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Climate Change Is The Greatest Threat To Human Health In History

David Introcaso

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In early October the United Nation's

Intergovernmental Panel on Climate Change (IPCC), the world's definitive scientific body on the topic, published, "Global Warming of 1.5C." Over 90 scientists from 40 countries reviewing 6,000 studies prepared the IPCC report in response to a 2015 Paris climate accord request. Its purpose was to discriminate between the effects of global warming at 1.5°C (2.7°F) versus 2.0°C (3.6°F). The Paris accord called for holding warming below 2.0°C while pursuing efforts to limit it to 1.5°C. For example, should temperatures increase to 1.5°C, the report found of 105,000 species studied, four percent of vertebrates, six percent of insects and eight percent of plants would lose half of their climatically-determined geographic range. At 2°C the percents double to triple. At 1.5°C we will lose 70 to 90 percent of coral reefs, at 2°C there will be a 99 percent loss.

The IPCC report is just one of the latest in an increasing number of publications by leading national and international science bodies that conclude all life on this planet is under existential threat. What does the IPCC report and the subsequently published 4th National Climate Assessment and Lancet's "Countdown on Health and Climate Change," the 2017 "Climate Science Special Report" (CCSR), , and the 2016 Obama Administration report titled "The Impacts of Climate Change on

Human Health in the United States; A Scientific Assessment," conclude relative to the effects of global warming on human health?

Background

Per all of these reports, the earth has warmed by 1°C since the pre-industrial era and two-thirds of this rise has occurred since 1986. The twenty warmest years on record have occurred over the past 22 years. Because air temperatures are significantly determined by ocean temperatures, they have warmed considerably over the past few years. In 2017 they were shockingly warm. They exceeded 2015, the second warmest ocean temperature year, by 1.51 x 10^22 Joules, or the amount of electrical energy China produces annually. Among other calamitous results of ocean warming is acidification - particularly problematic for phytoplankton that produces half the oxygen we breath.

As for global warming's cause, or the nearly linear relationship between greenhouse gas emissions ad atmospheric warming, over 42 billion tons of greenhouse pollution are dumped worldwide into the atmosphere every year and the amount is again increasing. Per the Global Carbon Project carbon emissions are expected to increase by 2.7 percent for 2018 due in part to five consecutive years of

rising oil consumption. The US is historically the largest emitter of greenhouse gas pollution and currently ranks second behind China in annual emissions. Carbon dioxide, now measured at over 400 parts per million (ppm), a 65 percent increase over pre-industrial levels, last occurred three million years ago. Concerning the discharge rate, last year's CCSR report concluded, “there is no climate analog for this century any time in at least the last 50 million years.”

Absent significant changes in political will worldwide, the EPA admitted in a recent enviromental impact statement that atmospheric carbon concentrations will rise to nearly 800 ppm by the end of this century. This would be due in part to President Trump's decision to withdraw from the Paris accord and decisions by the administration to relax restrictions on auto tailpipe emissions that account for approximately 20 percent of US greenhouse pollution, rules limiting coal fired power plants CO2 emissions that account for nearly 30 percent, and regulations requiring drilling companies to restrict venting or flaring methane, a far more potent greenhouse gas than CO2, and monitoring and repairing methane leaks. Atmospheric concentrations of methane are currently the highest on record.

Health Effects

While health has always been effected by climate and weather, it is the change in climate and climate variability, particularly changes in weather extremes, that is a significant threat to human health. Again, absent dramatic and near term changes in political will, temperatures are expected to increase by 4°C by the end of this century. What do increasing temperatures mean for human health? (Readers should note that unless otherwise indicated statistics cited below come from the Obama Administration's 2016 report.)

Severe Storms

Warmer air holds more water and greater or rising temperatures cause higher surface evaporation that in turn increases the number and severity of rain events, now termed rain bombs, resulting storm surge and the intensity, frequency and duration of hurricanes. For example, the devastation caused by last year's Hurricane Harvey was in part the result of Gulf surface temperatures for the first time on record never falling below 23°C. Hurricane Maria, the deadlie storm of the hyperactive 2017 Atlantic hurricane season, accounted for nearly 3,000 deaths across decimated Puerto Rico. Harvey, Irma and Maria combined caused over $300 billion in damages. This year's Hurricane Michael, with sustained 155 mph winds, was one of the four most intense

hurricanes to hit the mainland since records began in 1851. Michael made landfall along the Florida panhandle, where it reached nearly 20 feet in storm surge and remarkably remained a category three storm as far inland as Macon, Georgia. Recent research published in the journal Nature concluded global warming will cause hurricanes to become even more deadly by intensifying rainfall by as much as 10 percent and wind speeds by 25 mph.

Rising Seas

Beyond the increasing severity of hurricane events, global warming means the current rate of rise in Global Mean Sea Level is greater than any time in at least 2,800 years. As for rising sea levels from ice melt, should Greenland ice sheets thaw in their entirety they would add 20 feet to the height of global seas. The thaw of the West Antarctic Ice Sheet, that is presently vanishing faster than any previously recorded time, would add another 10 feet. At 20 feet, most of Florida and a third of New York City would be under water. Keep in mind 145 million people worldwide live three feet or less above sea level and 10 percent of the world's population or nearly 800 million live less than 30 feet from present sea levels. Eleven of the 16 megacities, those with more than 15 million people, are built on coasts, for example, Jakarta, Los Angeles, Manila, Mumbai, Osaka, Shanghai and Tokyo.

Rising seas or flooding compromises drinking water, human waste water treatment and storm water disposal that, in turn, results in increased risk of waterborne diseases caused by pathogens such as bacteria, viruses and protozoa. Between 1948 and 1994, 68 percent of waterborne disease outbreaks in the US were preceded by extreme precipitation events. Waterborne diseases may actually be underestimated by as much as 43-fold and by up to 143 times for *Vibr*io species, for example*, Vibrio cholera*e Severe storm events also means increased food contamination via increases in the transport of pathoge such as salmonella and noroviruses. Global warming is therefore influencing the fate, transport, transmission, viability and multiplication rate of pathogens in the food chain. Cases of Legionnaires' disease, spread by contaminated aerosolized water have not surprisingly increased by nearly 200 perce between 2000 and 2009.

Drought And Fires

Heat, stagnant heat, and drought increase the prevalence, intensity and duration of wild fires particularly in the US West. The Southwest has experienced the most persistent droughts since record keeping began in 1895. These are expected to intensify. The recent California wildfires, the deadliest by far in the state's

history, are in part a result of the state experiencing five consecutive years of unprecedented heat, 2018 rainfall at 20 percent of the historical norm and the worst drought in a millennium. The amount of carbon these fires can emit can be massive, further exacerbating overall trends in climate change. The forest and peat fires in Indonesia during 1997 were estimateto release upwards of 40 percent of total annual carbon emissions globally.

Such fires also have a lasting impact on air quality with serious health consequences. By 2050 it is anticipated western US wildfires will result in a 40 percent increase in organic carbon and a 20 percent increase in elemental carbon aerosol concentrations. When soil dust becomes airborne conditions such as asthma, acute bronchitis and pneumonia frequently result. Heat, drought and wild fires also contribute to worsening ground-level ozone pollution, particle pollution and increasing levels of aeroallergens such as pollen. Combined, these are responsible for tens of thousands of acute care episodes. Research showthat future ozone-related human health impacts are projected to lead to hundreds of thousands of premature deaths, hospital admissions and causes of acute respiratory illnesses including increases in asthma episodes in children due in part to a longer

ragweed pollen season. In 2013, the year of China's “airpocalypse,” researchers found that, in the 74 leading Chinese cities, air pollution was associated with an estimated one-third of the deaths.

Higher Temperatures

Higher temperatures cause heat exhaustion, heatstroke, hyperthermia and dehydratiothat in extreme cases can lead to death. What is more, they can worsen pre-existing conditions such as hypertension, cardiovascular, respiratory, cerebrovascular, kidney and diabetes-related conditions. For example, the 2003 European heat wave was responsible for upwards of 70,000 premature deaths. Calculating morbidity and mortality due to, or due in part to, extreme heat is difficult since medical records seldom capture related data. Nevertheless, researchers projt future warming, absent any adaptation, will result in an increase of 2,000 to 10,000 deaths annually in each of 209 US cities. Among other effects, warmer winter and spring temperatures means the earlier annual onset of Lyme disease cases that now number 35,000 annually in over 14 eastern states. Higher temperatures also affect what are termed vector-borne diseases carried by, for example, mosquitoes, fleas, ticks and rodents. Warmer temperatures, for example, speed up the reproductive cycle of cold blooded mosquitoes. Cases of mosquito-borne

Dengue fever, once unknown in the US, have doubled every decade since 1990. Currently there are 14 vector-borne diseases, including West Nile Virus, that are a national public health concern.

Cascade Of Consequences

The climate penaltis also the cause of a long list of mental and behavioral health conditions ranging from anxiety, depression and alcohol and substance abuse to post-traumatic stress and suicide. For example, following Hurricane Katrina in 2005, veterans with preexisting mental illness had nearly a seven times greater risk for developing an additional mental illness**.** Suicide attempts after Katrina among women living in temporary housing increased 15 times compared to regional averages, and incidences of violent crime including homicide and violence against women increased substantially.

As long as the worldwide economy is defined largely as fossilized capitalism, mass extinctions or the loss of phylogenetic diversity will continue. Among other things, we will also continue to see substantial worldwide fishery losses and the collapse of insect populations. The loss of insect populations will contribute to a profound negative effect on food production. For example, 30 countries are currently experiencing negative crop yields and there is

a one in twenty likelihood heat, climate change will cause the failure of corn production in China and the US. Production aside, it is worth noting higher concentrations of CO2 in the air stimulate carbohydrate production, starch and sugars, and growth in a number of widely consumed crops including barley, potatoes, rice and wheat. It also lowers the level of plant protein by as much as 15 percent. Increased atmospheric CO2 also depletes calcium, copper, iron, magnesium, zinc and other minerals in most plants by upwards of 10 percent because higher CO2 concentrations reduces plant demand for water resulting in fewer nutrients being drawn into plant roots. This is turn, could also contribute to greater rates of obesity.

Finally, there are any number of additional or cascading climate change-related health consequences that disproportionally affect pregnant women, children, the elderly and disabled, minorities and the poor. Vulnerability is a function of sensitivity to change and adaptive capacity to adjust or cope. The elderly are particularly vulnerable since they are frequently immuno-compromised, are prescribed certain medications that limit thermo-regulation or block nerve impulses and a significant percent are cognitively impaired and/or socially isolated. It is not surprising to learn half of Katrina deaths were among

people over 75 and African American mortality was two to four times higher than for whites. Keep in mind that from 2015 to 2050 the US population age 65 and older will nearly double from 48 to 88 million.

Conclusion

Studies show the current reality is for CO2 emissions to continue climb through 2040. This is due largely to China, Russia and Canada's current energy policies that, if unchanged, will drive global warming above 5°C before the end of this century. At 4°C, for example, 44 percent of vertebrates lose half their geographic range, plants and insects over two-thirds, global grain yields fall dramatically, the world's economy contracts by 30 percent and excess hyperthemia deaths in the US increase by over 700 percent.

As dire as anthropocene warming projections are, they have yet to fully account for feedback loops, or the fact warming temperatures become the cause of new sources of greenhouse gas emissions. After a certain point, one that may be less than two decades away, we will have irreversibly tipped toward self-perpetuating or runaway global warming or what a recent and widely discussed Proceedings of the National Academy of Sciences essay termed "Hothouse Earth." For

example, a decline in the Albedo effect, where less and less sunlight is reflected by the diminishing ice cover causes still more absorption of solar radiation or higher surface temperatures and a wide range of subsequent threats: warming sea beds and melting permafrost allows trapped methane, an extremely potent greenhouse gas, to escape into the atmosphere; increased rainfalls reduce soil absorption of greenhouse gasses; and reductions in Greenland ice can alter Gulf Stream ocean currents that in turn accelerates ice melt in the southern hemisphere.

The October IPCC report concluded that if the current rate of greenhouse gas emissions continue, temperatures will rise to 1.5°C above pre-industrial levels by 2040. In order to avoid, this the IPCC found greenhouse pollution must be reduced by 45 percent from 2010 levels by 2030 and completely, that is, by 100 percent, by 2050. Coal use, currently accounting for 40 percent of electrical production, would have to drop to nearly one percent. Renewable energy sources, currently supplying 20 percent of electrical production, would have to more than triple. The effort required to transform the world's economy, the report stated, would be so great “there is no documented historical precedent.”

US efforts to avoid what the world's leading climate scientists increasingly describe as total

dystopia remain anemic. Beyond the damage done by the president's efforts, recent state efforts to limit greenhouse pollution via increased dependence on renewables, a ban on new drilling and a carbon tax failed respectively, in Arizona, a California county and in Washington largely due to the fossil fuel industry spending over $60 million in opposition. As for the Congress, it has not legitimately attempted to address global warming for a decade. While the incoming Democratic House majority has at least bulleted the issue, the caucus may be more interested in interrogating Interior Secretary Ryan Zinke about his relationship with Halliburton and investigating ExxonMobil for allegedly deceiving the public about the harms of fossilized capitalism.

Federal health care regulators have not been interested of moving beyond updating CMS' “extreme and uncontrollable circumstances” policy to require in-patient providers to demonstrate they are moving toward becoming carbon neutral as a condition of Medicare participation. The health care industry, the second largest greenhouse gas polluter after the food industry accounting for nearly 10 percent of greenhouse pollution and supposedly dedicated to preventing and treating disease conditions caused or exacerbated by global warming, remains

largely indifferent. For example, according to Lancet's 2018 "Countdown" report, cited above, in 2017 the global value of funds committed to fossil fuel divestment equaled $428 billion. Of this amount the health care sector was responsible for a paltry 0.76 percent, or $3.28 billion.

We have been robbing the planet. It's only a question of how harsh or definitive the penalty will be. Nature bats last.

HealthAffairs

7500 Old Georgetown Road,
Suite 600
Bethesda, Maryland 20814
T 301 656 7401
F 301 654 2845
customerservice@healthaffairs.org