Mother Jones

What These Climate Scientists Said About Earth's Future Will Terrify You

I spoke with apocalyptic climate scientists about what our next generation faces, and their answers were bleak.

By Dahr Jamail | Tue Dec. 17, 2013 12:11 PM GMT

Social Title:

What these scientists have to say about climate change will terrify you

This story [1] first appeared on the TomDispatch [2] *website.*

I grew up planning for my future, wondering which college I would attend, what to study, and later on, where to work, which articles to write, what my next book might be, how to pay a mortgage, and which mountaineering trip I might like to take next.

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[3]Now, I wonder about the future of our planet. During a recent visit with my eight-year-old niece and 10- and 12-year-old nephews, I stopped myself from asking them what they wanted to do when they grew up, or any of the future-oriented questions I used to ask myself. I did so because the reality of their generation may be that questions like where they will work could be replaced by: Where will they get their fresh water? What food will be available? And what parts of their country and the rest of the world will still be habitable?

The reason, of course, is climate change—and just how bad it might be came home to me in the summer of 2010. I was climbing Mount Rainier in Washington State, taking the same route I had used in a 1994 ascent. Instead of experiencing the metal tips of the crampons attached to my boots crunching into the ice of a glacier, I was aware that, at high altitudes, they were still scraping against exposed volcanic rock. In the pre-dawn night, sparks shot from my steps.

[4]

How much should you worry about an Arctic methane bomb? The *Climate Desk* interviewed [4] leading experts skeptical of the threat.

The route had changed dramatically enough to stun me. I paused at one point to glance down the steep cliffs at a glacier bathed in soft moonlight 100 meters below. It took my breath away when I realized that I was looking at what was left of the enormous glacier I'd climbed in 1994, the one that—right at this spot—had left those crampons crunching on ice. I stopped in my tracks, breathing the rarefied air of such altitudes, my mind working hard to grasp the climate-change-induced drama that had unfolded since I was last at that spot.

I haven't returned to Mount Rainier to see just how much further that glacier has receded in the last few years, but recently I went on a search to find out just how bad it might turn out to be. I discovered a set of perfectly serious scientists—not the majority of all climate scientists by any means, but thoughtful outliers—who suggest that it isn't just really, really bad; it's catastrophic. Some of them even think that, if the record ongoing releases of carbon dioxide into the atmosphere, thanks to the burning of fossil fuels, are aided and abetted by massive releases of methane, an even more powerful greenhouse gas, life as we humans have known it might be at an end on this planet. They fear that we may be at—and over—a climate change precipice hair-raisingly quickly.

Mind you, the more conservative climate science types, represented by the prestigious Intergovernmental Panel on Climate Change (IPCC), paint scenarios that are only modestly less hair-raising, but let's spend a little time, as I've done, with what might be called scientists at the edge and hear just what they have to say.

"We've Never Been Here as a Species"

"We as a species have never experienced 400 [5] parts per million of carbon dioxide in the atmosphere," Guy McPherson, professor emeritus of evolutionary biology, natural resources, and ecology at the University of Arizona and a climate change expert of 25 years, told me. "We've never been on a planet with no Arctic ice, and we will hit the average of 400 ppm…within the next couple of years. At that time, we'll also see the loss of Arctic ice in the summers…This planet has not experienced an ice-free Arctic for at least the last three million years."

For the uninitiated, in the simplest terms, here's what an ice-free Arctic would mean when it comes to heating the planet: minus the reflective ice cover on Arctic waters, solar radiation would be absorbed, not reflected, by the Arctic Ocean. That would heat those waters, and hence the planet, further. This effect has the potential to change global weather patterns, vary the flow of winds, and even someday possibly alter the position of the

jet stream. Polar jet streams are fast flowing rivers of wind positioned high in the Earth's atmosphere that push cold and warm air masses around, playing a critical role in determining the weather of our planet.

McPherson, who maintains the blog [6] Nature Bats Last, added, "We've never been here as a species and the implications are truly dire and profound for our species and the rest of the living planet."

While his perspective is more extreme than that of the mainstream scientific community, which sees true disaster many decades into our future, he's far from the only scientist expressing such concerns. Professor Peter Wadhams, a leading Arctic expert at Cambridge University, has been measuring Arctic ice for 40 years, and his findings underscore McPherson's fears. "The fall-off in ice volume is so fast it is going to bring us to zero very quickly," Wadhams told [7] a reporter. According to current data, he estimates "with 95 percent confidence" that the Arctic will have completely ice-free summers by 2018. (US Navy researchers have predicted [8] an ice-free Arctic even earlier—by 2016.)

British scientist John Nissen, chairman of the Arctic Methane Emergency Group (of which Wadhams is a member), suggests [7] that if the summer sea ice loss passes "the point of no return," and "catastrophic Arctic methane feedbacks" kick in, we'll be in an "instant planetary emergency."

McPherson, Wadham, and Nissen represent just the tip of a melting iceberg of scientists who are now warning us about looming disaster, especially involving Arctic methane releases. In the atmosphere, methane is a greenhouse gas that, on a relatively short-term time scale, is far more destructive than carbon dioxide (CO2). It is 23 times as powerful as CO2 per molecule on a 100-year timescale, 105 times more potent when it comes to heating the planet on a 20-year timescale—and the Arctic permafrost, onshore and off, is packed with the stuff. "The seabed," says Wadham, "is offshore permafrost, but is now warming and melting. We are now seeing great plumes of methane bubbling up in the Siberian Sea…millions of square miles where methane cover is being released."

According to a study just published in *Nature Geoscience,* twice as much methane as previously thought is being released from the East Siberian Arctic Shelf, a two million square kilometer area off the coast of Northern Siberia. Its researchers found that at least 17 teragrams (one million tons) of methane are being released into the atmosphere each year, whereas a 2010 study had found [9] only seven teragrams heading into the atmosphere.

The day after *Nature Geoscience* released its study, a group of scientists from Harvard and other leading academic institutions published [10] a report in the *Proceedings of the National Academy of Sciences [11]* showing that the amount of methane being emitted in the US both from oil and agricultural operations could be 50 percent greater than previous estimates and 1.5 times higher than estimates of the Environmental Protection Agency.

How serious is the potential global methane build-up? Not all scientists [12] think it's an immediate threat or even the major threat we face, but Ira Leifer, an atmospheric and marine scientist at the University of California, Santa Barbara, and one of the authors of the recent Arctic Methane study pointed out to me that "the Permian mass extinction that occurred 250 million years ago is related to methane and thought to be the key to what caused the extinction of most species on the planet." In that extinction episode, it is estimated that 95 percent of all species were wiped out.

Also known as "The Great Dying," it was triggered by a massive lava flow in an area of Siberia that led to an increase in global temperatures of six degrees Celsius. That, in turn, caused the melting of frozen methane deposits under the seas. Released into the atmosphere, it caused temperatures to skyrocket further. All of this occurred over a period of approximately 80,000 years.

We are currently in the midst of what scientists consider the sixth mass extinction in planetary history, with between 150 and 200 species [13] going extinct daily, a pace 1,000 times greater than the "natural" or "background" extinction rate. This event may already be comparable to, or even exceed, both the speed and intensity of the Permian mass extinction. The difference being that ours is human caused, isn't going to take 80,000 years, has so far lasted just a few centuries, and is now gaining speed in a non-linear fashion.

It is possible that, on top of the vast quantities of carbon dioxide from fossil fuels that continue to enter the atmosphere in record amounts [14] yearly, an increased release of methane could signal the beginning of the sort of process that led to the Great Dying. Some scientists fear that the situation is already so serious and so many self-reinforcing feedback loops are already in play that we are in the process of causing our own extinction. Worse yet, some are convinced that it could happen far more quickly than generally believed possible—even in the course of just the next few decades.

The Sleeping Giant Stirs

According to a NASA [15] research report, "Is a Sleeping Climate Giant Stirring in the Arctic?": "Over hundreds of millennia, Arctic permafrost soils have accumulated vast stores of organic carbon—an estimated 1,400 to 1,850 petagrams of it (a petagram is 2.2 trillion pounds, or 1 billion metric tons). That's about half of all the estimated organic carbon stored in Earth's soils. In comparison, about 350 petagrams of carbon have been emitted from all fossil-fuel combustion and human activities since 1850. Most of this carbon is located in thaw-vulnerable top soils within 10 feet (3 meters) of the surface."

NASA scientists, along with others, are learning that the Arctic permafrost—and its stored carbon—may not be as permanently frosted as its name implies. Research scientist Charles Miller of NASA's Jet Propulsion Laboratory is the principal investigator of the Carbon in Arctic Reservoirs Vulnerability Experiment (CARVE), a five-year NASA-led field campaign to study how climate change is affecting the Arctic's carbon cycle. He told NASA, "Permafrost soils are warming even faster than Arctic air temperatures—as much as 2.7 to 4.5 degrees Fahrenheit (1.5 to 2.5 degrees Celsius) in just the past 30 years. As heat from Earth's surface penetrates into permafrost, it threatens to mobilize these organic carbon reservoirs and release them into the atmosphere as carbon dioxide and methane, upsetting the Arctic's carbon balance and greatly exacerbating global warming."

He fears the potential results should a full-scale permafrost melt take place. As he points out, "Changes in climate may trigger transformations that are simply not reversible within our lifetimes, potentially causing rapid changes in the Earth system that will require adaptations by people and ecosystems."

The recent NASA study [15] highlights the discovery of active and growing methane vents up to 150 kilometers across. A scientist on a research ship in the area described this as a bubbling as far as the eye can see in which the seawater looks like a vast pool of seltzer. Between the summers of 2010 and 2011, in fact, scientists found that in the course of a year methane vents only 30 centimeters across had grown a kilometer wide, a 3,333 percent increase and an example of the non-linear rapidity with which parts of the planet are responding to climate disruption.

Miller revealed another alarming finding: "Some of the methane and carbon dioxide concentrations we've measured have been large, and we're seeing very different patterns from what models suggest," he said [16] of some of CARVE's earlier findings. "We saw large, regional-scale episodic bursts of higher than normal carbon dioxide and methane in interior Alaska and across the North Slope during the spring thaw, and they

lasted until after the fall refreeze. To cite another example, in July 2012 we saw methane levels over swamps in the Innoko Wilderness that were 650 parts per billion higher than normal background levels. That's similar to what you might find in a large city."

[17]Moving beneath the Arctic Ocean where methane hydrates—often described as methane gas surrounded by ice—exist, a March 2010 report in *Science* indicated that these cumulatively contain the equivalent of 1,000-10,000 gigatons of carbon. Compare this total to the 240 gigatons of carbon humanity has emitted into the atmosphere since the industrial revolution began.

A study published [18] in the prestigious journal *Nature*this July suggested that a 50-gigaton "burp" of methane from thawing Arctic permafrost beneath the East Siberian sea is "highly possible at anytime." That would be the equivalent of at least 1,000 gigatons of carbon dioxide.

Even the relatively staid IPCC has warned [19] of such a scenario: "The possibility of abrupt climate change and/or abrupt changes in the earth system triggered by climate change, with potentially catastrophic consequences, cannot be ruled out. Positive feedback from warming may cause the release of carbon or methane from the terrestrial biosphere and oceans."

In the last two centuries, the amount of methane in the atmosphere has increased from 0.7 parts per million to 1.7 parts per million. The introduction of methane in such quantities into the atmosphere may, some climate scientists fear, make increases in the global temperature of four to six degrees Celsius inevitable.

The ability of the human psyche to take in and grasp such information is being tested. And while that is happening, yet more data continues to pour in—and the news is not good.

Out of the Frying Pan, Into the Fire

Consider this timeline:

- **Late 2007:** *The Intergovernmental Panel on Climate Change (IPCC) announces* [20] *that the planet will see a one degree Celsius temperature increase due to climate change by 2100.*
- **Late 2008:** *The Hadley Centre for Meteorological Research predicts* [21] *a 2C increase by 2100.*

- **Mid-2009:** *The U.N. Environment Programme predicts* [22] *a 3.5C increase by 2100. Such an increase would remove habitat for human beings on this planet, as nearly all the plankton in the oceans would be destroyed, and associated temperature swings would kill off many land plants. Humans have never lived on a planet at 3.5C above baseline.*
- **October 2009:** *The Hadley Centre for Meteorological Research releases* [23] *an updated prediction, suggesting a 4C temperature increase by 2060.*
- **November 2009:** *The Global Carbon Project* [24]*, which monitors the global carbon cycle, and the Copenhagen Diagnosis* [25]*, a climate science report, predict 6C and 7C temperature increases, respectively, by 2100.*
- **December 2010:** *The U.N. Environment Programme predicts* [26] *up to a 5C increase by 2050.*
- **2012:** *The conservative International Energy Agency's World Energy Outlook report for that year states* [27] *that we are on track to reach a 2C increase by 2017.*
- **November 2013:** *The International Energy Agency predicts* [28] *a 3.5C increase by 2035.*

A briefing provided to the failed U.N. Conference of the Parties in Copenhagen in 2009 provided this summary: "The long-term sea level that corresponds to current CO2 concentration is about 23 meters above today's levels, and the temperatures will be 6 degrees C or more higher. These estimates are based on real long-term climate records, not on models."

On December 3rd, a study [29] by 18 eminent scientists, including the former head of NASA's Goddard Institute for Space Studies, James Hansen, showed that the long-held, internationally agreed upon target to limit rises in global average temperatures to 2 degrees Celsius was in error and far above the 1C threshold that would need to be maintained in order to avoid the effects of catastrophic climate change.

And keep in mind that the various major assessments of future global temperatures seldom assume the worst about possible self-reinforcing climate feedback loops like the methane one.

"Things Are Looking Really Dire"

Climate-change-related deaths are already estimated [30] at five million annually, and the process seems to be accelerating more rapidly than most climate models have suggested. Even without taking into account the release of frozen methane in the Arctic, some scientists are already painting a truly bleak picture of the

human future. Take Canadian Wildlife Service biologist Neil Dawe, who in August told a reporter [31] that he wouldn't be surprised if the generation after him witnessed the extinction of humanity. All around the estuary near his office on Vancouver Island, he has been witnessing the unraveling of "the web of life," and "it's happening very quickly."

"Economic growth is the biggest destroyer of the ecology," Dawe says. "Those people who think you can have a growing economy and a healthy environment are wrong. If we don't reduce our numbers, nature will do it for us." And he isn't hopeful humans will be able to save themselves. "Everything is worse and we're still doing the same things. Because ecosystems are so resilient, they don't exact immediate punishment on the stupid."

The University of Arizona's Guy McPherson has similar fears. "We will have very few humans on the planet because of lack of habitat," he says. Of recent studies showing the toll temperature increases will take on that habitat, he adds, "They are only looking at CO2 in the atmosphere."

Here's the question: Could some version of extinction or near-extinction overcome humanity, thanks to climate change—and possibly incredibly fast? Similar things have happened in the past. Fifty-five million years ago, a five degree Celsius rise in average global temperatures seems to have occurred in just 13 years, according to a study published [32] in the October 2013 issue of the *Proceedings of the National Academy of Sciences*. A report [33] in the August 2013 issue of *Science* revealed that in the near-term Earth's climate will change 10 times faster than at any other moment in the last 65 million years.

"The Arctic is warming faster than anywhere else on the planet," climate scientist James Hansen has said [7]. "There are potential irreversible effects of melting the Arctic sea ice. If it begins to allow the Arctic Ocean to warm up, and warm the ocean floor, then we'll begin to release methane hydrates. And if we let that happen, that is a potential tipping point that we don't want to happen. If we burn all the fossil fuels then we certainly will cause the methane hydrates, eventually, to come out and cause several degrees more warming, and it's not clear that civilization could survive that extreme climate change."

Yet, long before humanity has burned all fossil fuel reserves on the planet, massive amounts of methane will be released. While the human body is potentially capable of handling a six to nine degree Celsius rise in the planetary temperature, the crops and habitat we use for food production are not. As McPherson put it, "If we see a 3.5 to 4C baseline increase, I see no way to have habitat. We are at .85C above baseline and we've

already triggered all these self-reinforcing feedback loops."

He adds: "All the evidence points to a locked-in 3.5 to 5 degree C global temperature rise above the 1850 'norm' by mid-century, possibly much sooner. This guarantees a positive feedback, already underway, leading to 4.5 to 6 or more degrees above 'norm' and that is a level lethal to life. This is partly due to the fact that humans have to eat and plants can't adapt fast enough to make that possible for the seven to nine billion of us—so we'll die."

If you think McPherson's comment about lack of adaptability goes over the edge, consider that the rate of evolution trails the rate of climate change by a factor of 10,000 [34], according to a paper [35] in the August 2013 issue of *Ecology Letters*. Furthermore, David Wasdel, director of the Apollo-Gaia Project and an expert on multiple feedback dynamics, says, "We are experiencing change 200 to 300 times faster than any of the previous major extinction events."

Wasdel cites with particular alarm scientific reports showing that the oceans have already lost 40 percent [36] of their phytoplankton, the base of the global oceanic food chain, because of climate-change-induced acidification and atmospheric temperature variations. (According to [37] the Center for Ocean Solutions: "The oceans have absorbed almost one-half of human-released CO2 emissions since the Industrial Revolution. Although this has moderated the effect of greenhouse gas emissions, it is chemically altering marine ecosystems 100 times more rapidly than it has changed in at least the last 650,000 years.")

"This is already a mass extinction event," Wasdel adds. "The question is, how far is it going to go? How serious does it become? If we are not able to stop the rate of increase of temperature itself, and get that back under control, then a high temperature event, perhaps another 5-6 degrees [C], would obliterate at least 60 percent to 80 percent of the populations and species of life on Earth."

What Comes Next?

In November 2012, even Jim Yong Kim, president of the World Bank Group (an international financial institution that provides loans to developing countries), warned [38] that "a 4C warmer world can, and must be, avoided. Lack of action on climate change threatens to make the world our children inherit a completely different world than we are living in today."

A World Bank-commissioned report [38] warned that we are indeed on track to a "4C world" marked by extreme heat waves and life-threatening sea-level rise.

The three living diplomats who have led U.N. climate change talks claim [39] there is little chance the next climate treaty, if it is ever approved, will prevent the world from overheating. "There is nothing that can be agreed in 2015 that would be consistent with the 2 degrees," says Yvo de Boer, who was executive secretary of the United Nations Framework Convention on Climate Change in 2009, when attempts to reach a deal at a summit in Copenhagen crumbled. "The only way that a 2015 agreement can achieve a 2-degree goal is to shut down the whole global economy."

Atmospheric and marine scientist Ira Leifer is particularly concerned about the changing rainfall patterns a recently leaked [40] IPCC draft report suggested for our future: "When I look at what the models predicted for a 4C world, I see very little rain over vast swaths of populations. If Spain becomes like Algeria, where do all the Spaniards get the water to survive? We have parts of the world which have high populations which have high rainfall and crops that exist there, and when that rainfall and those crops go away and the country starts looking more like some of North Africa, what keeps the people alive?"

The IPCC report suggests that we can expect a generalized shifting of global rain patterns further north, robbing areas that now get plentiful rain of future water supplies. History shows us that when food supplies collapse, wars begin, while famine and disease spread. All of these things, scientists now fear, could happen on an unprecedented scale, especially given the interconnected nature of the global economy.

"Some scientists are indicating we should make plans to adapt to a 4C world," Leifer comments. "While prudent, one wonders what portion of the living population now could adapt to such a world, and my view is that it's just a few thousand people [seeking refuge] in the Arctic or Antarctica."

Not surprisingly, scientists with such views are often not the most popular guys in the global room. McPherson, for instance, has often been labeled "Guy McStinction"—to which he responds, "I'm just reporting the results from other scientists. Nearly all of these results are published in established, esteemed literature. I don't think anybody is taking issue with NASA, or *Nature*, or *Science*, or the *Proceedings of the National Academy of Sciences*. [Those] and the others I report are reasonably well known and come from legitimate sources, like NOAA [the National Oceanic and Atmospheric Administration], for example. I'm not

making this information up, I'm just connecting a couple of dots, and it's something many people have difficulty with."

McPherson does not hold out much hope for the future, nor for a governmental willingness to make anything close to the radical changes that would be necessary to quickly ease the flow of greenhouse gases into the atmosphere; nor does he expect the mainstream media to put much effort into reporting on all of this because, as he says, "There's not much money in the end of civilization, and even less to be made in human extinction." The destruction of the planet, on the other hand, is a good bet, he believes, "because there is money in this, and as long as that's the case, it is going to continue."

Leifer, however, is convinced that there is a moral obligation never to give up and that the path to global destruction could be altered. "In the short term, if you can make it in the economic interests of people to do the right thing, it'll happen very fast." He offers an analogy when it comes to whether humanity will be willing to act to mitigate the effects of climate change: "People do all sorts of things to lower their risk of cancer, not because you are guaranteed not to get it, but because you do what you can and take out the health protections and insurance you need in order to try to lower your risk of getting it."

The signs of a worsening climate crisis are all around us, whether we allow ourselves to see them or not. Certainly, the scientific community gets it. As do countless communities across the globe where the effects of climate change are already being experienced in striking ways and local preparations [41] for climatic disasters, including increasingly powerful floods, droughts, wildfires, heat waves, and storms are underway [42]. Evacuations from low-lying South Pacific islands have already begun [43]. People in such areas, out of necessity, are starting to try to teach their children how to adapt to, and live in, what we are causing our world to become.

My niece and nephews are doing something similar. They are growing vegetables in a backyard garden and their eight chickens provide more than enough eggs for the family. Their parents are intent on teaching them how to be ever more self-sustaining. But none of these heartfelt actions can mitigate what is already underway when it comes to the global climate.

I am 45 years old, and I often wonder how my generation will survive the impending climate crisis. What will happen to our world if the summer Arctic waters are indeed ice-free only a few years from now? What will my life look like if I live to experience a 3.5 Celsius global temperature increase?

Above all, I wonder how coming generations will survive.

*Dahr Jamail has written extensively about climate change as well as the BP oil disaster in the Gulf of Mexico. He is a recipient of numerous awards, including the Martha Gellhorn Award for Journalism and the James Aronson Award for Social Justice Journalism. He is the author of two books:*Beyond the Green Zone: Dispatches from an Unembedded Journalist in Occupied Iraq [44] *and*The Will to Resist: Soldiers Who Refuse to Fight in Iraq and Afghanistan [45]. *He currently works for al-Jazeera English in Doha, Qatar. To stay on top of important articles like these, sign up to receive the latest updates from TomDispatch.com here [46].*

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[14] http://www.livescience.com/41326-2013-carbon-emissions-record-levels.html
[15] http://www.nasa.gov/topics/earth/features/earth20130610.html
[16] http://www.nasa.gov/topics/earth/features/earth20130610.html#.UpczGY0XQ34
[17] http://www.amazon.com/dp/1608463710/ref=nosim/?tag=tomdispatch-20
[18] http://www.theguardian.com/environment/2013/jul/24/arctic-thawing-permafrost-climate-change
[19] http://www.ipcc.ch/publications_and_data/ar4/wg3/en/ch2s2-2-4.html
[20] http://www.ipcc.ch/pdf/assessment-report/ar4/wg1/ar4-wg1-spm.pdf
[21] http://www.metoffice.gov.uk/media/pdf/s/g/informing-choices-adaptation.pdf
[22] http://www.unep.org/compendium2009/
[23] http://www.theguardian.com/environment/2009/sep/28/met-office-study-global-warming
[24] http://www.globalcarbonproject.org/
[25] http://www.copenhagendiagnosis.com/

[26] http://www.unep.org/pdf/UNEPEmissionsGapReport2013.pdf
[27] http://www.iea.org/publications/freepublications/publication/English.pdf
[28] http://www.csmonitor.com/World/Global-Issues/2010/1111/Global-temperature-to-rise-3.5-degrees-C.-by-2035-International-Energy-Agency
[29] http://www.plosone.org/article/info percent3Adoi percent2F10.1371 percent2Fjournal.pone.0081648
[30] http://daraint.org/climate-vulnerability-monitor/climate-vulnerability-monitor-2012/
[31] http://www.oceansidestar.com/news/web-of-life-unravelling-wildlife-biologist-says-1.605499#sthash.HbgAlDA1.dpuf
[32] http://phys.org/news/2013-10-climate-geological-instant.html
[33] http://www.sciencedaily.com/releases/2013/08/130801142420.htm
[34] http://news.discovery.com/earth/global-warming/climate-change-10000-times-faster-than-evolution-130718.htm
[35] http://onlinelibrary.wiley.com/doi/10.1111/ele.12144/abstract
[36] http://www.scientificamerican.com/article.cfm?id=phytoplankton-population
[37] http://centerforoceansolutions.org/climate/impacts/ocean-acidification/
[38] http://www.worldbank.org/en/news/feature/2012/11/18/Climate-change-report-warns-dramatically-warmer-world-this-century
[39] http://www.bloomberg.com/news/2013-11-04/kyoto-veterans-say-global-warming-goal-slipping-away.html
[40] http://www.politico.com/morningenergy/1113/morningenergy12117.html
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