**PRN- December 5, 2017**

**Saving the Planet, Saving Ourselves**

**By Richard Gale, Gary Null Ph.D**

The year 2017 was a record-breaking year for extreme weather and environmental catastrophes since records started to be kept in the 19th century. The Arctic experienced temperatures up to 70 degree F above normal. Many countries were baked in unusual heatwaves killing thousands. Incidents of droughts, extreme typhoons in the Pacific and hurricanes in the Atlantic, flash floods, and wildfires erupted daily in international news headlines. As recent as 2014, the World Meteorological Organization (WMO), following an analysis of NASA satellite footage of carbon dioxide movement around the planet, concluded that our warming planet has entered "unchartered territory at frightening speed." But 2017 was also the year when the statistical figures came in for 2016. The WMO reported that CO2 concentrations in the atmosphere rose at record speed. Currently it is at its highest level in 800,000 years. If anyone held any doubt that climate change is unreal, a fiction or fantasy, 2017 should have been wake up call to the most obstinate denialist. Scientists have warned about our current days of climate for several decades. For those who jumped on the bandwagon years ago when atmospheric and geological scientists voiced serious concerns about global warming and its dire consequences, it was a year with no huge surprises, except for the rapid acceleration of warming trends.

It is time that people, and more crucially our entire species, to accept the fact that climate change is the single most important threat to humanity’s survival. Certainly, a nuclear confrontation with North Korea or Russia is a horrifying scenario that could eliminate tens or even hundreds of millions of people. However, it is within humanity's means to avoid nuclear war. On the other hand it is highly improbable whether we can do much to deter climate change. Natural forces are far beyond our technological know-how and methods to control powerful planetary forces regardless of how many efforts to advance geoengineering or a dramatic shift to renewable energies are made. Perhaps it will slow the pace of global warming a little, but it too has its own destructive blowback. The Earth's history is a long story of numerous species birthing, evolving and eventually going extinct. There is no manifest destiny for our species. There is no divine promise that humanity may not in the future follow in the footsteps of the dinosaurs. Our lives are not transcendent to Nature nor the multitude of other natural forces, animals, plants, microbes and other life forms and molecules upon which our existence depends. This is a simple truth we must learn. And it must be learned quickly and without further delay.

In a July issue of *New York Magazine*, journalist David Wallace-Wells published a worst case, doomsday scenario of climate change's impact upon human society and the environment before the end of this century. His essay, "The Uninhabitable Earth," was based upon many private interviews with unnamed scientists who were willing to voice their deeper concerns about catastrophic events and eroding conditions humanity will face unless a concerted global response to reduce greenhouse gases is not launched immediately. Aside from several of Wallace-Wells’ factual errors, this was the first featured article to appear in a mainstream publication that focused on climate change's darker side. It became the most read article in *New York Magazine*'s history. However, earlier in 2003, Cambridge University astrophysicist and philosopher Martin Rees released his influential *Our Final Hour* warning that the pace of humanity's destructive activities presents a 50:50 chance for our civilization to survive past the end of the 21st century. Carcinogenic and unhealthy foods and high levels of deadly toxic chemicals in common everyday products are only minor risks comparedto many other postmodern technologies impacting our lives. Climate change, combined with the genetic engineering of new viruses, synthetic biology, artificial intelligence, andrape of the planet for its last remaining natural resources, according to Rees, is a recipe for certain disaster and will likely end in the extinction of our species. While many scientists and most of the general public who acknowledge the facts about anthropogenic climate change continue to hold enormous blind faith on human ingenuity and modern technology to prevent global warming's "end game," Rees and a distinguished, multi-disciplinary consortium of scientists at the Cambridge Center for the Study of Existential Risks acknowledge a darker side behind our over-reliance upon technological solutions--nuclear power, geoengineering, genetic manipulation of nature, etc.

Rees's 50:50 survival prediction was largely ignored after its publication over a decade ago. Nobody wants to accept that our survival is predicated upon a flip of a coin. Today, his predictions are being reevaluated and his supporters are increasing. And this is why Wallace-Wells' *New York Magazine*'s article is so important. There are more than ample reasons to fear the consequences of climate change on our health, food security, our livelihoods, well-being, and the survival of future generations, including our children. Extinction is forever, whether it be in a hundred, as the more pessimistic scientists suggest, or a thousand years or more. It is only a matter of time before killer heat waves become the norm, chemical-based industrial agriculture collapses, national economies are devastated, new plagues and health epidemics emerge, and climate and resource conflicts and wars increase. All of these have been previously predicted over the years, and each is already starting to cast its shadow over the planet. Fear combined with hope is a powerful motivating factor to embrace change in personal habits and lifestyle. Therefore, it is critical today for humanity to become afraid, to become intensely afraid without becoming paralyzed. We condemn ourselves only by our failure to wake up while clinging to faux optimism, and by refusing to take upon ourselves the appropriate actions when confronted with an immediate emergency.

Climate change science poses certain obstacles difficult for the average person to accept. Perhaps most evident is that the science and predictions appear too abstract. They can seem too foreign and impersonal. The calving of an enormous ice sheet in Antarctica or rapid Himalayan glacier melt do not set off alarm bells that threaten our cozy lives in American and European cities and suburbs. The events are too distant. We know that sea levels are rising. Everyone in Miami is aware of this fact because flooded areas in the city are now commonplace. The citizens of the Maldives and Solomon Islands certainly know this because their nations are already sinking under rising sea levels. But to imagine one's home or condominium along the coast being partially submerged permanently in the Atlantic Ocean is a time too far off to think about. Consequently, real estate developers continue their frenzy to build more residences up and down the Florida coast, and people continue to flock to the Sunshine State to purchase a sunny place to retire. It is almost obscene to imagine that four of the top ten cities witnessing the largest influx of migrants within the United States are also the most compromised by more immediate climate change and extreme weather conditions: Houston (No. 1), Miami (No. 2), Phoenix (No. 7) and Orlando (No. 10). In August 2017, Hurricane Harvey submerged over 100,000 homes throughout the greater Houston metropolitan area. While the storm itself cannot be attributed to humanity's contribution to global warming, the hurricane's intensity and power is certainly related. Rising sea levels and warmer sea surface off the Texas coast -- 7.2 degrees F above average making it the hottest spot of ocean surface in the world -- are the two major factors that made Harvey so catastrophic and deadly. And similar extreme tropic storms are only going to increase as the Earth gets warmer. As the planet's surface heats further and sea levels rise, climatic events become increasingly more extreme. Consequently our lives become more stressed, miserable, insecure and uncertain.

The British philosopher poet G.K. Chesterton wrote, "It isn’t that they cannot find the solution. It is that they cannot see the problem.” Individually, nobody can initiate the kind of grand massive change in collective humanity's relationship to the environment being demanded today. However, each of us can make determined and immediate changes in our personal lives and repair our personal rapport with the earth, nature, the ecology around our homes, neighborhoods and towns. No honor is gained by sitting and waiting for government to take concerted action to lessen greenhouse gas emissions and overhaul the federal regulatory system to hold private industries and polluters accountable. The corruption of Washington is beyond reform because government has itself become a private enterprise. Likewise, Americans are waking up to the realization that their votes are useless. Those who need to change the most--elected officials and legislators, corporate CEOs and Chairmen, professional institutions-- will not find the solutions until it is too late. In the meantime, they refuse to see the problem. And this is clearly evident by the fact that the fossil fuel industry is expanding rather than receding.

This chapter will lay out the fundamental problem humanity faces as climate change and global warming accelerate. Although a popular awareness of climate change is growing rapidly, most people still have difficulty connecting the dots between dramatic climate-related crises and calamities happening in far off regions of the planet and the impact these very same events have upon their personal lives. Therefore, I will be presenting the climate science in simple lay language, providing crucial examples, in order to make global warming a more personal affair. Unless the threats the Earth faces are understood and perceived as a threat to our personal wellbeing and that of our immediate families, loved ones and friends, the constructive, necessary change so direly needed will not unfold. Nevertheless, we must begin with ourselves because each of us possesses in her or his power the capacity to live in harmony with life and the greater whole of Nature. And then we must serve as an example of a conscientious, ecological lifestyle to those we meet.

--------------------------------------------

In August 2017, the 900-plus foot tanker Christophe de Margerie set sail from Russia's North Sea to South Korea. The cruise's novelty was that for the first time in recorded history a sailing vessel crossed the Arctic's Northern Sea Route without the need for icebreakers. The ship traveled freely, unencumbered across the broken, melting ice fields. This small incident regarding a tanker carrying natural gas half way around the world may seem incidental and insignificant, barely newsworthy. But for climatologists and Arctic ecologists it was an unexpected and disturbing event. It was another indication that the planet is racing faster towards an ice free Arctic. It was also a warning that global warming is accelerating beyond expectations. Back in 2013, the University of California was predicting that ships would be incapable of traveling freely across the North Pole before 2050. However, the Christophe's passage over the Arctic's southern frontier in under seven days holds a record. And this voyage would have never been possible without the acceleration of anthropogenic climate change.

As the Russian vessel made its way across the crown of the planet, at the opposite pole another surprising event occurred. On July 12, 2017, an iceberg, approximately 2,200 square miles or roughly the size of the state of Delaware, broke free from the Larsen C icesheet in Western Antarctica. This was the third gigantic Antarctic icesheet to collapse since 1995, and the largest to date. Glaciologists were startled because the speed of the sheet's disintegration was miscalculated. Although the break, commonly known as "calving," had been predicted several years prior, it was the suddenness that was disturbing. A week later, glaciologists' predictions were proven wrong a second time. It had not been a clean split as calculated earlier. Instead, like a stone hitting an auto's windshield, the break triggered a network of fissures indicating that the entire icesheet was quickly fragmenting and more sheets would be calving in the near future. Antarctica is often viewed as the last place on Earth that will be touched by global warming due to human activity. However, 2016 observed a record low of sea ice, according to the University of Washington, and 2020 is now targeted as the turnaround point when the degradation of the southern polar icesheets will be directly the result of human activity. Already, atmospheric temperatures in the Antarctic have been rising annually by 4-6 C. As warming seasons lengthen, ice sheets melt and calf faster and eventually the shelves thin further and disappear.

------------------------------------

For the twenty-first century, these two geological events, and many others, are indicative of the greatest threat to humanity: global warming and climate change. For the first time in human history, our species has entered an era of extraordinary and anxious uncertainty. Many are bewildered when they hear about the loss of an Antarctic ice sheet, prolonged droughts, temperatures reaching above 50 degree Celsius, flash floods, and uncontrollable wildfires. What does it mean when we hear that 2016 was the third year in a row to set a new record for average global temperatures? Is this simply a fluke? An aberration in the usual climate patterns we have become accustomed to? Will it continue or end?

The international scientific community is nearly unanimous in confirming that global warming is accelerating and human activity is its primary driving force. There is also near unanimous certainty the course we are following to reach catastrophic benchmarks is inevitable and completely outside our civilization's control. Those scientists who resist the international consensus are far and few between. The majority of dissenters lack a professional background in the Earth and Space sciences, climatology, glaciology and other disciplines directly associated with measuring and observing changes in the atmosphere and the Earth's geology. For several decades, scientists the world over have been running simulated climate models repeatedly to determine whether increased warming is anthropogenic or caused by human activity. And repeatedly whenever human-generated greenhouse gases--CO2, methane, nitrous oxide, water vapor, dust, etc.-- are removed from their equations, they are unable to account for the sudden rise in the Earth's temperature as the result of natural phenomena alone. Already the Earth is warmer than it has been for the last 120,000 years. However, when these same models introduce greenhouse gases into their equations, they accurately correlate with the actual temperature trends being witnessed. Long-term, 90% of planetary warming is linked to the actions of our species. The remaining 10%, according to Konrad Steffen, director of the Swiss Polar Institute, is "unexplained."

It is not uncommon for climatologists to underestimate the swiftness of climate-related events. The statistical and computational models to portend timelines for certain climate tipping points, although highly sophisticated, are unable to account for all variables and trends, particularly unforeseeable catastrophes such as mammoth biomass emissions from wildfires and other natural and human calamities. For example, researchers would not predictable calculate the explosion of BP’s Deep Horizon facility that discharged up to 520,000 tons of methane into the atmosphere, the equivalent of burning upwards to 3.1 million barrels of crude oil. Consequently dire findings are either found wanting or too sober as new observations upgrade earlier forecasts. Very soon the Arctic region will be ice free throughout the year. Conservatively the Arctic will lose all its ice during the warmest months before 2030. We still don’t know precisely many of the long-term consequences to the polar region and the planet's biosystems once this tipping point is reached. However, there are approximately four million people living along the Arctic Circle, including hundreds of thousands of indigenous people. Very likely, most of the coastal communities will be forced to migrate in the near future as shorelines dependent upon ice, freezing temperatures and colder seasons start to crumble and disappear. Acceleration is also exasperated by the thawing permafrost and tundra, and the massive release of methane and nitrous oxide, in the Arctic North. In point of fact, the polar North is collapsing.

The loss of the Arctic's albedo, the white world of ice that reflects the Sun's radiation back into space, has already passed its tipping point. For as long as humans have been on the third planet from the Sun, we will never return to a time when polar bears and seals thrived on frozen ocean surfaces. We can no longer prevent the Western Antarctic icesheets, including the Larsen and Ross sheets, from slipping away into the dark oceanic waters. The rush of fresh water from melting glaciers in Greenland are beyond our technological means to prevent the disruption in the Atlantic Ocean's conveyor belt. Based upon satellite data feeds, the Greenland sheets, according to David Barber at the University of Manitoba, are now melting six hundred times faster than the current modeling trends suggest.

Similarly, due to many complex and unknown factors, it is exceedingly difficult to ascertain exactly how high the oceans will rise if all Antarctic ice melts. For example, one of the largest Antarctic icesheets rests on solid ground below sea level. On the one hand, this makes the sheet far more unstable and geologists continue to try to determine its global impact following its last breath. Nevertheless the loss of the Ross icesheet in West Antarctica alone could raise sea levels 10-13 feet (3-4 meters). In 2014, NASA's Jet Propulsion Laboratory at the University of California at Irvine determined that the loss of the West Antarctic sheet is unstoppable. The circulation of the ocean's warmer waters beneath the ice continues to thin and melt the shelf. No technology nor even a drastic reduction in greenhouse gas emissions can prevent it. As if a warhead missile had already been launched, we can only sit and wait to experience the consequences befalling us upon impact.

For many years, scientists were not terribly concerned about a rapid melt of Antarctic icesheets. The southern pole has always been thought to be the last place on earth to experience global warming. For the past 40 years, winter ice has actually increased--until recently. In 2016, University of Washington researchers noted a perfect storm of conditions that, if repeated annually, will increase Antarctic ice melts and possibly trend towards declining ice buildup during the winter months. One of the causes the university scientists identified was a change in El Nino patterns that are now reaching the Antarctic.

In May 2014, Climate Central provided a probable scenario of American land lost due to a 10 foot increase in sea levels. Approximately 28,800 square miles of land mass would disappear with rising waters and force the dislocation of over 12 million people, primarily along the US eastern seaboard. Twenty-seven cities in Florida would be the most seriously affected. The report determined that the cost of lost property would be upwards to $950 billion--a very conservative figure. The majority of the loss would be in the southern states but also a third in New York and New Jersey.

The complete loss of 5 million cubic miles of ice now blanketing the Earth, including large mountain glaciers, could raise sea levels by 216 feet. San Francisco Bay Area would be a cluster of small islands. Along with Los Angeles and San Diego, the American East Coast would vanish. Bye bye London, Venice, Netherlands and most of Denmark. From Bangladesh across Southeast Asia to the Cardamom Mountains in Cambodia, only small islets would remain. Mt Fuji would remain as a standing volcano bulging monolithically out of the Pacific. Four out of five Australians would be displaced and vast regions of Africa would be uninhabitable. Scientists are hopeful that a complete ice free planet is over a thousand years down the stretch. But without doubt humanity has entered uncharted territory on the geological map. Our technological tools and modeling systems, albeit highly sophisticated, are still incapable of the daunting task to establish precise timelines. Unpredictable events and catastrophes affecting feedback loops, such as wildfires, volcanic eruptions, oil fires or industrial plant explosions—such as the Arkema chemical plant explosion near Houston after Hurricane Harvey—and the numerical increase in extreme weather events cannot be accurately calculated into greenhouse gas simulations. Harvey's rainfall is estimated to have been the worst in US history and the most devastating storm to hit Houston. Nineteen trillion gallons of water. For five days, the "capitol" of America's fossil fuel industry was flooded with torrential rains and wave surges, shutting down and damaging oil refineries and chemical plants along Texas' eastern coast. Over one million pounds of toxic pollutants and greenhouse gases were released. Such events fall outside the realm of computerized simulations and cannot be accurately included in predictive climate models. For this reason, scientific conclusions are often far more conservative than the actual state of the planet. Therefore we must start to realize that there is no precedent on the Earth's 4.6 billion year geological timeline to serve as a reliable baseline to accurately calculate climate-related events in the Anthropocene Age.

---------------------------------------

There is ingrained in the cultural DNA of modern civilization a mythic delusion that is at best ignored and largely denied by people whose lives depend upon the emotional security in believing in economic and scientific advancement to cure our problems. This blind faith is simply a sign of our addiction to progress. It is a myth that underlies our neoliberal capitalist agenda that praises infinite progress and development. It is also a myth embedded in our major religions, particularly the Abrahamic traditions, which gave rise to the 18th century economist Adam Smith’s metaphor of the capitalist marketplace as the work of "the invisible hand of God." This modern myth has been beautifully described and elaborated upon by ecological activist Derrick Jensen in his *The Myth of Human Supremacy.* And this dangerous idea, which depends upon being closed minded and blind to the non-human intelligences all around us, to the trillions of organisms, microbes, plants and animals upon which our lives and survival depend, is driving humanity towards its own annihilation.

There is a peculiar arrogance when sentimental environmentalists proclaim the Earth is sick and humanity must unite and collectively gather together and heal her. This view also perpetuates the myth of human supremacy over Nature and further reinforces the assumption shared by most members of the scientific community, private corporations, and among high governmental officials who have an unswerving faith in the potentials of human intelligence and ingenuity to override the forces of Nature. Regardless of how critical, or even desperate, a situation becomes, there dangles before us the faux promise that we can find the technology to solve it. But humanity is not a savior for the simple fact the Earth does not need saving, except from our own limited, awry perception and destructive actions. "Global warming," writes Roy Scranton, author of *Learning to Die in the Anthropocene*, "is what is called a 'wicked problem': it doesn't offer any clear solutions, only better or worse responses." Regardless of the billions of tons of carbon dioxide, methane and other greenhouse gases our culture pumps into the atmosphere, regardless of how acidic we turn the oceans, the Earth will tweak and re-tweak itself in order to return to a homeostatic state, with or without the numerous species now faced with extinction. It will continue to self-organize and reestablish stability. It may require many thousands of years after the Anthropocene has passed before she finds a new balance and bursts anew, albeit without us or the presence of countless other creatures and beings extinguished by climate change. This was the overriding theme in Alan Weisman's bestselling thought experiment, *The World Without Us*, later made into a PBS special, which portrayed a planet coming alive again after humanity destroyed itself. Earth will heal nicely, thank you, without our technological intervention and the hubris of the superiority complex unique to our species.

There are certain dominant characteristics that define psychopathic behavior. One is the inability to feel remorse over destructive behavior or for committing a crime that inflicts terrible suffering upon another. Another common psychopathic trait is to regard violent acts as permissible and perhaps even beneficial. Therefore, we destroy and kill thousands of species, live off a diet responsible for the butchering of billions of animals daily, mow over ecosystems for mining and development or to raise livestock and sow genetically engineered crops, survey and drill and drill some more for the Earth's last drops of fossil fuels, all in the name of capitalist growth and expansion. At the same time, corporations and the global elite, the captains of industry, our governments, international banks, our educational institutions, and the corporate media whitewash these ecocidal actions as being virtuous and necessary in order for us to enjoy the comforts and ease of postmodern civilization has to offer. Perversely, we are being told it is better to sustain the artifacts of our modern culture than the Gaian life support necessary to live, breath and nourish us.

Such a view is pathologically dangerous. And it is indicative of the human psychology that today defines the Anthropocene Age.

**The Anthropocene Age**

Today climate scientists and environmental activists refer to our postmodern era as the Anthropocene Age whenever they critique Western civilization's impact upon the changing climate and the planet's future ecological shifts and transformations. Indeed modern industry and technology is destroying the planet unwittingly. Its carbon footprint is evidenced everywhere we look. But it has become so pervasive that it goes largely unnoticed. The food on our dining table has a history of greenhouse gas release. So do our mobile phones, computers, jeans and sneakers, and so much more. Aside from extreme weather events, we often fail to notice the immediacy and rate of these changes, such as the arrival of certain predatory beetles invading trees on our lawns or the arrival of a plant species in our neighborhood park that should only thrive in a different clime. Or the arrival of new blights decimating forests.

A five-year University of Delaware study predicted that 72% of Southern states' needlegreen evergreen trees will disappear by 2050 due to the southern pine beetle. The insect is native to Central America, however, since 1990, milder winters have enabled the pest to migrate as far north as New Jersey and more recently onto Long Island. Massive tree die offs are occurring throughout North America and other continents. When Los Alamos National Laboratory, along with scientists from 18 other institutions and federal agencies, ran multiple global warming simulations to check and cross-check their results, the conclusion remained the same: climate change was the machine driving massive tree and forest die-offs. This includes the great boreal forest reaching around the planet's northernmost clime and one of the most important and last natural resources that assures we have oxygenated air to breathe. Already it is being observed that peat in the world’s boreal forests is decomposing at an astonishing rate and releasing methane, a greenhouse gas far more potent and dangerous than carbon dioxide.

On the US Pacific coast, a jelly-like creature known as a pyrosome has migrated from its native warmer tropical waters off the Central American coast as far north as the Gulf of Alaska. Pyrosomes are an invasive species, as are many other organisms that are multiplying with increasing global temperatures. These zooids are now so plentiful that fish school populations are threatened. They interfere with the fishing industry and fisheries and as a consequence the proliferation of pyrosomes has a direct adverse impact on communities and economies. In her book *Stung! On Jellyfish Blooms and the Future of the Ocean*, author Lisa Ann Gershwin writes, "We are creating a world more like the late Precambrian than the late 1800s--a world where jellyfish ruled the seas and organisms with shells did not exist. We are creating a world where we humans may soon be unable to survive, or want to." Gershwin further explains how the increase in jellyfish contribute to global warming. On the one hand, jellyfish consume enormous quantities of diatoms and other plankton, which help sequester carbon dioxide and expel oxygen. Second, jellyfish excrete carbon-rich waste taken up by ocean bacteria. As the number of bacteria increases in parallel to blooming jellyfish populations, they are converted into miniature factories pumping out carbon dioxide into the atmosphere and further acidifying the oceans' waters.

Or if you go to a market, would you notice that fish, including tuna and cod, are getting smaller? Fish too are directly affected by global warming. This was the conclusion of scientists at the Institute for the Oceans and Fisheries at the University of British Columbia based upon empirical data. Warmer oceans means less oxygen to sustain fishes' bodily functions because "fish are constrained by their gills in the amount of oxygen they can extract from water." The study estimates that 3.4 million metric tons of fish will be lost for each degree Celsius of atmospheric warming.

These several short stories reveal adverse effects happening at this very moment in the US alone due to global warming. They are among many thousands of others occurring across the globe. When we speak about climate change, the boundaries that divide national interests become irrelevant. Climate change and the heating planet is a global crisis of our own making. And very little is being done at either the political domestic and international levels to abate the sources and causes of this emergency.

Before the orgy of fossil fuel exploitation and consumption switched into hyper-drive around 1950, there were 90 percent more fish in our oceans. There was 40 percent more phytoplankton, one of the most important manufacturers of our planet's oxygen and an essential organism necessary to counter acidity caused by human waste and pollution. In less than 70 years, humans have already removed twice the number of trees still standing in the world's forests and jungles. There would be three times more fresh water. And there would be over 30 percent less greenhouse gases, especially carbon dioxide in the Earth's atmosphere. What is equally important to run through our mind's imagination is the gloomy scenario that during this same 70 year period, as the resources to sustain human life dwindle, our population steadily increases. Since 1950 (2.5 billion people) it will nearly triple to 7.6 billion by 2020. The simple math is clear that humanity is headed towards extremely dark and frightening times in the very near future.

It is comforting to become complacent and simply consider the gradual decay and death of the planet's ecosystems as unusual or freak coincidences. Rarely do we give thought about the deeper causal factors that point directly back to our individual and societal behaviors. Winters start later; spring arrives earlier. Prolonged rainfalls and extreme weather incidents are perceived as mere aberrations, as are months of excessive heat and drought. Scientists are fond of saying this is the new "normal" just as the mainstream media would have us believe that obesity and a shorter life span are new norms as well. But life continues. We passively accept the adverse changes subtlety affecting our lives. Assimilation and adaptation to inimical change is far easier and more comforting than waking up from our ignorance or denial of life-threatening problems. People simply say, "that was a weird year" or "the weather has been very strange lately," and assume everything will return to a median range the following year. Everything is supposedly cyclic, right? But the later years of normalcy don't reappear. Each year witnesses new record-breaking weather events somewhere in the world. And this is part of what the Anthropocene Age reflects.

So what is meant when we say that humanity and all other species, and the very planet itself, have entered the Anthropocene Age? The Anthropocene means more than what humanity does today or has done in the past since the dawn of modern industrial society over two hundred years ago when the steam engine was invented. The term is not descriptive solely of our present century but refers to an entire age in geological time. The earlier Cenozoic Era started 65 million years ago after the extinction of non-flying dinosaurs and the rapid appearance of mammals. Earlier geological ages also experienced catastrophic changes. The last and more recent Holocene era began at the end of the ice age approximately 11,700 years ago. But these changes were based upon natural geophysics and phenomena occurring within the planet's geological systems. Or they were accidental such as the case of an asteroid, roughly 6 miles in diameter, smashing into the Earth's surface and overnight altering the atmosphere and global temperature, which gave rise to the Cenozoic Era.

The Anthropocene is also utterly unique in geological time. It is not only the geophysical rhythms altering the planet naturally. That was the case for the previous epochs. During the past two hundred years, a new agent of geological change has appeared: modern Homo sapiens and the emergence of an industrialized civilization alienated from Nature and its origins. And this agent has now become so pervasive and independent from its natural lifeline, so alienated from its natural home which brought it forth, that like the Cenozoic asteroid, humanity has morphed into an alien power affecting and reshaping all geo- and eco-systems that would otherwise keep the Earth in a natural state of equilibrium and balance. This is the era of Anthropos, the Greek word for "human" but also appropriately the name of a social robot designed to mimic human behavior by Media Lab Europe. It is a new geological age of our own creation.

In 1873, an Italian geologist named Antonio Stoppani observed that humans were increasing their influence upon the world thereby adversely affecting the Earth's ecological systems. He proposed that the planet was entering a new era in its geological history, which he called the "anthropozoic era," the seventh geological age since the Earth formed in the Solar System as a cluster of gas and dust 4.6 billion years ago, and the eighth epoch during the age of mammals which began 65 million years ago. During his lifetime Stoppani's insights and predictions failed to take hold in the scientific community. Western civilization was still in the midst of the Enlightenment's euphoric high over the sudden burst of scientific discoveries and the powers of reason over instinct. It was during this Age of Reason when Darwin's theory of human evolution took hold of the intellectual imagination and gradually merged with utopian myths of infinite industrial and economic progress. The myth has since solidified into the Western consciousness, creating a worldview that today perceives our species as the masters and gods of creation, the supreme rulers of its terrestrial destiny.

The geological sciences would have to wait another hundred years before a Dutch atmospheric chemist and Nobel Prize laureate who first observed the hole in the ozone layer, Paul Crutzen, defined the Anthropocene Age as the arrival of a new epoch in Earth's geological history. Crutzen observed that human activity had passed a threshold whereby it had become the dominating and overwhelming force shaping the planet's internal systems and geology. According to Crutzen and his college Eugene Stoermer, a biologist at the University of Michigan, it was towards the end of the eighteenth century that the Anthropocene Age commenced with the first scientific evidence of two greenhouse gases, CO2 and methane, being generated by human industrial society. Today the definition has stuck and is rapidly becoming a household term.

But what does it mean for the Earth to have entered a new geological epoch? To better understand the full significance of the Anthropocene as a new geological era, imagine for a moment that all humans suddenly disappeared from the face of the Earth tomorrow. Or imagine we have all been beamed up into outer space by an alien race to free the Earth from humanity's destructive actions. Even with humanity absent, for the next ten to fifteen thousand years, all subsequent geological and climatic events will have a direct or indirect relationship to past human activities. Our civilization's footprints are so pervasive across the Earth's geo- and atmospheric systems that they will linger for many millennia, well after our species goes extinct. And it is with this arrival of the Anthropocene that humanity has emerged as the primary perpetuator of ecocide, the ruler and destroyer of the planet's environment, ecosystems and habitats.

A former member of the Australian government's Climate Change Authority, Clive Hamilton, writes, "The arrival of the Anthropocene contradicts all narratives, philosophies, and theologies that foretell a preordained and continuous rise of humankind to ever-higher levels of material, social and spiritual development." In his 2017 book, *Defiant Earth: The Fate of Humans in the Anthropocene*, Hamilton warns of the scientific hubris driving western nations to imagine we can geoengineer the weather, reduce the destructive threats of greenhouse gases, and assure the further growth of human capital and technological development to solve all of our civilization's and planet's problems as they arise. For Hamilton, the Anthropocene demands that everything we have taken for granted about our civilization--economic development, globalization and trade, politics and foreign policy, social structures, and more--needs to be reevaluated. More important there is an urgent demand for a completely new relationship humanity must create with the Earth and other species. Finally, it is time for nations, their rulers, and the leaders of industry to come to terms with the fact we are no longer able to turn back the geological clock.

If we limit our definition of the Anthropocene solely to climate change, we fail to grasp the larger picture and won’t recognize what is truly as stake. It is true that climate change has been the primary rationale for the term's coinage. Yet humans are altering the planet's geology, ecosystems and biodiversity in numerous other ways that are either indirectly related to the warming planet or something quite different. These other anthropogenic impacts and threats for human survival are more recent and coincide with the burgeoning of post-industrial technology and humanity's desire to conquer, dominate and manipulate Nature solely for its own greed and needs. Modernity moves further away from the natural fabric of life upon which our lives depend for survival. This trend continues to increase, even among the younger generations, which now spend less time playing outdoors and more time in front of computers, television sets and electronic games.

Richard Heinberg, a director at the Post Carbon Institute in California, warns that the continual expansion of modern civilization has long over-shot the Earth's capacity to provide the necessary resources upon which our lives depend. This problem, argues Heinberg, is the result of a severe imbalance in our human systems. The problem was first laid bare in 1972, when a group of MIT researchers released the now prophetic study *Limits of Growth*. The report accurately predicted many of the threats our societies face due to resource depletion, food production, manufacturing industries, over population, rising pollution, etc. It was the first important study to confirm that our civilization's worldview that there can be infinite economic progress that depends upon finite natural resources is a recipe for catastrophic collapse. For over forty years, leading ecologists have understood the human dilemma by *systems thinking*. In order to fully comprehend the big issues facing us, including our individual lives, it is imperative we put aside linear, rational thinking, and look at our problems systemically. This includes the many ways we understand our own health and the available solutions to tackling the problems of disease.

Nothing in Nature is linear. Nature operates according to a systems theory. It is inherently holistic, meaning the whole of Nature is greater than simply the sum of its parts (individual ecologies) and there are numerous interdependent relationships between those parts. This is as true for recognizing the larger consequences of climate change as it is for understanding the environmental costs of species extinction, destruction of the planet's ecosystems, monocrop agriculture and the livestock industry, deforestation, massive mining operations and so much more. Unfortunately, our political institutions and the tunnel vision of private interests are unable to grasp the systemic outcomes behind their actions. If they were, there would no longer be climate change denialists in public office. For this reason, technology will not ultimately save us.

Technology itself, including "green" technologies such as solar power and wind turbines, also relies upon resources that leave a carbon footprint. Solar panels require the use of arsenic, aluminum, cadmium, copper, gallium, sliver, tellurium and other metals. Wind turbines require steel alloys, nickel, chromium, aluminum and manganese. Most of these metals require mining, and all mining operations rely upon fossil fuels and emit greenhouse gases. Mining also contributes to ecological depletion of trees, flora and advances soil degradation. For sure, technologies will buy time. But none of them are the silver bullet to slam on the breaks of accelerated warming altogether. Perhaps one of the only promising solutions is an enormous scaling back on progress and development, which follows the old 1970s mantra "reduce, reuse, recycle." But such a policy is completely contradictory to the entire neoliberal economic machine that fuels corporate globalization and expanding markets. In short, climate change and the environment are moral issues, and free market capitalism, according to Jerry Mander and founder of the International Forum on Globalization, is fundamentally amoral and without any human value other than currency.

Our modern civilization is also reorganizing and shapeshifting the very DNA of terrestrial life. The evolutionary tree of life, which required billions of years of change, innovation, adaptation and development to bring forth the natural vitality of the world we live in today, is being transformed by technological alterations in a laboratory. In an article appearing in*Anthropocene Magazine*, Andrew Revkin wrote that "the revolutionary genetic editing tool CRISPR is poised to imprint humans' ambitions at least as profoundly as fossil fuels have changed the physical world." The tree of life, Revkin observes, and which Darwin envisioned, has been "utterly disrupted now that DNA sequencing allows a more complete view" of living organisms.

Unfortunately the nations of the world have yet to come to grips with the hotly debated long term ramifications of genetic engineering. Even less so, does science fully acknowledge the possible crises that may emerge through the interplay of released genetically modified organisms and abrupt climate change? For example, the Second Green Revolution's promise of more resilient crops to survive future pest and weed invasions and to produce higher yields from genetic engineering is rapidly crumbling.

If you visit any GMO soy field in the American Mid-West, mixed among the paler green soy plants you will observe taller, lusher and darker green plants or hogweed gradually dominating your view. Similar to microbial resistance to antibiotic therapies due to over-prescribing, super weeds are increasingly becoming resistant to Monsanto’s and the other agri-chemical companies’ toxic products. Crops grown by chemical industrial practices, such as nitrogen fertilizers, an array of pesticides and herbicides, machine tilling, and higher demands for water, are turning out to be nutritionally inferior to their organic counterparts. They have also become more susceptible to pest invasions, which in turn requires further application of potent, toxic chemicals. Yields are decreasing. More frequent episodes of extreme drought and excessive precipitation due to global warming further compound the struggles farmers face. Our entire infrastructure of food security is over-taxed, severely stressed and more difficult to keep afloat as more fertilizers, toxic chemicals and water are demanded. This positive feedback mechanism--an initial chemical based agriculture model that requires more of the same in order to keep pace with climate change--further drags down yields and creates additional economic and health stresses on people and families.

When we step back and take a look at our culture's anthropogenic footprint, we must also take into account other activities besides burning fossil fuels. Globally, tens of billions of tons of concrete, perhaps one of the most damaging substances on the environment ever invented, is used in construction and development. Private corporations smelt huge amounts of aluminum annually, which is an energy-intensive process. Energy spent on aluminum production is today more costly than the actual cost of the metal. Our soil, our rivers, lakes and the oceans are littered in plastic. The latest study conducted in 2016 estimated approximately eight million tons of plastic are dumped in the oceans annually. Worldwide the US' reliance on plastic continues to increase, and the plastic industry is petroleum-based. WorldWatch estimates that 4% of petroleum consumed goes into the manufacturing of plastics. And the US leads the developed nations in recycling the least amount of post-consumer plastic. Over 90% of it, approximately 32 million tons, is simply discarded or dumped into landfills.

After water, according to Columbia University's Earth Institute, "concrete is the most consumed substance on the planet." The rate of concrete production today is equivalent to every person on the planet consuming three tons worth annually. Concrete manufacturing accounts for 5% of CO2 emissions during the heating process of limestone. And our planet's landscape continues to be built upon concrete. Even as the Eastern sea board remains under alert for sudden bursts in sea rise (six times the global average between 2011 and 2015), flooding and higher surges during tropical storms, the insanity of rapid construction along the coast continues unabated. "It’s amazing to see construction along the East Coast," writes University of Florida's Arnoldo Valle-Levinson in *Geophysical Research Letters*. "That is the worst place to build anything." He envisions the cities in the southeastern US becoming "Venice-like," prone to tidal flooding, as global warming pushes forward.

Because Earth changes are driven by economic and industrial pursuits in the free-market, some researchers, such as Jason Moore at Binghamton University, argue our present age should be call the Capitalocene. For Moore and his followers, this is an age where our ecological degradation is being fueled by "inequality, commodification, imperialism and more." Moore is certainly correct in many respects. However, the capitalist agenda is not the sole culprit now destroying the planet and human lives. Communist China is equally criminal, the world's leader in greenhouse gas emissions and contributing to 30% of all anthropogenic CO2 release into the atmosphere. There are so many criminal defendants responsible for our climate catastrophes who are determined to keep the fossil fuel economy alive. In July 2017 the Climate Accountability Institute and its partners released a report charging only 100 corporations as being responsible for 71% of all global greenhouse gas emissions since 1988. If our governments were in fact democratic and possessed any integrity, these firms would be held responsible for untold damage done to the environment, towns and communities and families.

Today there is a growing consensus among many thought leaders who have spent much of their lives in the environmental movement that only widespread systemic change will ward off the colossal human suffering looming before us in the not too distant future. This requires forward-thinking action at every level of our modern society. And this begins with ourselves, dramatic changes in our own personal lives and then reaching out into our neighborhoods, towns, communities. "Even if our efforts cannot save consumerist industrial civilization," notes Richard Heinberg, "they could still succeed in planting the seeds of a regenerative human culture worthy of survival." This systemic approach, coupled with a "moral awakening," Heinberg believes, is the only real hope for survival before us.

**Humanity's Flirtation with Ecocide**

We are unable to grasp the fullness of our current condition and that of the Earth without appreciating modern civilization's ecocidal nature. The Vietnam War was more than a failed exercise in American foreign policy and its imperialist ambitions leaving 58,000 American soldiers, 1.1 million Vietnamese fighters and 2 million civilians dead. It was also the first war of ecocide, which brought this word into our modern lexicon. It was the first time a government intentionally destroyed the ecosystems of another nation that it perceived as an enemy. Over the course of eleven years, between 1961 and 1972, the US military's Operation Ranch Hand, dropped and sprayed 19 million gallons of the highly toxic dioxin herbicide, commonly known as Agent Orange, over 7,000 square miles of Vietnam's landscape, destroying jungles, forests, grasses and crops. Outraged, the bioethicist Arthur Galston first raised the idea of human-caused ecocide at the Conference on War and National Responsibility in 1970. Since then many prominent individuals such as the former Prime Minister of Sweden Olof Palme, Indira Gandhi and Richard Falk have submitted proposals to the United Nations to make actions by nations that intentionally destroy ecosystems an international crime.

And still we fail repeatedly to learn our lessons from the Vietnam experience. Besides destroying much of Vietnam's ecosystems, Monsanto's dioxin, a primary ingredient in Agent Orange, has cost the lives and health of millions of Vietnamese men, women and children. After four decades since America's withdrawal from the country, babies are still being born with birth defects due to this chemical weapon. Photos released by British photographer Francis Wade in 2014 of small children with massive physical deformities residing in the ThiNghe and ThienPhuoc orphanages are heartbreaking. Similar to the Nazi holocaust, this is another crime that should be remembered and never repeated. Instead, for the past 20-plus years since Bill Clinton sat in the White House, industrial chemical agricultural companies such as Bayer, Dupont, Monsanto, and Syngenta have been responsible for poisoning many millions of acres of agricultural land worldwide with highly toxic herbicides. Monsanto's glyphosate, commonly known as Roundup, is the world's most widely used herbicide that has been shown in multiple studies, including Monsanto's own research, to be carcinogenic. As of early 2016, over 9.4 million tons of the chemical have carpeted much of the planet's landscape, 1.3 million tons in the US alone. And glyphosate, along with a class of pesticides known as neonicotinoids and manufactured by the German company Bayer, have been proven in many studies to be largely responsible for the epidemic of honeybee colony collapse. Finally in 2016, the US Environmental Protection Agency admitted that neonics are the primary culprits for bee deaths, yet the pesticide remains on the market.

Honeybees, along with other pollinators such as butterflies and bats, are critical for humanity's future food security. Approximately three quarters of the world's food crops depend at least in part on insect and other pollinators, including apples, almonds, blueberries and cherries, oranges, coffee and chocolate, onions, cucumbers, avocados and many more. According to Professor Vera Lucia Imperatriz-Fonseca at the University of São Paulo in Brazil, "Pollinators are important contributors to world food production and nutritional security. Their health is directly linked to our own well-being."

However, agricultural chemicals are not the only threat to pollinators. So is anthropogenic global warming. Researchers at the University of Arizona's Department of Ecology and Evolutionary Biology determined that climate change was adversely affecting the interactions between pollinators and flowering plants. Insect foraging activity, colony vitality and life span are being impaired hence adding further stresses on crop production. With the world population predicted to reach 7.5 billion people by 2020, and chemical megacorporations and governments making every effort to increase profits by dumping more poisonous chemicals on the planet, thereby threatening the very lifeline of the foods we rely upon, is it not apropos to call this an act of ecocide? Is this not a crime against the security, survival and health of humanity?

Today, environmentalists and climate experts throughout the world recognize our fossil fuel driven civilization as the harbinger of global ecocide. It is no longer the oil and natural gas, coal and hydrofracking corporations who are solely responsible for climate change's acceleration. Our entire economy of product consumption is petroleum based, from plastic bottles to agriculture, petrochemical feedstocks, the asphalt covering 164,000 miles of major US highways, waxes and nylon, from paints to lipstick and nail polish, roofing and water pipes, and even the hundreds of billions of capsules used for pharmaceutical drugs. The golf balls the global elite mindlessly bat around on pristine acres of manicured fields are fittingly petroleum based. The list is endless. Postmodern culture literally swims in a cesspool of products, GMO frankenfoods and conveniences reliant upon fossil fuels. We see, touch, taste and smell fossil fuels repeatedly. As a civilization, we are a corporate Oil R Us.

Ecocide also includes humanity's race towards its own extinction. At some point, the Earth's apparatus to sustain human life becomes exhausted and then our species begins its gradual descent into non-existence. Anthropocentric climate change is our civilization's second flirtation with possessing the power and means for self-annihilation. After the dropping of America's nuclear bombs Fat Man and Little Boy on Nagasaki and Hiroshima respectively in 1945, physicists and theologians alike awakened to the terrifying realization that humanity now possessed the Promethean power to terminate its biological inheritance from the face of the Earth. The Cold War further reinforced this risk as the communist East and capitalist West increased their nuclear weapons arsenals in a game of chicken to win an ideological race for world domination.

It is a curiosity to note that it was around the time of the Berlin Wall's destruction and the collapse of the Soviet Union, which brought an end to the Cold War, that awareness about global warming began to increase and capture public attention. In essence humanity was relieved of one ecocidal scenario only to discover it was now faced with another. The election of the Green duo, Bill Clinton and Al Gore, introduced and popularized global warming into our public discourse. Although Clinton's 44-point plan to reduce greenhouse gas emissions was ineffective, expensive and largely a cop-out to placate America's largest industrial polluters--neither Clinton nor Bush and Obama after him agreed to ratify the 1992 UN Kyoto Protocol which would have forced nations to reduce their greenhouse gas emissions based upon scientific consensus instead of private interests--the conversation gained steam and environmental organizations responded in kind.

In addition to creating the conditions for our own extinction, our modern civilization is accelerating the annihilation of countless other species. Elizabeth Kolbert's seminal 2014 book *The Sixth Extinction* deserves to be on the bookshelf alongside Rachel Carson's groundbreaking *Silent Spring* as among the most important books during the past sixty years. The Sixth Extinction refers to our present time in the Earth's history when there is a massive number of species, biosystems, and ecologies being extinguished by modern human actions and technologies. According to one study nearly 40 percent of species will become victim of climate change extinction by 2050. Kolbert describes past environmental conditions that resulted in the die-off of many animal and plant species, how these disturbances affected the atmosphere, CO2 levels, and compares these ancient accounts with what we are doing today. For example, "we have dammed most of the major rivers of the world, increased levels of nitrogen higher than can be fixed naturally by terrestrial ecosystems, used more than half of the world’s readily accessible freshwater run-off, removed more than one third of the primary producers of the oceans’ coastal waters, and changed the composition of the atmosphere by deforestation and fossil fuel combustion." All species have a function in the vitality of the ecosystem they reside in. Although scientists may not understand or know all of the multiple interrelationships between any given species and another in the same habitat, the loss of each species further imbalances the ecosystem as a whole. And anthropogenic climate change plays an enormous role this ecological holocaust.

Al Gore called the destructive reality of climate change an "inconvenient truth." This is the truth denied by Big Oil and the fossil fuel industries responsible for the ecocide of many species and biosystems. Yet under our feet we discover a second and equally important "inconvenient truth" that threatens to terminate our existence: dirt. This too is an ecocide in the making but its leading instigators are the agro-chemical companies such Monsanto and Dupont. The human induced erosion of soil too warrants as deep a concern as the pumping of greenhouse gases into the atmosphere. And intrinsic to this problem of erosion is the degradation of dirt and the loss of its microbial content.

In his 2007 publication *Dirt: The Erosion of Civilizations*, University of Washington geomorphologist David Montgomery offers a history of what occurs when the Earth's thin, fragile layer of skin erodes away from under our feet. This tiny membrane of top soil, several feet deep and compromising only a ten-millionth of the Earth's radius is all humanity depends upon for its essential nutritional nourishment. The former cornucopia cradles of the ancient world, such as Mesopotamia and Egypt, collapsed largely due to soil mismanagement leading to runaway erosion. The once fertile land of Phoenicia transformed into a desert upon Alexander the Great's arrival, as did the area around the Sea of Galilee. And the same repeated soil mismanagement contributed to the demise of Greece, Rome, China, the Mayan civilization, Easter Island, the Amazon Basin and parts of Russia. This story has been repeated over and over again and is repeating itself again in the US and nation where Big Agriculture has found a foothold. When the stewardship of sustainable rich dirt is neglected, erodes and is swept away by wind and water, growing populations are no longer able to feed themselves. Leached soil, deprived of its essential microbial colonies and nutrients, no longer yields sufficient produce. A sustainable healthy society depends directly on the relationship between its population rate and the agricultural practices used.

In the 1920s and 1930s, Walter Lowdermilk, an official of the US Department of Agriculture, sojourned across Africa, the Middle East and China studying soil quality and erosion rates near ancient ruins where its residents abandoned their fields to the desert. Lowdermilk's conclusions for each ancient culture were consistent: poor soil conservation led to the demise of once thriving communities. Later in the 1950s, Lowdermilk issued a prophetic warning that has now come home to roost, "the United States was following ancient civilizations down the road to ruin."

The loss of many species is already having a direct impact upon the quality of human health. Further loss will diminish our access to nutritious food and further jeopardize our health. In his later book *The Hidden Half of Nature: The Microbial Roots of Life and Health*, Montgomery and his biologist wife Anne Bikle explore the relationship between the essential microbes, including bacteria, protists, fungi, viruses and archaea, in healthy agricultural soil to the life processes in our bodies. These organisms are crucial for assuring plants' health and their own immune responses to ward off disease. Similarly microscopic organisms upon which our health depends flourish within in our own bodies. The human body, writes Montgomery and Bikle, "is like an entire planet with a rich palette of ecosystems as different as the Serengeti and the Amazon." During recent years, new discoveries about the human gut's microbiome are being published. A healthy human microbiome equates with a healthy gut that in turn supports stronger immunity. Already, medical science has found that our microbiome can regulate immune responses against multiple sclerosis, prevent asthma, obesity, inflammatory bowel disease, hepatic inflammation, regulate neurodevelopment and mental health--including anxiety behaviors--prevent flu infections and even childhood ear infections.

A healthy microbiome is entirely dependent upon the foods we eat, including the microorganisms these foods provide. However this vibrant ecosystem that symbiotically co-exists with the cells in our body is under severe threat. Chemical industrial agriculture is murdering the soils upon which nutritious food crops depend and consequently weakening our bodies. Chemical companies' "kill-them-all" philosophy to develop more and more pesticides and herbicides, followed by more fertilizers, year after year, is turning our nation's farm soil into lifeless dirt and dust. A New York University study confirms that the average person's gut flora is being altered dramatically for the worse due to our modern lifestyle and common diet. As more and more land is stripped of its forests and grasslands to grow GMO crops and commercial mono-strain food plants for the benefit of the agro-chemical paradigm's profits, life spans are shortening due to malnourishment. It is inevitable our bodies will become weaker as nutrient-rich produce declines.

Furthermore, our agrochemical industry, and our junk food culture that relies upon it, dramatically contributes to the acceleration of global warming and reduces one of the critical stopgaps for slowing it down. According to a Consultative Group on International Agricultural Research report, one third of greenhouse gas emissions originate from our industrial agricultural system. Nitrogenous fertilizers substantially increase nitrous oxide emissions, a greenhouse gas with 300 times the atmospheric warming power as CO2. Although the air we breathe is 80% nitrogen, plants cannot use it. Instead plants require nitrogen in the form of nitrates, which is scarce except for in fertile, bioactive soil. Therefore the depletion of organic soil by over herbicide and pesticide use requires nitrate rich fertilizers for plant and crop growth. Moreover, nutrient-rich bioactive soil produced by organic regenerative agriculture will sequester atmospheric CO2 thereby reducing global warming. Barren, lifeless soil on the other hand is incapable of sequestering CO2. Therefore, our modern agricultural system is utterly contrary on every level for future, sustainable food security. A dramatic and urgent shift away from the industrial model to adopt organic, no-till, crop covered farming methods will greatly increase our land's capacity to sequester CO2, which one of the few solutions in our arsenal to slow global warming. At the same time yields and foods rich with phytonutrients and minerals will increase thereby assuring healthier produce as more and more arable lands are threatened by extreme drought and rains as climate change continues.

"The ecocidal narrative," writes the Norwegian environmental economist and psychologist Per EspenStokness, "says that people, governments, or corporations that irresponsibly kill off species or forests, or endanger climate stability are committing crimes against humanity." There are numerous environmental crimes being committed throughout the world. Rather than restricting these activities to decrease them, they are hastened to meet the demand for consumer greed and consumption. The annihilation of the rain forests in Papua New Guinea and the Amazon, massive strip mining for phosphates in Indonesia and rare earth metals across Africa, the orgy of logging whatever trees remain standing, the Athabasca tar sands in Alberta are only a few of many ecocidal examples at a time when the science unequivocally concludes these same activities must cease if there is any chance of survival.

Later in this chapter we will look at how climate change and violence go hand and hand, and is set to spark a fuse leading to climate wars that will further advance the ecocide of our planet and the suicide of our species. Several scholars are already predicting that as the world heats further outbursts of civil wars, ethnic cleansing, millions of refugees and conflicts between nations over the control of limited resources, especially water rights and remaining arable land, will escalate. In the early 2000s, Darfur was the first recognized climate war, and the later Syrian civil war starting in March 2011 is now being called by climate scientists another. Therefore the reconfiguration of the geopolitical map is already underway. The sad fact of the matter is that these forecasts are not new. The wealthy nations of the world, their militaries, and their pathological corporate and banking allies have been preparing for worse case scenarios. The rise of radical right wing political factions is just one example of a knee jerk reflex cropping up in developed nations. Nevertheless precious little is being done to prevent this horrendous scene from unfurling in the future. This too is another attribute of the ecocidal nature we are facing head on in our Anthropocene epoch.

**Climate Change**

There has been furious debate within the scientific community over best and worst case climate change scenarios. There are optimists, pessimists and even more who straddle the two in confused uncertainly. As noted above, climate change predictions are consistently being reevaluated and revised as new discoveries are revealed or following annual cycles of record breaking climatic events and extreme temperatures. Noteworthy is that amended predictions are often more dire thanprevious ones. Nevertheless, the scientific community is unanimous: climate change is accelerating more rapidly than forecasted, and time is running out for making fundamental structural changes in our economies and thinking. An Intergovernmental Panel on Climate Change (IPCC) report, authored by 235 scientists, warned that "only major institutional change will give a better than even chance that global warming will not exceed 2 C,” the internationally agreed threshold. It recommends that greenhouse gas emissions be reduced by 70% before 2050, and we are currently far behind reaching that target.

I refrain from outlining my own predictive timeline for modern civilization's and humanity's peak moment of existential crisis. Suffice to say, there is an end point when the Earth's conditions will no longer sustain human life. It could be 40 years, a hundred, a thousand or more. But the end will arrive eventually.

It is admirable to be optimistic, especially for believing in a positive future. It certainly has healthy benefits. It can reduce stress, anxiety and depression. However, uninformed optimism also has serious faults, and this is supported by psychological research. Six separate studies conducted jointly by Harvard and the University of California at Berkeley, including one addressing climate change, found that blind optimism in a favorable future curtailed people from making positive changes. Blind optimists were also more passive towards undertaking constructive environmental and social stances to counter those private and federal interests that most contribute to greenhouse gas emissions and the destruction of ecosystems. Optimists who are intellectually blind place undue faith in others to solve the world's problems. They look towards government, private corporations, institutions, and scientific technologies to conscientiously deal with dangers. They hold a seemingly religious faith in humanity's ingenuity to find solutions whenever an overwhelming threat presents itself. And hundreds of millions of people across the developed world are stuck in the stupor of blind optimism today. This is one reason why advancing constructive actions and policies to mitigate climate threats only creeps along at a snail's pace.

In the early 20th century, a wise spiritual teacher from India visited the West. Shortly after the First World War, when HazratInayat Khan was asked whether he was an optimist or pessimist, he replied, "I am an optimist. But an optimist with open eyes. To be an optimist with closed eyes is extremely dangerous." We need to open our eyes to the various climate scenarios associated with global warming in order to make informed and intelligent decisions about how we live, how we eat, and how we act. We should be undertaking dramatic changes not solely for our own welfare, but for our families, our children, our neighbors, friends, strangers and future generations. If the last four decades have taught us anything, we can no longer rely on the federal government nor our experts and pundits to guide us properly and wisely. Therefore, this section and the one that follows will outline the state of affairs now indicated by climate science and how global warming's effects will further impact our daily lives.

For the past 10,000 years, the Earth's surface has remained within a degree of 16 C (61 F). Compare this with blazing Venus and its average surface temperature of 894 degrees F or lifeless Mars at minus 60 C (minus 80 F). Venus' atmosphere is 96% CO2 and would melt a chunk of aluminum in seconds. Over those thousands of years, the Earth's ecosystems have developed into finely balanced ecologies with thriving biodiversity. Moreover, during the course of unusual yet natural episodes of climatic and geological change, these systems became increasing resilient to withstand extreme events such as cataclysmic storms and periods of severe drought or freezing cold. Throughout this period the Earth's temperature remained relatively constant thereby enabling healthy and vital ecosystems to emerge and flourish. Today all ecosystems, including our own human system, are in jeopardy.

What is critical to understand, and often confusing for a layperson, is that global warming refers to the rising temperature of the Earth's surface and not the rise and fall of average atmospheric temperature (i.e. the weather). Annual atmospheric temperatures can vary widely, as much as 10 degrees C and more from one year to the next. Cold years can be followed by hot ones, and this has been the case throughout most of our planet's recent history. Serving as a thermostat, the atmosphere regulates the Earth's temperature. It protects our world from too much heat, and traps heat rising from the Earth's surface to keep us warm.

The Earth's temperature is now almost 1.6 C above the normal baseline. Scientists believe this the hottest the Earth's surface has been in at least 120,000 years. This number might seem remarkably insignificant in the context of atmospheric change, but it is dangerous for the changing Earth's surface temperature. The IPCC and the Paris Agreement mandate that surface temperature must remain under the 2 C threshold. However, most climatologists today believe the 2 degree threshold is now unavoidable. Some, such as Robert Henson at the British Met Office, predict an annual rift could be experienced as soon as 2030. Crossing this 2 degree threshold would be catastrophic, and most climatologists are fearful it may be inevitable. Of course it would require several years of unusually high global temperatures for 2 degrees to become the norm. Nevertheless, a 2 to 3 C temperature rise could potentially result in annual average temperatures of 104 F or more throughout most of Europe and North America. It would be far more unbearable closer to the equator. A 4 C increase would threaten much of human life on the planet except in what remains of pockets of cooler climes. Conservative World Bank estimates conclude we would reach 4 C by 2100. The Bank's conclusion was clear, "We cannot continue down the current path of unchecked, growing emissions." Numerous species have already reached extinction from the heating planet. And humanity will certainly find its final resting place if the temperature were to rise to 6 C and greater.

James Hanson, one of world's most respected climate scientists and former head of NASA’s Goddard Institute for Space Studies, has stated that all fossil fuel burning must cease by 2030 if humanity has any chance for survival. Hanson writes,

“If we should ‘succeed’ in digging up and burning all fossil fuels, some parts of the planet would become literally uninhabitable, with some times during the year having wet bulb temperatures exceeding 35°C. At such temperatures, for reasons of physiology and physics, humans cannot survive… it is physically impossible for the environment to carry away the 100W of metabolic heat that a human body generates when it is at rest. Thus even a person lying quietly naked in hurricane force winds would be unable to survive.”

Opponents of anthropogenic climate change have argued that there was a pause in global warming that began in 1999 and continued into 2014. This period was marked by slowing global mean temperatures. This argument is still frequently voiced by the deniers as evidence to support their view that current warming trends are nothing less than a natural cyclic, atmospheric phenomenon. However, 2014 through 2016 was a turning point as temperatures passed pre-industrial levels. These were record breaking years and 2017 continued the warming trend. Consequently, scientists at the University of Alaska's Arctic Research Centre returned to the earlier data for reevaluation. Their findings concluded there never was a hiatus, a pause, in a global warming. Rather than slowing down, it has continued to rise at approximately 0.112 degrees C per decade. In fact, warming never stopped.

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

There are five major greenhouse gases: carbon dioxide (CO2), methane (CH4), nitrous oxide (NO2), water vapor and a class of aerosol compounds known as chlorofluorocarbons or CFCs. The halogen compound Freon used to cool your car engine and refrigerator is one common CFC. These gases can linger in the atmosphere for several to hundreds of thousands of years, such as the case for the most readily generated industrial gas CO2. Although most of humanity's output of CO2 will be sequestered in the ocean within a 200 year period from its initial release, the remainder will remain in the atmosphere for many millennia, well after human life on Earth ends. And unfortunately the rate of industrial society's release of CO2 has not abated and continues to rise.

Methane on the other hand will remain in the atmosphere for approximately twelve years, a seemingly short period of time compared to CO2. Yet this is hardly insignificant; it carries a caveat with dire consequences. The greater the concentration of methane builds in the troposphere, the longer it will linger before it is oxidized. There is a direct correlation between methane's atmospheric density and its longevity, and therefore its global warming effects.

Nitrous oxide or N2O is the third most prominent greenhouse gas humanity being released and contributing to global warming. Although it accounts for only about six percent of greenhouse gas concentration, it is 300 times more potent than CO2, has an atmospheric lifespan of 110 years, and is largely emitted by the agricultural industry for manufacturing fertilizers. Unfortunately, N2O is more than a greenhouse gas. It can also impair the ozone layer and destroy tropospheric ozone. The combustion of petrochemicals and solid waste are also major sources of N2O being spewed over our heads. More recently the defrosting of permafrost has also been found as a another source for N20 emissions. This is another reason why the millions of square miles of permafrost poses such a high risk of sudden, cataclysmic climate change.

On every account imaginable, modern chemical agriculture is a thorough disaster in the long term. Aside from its failure to meet its promises of more robust crops and higher yields, its entire paradigm is putting our planet at enormous risk. Overuse of synthetic fertilizers made with nitrogen-rich compounds is polluting fields, water runoffs, rivers and lakes. Bacteria and other microorganisms feed off these chemicals and release N2O as byproduct waste. The University of Minnesota conducted an unusual study. Every hour for over six years (2010-2016), N2O levels were measured from a 200 foot tower erected over a chemical-reliant farm. Nitrous oxide levels were found to be highest during the warmest months as well as the warmest of the six years. This research is very disturbing because the Earth is still heating up and American and European agricultural companies, such as Monsanto, DuPont, Bayer and others, are committed to colonizing the developing nations with their heavily chemical-reliant farming model.

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Two decades ago when I started reporting and giving commentaries about global warming's future threats, climatologists put their attention on certain landmark events commonly known as "tipping points," which would dramatically disrupt the equilibrium of the Earth's geological and atmospheric systems. These tipping points, often listed as twelve in number, are limited to singular changes in the Earth's geological and oceanic conditions that would accelerate global warming, such as the melting of ice fields in the Arctic, Greenland and Antarctica, loss of mountain glaciers, thawing of the northern permafrost and tundra, disruption of the Indian and West African monsoon seasons, desertification, loss of tropical rain forests (especially the Amazon and New Guinea), etc. Recently the probable loss of the planet's largest biome, one of the great wonders of the natural world, the boreal forests, which spans the Northern Hemisphere from North America, Siberia and northern Europe, has been added as another tipping point. According to an article published in a 2007 issue of *The Cryosphere*, the melting of the Arctic's summer sea ice has already passed its threshold. Today, the larger picture of climate change has replaced the more compartmentalized view of global warming, which is now understood as one phenomenon in the larger picture of climate change. The rapid changes in the global climate include many other destructive and environmental elements in addition to the warming of the Earth and our atmosphere.

For many years I have hosted programs that addressed the major twelve tipping points agreed upon by the vast majority of the international climatology and geological scientific communities. However, the tipping points are more or less milestone events. They only provide a small sliver's view of the problem. Unto themselves, they inadequately explain the deeper underlying dynamics and interrelationships with other forces that will bring forth the catastrophic conditions so often associated with climate change and global warming. To better understand the powerful forces at work on the Earth, gaining a greater appreciation for various dominant feedback loops is more instructive. Therefore, I will only list the twelve tipping points and then later proceed into deeper explanations of the more important and worrisome positive feedback mechanisms now underway.

1)Melting of the Arctic polar ice cap. The threshold for this tipping point has already been passed and conditions are accelerating towards an ice-free Arctic.

2) An ice- and glacier-free Greenland. It is estimated this may raise sea levels by twenty feet.

3) Disintegration of the West Antarctic ice shelf. As described earlier in this chapter, the breakup of this icesheet is now in motion.

4) Loss of the Earth's glaciers, which will contribute to less albedo.

5) Disruption of the Atlantic Ocean's conveyor belt from the Gulf Stream due to the entry of fresh water from the melting of the Arctic and Greenland

6) The permanent fixture of the warm ocean water phase in the central equatorial Pacific Ocean, better known as El Nino

7) Disruption of Indian and Southeast Asian monsoon season; and disruption of the West African monsoon and the Sahel system (the ecoclimatic zone between the Sahara desert in the North and the Sudan savanna to the south).

8) Melting of the permafrost and tundra along the northern Arctic clime and its release of vast quantities of methane greenhouse gases, commonly known as the "clathrate gun effect"

9) Desertification or the expansion of deserts consuming semi-arid lands.

10) Loss of the ozone layer above the Arctic

11) Loss of the rainforests, especially in the Amazon and New Guinea. This also includes forest dieback due to droughts.

12) Loss of the northern boreal forests reaching around northern climes of Canada, Siberia and Scandinavia.

Although these tipping points are critical benchmarks in the progress of ongoing climate change, in 2010 scientists started to observe and report more frequently about feedback loops. In 2011, two more loops were observed and four more in 2012. The number of feedback loops continues to increase and over 60 have been identified so far. Feedback loops also help us to better understand the long-term consequences after tipping points are reached. There is considerable overlap between many of these feedback mechanisms and many work in conjunction with each other thereby intensifying the atmospheric and geological changes taking place.

Climatologists have observed two opposing kinds of feedback loops: positive and negative feedbacks. Positive feedback, which concerns us the most, is when a system is placed under extreme stress, it effects another force which in turn intensifies and pushes the momentum of the initial system. Subsequently that system accelerates in the direction it is being forced towards. A positive feedback therefore forces an increase in net temperature change. The common and obvious example is the melting Arctic. As the ice melts, there is less white surface to reflect the sun's solar radiation back into space. This is referred to as the loss of albedo. The ocean gets darker, absorbs more heat, and further warms the ocean hence accelerating further ice thinning and shrinkage. This is an especially rapid feedback mechanism, called a "charney" loop. The increase of water vapor--another greenhouse gas--being released into the atmosphere as the days get hotter is another charney feedback.

We also find feedback loops operative in our bodies. Take blood clotting as one example. When a blood vessel is damaged, such as from a bruise, our platelets immediately gather at the site of the vessel's injury. A series of chemical processes is activated that enable the platelets to adhere to the wound while simultaneously attracting more platelets to gather until a clot is formed.

Negative feedback loops, which are favorable for the Earth to maintain its homeostasis, offset net temperature increase. Unfortunately there are far less negative feedbacks than positive loops, and many of these remain theoretical, such as Black Body Radiation in an ice free ocean that might release thermal radiation away from the Earth. Using the melting Arctic ice again as an example, there is another theory that a dark Arctic ocean may directly absorb more CO2 into its waters. Increasing desertification also presents another negative feedback. A desert, like the ice sheets, reflects the sun's heat back into space. As more land turns into desert in parts of Africa, Western China, Central Asia and elsewhere, larger landmasses will produce an albedo effect to offset the Earth's rising temperature. Unfortunately, our growing deserts and high altitude winds traveling across the oceans pose serious warming problems as well. Never the less, when all the positive and negative feedbacks are weighed in a scale for comparison, the latter will certainly not reset global warming trends. Negative feedbacks may slow global warming rates; however the net energy represented by all positive feedbacks is far greater than the little relief and comfort the positive loops can cumulatively provide.

Some negative feedback mechanisms are more important to understand than others. Below are the more important feedbacks now in effect.

**Ice Albedo Feedback**: Albedo, meaning "whiteness" in Latin, is a term to measure the amount of incident solar radiation, such as sunlight, reflected off of a surface. Albedo is measured on a scale of zero (pure black) to 1.0 (a surface that reflects away all radiation striking it). Clean freshly fallen snow is 0.9. The Antarctic icesheets are approximately 0.8. For example, if you own two automobiles in your driveway, one white and the other black, and both are baking in the sun, you will find that the surface on the white vehicle feels less hot. Likewise, when you sit in your white car it will feel less hot than if you were to sit in the black one. After a large snowfall, when everything is covered in white, more sunlight is reflected back into space and this further contributes to colder air. As the snow melts, grass and dirt reappear and the surface darkens.

The albedo effect feedback loop has been known and worried climatologists for a very long time. As the polar icesheets, glaciers, sea ice and regions covered with snow continue to disappear, they are replaced by darker surfaces, thereby absorbing rather reflecting solar heat. More captured heat increases ice melting and hence larger swathes of darker surface to absorb even more sunlight.

A second feedback associated with the albedo effect is the increase in the ocean's volume contributing to rising global sea levels. With respect to land that has been covered in snow and ice, the loss of albedo also engenders earth movement, such as earthquakes and shifting of ice shelves. This in turn disrupts the terrestrial structural support icesheets and glaciers rest upon and advances their decline and eventual collapse. This last point is of great concern to Antarctic researchers who monitor one of the largest icesheets that rests on ground below sea level and is particularly susceptible to dramatic earth movement in the future as the sheet gets thinner.

Professor Peter Wadhams at the Scott Polar Institute at Cambridge University has spent his entire career studying the Arctic. He was the first scientist to show that the northern polar ice cap was shrinking. According to Dr. Wadhams, who I have had an opportunity to speak with on a couple occasions, the Arctic will certainly be ice-free in its central basin before the end of this decade. During a 2016 interview with the British *Guardian* newspaper, he explained that "sea ice reflects about 50% of the solar radiation it receives back into space. By contrast, water reflects less than 10%. So if you replace ice with water, which is darker, much more solar heat will be absorbed by the ocean and the planet will heat up even more rapidly than it is doing at present."

Greenland is also rapidly darkening. Although it is natural for ice melt during the warmer seasons, this loss is compensated for during the winter months when there is greater snowfall and freezing temperatures. However, any annual net loss of albedo is a disaster and a reason for concern.

Loss of albedo is also happening across all of the world's highest mountain ranges and peaks. There are over 5,500 glaciers in the Himalayan Mountains of the Hindu-Kush, which includes Mt. Everest. Over a billion people depend upon the river waters issuing from these glaciers. And these glaciers reflect much of the sun's radiation back into space. Yet according to the International Centre for Integrated Mountain Development in Nepal, all of the Himalayan range's albedo may be gone by the end of this century.

As I mentioned earlier in this chapter, climatologists have believed that Antarctica, and the eastern Antarctica iceshelf in particular, will be the last place on the planet to experience anthropogenic climate change. However this scenario has had to be reevaluated in recent years. Summer ice is now melting ten times faster during the past fifty years. Already, as explained earlier, the Western Antarctic sheet is becoming progressively less stable. A 2015 paper jointly researched by Woods Hole Oceanographic Institute and Utrecht University in The Netherlands suggests that the entire Antarctic continent could be unstable by century's end.

At one time, there were many glaciers on the high range peaks in Africa. Today only a few remain on Mt. Kilimanjaro, Mt. Kenya and Rwenzori Range on the Congo-Uganda border. America's glaciers are also disappearing rapidly. At the end of the 19th century there were 150 counted glaciers in Glacier National Park in Montana. As of 2017, only 26 of the remaining 39 can scientifically be considered as actual glaciers. The same is occurring throughout the remaining glacial peaks in Mexico, the Sierra Madre of Colombia and the Andes, across Europe and elsewhere.

**Extreme Storms:** When a Category 4 or 5 hurricane hits land, we are fully aware of the devastation left in its wake. Hourly we observe images of flooding, collapsed roofs on homes, and snapped trees and poles on the news and weather channels. What we do now observe are the invisible feedback mechanisms of greenhouse gas release from these storms. Large hurricanes and typhoons create an updraft that carries moisture as far as the stratosphere, which begins between 8-12 miles above the Earth's surface (higher along the equator). Not only does this reduce the ozone layer, which resides in the lower stratosphere, but it also carries water vapor into this higher atmospheric zone that otherwise has very little. The largest percentage of greenhouse gases emissions released into the atmosphere reside in the troposphere, the layer immediately above our heads.

There were a record number of devastating hurricanes in the Atlantic and Caribbean during the 2017 storm season. Hurricane Irma, which plummeted Puerto Rico into darkness, was the strongest tropical storm in the Caribbean on record. Hurricane Harvey leveled Houston with rising sea levels combined with unusually large rainfall. The capitol of America's oil industry had more rain in a week than it usually gets in a year. Two months later, tens of thousands of Houston residents remained homeless. Barely a single major network drew a correlation between these storms and anthropogenic climate change. Although the news portrayed the 2017 hurricane season as shocking and unusual, it is perfectly consistent with scientists' warnings about the planet's warming trends. Warmer ocean waters, combined with rising winds and hotter air, are the recipe for larger and more powerful storms. Asked whether we will experience a change in cyclone-like storms in the future, MIT's head of atmospheric science, Kerry Emmanuel, stated, "we expect that Category 3, 4, and 5 storms will become more frequent globally as the climate warms.... Per-storm losses of life and property will rise."

It is important for the reader to understand that no climate scientist will conclude that climate change is directly responsible for a hurricane. Hurricanes have occurred on the planet for millions of years. What scientists do agree on is that climate change exacerbates the intensity and strength of hurricanes and contributes tothe moisture density for extreme precipitation.

**A Wetter Troposphere:** When we think of global warming and fossil fuel emissions, in particular CO2, as the single most important culprits to be most worried about, we are only partially correct. Indeed, humanity's release of greenhouse gases, such as CO2 and methane, have passed their threshold and now drive climate change. Nevertheless, the actual greenhouse effect is due to the predominance of water vapor being stored in the planet's troposphere due to the Earth surface's warming temperature. It is estimated that 60-70 percent of the planet's warming is associated with atmospheric water vapor. Because the other gases are non-condensable, they more readily become packed into the atmosphere; whereas, water vapor condenses and is released as precipitation. The increase of moisture entering the Earth's troposphere has been called the "mother of all feedback loops."

In 2014, climatologists at the Atmospheric Sciences department at the University of Miami, identified what they believe to be the largest feedback system that will amplify anthropogenic warming. Between 1979 and 2004, there has been a gradual moistening of the upper troposphere, and this increase can only be attributed to humanity's release of carbon dioxide. This has been the first study to finally confirm a direct relationship between human activity and a rise in water vapor into the upper troposphere above the Earth's surface. This feedback mechanism is solely related to the way the sun's energy reaches the earth, then reflected back and reabsorbed again by CO2 and water molecules, and finally emitted back to earth again. As the buildup of water vapor in the atmosphere thickens, it further heats the earth's surface, hence accelerating more water evaporation into the upper troposphere. Our release of greenhouse gases exacerbates this feedback loop by trapping the reflected heat within the atmosphere. Consequently, less heat energy gets reflected back into space. Scientists are now predicting that water vapor will be playing a far greater role in a rapidly heating planet in the years to come.

**Methane Release:** Global warming's largest and most frightening ticking time bomb is the release of methane held frozen in the tundra and permafrost in the upper northern hemisphere. It is unfathomable to contemplate the full consequential weight of widespread permafrost melt. Ground-stored methane is the global warming bubble of our time. Unfortunately, the aftermath of bursting bubbles, including economic bubbles, are often far worse than anticipated. "The global warming bubble," says environmental columnist Robert Hunziker, "is found in every remote corner of the planet but it's most prominent in the Arctic, where temperatures are increasing 2-3 times faster than elsewhere on the planet." Hunziker reminds us that unlike the 2008 Wall Street financial collapse, money cannot fix this. A blowout of a climate change bubble cannot be bailed out.

For a moment, consider the situation we now face and that we have been experiencing with record-breaking high temperatures, torrential storms and flooding, and widespread forest and grassland fires. The results are in. Human emission of greenhouse gases has contributed significantly to the severity of these climate events. At present, the Earth's atmosphere contains approximately 850 gigatons of carbon (one gigaton is equal to one billion tons). We are already feeling the aftermath of that much carbon concentration above our heads shown by the examples I presented earlier in this chapter. However, according to the National Snow and Ice Data Center (NSIDC), across the entire Arctic Circle, in the tundra and permafrost, sleeps about 1,400 gigatons of frozen carbon, primarily as methane. Although most greenhouse gas emissions are CO2 and will remain in the atmosphere for hundreds and even thousands of years, methane leads to global warming on crystal meth for ten to twenty years before it decomposes into CO2. Compared to CO2, the IPCC estimates that methane is 86 times a more potent and warming greenhouse gas. At present, the Russia-US Methane Study at the International Arctic Research Center estimates the atmosphere contains five gigatons of methane. Therefore, imagine the gradual release of a thousand gigatons more. The release of the Arctic's trapped methane will lead to runaway global warming. No amount of human ingenuity, technology or prayer will be able to slow or halt it.

Arctic methane release is not a far off scenario. It is happening at this moment. Seamen traversing the polar ocean now observe vast methane plumes bubbling from the Arctic Ocean floor. In response to the growing evidence of methane release, Jason Box, a renowned Arctic and Greenland scientist, tweeted, "if even a small fraction of Arctic sea floor carbon is released to the atmosphere, we're f'd."

Methane has always been released into the atmosphere. However it has not posed a warming threat. Global warming increases humidity as more land water evaporates. As the humidity increases, so does the amount of ice particles in the upper region of the troposphere. Atmospheric ice reduces the oxidation of methane. Consequently, as global temperatures increase, the methane's warming potential also increases.

Methane contained in the permafrost has two different sources. Methyl clathrate are methane molecules trapped in cages by ice crystals. Not only are they found deep in the Arctic tundra but also deep in the Arctic Ocean. Once warmed, the ice cracks thereby releasing the trapped methane. The other source of methane is found in the frozen organic matter in the permafrost itself. It is made of a thick layer of soil from numerous dead plants and animals that have been frozen deep in permafrost for thousands of years. Once this organic material warms, bacteria and other microbes further decompose this matter and release carbon dioxide and methane as waste into the atmosphere. To better understand this process Kevin Schaefer, a scientist at the NSIDC, offers an example. "It's like taking a bag of frozen broccoli out of the freezer and putting it into the refrigerator. Once it thaws, it will eventually decay and break down." Moreover, the permafrost holds oxides of nitrogen, another greenhouse gas. With the advance of global warming, there is now 1,400 gigatons of greenhouse gases waiting like a time bomb to escape its captivity in the frozen Arctic landscape.

Another source of methane in the northern clime are methanogens. These methane releasing microbes are plentiful in the Arctic waters. Scientists still do not know the extent of the danger these organisms present. While the water remains at freezing temperatures, they are unable to proliferate. They have been there for many millennia. However, as the ocean surface warms, there is fear that methanogens will dramatically increase their bioactivity and start releasing methane.

A summary of the methane threat compiled by retired Earth systems scientist Malcolm Light with the Arctic Methane Emergency Group includes the following recent events that are now accelerating:

* Methane emissions are quickening faster than CO2 and have increased 300% during the last 200 years. In some regions of the Arctic, permafrost melt has risen 400% during the past 50 years.
* Enormous amounts of methane have been belching across the entire Northern hemisphere, particularly in the Eurasian basin.
* Active methane zones in the Arctic are now descending down Greenland's Eastern coast. This is largely the result of warmer waters in the Atlantic Ocean's Gulf Stream.
* The Eastern Siberian ice shelf, a region of approximately 810,000 square miles, has been melting more rapidly with methane release increasing by 9 million tons during a two year period.

It is also wise to remember that the methane threat is not limited to the Arctic and the northern tundra. The melting of Greenland and the Antarctic icesheets will also release gigatons of methane held in deep reservoirs.

For many years, Natalia Shakhova at the University of Alaska's International Arctic Research Center, and an expert on Siberia's tundra and permafrost, has been warning of the ticking time bomb posed by sequestered methane ready to be released once a certain threshold of permafrost melting is passed. In a study published in the December 2016 issue of *Paleoworld* we are reaching a potential apocalyptic event similar to the mass extinction that occurred during the Permian age 250,000 million years ago. At that time 90% of all the Earth's land and aquatic species were decimated from the dramatic release of methane hydrates. The study warns that "the end Permian holds an important lesson for humanity regarding the issue it faces today with greenhouse gas emissions, global warming, and climate change."

Such an extinction event need not take long to reach its final conclusion. It could be sudden and unexpected like a black swan episode. Shakhova has warned of the potential for a gigantic methane "burp" sitting and waiting discharge. A single 50 gigaton "burp" would be the equivalent to two-thirds of all CO2 emitted by humanity since 1850. And according to a study published by Arctic scientist Peter Wadhams in the prestigious journal *Nature*, a sudden 50-gigaton methane ejection is completely plausible and likely. Such an event could quickly change the climate for the worse overnight. The researchers also estimated there would be a $60 trillion price tag to the global economy due to drought and flooding, extreme weather and declining agricultural security and physical health if such a cataclysmic event were to occur.

Although we have been focusing on positive feedback loops, which are undesirable, the warming tundra does introduce a negative feedback that may give some relief. As the permafrost melts and seasons warm, we might expect a burst of plant and tree growth in the thawed tundra's nutrient rich soil. This would mean a larger release of oxygen, which is critical for slowing global warming. More oxygen in the atmosphere will also increase the oxidation of tropospheric methane and reduce its global warming potential.

**Loss of Forests and Grasslands:** Every major wildfire across forests and grasslands contributes to enormous release of CO2. In 2017 alone, hundreds of wildfires burned across the American West and north into Western Canada. In August and September of that year, over 2 million acres were ablaze from over a hundred separate fires, roughly the size of Rhode Island and Delaware combined. For the entire summer approximately 8 million acres were lost, which is almost 3 million more acres than the average for the past ten years. Although it is estimated that 84% of wildfires are started by people, the conditions for their severity and spread is now largely due to climate conditions, especially drought. This was only for the US. That same year, the European heatwave nicknamed "Lucifer" set off wildfires in Italy, Portugal and Romania. Emergency-level wildfires also plagued Siberia, large swathes of Brazil, Chile, New Zealand and South Africa.

According to a joint study conducted by Australian and American researchers in 2017, catastrophic wildfires are expected to increase by 20% to 50% in the coming decades. The Western US is particularly vulnerable due to droughts, winds and changing wet seasons as longer dry periods suck more moisture out of trees and ground-covered vegetation. More frequent electrical storms have long been predicted as a consequence of global warming, which puts western forests and grasslands in further jeopardy. Fires are also reaching the northern tundra regions where natural fires have been unknown for thousands of years. A wildfire burned for over a week in Western Greenland to the shock many. In 2014, fires in the northern tundra were igniting only 70 miles away from the Arctic Ocean. As natural fires continue to move northward, soot and carbon fallout will continue to warm and melt existing icesheets.

Atmospheric scientists are unable to accurately calculate how much wildfires increase CO2 concentrations. An earlier computer model estimated that California wildfires during an eight day period in 2007 were equivalent to 25 percent of the average monthly emissions from all fossil fuel burned in the entire state of California. And more recent wildfires have been far more devastating and more frequent. The 1997 fires that swept across Indonesia were estimated to have released up to 2.5 gigatons of carbon, which was somewhere between 13 and 40 percent of all the world's carbon emissions that year.

What is worse, with the planet warming and vegetation coverage becoming drier and more parched, a Kansas State University study predicted that CO2 released from wildfires will conservatively double by 2100. As noted earlier, as the weather warms the migration northward of invasive insects, particularly beetles, is killing off forests. This too is a feedback loop. Dying, infested trees increase the likelihood of fires and thereby add more CO2 in the atmosphere, which then further heats the planet. This dire scenario is compounded by hotter weather and the loss of seasonal weather conditions that will make it more difficult for trees and shrubs to rebound after devastating wildfires.

A final feedback mechanism at work with climate change and increasing wildfires is lightning strikes. For example, according to California's Department of Forestry and Fire Protection, there were over 8,600 wildfires in 2017. Aside from the massive loss of personal property, homes and buildings, and even human life, over 1.1 million acres of land were lost in blazes. There was also reported a record number of lightning strikes that same year. During a single 48 hour period, Northern California experienced 3,000 strikes, and during another storm period over Southern California an extraordinary 40,000 strikes were reported. For many years, the rise in extreme storms, including electrical storms, has been predicted as a consequence of warming trends. In a 2014 study published by *Science*, every one degree Celsius increase in the planet's average temperature will boost the frequency of lightning strikes by approximately 12 percent. Long periods of drought, below average rainfall, and dying trees, shrubs and dry grasslands create perfect conditions to ignite forests, fields and neighborhoods as storms become more extreme and perhaps recurrent.

**Soil Erosion:** In 2016, biologists at Kansas State University identified a new positive feedback loop that will increase future warming. The planet's soil is one of the Earth's most important carbon sinks. "Globally," the study's lead researcher John Blair wrote, "soils hold more than twice as much carbon as the atmosphere." Consequently, even a small rise in carbon released from soil "can have a large impact on atmospheric greenhouse gases and future warming." By 2050, the release of soil carbon will be equivalent to 17% of human greenhouse gas emissions during the same timeframe. Warming weather advances soil CO2 release thereby contributing to further warming and in turn accelerates further soil carbon release.

Kansas State's study was confirmed and further expanded upon the following year by scientists at Woods Hole's Marine Biology Laboratory. The 26-yearlong study concluded that a self-reinforcing and "perhaps uncontrollable" positive feedback loop is occurring between forest soils and global warming as microbial activity accelerates in warmer soils. The study discovered that the soil's microbiome undergoes a cycle of stages in its activity. Currently, the planets soil is in a dormant phase but in several more years is predicted to arouse again with a higher degree of severity. And there is no way to turn the Earth's soil microbial activity off.

Flooding and extreme storms, in addition to modern industrial agricultural practices, erode soil thereby removing the organic medium necessary for plants and crops to absorb CO2. As soil dries up, it releases CO2 and methane. We can think of organic soil as an enormous bank vault for carbon. However, when soil loses its organic ingredients, becoming dry and lifeless, rather than containing carbon, it releases it. It is estimated that if all the world's soil were too dry by only 0.3 percent, it would release an entire year's worth of fossil fuel emissions.

Loss of soil means lower crop yields at a time when the world's population continues to grow. Food insecurity will become a global problem with immense ramifications for social and political stability. The US is particularly subject to agricultural collapse due to its over-reliance upon large scale industrial agriculture, immersed with pesticides and fertilizers which further erode top soil. Climate change, as well as rising competition, have already adversely affected America's wheat yields. For decades the US was the leading wheat producer and exporter. Yields are now decreasing, and in 2016 Russia toppled the US from its leading spot. In addition, lower crop yields will result in a greater divide between supply and demand. Food prices will skyrocket.

California is America's breadbasket. It grows and exports over 400 types of agricultural products. The six year drought--less rainfall, higher temperatures and radiating sun-- meant lower yields in corn, wheat, alfalfa, tree nuts and fruits, citrus, vine-grown foods and other crops costing farmers billions of dollars in lost revenues. Moreover, longer drought episodes require more water. Already climate change is affecting California's winter snowpack, which is recording all-time lows annually. Water levels in reservoirs and aquifers are declining. Given the current agricultural methods employed on most Californian farms, the situation is unsustainable if temperatures continue to rise and for longer stretches of time.

The consequences will be more hunger. Already, according to a Global Health Institute study published in a 2014 issue of the *Journal of the American Medical Association*, the rise in plant diseases has caused a 16 percent decrease in crop yields. Fields with poor soil and heat-scorched produce weaker plants that are more susceptible to illness. The study predicts that these diseases will flourish with ongoing climate change.

I often encourage my radio program audience to learn something about farming and start to grow their own food. There will come a time when we can no longer assume that all the foods we are accustomed to see on grocery store shelves will be readily available or affordable. Today there are numerous methods and a large array of innovative resources and information to learn to grow a large variety of foods in our own homes, yards, and neighborhoods. This is a time when we all need to learn to become farmers.

**Desertification:** An extensive review of the scientific literature regarding the status of the planet's major deserts unanimously confirms climate change's impact upon these very sensitive ecosystems. The world's deserts, which make up approximately a quarter of Earth's landmass, are growing instead of retreating. Rising temperatures and higher concentrations of greenhouse gases are only one of the problems. In the semi-arid regions, often bordering larger deserts, direct human activity is largely to blame: over-grazing and over-irrigation that raises the soil's salt levels, mining activities, and the extraction of fossil fuels. All these factors combined are turning semi-arid areas into deserts.

The major deserts of the world--the Sahara, Arabian, Gobi, Kalahari, Australia's Great Victorian Desert, the Syrian and the Great Basin Desert in the US (in fact, the Earth's two largest deserts are the Antarctic and Arctic deserts which comprise 14 million and 13.7 million square miles respectively)--are not the only areas where desertification is expanding. In 2016, the European Centre for Geoscience Research in France published a paper warning that much of southern Europe's land along the Mediterranean will shift into desert conditions if the planet's temperature reaches 2 degrees C. The study compared parts of France, Portugal and Spain with current conditions facing the American Southwest where semi-arid lands are undergoing rapid desertification.

You may think that the warming of remote deserts will have little, if any, impact upon our own lives. However, the new climate world we now live in is also altering global wind patterns and their intensity. If it is late Spring or early Summer, and you are reading this right now, and happen to be on the Atlantic coast and sneezing, it could be that the "river of dust" has reached your home from the Sahara desert. Tons of sand rise in the North African deserts annually and find its way across the ocean and settles across the Americas. This means sands and dust from desert wind storms, besides affecting populations, cities and towns on the outskirts of deserts, can reach across many thousands of miles. A 2008 study out of the universities of Houston and Miami measured Saharan dust doubling the atmospheric dust over Houston. The drying of the American southwestern states now contributing to enormous dust storms enveloping Phoenix will carry particles from low lying regions to higher altitudes where snowpack isan invaluable water resource. Throughout the American West, mountain snowpack is declining and melting faster. The role desert deposits play in the dramatic changes occurring in high altitude snow dynamics was confirmed by a joint study conducted by NASA and the University of Colorado in 2013.

There is an upside, nevertheless, to dust storms. Aside from the serious risks that excessive atmospheric sand and dust poses to animal and human health, an increase in atmospheric particles from the deserts has a dimming effect. After especially large wind storms in deserts, the sands cool. Sand storms are extremely important events for sustaining deserts' fragile ecologies. Unlike greenhouse gases, which remain in the troposphere for many years, desert particles settle relatively rapidly. They serve as a thermostat for temperature swings necessary for desert life. However, when combined with the many other climate change feedback loops, dust and sand storms also exacerbate and accelerate the problems of a warming earth.

Other positive feedback loops that will further contribute to the release of greenhouse gases are listed below. Some were presented and discussed in detail earlier in this chapter. This list can serve as quicker reference.

* The weakening of ecosystems' resilience will increase pests, creating disease and further release CO2 and methane.
* Disruption of the thermohaline conveyor belt due to melting ice in the ocean off the coasts of the Antarctic in the Arctic coast of Greenland. The result has been an added force contributing to the melting of polar permafrost and less salty offshore ocean surfaces.
* As beetles and other disease-causing pests migrate further north, trees and plants will die off more rapidly. Dead forests will further release methane which can ignite into wildfires, which in turn emit massive amounts of carbon dioxide into the atmosphere.
* Soil erosion due to extreme storms and floods remove the organic medium that enables plants to grow and absorb CO2.
* The increase and severity of extreme weather events creates conditions whereby less CO2 is absorbed, which then accelerates warming and in turn aggravates conditions responsible for more extreme weather events.
* Sea level rise combined with floods creates new swamps that over time will release more methane.
* The rise in the Earth's surface temperature leads to higher water vapor humidity entering the stratosphere, which resides above the troposphere. This activity is already responsible for 5-10% of total global warming.
* Rising atmospheric CO2 accelerates the loss of carbon sequestered in forest soil.
* Warmer ocean waters kill off phytoplankton which are crucial for sequestering CO2.
* As ice in the higher altitudes gets thinner, such as in Antarctica, parts of Greenland and mountain glaciers around the world, not only will sea levels rise, but it hastens the pace for when there will be no more ice caps and sheets to absorb hundreds of quintillions joules of energy as they melt.
* Extreme storms, hurricanes and typhoons create updrafts that carry moisture into the stratosphere. This will reduce atmospheric ozone and allow storage of more water vapor greenhouse gas.
* The Northern Hemisphere climate zones consist of three separate "cells" or climate bands acting individually and together with each other. Besides the tropical Equator and the North Pole is a middle cell where the majority of the forests and major food crops thrive. This zone includes the major portion of the US, Europe, Russia and China. The loss of this middle cell due to overheating will force the heat from the Equator to reach the pole more efficiently.

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Finally, although it is very convenient to toss all the blame for climate change upon the backs of runaway neoliberal capitalism, the fossil fuel and agro-chemical corporations, mega-building construction and development, and other industries, we must also look at our individual carbon footprint. A decade ago, China surpassed the US for the number one position in greenhouse gas emissions. However, American families still hold the top position in the average carbon footprint per person. Astronomically so. For 2014, every American was associated with 16.2 metric tons of CO2 emissions. China, with over 1.3 billion citizens--four times larger than the US -- had an average footprint of 7.2 metric tons. Most of what we own, eat and do leaves a carbon residue behind it: the energy used to heat or cool our homes, automobiles, air flights, our daily diet, clothes and textile, computers and electronic equipment and other manufactured goods, our reliance upon telephones, mobiles and the internet, pharmaceutical drugs and much more.

The Center for Sustainable Systems at the University of Michigan annually generates a carbon footprint factsheet. If we look at our household food consumption alone, we can get a deeper appreciation of our individual contribution to climate change. Although agriculture constitutes for only 5.8 percent of total human-generated CO2 emissions, this is according to the EPA. International estimates from the World Resources Institute and the United Nations' Food and Agricultural Organization places the figure as high as 18 percent. The average American household's food consumption is responsible for emitting 8.1 metric tons of CO2 every year. The livestock industry, which provides meat and dairy products, emits far more greenhouse gases, and methane and nitrous oxide in particular, than fruit, grain and vegetable agriculture. Raising animals for food is a far less efficient use of energy because of the lengthier transfer of energy from soil to plant to animal and eventually to our dining room table. Meat and dairy add 47 percent and 19 percent respectively to the total greenhouse gases in the food sector, including transportation. Compare this with the 3.6 percent for fruits, 3.0 percent for grain products and 4.9 percent for vegetables.

If a person were to eat only locally grown food for a single year, it would be the equivalent of not driving 1,000 miles in your vehicle. Going vegetarian for only one day a week would save the equivalent of driving 1,160 miles. Adopting the habit of purchasing only organically grown food instead of conventional produce saves between 30-50 percent energy usage.

**What Will Climate Change Mean for Your Future?**

There are many illnesses challenging humanity and the global environment that are increasingly consuming the present and will continue to do so in the future. There is social and economic inequality and a growing disparity between the have-s and have not-s. There are serious crises in sustainable human development with poverty growing in many parts of the world. Women, children and youth continue to be victims of imbalanced power forces at many social levels and across cultures. For example, among all developed nations, the US remains second only to Japan with the smallest percentage of elected women leaders in public office. Wars and conflicts continue, all inevitably associated with land possession, competition for natural resources such as water rights as in some of the African tribal conflicts, possession of physical places considered holy by warring constituencies. There are many other imbalances between the various organs of humanity's body that are reaching critical red and being brought about by humanity’s unconscious shadow. And as this chapter has intended to convey, there is the overwhelming specter of climate change and global warming hovering over our way of life, our environment and our future. In large measure, the engine driving our planet towards 4 degree C and higher has been the exploitation of the Earth's natural resources.

People worry about their future in more or lesser degrees. We also tend to find different worrisome developments in our world that bother somepeople more than others. In my estimation, there are three principle categories that are today leading our world towards an apocalyptic conclusion: disruption of the planet's biodiversity and ecological balance, the acceleration of conflict, war and hatred, and finally growing inequality and poverty. And although each refers to various sets of critical issues and crises, all are intermeshed since climate change is probably the most concrete example of a holistic system theory operating throughout our daily lives. At the same time, all of these refer back ultimately to the more essential spiritual crisis confronting humanity and the degradation of decent ethical values.

No single person nor institution can accurately surmise what the future holds as the Earth continues to warm. Numerous scenarios can be imagined, each mixed with some truths and falsehoods. How populations, governments, corporations and international institutions respond when the kettle starts boiling are also unpredictable factors. They may turn more progressive solutions and work in communal harmony together to address the global crises, or conversely they may descend into authoritarian and fascist tribalism. But regarding one fact we can be absolutely certain: individuals, communities, towns and cities, governments and nations will experience increasing stress and lives will be at stake.

We do not have to look any further than the US Pentagon's own assessment to become critically warned about what climate change portends for the future. In 2003, a Pentagon report, "An Abrupt Climate Change Scenario and Its Implications for United States National Security," stated, "an abrupt climate change scenario could potentially de-stabilize the geopolitical environment, leading to skirmishes, battles and even war due to resource constraints." Again in 2015 another Pentagon study commissioned by Congress, as a follow up to its 2014 *Climate Change Adaption Roadmap*, reported in no uncertain terms that climate change is the number one national security threat facing the nation. All of the adverse environmental effects scientists have been warning about for years were restated, including the dangers of melting polar ice and sea level rise, more frequent extreme weather events, and more devastating floods, wild fires and droughts.

Depending upon where you live, the harsh realities of climate change will be felt differently. As explained earlier, American coastlines, especially along the Atlantic seaboard from the Florida Keys to Boston, will experience the brunt of sea level rises. All the major cities dotted along the Atlantic are sitting ducks for extreme storms, ocean surges and increased flooding. And no major concerted effort is being made to prevent or lessen any of the impacts of higher category storms and rising tides. On the other hand, inland New England to eastern New York, along with the northern Midwest regions near the Great Lakes, are best positioned for the decades ahead.

Vermont, for example, is the most politically progressive, environmental-friendly state in the nation. A joint collaboration between the state government, Vermont's universities and local farming and renewable energy organizations has brought the state to 90 percent self-reliance for its energy, food and housing needs. Compared to the dismal sustainability statistics throughout most of the remaining 49 states, this is a remarkable proactive achievement. But climate change gives no consideration for borders and boundaries nor state legislatures. Excessive rains, which will contribute to floods, will likely plague even the best and healthiest of regions. During extreme flooding events crops will be destroyed and orchards damaged across the inland Northeastern states.

For much of the remainder of the United States, aside from local regions commonly referred to as "lifeboat zones," conditions will worsen from longer periods of drought, extreme storms and tornados, and water shortages. Again, it is the agricultural industrial paradigm along with the oil and natural gas companies deteriorating the landscape, which will make future warming even more devastating. Although several decades away, the Ogallala fossil water aquifer, which provides eight states from South Dakota to Texas with the water necessary for extensive irrigation, is gradually being depleted. This is the breadbasket of America, supplying at least 20 percent of the nation's crop harvest. This 10 million year old deep reservoir was created during the Pliocene age and would require over 6,000 years to replenish itself naturally. In some regions, such as Western Kansas, the water level is expected to peak in 2040. After that time, accessible water will steadily decline.

Industrial agriculture is water-intensive. US farms use approximately 57 million gallons of water per day for irrigation. This is almost 300 percent more than water consumed daily through our public water supply systems that feed into our homes and businesses. Chemical-based agriculture, because it contributes to rapid soil degradation and erosion, requires far more water than organic farming to produce a similar yield. Organic, living soil retains moisture and also uses nitrogen more efficiently. Finally, since organic agriculture has no need for chemical fertilizers, pesticides and herbicides, it produces only a small carbon footprint. A study conducted by the Rodale Institute measured the amount of energy required to grow a hectare of organic corn versus a hectare of corn using conventional chemical methods. On average, the conventional crop required 71 percent more energy than the organic. Forty-one percent of this energy excess was due to the use of nitrogen-based fertilizers.

However, aside from conventional agriculture’s contribution to greenhouse gas emissions, it also threatens our nation's food security. First, it is a mono-crop based system. A single virulent, pesticide-resistant organism could destroy millions of acres of crops. Second, the entire model destroys the immunity of the land and the crops and plants themselves. Plants are living beings too. Imagine if you were sprayed down several times a year with toxic poisons. Surely your immune system would weaken and leave you vulnerable to a wide variety of illnesses, diseases and infections. Plant foods are no different. In brief, chemical agriculture is completely antithetical to the art and science of farming. It is nothing more than a profit-driven enterprise impoverished of any scientific or moral ground given to human health, future crop and food security, and ecological sustainability.

Globally, agriculture contributes to approximately five percent of all anthropogenic CO2 emissions, between 10-12 percent of all methane (primarily from livestock) and between 33-60 percent of nitrous oxide. Big agricultural firms are largely the responsible culprit. This industry is every bit on par with the worst exploiters and peddlers of fossil fuels. This should be an additional incentive for people to avoid eating foods grown by conventional means. The moral imperative to boycott and refuse to purchase chemically grown produce and genetically altered foods engineered by corporations such as Monsanto and DuPont is now critical.

On the other hand, organic agricultural methods depend up the health and sustainability of soils, the biosystems surrounding farms, and the farmers themselves. A paper comparing the pros and cons of organic and conventional agricultural methods published in *Critical Reviews in Plant Sciences* beautifully summarizes the means and ethic behind organic farming. The authors state that organic methods "rely on ecological processes, biodiversity and cycles adapted to local conditions rather than the use of inputs with adverse effects." These foreign inputs include toxic chemicals, synthetic fertilizers, extensive mechanical tilling, and inordinate amounts of irrigation. The scientists conclude, "Organic agriculture combines tradition, innovation and science to benefit the shared environment and promote fair relationships and a good quality of life for all involved."

The collapse of the nation's food security, either through drought associated with global warming, extreme flooding or the over-reliance of industrial agricultural technology, has other adverse effects besides higher food prices. It will also trigger border conflicts between various factions and nations and even wars. For many millions of people around the world, climate change is going to make day to day life increasingly unbearable.

The 2015 Pentagon report cited above also confirms a conversation I had with Mark Cane at Columbia University's Lamont-Doherty Earth Observatory, who observed that the political strife and turmoil in Syria was fundamentally one of our first hard examples of a war triggered by climate change. Between the years 2006 and 2010, Syria was tormented by its worst recorded drought, likely contributed by man-induced climate change. This prolonged drought destroyed the country's breadbasket, which happened to include the city of Aleppo that had become a stronghold for ISIS. Already water stressed, the drought reduced precipitation during the wet season dramatically. Over 200,000 Syrian farmers lost their lands because of water shortages. This played a significant role in the massive migration of people out of Syria into Europe. Although other factors played a significant role in the eruption of an Arab Spring, civil war and the rise of ISIS and al-Qaeda, and US intervention in Syria to foment regime change, a growing body of research indicates that environmental conditions were a huge contributor behind the instability of Syria that has led to the conflict.

In recent years several important publications including Harald Welzer's*Climate Wars: Why People Will Be Killed in the 21st Century*, Christian Parenti's*Tropic of Chaos: Climate Change and the New Geography of Violence*, and Gwynne Dyer's *Climate Wars: The Fight for Survival as the World Overheats*, each predict the growing conflicts, struggles and violence that will increase as we march towards a 2-3 degree C and eventually a 4 degree C rise in global temperature. This dire future is compounded by a population boom that has nearly doubled since 1960. The future will surely face insufficient resources, lower agricultural crop yields, growing inequality and corporate and governmental corruption. It is therefore imperative for people to begin to wake up to this new environmental reality.

 In an interview on Vox media in February 2015, then President Obama got it right. Climate change, the President said, affects far more people than terrorism. On other matters, Obama was dead wrong, such as undermining the 2009 Copenhagen climate accord and "lobbying" on behalf of American private energy interests to weaken the Paris agreement. Yet in a Pew Research Center survey, 76% of Americans felt terrorism was our greatest threat and should be our nation's top national security policy. On a daily basis, more people are imperiled by the life-threatening effects of climate change than any other human activity. This also includes the rise of new infectious diseases and pathogenic organisms that thrive in warmer conditions. In a study by the Institute for Economics and Peace, during a 13 year period starting in 2000, approximately 100,000 people died globally directly due to terrorist attacks. However since 2012, approximately 400,000 people die annually due to environmental episodes related to climate change. And this number is increasing exponentially as living conditions worsen and essential resources decrease. In 2012, twenty governments commissioned a study conducted by DARA International and conservatively estimated there would be 600,000 climate change related deaths annually by 2030. Prolonged droughts and lengthier and hotter heatwaves contribute largely to this rise.

DARA's primary report only looked at deaths associated with natural catastrophes driven by anthropogenic climate alterations. Unfortunately, when other human factors are added into the mortality equations, such as the consequences to human health from the constant release of CO2, methane, and toxic particulate matter from burning fossil fuels, chemical poisoning from agricultural pesticides, the situation worsens. Once these are entered into the larger scenario of climate change, the number of deaths leaps to almost 5 million people per year.

The majority of Americans regard global warming as a very real problem, 70% according to a 2016 Yale University survey. Nevertheless the public still perceives climate change as too impersonal, distant, and unlikely to have any immediate impact upon their lives and financial wellbeing. Most people continue to believe that aside from the weather getting hotter or wetter, their lives will not change substantially. But if we can understand more deeply how climate changes will directly disrupt our lives, our health, and our purses, then it might trigger our determination to make the necessary changes in our lives so that we are not contributors to the problems, but rather their solution.

We might look again at the melting Arctic ice again as an example. On the face of it, an ice free Arctic might appear to have very little personal significance. But consider for the moment that under the Arctic waters lie 90 billion barrels of crude oil, 1.7 trillion cubic feet of gas and an additional 44 billion barrels of other natural gas liquids. All of this black gold now awaits the corporate wolves of Big Oil and Gas and those nation's whose economies and market growth rely heavily upon fossil fuel-produced energy, especially Canada, Russia and the US.

Climate change and the endless burning of fossil fuels are already having a dramatic impact upon people's health. Dr. Jonathan Patz, director of the Global Health Institute at the University of Wisconsin, charts the rise of health problems and diseases associated with longer periods of hotter days that can be directly attributed to anthropogenic greenhouse gas emissions, especially in large urban cities. His Institute predicts a startling increase in respiratory and infectious diseases, malnutrition and hunger, and mental disorders. Heat stroke and cardiac arrest can also be heat-related illnesses. People with allergies and asthma will suffer more due to the worsening of ozone haze that accompanies hotter weather.

In increasingly drier regions diseases such as malaria and Lyme’s will spread. In areas with excessive rainfall, we will witness a rise in waterborne infections that contribute to gastrointestinal diseases. And with the escalation of extreme weather conditions adversely affecting people's livelihood, mental disorders such as depression, anxiety and post-traumatic stress disorder are on the rise.

A lesson we can learn from indigenous peoples across the globe is the law of maintaining a constant balance between what we need in order to survive and be authentically happy from our personal cravings and thirsts to accumulate more. One of the foundational rules in ecological science that assures an ecological system remains healthy, vital and resilient to uncertain catastrophic events is that all its numerous parts exist in a deep co-independent relationship with each other. There are direct cause and effect relationships between the sunlight hitting a forest, the cycles of precipitation, the specific plant species that depend upon the sun's radiant energy, soil microbes, insects, animals and their predators and so much more that comprise an entire ecosystem. Each receives enough from the others and this is sufficient for the system’s survival, health and progeny. If any one of these many parts of an ecosystem disappears or goes missing, the system's balance is tipped, injured and weakened. Likewise, if any one of these parts increases and accumulates beyond the ecosystem's intricate web of balances, the entire system is disrupted. Accumulation is the progenitor of a blockage in energy and the flowing exchange between the many species throughout any given system; and ecological environments are simply energetic systems, where all the parts dance together in an exchange of giving and receiving. This principle is well-known in the traditional medical systems of China and India. An accumulation of any of the major humors or “fluids” within the body blocks energetic flow and weakens certain organs. Abnormal accumulation creates the conditions for disease. Ecosystems suffer in the same way. Sudden climate change and humanity's addiction to pillage and horde more and more resources from the environment are weakening our planet's biosystem's immunity. And all natural ecologies in the world today--tropical and boreal forests, grasslands and wetlands, rivers and lakes, the oceans, etc.--are direly ill. As the biological conservationist Prof. Guy McPherson is fond of saying, "humanity now has one foot in hospice."

Our ancient forefathers and foremothers had a far greater appreciation for the fragile balance between human culture and the natural environment, and this balance needs to be preserved and sustained for our well-being and the prosperity of future generations. In the earliest Hindu scripture, which place an enormous value upon non-human life, the Earth and all its residents are described by the term *vasudheivakutumbakam*, which can be roughly translated as "Earth is one family without any doubt." Everything we consume must derive from somewhere else. When we take too much unnecessarily, it deprives others of their welfare. This is very similar to the United Nation’s definition of sustainability. The current widening inequality gap between the wealthy elite and everybody else is an example that applies equally to humanity's relationship to earth, which is now depriving millions of ecosystems around the world from thriving. Eventually, the Earth will be unable to provide for our hunger and thirst for more. Then what shall we do after all we have economically and psychologically depended upon for so long is yanked away from us?

A dominant mental illness infecting modern society is its failure, perhaps more properly its refusal, to weigh the probable causes motivating its actions. Levelling a tropical forest in the Amazon basin may be good for the business of sowing genetically modified soy beans or to graze more beef cattle, but what is the long-term effect? At what cost is the payback? This principle also applies to our personal lives. If we learn to weigh our actions in scale with their likely effects honestly, we can enrich and improve our lives immensely. And we can be comforted knowing that our actions will not adversely affect the lives of others. Natural biosystems do this instinctively. It is inherent throughout the energetic flow, balance and stability within healthy ecological communities. And it is part of the wider ecological awareness that we so desperately need to adopt and cultivate, and so urgently.

Two decades into the 21st century, we now need to take a difficult and even ruthless look at modern society and draw the conclusion that it is seriously ill. During the middle of the last century the great German-American existentialist philosophers Paul Tillich, and one of the most influential theologians in modern times, attempted to tackle the deeper underlying problems he witnessed were increasing and dominating modern culture. Paraphrasing Tillich’s work, for any serious intellectual inquiry into a dire problem, three fundamental questions need to be asked and addressed. First, what is the problem? What is our disease? As individuals, as a society, as a global family, why are we not where we ought to be?

Tillich's second question is: what is our vision? If we were to be whole, healthy and vibrant human beings residing in harmony with a robust and flourishing planet, what might it be like?

Finally, his third question is, how do we move from the first question to the second. In other words, what is our medicine?

I leave these as questions for each reader to deliberate to themselves. Each of us will find our own answers and guidance for the best path to follow. Nevertheless, to dive into this undertaking, deep deliberation and acquiring a sufficient amount of knowledge is demanded. Then we step into the path that leads to an awakened ecological awareness and are able to consciously disembark from the road leading towards further discord, denial and ultimately ruin. This new path will demand us to make realistic and doable changes, adopt new initiatives and interests in order to loosen and discard our personal constraints. After we individually succeed in this endeavor will we be able to say we are no longer a part of the problem. Rather we are now an active participant in the solutions.

**Climate Change Resistance**

It is not uncommon to hear environmentalists and those who understand the life-threatening consequences of climate change and global warming to label their opponents as "climate change deniers." There is considerable reason to identify those who absolutely refuse to accept humanity's contribution to the changing climate as deniers. Nevertheless, this word has assumed a derogatory and negative tone, not dissimilar to calling someone an idiot or moron. Rather, if we look at the underlying rationales for why people, industries and even governments would deny the tens of thousands of studies and articles published all over the world, we appreciate the psychological resistance against accepting global warming's truths and the immense role human activity has contributed to our heating planet.

In late October 2012, the most destructive storm in the history of the Northeastern US descended upon New York City. Although rated a Category 2 storm, Hurricane Sandy devastated Manhattan. The East River rose over its banks flooding lower Manhattan with wave surges as high as 14 feet. Subway lines and tunnels were flooded. According to a Washington Post article, approximately ten billion gallons of raw and partially treated sewage was released into public spaces, potentially creating a life threatening hygienic catastrophe. The city literally shut down for several days.

The National Center for Atmospheric Research has now determined there was a direct relationship between Sandy and human-generated climate change. Regarding the severity of the hurricane's impact upon New York, their report partially placed the blame on the warming ocean waters due to human activity. "It is possible that the subways and tunnels,' the report stated, "may not have been flooded without the warming-induced increases in sea level and storm intensity and size." In short, the consequences of our modern industrial society's influence over the climate is putting extreme weather on steroids.

However there is another and more disturbing side to the Hurricane Sandy story. After Hurricane Donna smashed into New York's and New Jersey's seaboard in 1960, the Army Corps of Engineers undertook a series of thorough infrastructural analyses to find solutions to protect New York's five boroughs from future tropical storms. The Corps' recommendations included making the beaches deeper and building ocean walls between 15-18 feet in height in the event of unanticipated higher sea surges.

In 2011, just a year before Sandy, the Army Corps conducted another analysis, but this time investigating the impact of a Category 4 hurricane. The report warned that 2,900 miles of New York streets would be flooded from a 15 foot sea level rise, reaching two miles into Brooklyn and Queens. Severe flooding would prevent ambulances, fire engines and emergency vehicles from reaching accidents and saving victims. Within 40 minutes, the subways would fill with sea water. Lines of cars in three of the four tunnels entering Manhattan would be submerged. And over a million people would be without electricity because ten of the city's major power stations would be forced to shut down.

These warnings have been with us for over 50 years, and yet no concerted efforts have been made to prepare the metropolitan area for severe weather events. After Sandy, then Mayor Bloomberg estimated the costs of destruction would be over $19 billion. Imagine how less that might have been if the state and city had invested in ways to lessen the warnings. Instead, today whenever anyone looks out over the Manhattan skyline, and particularly towards the lower West Side, over a dozen huge construction projects come into view. These are enormous sky rise residential complexes with small apartments starting at a million dollars and up. Rather than focusing on a new and modern infrastructure to prepare for the next Sandy and worse, investment is streaming into a real estate bonanza to keep up with the city's increasing population. How much in subsidies are the construction elites receiving at the expense of preparing to assure New York's residents are safe from a Category 4 storm? For millions of people, New York City is the place to be, regardless of how vulnerable and fragile it is to devastating climate change events.

The question may be raised as to whether New Yorkers and the city government is in climate change denial or is there something else we must consider. Even though 2016 was a record breaking year for severe, catastrophic weather events, most regard this as just another day in the life. And New York City is not alone. America's coastal cities, including Boston, Washington, Charleston, dozens along the Florida coastline and others are more concerned with economic growth and development instead of human and environmental safety.

Capitalism and the ideology of human progress has further removed us from having a healthy relationship with nature and the environment. What is needed today is the birthing of a new ecological awareness or consciousness that deepens our relationships with the forces of nature and compels us to understand and firmly acknowledge our dependence on the natural world for our survival. For each generation, its understanding and even definition of what is "natural" or not undergoes fundamental.

For those of us who are over fifty years old and grew up in a suburb or a non-rural medium-sized town imagine what you might observe if you returned to see the landscape you played and frolicked in as a child. You would likely find plots of forests or woods that brought many hours of creative enjoyment and exploration leveled and replaced by new homes and manicured lawns. Many if not most of the trees that provided shade on hot summer days will have vanished. A child growing up in your old town today would likely have a very different understanding of and experience with nature compared to yourself. Now imagine what your town was like when your parents were children. There would be more trees, perhaps even orchards or local farms on your town's outskirts. And next go further back to the time of your grandparents' childhood and then your great grandparents. That same town would be sparsely populated and surrounded by thriving ecosystems that have now completely disappeared. There would have also been more wildlife, birds, reptiles and other animals that have long disappeared. Therefore, it is feasible to conclude that with each generation, its interaction with nature has undergone fundamental changes whereby today we are more alienated from the natural environment than ever before. We need to relearn what perpetual economic and social progress has forced us to unlearn.