NATURALIST'S CORNER

Why Biodiversity Matters

Extinctions have a profound effect on us and on all living things.

As naturalists, we try to preserve species and their environments. But do we fully understand what is at stake? It is sad to see things disappear — the last of the tortoise species we saw on a Naturalists' Club trip to the Galapagos Islands, the last passenger pigeon, the last Golden Toad, the last Ivory-billed Woodpecker. However, our present predicament goes way beyond just the sadness of loss. We need biodiversity — essentially, the company of many different kinds of organisms on this planet — for our own survival.

Extinction is permanent. It is the death of an entire species or kind of organism. This planet hosts 1.3 billion identified species and probably another 7 billion we have not yet identified. Though calculated in various ways, biodiversity describes the total number of all the species on earth. Every day, 150-200 plant, insect, bird and mammal species become extinct. Extinction is the removal of a species from the total biodiversity. To date, 99% of all species that have ever lived on this planet have gone extinct. The rate of extinction is rising rapidly, and many biologists see this as the sixth great extinction on Earth in its 4.5 billion year history. The cause of this great extinction is not an asteroid or a geological collision. The cause is man.

Should we worry? How could extinction of a butterfly or a tree possibly affect humans, who imagine themselves as the culmination of evolution? The short, answer is yes, we should be worried. Extinctions have a profound effect on all species, including our own.

While biodiversity describes the number of separate species, a full understanding of impacts of extinction will require that we consider not just the total number of species lost but also the connections of those species to others. If a species goes extinct, those connections are lost. Bats eat mosquitos that grew up in the pond where fish depend on mosquito larvae for food — just to name two of the connections. Scientists have yet to discover most of the species that live on Earth and cannot be aware of all the connections of each species to others.

Do you know what animal is the most dangerous to man? Is it snakes, sharks, lions or spiders? No, it is the mosquito, which kills more humans than any other animal. Imagine if we were to exterminate all mosquitos. The network that connects mosquitos, birds, bats, and fish would be destroyed, and the collapse of those connections might result in the death of far more humans than do mosquito-borne diseases.

Edward O. Wilson has long championed the idea that biodiversity is essential for a healthy planet. He did a series of experiments on island populations, assessing whether the size of the island impacts its biodiversity. He defined island, broadly, as an area of land in the sea or a patch of forest left after logging or encroachment by construction projects. From Wilson's work emerged a mathematical relationship between an island's size and its biodiversity. Environmental fragmentation causes smaller islands, and smaller islands support less biodiversity.

Back to the importance of connections between species. A Finnish scientist, Haahtela, found that populations of certain butterfly species were declining. In parallel, the incidence of inflammatory diseases in the human population was increasing. The habitat that the butterflies needed was becoming fragmented into smaller "islands", altering the underlying connections. The declining butterflies were not the cause of human inflammation, but were the canary in the coal mine that signaled unseen disruptions.

A recent paper assessed the microbiome of teenagers and the diversity of native plants in their backyards. Teenagers whose backyards hosted a greater diversity of native plants (with, of course, a greater diversity of insects and microbes that live on those plants) had greater diversity of microbes on their forearms. Moreover, teens with a greater microbe diversity on their forearm had significantly fewer allergies. This is compelling evidence that kids need to experience the outdoor environment — and get dirty — in order to stay healthy!

Biodiversity is not just about the larger plants and animals. The soils in our forests contain 10,000 to 50,000 species per gram of soil. A gram is about the weight of a postage stamp or a pinch of salt. Imagine the interconnectedness among all those species!

There is a growing concern that the lowering biodiversity of our gut microbes is causing chronic illness in human populations. We used to think that bacteria were universally bad. Now, though, it is clear that not having enough different kinds — which is to say, having low micorbial biodiversity — increases the likelihood of diabetes, Crohn's disease, obesity, allergies, colorectal cancer and high cholesterol. Recent studies link low microbiome biodiversity to Parkinson's disease, Alzheimer's disease, and even autism spectrum disorder. Indeed, biodiversity and the connections among organisms are very important.

Last month, Diane Genereux wrote an article on determining whether the red wolf is a species distinct from other wolves. If a group of organisms is determined to be a distinct species and is determined to be endangered it can qualify for protection. When biodiversity is high, it is likely that some subset of species will have the features needed to survive in a changing environment. If biodiversity is markedly reduced and connections among species are disrupted, environmental change has the potential to produce even more dire outcomes.

We all know the dinosaurs are extinct. However, a few species did escape extinction, and their descendants diversified into the birds we know today. Had there not been a large number of different dinosaur species — which is to say, high biodiversity —we might not have all the bird speices we have today.

A healthy human is a person with a high biodiversity of gut microbes. A healthy forest is one with a high biodiversity of organisms from the soil to the trees to the insects and birds. A healthy planet is one with a high biodiversity and a low extinction rate. With a large number of different organisms there is the chance that at least some will escape difficult times to produce a whole new branch of life. This is worth fighting for and, yes, the extinction of one kind of fungus or bug could directly affect those uncharted connections with other organisms, with potential consequences for all species — including our own. *~ Sonya Vickers*