These were at least a chain (66 feet) away from the *Trypodendron* traps. Sites included (1) WB-1: mixed hardwoods, with trees sapling-sized to about 12 inches DBH, (2) WB-2: mixed hardwoods, sapling to pole-sized, with considerable regeneration, and (3) WB-3: mixed spruce, with high components of Norway spruce and downed material.

The pheromone "Woodborer Combo" lure used in the Lindgren funnel traps consisted of two components: ultra-high release (UHR) ethanol and UHR alpha-pinene, where the alpha-pinene was 75 % S (-) enantiomer. The killing agent was 50:50 water and propylene glycol in a phosphate-free formula. I hoped to pick up a variety of woodboring species in these traps.

Lindgren funnel traps ran from May 31 to September 8, 2012. Fresh lures were placed in the traps mid-season on June 11, 2012. There were 11 collection periods. Trap contents were emptied every two weeks through paint filters with screen inserts. Insects that were collected were frozen until samples could be processed. (See Figure 3 for trap locations.)

Figure 2. One of three Lindgren funnel traps deployed at Hinesburg Town Forest May 31, 2012. *Photo: T. Hanson*

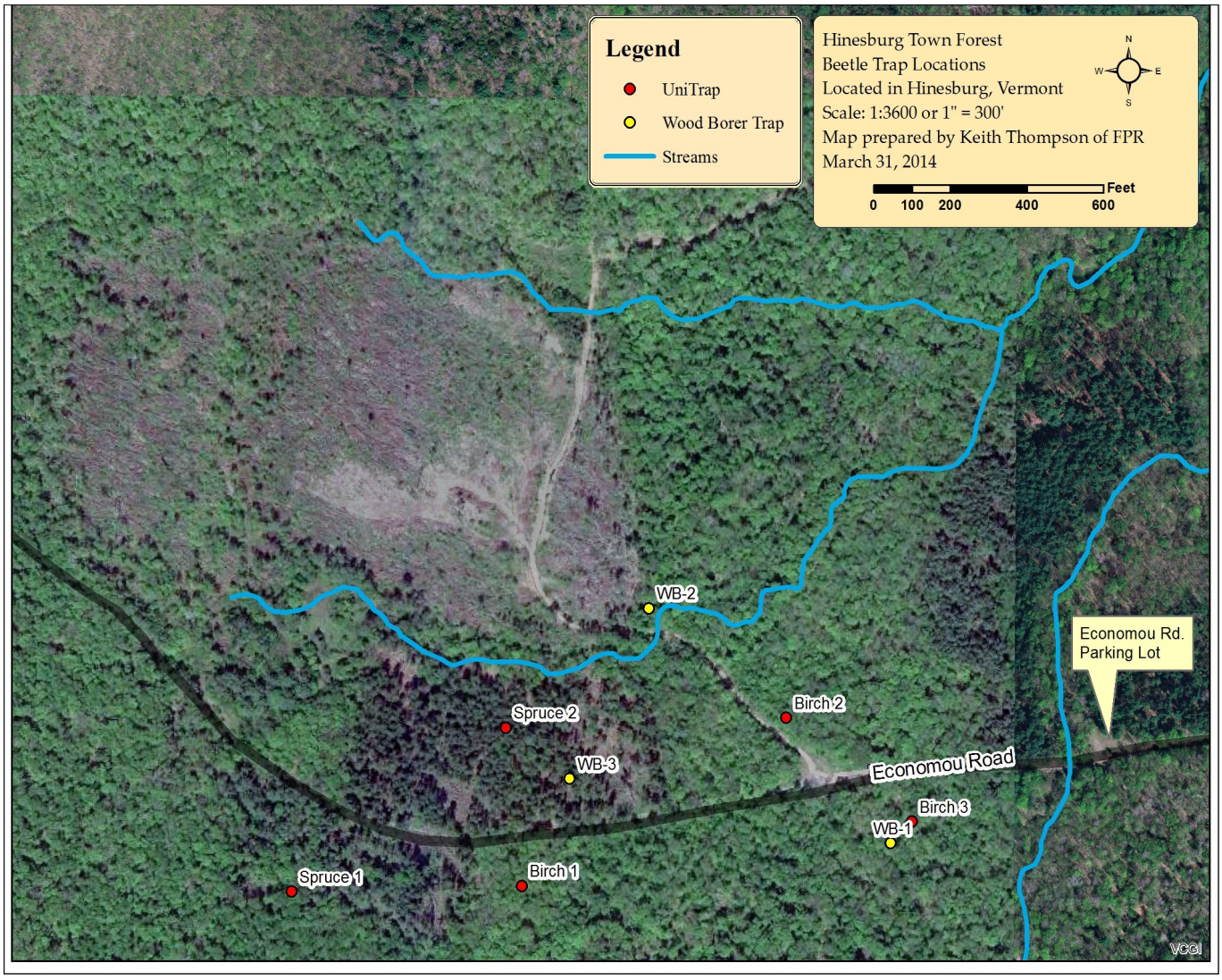


Figure 3. Locations of Uni-traps and Lindgren funnel traps used for insects surveys at the Hinesburg Town Forest from May 12—Sept 8, 2012. Map prepared by Keith Thompson, Chittenden County Forester.

Trapping Results

During processing, specimens for each collection period and each trap were rinsed and then sorted into four categories: bark beetles (Scolytinae), longhorn beetles (Cerambycidae), other coleoptera (beetles), and other insects.

About 9,000 insects were collected during this survey. Of these, 6,549 were retained. Those discarded included specimens like moths and flies that were captured in the fluid so that key features were damaged, and other insects that were considered an incidental by-catch. The taxa that were attracted to stressed, wounded, and downed trees were a priority for this study. These included mostly wood-boring and wood-feeding insects, but I was also interested in the insect predators of these species as well as insects that were attracted to fungi and/or sap associated with the trees. Fungi, so important in the process of wood decomposition, had begun to grow on some of the dead and dying trees, providing plenty of food for fungus-feeding beetles. Below, I've given a brief description of the characteristics of some of the families of insects collected in the traps, followed by some details of what was collected.

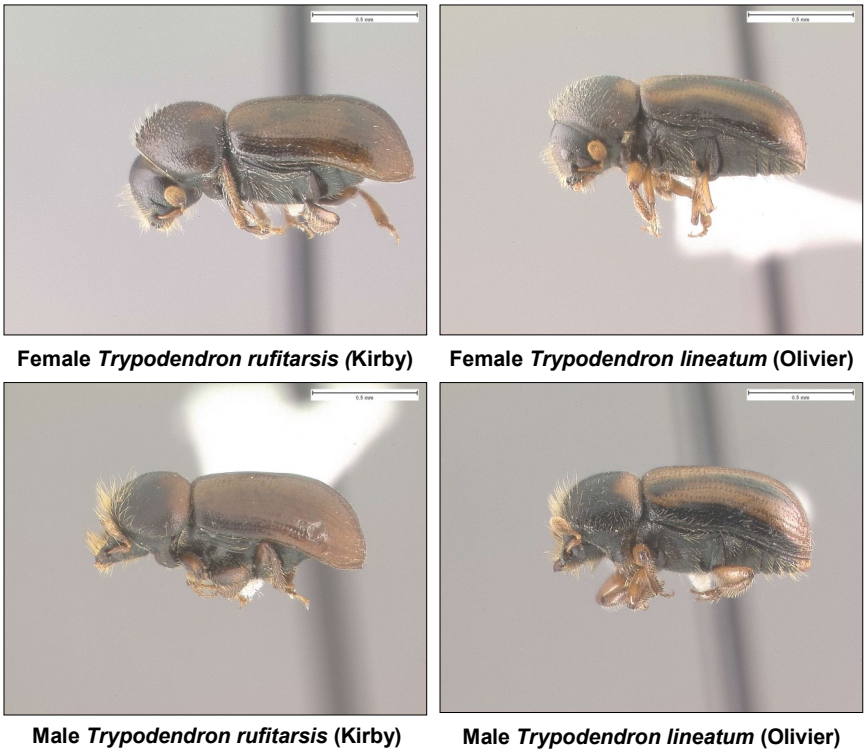
Bark and Ambrosia Beetles – Family Curculionidae, Subfamily Scolytinae

The family Curculiondae is enormous and diverse and its members occupy a broad range of habitats. In this study, and in other work that involves stressed, dead or dying trees, members of the subfamily Scolytinae (bark and ambrosia beetles) are often present in large numbers. Generally speaking, the small, cylindrical bark beetles tunnel into inner bark, wood, or seeds and cones. The tunnels, referred to as galleries, are often very distinctive and specialists can sometimes determine the species of bark beetle by studying the configuration of the mating chamber, egg niches, entrance and emergence holes and other aspects of the adult and larval tunnels. Ambrosia beetles feed on fungi that they introduce into tunnels bored in the sapwood and sometimes heartwood. The fungi grow on the walls of the galleries and often result in a black stain. (The distinctly-beaked members of the family Curculionidae, referred to as weevils, are mentioned separately on page 9 this report.)

Uni-trap Results

Uni-traps, which were baited specifically for ambrosia beetles in the genus *Trypodendron*, captured 450 bark beetles. *Trypodendron* beetles (352 specimens) were collected at all five sites, and included four species, *T. borealis* (294 specimens), *T. lineatum* (32 specimens), *T. retusum* (5 specimens), and *T. rufitarsis* (21 specimens).

More *Scolytinae* beetles were collected in traps in the two spruce stands (241 and 122, respectively) than in those in the three mixed hardwood stands (36, 27 and 24, respectively).



Female *Trypodendron rufitarsis* (Kirby) **Female *Trypodendron lineatum* (Olivier)**

Male *Trypodendron rufitarsis* (Kirby) **Male *Trypodendron lineatum* (Olivier)**

Figure 4. Trypodendron rufitarsis and T. lineatum. Adults of both sexes show color differences of legs and elytra. Photos: R. Acciavatti

T. lineatum has a wide range of conifer hosts throughout its range and has been reported to rarely infest several broadleaf deciduous tree species. *T. retusum* is known to feed on aspen and cottonwood species and T. borealis on larch, hemlock, members of the cypress family, and some hardwoods. *T. rufitarisis* is widely distributed across North America from Alaska to Nova Scotia and southward to California and Arizona. Hosts include Jack pine, lodgepole pine, ponderosa pine, Jeffrey pine, limber pine and Englemann spruce. Published distribution and host records for this species in the eastern US have been lacking. From work done in 2009, we can now report the presence of *T. rufitaris* is in Vermont where red pines and red spruces are likely hosts.

Sixteen other species of Scolytinae were collected in the Uni-trap survey including *Anisandrus sayi* (40 specimens), *Crypturgus borealis* (1), *Dryocoetes affaber* (5), *Dryocoetes autographus* (1), *Hylastes opacus* (1), *Hylesinus aculeatus* (2), *Hylurgops rufipennis piniflex* (1), *Hypothenemus* sp. (5), *Orthotomicus caelatus* (2), *Pitogenes hopkinsi* (1), P*ityophthorus* sp. (22), *Polygraphus rufipennis* (2), *Pseudopityophthorus* sp. (1), *Xyleborinus alni* (1), *Xylosandrus germanus* (10), and *Xyloterinus politus* (3).

Lindgren Funnel Trap Results

There were 5,139 bark beetles collected in the Lindgren funnel traps during the survey, and 29 species of bark beetles were represented. The trap located in the mixed spruce stand (WB-3) collected the highest number of beetles over the course of the trapping period (2,532 beetles) and was the most diverse in numbers of species collected, with an average of 11.5 species over the 11 collection periods (Tables 1 and 2).

Of the 29 species observed, the most numerous were *Trypodendron borealis* at 53.2% (2,732 specimens), *Xylosandrus germanus* at 21.6% (1,109 specimens) and *Dryocoetes affaber* at 10.5% (540 specimens) (Figure 5).

Site ID	Site description	Latitude	Longitude	Number of beetles collected	Average number of species/collection period
WB-1	Mixed hardwoods, with trees sapling-sized to about 12 inches DBH	44.31970	-73.02746	1,788	5.4
WB-2	Mixed hardwoods, sapling to pole-sized, with considerable regeneration	44.32131	-73.02989	789	7.4
WB-3	Mixed spruce, with high components of Norway spruce and downed material	44.32013	-73.03067	2,562	11.5

Figure 5. Trypodendron borealis (male), Xylosandrus germanus (female), and Dryocoetes affaber (male). **Photos by R. Acciavatti, J. Hulcr, www.ambrosiasymbiosis.org, and Univ. of Alaska Museum, bugguide.net.**

Table 2. Scolytinae collected in Lindgren funnel traps baited with UHR ethanol and alpha-pine at Hinesburg Town Forest from May 31 to September 8, 2012. Data include overall numbers and percent of each species collected.

Species	Number of this species found at each site			Total number of each species	Percent of total
	WB-1	WB-2	WB-3		
Anisandrus sayi	34	18	19	71	1.38
Cryphalus ruficollis	0	0	16	16	0.31
Crypturgus borealis	0	4	23	27	0.53
Dendroctonus valens	1	14	16	31	0.6
Dryocoetes affaber	44	22	474	540	10.51
Dryocoetes autographus	37	41	87	165	3.21
Gnathtrichus materiarius	8	20	13	41	0.8
Hylates opacus	5	8	11	24	0.47
Hylastes porculus	0	0	6	6	0.12
Hylesinus pruinosus	0	0	2	2	0.04
Hylurgops rugipennis piniflex	1	17	9	27	0.53
Hypothenemus species	1	0	0	1	0.02
Ips calligraphus	0	0	2	2	0.04
Ips grandicollis	2	14	17	33	0.64
Ips pini	1	2	7	10	0.19
Monarthrum fasciatum	0	0	1	1	0.02
Monarthrum mali	0	3	7	10	0.19
Orthotomicus caelatus	13	13	50	76	1.48
Phloeotribus liminaris	0	0	2	2	0.04
Pitogenes hopkinsi	2	7	8	19	0.37
Pityophthorus sp.	2	1	9	12	0.23
Polygraphus rufipennis	1	20	117	138	2.69
Pseudopityophthorus	0	0	2	2	0.04
Scolytus piceae	0	0	1	1	0.02
Tomicus piniperda	0	1	2	3	0.06
Trypodendron borealis	1088	379	1265	2732	53.16
Trypodendron lineatum	3	6	21	30	0.58
Xylosandrus germanus	542	192	375	1109	21.58
Xyloterinus politus	3	5	0	8	0.16
Totals	1788	789	2532	5139	100

More bark beetles (a total of 2,799 specimens) were found in the trapping period May 12 through May 27, 2012, than on any other trapping dates (Figures 6 and 7). Species diversity for all three sites was highest during that same collection period, when 11 and 14 species of bark beetles were identified from hardwood sites WB-1 and WB-2, respectively, and 22 species were found in traps from WB-3.

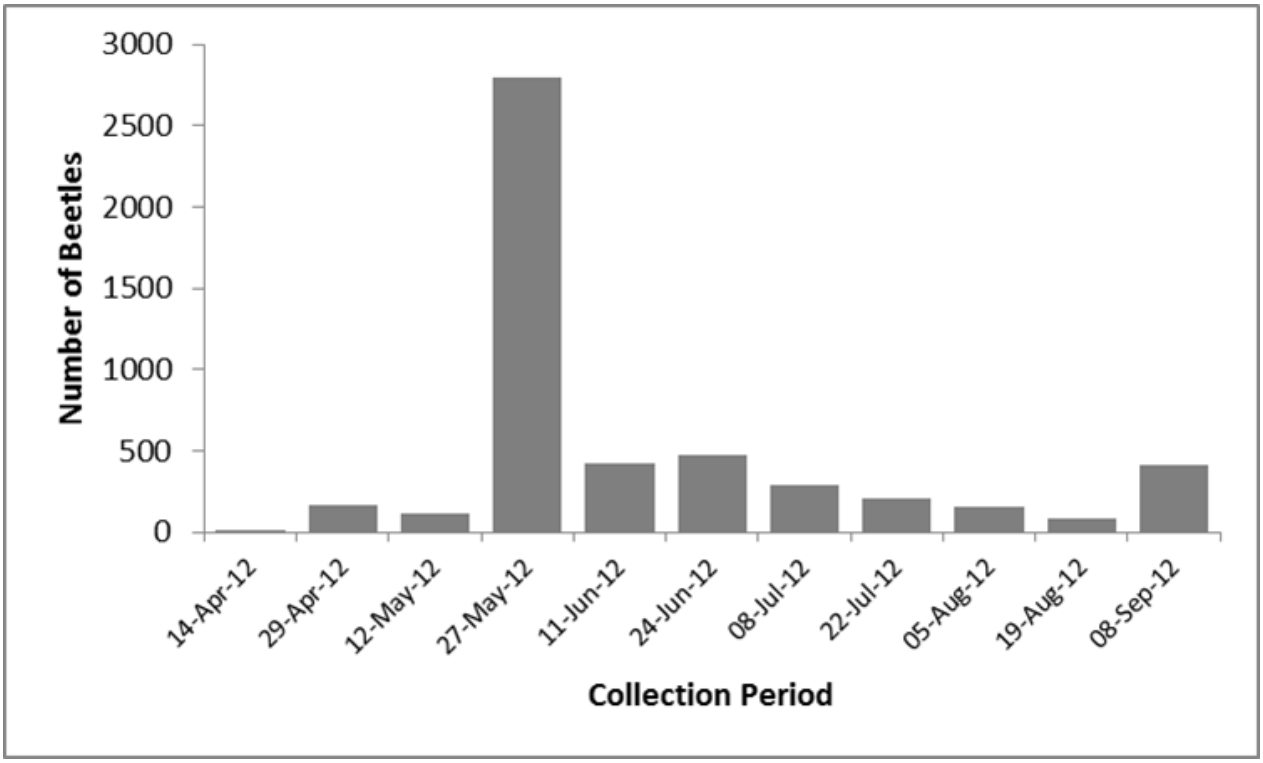


Figure 6. Bi-weekly numbers of bark beetles collected in Lindgren funnel traps deployed at Hinesburg Town Forest May 31 - September 8, 2012.

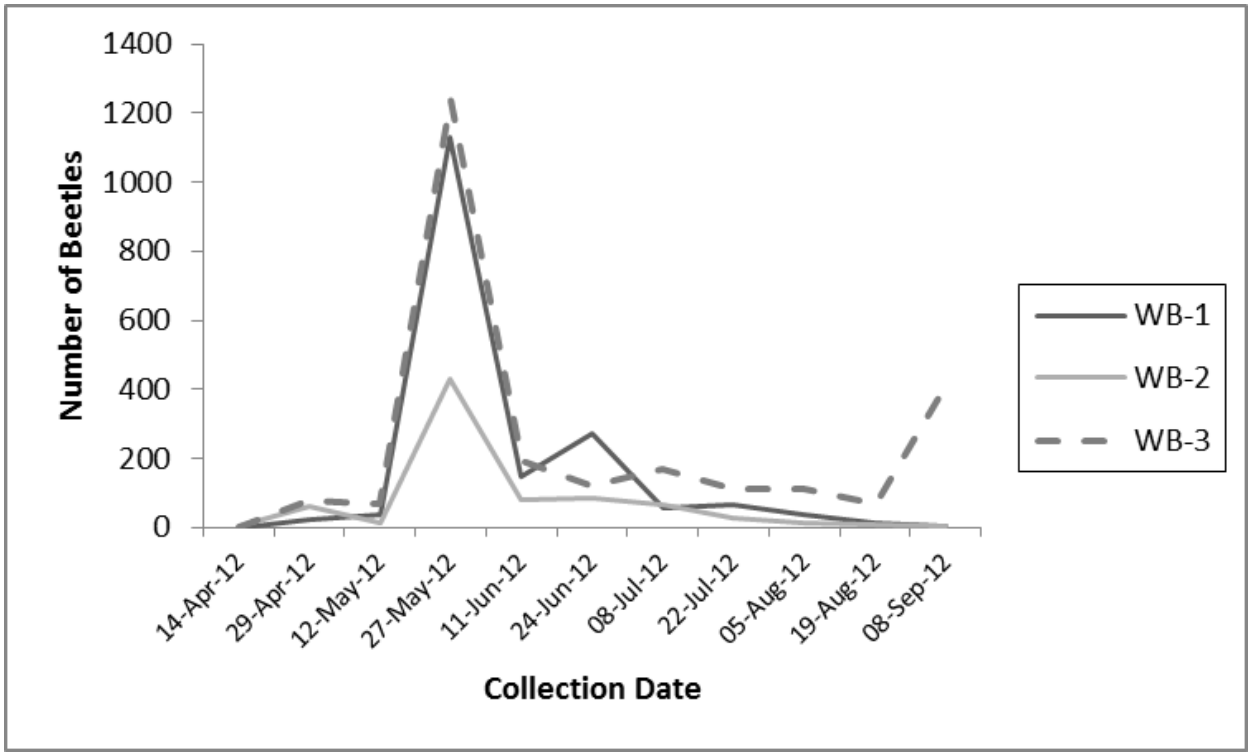


Figure 7. Bi-weekly numbers of bark beetles collected at each of three trap sites at Hinesburg Town Forest.

Longhorn Beetles — Family Cerambycidae

Many members of this family are recognized by their long antennae. These beetles are also sometimes referred to as round-headed borers because the emergence holes of some species are circular. Most feed in trees and other woody plants. Trees of all ages and sizes are hosts for one species or another, and all plants parts, from the twigs to trunk, are attractive to longhorn species. Some attack recently felled trees and others prefer living trees. Some species are considered beneficial, as they hasten the degradation of dead and dying trees, slash and stumps. Nearly 350 species and subspecies of cerambycids have been recorded in the Northeast.

Only 34 longhorn beetle specimens were picked up in our traps during this survey, with 10 species represented (Table 3). The most common (11 specimens) was *Tetropium cinnamopterum*, sometimes called the eastern larch borer (though known to mine beneath the bark of living and dying pine) (Figure 8). We also found three specimens of *T. schwarzianum*, and possibly a single specimen of a third species (T*. parvulum*) in the traps. We did not find, thankfully, *T. fuscum*, a close relative of these beetles. Known commonly as the brown spruce longhorn beetle, *T. fuscum*, is a native of Europe that has been found only in Nova Scotia, Canada. This particular species of *Tetropium* has been identified by USDA-APHIS as a serious threat to red, white, and Norway spruce, and surveys have been ongoing in multiple states, including Vermont.

Species	Number
Asemum striatum	4
Clytus ruricola	2
Cyrtophorus verrucosus	2
Evodinus monticola monticola	1
Microgoes oculatus	1
Rhagium inquisitor	4
Tetropium cinnamopterum	12
Tetropium schwarzianum	3
Tetropium sp.	1
Xylotrechus integer (Figure 9)	4

Table 3. Cerambycidae collected in Lindgren funnel traps baited with UHR ethanol and alpha-pine at Hinesburg Town Forest from May 31 to September 8, 2012.

Figure 8 (right). Tetropium cinnamopterum. Photo: S. Valley, Bugwood.org.

Figure 9. Adult Xylotrechus integer. The larvae feed on balsam fir and hemlock. Photo: T. Murray, Bugguide.net.

Horntails or Woodwasps— Family Siricidae

The woodboring, non-social wasps in the family Siricidae get their common name "Horntail" from the strong, projecting spike on the last section of the abdomen. In contrast to the "wasp waist" of many familiar wasps, the siricids have a broad waist. Their ovipositors are adapted to lay eggs in wood. There are about 20 species in North America, and most of these are associated with conifers. The horntail most familiar to people in the Northeast, however, attacks deciduous trees. This is the so-called "pigeon tremex" (*Tremex columba*) that attacks weakened or diseased hardwoods such as sugar maple and beech.

Siricid wasps may take one to three years to complete development. Most species are associated with symbiotic wood-decay fungi, introduced by the female during egg-laying. Larvae feed on the fungus and digested wood as they burrow. During this survey, 17 siricids, representing three species, were collected (Table 4).

Species	Common Name	Number
Urocerus albicornis	White-horned horntail	7
Urocerus cressoni	Black and red horntail	7
Sirex cyaneus	Blue horntail	3

Table 4. Siricidae collected May 31 - Sept. 8, 2012 at Hinesburg Town Forest in Lindgren funnel traps baited with UHR ethanol and alpha-pine.

Figure 10. Urocerus albicornis host records include a variety of conifers, including fir, larch, spruce, pine, Douglas fir, hemlock and western red cedar. Photo from Schiff, et al, Guide to the Siricid Woodwasps of North America.

Weevils — Family Curculionidae, various subfamilies

Adults weevils are sometimes referred to as snout beetles because the head is prolonged into a beak or snout, with the chewing mouthparts are at the tip of the snout. The legless larvae generally feed in cells or hollowed out cavities underneath the bark. Adults of some species, such as *Hylobius pales* ("pay-lees"), are attracted to freshly cut-over pine lands where they breed in stumps and old root systems.

At least nine species of weevils (103 specimens total) were captured in the Hinesburg traps. The most prevalent were *Hylobius* species and *Pissodes strobi*, the white pine weevil, known to attack at least 20 different tree species, including ornamentals.

Other Insects

The insects mentioned so far, and indeed many of the insects collected during this study, were attracted to weakened, damaged, dying or dead trees. Along with these insects came natural enemies (predators, parasitoids and hyperparasitoids) of the insect borers and other inhabitants of downed or damaged trees. Sap and fungus feeders were present, along with species that merely use the spaces provided by the tunnels and galleries as living quarters. Carrion beetles, ready to feast on the dead insects in the traps, also appeared. The trees in the Hinesburg Town Forest, whether hale and hearty or injured and ailing, provide structure, shelter and food for a wide variety of organisms. For a summary of insect families and numbers of individuals identified to date, see table 11.

Family	Common Name	Feeding Habits/Behavior	Number
Buprestidae	Metallic woodboring beetles	Larvae feed on wood; adults on leaves	2
Carabidae	Ground beetles	Larvae and adults of most are predators of insects and snails	7
Cerambycidae	Longhorn beetles	Most are woodboring in larval stage; flower feeding as adults	34
Cleridae	Checkered beetles	Various, but many are predaceous on wood and bark-boring insects	154
Cucujidae	Flat bark beetles	Predaceous on mites and small insects found under bark	6
Curculionidae	Snout beetles	Various, but larvae of ours feed in stumps, logs and trunks	103
Elateridae	Click beetles	Underground plant parts, a few are predators, adults on leaves	83
Endomychidae	Handsome fungus beetle	Feed on spores and hyphae of fungi	17
Erotylidae	Pleasing fungus beetles	Larvae and adults feed on fungus, often beneath the bark of dead stumps	6
Lampyridae	Fireflies	Larvae are predaceous and feed on small insects and snails	8
Leiodidae	Round Fungus Beetles	Various fungi and slime molds	5
Lucidae	Net-winged beetles	Larvae are predaceous; adults feed on decaying plant material or other insects	2
Lymexilidae	Ship timber beetles	Larvae are woodborers and believed to form symbiotic relationships with ambrosia fungi	37
Melandryidae	False darkling beetles	Feed on fungal hyphae or decomposing wood	3
Mordellidae	Tumbling flower beetles	Various, but ours feed on decaying wood and fungi	12
Nitidulidae	Sap beetles	Feed on fermenting sap fluids	298
Scarabaeidae	Scarab beetles	Diverse feeding habits; ours feed on roots	8
Scolytinae	Bark and ambrosia beetles	Inner bark/fungi	5589
Silphidae	Carrion beetles	Decaying organisms and fungi	2
Siricidae	Horntails or woodwasps	Mostly dead or weakened trees where they introduce a fungus	16
Silvanidae	Silvanid flat bark beetles	Most feed on fungi	5
Staphylinidae	Rove beetles	Various, but many are generalist predators, others feed on mushrooms	14
Tetratomids	Polypore fungus beetles	Feed on fungi associated with the decay of wood	13
Various families		Various feeding styles	125
Total			6549

Table 5. Summary of families of insects collected May 12 - Sept. 8, 2012 in baited Uni-traps and Lindgren funnel traps at Hinesburg Town Forest.

Summary

The variety of feeding behaviors and preferences manifested by insects we captured is noteworthy, but to get a true picture and appreciation of the diversity within this forest, one would need to study the leaf litter and soil, the grasses and plants that make up the ground cover, the invertebrates, amphibians, reptiles, birds and mammals, lichen and fungi, and additional tree species.

During this survey, we collected thousands of insects and began putting names to what we found. The process of identification is fascinating, but can also be painstaking, with differences from one species to the next resting on minute features like the length of hairs on a given leg or the arrangements of elytral punctures. Knowing which insects are present is a start, but one really needs to gain insight into the extent and complexity of behavioral traits, mortality factors, interactions between various species and much more. Each specimen represents part of a natural system, a system that we, too, are a part of. Few of these relationships are easily comprehended.

Figure 11. Many specimens of Thanasimus dubius (Cleridae), a voracious predator of bark beetles, were found during this survey. Photo: G. Lenhard, forestry-imagaes.org.

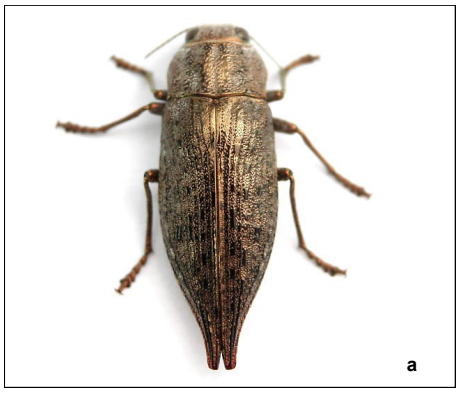
Many of the insects we found were undoubtedly enjoying the immediate and varied consequences of a temporary "collapse" of a large-vegetable ecosystem. In this forest setting, they are important in the turnover of trees, acting as primary decomposers and allowing for the recycling of nutrients locked away in the woody and herbaceous material of the trees. The felling, decay, and recycling of large trees and smaller plants provide numerous and complex associations for the organisms which take part. How the plant species in the immediate environment reproduce will set the stage for the next round of growth. Whether native species or invasive shrub-level woody plants are able to secure these areas in the short run remains to be seen, but the outcome may define this region for years to come.

As Chittenden County Forester, Keith Thompson, pointed out, "In part, the blowdown took place as a result of an extremely rare wind event. The area had been tended and cared for with the best interest of the forest and its use by the public in mind. The story of this coincidence is told on the ground in the only way that the power of it can be truly understood, as a toppled forest. The regeneration of this site will be a demonstration of forest resilience or lack of it. The opportunity to tell this tale on public land, very close to public access, is a unique opportunity."

The findings discussed here offer a window on the variety of organism interactions that such an event might produce. Through this study, we were able to document major groups of forest insects found in a wind-disturbed site. Our survey and monitoring tools were limited to baited traps, which gave us interesting data on the presence and abundance of insects that responded to the pheromones and/or to each other. Comparing this information to work done in similar, undisturbed stands would provide worthwhile comparative data and help to elucidate the role of these insects as indicators of forest health.

This report was prepared by Trish Hanson, Forest Biology Lab Entomologist. Thanks are due to Keith Thompson for his support of the project, to Robert Acciavatti for initial reconnaissance, lures, traps, Scolytinae identifications and advice, to Luke Curtis for field assistance, and to Mary Burnham for assistance with insect identification work.

Gallery of Some of the Insects Found at Hinesburg Town Forest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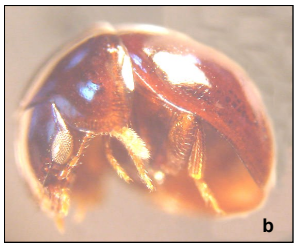
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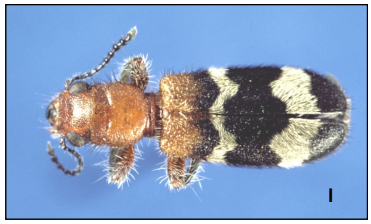
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Key to photos: **a, *Dicerca divaricata*** (R. Bernard, bugguide.net); **b, *Agathidium* sp.**(C. Majka, bugguide.net); **c, *Hylobius pales*** (J. Duque, forestryimages.org); **d, *Cossonus* sp.** (T. Murray, bugguide.net); **e, *Penthe pimelia*** (A. Wild, Myrmecos); **f, *Elateroides lugubris*** (T. Murray, bugguide.net); **g, *Zenodosus sanguineus*** (T. Murray, bugguide.net); **h, *Trypodendron borealis*** (R. Acciavatti); **i, *Glischrochilus sanguinolentus*** (K. Hillig, bugguide.net); **j, *Cucujus clavipes*** (C.Roar, bugguide.net); **k, *Phymaphora pulchella*** (T. Murray, bugguide.net); **l, *Thanasimus dubius*** (G. Lenhard, forestryimages.org).

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