Attachment A: The Consequences of the Climate Catastrophe Have Started and Will Worsen Exponentially

The Consequences of the Climate Catastrophe Have Already Started and will Worsen Over Time:

- Ongoing: Extreme Weather
- Ongoing: Wildlife Populations Reaching Point of No Return
- 2024-2030: Decline of Pollinators: Insect and Bird Populations
- 2025-Onward: Conflicts Over Dwindling Resources (Water, Land, Food, Fuel)
- 2030-2040: Massive Collapse of Agriculture
- 2040-2050: Massive Acceleration of Ecosystem and Biodiversity Loss
- 2050+: Mass Death of Humans

- **Ongoing: Extreme Weather**
  - Extreme heat waves in North America and the Middle East reaching almost 60°C
  - Severe storms and flooding in Eastern Europe and North Africa
  - 40% of the global population will live in areas experiencing severe water stress in the next 5 years
  - Unprecedented wildfires raging across Canada, the United States, Greece, and Algeria in 2023. resulted in 2.98 million tons of CO_2 emissions—(647 million cars)
  - Increasing frequency and severity of extreme sand and dust storms in the Middle East and North Africa
- **Ongoing: Wildlife Populations Reaching Point of No Return**
  - Wildlife populations have plummeted by 73% on average since 1970
  - In biodiversity-rich regions like Latin America and the Caribbean, declines have reached as high as 95%
  - Freshwater species have experienced a population decline of 85% in the past 50 years

Attachment A: The Consequences of the Climate Catastrophe Have Started and Will Worsen Exponentially

- **2024-2030: Decline of Pollinators: Insect and Bird Populations**
  - Decline of 45% in insect populations compared to the 1980s
  - 40% at risk of becoming extinct in the coming 20 years
- **2025-Onward: Conflicts Over Dwindling Resources (Water, Land, Food, Fuel)**
  - Escalating conflicts over water access in arid regions
  - 90% of soils degraded by 2040, leading to food shortages and land conflicts.
  - Disruption of energy supplies will heighten competition for fossil fuels
- **2030-2040: Massive Collapse of Agriculture**
  - By 2030, an estimated 40% of the global population will be living in areas of severe water stress
  - 90% of the world's soils face degradation by 2040
  - ~900 million people expected to be facing hunger by mid century
- **2040-2050: Massive Acceleration of Ecosystem and Biodiversity Loss**
  - Over 1 million plant and animal species at risk of extinction
  - About one-third of global freshwater biodiversity has already been lost, with further loss projected to 2050
- **2050+: Mass Death of Humans**
  - By 2050 climate change may cause 14.5 million deaths
  - 8.5 million extra deaths due to floods
  - 500 million people at risk of vector-borne disease

Attachment B: Carbon Looping and Tipping Points Excluded from Net-Zero Model Continue Warming the Planet and Lead to Ecological Systems Collapse

Indirect Emissions Triggered by Human Actions Keep Warming the Planet Even After Reaching Net-Zero

- **Carbon Looping: Positive feedback loops that accelerate global warming (even after emissions cease, existing atmospheric GHG continues to warm the planet)**
  - Examples:
    - Reduced ice cover, reflects less sunlight/heat, creates positive feedback loops that amplify warming.
    - As temperatures rise, permafrost (permanently frozen soil) in the Arctic begins to thaw releasing huge amounts of methane and other GHG
- **Tipping Points: Critical thresholds in ecological systems where small changes can lead to significant and often irreversible impacts**
  - Examples:
    - The Amazon transitioning to a degraded savannah/desert. This shift may occur if 20% to 25% of the forest is lost due to deforestation, with approximately 17% already lost.
    - Coral reef bleaching. A rise in only 1-2°C results in the loss of up to 90% of coral cover, which destabilizes entire marine ecosystems
    - Change in ocean currents are leading to a collapse of jet streams that will cause more extreme weather and rising oceans

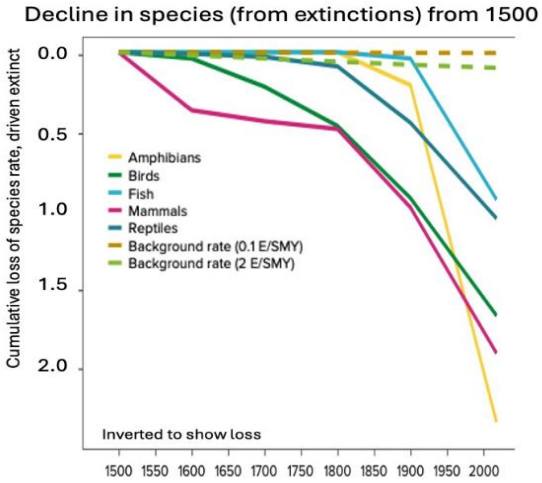
Attachment B: Carbon Looping and Tipping Points Excluded from Net-Zero Model Continue Warming the Planet and Lead to Ecological Systems Collapse

- **Ecological Systems Collapse: As feedback loops intensify and tipping points are reached, they cause ecological systems to collapse**
  - Examples:
    - Oceans and Aquatic Systems:
      - Collapse of the Atlantic Meridional Overturning Circulation ("AMOC")
      - Death of over 25% of Marine Species Living in Coral Reefs
      - Ocean Acidification
      - Rapid Decline of Fresh Water Lakes
      - Mangrove and Wetland Die-off
      - Irreversible Ground Water Decline
    - Glaciers
      - Melting of Antarctica's "Doomsday Glacier"
      - Melting of the Arctic including Greenland's glaciers
    - Forests and Wildlife:
      - Massive Deforestation
      - Destruction of the entire Amazon River Basin
      - Boreal Forest Die-off Across the Northern Hemisphere
      - Extinction of Birds and Pollinators

Attachment B: Carbon Looping and Tipping Points Excluded from Net-Zero Model Continue Warming the Planet and Lead to Ecological Systems Collapse

Sources of Mass CO2 and Methane Release Create Positive Feedback Loops

Mass Death of Coral Reefs



Massive Decline of Global Species

Recorded Fires in the Amazon in the Past 50 Years

Attachment B: Carbon Looping and Tipping Points Excluded from Net-Zero Model Continue Warming the Planet and Lead to Ecological Systems Collapse

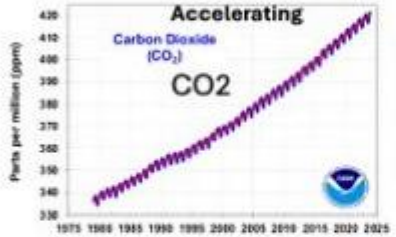
Accumulating GHG Leading to Carbon Looping and Tipping Points

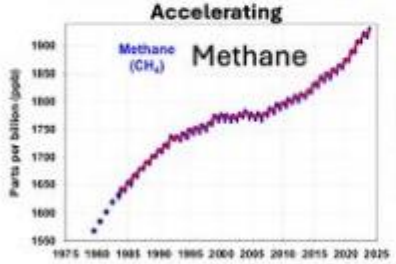
Accelerating Atmospheric Greenhouse Gases (2023)

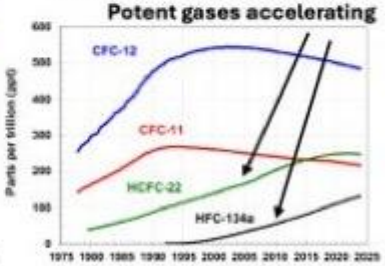
NOAA's Annual Greenhouse Gas Index Updated Summer 2024

CO2.

Atmospheric CO_2 has increased by an average of 1.90 ppm per year over the past 45 years (1979-2023).
This increase in CO_2 is accelerating — while it averaged 1.6 ppm /yr in the 1980s and 1.5 ppm /yr in the 1990s, the growth rate averaged 2.5 ppm per year during the last decade (2014-2023). **The annual increase 1 Jan 2023 - 1 Jan 2024 was 2.83 ppm (88% increase).**







METHANE

Atmospheric methane has increased more rapidly over the past few years than a any other point on record from (1983). The recent rapid increase follows a period from 1999 to 2006 when the atmospheric CH4 was nearly constant. Causes for the recent increase include warm temperatures in the Arctic in 2007 and increased precipitation in the tropics during 2007 and 2008 contributed in the early years (wetlands). Isotopic measurements argue for continued increasing microbial emissions after 2008 (i.e., from wetlands or agriculture)

NITROUS OXIDE

Atmospheric nitrous oxide continues to grow, **is also increasing**. The annual increas measured for N_2O during 2020, 2021 and 2022 are among the fastest recorded (1.3 ± ppb yr^{-1}).

Synthetic F-GASES (most potent & long lasting)

Effective radiative forcing from the sum of observed CFC changes ceased increasing in about 2000 and has continued to decline ever since.
Radiative forcing from HCFCs has recently peaked and started to decline. HFCs are increasing.
Radiative forcing from the sum of these three chemical classes has changed very little over the past decade
HFCs are manufactured mainly for use as refrigerants, including air conditioning and heat pumps. They are also used in foams, aerosols, fire protection and solvents. They were developed as alternatives to stratospheric ozone depleting chlorofluorocarbons (CFCs) Highly potent with warming 100s to 1000s X CO2
They are the fastest increasing greenhouse gases

Peter Carter, Climate Emergency Institute