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Scientists Warn of "Biological Annihilation" as Warming Reaches Levels Unseen for 115,000 Years

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In-depth Report: Climate Change

Featured image: Aerial view of the Amazon, near Manaus, the capital of the Brazilian state of Amazonas. (Photo: CGIAR / Flickr)

Camp 41, Brazilian Amazon — Less than 30 years ago, the Earth's tropical rainforests held the carbon equivalent of half of the entire atmosphere. But as atmospheric CO2 has escalated along with the deforestation of so much of the tropics, that is no longer the case. Nevertheless, carbon stored in tropical rainforests is still significant. According to NASA,

> "In the early 2000s, forests in the 75 tropical countries studied contained 247 billion tons of carbon. For perspective, about 10 billion tons of carbon is released annually to the atmosphere from combined fossil fuel burning and land use changes."

This is one of the countless reasons why losing them would be catastrophic to life on Earth.

I'm writing this dispatch just having emerged from the heart of the Amazon, the most biodiverse place on the planet. I was fortunate enough to spend some time with **Tom Lovejoy**, known as the "Godfather of Biodiversity," at the famous Camp 41, which is filled with researchers and scientists. Throughout our conversations, Lovejoy emphasized the staggering amount of biological diversity in the Amazon, which has thousands upon thousands of species of trees, fish, birds, plants and astronomical numbers of insect species.

> "We've only scratched the surface, and are discovering new species of birds all the time," said Lovejoy, who was the first person to use the term "biological diversity" in 1980 and made the first projection of global extinction rates in the "Global 2000 Report to the President" that same year.

Lovejoy, who founded the public television series "Nature" and is now a senior fellow at the United Nations Foundation and a professor of environmental science and policy at George Mason University, views anthropogenic climate disruption (ACD) from the perspective of the fact that we are essentially "social primates."

> "We are so stuck on ourselves, we don't consider the fact that the life sciences are a giant library that is continually acquiring new volumes," Lovejoy explained. "It's like we are just a bunch of social primates mutually grooming each other while the environmental lion sneaks up."

Lovejoy warns that as ACD progresses and temperature limits continue to be exceeded, we are losing parts of the biosphere that we don't even know exist.

Here in Brazil, I learned of a January 2016 science expedition of 50 scientists who spent 25 days in a remote area of the Amazon and discovered 80 new species.

Lovejoy posed a question for me, that is a warning to us all:

> "So what does it matter if we go over these limits and lose a few books in the biological library?"

He warned that as we keep removing books from the library — in other words, causing extinctions — we do not know which book(s) could cause a biological death spiral that could bring down the entire system.

An overview of some of the more stunning scientific reports and climate developments underscore this.

For anyone who thinks the biological library analogy might sound extreme, consider the fact that Stanford biologists recently issued something of a prelude to extinction. Having long since warned that the Sixth Mass Extinction event is already well underway, in a study recently published in the journal, Proceedings of the National Academy of Sciences, researchers said that billions of populations of animals have already disappeared from Earth, amid what they called a "biological annihilation," and admitted that their findings revealed a situation that was worse than they'd previously thought. The study showed that more than 30 percent of all vertebrates are experiencing declining populations, and the prime drivers of the annihilation are human overpopulation and overconsumption, especially by the rich, as well as habitat destruction, pollution and of course, ACD.

> "The resulting biological annihilation obviously will have serious ecological, economic and social consequences," reads the study. "Humanity will eventually pay a very high price for the decimation of the only assemblage of life that we know of in the universe."

Meanwhile, a study recently published in Nature revealed that ice-free areas in the Antarctic will surge by up to a quarter (17,000 square kilometers) by 2100 if CO2 emissions are left unchecked.

As if to underscore that point, in July one of the most massive icebergs ever recorded broke free of the Larsen C Ice Shelf. The iceberg itself measures 5,800 square kilometers and is estimated to weigh one trillion tons.

And there are no indications that things will slow down. Recent research from Harvard University published in the journal, Science Advances, revealed that temperature increases measured over recent decades fail to fully reflect the planetary warming that is already in the pipeline for our planet, and showed that the ultimate heating up of the Earth could be much worse than previously feared.

> "The worrisome part is that all the models show there is an amplification of the amount of warming in the future," **Cristian Proistosescu** of Harvard

> University, who led the new research, told the Guardian. And the situation might be far worse, as his work shows climate sensitivity could be as high as a stunning 6C.
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> "Some have suggested that we might be lucky and avoid dangerous climate change without taking determined action if the climate is not very sensitive to CO2 emissions. This work provides new evidence that that chance is remote," **Bill Collins** of the University of Reading in the UK told the Guardian.

On that note, an in-depth article published in July in New York Magazine, titled "The Uninhabitable Earth," is certainly worth reading. The heavily researched piece, which has generated much controversy, notes:

> "The Earth has experienced five mass extinctions before the one we are living through now, each so complete a slate-wiping of the evolutionary record it functioned as a resetting of the planetary clock, and many climate scientists will tell you they are the best analog for the ecological future we are diving headlong into."

Similarly, recently published research generated at Cornell University revealed that by 2100, a staggering 2 billion people, or one-fifth of the total global human population, could become ACD refugees due to rising seas alone.

> "We're going to have more people on less land and sooner than we think," lead author **Charles Geisler**, professor emeritus of development sociology at Cornell, said. "The future rise in global mean sea level probably won't be gradual. Yet, few policy makers are taking stock of the significant barriers to entry that coastal climate refugees, like other refugees, will encounter when they migrate to higher ground."

The New York Times published an important article highlighting global efforts by scientists to build and protect repositories for things like ice, seeds and mammals' milk in order to preserve them as evidence of a natural order that is rapidly disappearing. Last October, the Svalbard Global Seed Vault became flooded with rain; thankfully it was saved just in time, because otherwise we could have lost the seed backup plan for thousands upon thousands of species of plants. The San Diego Zoo maintains a frozen zoo of cryogenically preserved living cell cultures, sperm, eggs and embryos for 1,000 species, while the National Ice Core lab in Colorado holds approximately 62,000 feet of rods of ice from rapidly melting glaciers and ice fields in the Arctic, Greenland and Antarctica for future study.

Incredibly, a recently released report showed that only 100 companies are the source of more than 70 percent of the entire planet's greenhouse gas emissions since 1988.

Meanwhile, global warm temperature records continue to be set at a staggering pace. Global temperatures for June this year were surpassed only by June in 2015 and 2016. If temperatures continue as expected, 2015, 2016 and 2017 will be the three hottest years ever recorded. Estimates now show that warming has reached levels not seen for 115,000 years.

Earth

Profound changes are evident on land this summer. Abrupt ACD is a consistent and primary feature of previous mass extinction events. While a slight extinction rate is natural and normal, what we are witnessing today is extremely accelerated. History shows us that sudden and dramatic change in climate was the catalytic event that drove previous extinctions. (Having just come out of the middle of the Amazon rainforest, it is particularly clear to me right now that we've little idea how much we are losing already.)

Things are changing fast enough that a multimillion-dollar ACD study in the Canadian Arctic had to be canceled — because of ACD. The four-year study, launched by the University of Manitoba and several other universities, had to cancel the first leg of their study due to warming Arctic temperatures that were causing hazardous sea ice to travel much further south than usual, causing safety concerns for the scientists.

Meanwhile, as sea-level rise projections continue to increase, it is currently estimated that at least two billion people will be driven out of their homes by 2100 and be forced into the interior of their countries to look for new places to settle.

Things are getting hot and dry enough in Montana that farmers there have to consider new ways to grow wheat, while in Morocco, a 2014 study revealed that in the previous decade, the number of nomads in one particular region of that country had fallen by 63 percent in one decade, again due to hotter and drier conditions that made their way of life impossible.

Water

As usual, there is ample evidence of ACD's impacts across the watery realms.

In the Eastern Pacific, massive numbers of jelly-like organisms that are native to tropical seas are now invading Pacific coastal waters from Southern California all the way up into the Gulf of Alaska. Pyrosomes, which are colonies of hundreds to thousands of tiny zooids, have become so widespread as a result of warming ocean waters, they are causing big problems for commercial fisherfolk: They clog nets, completely preventing fishing in some areas. In May, one single scoop with a research net brought up 60,000 pyrosomes.

Another major issue plaguing the fishing industry along the West Coast of the US is worsening ocean acidification. The region's billion-dollar fishing industry, along with the fragile coastal ecosystems, is suffering as the oceans continue absorbing more CO2 from the atmosphere and becoming more acidic. In Washington State, another pronounced example of this is that the Puget Sound area's signature oysters are struggling to survive: They and other shellfish appear to be on their way out, due to the increasing acidity of their habitat.

A recently published study has confirmed that Earth's oceanic basins are warming more rapidly than ever before in recorded history.

Thus, not surprisingly, the fourth largest ice shelf in Antarctica is in the process of melting down to its smallest area ever recorded, and another report shows that sea level rise around the world is accelerating due to how quickly the Greenland Ice Sheet is melting: That Ice Sheet alone is now responsible for one-quarter of all global sea level rise.

In other melting ice news, have a look at this fascinating tool to view how major glaciers in the Alps have dramatically melted over the last century.

At the other end of the water spectrum, a drought in Northern China has now become

the worst in recorded history for that country, as economic losses to farmers in that region are now approaching $1 billion for this year alone.

Air

Hot temperature records and extreme heat waves continue to be the norm, and they are intensifying. In late June, the southwestern US was wracked by extreme heat, as Phoenix and Las Vegas cooked. The National Weather Service issued an excessive heat warning for parts of Southern California and Arizona, cautioning of "a major increase in the potential for heat-related illness and even death."

Earlier in the summer, Iran saw temperatures reach new heights: The city of Ahvaz experienced one of the hottest temperatures ever recorded on the planet, coming in at 128.66F. Extreme heat also plagued the UK, France, Switzerland, Belgium and the Netherlands, forcing some regions to ration water. Belgium also saw its hottest nighttime temperature ever.

Climate Central, in partnership with the World Meteorological Organization, has created a graphic which you can use to check future temperatures for many major global cities. According to the graphic, up to a dozen cities will heat up so much there is currently no analog on Earth to which we can compare them.

> "Khartoum, Sudan's average summer temperature is projected to skyrocket to 111.4°F (44.1°C) if carbon pollution continues unchecked," the press release that accompanied the graphic stated. "That shift underscores that unless carbon pollution is curbed, the planet could be headed toward a state humans have never experienced."

A report in the Hindustan Times revealed that Delhi could become as hot as the United Arab Emirates' Sharjah by 2100, as the average summer high temperatures in major Indian cities could rise by 3 to 5 degrees Celsius.

As usual in the summers nowadays, there is more bad news on the methane front. Remember, methane is 22 times more potent of a greenhouse gas than CO2 over a 100-year timescale.

The Siberian Times reported recently that two fresh craters were found on the Yamal Peninsula. The newspaper stated that

> "the formation of both craters involved an explosion followed by fire, evidently signs of the eruption of methane gas pockets under the Yamal surface."

The craters, each of which is approximately 25 feet in diameter and roughly 65 feet deep, can be viewed here.

Fire

The heat wracking the planet this summer has been accompanied by intense wildfires.

In Siberia, multiple blazes kicked off wildfire season across the tundra and boreal forest. The fires burned at a rate unheard of for at least the last 10,000 years, and released vast stores

of carbon stored in the trees and soil, creating yet another positive feedback loop for ACD: More wildfires create more heat in the atmosphere, which creates more wildfires, and on, and on. The NASA satellite photos of the burning area are disturbing.

Closer to home in California, raging wildfires forced roughly 8,000 people to evacuate as out-of-control fires destroyed homes and threatened thousands of other structures.

Along coastal Alaska and Canada's Northwest Territory, large wildfires burned near the shores of the Arctic Ocean — water that was, until recently, frozen. In British Columbia, 14,000 people have fled as more than 1,000 firefighters battle numerous large blazes.

Drier dry spells and higher temperatures mean longer, more intense wildfire seasons, which is precisely what we are seeing. The US this year is on pace to have a record-breaking wildfire year, with at least 3.5 million acres burned already. By April, early on in wildfire season, more than 2 million acres had burned, which is nearly the average consumed in entire fire seasons during the 1980s.

Denial and Reality

There's never a dull moment in the denial world these days.

In Florida, that state's extremist ACD-denying **Gov. Rick Scott** signed legislation making it easier for Florida residents to challenge science that is taught in public schools, so if an ACD-denying parent doesn't like a science textbook that teaches the basic physics of how greenhouse gases work, the book could end up being banned.

Trump-appointed EPA Administrator Scott Pruitt, an ACD denier and pink slipped 38 members of the EPA's Board of Scientific advisors, which is merely a drop in the bucket compared to dozens of other major environmental roll-backs the Trump administration has pulled off thus far, including forcing NOAA [National Oceanic and Atmospheric Administration] to erase human activity references to greenhouse gases in its Annual Greenhouse Gas Index.

Thankfully, reality continues to thrive in other parts of the world: In France, the sale of petrol and diesel cars will be banned beginning in 2040 — just one of the steps that country is taking to meet its portion of the Paris climate agreement.

Surprisingly, in the US a recent poll by Yale University's Program on Climate Change Communication showed that roughly two-fifths of the population believe ACD is likely to kill off all humans.

In other positive news, slowly but surely more reports addressing overpopulation's critical role in ACD are surfacing. One published in July in the Guardian suggested people who are serious about doing something about ACD should have fewer children. By way of example, a recent study published in Environmental Research Letters calculated that having one less child would bring a reduction of 58 tons of CO2 for each year of a parent's life.

This suggests, in turn, that countries that are serious about addressing ACD should be developing strong protections for reproductive rights, increasing the availability of birth control and abortion, working toward gender justice and ensuring that comprehensive sex education is provided in all schools.

A mega-dose of reality for all of us here on Earth: Earth's sixth mass extinction event is already well underway, the aforementioned event researchers are already referring to as causing the "biological annihilation" of wildlife, and that is already far more severe than previously feared.

> "It's as simple as bacteria in a test tube," was Lovejoy's response when I asked his take on the overpopulation crisis. "You can only have so many before you run out of nutrients."

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