Earth's Climate in Anthropogenic Change

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> "Through his worldwide industrial civilization, Man is unwittingly conducting a vast geophysical experiment. Within a few generations he is burning the fossil fuels that slowly accumulated in the earth over the past 500 million years." – President's Science Advisory Committee [for Lyndon B. Johnson], 1965
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> "The climate crisis affects us all and represents the single, gravest threat to social justice today." – Gilbert Houngbo, ILO Director-General, 2024
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> "[C]limate change…affects everyone and everything, including extreme weather, national security, food security, biodiversity, economic stability and global health." – Rebecca Leber, 2024

After hearing about the Global Warming and Climate Change in 1986, I decided to dedicate the second half of my life to this issue. Being neither a scientist nor historian, I am honored to contribute this article to disseminate the understanding of the subject. Following Section I that outlines the issue, I

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briefly trace the scientists' earlier exploration of Greenhouse Effects (GHE) in Section II, and note how the world has responded to it in Sections III and IV.

I request the readers to accept a few points. First, because the article must fit within the maximum length, I avoid to discuss hundreds of relevant themes/events of significance. Second, for the same reason, 'References' adopts a simplified system. Third, to make this article a useful start of your own exploration, I minimize my own passages, and maximize quotations from the original materials and from published reviews. I hope you will be comfortable of these styles, and find this modest article educational, informative, and illustrative of some of the key aspects of this broad issue.

Ⅰ. Climate Change Tragedy

What is Climate Change and why it is a 'tragedy'? "What is climate change? A really simple guide" (2024) by BBC [British Broadcasting Corporation] News defines, "Climate change is the long-term shift in the Earth's average temperatures and weather conditions," connecting Global Warming and Climate Change by "temperatures." I follow BBC's view, and treat Global Warming and Climate Change as heavily overlapping, if not interchangeable, notions.

Why is Earth's surface space warming lately? BBC News (2024) employs IPCC's [Intergovernmental Panel on Climate Change; 1988-] account as follows.

> "This long-term climate change has been caused by human activity, the IPCC says, mainly from the widespread use of fossil fuels - coal, oil and gas - in homes, factories and transport. When fossil fuels burn, they release greenhouse gases - mostly carbon dioxide (CO_2). This traps extra energy in the atmosphere near the

> Earth's surface, causing the planet to heat up. Since the start of the Industrial Revolution - when humans started burning large amounts of fossil fuels - the amount of CO_2 in the atmosphere has risen by about 50%, external."

How much has the Planet been warmed? BBC News states: "Over the last decade, the world was on average around 1.2C warmer than during the late 19th Century." Indeed, the 21st century world is not only significantly warmer than it was in the 19th century, but the update data show that the warming rate has escalated (in part contributed by the natural El Niño weather phenomenon): "It has now been confirmed that global warming exceeded 1.5C across the 12 month period between February 2023 and January 2024."

Why is warming the Planet a 'tragedy'? For one thing, warming Planet's atmosphere causes Climate Change that has gravely damaged humanity. Globally, numerous people have lost residences (by flooding, desertification, sea level rise) or lost economic bases for life (by drought or flooding of farmland, wildfire), and suffered from the eco-social 'chain reactions' – e.g. food insecurity causes worldwide inflation of its prices, which in turn causes people's attacking others to supplement own crop failure. On the overall cost to humanity, BBC states: "About 3.3 to 3.6 billion people are highly vulnerable to climate change, according to the IPCC." As the official human population was about 8 billion in 2022, which means nearly a half of all humans have become "highly vulnerable" by Climate Change (Dyvik, 2024). According to ILO (International Labour Organization), "over 90 per cent of people living in climate-vulnerable countries" do not have "social protection" against Climate crisis (UN News, 12 September 2024).

For another thing, Climate Change raises 'ethical issues': some have benefitted from activities that have warmed the Earth, and others have suffered from that ecological transformation. This contradiction arises because we belong to distinct 1) geographical areas, 2) economic classes, and 3) generational categories. Regarding Point 1), Kolbert (2022) remarks: "The U.S., with less than a twentieth of the globe's population, accounts for a quarter of aggregate emissions. Europe, with about six per cent of the world's population, is responsible for another fifth." Yet, much fewer Americans or Europeans are victimized by Climate Change than those of the Global South.

Regarding Point 3), Climate Change is 'unfair' to younger generations. The escalating atmospheric pollution makes it uncertain whether today's Youth, Child and Unborn generations can survive as much as their grandparents have done. Thus Greta Thunberg (2019; 2003-) critiques the 'adult-centric-view': "When you think about 'the future' today, you don't think beyond the year 2050. By then I will, in the best case, not even have lived half of my life. What happens next?" (p. 10).

Finally, while Climate Change is human-promoted, most of its victims are non-humans. Due to the transformation of ecosphere, Earth is in the Sixth Mass Extinction event. Already in 2011, *Science* published an article "Are We in the Middle of a Sixth Mass Extinction? Study finds that three-quarters of Earth's species could vanish within 300 years" (Gibbons, 2011). Given the escalation of geophysical and biochemical changes since 2011, many of the three-quarters of species may face extinction in 100 or even less years.

Following sections provide the historical information albeit briefly. How have the earlier scientists explored the 'Global Warming Theory' since the 19th

century, and been countered since the 20th century?

Ⅱ. From Speculation to Warning

I coin the term 'Global Warming Theorist' to refer to the scientists who pioneered this phenomenon. Who initiated this tradition? Internet sources agree that a French scientist and advisor of Napoleon I (1767-1821) was the first one. Carlin/ History News Work (2020) state:

> "Joseph Fourier [1768-1830] was Napoleon's science adviser… [H]e studied the nature of heat transfer and concluded that given the Earth's distance from the sun, our planet should be far colder than it was. In an 1824 work, Fourier explained that the atmosphere must retain some of Earth's heat. He speculated that human activities might also impact Earth's temperature."

In USA, Eunice Newton Foote (1819-88), a known social campaigner (vs. slavery, male domination), was the leading figure. At the 1856 meeting of the American Association for the Advanced Science, her "Circumstances Affecting the Heat of the Sun's Rays" was delivered by a man on her behalf. She wrote: "An atmosphere of that [CO_2] gas would give to our earth a high temperature; and if…the air had mixed with it a larger proportion than at present, an increased temperature…must have necessarily resulted" (Sommerlad, 2021).

Foote's vision was confirmed by the Irish physicist John Tyndall (1820-93). Sommerlad (2021) remarks: "In 1859, Tyndall began to study the impact of thermal radiation on different gases and aerosols…to see which played a role in trapping heat." A month later, Tyndall "was demonstrating…before the Royal Society in London…that coal, gas and ether strongly absorbed radiant heat and

therein proved the greenhouse effect first theorised by Fourier." Tyndall stated: "When heat is absorbed by the planet, it is so changed in quality that the rays emanating from the planet cannot get with the same freedom back into space"; "Thus the atmosphere admits of the entrance of solar heat; but checks its exit, and the result is a tendency to accumulate heat at the surface of the planet."

Other European pioneers include Svante Arrhenius (1859-1927) and Nils Gustaf Ekholm (1848-1923). Sommerlad (2021) writes that Arrhenius's "calculations led him to conclude that CO_2 emissions from man's fossil-fuel burning industries and other combustion processes were large enough to cause global warming," yet "it was his colleague, Nils Gustaf Ekholm…who coined 'greenhouse effect', arguing that humans should be able to 'regulate the future climate of the earth' by taking control of its CO_2 emissions."

By the first half of the 20th century, Global Warming Theorists shared today's anxiety – CO_2 and other GHGs could make Planet no longer habitable for humanity through Climate Change. What made them apprehensive was the dramatic increase in the consumption of fossil fuels. A British steam engineer Guy Stewart Callendar (1898-1964) was "spotting a clear correlation between CO_2 levels in the atmosphere and the global temperature," and in 1938 "he was able to demonstrate…before the Royal Meteorological Society that the earth's temperature had risen over the past 50 years," spreading the term 'Callendar Effect' (Sommerlad, 2021).

In the 1950s the theorists' anxiety intensified as the American Oceanographer Roger Reveille (1909-91) found that 1) the oceans had lesser capacity to absorb CO_2 from the atmosphere than previously thought, and 2) the atmospheric CO_2

lingeres for a far longer period than had been expected, allowing itself to accumulate over time (Carlin / History News Network, 2020). However, they could not be too persuasive because they thought (in the words of Ralf Keeling [1957-]) "atmospheric CO_2 concentrations varied widely depending on place and time" (Vasquez, 2021). Yet, by the late 1950s (Ralf's father) Charles Keeling (1928-2005) a) invented a way to accurately measure atmospheric CO_2, b) noticed "CO_2 concentrations weren't actually as variable as previously thought," and c) started to measure its density at the Mauna Loa Observatory in Hawaii (on behalf of the Scripps Institute of Oceanography) because "remote areas away from the influence of human activity" seemed suitable to measure CO_2 (Vasquez, 2021). Another station was established in the South Pole. Vasquez (2021) states:

> "Data collection began in 1958; CO_2 levels now read 315 ppm… It wasn't until the end of the 1960s…that the data finally became clear. The Mauna Loa and South Pole CO_2 records, which would together become known as the Keeling Curve, showed that the CO_2 was undoubtedly rising—concentrations had increased to around 325 ppm."

In 1970, Charles Keeling warned the American Philosophical Society of the coming era of Climate Change by accumulating the CO_2 in the atmosphere:

> "[I]f present trends are any sign, mankind's world…will be *in greater immediate danger*… If the human race *survives into the twenty-first century*…the people living then…may…face *the threat of climatic change* brought about by *an uncontrolled increase in atmospheric CO_2 from fossil fuels*" (quoted in Vasquez [2021]; italics mine).

His warnings have been confirmed valid. By the time Keeling passed away in 2005, the global CO_2 levels had risen to 380 ppm, and we live the twenty-first century "*in greater immediate danger*" by "*the threat of climatic change* brought about by *an uncontrolled increase in atmospheric CO_2 from fossil fuels*" (ibid.; italics mine).

Section III will selectively illuminate interactions between Climate Change Theorists and US federal administrations in the 1960s~70s. I focus on this point because 1) USA was by far the biggest CO_2/GHG emitter of the 20th century, 2) USA was where Keeling and other theorists were warning the coming Climate Change, 3) my quick internet search let me find sources on this subject, and 4) the 1960s-70s must have been early enough for US administrations to employ 'Keeling Curve' and other data to avert the escalating GHGs emissions and the resultant Climate Change that has been killing numerous peoples annually in this century.

Ⅲ. How Presidents Johnson and Nixon Received Warnings

The US administrations of Lyndon B. Johnson (President, 1963-69) and Richard Nixon (President, 1969-74) were the earliest receivers of Climate Change warnings with the reliable records of Keeling Curve. While their predecessors and successors have also been responsible to today's Climate disasters, the Johnson-Nixson era deserves a particular attention as the 'initial period with solid data' predicting today's Climate disasters.

Carlin / History News Network (2020) states, prior to "Charles David Keeling conclusively showed that atmospheric CO_2 concentrations were rising," and even "[b]efore John F. Kennedy took office [President, 1961-63], many scientists were already warning that current emissions trends had the potential to

drastically alter the climate within decades" (italics mine). After Johnson succeeded the presidency, he received a book from his own President's Science Advisory Committee titled *RESTORING THE QUALITY OF OUR ENVIRONMENT: Report of The Environmental Pollution Panel*, dated November 1965. The book (317 pages) started with a critique: "Ours is a nation of affluence. But the technology that has permitted our affluence spews out vast quantities of waste and spent products that pollute our air, poison our water, and even impair our ability to feed ourselves."

The portion directly concerned with Climate was "APPENDIX Y4 Atmospheric Carbon Dioxide" (by *Chairman* Roger Revelle, "C. D. Keeling" and others), in which most relevant to us was "Section I. CARBON DIOXIDE FROM FOSSILE FUELS – THE INVISIBLE POLLUTANT." Its sub-section underlined that humanity's production of CO_2 had become about 25 times within one century and was further escalating.

> "Throughout those hundred years, the rate of fossil fuel combustion, and thus of CO_2 production, continually increased, on the average about 3.2 percent per year. *The amount produced in 1962 was almost 25 times the annual production in the mid-1860's. The rate of increase may be accelerating*. During the eight years from 1954 to 1962, the average rate of increase was 5%" (pp. 119; italics mine).

Section 1's "CONCLUSIONS AND FINDINGS" warned that by year 2000, the atmospheric CO_2 could cause much Climate Change: "By the year 2000 the increase in atmospheric CO_2 will be close to 25%. This may be sufficient to produce measurable and perhaps *marked changes in climate*..." (pp. 126-27;

italics mine). Moreover, it predicted that Climate Change would likely be harmful to humanity, and urged to explore the ways to counterbalance this atmospheric transformation.

> "The climate changes that may be produced by the increased CO_2 content could be *deleterious* from the point of view of human beings. The possibilities of deliberately bringing about *countervailing climate changes therefore need to be thoroughly explored*" (p. 127; italics mine).

Knowing Johnson very little, I hesitate to comment on how he received, reflected and responded to these warnings. But realizing that USA in the 1960s went through dramatic turmoil from the Civil Rights movement and the protest against the Vietnam War, I am not surprised that Johnson was swamped with other issues. Stated differently, even if Johnson understood Climate Change would be a serious issue, it is conceivable that Johnson gave higher priorities to those imminently explosive issues. Afterall, year 2000 would be 35 years later.

For the administration of Richard Nixon, I select Rachel Santarsiero's (2024) "The 'Carbon Dioxide Problem': Nixon's Inner Circle Debates the Climate Crisis" as the main source of information. She cites from the just posted "declassified documents" (in April 2024) by "the National Security Archive's Climate Change Transparency Project," which "seeks to uncover previously closed and classified documents that illuminate the policy debates and decisions that have guided the United States through more than 40 years of climate change negotiations and global environmental issues."

Santarsiero (2024) indicates that, in public, Nixon expressed himself as a leader

committed to the environmentalist cause: "In his first State of the Union Address in 1970, President Nixon designated *the environment as the defining issue of the decade*: '*The great question of the Seventies* is… shall we *make our peace with nature* and begin to *make reparations for the damage we have done to our air, to our land, and to our water*?'" (italics mine).

Although Nixon proclaimed that the priority for the 1970s was Ecology-Human relation, his true Mind/Heart drastically differed from his pronouncement. Santarsiero (2024) informs:

> "According to historian Joan Hoff, Nixon 'turned the environmental policies over to Ehrlichman [John D., White House Domestic Affairs Advisor, 1969-73],' telling him to '*keep me out of trouble on environmental issues*,' while privately continuing to *call the environmental movement 'crap for clowns*'" (italics mine).
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> "Despite his green record as president, Nixon was…often *derisive in his personal opinions about environmentalism*. In a private meeting with Henry Ford II [CEO, Ford Motor Company, 1947-79], Nixon said *environmental predictions were 'greatly exaggerated*' and he *blasted environmentalists* for wanting humans to '*go back and live like a bunch of damned animals*'" (italics mine).
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> "Nixon and principal foreign policy advisor Henry Kissinger [National Security Advisor, 1959-75] *never* '*assigned any significance to environmental concerns*' in any of their later foreign policy writings" (italics mine).

Santarsiero (2024) believes Nixon's 'green posture' was entirely deceptive, reflecting only his "recognizing the huge political power of environmentalism" of the era. In addition to his twisted Heart, Nixon's Mind was stunningly impoverished, totally unaware that humanity exists only as a part of the ecological whole. Such his intellectual poverty is revealed in his labelling 1) the environmentalism as "crap for clowns," 2) alarming predictions advanced by the environmentalists as "greatly exaggerated" (though we now know that their predictions were indeed underestimated), and 3) non-human animals as "a bunch of damned animals" (although he shared 99% of Chimpanzee's DNA). Moreover, 4) asking his aid to "keep me out of trouble on environmental issues," and 5) reportedly never "assigned any significance to environmental concerns" show his disability to envision the catastrophic world by polluting it – a pathetically irresponsible attitude for President of the country with largest GHG emissions, and having much influence to affect the policy orientations worldwide.

Ⅳ. Wishing You Can Retain Much Hope for the Future

I apologize the readers two things: 1) I have just informed you one of the most upsetting and depressive stories of our species; 2) I failed to reserve enough space to have a constructive discussion for this concluding section.

For Point 1), Ralf Keeling (2024) represents the widespread despair common among the environmentally concerned people of my generation:

> "Not only is CO_2 now at the highest level in millions of years, it is also rising faster than ever. Each year achieves a higher maximum due to fossil-fuel burning, which releases pollution in the form of carbon dioxide into the atmosphere… Fossil fuel pollution just keeps building up,

> much like trash in a landfill" (quoted in Monroe, 2024).

Many of us, who have dedicated ourselves since the late 20th century to leave a reasonable environment for the younger generations, are gravely disappointed, as we find it incapable to envision a bright future. A few of us, however, are capable to come out with somewhat more positive consciousness. For instance, Leber (2024) states:

> Thanks to technological advancement, it's become even easier to imagine a future without fossil fuels. Though we can't correct for the wasted time derailed by fossil fuel misinformation campaigns and science conspiracy theories, we still have it in our power to take action today. The challenge, then as now, is one of political will.

I wish you can look at the state of the world like Rebecca Leber does, and enjoy exploring many hopes throughout your life. Thank you so much for having read and reflected on this modest article. Good luck with you.

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