COVID-19: Dress Rehearsal for a Climate in Crisis

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As I write, in May of 2020, I can gaze at the white oaks towering over my eastern Iowa home, their mint-green leaves swelling more each day as they fill with moisture. Every leaf cluster sports a tassel of dangling drupes. Soon yellow clouds of pollen will drift from these drupes to flow through the woodland canopy, fertilizing tiny female oak flowers that will grow into acorns by autumn. Some will drop with a ping on the roof of our house, playing a random melody.

My husband and I built this house with our own hands back when we were young, forty-three years ago. In the years since, I have come to know the patterns of our oak woodland well. The sequence of birds returning each spring to nest here: the eastern phoebes who nest under our porch arrive by late March, eastern towhees call from the brush soon after, and Baltimore orioles peck orange slices at my feeders by early May. The mating season of frogs in nearby ponds: chorus frogs and spring peepers singing already in March, ceding to leopard and tree frogs, with bullfrogs and cricket frogs vocalizing through June. The coming of wildflowers: the anemones of early April followed by Jacob's ladder and bellwort, which give way to seas of wild geraniums swelling in waves over May's forest floor.

The timing of each awakening has been scripted into these species' genes as well as onto my mind. Living here as I have for so long, I can't imagine how these ancient life-shaping patterns could ever falter. Even though I sense our gradually warming weather is triggering insidious small changes—frogs singing on overheated December days, for example—I cannot imagine the collapse of ecological systems that have safeguarded this diverse, noisy, vibrant life in our woodland for thousands of years. Any sort of abrupt breakdown of our planet's natural systems seems unimaginable to me. Surely this woodland and its life-guarding processes will be here for all time. Won't they?

Late in 2019, in Wuhan, China, a new coronavirus with animal origins started infecting humans and took off. Such an event was not unusual: the World Health Organization reports that 60% of emerging infectious diseases originate in animals. But the 2019 virus was unusual in the ease and lightning speed with which it spread to and among humans, traits that initiated its appearance in many other countries in under two months, including the U.S. by January 20. By late March, the virus had flown round the world, leaving severe respiratory illness and death in its wake as well as stay-at-home orders, school and business closures, and economic alarm. Nearly a third of the world's population lived under restrictions. Billions of lives had changed overnight because of a tiny organism's capability to reshape human life and society.

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Meanwhile, a second and even more powerful force was steadily reshaping Earth's fundamental processes—recharting atmospheric circulation patterns, heating ocean waters to miles deep, shooing ocean fish beyond their normal range, melting polar ice that had been thickening for millennia, multiplying the fury of hurricanes and depth of floods, and wielding countless more swords. Climate change is already hailed as humanity's greatest existential crisis, although its consequences are felt regionally rather than globally. But with time, climatic upsets will intensify and expand into multidimensional global bedlam.

Today, as I write, the COVID pandemic continues its chaotic march. As of May 23, 5.4 million cases and 343,975 deaths had been reported worldwide. The U.S. claimed about 30% of the world's diagnosed cases and nearly 100,000 deaths. In some states, disease numbers are decreasing. In others, they are rising. And everywhere questions are multiplying. How can we balance health concerns with economic collapse? How will today's nearly 40 million unemployed U.S. workers keep their lives afloat? And—most of all—when and how will this virus allow us to return to normal?

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Is that question even valid? What *is* normal?

Less obvious but perhaps more crucial, how will COVID-19's massive upheavals affect our dealings with climate change? This question cries out for a comparison of the two looming crises: what they hold in common, how they differ, and what COVID-19 has taught us about the climate crisis, issues that I consider in the remainder of this essay. Specifically, I examine the warnings and scientific proof of each, their effects and end points, and possible solutions, including how COVID-19 could help us deal with climate change.

What *warnings* have COVID-19 and climate change given us?

Neither COVID-19 nor climate change arrived unannounced. Both the Trump administration and previous administrations had been amply warned of the likelihood of a global pandemic. And two other new coronaviruses causing acute respiratory failure had moved from bats to humans this century: SERS in 2003 and MERS in 2012. Thus, when a third coronavirus emerged in China in 2019, we should have been on the alert. By January 2020, when COVID-19 proved it could travel, infect people swiftly, and kill, we should have been readying for the onslaught. But a serious public health response was not initiated until March. Many say that the slow response robbed us of much-needed personal protective equipment, medical tests, and control policies that could have saved thousands of lives. For example, a Columbia University study released May 22 concluded that had the U.S. adopted social distancing one week earlier—on March 8 instead of March 15—our country would have avoided 35,927 deaths.

Climate change entered the world in the mid-1700s alongside the Industrial Revolution, which traded the burning of fossil fuels for muscle power. Within decades, problems became obvious. In 1824, a French physicist defined the Greenhouse Effect, a founding principle of climate science, which theorized that fossil fuels' release of carbon dioxide would keep more heat in the atmosphere and thus raise global temperatures. By 1900, we had a list of greenhouse gases and had calculated their ability to raise temperature. Since 1958, atmospheric measurements of slowly increasing levels of carbon dioxide have provided proof of climate change. Around 1980, atmospheric levels started shooting upward, along with global average temperatures, trends that continue to the present. By late in the 1980s, scientific communities were sounding the alert and pushing for active climate change mitigation. Warnings have grown more numerous and more alarming ever since.

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Yet the response to climate change, as with COVID-19, has been sluggish. Both have been called a hoax by politicians, and recently the federal government has negated government policies that might have mitigated climate change. With each withdrawal from action, we have become more committed to reactive rather than proactive responses—to mopping up destructive storms rather than preventing them. We need to flip our stance to proactive action.

What *scientific proofs* do we have?

Science seeks to replace anecdotal stories with repeatable observations and verifiable data. Put more simply, scientists collect

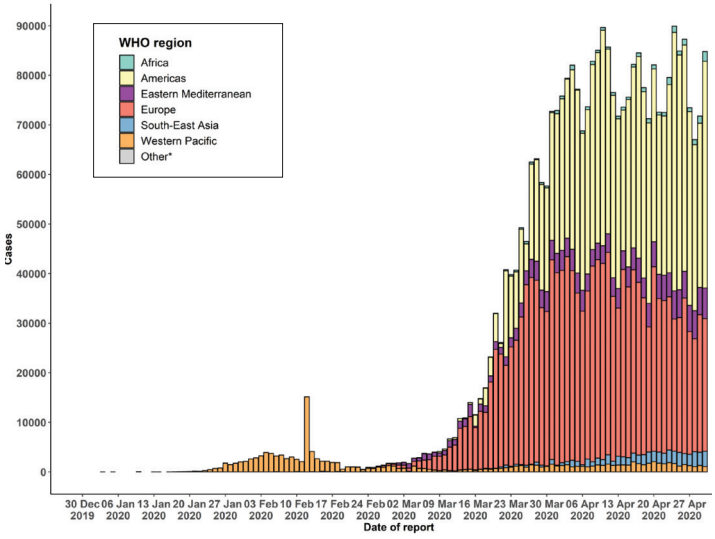


Figure 1. Worldwide number and rapid rise of confirmed COVID-19 cases, Dec 30 2019-May 1 2020. (World Health Organization, https://www.who.int/docs/default-source/coronaviruse/situation-reports/20200501-covid-19-sitrep.pdf)

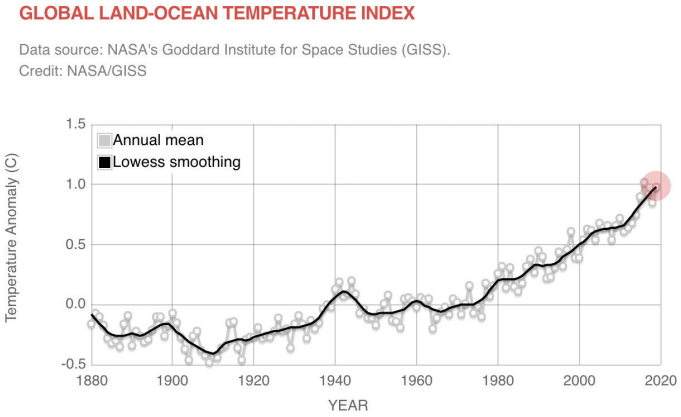


Figure 2. Rise in global average temperature since the beginning of climate records in 1880 to 2020. (NASA Global Climate Change, Vital Signs of the Planet, https://climate.nasa.gov/vital-signs/global-temperature/)

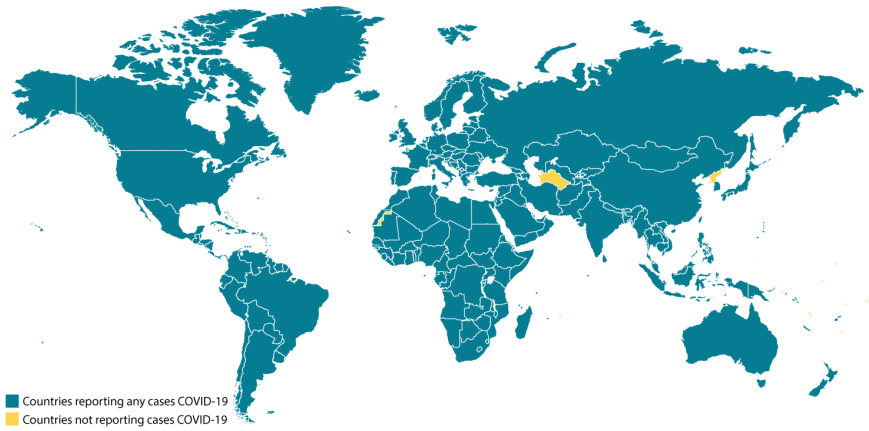


Figure 3. Global extent of COVID-19 on April 8, 2020 (Centers for Disease Control, based on World Health Organization data, https://www.cdc.gov/coronavirus/2019-ncov/global-covid-19/index.html)

Temperature data, dating back over a century, are gathered at thousands of sites daily, on land, deep into the ocean, and high into the atmosphere. Merging these numbers allows us to calculate the planet's global average temperature.

numbers, lots of numbers: for COVID-19, the number of diagnosed cases and deaths; for climate change, air temperatures and carbon dioxide concentrations. The climate data-collection system is particularly impressive. Temperature data, dating back over a century, are gathered at thousands of sites daily, on land, deep into the ocean, and high into the atmosphere. Merging these numbers allows us to calculate the planet's global average temperature. They also feed into thousands of research projects.

Analysis of these numbers reveals the rapid increase of both COVID-19 cases and global average temperatures (figures 1 and 2). Maps based on these data vividly display the global extent of both crises (figures 3 and 4). Data-driven mathematical models suggest potential futures that can guide our decision making—for example, modeling average temperature increases for this century shows that if we take extreme action, we are still able to avoid the worst ramifications of climate change (figure 5).

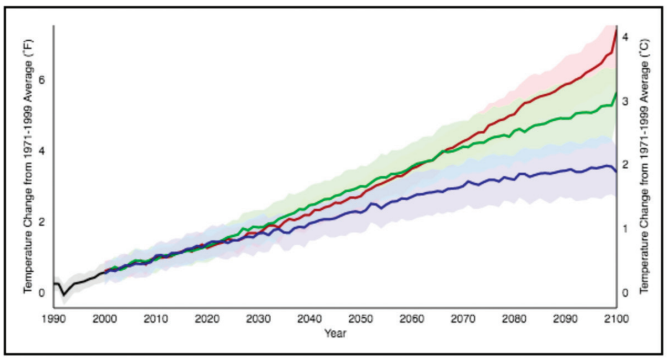
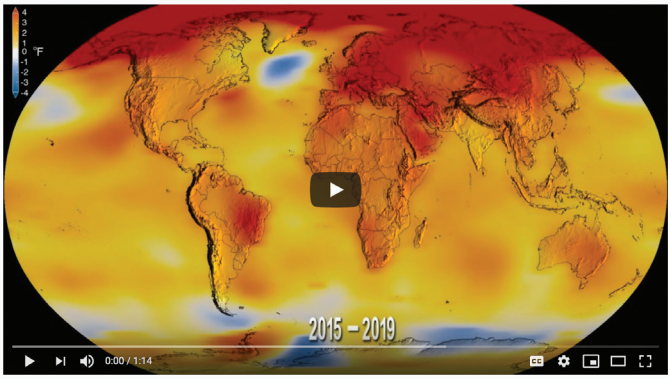


Figure 5. Graph of actual global average temperature changes to 2020, and projected temperatures to 2100, based on mathematical models of 3 emissions scenarios. The blue scenario shows that if we reduced carbon dioxide emissions now, we could keep Earth's average temperature below the requisite 3.6°F (2°C) increase. Otherwise global average temperatures will rise far higher. (NOAA Climate.gov, Climate Change: Global Temperature Projections. David Herring, 3-6-2012. https://www.climate.gov/news-features/understanding-climate/climate-change-global-temperature-projections)



2019 Was the 2nd-Hottest Year on Record

Figure 4. Average global temperature increasess from 2015 to 2019, which was the second warmest year on record, and ended the hottest decade on record. (NASA Goddard; https://www.youtube.com/watch?v=10H2ILuXjO8&feature=emb_rel_end)

COVID-19 graphs follow disease changes over days or weeks. The goal has been to smooth the curve of a given outbreak—that is, to lower the peak number of infections. Enacting specific public health policies, for example, requiring sheltering at home or wearing masks, spreads infections over a longer time period so that medical resources are not overwhelmed.

Modeling climate change is far more complex and can include tracing carbon dioxide concentrations back tens of thousands of years through measuring gas concentrations in Antarctic ice-core bubbles. Graphing these data demonstrates that recent burning of

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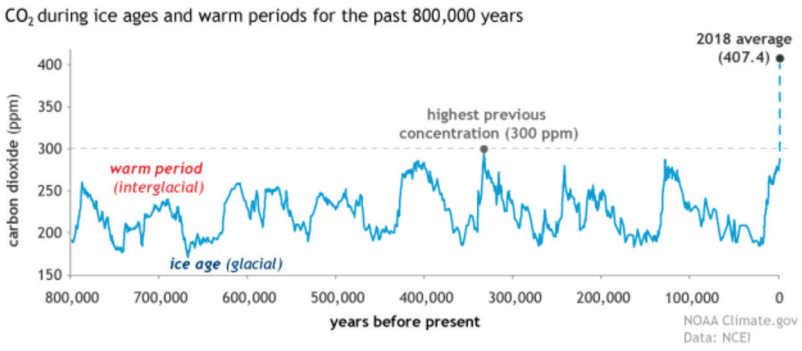

Figure 6. Since around 1900, atmospheric carbon dioxide concentrations have risen well above 300 parts per million, which was the highest concentration for at least 800,000 years, far longer than modern humans have roamed Earth. This rise is responsible for increasing global temperatures and their many climate-change ramifications. (NOAA Climate.gov; Data NCEI; https://www.climate.gov/news-features/understanding-climate/climate-change-atmospheric-carbon-dioxide)

fossil fuels has raised atmospheric carbon dioxide to 416 parts per million this April, well beyond its limits for at least 800,000 years (figure 6). Simultaneously, Earth's global average temperature has increased 1.8°F (1°C).

Climate models also gaze into the future. With minor variations, multiple models come to an unsettlingly similar conclusion: if we do not reduce the use of fossil fuels, by 2100 Earth's atmospheric carbon dioxide will have doubled to around 800 parts per million (figure 7). Without action, the global average temperature will have risen 6–10°F (3–6°C) (see figure 5). Our planet has not been this hot for the last 55 million years. With such a rise, life as we know it would be impossible over much of Earth's surface.

These numbers, trends, and models demonstrate beyond question that both COVID-19 and climate change are real crises that are getting worse. However, in the U.S., both crises have unfortunately been politicized. The discounting of science has lost us valuable time, slowed science-based policies and mitigation efforts, and magnified potential dangers.

What are the *effects* of each?

COVID-19 and climate change are remarkably similar in their ability to weave a grim narrative of calamities, one mishap spawning another, spinning a bewildering array of divergent but interacting disasters. When the World Health Organization declared that COVID-19 was a pandemic on March 11, all focus was on lessening illness and death. But already that month, job loss and the economy also claimed our concern, with massive federal legislation addressing both medical and financial systems. In the weeks since, questions about COVID-19 and racial inequality, health insurance, school closures, state finances, mental health, food supplies, and other issues have risen to the fore. It's clear that the pandemic is reaching all aspects of American life and will do this for some time.

Climate change, like COVID-19, increases human illness—in

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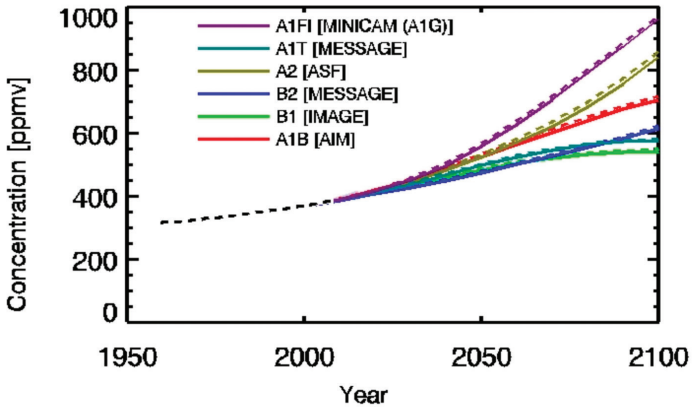

Figure 7. Projected increase in atmospheric carbon dioxide by 2100, as calculated by several mathematical models with varying emissions scenarios. (Intergovernmental Panel on Climate Change, data distribution centre, https://www.ipcc-data.org/observ/ddc_co2.html)

particular, allergies and asthma, heart attacks, and heat-induced problems. But for the most part, it touches human life by altering the natural environment. Consider climate change in Iowa. Average temperatures here have increased only 1°F (0.6°C), about half the global average. But even this small rise means wetter skies (hotter air holds more moisture and increases water evaporation), which in turn increase precipitation. Iowa's absolute humidity has risen 2–4% per decade in the last 50 years, and annual precipitation has soared from 32 to 38 inches since 1988. From mid-2018 to mid-2019, Iowa's skies dumped an amazing 51 inches of water, an all-time 12-month high. Because hotter air also holds more energy, storms here (and around the globe) have become more

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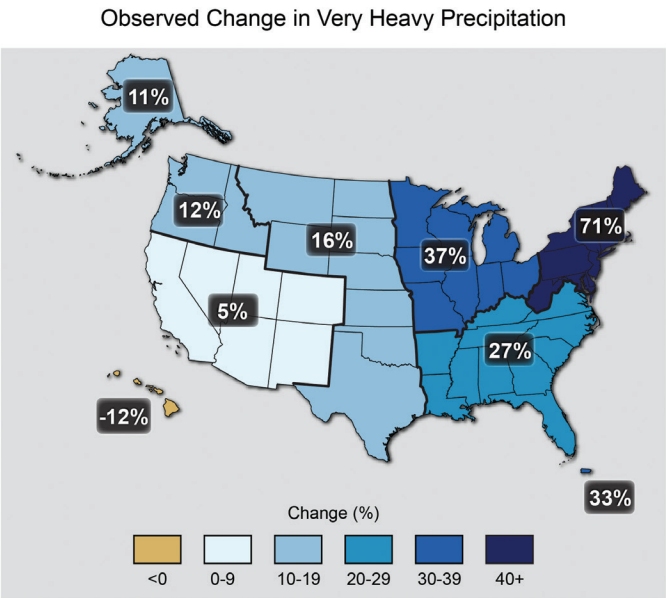

Figure 8. In the last 3 to 5 decades, heavy downpours have increased by 37% in Iowa and nearby states – a sure sign of the increased moisture and energy in our warming Midwestern skies. (The Third National Climate Assessment, 2014, Ch. 2: Our Changing Climate. Climate Change Impacts in the United States, Heavy Downpours Increasing. https://nca2014.globalchange.gov/report/our-changing-climate/heavy-downpours-increasing)

extreme: midwestern very heavy downpours have increased 37% (figure 8). All these increases in temperature and moisture have translated to more flooding, soil erosion, water pollution, waterlogged soils, mold, and their costly spinoffs.

Similar tales of interlocking climate shifts could be told of other regions around the globe. Of the Arctic—the fastest-warming region on Earth—and its dramatic loss of ice as it speeds toward ice-free summers, of heat-challenged polar bears and walruses, of Native villages collapsing into the seas. Of ancient Arctic permafrost melting and shooting methane (another potent greenhouse gas) skyward.

Or consider the oceans, which are rising as ice melts and the water heats—the oceans' global average temperature is up 2.7°F (1.5°C) since 1900, sea level is up 8 inches—losing oxygen, feeding more intense hurricanes, and becoming more acidic.

Both COVID-19 and climate change are reshaping the planet in myriad ways with tremendous costs. COVID-19's fast-paced destruction demands tremendous financial resources. However, climate change's less obvious, slower-paced effects are longer-lasting and with time will become more deadly and expensive. Already, for 2017, federal costs of weather and climate-related disasters topped a record $306 billion. The defining mission of our time has become addressing the climate crisis now, before its destructive patterns overwhelm us.

What are the eventual *end points* of each?

Where are the COVID-19 pandemic and climate change taking us? We know that both can transform lives and societies in a twinkling, but beyond that the two diverge, and that divergence makes all the difference. COVID-19 has attacked like a firestorm, fast and furious, but once an effective vaccine and therapeutics are developed and the economy has rebounded, this pandemic will become a memory.

> Individual actions remain important. Since we are now struggling to limit climate change's worst ramifications, every personal act, no matter how small, makes a difference.

Not so with climate change, which has no vaccine, no quick fix. It glides forward like a glacier—strong, slow, and relentless. As it erodes the planet's long-term functions and processes, rewriting the planet's operating instructions, climate change is altering life on Earth forever, at least as far as human civilization is concerned.

Climate change's effects are irreversible because we cannot turn climate change off, for two reasons. First, carbon dioxide has a very long atmospheric half-life. About a quarter of the carbon dioxide that we release today—with every trip in our cars, every use of fossil fuel–generated electricity—will remain in the atmosphere a thousand years from now, returning excess heat to Earth, warming our soils and air, oceans, and forests. Second, the vast majority of today's excess heat has been absorbed by the oceans, which at some point will start releasing that heat to further warm the atmosphere.

Does this mean that efforts to reduce climate change are hopeless? Just the opposite. It means that we need to supercharge our efforts now, before worsening climate patterns become further entrenched. A 2018 Intergovernmental Panel on Climate Change special report has provided guidelines for our actions: we need to keep total warming well below 3.6°F(2°C), ideally below 2.7°F (1.5°C), by decreasing emissions 45% by 2030 and reaching net zero emissions by 2050.

Limiting future emissions will not eliminate current climate change, but it *will* lessen its future intensity and effects, which would be momentous. Each action also will help protect us from reaching points of no return, the tipping points that, once begun, we cannot escape—the complete melting of Greenland's and Antarctica's ice sheets that will eventually raise sea levels 220 feet, the collapse of tropical rainforests, shifts in Atlantic Ocean currents, and other irreversible effects. Working toward these aspirations will brighten the future of billions of unborn children and millions of other species.

What are their possible *solutions?*

Here, once again, COVID-19 and climate change are largely similar. Both will be with us for the long term. But we know what we need to do to limit their consequences. And we largely know how to do it, with techniques continuing to multiply. Thus, we

I assert that COVID-19 … could serve as a crucial impetus to accelerate climate change mitigation efforts.

can restrain these crises' control over our lives. We simply need to get the job done, and fast. With COVID-19, that task appears to be straightforward: continue social limitations until effective therapeutics and a vaccine largely eliminate the virus's threat, possibly within the coming year.

Basic climate change solutions are equally straightforward: decrease fossil fuel emissions dramatically and rapidly, effectively eliminating them by mid-century or before. Move to a carbon-neutral world by replacing fossil fuels with renewable energy sources—solar and wind power and others—for both transportation and the generation of electricity, which together produce the majority of U.S. greenhouse gas emissions. Other major sources, for example agriculture, will require additional actions such as increasing carbon storage in soils.

The switch to renewable energy is happening. Renewables are now cost-competitive. In 2018, 37% of electricity generated in Iowa came from wind and solar power, and that amount is increasing annually. California now mandates solar panels on every new dwelling. Many businesses, including Google and Apple, are committed to buying only renewable energy. Electric vehicles are growing in popularity, with Tesla leading the way, and VW, Ford, and others committing to electric models. Amazon recently ordered 100,000 electric delivery vans. Around the world, similar switches are underway, with China now using hundreds of thousands of electric buses and (along with Britain and Norway) talking about banning the manufacture and use of fossil fuel cars. Energy conservation and ongoing technological innovation are important components of attaining carbon neutrality. We now can construct carbon-neutral buildings, which generate all the electricity they use, and even carbon-negative structures, which soak up more carbon dioxide than they emit. Other carbon-neutral examples of all sorts abound.

With today's urgency to limit climate change, we need to act on all levels. Federal policies and economic incentives supporting carbon-neutral initiatives are crucial, although these have lagged recently. State and local governments have been partially filling the gap by, for example, formulating their own plans for reaching carbon neutrality by mid-century. Britain, France, Germany, and dozens of other nations have done the same. But similar U.S. federal actions are crucial. A carbon tax on fossil-fuel energy would be a good start, as would cutting the large financial subsidies for oil companies. With tipping points biting at our heels, speed is crucial.

At the same time, individual actions remain important. Since we are now struggling to limit climate change's worst ramifications, every personal act, no matter how small, makes a difference. Virtually everything, from clothes to food to transportation to electrical energy, from voting to vacations to what we talk about with friends, relates to climate change in some way. Learn more. Stay engaged. Minimize your emissions.

How might COVID-19 help us deal with climate change?

To complete our comparison, I propose one final question. What has COVID-19, whose day-to-day effects are blatant, taught us about climate change, whose effects may remain invisible to some? I assert that COVID-19 has not been all bad. In contrast, it could serve as a crucial impetus to accelerate climate change mitigation efforts. Consider the following.

Motivation

We humans seem primed to believe that the impossible will never happen, at least not to us. COVID-19 has vividly demonstrated the opposite. In a few short months, this simple virus delivered a dress rehearsal for what far-more-robust climate change could pull off as it starts ripping through the world's expectations, populations, and economies. Shouldn't this fact speed our efforts to attack climate change with vigor?

At the same time, COVID-19 has shown us that we are capable of dealing with unimaginable global crises. Despite pressures and fears that could have overwhelmed us, our nation and people have risen to the challenge and addressed the problem straight-on. Medical professionals have provided the care needed. Legislators have negotiated bipartisan support to finance the initial massive recovery plans.

On a personal scale, individuals are also reporting satisfaction in returning to quieter lives and slower-paced pleasures while sheltering at home. They talk of a shift in values, of the importance of community, of the warmth and friendliness now being expressed, of neighbors affirming shared goals and coming together to solve common problems, all of these enriching their lives.

COVID-19 has reminded us of the concrete benefits of reducing fossil fuel use. With stay-at-home orders and declining travel, the air of large cities has cleared dramatically, uncloaking distant vistas and revealing the crisp beauty of unpolluted skies. Studies have found decreases of 35% and 60% respectively in particulate matter and nitrogen dioxide. In addition, by early April, daily global carbon dioxide emissions had decreased 17%. One might assume that these drops would lessen the asthma attacks, allergies, heart attacks, and millions of premature deaths each year associated with fossil fuel use.

Methods

On March 18, President Trump tweeted, "We are at war with an invisible enemy, but that enemy is no match for the spirit and resolve of the American people." Soon Trump became a self-appointed "wartime president," and the military metaphor was adopted on multiple fronts. Such a call to action has long been suggested as necessary to successfully address climate change, which

begs for a mobilization like that of World War II's Manhattan Project, which brought our best minds and unlimited resources into unified, crisis-driven focus. Trump applied military words to energize the attack on COVID-19. We would do well to similarly craft an all-consuming battle against climate change.

COVID-19 could offer economic assistance toward this end. In March, the U.S. Congress adopted three COVID-19 relief bills, including a nearly $2 trillion economic stimulus package, the largest in U.S. history. New legislation allocating additional funding is now being discussed. These aid packages offer the possibility of providing unprecedented funding to promote renewable-energy and energy-efficiency programs. Simply stated, portions of economic stimulus funds and programs could serve double duty: to ameliorate COVID-19's destruction and simultaneously speed our transition to carbon-free energy sources. Already in April, Germany and Britain suggested exactly this, stating that efforts to revive the global economy must also ensure a green recovery that simultaneously helps the world tackle climate change. In May, the European Union expressed the same, suggesting its European Green Deal—a blueprint for reaching zero emissions by 2050—as the heart of its economic response to COVID-19. If the U.S. would likewise tie its emergency relief to climate mitigation, this could make a huge difference in moving us toward a healthier climate future.

Opportunities

These tumultuous times are leaving their mark. Some days I realize that I am grieving, missing the life I had, wanting to turn the clock back. The urge to look backward at old desires and behaviors is strong. But then I realize that the past is gone. I am changing, as are we all. We will, with time and effort, regain stability, but it's unlikely that we can return to a pre–COVID-19 world. Nor, I think, would we want to. COVID-19 has revealed too many inadequacies—medical systems unprepared for pandemics, imbalance between care and outcomes for rich and poor, white and black—and more lessons are sure to come. And as comforting as replicating past institutional and personal habits may seem, doing so may be self-destructive or, at least, unfair to us and to the future. Do we really want to return to largescale dependence on fossil fuel energy, along with the resulting smog-filled cities, health problems, and oil spills? To become hostages to an increasingly problematic climate? Should *that* be our legacy?

Consider this alternative. COVID-19 has toppled institutions and habits that once seemed unchangeable. But by doing so, it has opened the door to opportunity. By creating a vacuum, COVID-19 has gifted us with the choice of working to forge a safer, healthier future rather than struggling to rebuild a problematic past. Why not see today's disquiet as an invitation to enter a future without fear of environmental threats, where concerns about oncoming storms, flooding, extreme heat waves, agricultural shortages, and economic collapse are assuaged rather than multiplied? A stronger, more unified world where proactive mitigation of climate change lessens despair and ambivalence?

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In the coming months, the choice to do so would require government policies, economic incentives, and myriad smaller decisions to advance the shift to renewable energy. Seattle, for example, recently decided to permanently close twenty miles of temporarily closed city streets to most vehicles to promote bicycle and foot transportation. Local decisions such as this one could coalesce to form a major paradigm shift. Making this shift may not always be easy. But by seeing COVID-19's toppling of systems, powers, and patterns as a prologue to better times, we will be moving in the right direction.

As I write, I marvel at how a mere speck of life, an infinitesimal virus invisible to the naked eye, has been powerful enough to shut down global societies and economies overnight. Then I raise my eyes and glance out at the wholeness and healing green of the woodland around our house. I notice a walnut-sized nest in the branch just beyond our deck. I spot its co-owner: a ruby-throated hummingbird perched nearby, ferociously defending its territory by dive-bombing a red-headed woodpecker who nonchalantly pecks at a tree trunk searching for dinner. Each bird loves the planet in its own way, I realize, trusting that its needs will be met as they always have. These strengths of species and nature are, to me, much more powerful than the virus. This is what I want to foster. This natural world. This kind of trust and security, this sense of safety. This sort of love for our planet. This is the faith I want to share: this inbred knowledge that all will be well, if our love and concern for those to come lead to understanding, and understanding leads to wisdom, and wisdom, in turn, leads to action.

References:

All figures are from open sources, which are cited in the captions. Recent news information mentioned in the essay is taken from reliable press sources, mostly *The New York Times*. Data on COVID-19 are from the Centers for Disease Control and World Health Organization websites. Iowa climate data is from Justin Glisan, Iowa's State Meteorologist, and Gene Takle, emeritus professor at Iowa State University and founder of its Climate Science Center. National and global climate data are from NASA and NOAA websites as well as U.S. National Climate Assessment reports and reports of the Intergovernmental Panel on Climate Change, the world's most esteemed global climate science research organization. Reports of all of these remain reliable sources of climate change information. Readers should be aware that random web searches for climate change information may bring up unproven and distorted data and concepts.