After the Fact | Ocean, People, Planet: The Impacts of Climate Change

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TRANSCRIPT

Michael Oppenheimer, Albert G. Milbank professor of geosciences and international affairs and director of the Center for Policy Research on Energy and the Environment, Princeton University: If the Earth were to warm 4 or 5 degrees Celsius, it would be a disaster for humanity. It would be a biological disaster for the ocean. But the ocean, as a physical entity, it's not going to disappear. But it's going to be a totally different phenomenon than it is today.

Dan LeDuc, host: Welcome back to "After the Fact." For The Pew Charitable Trusts, I'm Dan LeDuc, and today we continue our "Ocean, People, Planet" series with a conversation with Michael Oppenheimer about how the planet's changing climate is affecting the ocean.

A 2021 Pew Research Center survey found that about half, or 51%, of Americans think the United States is doing a bad or somewhat bad job of addressing climate change. That's our data point for this episode. And, of course, most of us are living through the effects of climate change ourselves—the heat waves, droughts, and flooding from more frequent severe storms.

Michael Oppenheimer knows all about this. He directs the Center for Policy Research on Energy and the Environment at Princeton University and is a longtime participant in the United Nations' Intergovernmental Panel on Climate Change. That group won the Nobel Peace Prize in 2007 for its work. Professor Oppenheimer's research examines the impact rising temperatures have on ice sheets and sea level. He also studies how humans are responding to those changes. Here's our conversation.

Let's start off, if we could, with you just defining climate change so that people really understand what we're talking about and its relationship with the ocean.

Michael Oppenheimer: I'm assuming people understand that the climate itself is the average of the weather over long periods of time. Earth would have a climate, whether or not human beings were here. Because there are certain gases that exist naturally in the atmosphere that are transparent to sunlight; sunlight comes in, is absorbed by Earth's surface, warms the Earth. And some of the heat in the sunlight tries to return into space. But some of these gases in the atmosphere have the property of trapping heat as it tries to go back into space in the form of infrared radiation.

That trapping is called the "greenhouse effect." It's a good thing. Because without it, Earth would be about 60 degrees Fahrenheit cooler than it is, a frozen desert. You and I wouldn't be here to talk about it. But the greenhouse problem, which is also the climate change problem, occurs because humans are increasing the levels of those gases, or at least some of them, in the atmosphere—primarily carbon dioxide from burning coal, oil, natural gas, deforestation, and a bunch of other causes.

This buildup of the greenhouse gases has already made Earth about 2 degrees Fahrenheit warmer than it would be absent the human-made buildup of the greenhouse gases. And the projections for the rest of this century are a continuous warming. And whether that warming is a lot or a little depends on what we do in the way of trying to restrain these emissions.

Dan LeDuc: You talked about a 2-degree change, and to make sure everybody understands what we're talking about, this is not the difference of between a 70-degree day and a 72-degree day. The implications are much greater when you talk about the overall global temperature.

Michael Oppenheimer: Right. The key thing with climate is that if you change the average or mean temperature a little bit, say, a couple of degrees Fahrenheit, you change the extremes a lot. So, you change the number of very hot days a lot. And it's the very hot days or the days with very high precipitation, or the days where the seas become very high because of the combination of a high tide and a storm, that are the things that cause humans a great deal of problems. So, it's not so much the change in the mean, although that can be problematic; it's those big outlier events that we don't see many of today that we're going to see a lot of in the future.

The climate is initially an atmospheric phenomenon, but it ties to the whole rest of the Earth's system. The climate both affects and is affected by the icy parts of Earth, the poles. And, of course, 70% of Earth's surface, as we all know, is ocean water. And not only does the climate and climate change affect the state of the oceans, but that change that it has ripples back, and affects what's going on in the atmosphere.

Dan LeDuc: I've heard you reference something you call "the climate danger zone." What do you mean by that? And what are the different factors that have gotten us to this point?

Michael Oppenheimer: Exactly 30 years ago, the countries of the world, including the United States, came together and signed a treaty called the "U.N. Framework Convention on Climate Change." And in that treaty, there's a section, which is called "Article 2," which says that the objective of the treaty is to avoid, quote, "dangerous anthropogenic interference with the climate system." That means that human beings shouldn't emit so much in the way of greenhouse gases that it pushes this system too far off the more or less equilibrium state it's been in for a long, long time.

As recently as the Paris Agreement, which was a meeting of all the parties to the Framework Convention that occurred in 2015, at that Paris Agreement, there was finally a global consensus on what "dangerous climate change" meant. The countries, based on the scientific evidence and on political reality of what was achievable, decided that a warming of greater than either 1 1/2 or 2 degrees Celsius, which is something in the range of 3 to 4 degrees Fahrenheit; that kind of warming would be the boundary where we tip over into a dangerous climate. "Dangerous" meaning a lot of people dying essentially from the effects of too much heat, or drowning in floods, or due to food insecurity because crop yields would be decreasing at that point. Or in the case of the oceans, that sea level would have risen due to the effect of the warming on ocean water and on ice so much that certain areas of the world would be flooded so often, essentially unlivable, or so expensive to defend that it would be effectively impossible for many countries to protect themselves.

Dan LeDuc: So, we know what potential bad stuff can be, and you've described it. What are the actual changes that we can point at now that are actually occurring, and people are starting to live with and see themselves?

Michael Oppenheimer: So, already, just at the 1-degree Celsius or about 2-degree Fahrenheit warming that we've already seen, we're seeing a very significant increase in the number of very hot days. And, so, the area of the Earth which is affected by the combined extra heat and extra humidity has started to expand and that's going to continue. And we can now do something we couldn't do 20 or 30 years ago. We can look at an extreme event like a heat wave, or like a hurricane, like, for instance, Hurricane Harvey, which dumped a monumental amount of rainfall. Those kinds of extremes were very rare, or it didn't happen at all in human experience previously. And, now, when they happen, we can say, how much of that extreme event was caused by climate change?

Dan LeDuc: I've also been reading how climate change has reached a point where some of the damage is done already, that we can't reverse. If you could, you are a scientist, not an artist. But I'm going to ask you to paint two pictures for us here. One is sort of where we are now if we can make some change and the existing damage that's been done. Paint that picture. But then also, after that, paint the picture of what could happen if not enough happens and some of these changes continue and the bad stuff starts to occur.

Michael Oppenheimer: I think I can sum this up in one number. I was an author of an IPCC report, or report of the Intergovernmental Panel on Climate Change, which was a special report on the oceans. And it was published two years ago. The most startling number we saw that we developed in that report was that the frequency of flood levels at the coast that—and I want to say flood levels occur at the coast because of either super-high tides, or storms that come with a storm surge, with a storm literally lifts the surface of the ocean due to low pressure and drives it inland. And we noticed that the frequency of those very unusual events, which let's say occur once a century some of them, or less, would now occur by 2050, 28 years from now, would

occur at many locations on the U.S. coasts and the world's coasts once per year rather than once per century.

Our ability to deal with those storms and those flood conditions depends on how much time we have to recover from when a flood has happened. And if you have a monumental flood like happens in either a Hurricane Harvey or a Hurricane Sandy and you don't have just a matter of days, but you need years to recover. In fact, the Northeast, there are still a lot of places that haven't fully recovered from Hurricane Sandy.

That's why governments have generally used the once-in-100-year storm as a benchmark because they know you need not just years but, in some cases, decades to really recover. Well, what happens when the once-in-100-year storm hits you every year? No matter how good we get at adaptation, it's going to be really rough. And you can tell the same story, only the details are different for heat waves, droughts. These are the kinds of extreme events that are going to come barreling at us. And, again, if we can slow down the rate at which that frequency is increasing and at the same time—and this is very important—up our game in protecting ourselves called "adaptation," we have a chance to actually move into a world that is sustainable. But if we don't, we'll move into a future that's headed straight downhill. And the train will be running away from us, and there'll be no way to catch up.

Dan LeDuc: Let's talk about the role of the ocean itself in all of this, because it is showing us effects but also helps us absorb effects. Can you talk a little bit about the science of the ocean in climate change?

Michael Oppenheimer: The ocean is so big and has so much mass that it creates an inertia in the problem. We've actually put so many greenhouse gases in the atmosphere that if the ocean weren't there absorbing a lot of the heat and slowing down the warming of the land surface, we'd already be several degrees warmer. So, the ocean is doing us a favor. About half the carbon dioxide we emit gets dissolved in the ocean naturally.

That's a little benefit that nature gives us. So, the ocean has given us a double favor of slowing down the problem. Unfortunately, there's a price to pay. What does the ocean do with the heat? Well, one way it absorbs heat is by expanding. What does the expanded ocean water do? That sea level rise or at least part of it. Riding on the ocean is a lot of frozen sea ice. That sea ice melts as the ocean surface warms. That's an effect that climate change is having on the ocean. And because sea ice is fresher than ocean water, which is quite salty, it has the effect of freshening the waters.

One of the major currents of the ocean is called the "meridional overturning circulation" of the Atlantic. It's a conveyor belt, and it pops its head up around just south of Greenland. And that's also an area where the salinity is changing and that's slowing that current down. All the projections are it slows down further in the future, and we can't really accurately predict what

happens as it slows more and more. It could slow enough to really throw the climate in the far northern latitudes into kind of a topsy-turvy situation. And this has been a fear for a long time.

The ocean and keeping the ocean in its natural state really, it's a flywheel in the climate system. And the more that we torture it, the more its flywheel capability disappears. The less it's able to absorb carbon dioxide, the less ice floats on its surface. The more the Earth warms. The faster the warming.

Dan LeDuc: You're talking about something that's occurred over a great deal of time. We now have to act in a shorter period of time and a much faster way in response. So, what are like a couple of big things that need to be done as quickly as possible?

Michael Oppenheimer: Look, the way to look at it is the biggest thing you can do is find a way to generate energy that isn't dependent on fossil fuels. That's the biggest chunk of the problem. You also need to bring an end to deforestation, because cutting and burning trees puts carbon dioxide in the atmosphere. We also have to improve our cultivation practices, because a lot of methane and nitrous oxide, two other greenhouse gases, escape into the atmosphere through agriculture.

So, those are the way it divides up, and then you can subdivide it further. Transportation. If everybody is going to run around in a single-passenger automobile, [but] we're never going to solve the problem. I say that knowing that we seem to be on the verge of a revolution in the auto industry of transitioning to electric vehicles. But if those electric vehicles are powered by electricity that was generated by coal or natural gas, it isn't going to help all that much.

So, at the same time, we have to be changing the primary generation of energy to energy from the sun. That is, solar photovoltaic cells to generate electricity; wind turbines to generate electricity; geothermal energy, which is ancient energy buried under Earth's surface; some hydro power. These are sources which don't emit carbon dioxide except to some extent in the production of the machinery, which generate like a wind turbine or a set of solar cells. So, we got to do that as quickly as possible, and it's happening. It's just needs to step up the pace.

The second thing we need to do is get ahead of the curve on transmission systems. In some countries, a lot of electricity is wasted because the transmission systems are old and dilapidated, not maintained. According to recent analyses, you could probably serve or satisfy about 85% of the projected future electricity demand, or, I should say, displace about 85% of fossil fuel burning by a new system, which would have to be based on renewable energy, a smart modern grid to move it around to where it needs to be when it's needed. And, for a time, with a little backup from natural gas. And, in that way, we could have an economy, which is driven by electricity, where the transportation system would be dominated by electricity, and we would be minimizing the carbon dioxide emissions, and eventually get totally off fossil fuels.

Dan LeDuc: You've described very well the scientific and technological limitations of the advances as well as now we know the limitations that we have to overcome. A lot of that also,

though, are going to be business decisions, political decisions, policy decisions. For a long time, this issue of climate change was a divisive issue. It seems, according to polling, less so now.

Michael Oppenheimer: I don't want to try to fool anybody here. There are people who are hurt by any transition. And it's true that people who mine coal will be hurt by this.

And, so, we have a responsibility, both, in my view, a moral responsibility but also a very practical responsibility, to cut short political opposition to help those communities transform themselves into something else and not be dependent on coal. But these are things our society has done before. This is maybe at a more massive scale and has to be done quicker than previous transitions. But there's a long history of energy transitions, once they get started, really taking off.

So, that's the one thing that gives me optimism about this. We are in the middle of an energy revolution. And if we don't mishandle it, there's a pretty good chance we can get where we need to go and that other countries may get there, too.

Dan LeDuc: Our thanks to Michael Oppenheimer for that conversation. In our next episode, we travel to the Blackwater National Wildlife Refuge on Maryland's Eastern Shore and may even get a little wet as we look at the effects of climate change up close. The story there even has the U.S. military concerned. Our thanks to you for listening. To learn more about this season, visit pewtrusts.org/oceanpeopleplanet. Until next time, I'm Dan LeDuc for The Pew Charitable Trusts, and this is "After the Fact."