

Haley Mellin

In Conversation with Don Church

Don Church, PhD is president of Global Wildlife Conservation, one of the foremost international organizations committed to habitat and wildlife conservation. Prior to joining Global Wildlife Conservation, Dr. Church led the Biodiversity division at Conservation International. He previously served as executive director of the Amphibian Survival Alliance and protecting endangered amphibian and reptile species is one of his major focuses. Dr. Church also works to identify priority sites and opportunities for species conservation and to develop innovative strategies to address threats beyond habitat loss. Haley Mellin, PhD is an artist who works in painting and land conservation.

Haley Mellin (Rail): What is biodiversity?

Don Church: Biodiversity, in the broadest sense, represents life in all its variations from genes to ecosystems. Most often, particularly in conservation, we think about biodiversity in terms of the variation and numbers of species. I like to describe species as the terminal nodes (think leaves!) at the end of each branch in the tree of life. Each species has an evolutionary relationship to every other species that is defined by the distance (length of the branches) between these nodes.

Rail: Why does conserving biodiversity matter?

Church: First of all, I believe in the intrinsic value of every species and I believe it is our responsibility to conserve them for future generations. This is philosophical, of course, but I believe it would be a more common view if people appreciated the intelligence of many of our planet's co-inhabitants. We recently lost the Yangtze River Dolphin and are on the cusp of losing one of the world's seven porpoise species, the Vaquita, which only lives in the Gulf of California. Scientists who study how these animals communicate tell us that we are nowhere close to understanding how intelligent they are. They may hold answers to questions that we have yet to even ask, and yet we are letting them slip away without hardly a second thought. We have derived only some knowledge about this planet we share. I find it curious that we persist in investing fortunes in searching for extraterrestrial life when intelligent life, potentially with answers to some our biggest questions, is all around us.

Rail: I know the loss of a single species is devastating, can you explain why?

Church: Removing species from ecosystems is like a global game of Russian roulette. Species are the building blocks of

food webs, which hold together ecosystems. We depend on these healthy, functioning ecosystems for basic necessities such as freshwater, stable climates, and the very air we breathe. We don't always know how the decline of a species, alone, or in combination with others, will cause the ecological collapse of any given region. It makes sense to save the species that make up the one home we have for the foreseeable future.

Human synthesis of new molecules for medicine cannot catch up to 4 billion years of evolution. That's how long life has been on Earth. Hence, there is far more potential for major medical breakthroughs by researching products produced by microorganisms, plants, and animals than there is in tweaking molecules already in the lab. The vast majority of compounds produced by species have yet to be researched for potential medicinal or other applications. Almost all existing medicines were derived from compounds produced by species.

In addition to medicines, clean air, and climate stabilization, food security is another reason why we need to care about the loss of species in distant parts of the world. We like to think that things will always be the same, but conditions change and we need to adapt. Diversity from around the world provides us with more options for adaptation. We think of our food sources as being static and cultivated without connection to biodiversity, but history tells us that changing conditions can require radical alterations in what societies eat in order to survive. A few hundred years ago, mass starvation would have occurred across Europe without the introduction of the South American potato, and in China without the novel sweet potato. All food crops originated from wild species. We do not know what new species may be our food security lifeline in the coming decades, especially given the very dramatic changes in climate we are experiencing now.

When I was in college, no one valued the forests and grasses as climate stabilizers. Now we know that both are absolutely critical in preventing devastating climate change due to their sequestration of carbon. It makes me wonder what we will learn over the next few decades. What other services do species provide us that we currently take for granted? We have a lot to learn.

Rail: How long does it take for a new species to evolve?

Church: It's super variable! In part, it depends on what group of organisms you are considering. For example, speciation (creating a new species) in bacteria can be far more rapid than in any animal group simply because they replicate faster. This means a faster generation time, which means a more rapid accumulation of the genetic mutations that give a survival or reproductive edge within a population. As these genetic changes accrue and are represented throughout a population, a new species can be formed. In theory, even one mutation can result in a speciation event if it causes a major difference in the organism relative to the rest of the population, but this is rare. Usually, species are created through the accumulation of many mutations over time that, together, change a population to the point that it is noticeably different from other populations. At this point, a new species has been "born." Because they replicate so quickly, a new species of bacteria could pop up literally overnight under the right conditions (this is

why it's hard to win an arms race using antibiotics!). In contrast, a Galápagos tortoise won't even begin breeding until it's 40 years old in the wild. Obviously, any mutation in them is going to take much longer, on the order of millennia, to establish throughout a population.

In addition to generation time, the rate of speciation is driven by the strength of selective forces. For example, a drastic change in environment can lead to individuals of a certain genetic composition within a population to have tremendous advantages in survival and reproduction, even to the extent that they may be the only ones to survive and reproduce. Extreme and repeated changes in the environment can cause strong and continued selective pressure on a population with the end result being a population composed of individuals that are significantly different than individuals in the original population (and different from populations that did not experience the changes).

For the plants and animals that we usually think about, speciation takes a very long time. When we lose them, they are not replaced. Life persists after ecological disasters, but we want more than just rats and roaches, right?

Rail: A friend recently recommended that I read the book *The Sixth Extinction*. It opens with the fact that, historically, in a group such as amphibians (frogs, salamanders, and caecilians), only one species, on average, would go extinct every 1,000 years or so. Now we lose species much more rapidly, and we don't have another tens of millions of years to wait for new ones to evolve. What is your biggest concern about species decline?

Church: I like that you used the word "decline" and not extinction. My immediate and emotional response is that I am simply very sad when species slip away on our watch, and I miss the ones that I never knew. But, I'd have to say that my biggest concern is that we don't know what we are changing with each species decline. For a species to participate in the ecological web, it takes more than a couple animals in a zoo or a few in a park. If that's what we have to work with, I'll take it, because those are the proverbial seeds for reestablishing a species. But true ecological value comes from thriving, healthy populations within natural ecosystems. This is when a species contributes to ecological integrity.

Rail: Good point. What are other key points about protecting biodiversity?

Church: Ecologists have shown that diversity begets diversity. As species decline, some species can benefit but, overall, more species begin to decline. It's an unravelling. You see where that takes us. We like to think we are separate from all that, but that's a mighty big gamble to take given that the endgame is potentially absolute, and, even if it is not, there is no doubt it could be miserable for our descendants. It's not that life on this planet will not persist. It will, no matter what, but we evolved in a particular set of conditions in terms of the history of life on this planet. We have not been around very long. We don't really know how good we are at adapting yet. Doesn't it make sense to stabilize the conditions under which we thrive? Keeping species from declining is

fundamental to this and far less expensive and much less risky than banking on our ability to engineer our way out of an ecological apocalypse.

Rail: What is the best way we can stop the decline of a species?

Church: Save their homes. By this, I mean to protect their habitats, the places they live. In turn, they contribute to keeping these places—the oceans, reefs, forests, deserts, and grasslands of the world—ecologically stable and resilient and we benefit from the resulting clean air, freshwater, the list goes on. It's not always enough, however. Some threats, such as poaching, mean that we need to intervene and manage these places so that the species within them can persist.

Rail: How did you get involved with conservation?

Church: My earliest memory is trying to protect a beetle that kids were trying to crush in daycare. For some reason, I always wanted to protect animals. Yes, I care about plants too, but more as a way to feed animals, if I'm honest.

Rail: You've focused part of your life on bats and amphibians. Can you share their importance within ecosystems?

Church: Bats and amphibians are huge contributors to our environment. They keep in check crop-eating and disease-carrying insects. Some bats are important plant pollinators. Because many amphibians have a biphasic lifecycle (think tadpoles and frogs) they move energy between aquatic and terrestrial ecosystems. Unique compounds on the skins of some amphibians are showing great medicinal promise. Also, because many use both aquatic and terrestrial environments and breathe largely through their skin, amphibians may be more exposed to contaminants, more vulnerable to climate change, and overall more responsive to environmental change, thereby becoming the proverbial canary in the coal mine. It turns out that many of them, especially amphibians and reptiles, are in far more trouble than birds and mammals. More of them are endangered and fewer of them are protected within parks. That's not to say that they're more important, but we are at great risk of losing a lot of them if we don't focus some attention on them. And personally, I'm drawn to these underdogs, the weird animals.

Rail: What is something that any person can do immediately to help? I eat vegan, which is by far the best diet for conserving wildlife and the planet. What would you add?

Church: An easy task: stop buying bottled water and using plastic bags and straws. Recycling is not enough. There is too much plastic out there and it ends up everywhere. It affects many species directly. Beyond that, contribute to protecting the places where life, in all its wonderful forms, continues to flourish and contributes to the quality and the essential conditions that make our planet habitable.