



## Climate Feedback Loops: Introduction

### Key Points and Guiding Questions

#### SUMMARY

Fossil fuel emissions from human activity are driving up Earth's temperature – yet something else is at work. The warming has set in motion nature's own feedback loops, which are raising temperatures even higher. The urgent question is: Are we approaching a point of no return, leading to an uninhabitable Earth? Or do we have the vision and will to slow, halt, and reverse these feedback loops?

Tip # 1: Get familiar with the content.

Tip # 2: Create connections between what viewers say in the discussion and key concepts from the film. Use your knowledge of the presentation to make these connections.

Tip #3: Practice empathy. This content may be hard to understand for some viewers.

## INTRODUCTION TO CLIMATE FEEDBACK LOOPS

- **Human-Caused Warming** – Humans are warming the planet by burning fossil fuels such as oil, coal, and natural gas, which emit carbon dioxide, methane, nitrous oxide, and other heat-trapping gases into the atmosphere.
- **Feedback Loops** – The warming climate triggers nature’s own warming mechanisms, or feedback loops.  
Fossil fuel emissions → warming climate → feedback loops triggered → heat-trapping gases emitted → more warming → more feedback loops

An example of a feedback loop is the warmer atmosphere thaws permafrost, which emits carbon dioxide and methane, which in turn warms the atmosphere further.

- **Tipping Points** – A tipping point in the climate system is a threshold that, when exceeded, can lead to large changes in the state of the system. Tipping points can form a cascade, with each one triggering others, creating an irreversible shift to a hotter world.
- **A Climate Suited to Life** – The sun’s radiation passes through atmospheric gases, such as oxygen and nitrogen, to Earth’s surface, which absorbs some of the radiation. The rest would bounce back to space, except for less than 1% of atmospheric gases, such as carbon dioxide, methane, nitrous oxide, water vapor, and others, that trap heat and warm the atmosphere. These greenhouse gases are essential in regulating Earth’s climate.
- **Earth’s Geologic Past** – The geological record shows that millions of years ago, complex global processes, including feedback loops run amok, led to abrupt changes in Earth’s climate system, resulting in “Snowball Earth” periods, when the planet was covered in snow and ice, and “Hothouse” periods, when there was virtually no ice, and dinosaurs roamed forests and swamps at the poles. This is the first time that humans have been responsible for a climate change this abrupt.
- **Rising Carbon Dioxide** – Since the Industrial Revolution, CO<sub>2</sub> has risen from 280 parts per million (ppm) to over 415 ppm today. By the end of the century, the level could approach 800 ppm. Doubling CO<sub>2</sub> from pre-industrial levels could produce a temperature rise of more than 8 degrees Fahrenheit.
- **Carbon Absorption** – Today, oceans absorb around one-quarter of the CO<sub>2</sub> in the atmosphere and plants absorb approximately another quarter.

But this percentage is shrinking as forests are destroyed and oceans warm.

- **Climate Modeling** – Because of early groundwork and experimentation in the field of climate modeling, recent models have accurately predicted what we’re seeing today and what the future holds for the climate.
- **Climate Policy** – Climate policy should be designed to avoid setting off feedback loops and crossing tipping points, but scientists don’t know yet how much more warming the planet can accommodate.
- **Reversing Feedback Loops** – If we cut fossil fuel emissions, stop deforestation, and regreen the Earth, we could slow, stop, and reverse feedback loops and begin to cool the planet. But even if we cut emissions today, it would take hundreds to thousands of years for the climate to return to what it was before humans began warming it. If we don’t act, we will have tripled the atmospheric CO<sub>2</sub> content over its preindustrial levels by the end of the century.
- **How to Change** – We have the technology and knowledge to stop the feedback loops. But we need leaders who understand the urgency of the climate crisis and an energized public to advocate for change.

## Discussion Questions:

### Feedback Loops

What is a positive feedback loop? What is a negative feedback loop?

A positive feedback loop enhances or amplifies the effects of change, producing instability, such as warming creating more warming. A negative feedback loop reduces and or dampens the effect of change, helping maintain balance.

Have you heard of feedback loops before? If so, where?

Can you think of examples of positive and negative feedback loops from your everyday experience?

What is warming the Earth and setting off feedback loops?

Why are feedback loops so important in understanding climate change?

Is it possible to slow, halt, or reverse feedback loops?

## **Introduction**

How is the guitar, speaker, and mic illustration an example of a positive feedback loop?

What is a tipping point? Can you give an example? What will happen if the climate reaches a tipping point?

How is Earth's climate regulated so it's just right for life?

What are heat-trapping gases and what percentage of the atmosphere do they represent?

Can you name some of the heat-trapping gases?

How much heat do oxygen and nitrogen absorb?

Is heat absorbed by heat-trapping gases as it comes from the sun to Earth? Or is it absorbed as it bounces off the Earth and goes back into space?

What happened during periods of Snowball Earth and Hothouse Earth?

What do Snowball and Hothouse Earth tell us about what is possible when it comes to our climate?

Why is a warming climate such a threat to human life on the planet?

How do particular images impact your reaction and reception of the messages in the film? What images had the biggest impact on you?

Have you heard anything in the news lately that affirms or contradicts any of the issues presented in this film?

## **General**

Should we focus on reducing emissions of carbon or focus on finding ways to store it? Or both?

Do you think we can continue living the way we have been while also reducing global warming?

How can we manage Earth in ways that help us mitigate climate change? What are some possible positive steps humans can initiate?

*What do you feel motivated to do?* The film ends with a message of the need to act. While feedback loops mean that one problem can cause many more, they also imply that one solution can trigger many others. What are some possible action steps humans can take?

Why is the content of this film important for the world to know?

## Resources:

[Tipping Points and Feedback Loops](#)

[Why Positive Climate Feedbacks Are So Bad](#)

[15 Climate Feedback Loops and Examples](#)

[How Feedback Loops Are Making the Climate Crisis Worse](#)

[When Nature Harms Itself](#)

[Drawdown - Solutions to decrease your carbon footprint](#)

[How You Can Stop Global Warming](#)