

The Nature of Health

OR THE HEALTH OF NATURE?

**DOES DISTURBING NATURE COME BACK
TO HAUNT US BY MAKING US SICK?**

**Spoiler:
Yes it does.**

The Novel COVID-19 Virus

The Nature of Health or the Health of Nature?

In eastern Great Britain, archaeologists found sharp reductions in the number of pottery shards in various digs. This curious dearth of pottery lasted for about 2 centuries, until the number of pieces embedded in the black earth under the lush, English greenery started rising again. As you may have guessed, less pottery means less people.

This lack of both pots and people occurred during the Middle Ages from the 1300s to 1500s when the infamous black death swept through continents. **The Bubonic plague** killed nearly a third of Europeans, and ravaged populations in Asia and Middle East. Caused by a bacterium, it's spread to humans from rodents via another animal, fleas.

The Bubonic plague is a dramatic example of the undeniable role of animals and the environment in human health. Unless you've gone completely off the grid, reminders come every five seconds about the current infectious disease outbreak of the novel virus, COVID-19. Viruses are odd beasts that consist of only genetic material and a protein coat, and exist somewhere in the nebulous region between life and non-life. COVID-19 comes from a larger family of coronaviruses which can infect people and animals like cattle, bats, and cats.

That link to wild animals might make you wonder, does our large footprint on the natural world have anything to do with the absurd amount of Netflix I've watched recently? More specifically, does disturbing nature sometimes come back to haunt us by making us sick? Spoiler: yes, it does.

Disrupting natural ecosystems comes with many costs, a big one being disease. In general, activities that increase contact between humans and wildlife may transmit diseases to new (human) hosts. Activities like land-use change, modifications in agricultural and other food production practices, and wildlife trade and hunting are great examples of this, and these are the drivers behind around half of the emerging infectious diseases in the last several decades. Also, once a natural environment is disturbed, certain species that are more likely to transmit diseases to humans, like rats, can flourish. A good example of this is in our backyard in the Everglades.



Exotic animals are sold in many Asian "Wet Markets" for human consumption. The Novel COVID-19 virus is believed to have originated from markets such as these.



Hispid Cotton Rat

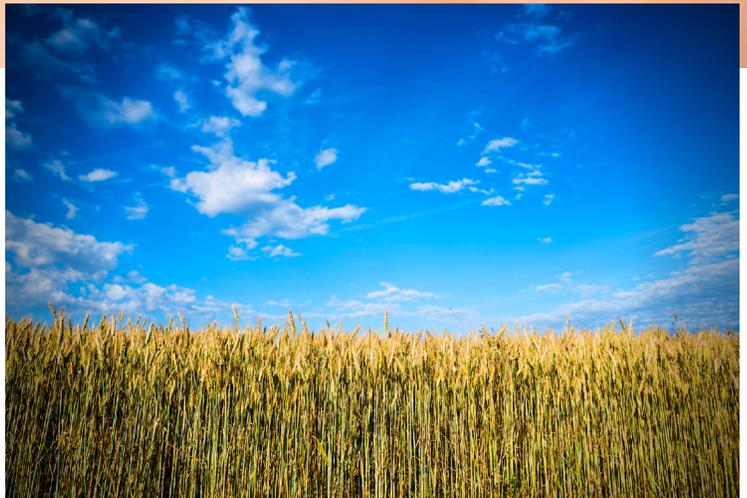


Burmese Python

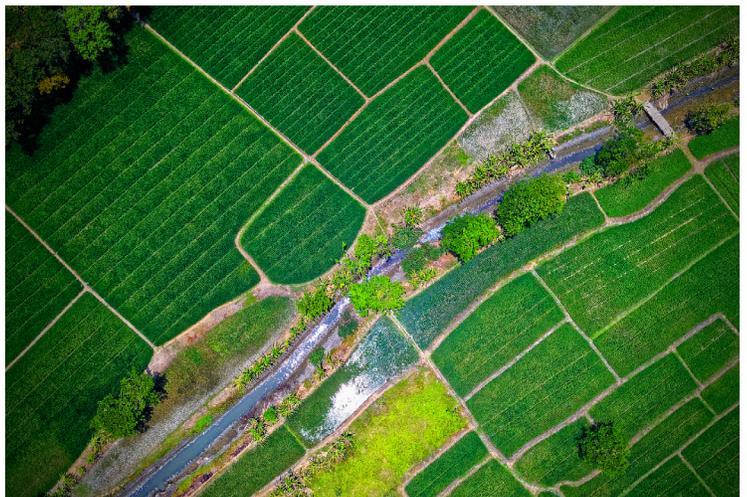
The "**Everglades virus**" is actually found throughout Florida, and it is transmitted to humans from rodents like cotton mice and hispid cotton rats by mosquitoes. Although rare, it can cause fever, headaches and in severe cases, neurological damage. This unusual disease might have been just a note in a medical journal until a huge disturbance slithered into the Everglades: Burmese pythons. These pythons, native to south and southeast Asia, were brought to the U.S. as pets through the wildlife trade. Some were released irresponsibly, and now they number in the tens of thousands in South Florida. This proliferation of snakes with voracious appetites has caused huge declines in mammals in the Everglades like rabbits, racoons, foxes, opossums, and deer. Rodent populations, on the other hand,



have been spared this fate. In response, mosquitoes transmitting the disease shifted from feeding on a variety of prey to primarily hispid cotton rats in the Everglades. While still under investigation, this chain of unsettling events could lead to a greater prevalence of the Everglades virus, and consequently, our risk of contracting it from mosquito bites.



Land-use change can lead to another swarm of effects, quite literally. Other infectious illness can be transmitted to humans mainly by mosquitos or ticks. These diseases kill hundreds of thousands of people each year, and include ghastly maladies like zika, dengue, Lyme disease, and yellow fever. Outbreaks of yellow fever or the “yellow plague” used to occur in the U.S., in fact there was one in Miami at the turn of the 19th century.



Transmitted by mosquitoes, it was brought here by an infected passenger on a steamship. When the first deaths occurred, restrictions were imposed on non-essential businesses and travel, makeshift hospitals and quarantine camps were thrown together, and widespread panic ensued. Sound familiar? Fortunately, we've had a vaccine for the last 80 years. Another particularly lethal disease is malaria, which is also transmitted to humans via mosquitos, and kills over 400,000 people each year. Malaria was present in the U.S. and was a major scourge in Florida until the early 1950s when it was eradicated with copious amounts of DDT and other mosquito control measures. It's still rampant in other parts of the world though, and deforestation and changes in land use led to surges in malaria in Asia, Africa, and Latin America. Perhaps the only positive impact of malaria comes from Asia. British soldiers stationed in colonial India took quinine to prevent contracting malaria, and eventually starting mixing it with sugar, lime, tonic water, and gin to make it less bitter, thus creating a popular cocktail: gin and tonic.

So, if biodiversity is a source of new pathogens, it might be reasonable to think that lower levels of biodiversity would mean less infectious disease outbreaks. However, the opposite appears to be true. Studies have found that a loss of biodiversity tends to increase the transmission of pathogens and disease.

Take for example a group of deadly viruses, hantaviruses, that are spread mainly by rodents like deer mice, common cane mice, or northern pygmy rice rats. These host species have a higher prevalence of hantavirus infection when there are fewer species (i.e., less biodiversity) of other small mammals around. Put another way, with more species (i.e., high biodiversity) of small mammals in an area, the host species encounter other members of their own species less often, slowing the spread of the disease. Loss of biodiversity can also impact disease through declines in competition and predation. If species that ate or competed with the hosts disappear from an area, host species numbers may increase. And when the number of animals infected with a disease grows, so does our risk of contracting it.

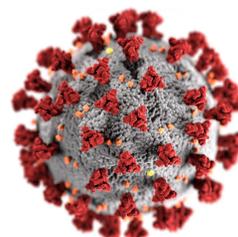
Despite the overall benefits of biodiversity, sometimes an extra species may not be a good thing, particularly when it's invasive. Invasive species can bring novel pathogens and diseases that infect other wildlife or humans, or may transmit diseases already present in an area to humans. We have that problem here in Florida with the giant African land snail. These snails were brought to the U.S. as pets and for educational purposes in the 1960s from East Africa. Eradicated once, we were freed from their slime trails until they were rediscovered in 2011 in Florida. These snails eat a variety of fruit and vegetable crops, ornamental

plants, and the even stucco and paint off of houses. If that weren't bad enough, they also carry a parasite from rats that causes meningitis. While this specific type of parasite-transmitted meningitis in humans is rarely life-threatening, it can lead to painful headaches, vomiting and a stiff neck.

Going back to the million-dollar question, the COVID-19 pandemic didn't stem from the destruction of a remote forest or an invasive species, so is our current predicament linked to the disruption of nature? Turns out, there could be quite a strong connection. The pandemic likely originated in a seafood market in Wuhan, China, but this market was not limited to seafood, it also sold wild animals like live wolf pups, scorpions, salamanders, rats, crocodiles, foxes, and turtles. Although the origin of the disease is still being investigated, one idea is that bats transmitted COVID-19 to another animal for sale at that market, perhaps a pangolin, which then transmitted it to humans. This may make you think unkindly of bats and other wildlife, but that wouldn't be a fair way to look at the situation. The real culprit in the COVID-19 example appears to be the trade and the consumption of wild animals. In one nightmarish scenario of wildlife hunting gone wrong, villagers in the West African country of Gabon killed and ate a chimpanzee. A few hours later, some people got a terrible fever, and eventually over half the village died. They had just unwittingly contracted

the deadly Ebola, which can kill up to 90% of the people it infects. Wild animals are the natural hosts of many diseases, some of them pretty horrific when they find their way to human hosts. Since the outbreak of COVID-19, China has banned the raising and consumption of wild animals. This is a step in the right direction, but the use of wild animals for non-consumptive purposes like medicine or research is still allowed. Effectively addressing the human health threats posed by wildlife trade, illegal trafficking, and poaching of wild animals would help protect populations of vulnerable species and humans alike.

Preserving natural habitats, reducing the spread of invasive species, and maintaining biodiversity are all good ways to promote the well-being of our ecosystems, which spares us from a lot of dreadful diseases too. So, as it turns out, protecting the health of nature is actually quite good for our health too. In this time of quarantine, The Everglades Foundation continues to focus on measures to protect the Everglades, South Florida's own backyard, by restoring the ecosystem and reducing threats to its biodiversity. Let's reflect on what the archives of history have shown us and maybe enjoy a gin and tonic while you are at it.



NOVEL CORONAVIRUS
COVID-19