



I William Haaf (Kennett Square, Pa 19348) am a scientist retired. I support RGGI and valid action steps to reduce burning fossil fuels for the following reasons:

I was employed by DuPont for 38 yrs. My last 15 were as corporate manager of Product Stewardship. I have closely followed the science and risks of climate change for over 25 yrs. I am very concerned about the huge risks to all our grandchildren from an overly heated planet. Anyone now 20 or younger will see many bad impacts including the terrible irreversible warming of both the permafrost and sea bed methane. The warming will cause much more green house gas emissions from these sources. This unstoppable release will greatly overheat the world resulting in: large land areas being too hot to live; huge coastal flooding; hundreds of millions displaced and must emigrate (no where to go); all polar bears dead; many forests dead from heat and drought; crop failures and yield losses; acidic oceans kill off all corals; fish stocks plummet and more. These impacts all pose a real threat to the viability of our civilization. Wars will ensue as water and food and cooler land becomes scarce.

We must quickly stop burning all fossil fuels and also capture carbon dioxide directly from the atmosphere. I support all energy generation that has zero or minimal GHG emissions. that includes fail safe nuclear. I also support carbon capture and sequestration. And tree and sea grass plantings.

**These issues and impacts are well explained in the following document.**

### **CLIMATE CHANGE EVIDENCE & CAUSES.**

<https://www.nap.edu/read/25733/chapter/1> .. Note hard copies are for sale. 5 for \$5.

**UPDATE 2020** *An overview from the Royal Society and the US National Academy of Sciences*



National Academy of Sciences. 2020. *Climate Change: Evidence and Causes: Update 2020*. Washington, DC: The National Academies Press. doi: 10.17226/25733.

**CLIMATE CHANGE IS ONE OF THE DEFINING ISSUES OF OUR**

**TIME.** It is now more certain than ever, based on many lines of evidence, that humans are changing Earth's climate. The atmosphere and oceans have warmed, which has been accompanied by sea level rise, a strong decline in Arctic sea ice, and other climate-related changes. The impacts of climate change on people and nature are increasingly apparent. Unprecedented flooding, heat waves, and wildfires have cost billions in damages. Habitats are undergoing rapid shifts in response to changing temperatures and precipitation patterns.

The Royal Society and the US National Academy of Sciences, with their similar missions to promote the use of science to benefit society and to inform critical policy debates, produced the original *Climate Change: Evidence and Causes* in 2014. It was written and reviewed by a UK-US team of leading climate scientists. This new edition, prepared by the same author team, has been updated with the most recent climate data and scientific analyses, all of which reinforce our understanding of human-caused climate change.

The evidence is clear. However, due to the nature of science, not every detail is ever totally settled or certain. Nor has every pertinent question yet been answered. Scientific evidence continues to be gathered around the world. Some things have become clearer and new insights have emerged. For example, the period of slower warming during the 2000s and early 2010s has ended with a dramatic jump to warmer temperatures between 2014 and 2015. Antarctic sea ice extent, which had been increasing, began to decline in 2014, reaching a record low in 2017 that has persisted. These and other recent observations have been woven into the discussions of the questions addressed in this booklet.

Calls for action are getting louder. The 2020 Global Risks Perception Survey from the World Economic Forum ranked climate change and related environmental issues as the top five global risks likely to occur within the next ten years. Yet, the international community still has far to go in showing increased ambition on mitigation, adaptation, and other ways to tackle climate change.

Scientific information is a vital component for society to make informed decisions about how to reduce the magnitude of climate change and how to adapt to its impacts. This booklet serves as a key reference document for decision makers, policy makers, educators, and others seeking authoritative answers about the current state of climate-change science.

**Marcia McNutt**

*President, National Academy of Sciences*

**Venki Ramakrishnan**  
*President, Royal Society*

## **SUMMARY**

### **CLIMATE CHANGE Q&A**

- 1 Is the climate warming?
- 2 How do scientists know that recent climate change is largely caused by human activities?
- 3 CO<sub>2</sub> is already in the atmosphere naturally, so why are emissions from human activity significant?
- 4 What role has the Sun played in climate change in recent decades?
- 5 What do changes in the vertical structure of atmospheric temperature—from the surface up to the stratosphere—tell us about the causes of recent climate change?
- 6 Climate is always changing. Why is climate change of concern now?
- 7 Is the current level of atmospheric CO<sub>2</sub> concentration unprecedented in Earth's history?
- 8 Is there a point at which adding more CO<sub>2</sub> will not cause further warming?
- 9 Does the rate of warming vary from one decade to another?
- 10 Did the slowdown of warming during the 2000s to early 2010s mean that climate change is no longer happening?

### **THE BASICS OF CLIMATE CHANGE**

#### **CLIMATE CHANGE Q&A (continued)**

- 11 If the world is warming, why are some winters and summers still very cold?
- 12 Why is Arctic sea ice decreasing while Antarctic sea ice has changed little?

13 How does climate change affect the strength and frequency of floods, droughts, hurricanes, and tornadoes?

14 How fast is sea level rising?

15 What is ocean acidification and why does it matter?

16 How confident are scientists that Earth will warm further over the coming century?

17 Are climate changes of a few degrees a cause for concern?

18 What are scientists doing to address key uncertainties in our understanding of the climate system?

19 Are disaster scenarios about tipping points like “turning off the Gulf Stream” and release of methane from the Arctic a cause for concern?

20 If emissions of greenhouse gases were stopped, would the climate return to the conditions of 200 years ago?

## **CONCLUSION.. ACKNOWLEDGEMENTS**

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