Video 8

Climate Change in the Arctic, Part I
The Arctic Ice Cap

Hello! I'm very glad to see you again.

Now that we have looked at the Big Picture—the First Global Generation in Human History, and the Renaissance which you have the *opportunity* to build—let's turn our attention to the urgent crisis which you face today.

Global warming is the warming of our entire planet, caused by the blanket of pollution which we have wrapped around our once beautiful Earth. *Climate change* is the complex mix of changes in the climate *in a specific region of the world*. I would like to talk with you today about climate change in the Arctic, at the very top of our planet. I have lived in the Arctic—above the Arctic Circle in northern Norway—for ten years as a teacher, so part of what I say today comes from personal experience, and part comes from reading a multitude of books and articles.

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One of the most important features of planet Earth is the thin sheet of curving ice which caps the top of our planet. This sheet of ice, only one to four meters thick, floats on the Arctic Ocean.

During the Arctic winter—when planet Earth points her axis away from the sun—the top of our planet is dark. Without sunlight, the Arctic becomes extremely cold, and thus the ice cap *expands* in surface area. The curving sheet of ice reaches as far south as the northern coast of Russia, and the northern islands of Canada, as well as the coast of Greenland.

During the Arctic summer—when planet Earth points her axis toward the sun—the top of our planet is bathed day and night in sunshine. The Arctic becomes much warmer, and thus the ice cap *shrinks* in area. The curving sheet of ice reaches its smallest size in mid-September.

As the ice cap shrinks during the summer, it exposes more and more open water around it. The white ice and its blanket of snow *reflect* most of the light from the sun. However, the dark water of the Arctic Ocean *absorbs* most of the light from the sun, and thus the water becomes incrementally warmer. As the water becomes warmer, it

melts the ice sheet *from below*, causing the ice to melt at the edges, and thus to shrink even further. The melting from below also causes the ice sheet to become thinner, and thus more fragile.

Now listen carefully, and you will understand how this melting process becomes a *feedback loop*: feeding itself so that the process happens faster and faster.

As the ice cap melts, it reveals more and more open water. That water absorbs more and more sunlight, and thus becomes warmer and warmer. The warming water melts more and more ice, which reveals more and more open water. The melting happens faster and faster; it *accelerates*.

Satellites have been measuring the Arctic ice cap since 1979. During the summer of 2012, the ice cap shrank to its smallest size, setting a record. On February 25, 2015, the maximum winter size of the ice cap was the smallest on record. For forty years, we have watched a crucially important feature of planet Earth . . . as it slowly disappears.

We are losing our heat shield. The Arctic ice cap *reflects* about 90% of the sunlight that shines on it, sending that light back out into space. The Arctic Ocean *absorbs* about 90% of the sunlight, keeping that surplus energy—in the form of heat—right here on planet Earth.

Thus the planet becomes steadily warmer. This is one cause of global warming.

Scientists tell us that the sheet of ice has capped our world for roughly three million years. Anthropologists tell us that our earliest human ancestors first appeared in East Africa three million years ago. Ever since human creatures built their fires and hunted in groups, the Arctic ice cap has been keeping our planet at a steady, cool temperature. Now modern humans—with all of our intelligence—are knowingly and willfully destroying our heat shield.

So here is a Big Question for you: Should we be doing this?

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Now consider that as the Arctic Ocean warms, the winds blowing across the surface of the water become warmer. Those warming winds blow across the land which surrounds the Arctic: northern Russia, Alaska, northern Canada, and northern Scandinavia. Much of this land is *tundra*, defined as:

"A level or rolling treeless plain that is characteristic of arctic and subarctic regions. Tundra consists of black mucky soil with *a permanently frozen subsoil*. Tundra has a dominant vegetation of mosses, lichens, herbs, and dwarf shrubs. Tundra may also refer to similar regions confined to mountainous areas above the timberline."

(*Tundra* is an ancient word, coming originally from the Kildin Sami people who have been herding their reindeer for thousands of years on the Kola Peninsula in what is now northwest Russia.)

Note that tundra has "a permanently frozen subsoil". This is the "permafrost", soil just beneath the surface of the tundra which has been frozen since the last ice age. The upper layer, called the "active layer", which is a few meters thick, thaws during the warm summer, then freezes during the winter. The lower layer, which can be hundreds of meters thick, remains permanently frozen, a remnant of the last ice age.

Now here's the problem. Before the last ice age, the land wrapping around the Arctic Ocean was covered with thick vegetation, including trees. Animals such as wooly mammoths lived in the northern forests. The soil, much warmer then, was filled with bacteria which fed on dead plant and animal matter, as bacteria still do today. As a byproduct of their metabolism, the bacteria released methane, as bacteria still do today.

When the planet slowly became colder (just before the last ice age), the plants and animals living at the top of the world gradually died. They provided a feast for the bacteria. When snow and eventually ice covered the land, the organic matter, including the bacteria, was capped by the ice. Vast quantities of methane were trapped within the frozen soil.

Until now. As the Arctic Ocean warms more and more each year, the winds blowing across the surface become warmer. The winds blow across the surrounding land, warming the tundra and thus . . . thawing the permafrost. Already bubbles of methane are rising up from the rotten ice in the soil. These bubbles, rising from the bottom of the many lakes, may be trapped in the ice forming on the lakes in the autumn. People have bored down into this ice, releasing the methane. When they hold a cigarette lighter to the escaping gas, BOOM! Bright burning methane rises ten meters into the air.

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Now what does all of this mean for us?

As the Arctic ice cap melts at an accelerating rate, the Arctic Ocean becomes warmer. The Arctic winds become warmer. The tundra becomes warmer. The permafrost thaws at an accelerating rate, as it is now doing in a giant ring around the top of the world. Increasing amounts of carbon dioxide and methane are released from the thawing soil; they rise into the atmosphere and contribute increasingly to the ever thickening blanket of greenhouse gases.

As a greenhouse gas, methane retains far more heat than carbon dioxide. Both gases will remain in our atmosphere, blanketing the planet, for decades at least.

Thus the release of Arctic methane on a planetary scale can cause substantial warming to our world, in the near future.

When will we reach the *methane tipping point*, when the permafrost has thawed to the point where methane is released in dangerous quantities? We don't know.

We *do* know that summer after summer, heat waves around the world set new records. Drought parches the farmland. Wildfires are burning from California to Siberia.

We also know that the Arctic is warming much faster than the rest of the planet.

Methane is the Big One. Oil companies do not talk about the methane trapped in the Arctic permafrost. Paid politicians do not talk about methane. Most schools do not talk about methane.

Scientists *do* talk about methane. But they wonder, Is anyone listening?

My hope, Young People of the World, is that *you* are listening.

Thank you.

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John Slade

Saturday morning
February 9, 2019.
Back from Trondheim, sick from stomach flu.