The Little Things That Run the World – Part I

In my article "Why Should We Care About Mitchell's Satyr?" (Winter 2022-2023 issue of the *INPS Journal*), I cited the well-known scientist E.O. Wilson (2006), "More respect is due the little things that run the world." Near the end of the same article, I mentioned that I wanted to further explore why it matters that many species of plants and animals around the world are disappearing due to human actions. This article begins that discussion which will be continued in a future issue of the Journal.

Paul Rothrock

*The black field ant (*Formica subsericea*) would have been well-known to E.O. Wilson. This worker, attracted by a nutritious elaiosome, is carrying a seed of yellow trout-lily (*Erythronium americanum*) back to her nest – one example of the wonderful symbiotic interactions between species.*

In his book *The Creation*, Wilson wrote that "Humanity doesn't need a moon base or a manned trip to Mars. We need an expedition to planet Earth, where probably fewer than 10 percent of the life forms are known to science, and fewer than 1 percent of those have been studied beyond a simple anatomical description and a few notes on natural history." This is at a time when many life scientists believe we are now in the early stages of the sixth great extinction of life forms on Earth, almost entirely caused directly or indirectly by human activities. Those of us who care about biodiversity find it disturbing that many species will be going extinct even before we know that they ever existed.

According to Wilson, insects comprise the greatest diversity of species among all organisms and the total number of known species in 2006 was around 900,000. However, he says that the true number, including those remaining to be discovered and classified, may exceed 10 million. Those who watch nature programs on TV and see all the amazing creatures on land and sea and marvel at the diversity probably assume that naturalists and scientists know everything there is to know about Earth and its inhabitants. The idea that perhaps less than ten percent of Earth's insect species are known simply in terms of classifying them as distinct species seems a bit shocking. And then consider the fact that for the ones that are not yet known to exist, it's impossible to know what contributions they make to ecosystem function.

Wilson's specialty was ants, and he postulated that at any given moment in time the weight of all ants in the world may be as much as the entire human population, which is now over eight billion people. And that's just ants, a small fraction of the great number of insect species. Within the realm of scientific classification of organisms, insects are within the phylum known as arthropods. Besides insects, other arthropod kin include enormous numbers of other creatures (both number of species and total biomass) such as spiders, mites, millipedes, centipedes, and pillbugs.

Nematodes, members of another phylum, comprise another exceptionally large biomass of organisms. Of them, Wilson says, ". . . at the very apex, the amazing nematode worms, whose vast population swarms, probably representing millions of species, make up four-fifths of all animals on Earth. Can anyone believe that these little creatures are just there to fill space?"

In addition to the organisms already mentioned, there are enumerable additional small animals and plants from macroscopic to microscopic in size including undescribed species of violets (*Viola* spp.), mosses, lichens, fungi, bacteria, mycorrhizae, and the aquatic plants and animals known as phytoplankton and zooplankton. The life functions of these organisms vary widely but include producers, consumers, predators, parasites, and decomposers of all kinds, shapes, and sizes. A truism of ecological science is that ecosystem stability operates best through diversity and relationship complexity. They may not be readily visible to us, but taken as a whole, the little things comprise an enormous component of total life on Earth, and thus they likely are the most important strands in the web of life. Within the realm of their Lilliputian world, the most basic organic and inorganic elements are broken down into usable forms that tiny organisms utilize and bring into the flow of materials moving upward through never-ending

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cycles of living and dying.

According to my old college ecology textbook (Odum 1959), the kinds of interactions between two species are defined and categorized into eight combinations depending on whether each organism is unaffected, benefited, or adversely affected by their association. The categories include neutralism, competition, mutualism, protocooperation, commensalism, amensalism, parasitism, and predation. I won't describe each of these but will briefly mention mutualism as it relates to a specific case. We have learned in biology classes that lichens are a kind of composite organism that arises from an alga or cyanobacteria living among the filaments of fungi in a mutualistic relationship. It is a relationship in which growth and survival of both components is benefited and neither can survive under natural conditions without the other. This arrangement is also referred to as symbiosis. Unlike lichens, most interactions between two species are definitely not beneficial to both. Such an example is that of a hawk eating a vole where the hawk gains sustenance and the vole dies. Our planet is flush with winners and losers among life forms, yet when the entirety of Earth's ecological processes are considered, they comprise something akin to symbiosis even if that term doesn't fit from a technical definition standpoint. In his book *Flowering Earth*, Donald Culross Peattie (1991) describes it like this: ". . . if you look again at the fact of symbiosis you see that in principle it is universal. For all organisms are a part of the web; their underlying and vital relationships are one vast multiple symbiosis." To which E.O. Wilson might add, "run by little things."

References

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The Little Things That

By Lee Casebere

When watching TV during late winter or early spring, it's not unusual to see commercials aimed at the farming community with promises that the advertised product "kills nematodes." The viewer doesn't need to think too hard to conclude that nematodes must be evil creatures that need to be eliminated. In Part I of this article (Spring 2023 issue of *INPS Journal*), I referenced E.O. Wilson (2006) where he said that nematodes comprise an enormously large biomass of organisms for which the number of species is unknown but perhaps is in the millions. He posed the question, "Can anyone believe that these little creatures are just there to fill space?" Of course, they're not. One point that we forget or ignore regarding the little things is that the vast majority of insects and other invertebrates are not harmful to us in any way, and in fact are essential within the realm of desirable ecosystem function. Unfortunately, millions of species are unknown and undescribed, so we can't even speculate what they might contribute to the proper functioning of the collective Earth organism.

Lee Casebere

As a mosquito control worker prepares his equipment, a bluebird brings food to her chicks.

A main point I want to emphasize in these two articles about the little things is that humans are a part of, not separate from, the web of life. Echoing the quote by Peattie (1991) from Part I, "For all organisms are a part of the web; their underlying and vital relationships are one vast multiple symbiosis." And that vast multiple symbiosis functions best and most smoothly through its vast diversity of species and through the complexity of the inter-relationships between all the various species. Thus, the ecologist's mantra – diversity and complexity; diversity and complexity; diversity and complexity!

It's true that some species of nematodes are harmful to crops, yet products made to kill nematodes not only kill the bad ones, but the good ones too, as well as vast numbers of other kinds of invertebrates. Joining the products used to fight agricultural pests in recent decades is the class of pesticides known as neonicotinoids or neonics for short. Studies indicate that they appear to be the worst in generations regarding their harmful effects on myriads of little things and larger ones as well, including birds and small mammals. Today they are largely used to coat crop seeds used over millions of acres of farmland. Thus, they are not spot treating a pest problem if and when one develops but in effect pre-treating entire fields as a kind of insurance against would-be pests should they dare to come. This exposes millions of additional acres of land and trillions of non-target invertebrates to the harmful effects of neonics. Studies are showing that neonics are long-lived in the soil and water and easily move from ag fields into the surrounding landscape. Here they are taken up by trees, shrubs, and other non-crop vegetation, where they kill non-target invertebrates. Studies also show that when treated seeds become exposed above ground, birds and small mammals eating them can die through ingesting only small quantities of the seed. In streams and lakes, the chemicals kill aquatic invertebrates which in turn affects populations of fish and other aquatic life (an especially insightful article about neonics was featured in *Living Bird* magazine [Weidensaul 2022]).

Agriculture, a big business in Indiana, employs thousands and contributes $35 billion to Indiana's economy. But agriculture, especially row-crop agriculture, has changed dramatically over the past generation and might almost be characterized as little more than hydroponics on a massive scale. Today, natural soil fertility doesn't mean much. Fields are given specific combinations of fertilizers, herbicides, and other pesticides that produce great yields in spite of soils that have lost natural fertility associated with a healthy soil biome.

I am not oblivious to the lives and concerns of the farming community. I grew up in a small farm town and my relatives on mom's side of the family were heavily involved with farming. But farms like the ones I intimately knew as a child 60 years ago don't exist today. They have evolved into something less diverse, less interesting, and more threatening to the well-being of us all. The broader impacts of Midwest agriculture reach the shrimp producing waters of the Mississippi Delta

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and of the Gulf coastal wetlands, resulting in a dead zone due to the many pollutants from the Mississippi, Missouri, and Ohio River watersheds. Midwest agriculture has consequences on those farmers who produce honey, apples, cherries, plums, and peaches. It's now being learned that chemicals being used for corn, beans, and wheat are implicated in the decline of honeybees and pollinators in general. Neonics are especially implicated in these declines. Fortunately for the row croppers, corn, soybeans, and wheat don't require insect pollinators in order to get a bumper crop. But do row crop farmers care about the many crops that do require insect pollinators or the farmers who raise them?

It feels as though there is little we can do when harmful practices are being done on enormous acreages of land over which we have no control or influence. But small things help if enough of us put them into practice, and attitudes can be changed. Take pride in doing good things in spite of the actions of others. Use pesticides with restraint. If a pest comes along, spot treat it as focused as possible knowing that pesticides don't just kill the intended target. If you feel you must fertilize and weed-treat your lawn, do it with restraint. Don't use mosquito control companies. In spite of what they tell you, the sprays kill more than just mosquitoes including pollinators you want visiting your native plant garden. If you have available space and a green thumb, grow your own vegetables. Otherwise, buy organic when available. Join conservation organizations whose work is aligned with your conservation, plant, and wildlife interests. Join a local land trust. Consider joining a national environmental advocacy organization whose work includes legal challenges to companies that pollute and otherwise contribute to environmental degradation. Write letters to local, state, and federal agencies and elected officials to state your positions on conservation matters of importance to your lifestyle and conscience.

And do not forget to enjoy life, and not just yours but also the non-human by becoming more attuned to your surroundings – the trees, shrubs, non-woody plants, the birds, mammals, and insects. Learn some bird songs. These things help you better understand where you live and to care about keeping it healthy. And if you partake long enough and deeply enough, they help you better understand who you are – part of unimaginable diversity and complexity (run by little things).

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*Bumblebee (*Bombus *sp.) populations, a common pollinator of* Silphium*, have declined by 90% over the past two decades. States with the most significant dip in bee numbers have the largest increase in the use of neonicotinoids and other agricultural pesticides. (*https://www.smithsonianmag.com/smart-news/american-bumblebee-has-vanished-from-eight-us-states-180978817/*).*