How ground beetles (Coleoptera: Carabidae) respond to various silvicultural treatments in the northern hardwoods and pine plantations of the Great Lakes Region

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Silvicultural practices in forestry include activities such as site preparation, tree planting, thinning, and tree harvesting. Sometimes single trees are removed while in other cases large tracts of forest are clearcut. Logging activities bring about many environmental changes in light, temperature, soil moisture and vegetation structure, and thus can influence local plant and animal communities. Ground beetles (Carabidae) are good bioindicators of environmental change because they are (1) highly sensitive to habitat alterations, (2) diverse, (3) abundant, and (4) well known taxonomically. There are about 2,500 described species of Carabidae in North America. Most carabids are carnivorous predators that mostly hunt at night. Many other carabids are herbivores feeding primarily on seeds. After trees within an area of forest have been harvested, grasses and sedges often quickly colonize the newly opened sites that now lack forest canopy trees. These newly cleared sites attract many carabids known as open-habitat specialists, which are also predominantly seed feeders.

We were involved in four studies in the Lake States in the 1990s and early 2000s that monitored changes in the carabid community because of various forestry practices. Details of each of these studies have recently been published (Haack et al. 2024a, 2024b, 2025a) or soon will be (Haack et al. 2025b). In all four studies, we used similar barrier pitfall traps to collect carabids. A summary of each study is given here with a few highlights.

The first study to be published took place on the Huron-Manistee National Forest in Newaygo County, Michigan. This project involved removal of mature red pine stands that had been planted on former dry sand prairie sites. We sampled in 3 different years (1996, 1997, 1999) both before and after logging the red pine stands, as well as in nearby oak-pine barrens and prairie sites. Overall, 16,259 carabids were collected, representing 92 species. We collected 27 species in the uncut red pine stands, 28 in the oak-pine barrens, 41 in the natural prairie, and 77 in the clearcuts. The carabid assemblages in the two forested sites (uncut red pine stands and the oak-pine barrens) were very similar, with many forest specialists present. However, the mix of carabid species in the prairie and clearcut sites were different, with many more open-habitat species present. The top five most frequently collected species based on all specimens collected were: *Harpalus pensylvanicus* (25.2% of 16,259), *Carabus goryi* (24.0%), *Synuchus impunctatus*

(10.3%), *Pterostichus pensylvanicus* (7.7%) and *Harpalus lewisii* (6.3%).

The second published study examined changes in the carabid communities in aspen sites on the Huron-Manistee National Forest in Oscoda County, Michigan, where three levels of soil compaction and three levels of biomass removal were tested. We sampled in 1995, the second growing season after the trees had been cut and the treatments imposed. Overall, we collected 3690 carabids that represented 46 species. We found little impact of soil compaction on the carabid communities. However, with respect to biomass removal, we found similar assemblages in the "stem-only harvested" and "whole-tree harvested" plots, but a different mix in the plots subjected to both whole-tree harvesting and removal of the upper litter layer (e.g. more species that preferred open habitats and recent site disturbance were present). Again there was a shift from forest specialists in the uncut aspen stands to more open-habitat species in the clearcut aspen plots. The top five species were: *Cyclotrachelus sodalis* (17.3% of 3690), *Myas cyanescens* (14.6%), *S. impunctatus* (12.8%), *Pterostichus mut*us (10.6%), and *Carabus nemoralis* (10.4%).

The third study took place on the Nicolet National Forest in Forest County, Wisconsin. Several forest gaps of five different sizes (diameters of 18, 33, 66, 100, and 150 feet and a no-cut control) were cut in a mature northern hardwood forest dominated by sugar maple. Smaller gaps favor regeneration by shade-tolerant tree species like sugar maple, whereas larger gaps favor tree species of intermediate shade tolerance, like yellow birch. We sampled the year before logging in 1994, and then two years after the gaps were cut in 1997. Overall, we collected 27,111 carabids that represented 60 species. The carabid communities in the smaller 18- and 33-foot diameter gaps were similar to the species mix in uncut forests. However, the carabid mix was very different in the 100- and 150-foot-diameter gaps, with many more open-habitat species found and fewer forest specialists. The top five species were: *S. impunctatus* (35.6% of 27,111), *Calosoma frigidum* (13.3%), *Pterostichus coracinus* (9.6%), *Calathus ingratus* (5.1%), and *Pterostichus melanarius* (3.7%).

Calosoma frigidum adult male

(Photo by Frank Guarnieri)

It is noteworthy that only 16 *Calosoma frigidum* adults were collected in 1994, compared with 3595 in 1997. This carabid is commonly called the "Cold-Country Caterpillar Hunter." We suspect that populations of this beetle were increasing dramatically in response to building populations of the Bruce spanworm, *Operophtera bruceata* (Lepidoptera: Geometridae), which is a maple defoliator that reached outbreak levels in the area in 1998.

The fourth study is currently in review and deals with changes in the carabid assemblages near and upland from seasonal ponds (= vernal pools) in primarily mature aspen forests in Minnesota where various levels of tree harvesting occurred in the winter of 2000-2001. Minnesota

requires that a 50-foot-wide buffer of trees be left uncut around seasonal ponds during logging operations, which usually occur during winter. We wanted to examine if the carabid species mix was similar both near and upland from seasonal ponds before any logging, and how the species mix changed once the upland forest was clearcut and the buffer areas were treated in various ways.

There were four treatments: (1) control sites where no logging occurred in the 50-foot-wide pond buffers as well as in the adjacent upland forest, (2) uncut 50-foot-wide buffers were left around ponds but with the upland forest clearcut, (3) partially cut buffers (50% reduction) were left around ponds with the upland forest clearcut, and (4) the buffers were clearcut to the pond edge as well as the upland forest but with a few residual uncut patches of trees left in the uplands. We sampled before (2000) and after logging (2002).

Overall, we collected 15,857 carabid specimens that represented 99 species. We found similar carabid communities near and upland from the seasonal ponds in 2000, the year before any logging. However, after logging, the clearcut uplands had the most distinct assemblages, with many open-habitat species colonizing the cut sites along with reductions in forest specialists. The carabid mix in the uncut buffers was most similar to the (uncut) control plots (with many forest specialists present), while the mix in the clearcut buffers was most like the clearcut uplands (with many open-habitat species present). When the uplands were clearcut the uncut buffers and residual forest patches served as refugia for many forest specialists and flightless carabids. The top five species were: *Platynus decentis* (34.7% of 15,857), *Pterostichus pensylvanicus* (12.2%), *Synuchus impunctatus* (6.8%), *Agonum retractum* (6.2%), and *Agonum cupripenne* (5,9%).

Overall, 170 carabid species were collected in all four studies combined. Of these, 17 species were collected in all four studies; 21 were collected in three studies; 34 were collected in two studies; and 98 were collected in just one study. The 17 species collected in all four studies were: *Agonum cupripenne, Agonum placidum, Agonum retractum, Bembidion quadrimaculatum oppositum, Calosoma frigidum, Cymindis cribricollis, Harpalus laticeps, Harpalus providens, Harpalus somnulentus, Myas cyanescens, Poecilus lucublandus, Pterostichus melanarius, Pterostichus mutus, Pterostichus pensylvanicus, Pterostichus tristis, Sphaeroderus stenostomus leconte*i, and *Syntomus americanus*. Three new state records were reported in these studies: *Dicaelus furvus furvus* Dejean and *Hartonymus hoodi* Casey for Michigan (Haack et al. 2024a) and *Badister reflexus* LeConte for Minnesota (Haack et al. 2025b)

Currently, 528 carabid species (including tiger beetles) have been reported in Michigan (Ruesink et al. 2023), 460 in Minnesota (Dawson and Horn 1928, Tinerella and Rider 2000, Gandhi et al. 2005), and 499 in Wisconsin (Messer 2009, 2014). Therefore, assuming there are about 500–600 carabid species in this 3-state region, then our 170 species from four locations in the northern hardwoods and pine plantations of the Great Lakes Region represent about 28–34% of all carabid species present.

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Recap of the 71st Annual Meeting of the Great Lakes Entomological Society

October 25, 2025, 1 to 5 pm, via Zoom.

Over twenty members attended the meeting. Participants had the opportunity to see several fine presentations and there was ample time for important discussion during the business meeting that followed.

Our featured speaker was Dr. Hannah Burrack, the Professor & Chair of the Department of Entomology at Michigan State University. Her presentation, "Department achievements and challenges in a time of difficult funding", provided an excellent overview of the department, its ties with other university entities, and current funding challenges.

Dr. Burrack also discussed graduate and undergraduate student enrollment trends, proudly noting that the department welcomed its largest incoming class ever. Fifteen new majors and twelve minors joined "Team Emerald Ash Borer, bringing the department to 48 undergraduate majors. Numbers have nearly doubled over the past three years, reflecting growing interest in entomology and the department's expanding academic opportunities.

Presentation Abstracts and more

Investigating the Effect of Urban Habitat Fragmentation on Parasitoid Wasp Diversity in Two Michigan Wetlands

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Wetlands are some of the most ecologically significant ecosystems in the world and are often very biodiverse, containing many unique species. Terrestrial insects make up most of this diversity. Parasitoid wasps occur in most ecosystems and serve critical ecological roles like host population management, pest control, and pollination. Considering their diversity in most ecosystems, they likely make up a significant component of the terrestrial