

Insect Armageddon: Part 1

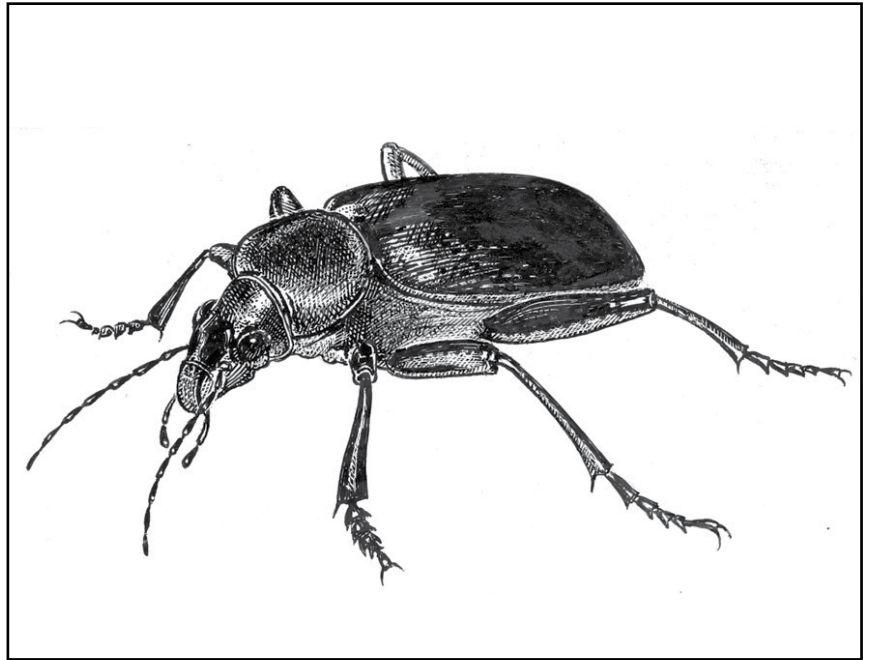
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Images of melting polar ice caps, rampaging forest fires in Siberia, and sweltering Europeans coping with a recent record heat wave crowd the TV news and social media feeds over this scorching July and early August. Another set of victims, millions of them, are suffering without any video footage. But we know from emerging scientific surveys that they are fast disappearing. I would say ‘dropping like flies’ if it weren’t so accurate.

Entomologists, ecologists, and any close observers of nature and attentive readers of environmental news have noticed an alarming phenomenon: insect numbers are plummeting rapidly. Changing climates are a big part of the problem but another is the widespread use of pesticides. The changes were first observed by anecdotal accounts of motorists and motorcyclists in Germany who noticed the drastic decline in moths and butterflies and other flying insects (including flies) plastered against their windshields. Soon citizen scientists contributed to the death count monitoring the decline in well-known showy species of butterflies. More recently, field scientists who have tracked insect abundance and diversity have started to revisit field sites they sampled decades ago and came up with alarming statistics.

One scientist who studied the diverse group of elegant small lizards called anoles (genus *Anolis* with over 400 species), returned to the spot in Puerto Rico where several decades ago he had sampled for insects—*Anolis* food. In his original study, he found



Ground Beetle (Carabidae). He's a handsome guy.

insects to be abundant; today in the same lush tropical forest many groups of insects were scarce. The problem is so widespread and of concern that some scientists have dubbed it an Insect Armageddon.

But before the sobering part of this column resumes, let’s celebrate the evolutionary exuberance of insects, in particular, beetles. Perhaps the most famous exchange in encounters between 20th century theologians and evolutionary biologists came when the great British scientist J.B.S. Haldane was engaged in conversation with the Archbishop of Canterbury. The cleric asked Haldane: “From your detailed studies of nature what can you discern about the guiding hand of God?” (or something close to that). Without hesitating, Haldane replied, “The Good Lord must have had an inordinate fondness of beetles.”

The cheeky response was based on studies by naturalists that showed beetles to be the

most diverse group of insects and the beetle order—the Coleoptera—to embrace more species than any other group in the animal kingdom with about 330,000 known species. Within the beetles, the polyglot of species classified as ground beetles in the family Carabidae are among the most diverse: more than 40,000 species have been found worldwide and 2,000 species in North America alone.

A biologist with the Smithsonian who specialized on Carabids and other beetle families made three important scientific discoveries by doing something a little crazy. He brought an insect fogger to the Amazon and started doing something unthinkable: he sprayed the leafy canopy of a living *Leuhea*, a common tropical rainforest tree and set up a systematic set of traps to catch what would fall dead from the leaves and branches. This rain of beetle specimens and other insects gave the first stunning result: over 1200 species of beetles were living in each

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LOCAL NATURE

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individual tree of this species of *Leuhea, L. seemannii*.

The second fascinating insight was that many of these canopy-dwelling beetles were actually Carabids, whose common name is ground beetles—a misnomer if there ever was one, and that many more beetles lived in the canopy than on the ground in the rainforest. But the most important finding of all was that 163 species were found only in *Leuhea seemannii* trees—that is endemic to them—but NOT in neighboring trees of a different genus or species!

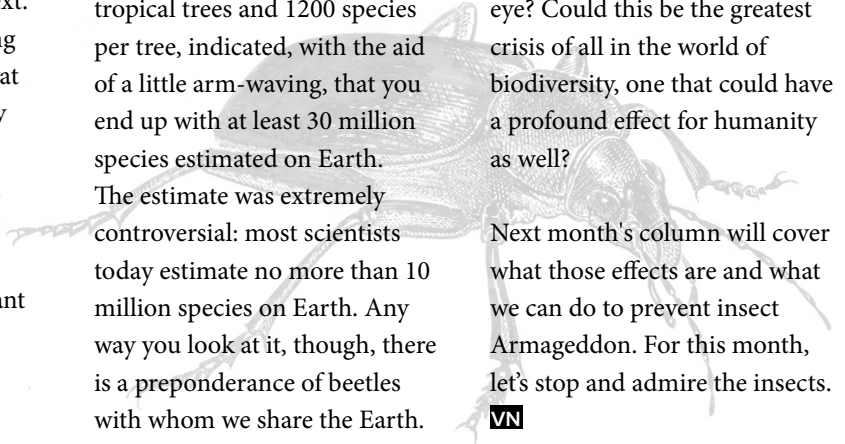
The great insight for conservation was that when one tree was fogged and the beetle rain catalogued and counted, that wasn't necessarily an indicator of the beetles in an adjacent tree of a different species because there could be a remarkable turnover of rosters of beetles from one canopy tree species to the next. This turnover of species along gradients or elevations is what scientists term Beta-diversity (alpha-diversity would be the number of species found in a single tree or a single hectare). Conserving beta-diversity is the most important and most neglected feature in conservation plans in the tropics—we just don't know

enough about how species compositions change from one tree or one patch of forest to the next.

Then this scientist, Terry Erwin, really went out on a limb. Doing some simple arithmetic, he proclaimed that his experiments, based on an assumption of 50,000 species of tropical trees and 1200 species per tree, indicated, with the aid of a little arm-waving, that you end up with at least 30 million species estimated on Earth. The estimate was extremely controversial: most scientists today estimate no more than 10 million species on Earth. Any way you look at it, though, there is a preponderance of beetles with whom we share the Earth.

But it is not just the sheer diversity of insects, it is their staggering numbers, at least when you compare them to other creatures, that is so stunning. And it is their rapid demise that have scientists up in arms. First it was the bees, then butterflies, but what about all the micro-insects we can barely distinguish with the naked eye? Could this be the greatest crisis of all in the world of biodiversity, one that could have a profound effect for humanity as well?

Next month's column will cover what those effects are and what we can do to prevent insect Armageddon. For this month, let's stop and admire the insects. **VN**



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