Unpredictable human factor in climate change

By **New York Times News Service**
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In Photo: Arlene Estle stands outside her home, which was damaged by floodwaters from Hurricane Harvey, in Houston on September 11. Victims of Harvey, desperate to rebuild their homes and lives, are facing the harsh reality that it may take months for an overwhelmed construction industry to address their needs.

As Hurricane Harvey bore down on the Texas coast, few people in that state seemed to understand the nature of the looming danger.

The bulletins warned of rain falling in feet, not inches. Experts pleaded with the public to wake up. J. Marshall Shepherd, head of atmospheric sciences at the University of Georgia and a leading voice in US meteorology, wrote before the storm that "the most dangerous aspect of this hurricane may be days of rainfall and associated flooding."

Now we know how events in Texas turned out. Shepherd and his colleagues have spent their careers issuing a larger warning, one that much of the public still chooses to ignore. I speak, of course, about the risks of climate change.

Because of atmospheric emissions from human activity, the ocean waters from which Harvey drew its final burst of strength were much warmer than they ought to have been, most likely contributing to the intensity of the deluge. If the forecasts from our scientists are anywhere close to right, we have seen nothing yet.

In their estimation, the most savage heat waves that we experience today will likely become routine in a matter of decades. The coastal inundation that has already begun will grow worse and worse, forcing millions of people to flee. The immense wave of refugees that we already see moving across continents may be just the beginning.

Scientists urged decades ago that we buy ourselves some insurance by cutting emissions. We yawned. Even today, when millions of people have awakened to the danger, tens of millions have not. So the political demand for change is still too weak to overcome the entrenched interests that want to block it.

In Washington progress on climate change has stalled. The administration has announced its intent to withdraw from the global Paris climate accord. And top Trump appointees insist that the causes of climate change are too uncertain and the scientific forecasts too unreliable to be a basis for action.

This argument might have been halfway plausible 20 years ago—or, if you want to be generous, even 10 years ago. But today?

Today, salt water is inundating the coastal towns of the United States, to the point that they are starting to put giant rulers in the intersections so people can

tell if it is safe to drive through. The city leaders are also posting "no wake" signs—not on canals but on the streets, to stop trucks from plowing through the water so fast as to send waves crashing into nearby homes.

We all see the giant storms, more threatening than any in our lifetimes—and while scientists are not entirely comfortable yet drawing links between the power of these hurricanes and climate change, many people are coming to their own common-sense conclusions.

As the challenges in the real world worsen, some senior Republicans continue to question the link between human-caused emissions and rising temperatures.

Scott Pruitt, the head of the Environmental Protection Agency, said this on CNBC in March: "I think that measuring with precision human activity on the climate is something very challenging to do and there's tremendous disagreement about the degree of impact, so no, I would not agree that it's a primary contributor to the global warming that we see."

Note that he acknowledges the planet is warming. Note that he offers no alternative hypothesis about the cause of that warming—nor will he ever, for the simple reason that there is no plausible alternative. But still, he clings to uncertainty as a reason to do nothing.

To be sure, fair-minded people can and should ask: What are the real uncertainties?

They exist in climate science, and despite claims to the contrary made by climate denialists, nobody hides them. You can spend long days at conferences, as I have, hearing from the scientists themselves about all the error bars of their studies and all the weak points of their computer models.

We are not entirely sure, for instance, how much the planet will warm in response to a given level of emissions. That is a pretty basic question, and the inability of climate science to narrow it down has been one of the great frustrations of the field these past few decades.

In the 1970s the experts made a best guess about how sensitive the Earth would be to greenhouse gases, and as evidence accumulates, that early estimate is holding up pretty well. Forecasts from the 1980s and 1990s about the rate of warming have proved fairly accurate, too, give or take 20 percent.

In fact, to the degree our scientists have made a systematic error, it has been to understate how quickly things would unravel. The sea ice in the Arctic is collapsing in front of our eyes. Even more ominously, land ice is melting at an accelerating pace, threatening a future rise of the sea even faster than that of today.

Huge forest die-offs are beginning, even as the remaining forests work overtime to suck up some of the carbon pollution that humans are pumping out. We are already seeing heat waves surpassing 120 degrees Fahrenheit, sooner than many experts thought likely.

Yet, it is true, the list of uncertainties is still long and vexing. Scientists have trouble, for instance, turning their broad global forecasts into specific predictions for a given locality.

Want to know what the average temperature is going to be in Athens, Georgia, in 2050? Wonder how the Asian monsoon, whose rains feed billions, will hold up in the 2070s? Those forecasts exist, but even the scientists who made them are not going to advise you to put much stock in them.

Yet, here is the crucial point, and one you never hear the climate denialists own up to: the uncertainties cut in both directions.

Every time some politician stands up and claims that climate science is rife with uncertainties, a more honest person would add that those uncertainties could just as easily go against us as in our favor.

And if they do go against us? We might be looking at, oh, 80 or 100 feet of sea-level rise in the long haul, a direct result of the failures of this generation to get emissions under control. What kind of shape do you think Miami—or for that matter, New York—is likely to be in after 80 feet of sea-level rise?

The truth is that the single biggest uncertainty in climate science has nothing to do with the physics of the atmosphere, or the stability of the ice, or anything like that. The great uncertainty is, and has always been, how much carbon pollution humans are going to choose to pump into the air.

In fact, calculations have been run on this. If you want, say, a forecast for global temperature in 2100, the uncertainty about how much pollution we will spew out is at least twice as large as any uncertainty about the physical response of the climate to those emissions.

So despite arguments like Pruitt's, a century of climate science has brought us to the point where we can say this definitively: We are running enormous risks. We are putting nothing less than the stability of human civilization on the line.

And yet most of us have still not bestirred ourselves to care, much less to march in the streets demanding change. We are like the people in Texas who did not take those flood warnings seriously enough, except that the stakes are so much larger.

Is this failure to act the legacy our generation wants to leave for the generations yet to come?

Justin Gillis/New York Times News Service

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