

Essay #2: What climate chaos might look like

Introduction:

I am not advocating climate chaos. Instead, I'm trying to make the case that as we progress into a time of climate change, chaos is likely to come.

This is the second essay in a series intended as background reading for the seminar series, "Living in a Time of Climate Chaos," which will start Saturday October 26, from 2:00 to 4:00 PM at the Sierra Foothills Unitarian Universalist church in Auburn, CA.

This essay is intended to present information related to why anthropogenic climate change might, along with other factors, lead us into a time of social chaos. I want to make it clear that I am not presenting exact predictions, but rather examples of trends. In fact, any specific scenarios described here are almost guaranteed to be wrong. Never-the-less, I believe the descriptions of trends are sound.

I also want to make it clear this presentation is not comprehensive – this is a brief sketch; a thorough examination would require a year or more and involve hundreds of pages of description. I have also tried my best to filter out hysteria and hype. I must admit however there was no way of making this information upbeat.

You will notice that at the end of each specific area of climate change related impacts, I have offered a Chaos Quotient – a summary of the those impacts that could disrupt social order. This is for your convenience as you read through this work and as we ultimately discuss the subject. It is important to keep in mind that there will almost surely be synergy among the many impact areas (and in relation to background factors listed immediately below) that would make social chaos more likely than would any single stressor.

What would social chaos look like:

This essay is not an exploration of either social order or chaos itself. Rather, it is a summary of how climate change impacts may push society toward chaos. But what is social chaos?

I could simply say it's when society as we know it no longer provides for our needs. We'll know it when we see it, but until then it's hard to describe. But that is not sufficient.

The chaos I'm talking about would include some or all of the following specific conditions: Certainly the institutions that bring us the our goods and services will to some degree break down. These would include systems that provide food, health-care, utilities, various consumer goods, utilities, transportation, and communication. I'm not necessarily predicting these systems would disappear, but their functioning would be impaired.

A society in chaos would mean the world around us would be in flux, with less dependability in the factors that make up our everyday life. It would likely mean a breakdown in community (political) discourse and decision-making, and certainly an erosion of community services.

There may be changes in the application of power and authority (as now expresses by the rule of law) – either their erosion, or their abuse. With that may come the breakdown social honor, which would result in an erosion of spontaneous social order.

Ultimately, perhaps ultimately most important would be an overall loss of the hope of attainment – the loss of hope in our future.

There are many examples of social chaos readers can study. Certainly some degree of chaos follows most disasters. Some people do rise to the occasion and help their neighbors (and often strangers). Others sink to the occasion and loot from them.

On a broader and deeper scale, we can look at Beirut, or Sarajevo during the Bosnian war, or Syria in the current civil war. Each of these were centers of culture and economic success; each descended into deep chaos in a matter of months or years. I believe the lesson in these examples is that our past economic success and social cohesion does not immunize us from social chaos – it can happen here.

Background factors that already push our society toward chaos:

Before I dive into describing the social, economic, and political stresses that might come from the climate crisis – either from the physical impacts or from efforts to prevent the them – I want briefly touch on a backdrop of pre-existing social flaws, brittleness, and stressors in our economy and society. These, in combination with climate change stressors, would tend to accelerate a move toward social chaos.

A thorough exploration of these would take volumes, so I have simply listed them below so we can keep them in mind as we explore climate change induced chaos. And please remember that the factors below are dynamic – some are more important at some points in time, others at other points.

- **Underlying social and economic flaws**
 - political divisions and derisiveness
 - wealth gap
 - racial divides
 - religious divisions
- **Brittleness in the system**
 - heavy dependence on fossil fuels
 - heavy dependence on tech
 - heavy reliance on high-tech communications
 - high reliance on fossil-fuel powered transportation – in business & commerce, and in personal lifestyles
 - Heavy dependence on fossil-fuel powered electricity generation
- **Potential stressors**
 - Climate change (described below)
 - the physical impacts
 - aftermath of climate policies
 - Political disruption (eg, decisive presidential election and its aftermath)
 - terrorism
 - War – foreign or domestic
 - pandemic
 - famine
 - religious conflict (probably couched as political conflict, or visa versa)
 - racial conflict
 - economic recession/depression
 - a national default

Potential stressors from climate change impacts:

Heat

If current emission trends continue, global average temperature could increase as much as three degrees C (5 degrees F) by 2050 and 5 degrees C or more by 2100. In addition, with climate change comes increasing weather variability – the low and particularly the high temps will vary more widely from the average than they do now.

In our region, the Sacramento valley and foothill/mountains, highs could increase by 10 degrees F or more during this century. People's ability to cope with these high temps will depend on their location and income. The well-heeled and/or those living in the mountains may do OK, whereas the poor in the valley may not be able to afford the cost of increased air conditioning.

If this is the case, we may see a whole economic class that become “heat refugees” and require extensive heat related social service. The higher heat may also increase electricity rates for those who still need to buy from utility companies (those who couldn't afford to buy their own solar power

systems). Ultimately, many may need to move.

The higher heat temperatures will limit the availability of locally grown fruits and vegetables (including those from home gardens). They will also affect local ecosystems, requiring the flora and fauna within them to them northward and up-slope (into the mountains) or die. For example, the lowest altitude of tenability for conifer forests in the Sierras is expected to shift up-slope 500 feet in elevation for every degree C the climate warms. Unfortunately, individual conifer trees and many of their forest companion plants don't migrate. They will die.

Finally, the warmer temperatures will mean less of our mountain precipitation will fall as snow and more as rain. In addition to affecting the ski industry, this will reduce the amount of precipitation stored as winter snow-pack. This in turn, will mean more riverine flooding in the wet season and less water available for agricultural and urban uses in the dry season.

The basic warming described above will also happen nationally and globally. True, the average temperature increases will be somewhat less in the tropics and considerably more near the poles, but the average temperature increases for this region will be about the global average.

Nationally we can expect thousands, perhaps eventually millions of heat refugees. The stress of these folks on social service organizations will be extensive. Internationally, whole regions may become uninhabitable, at least during the summer. The people who currently live there will need to either move or die – potentially leading to substantial numbers of global heat refugees.

Agricultural experts expect the increased heat will reduce food crop production in the tropics and lower temperate areas. Northern latitudes may become more tenable for agriculture if the soils are appropriate, the requisite infrastructure investments can be made, and weather variability doesn't become too extreme (On balance, the Ag. Folks expect food production to drop due to increasing heat – see the section on food below).

Nationally and globally, ecosystems will need to shift northward to accommodate the warming climate. That said, it is difficult to see whole forests shifting hundreds of miles north in the span of a few decades.

The Chaos Quotient:

- more heat refugees
- more need for heat-wave related social services
- loss of habitat from heat related ecosystem shifts
- economic implications of the above

Mega-droughts

Climate forecasters believe there is an 80% chance that mega-droughts (severe droughts that lasts for twenty years or more) will hit the western US between the years 2050 and 2099. (“A 'Mega-drought' will grip the US in the coming decades, NASA researcher says,” Darryl Fears, Washington Post, Feb. 12, 2015.)

For perspective on impacts, the drought in Syria that, in part, led to its civil war lasted from 2006 to 2010. The California drought that led to the death over a hundred million pine trees lasted from 2011 to 2015. If these four-year droughts had dramatic impacts, consider what a twenty or thirty year drought would do.

Certainly it would lead to spectacular ecosystem die-offs particularly perennial plants and the animals that depend on them. Agricultural production would decline – at its peak, California's four year drought idled over a half-million acres of irrigated acres. That drought also reduced regional economic activity almost \$3 billion a year.

The California drought did cut into urban water supplies, but a better example of this impact is in Cape Town, South Africa. There, an extended drought took the city to within three months of Zero day – the day when the taps would have run dry. Although some rain has returned, Cape Town

citizens are still restricted to 50 liters (13 gallons) of water per day for all their personal needs. Their drought was also four years long.

An example of more extreme drought impacts is the 2010 to 2012 drought in Somalia, which killed 260,000 people. And the Syrian civil war, initiated because of the government's poor reaction to a severe drought, has torn the country apart, created over 13 million internal and external refugees, and killed as many as 560,000 people.

For a broader perspective, 1.4 billion Americans and 1.1 billion people globally are currently water-stressed. These numbers will increase dramatically from mega-droughts. The Water Footprint Network predicts that by 2050, nearly five Billion will be water stressed.

The Chaos Quotient:

- more refugees
- less food production
- drought related loss of ecosystems
- possible return of “dust bowl” conditions
- impaired transportation on great rivers
- economic implications of the above

Wildfires

In California, wildfires are the most potent of possible local natural disasters (if it's fair to call largely human caused and climate-change enhanced wildfires natural). With climate change, the problem is getting worse. The acreage within the state burned by wildfires has doubled in the past half-century.

Last year, California wildfires burned almost 2 million acres (out of a total of 105 million), destroyed 22,751 buildings, and killed 103 people. In 2017, the latest year for which full data is available, wildfires cost the California economy at least 18 billion dollars, including 1.8 billion in suppression costs. (Note the insurance losses on a single 2018 fire – the Camp Fire – exceeded \$12 billion).

For us here in the Sierra foothills, the wildfire threat is huge, and it's growing. Research tells us that wildfire median area burned (in California and elsewhere) will increase 200 to 400 percent for every degree C the average temperature increases. ¹ When they burn our forests, they burn our houses, sear our landscapes, and scar our hearts.

Globally, attention is now rightfully focused on burning in tropical forests, with special attention to Amazonia, which makes up an important part of the “lungs of the world” – producing more than 20 percent of the our oxygen. The continued destruction of the Amazon forests pushes the region toward a threshold beyond which the viability of that whole ecosystem is at risk, potentially shifting the current tropical forest to tropical Savannah.

Equally important is the huge northern boreal forest. This stretches across northern North America, Europe, and Asia. Wildfires are also intensifying there, and huge fires have burned in Alaska and Northern Canada and Siberia during the past few years. In 2015, for example, 70 million acres of forest burned in Siberia.

These forests, which were historically net carbon sinks (storage areas) have now become net carbon sources to the atmosphere. Even worse is the fact that many of the fires are burning deep in to the legacy CO₂ stored in the soils. In addition to the greenhouse gas emissions, these fires are changing Arctic hydrology and weather cycles.

We should also not forget that climate change is causing an increased wildfire damage in other Mediterranean climates around the world – southern Europe, the Middle East, Australia are just a few of the regions affected. Like here, the people of those areas fear for their property and lives, and suffer tremendous losses due to the growing wildfire risk.

The Chaos Quotient:

- direct injury, death, and damage from the increasing fires
- increasing wildfire refugees
- damage and disruption to utility, transportation, housing infrastructure (and the possible permanent abandonment of infrastructure in some areas.
- Increased lumber prices (from loss of forests)
- increased insurance costs (and the possible loss of coverage in some areas)

Flooding:

As our climate warms, the snow-line in the mountains will rise, and more of our local precipitation will fall as rain. As a result, rather than being stored in the mountain snow-pack, precipitation will run directly down into our rivers. At the same time, climatologists expect more “atmospheric river” type warm storms to visit California. This combination is expected to lead to more flooding in Northern California's rivers and creeks.

In the Sacramento delta and valley, this flooding may be intensified as ocean level rises push tidewaters further inland, particularly if storm-related tide surges coincided with heavy, warm storms. Parts of the delta, and possibly even neighborhoods in Sacramento will be at risk.

The river and creek flooding projected in our local area is also expected in watersheds around the world. Recent floods in the Mississippi, Indus, and Ganges rivers are mild examples of what's to come.

Scientists expect sea level to rise 3 to 6 feet by the end of the century. Recent paleo-climate analysis shows that during the Pliocene epic (three million years ago), when the atmospheric CO₂ levels were 400 parts per million (they are now over 410) the ocean temperature was 2 degrees C higher and the ocean was 65 feet higher. ⁱⁱ If this history is relevant for our future, large parts of San Francisco and the Sacramento valley are almost certain to eventually flood.

And as the ocean level rises, all of the world's coastal cities, great deltas, and lowland agricultural valley's will be subject to permanent flooding. The people who live, farm, and manufacture there will need to move or drown. And the great shipping ports – a key component of the world's oceanic transportation system, will need to be moved or protected. Disruptions of their operations will surely occur.

The Chaos Quotient:

- more creek and river flooding
- more storm related damage to dams, levies, and other elements of our water infrastructure (eg the 2017 Orville Dam failure)
- Intensified delta and valley flooding from rising ocean levels. (Note: the tides already cause a 3 foot fluctuation of river levels in Sacramento.)
- chronic flooding around the world from ocean level rise
- disruption of global shipping
- hundreds of millions of refugees
- expect economic impacts in the \$ Trillions, for example:
 - billions in damage from the 2019 Midwest flooding
 - natural disasters (mostly storm related) cost the US economy \$307 billion in 2017.
- Sea level rise could cost the world \$14 Trillion by 2100 ⁱⁱⁱ

Disease:

The global tropics are home to some of the most intractable diseases know to humanity. Chagas, Dengue, Sleeping Sickness, Malaria, Hemorrhagic Fevers, and others diseases have plagued people in the worlds tropical areas for time immorial. Just one example – it has been estimated that mosquito-borne illness has killed half the people who have ever lived. ^{iv}

Fortunately, in the past century, public health efforts have reduced the impact of some of these diseases, particularly in the southern US. There are vaccinations that impart immunity for some. But they are still huge health problems. According to World Health Organization (WHO) in 2017 there were 219 million cases of Malaria in 87 countries, which resulted in 435,000 deaths. And again, according WHO, there have been 17 outbreaks of Ebola Hemorrhagic fever since 2000.

These diseases are devastating to the victims, and to the economics where they appear. The global economic cost of Malaria is estimated at 12 Billion per year. The Ebola outbreak in West Africa from 2013 to 2016 killed at least 11,300 people and cost an estimated \$52 Billion (“West Africa's Ebola outbreak cost \$53 Billion,” Tom Miles, Reuters). That epidemic virtually shut down the countries of Sierra Leone, Guinea, and Liberia for months. Fortunately, except for isolated cases, an international effort prevented the disease from spreading beyond West Africa.

But many of these diseases are expected to spread northward with climate change despite best efforts to contain them. The range of *Aedes Aegypti*, the mosquitoes that carry Dengue fever, Zika virus, Chikungunya, and Yellow Fever is currently restricted to the tropics, with short seasonal intrusions (a few months each year) into the Southern parts of California, Arizona, and New Mexico. By 2080, under business as usual warming, it will spread over most of North America, as well as Northern Europe and Asia. And in California, it will be present for half the year in the Central Valley and foothills. (“How does climate change affect disease,” Stanford University – Stanford Earth).

Other species of disease carrying vectors – other species of mosquitoes, flies, ticks, etc. are also expected to spread north with the warmer weather. Good public health can protect us against some of the disease they carry, but our vulnerability will, even in the best of times, will increase. And we won't be facing the best of times.

Finally, in addition to human diseases, climate change may increase the incidence and severity of plant disease problems both in tropical and temperate parts of the world, which will affect global food production.^v

The Chaos Quotient:

- increased local sickness and death from once tropical diseases
- vastly increased stress on local health-care systems
- increase in refugees trying to escape pandemic areas
- growing economic costs of health care, particularly in lower latitude temperate regions (California, Southern Europe, South Asia, far north and far south Africa, Australia, and parts of South America).
- Increased social and economic disruptions from epidemics

Food

While there are local farms that supply food to our local markets, and the nearby Sacramento Valley produces a plethora of vegetables, fruits, and nuts, most of us get our food from the global food chain through our plentiful supermarkets. Thus, here I will focus on global food supplies.

Four of the areas discussed above, heat, mega-drought, flooding, and disease; while significant impacts on their own, will in turn affect food production.

Heat waves will reduce production, if they don't kill crops outright. At some stage of warming, they will render agriculture untenable in some areas.

The UN's Food and Agriculture agency estimates that 36 percent of the world's total food harvest comes from irrigated land. Droughts will of course reduce the water available for those crops. But they will also reduce, drastically in some cases, harvests from dry-land agriculture.

Riverine flooding not only kills people, it devastates crops and cropland. The 2010 floods on the Indus river killed 1500 people and affected 20 million more. But the flooding also destroyed 700,000 acres of cotton, 200,000 acres each of rice and cane, 500,000 tonnes of wheat, 300,000 of

animal fodder.^{vi}

And rising ocean levels will flood all of the world's major agricultural deltas – the Indus, Ganges, Nile, Mississippi, Niger, and many more (including the Sacramento). It will flood up the low-lying agricultural valleys, turning them into bays and estuaries.

Plant diseases already reduce global food production by 30 percent (FAO). Climate-change induced plant diseases are expected to intensify in the tropics and spread across temperate agriculture.

Finally, the increase in weather variability expected from climate change – both the precipitation variability and the temperature variability – is expected to cause ongoing disruptions to agricultural operations around the world.

Adding all these impacts, scientists estimate that for every one degree C rise in temperature, global food production will drop by 5 to 15 percent (National Academy of Science, 2011). Current trends are expected to raise global temperatures 3 degrees C by 2050 and 5 or more degrees by 2100. This computes to the possibility that global food production could fall almost 50% by mid-century.

The Chaos Quotient:

- more food refugees (like those already coming out of central America)
- increased food prices, along with shortages of some products
- increasing overall food shortages, initially affecting the poor and increasingly affecting all of us.
- Surprise food disruptions (caused by droughts, disease outbreaks, heat waves, floods)

Refugees

All six impact categories describe above will result in increases in refugees – people fleeing the impacts of climate change. The International Organization for Migration projects between 25 million and 1.5 Billion climate refugees by 2050. the UN International Organization for Migration estimates 25 million to One billion for the same time-frame.

Where will all these people go? How will they live? How will they house, cloth, feed themselves after they have been driven away from their homes?

The current refugee crisis in Europe has been triggered by approximately a million people fleeing there because of the Syrian civil war. The US immigrant crisis, though arguably intensified by political manipulations, is about the immigration of less than a million people a year.

Imagine the social and political upheaval from ten million, or a hundred million, or more. Will we lift our lamp and shelter these tired, poor masses? Or will we drive them away? This is a crucial ethical question given that we, through our emission of greenhouse gases, are causing the conditions that will have led to their dislocation.

The Chaos Quotient:

- economic, political, and social disruption from millions of refugees entering California, the US, and other developed countries.

Aggregating the economic impacts:

Every local climate-caused crisis will hit our local economy. Heat-waves can disrupt school and civic schedules, as well as business and commerce. Major wildfires can disrupt the operation of health-care facilities, local business and commerce, cause massive local housing shortages, and on and on (the 2018 Camp Fire is a good example). Local and regional flooding can disrupt transportation, as well as housing, business and commerce. As an example, the cost of natural disasters in the US in 2017 totaled \$306 Billion (NOAA, 2018) – most of these costs falling on local economies. And they will grow exponentially as climate change progresses.

More broadly, extreme weather has cost the US economy 1.6 trillion dollars since 1980. Looking

ahead, a 4 degree C rise in global temp by 2100 would cause the global economy to decline more than 30% from 2010 levels – worse than the great depression of the 1930s, when global trade fell by 25%.^{vii} And don't expect that the US economic wealth will mean that we will avoid the economic costs of climate change – analysis shows that the economic cost in the US will be among the highest in the world.^{viii ix}

And its important to keep in mind that these numbers assume that climate-caused economic decline will be orderly – perhaps a heroic assumption, particularly since both nationally and globally, climate change will increase both social and economic inequity. The rich can vastly more easily move their productive assets and their households to more climate-friendly areas than the poor, but the poor and near poor will surely respond.

Aggregating the Chaos stressors from climate damage:

I want to try to encapsulate the information above. If climate change progresses on its current trajectory, our local area and the broader world will be hit by acute crises – heatwaves, conflagration wildfires, major storm events, with both riverine and coastal flooding, pandemics; chronic crises – droughts, famine, endemic diseases, incremental ocean-level rise, influx of locally generated and foreign refugees, and climate-related economic decline.

Potential stressors from a response to government climate policies:

I want to change gears and explore what might happen if humanity took the warnings from science on climate change serious. The catalog of impacts above is based on the assumption that national and international government actions will not be sufficient to prevent our climate from tipping into catastrophic climate change. I think this will be the most likely situation, but still, it is worth examining the stressors that might hit us if governments did enact policies that were effective in preventing outright climate collapse.

Based on the best available science, the world needs to arrest the warming at 1.5 degrees C or below in order to keep us from falling into a cascades of climate tipping points that would take us to 5 degrees C or higher (see essay 1 of this series for a fuller explanation of tipping points).

Achieving that – keeping the warming below 1.5 degrees – would require humans to cut our greenhouse gas emissions in half within the next 5 to 10 years and to zero within the next 10 to 20.

Setting aside the political difficulties (perhaps impossibilities), what would happen in this country if government policies that would actually achieve this were instituted?

Forty-two countries already have carbon taxes, or equivalent cap-and-trade programs, that price carbon dioxide emissions an average of \$8 per ton. But there has been severe backlash in some of these countries. Australians reacted fiercely to a \$23 per ton price. In France, a proposed gasoline tax increase of 6 or 7 cents per liter (about 25 cents per gallon) triggered riots which caused four deaths, 250 injuries, millions of dollars in damages.

In the US, conservative think-tanks have spewed out climate denial misinformation on climate change for three decades. Conservative commentators argue that the entire climate issue is a conspiracy designed as a cover for a Soviet-style liberal/socialist takeover of the government. Conservative politicians parrot the information they receive from these sources.

And apparently many everyday Americans listen to this misinformation. Fifty-eight million deny the reality of climate change.^x Only 56 % say protecting the environment is a top priority. Fifty-one percent say climate change policies make no difference or do more harm than good.^{xi} Finally, only a third of Americans would support an extra tax of \$100 dollars a year to fight climate change.^{xii}

And yet, last year the UN reported that governments need to impose effective carbon prices of \$135 to \$5,500 per ton of CO₂ in order to keep global warming below 1.5 degrees C.^{xiii}

For a bit more perspective, the average American emits about 20 tons CO₂ or its equivalent each

year. The UN recommendations for avoiding the cascade of climate tipping points would tax each person \$2700 to \$110,000 per year. This is compared to what most Americans want – no tax or at most a tax limited to \$100 a year.

So again, what might happen if our government went through a radical shift and started supporting real action on climate change? What if it adopted a carbon pricing program along the lines of the UN recommendations? How many Americans would accept a tax of \$2700/ year, let alone taxes orders of magnitude higher? How would they express their objections? A letter writing campaign? (Unlikely, that's what progressives do, not conservatives.) Non-violent demonstrations? Maybe some, but how many of the climate deniers are second amendment folks? How long might they stay nonviolent in the face of what they've been convinced is a socialist conspiracy to control their government and their lives?

Parting thoughts:

It's hard to fully grasp the dangers our society faces as we move into the age of climate change. Social undercurrents already present threaten to burst to the surface and spill us into chaotic situations. When we add all the stressors from climate change, and particularly the opportunities for interaction between our existing social weaknesses and newly imposed climate impacts, it seems hard to imagine that our world will continue to muddle along in its current semi-orderly state.

I think the example of Syria is particularly instructive. A four-year drought and its resulting famine triggered a public response which was poorly handled by an uncaring, authoritarian government. This precipitated into a civil war which, as describe above, killed hundreds of thousands and displaced millions. Then a small fraction of those displaced fled to Europe, where their presence destabilized the politics across the whole region.

So in Syria one climate stressor triggered a cascade of impacts that affected a whole continent. And Syria was a minor incident compared to what will come.

All of these are forces we individuals can't stop. And so, I believe we need to come together and figure out how to live in their shadows.

Respectfully, Allen Edwards

iClimate Stabilization Targets: Emissions, Concentrations, and impacts over Decades to Millennial, National Research Council, 2011.

ii“Climate change could be hurling earth back to the future, raising sea level by 65 feet,” Georgia Rose Grant and Timothy Naish, Newsweek, 10/3/2019.

iii Phys Org, Institute of Physics , July3, 2018.

iv“Mosquitoes may have killed half the people who ever lived,” New Scientist, 7 August 2019

v“Climate change, crop plant diseases and future food production,” Dr. Jillian Lenne, World Agriculture, July, 2018

vi“2010 Pakistan floods,” Wikipedia.

vii“Climate change facts and effect on the economy,” Kimberly Amadeo, The Ballance, Kune 25, 2019.

viii“Climate change will cost US more in economic damage than any other country but one,” Stacy Morford, Inside Climate News, August 2019

ix“Climate change will cost US more in economic damage than any other country but one,” Stacy Morford, Inside Climate News, August 2019

x “Surprise! New pol shows Americans lead the developed world in climate denial, Yessenia /Funes, Earther.Gismodo, 5/8/19.

xi “How Americans See climate change in 5 charts” Cary Funk and Brian Kennedy, Factank, Pew Research Center, April 19, 2019.

xii “Americans demand climate action, as long as it doesn't cost much: Reuters poll,” Valerie Volcovici, Reuters, June 26, 2019.

xiii“New U.N climate report puts a high price on carbon, Brad Plumer, The New York Times, October 8, 2018