**The Climate Cart**

**Issue 3: Excessive Heat** (extract) August, 2023

The following is an extract adapted from the third issue of a series, Climate Cart. The original was prepared for the Sierra Club’s Climate Adaptation and Restoration Team, on which I serve. The purpose of the series is to provide compact, up-to-date information on aspects of the climate crisis in which local action can make a difference.

Prior to the Industrial Revolution, the earth was in rough heat equilibrium. A fairly steady influx of heat from the sun balanced radiation from the planet to provide a dependable global heat level, varying by the season, the weather, and the location, and sustaining a comfortable average global temperature. But when carbon dioxide began accumulating in the atmosphere as we burned fossil fuels, it heated the atmosphere so that it began to hold more water vapor. Water vapor and CO2 are the primary greenhouse gases. Like a blanket, they keep the earth from radiating some of the heat it gains from the sun. As CO2 accumulates, the hotter the earth becomes, the more water vapor is in the atmosphere, and the hotter we get.

**How hot is it?** It is hotter than it has been for at least 125,000 years. No human civilization has ever had to deal with the heat waves which occupy our evening news.

How hot it feels depends not only on the heat but on the humidity. We and some other animals have evolved protection against excessive heat. We are particularly good at sweating, and we have lost most of our hair to make the sweating more efficient (with matted hair on only a couple of places). But our strategy only works if the air is dry enough to receive the 3 gallons of water a day we are capable of sweating. The wet bulb temperature indicates the temperature recorded on the bulb of a thermometer wrapped in a wet pad—a surrogate for our body. When the wet bulb temperature reaches 85F, we begin to suffer. When it goes above 88F (31C), we begin dying (depending on our age, physique, and condition). A 10-minute video from PBS explains wet-bulb temperature and sketches the growing regions vulnerable to life-threatening heat stress. <https://climatecrocks.com/2023/05/12/pbs-more-areas-too-hot-to-work-too-hot-to-live/>

Jeff Goodell’s The Heat Will Kill You First (Little, Brown, & Co., 2023) is a fine source for heat info. There, on page 22, you may read that 489,000 people died from heat in 2019—an underestimation, but more than from guns or illegal drugs. More than from all other natural disasters combined—including hurricanes and wildfires.

**How hot will it get?** The CO2 in the atmosphere is higher than it has been for about three million years. The earth will grow hotter as it reaches equilibrium. The more greenhouse gases we add, the higher that equilibrium temperature. Somewhere along the way, given our current CO2 level, we will pass the point of human survival, indeed of the survival of almost all of earth’s living things. We could, of course, stop burning fossil fuels and draw down the carbon we have already added to the atmosphere and the oceans.

“Global Warming in the Pipeline” (2023) by James Hansen and a team of coauthors is the latest and best account of what we are in for. At 440 parts per million of CO2, the earth will be ice free at equilibrium. We are at 419 ppm. <http://www.columbia.edu/~jeh1/Documents/PipelinePaper.2023.05.19.pdf>

Earth has been in the Goldilocks zone: not too cold, not too hot. By adding two trillion tons of greenhouse gases and a billion nuclear bombs of heat we are in the process of pushing ourselves outside the zone. <https://phys.org/news/2023-05-trillion-tons-greenhouse-gases-billion.html> Essentially, we are in the position of trying to keep things together while we mitigate our greenhouse gas emissions and draw down enough of the coal, oil, and gas fumes we have already sent aloft to reduce the atmosphere’s CO2 and, thus, water vapor to the point that we will have regained the climate niche in which we developed and which we require to live.

**What is to be done while we wait to reachieve our niche?** Stay cool. Take work breaks. Keep hydrated. Hang around green things—they pump water into the air and keep the surroundings cool by, in effect, sweating as we do. Check up on one another to make sure that we are not succumbing to the heat and to get people who need it to heat shelters. (Survival in urban heat waves often depends on the community connections people have made for mutual support.)

In 2020 researchers at Purdue University developed a new ultra-white paint. Most ultra-white paint, colored with titanium dioxide, can reflect 90% of the sun’s energy, but at wavelengths which eventually heat the ambient air. As with air conditioning, cooling is balanced by heating elsewhere within the system. Purdue’s ultra-white uses a barium sulfate mixture to radiate back 98% of the sun’s heat at wave lengths to which the atmosphere is transparent. The reflected heat escapes back to space. Areas beneath the new ultra-white paint are as much as 19F cooler, and the general surroundings are cooled as well. <https://www.purdue.edu/newsroom/releases/2021/Q2/the-whitest-paint-is-here-and-its-the-coolest.-literally..html>

If 1-2% of the earth’s solid surface were to be painted the new ultra-white, we could send to space the heat we are suffering from our fossil fuel habit. The paint is a year or so from commercial availability, but we can fantasize—and maybe even plan. (The Times has a paywall but it’s our only source.) <https://www.nytimes.com/2023/07/12/climate/white-paint-climate-cooling.html#:~:text=In%202020%2C%20Dr.%20Ruan%20and%20his%20team%20unveiled,formulation%20that%20increased%20sunlight%20reflection%20to%2098%20percent>.

**What can you do about the suffering from excessive heat?** “Stay cool”—are there sufficient heat shelters in your community to handle those without air conditioning? Are they open at night, when we need to be able to cool off and recover from the heat stress of the day? If the power were to fail (both nuclear and fossil fuel power sources are vulnerable to heat stress), are there shelters with solar panels and batteries to supply cool air through a reasonable failure period?

Does your community see that employers make provision for work breaks? For shaded or cooled rest spaces and hydration? (In states such as Florida and Texas such issues will require organization at the state level. Attempts in several states to protect workers from excessive heat have fallen to Republican opposition. <https://stateline.org/2023/06/20/many-states-decline-to-require-water-breaks-for-outdoor-workers-in-extreme-heat/> )

“Green spaces”—can you identify neighborhoods which need more trees?

“Community support”—is anyone offering to maintain a list of people who need to be checked on in a heat wave? Older people with poor or no air conditioning are likely to need that, but so are many others in less affluent neighborhoods. If your neighborhood is one of those, it needs someone to undertake the role of organizer, and maybe that is you.

Then there is the new ultra-white paint. Some homeowner’s associations forbid any roofs colored lighter than beige. A little publicity and rabble rousing would bring the pressure necessary to change that. Your transportation authority might be interested in identifying paved shoulders and other surfaces which would look well in ultra-white. An ultra-white promoter might look for likely roofs, public and private. Organization and education now will save lives later; at the worst, you will have called attention to the use of white paint.

Chances are that your community is already experiencing the effects of excessive heat and will support your efforts to deal with it. You may benefit from a chance to work with a Sierra Club unit or others who are confronting the heat.

The next issue of the Climate Cart will be on floods, drought, and water supply. Our intention is to maintain an up-to-date discussion on the following topics: vulnerability studies; sea level rise; excessive heat; floods, drought and water supply; public health; relocation programs and community rebuilding; and rewilding. We believe that these are fields of action in which you and people like you can make a difference.