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EFFECTS OF GLOBAL WARMING

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This paper is an update to my paper from April, 2010 titled ***Climate Change Conundrum***. Nearly ten years have passed and changes have taken place in the Earth's environment to justify heightened concerns in regards to the effects of **Climate Change / Global Warming** caused by greenhouse gases and other consequences of these acts.

HISTORICAL TEXT

The **Effects of Global Warming** we are experiencing are brought about by **greenhouse gases** (GHG) being added to the atmosphere. These gases include carbon dioxide (CO₂) responsible for about 80 percent, and other gases such as methane (CH₄), nitrous oxide (N₂O) and other trace gases for the remaining 20 percent. Current **atmospheric CO₂** is at **408.55 ppm dated Sept. 2019**, and pre-industrial levels were around **270 ppm in 1880**. The **Natural Greenhouse Effect** on Earth is 33 degrees C (59.4 degrees F). Without this effect the Earth would be uninhabitably cold.

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An Irish physicist, **John Tyndall**, in the **1860's** realized the dominant impact of atmospheric water vapor in keeping **Earth's** surface warmer than it otherwise would be, writing:

“This aqueous vapor is a blanket more necessary to the vegetable life of England than clothing is to man. Remove for a single summer-night the aqueous vapor from the air which overspreads this country, and you would assuredly destroy every plant capable of being destroyed by a freezing temperature. The warmth of our fields and gardens would pour itself unrequited into space, and the sun would rise upon an island held fast in the iron grip of frost. The aqueous vapor constitutes a dam, by which the temperature at the earth's surface is deepened: the dam however, finally overflows, and we give to space all that we receive from the sun.”

The final statement in Tyndall's quote refers to the fundamental concept, conservation of energy: ***Earth must radiate to space the same amount of energy that it receives from the Sun.***

Tyndall and others have been given credit for the concept of the greenhouse effect, that such gases are transparent to sunlight but absorb heat (**Infrared**) radiation. But Tyndall himself had an inkling that changes of greenhouse gases may account for known climate changes as he was speculating about the ice ages. In correspondence on **June 1, 1866**, he stated that ***changes in radiative properties alone were unlikely to be the root cause of glacial epochs.***

Tyndall had neither the tools nor data needed to interpret the root causes of the ice ages. These tools did not become available until the 1970's revealing that he was correct in both his original speculation and his cautionary correspondence.

There have been many other writers and scientists that have informed us of the dangers of global warming long term outcomes. **Roger Revelle** and **Hans Eduard Suess** altered the course of CO₂ climate story in research made in 1957. The crucial insight of the Revelle and Suess analysis was that excess CO₂ in the air from fossil fuel burning has a much more difficult time getting into the ocean than prior simple calculations suggested. More precisely, fossil fuel CO₂ molecules can get into the ocean surface, but the ocean ejects almost as much CO₂ back to the atmosphere. Ocean chemistry is a complex soup. Technically, ocean water is a buffered solution that resists a change in acidity. This buffering effect reduces by about a factor of ten the net flux of fossil fuel CO₂ into the ocean. The ocean absorbs more of the fossil fuel CO₂ as water from deeper layers mixes to the surface, but deep mixing requires centuries. The resulting long time scale for uptake of fossil fuel CO₂ is the reason that fossil fuel burning poses a threat of major climate change.

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Revelle's insight and communication ability came into play in a summary statement in the paper:

“Human beings are now carrying out a large scale geophysical experiment of a kind that could not have happened in the past nor be reproduced in the future.”

He publicly speculated that in the 21st century the greenhouse effect might exert “a violent effect on the earth's climate” (as quoted by **Time Magazine** in its 28 May 1956 issue). He thought the temperature rise might eventually melt the **Greenland** and **Antarctic** ice sheets, which would raise sea levels enough to flood coastlines, and in 1957 he told a congressional committee that the greenhouse effect might someday turn **Southern California** and **Texas** into deserts.

RECENT EVENTS

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Now we move on into the late 70's and 80's as provided by an informative book published in April 2019 titled “**Losing Earth: A Recent History**” by **Nathaniel Rich**. The story of climate politics between 1979 and 1989, both in the **United States** and internationally, is one of great

possibility and almost total failure. While limiting the devastating effects of carbon emissions was more difficult to do during the 1980's than Rich suggests in his book, he effectively excavates an era when alliances were unsettled, minds were far more open to change, and a determined, well-informed effort nevertheless came to naught or more directly nothing.

Today, the most obvious enemy of meaningful action on climate change is the **Fossil Fuel Industry**, which has emphasized the complexity of the Earth's climate in order to divide the public and immobilize our politics. But as Rich points out in 1979, the basic science of climate change was not considered especially complicated—or especially controversial. Many government scientists, and researchers at companies such as **Exxon**, understood and accepted that the carbon dioxide produced by fossil fuel combustion was radically transforming the atmosphere and heating up the planet.

Predicting the precise effects of climate change; exactly what will happen when and where, is complex because the global climate system is extremely complex. But for more than a century, as stated in Rich's book, "*The general consequences of loading the atmosphere with carbon dioxide have been about as debatable as gravity.*"

In the spring of 1979, when a thirty-two-year-old Cornell graduate named **Rafe Pomerance**, then the deputy legislative director of the environmental organization **Friends of the Earth**, stumbled on a brief reference to climate change in a government report, it wasn't difficult for him to grasp the implications. The report, an **Environmental Protection Agency (EPA)** analysis of the future of coal as an energy source, mentioned in passing that the continued use of fossil fuels could lead to "*significant and damaging*" changes to the global atmosphere within two or three decades. Pomerance had a degree in history, not science, but as Rich recounts, he was immediately struck by the possibility that humankind was knowingly destroying the conditions required for its own survival. He asked himself; "*Why didn't he know about this? Why didn't everyone?*"

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Pomerance did research on the available evidence for climate change, beginning with a 1979 report to the **Department of Energy (DOE)** by the "**Jasons**", a semi-secret team of elite scientists established in 1960, and periodically convened to find scientific solutions to US national security problems. They concluded that carbon dioxide levels would double as early as

2035 and no later than 2060, and predicted that this would *increase average global surface temperatures by 2 to 3 degrees Celsius (3.6 to 5.4 degrees Fahrenheit), create dust bowl conditions across North America, Asia, and Africa, and cause famines and droughts so severe and long-lasting that they would bring about mass human migration*. The Jasons' wrote, "The warming would also lead to the "ominous feature" of rapid ice melt at the poles; releasing enough water, to raise the oceans by 16 feet."

The Jasons had already sent the report to dozens of government agencies, industry groups, and individual scientists in the US and abroad, but no action had been taken. Pomerance arranged for the report's lead scientist, **Gordon MacDonald**, to give a series of informal briefings to senior government officials, and soon learned that few, if any, had grasped the importance of the Jason's findings. Even **President Carter's** chief scientist, **Frank Press**, who was familiar with the carbon dioxide issue, had told Carter that the "present state of knowledge" did not justify taking action. When MacDonald spoke to Frank Press and the staff of the president's **Office of Science and Technology Policy**, he warned of a snowless New England, flooded coastal cities, and a 40 percent drop in US wheat production within his listener's lifetimes. He said the administration's support for synthetic fuels; liquid fuels synthesized from coal or natural gas, was a step in exactly the wrong direction. Coal production, he added, would ultimately have to end. MacDonald's recommendations were, to say the least, politically unattractive, but his vivid description of the costs of inaction convinced Frank Press to request a full assessment of the carbon dioxide problem from the **National Academy of Sciences (NAS)**.

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When the National Academy team convened in **Woods Hole Oceanographic Institution** on Cape Cod, in the summer of 1979, they called the NASA researcher **James Hansen**, who at the time was one of a handful of scientists studying the effects of carbon emissions using computer models of the global climate. Hansen's predictions and others led the team to conclude that the Jasons had been optimistic; as outlined in Rich's book, their results showed that "when carbon dioxide doubled around 2035, global temperatures would increase between 1.5 and 4.5 degrees Celsius (2.7 to 8.1 degrees Fahrenheit), with the most likely outcome falling in the middle; a warming of 3 degrees." The last time the planet had been so warm was during the middle of **Pliocene Epoch** from 3.3 to 3 million years ago, when the seas were eighty feet higher and

beech trees were growing in Antarctica. In its report, the National Academy team warned that “*a wait-and-see policy may mean waiting until it is too late.*”

The National Academy of Sciences (NAS) first report was generally accepted as authoritative, so much so that the fossil fuel industry recognized, Rich writes, that a “*formal consensus about the nature of the crisis had held together.*” **Exxon**, along with the **American Petroleum Institute (API)**, had been studying the effects of carbon dioxide emissions since mid-1950, but lack of government concern had made it easy for the industry to justify inaction. After the release of the National Academy report, however, Exxon research laboratory manager **Henry Shaw** recommended to his superiors that the company “*start a very aggressive defensive program, because there is a good probability that legislation effecting our business will be passed.*” Exxon executives created a new climate research program with an annual budget of \$600,000, charging it with quantifying the company’s responsibility for climate change; and ultimately minimizing the regulatory burden on the company.

Within a few years, the industry’s posture would shift from “*aggressive defensive*” to simply “*aggressive*”, and Exxon and its allies would launch an all-out attack on both climate legislation and the science supporting it. But in 1980 both Shaw and his bosses at Exxon believed “*cautious cooperation*” was wiser than defiance; **Congress** had just held its first hearing on climate change; **Carter** had ordered another, more comprehensive climate change report from the National Academy; and the **National Commission on Air Quality** was meeting to help develop climate legislation.

When it came time to commit to specific solutions, the experts began to hesitate. **China**, the **Soviet Union**, and the **United States** were each accelerating coal production; Carter was planning to invest \$80 billion in synthetic fuels. Proposed laws or regulations would focus attention on the costs of emissions reduction, instantly politicizing the issue. In his book, Rich recounts, the experts had abandoned solutions and were even reconsidering their statement of the problem, loading it with caveats, such as; *Were climatic changes “highly likely” or “almost surely” to occur? Were said changes of an “undetermined” or “little-understood” nature?* In the end, the meeting’s final statement was weaker than the language the commission had used to announce the workshop.

When **President Ronald Reagan** was inaugurated in January 1981, he began a wide-ranging attack on US environmental policy, appointing zealously anti-regulation partisans to head the

Environmental Protection Agency (EPA) and the **Department of the Interior (DOI)** and threatening to open public lands to more mining, drilling, and logging. The nation's undeveloped climate policy, however, was largely left alone; the administration's standard response to questions about the connection between rising global temperatures and carbon emissions was that no governmental action would be taken until the National Academy completed its second climate change report, the comprehensive analysis of social and economic effects commissioned by President Carter.

The **National Academy of Sciences (NAS) second report** was released in October 1983, and while its overall tone was cautious, it was punctuated with grim warnings. “**We are deeply concerned about environmental changes of this magnitude**”, the authors stated in their executive summary. “**We may get into trouble in ways that we have barely imagined.**” They recommended present-day researchers prioritize work on renewable fuels; “**The potential disruptions associated with CO₂ induced climate change are sufficiently serious to make us lean away from fossil fuel energy options, if other things are equal.**”

In interviews, however, lead author of the NAS second report, **William Nierenberg**, and his coauthors emphasized the need for “**caution, not panic**”, and predicted the climate problem would be “**manageable in the next hundred or so years.**” Like many scientists of his era, Nierenberg believed ingenuity; especially American technological ingenuity, that had won World War II and developed the aerospace and computer industries, would protect humanity from worst-case scenarios. Headlines reflected the interviews, not the contents of the report itself, and both the **Reagan administration** and the **fossil fuel industry** readily accepted their interpretation.

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Climate change never recaptured the sustained attention it had received earlier in the 80's. During his 1988 presidential campaign, **George H.W. Bush** promised to be an “**environmental president.**” “**Those who think we are powerless to do anything about the greenhouse effect,**” he told supporters at a campaign stop in **Michigan**, “**are forgetting about the White House effect.**” Once in office, however, Bush proved to have only a passing interest in climate change, and his chief of staff, **John Sununu**, was suspicious of environmentalists and environmental policy. Sununu, an MIT graduate who liked to call himself an “**old engineer,**” had a rudimentary climate model installed on his desktop computer and, after unsuccessfully attempting to replicate

Hansen's conclusions, declared them to be “**poppycock**.” He told **James Baker, Bush's Secretary of State**, to “**stay clear of this greenhouse effect nonsense**,” and issued a similarly stern warning to **EPA administrator, Bill Reilly**, a lawyer and urban planner whose support for emissions reductions was soon drowned out by Sununu and his supporters.

In **November 1989**, when the world's environmental ministers from 68 countries gathered in the **Netherlands** to agree on a framework for a **Global Emissions Treaty**, US representatives sabotaged the negotiations, forcing the group to abandon any hard limits on emissions of greenhouse gases and diluting the meeting's final statement to a vague call for reducing emissions “**to a level consistent with the natural capacity of the planet**.” The decade of possibility was over, and Sununu, who presided over its undignified end, could easily be blamed for its failure. But as Rich points out in his book, Sununu's success was made possible by the weakness of US public and political support for climate action; by 1989, after a succession of halfhearted expert warnings, the once-widespread concern about climate change had subsided into complacency. The environmental group **Greenpeace** condemned the plan as a “**disaster**” and “**major setback in moves to halt the greenhouse effect**.”

And here comes the 90's. **Al Gore Sr.**, a powerful Senator from Tennessee, saw to it that his son was elected to the **House of Representatives**, serving from 1977 to 1985, then going on to the **Senate** from 1985 to 1993. **Al Gore Jr's** primary issue was his conviction that the Earth would perish if we did not eliminate fossil fuels. In 1992 **Gore advanced to Vice President** under **President Bill Clinton**, where he was able to enact policies and direct funding to ensure the climate change agenda became a top priority of the United States Government. Gore's mission was boosted when Clinton gave him authority over the newly created **President's Council on Sustainable Development**.

Considering the Council was tasked with advising the **President** “**on matters involving sustainable development**,” and alternative points of view on the science of climate change were effectively excluded, it was a foregone conclusion that the **Clinton Administration** would go in the direction Gore wanted. Indeed, in their cover letter to the President accompanying their 1999 report, **Advancing Prosperity, Opportunity and a Healthy Environment for the 21st Century**, the Council stated: “**Our report presents consensus recommendations on how America can reduce greenhouse gas emissions and take other steps to protect the climate**.”

A cornerstone of **Gore's strategy** was to ensure that all high-ranking government officials who had any involvement with funding policies relating to climate change were in line with his vision. These agencies included the **Department of Energy (DOE), Environmental Protection Agency (EPA), National Science Foundation (NSF), Department of Education (DOE), National Oceanic and Atmospheric Administration ((NOAA), and National Aeronautics and Space Administration (NASA).**

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An example of **Vice President Gore's** power was shown when physicist **Dr. William Happer**, then **Director of Energy Research** at the **DOE**, testified before Congress in 1993 that scientific data did not support the hypothesis of manmade global warming. Gore saw to it that **Happer was immediately fired**. Fifteen years later, Happer quipped, **"I had the privilege of being fired by Al Gore, since I refused to go along with his alarmism. I did not need the job that badly."**

As defined in Rich's book, today there is another layer of resistance; the **Climate Change Denialism** created and encouraged by fossil fuel companies. **Exxon** continued its tacit cooperation with policymakers until after the 1989 conference in the Netherlands, when federal regulations had slipped from unstoppable to unlikely. Then Exxon and its competitors began to support an **American Petroleum Institute (API)** press campaign that paid scientists to write **Op-Eds** emphasizing the uncertainties in climate science. The press campaign was so successful and so cheap to run that it quickly expanded. By the early 2000's, **API-supported groups** were questioning not only the accuracy of climate change predictions but the basic science.

Now those tactics are institutionalized; **President Donald Trump's** administration appointees have eliminated the last of some long-range climate models, dropped worst-case scenarios from the quadrennial **National Climate Assessment**, and proposed a **"climate review panel"** that would question the work of government climate scientists. The panel would be headed by **Dr. William Happer**, a physicist who once compared the **"demonization"** of carbon dioxide to **Hitler's "genocide of the Jews"**. Recall, he is the person fired by **Vice President Al Gore** in 1993 after testifying before Congress that scientific data did not support the hypothesis of man-made global warming.

OUR LAST CHANCE PLAN OF ACTION

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In 2019, the **Intergovernmental Panel on Climate Change (IPCC)** predicted that within roughly twelve years, barring radical changes in energy use, humanity will have committed itself to at least **1.5 degrees Celsius (2.7 degrees Fahrenheit) of warming**; and to all the catastrophes that come with it, from sea-level rise to increasingly severe wildfires and hurricanes.

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Another organization called **Job One for Humanity – Prevent Global Warming Extinction** organized what they refer to as “***Our last chance 2025 global fossil fuel reduction targets.***” The following two items are the absolute minimum total global fossil fuel reductions that must occur to prevent the strong probability of humanity going extinct not sometime after 2100, but within the next 30-50 years.

One: **All “Industrially Developed” nations** must reduce their total fossil fuel use by 75 percent by **2025** and then continue reducing fossil fuel use to **net-zero carbon emissions** by **2035**. Net carbon zero emissions in this solution means that no additional fossil fuel emissions are going into the atmosphere that are not also simultaneously being removed from the atmosphere by natural means. (***Only about 20 countries produce 70 percent or more of the world's carbon emissions.***) Think of developed nations like most members of the **G20 Group**; Argentina, Australia, Canada, China, European Union, France, Germany, India, Italy, Japan, Russia, Saudi Arabia, South Africa, South Korea, Spain, Turkey, the United Kingdom, and the United States.

Two: **All “Developing” nations** must maintain their total fossil fuel emission levels as they were at the beginning of **2019** and not allow them to go any higher. Then by **2045**, all developing nations must also be at **net-zero carbon emissions**. This allowance for developing nations to stay at the level they are now and gradually reduce down to net-zero carbon emissions by 2045 is part of an essential justice and equity equation.

The **developed nations** created their wealth by producing the majority of all carbon emissions in the atmosphere today. The developed nations have caused almost all of our current global warming extinction emergency.

IMPENDING TIPPING POINTS

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The eleven major **global warming tipping points**, other than increasing temperature, within interacting climate, human, and biological systems are the following:

- A. The total amount of melting ice.** Increased heat melts more **sea ice, ice shelves, and glaciers**, resulting in more water flowing into our oceans and **increasing sea levels**. This process repeats with each increase in temperature in an endless, self-reinforcing cycle; a **positive feedback loop**. At some point, this positive feedback loop triggers a **tipping point**, and the increased heat and ice melting process can go from a gradual linear progression (1, 2, 3, 4, 5, 6, 7, 8, 9, 10) to a far steeper exponential progression (2, 4, 8, 16, 32, 64, 128, 256, 512, 1024, 2048, 4096, 8192, 16384).
- B. The loss of the atmospheric carbon-eating forests because of heat, drought, wildfires, and timber-harvesting or agriculture-related clearcutting.** As temperatures rise and droughts, heat, forest fires, and clear-cutting kill trees, **we lose our essential carbon-eating forests**, which increases the carbon and heat in the atmosphere. This process eventually triggers a **tipping point** and the forests' loss of carbon-eating capabilities goes from a gradual linear progression into a steep exponential progression of forest loss and escalating carbon in the atmosphere. This results in a sudden additional spike upward in average global temperature.
- C. The changes in major ocean currents that help to stabilize our weather and seasons.** Research is now expanding on how **increasing heat will effect currents like in the North Atlantic**. Because of global warming, if the North Atlantic current were slowed down or diverted from its presently established pathway, it would create very significant **changes in weather patterns**, which would effect growing seasons, rain, snowfall, and temperature—all of which have strong **effects on vital crop yields**.

- D. The global warming-caused pandemic potential.** When ancient ice, glaciers, permafrost, or frozen tundra melts, it **releases still-living bacteria and viruses never seen before**. This means we could soon be unleashing the **ultimate global pandemic**. So many different types of new bacteria and viruses could be released at once that even our best scientists would not be able to create and distribute the vaccines needed in time to contain disease outbreaks or a **growing global pandemic**.
- E. The ever-increasing atmospheric heat captured and stored by the oceans and sent to lower levels of the ocean.** These captured and stored masses of deep warm water can suddenly rise to the surface again. This will release a massive amount of additional heat directly into the atmosphere and quickly spike the average global temperature.
- F. Total weight of rising seas and melting ice shifting.** Although research is sparse in this area, it has been posited that the total massive weight change from all ice melt areas (where ice covers land masses) as well as the heating, expanding and shifting weight effect on seas caused by global warming **can move existing tectonic plates**. This plate motion could cause earthquakes and volcanic eruptions at an unprecedented scale. If the shifting of these tectonic plates causes numerous or massive volcanic eruptions around the planet, we could also go into a **volcanic winter**. If the shifting of tectonic plates triggers a **super-volcano-like eruption**, the years that the sun would be blocked could kill off most of the human population.
- G. Soils that normally absorb carbon begin releasing it back into the atmosphere from their previously stored or inherent carbon because of the escalating heat.** This increasing **heat-induced release of carbon by the soils** creates a self-reinforcing **positive feedback loop**. This triggers a soil carbon release **tipping point** and the process goes into a more exponential progression. This also results in a rapid increase in average global temperature.
- H. The total amount of water vapor in the atmosphere.** Water vapor is the gaseous state of water. It is the most important natural greenhouse gas. When it condenses onto a surface, a net warming occurs on that surface. In the atmosphere, water vapor increases as heat increases. Increased heat evaporates more water from oceans, lakes, and rivers, which creates more water vapor and heat in an endless self-reinforcing cycle. At some point, this positive feedback loop triggers a **tipping point**, and the process goes from a

gradual linear heat producing progression into a steeper exponential progression. The result is that the average global temperature increases even faster. Humans cannot survive if the air is too moist and hot, which would happen for the majority of human populations if global temperatures rise by **11 to 12 degrees C (19.8 to 21.6 degrees F)**, as land masses warm faster than the global average.

I. **The albedo effect**. The whiteness of polar ice reflects heat away from the planet and is called the albedo effect. As the **polar ice melts**, significant areas darken and therefore absorb more heat rather than reflecting it outward. At some point in this melting process, a self-reinforcing **positive feedback loop** occurs, which again reduces the albedo effect's total heat-reflecting capabilities. This in turn further **increases global warming**. As before, this self-reinforcing cycle of loss of reflectivity and increasing heat will eventually move from a gradual linear progression to a steep exponential heat increasing progression.

J. **The release of methane from the warming of polar permafrost and tundra**. As the temperature continues to increase, a self-reinforcing **positive feedback loop** triggers a **permafrost and tundra methane release tipping point**, leading eventually to the exponential progression mentioned before. This could be a very **critical tipping point** because **methane produces 20 to 100 times the heat-creating effect in the atmosphere as compared to carbon dioxide**. This increased methane within our atmosphere will also remain there from three years to decades before it decays back into simple carbon. To emphasize how dangerous this is for our future, in February 2013, scientists using radiometric dating techniques on Russian cave formations to measure melting rates warned that a 1.5 degrees C (2.7 degrees F) global rise in temperature compared to pre-industrial levels was enough to start a general permafrost melt. We are almost at 1.5 degrees C right now, and even higher temperatures are inevitable. **Please also note that melting permafrost in tundra also has the potential to cause local and global pandemics caused by ancient viruses and bacteria being released from the permafrost**. Already in Siberia they have had **anthrax** and **smallpox outbreaks** because of melting permafrost and tundra.

K. **The die-offs of carbon-eating and oxygen-producing sea plankton** because of the warming, carbonization, and acidification of the oceans. As this continues to intensify, it

also creates a self-reinforcing **positive feedback loop**, which triggers a **tipping point**, and the die-off process goes from a gradual linear progression into a steeper exponential progression. This results in sudden and rapidly increasing **die-offs in the ocean fish populations that live on this plankton**, as well as sudden and rapidly increasing drop-offs in the ocean's oxygen-producing capabilities. (**Oxygen-producing plankton are critical to our future, as they produce 50-80 percent of the world's total oxygen supply**).

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This was a lot to take in, and there is much more to learn regarding the effects of global warming. Are there any questions?

Resources and Links:

- 1980 National Commission on Air Quality Carbon Dioxide Workshop: <http://www.climatefiles.com/exxonmobil/1980-national-commission-air-quality-carbon-dioxide/>
- National Climate Assessment: <https://nca2014.globalchange.gov/report>
- Job One for Humanity: <https://www.joboneforhumanity.org/>
 - https://www.joboneforhumanity.org/today_s_real_annual_fossil_fuel_reduction_targets
 - https://www.joboneforhumanity.org/today_s_five_most_important_facts_about_global_warming
 - https://www.joboneforhumanity.org/global_warming
- Wikipedia: https://en.wikipedia.org/wiki/Main_Page
- National Geographic: <https://www.nationalgeographic.com/>
- Competitive Enterprise Institute: <https://cei.org/>
- James Hansen: <http://www.columbia.edu/~jeh1/>
- Citizens Climate Lobby: <https://citizensclimatelobby.org/>
- Intergovernmental Panel on Climate Change (IPCC): <https://www.ipcc.ch/>
- Association for the Tree of Life: <https://www.tree-of-life.works/>
 - Climate and Ecological Delusions and Contradictions That Will Rapidly End Humanity...Unless...: https://www.cecoalition.org/sound_alarm
- Climate Emergency Coalition: <https://www.cecoalition.org/>
- The G20: <https://dfat.gov.au/trade/organisations/g20/Pages/g20.aspx>
- World Nuclear Association: <https://www.world-nuclear.org/>
- Woods Hole Oceanographic Institution: <https://www.whoi.edu/>