Lands surface change on Alaska tundra creating longer, warmer summers in Arctic

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A gradual lengthening of the snow-free season in Alaska's tundra, and a corresponding northward progression of the growth of shrubs and trees, may be creating a cycle of warmer and longer summers in the Alaskan Arctic according to a new study to be published in the Sept. 22, 2005, issue of *Science Express*.

The resulting atmospheric heating in the region of northern Alaska is equivalent to what might be observed if there was a doubling of carbon dioxide in the atmosphere. Continuation of this trend could further amplify atmospheric heating in the region by two to seven times and could possibly contribute to broader changes in climate.

"We suggest that a noticeable summer warming trend in Alaska is best explained by a lengthening of the snow-free season there," said Howard E. Epstein, an associate professor of environmental sciences at the University of Virginia and a co-author of the new study. The scientists determined that the increasing summer temperatures in northern Alaska could not be attributed to regional atmospheric circulation patterns or to a reduction in sea ice in the summer or to an increase in cloud cover. The observed summer temperature increases are likely related to a global warming trend that has led to a longer snow-free season and an increase in the extent of woody vegetation. Both of these changes increase the amount of solar radiation that goes into heating rather than being reflected back to the atmosphere.

Epstein said that since the early 1960s the spring thaw in Alaska's tundra

country is arriving an average of 2.3 days earlier each decade. As a result, plants in the region now "leaf out" about 2.7 days earlier than in previous decades. Likewise, the first freeze each year is arriving slightly later, allowing plants to extend their growing season. The longer growing season is allowing shrubs and trees to slowly migrate northward. The increasing woody vegetation is further warming the near-surface atmosphere by absorbing rather than reflecting incoming solar radiation.

"The vegetation change is pretty dramatic," Epstein said. "The tundra is getting greener, and there is a noticeable increase in shrubs. This is observable from satellite data and by observations on the ground. Native American people in the region and nearby areas also have noted the changes in weather and vegetation."

Because there is a shorter period of snow on the ground, solar radiation is absorbed by the land surface more readily and contributes to heating, thus accelerating the melting of snow and allowing for more plant growth. Over time, as the permafrost begins to melt, ancient organic matter that has been frozen for thousands of years is exposed, potentially adding more carbon dioxide to the atmosphere.

The result is a positive feedback loop that could continue to raise temperatures in the region and further lengthen the snow-free period each year.

Since the early 1960s, scientists have identified "hotspots" of slowly increasing average summer temperatures in the Arctic, from 0.15 degrees Celsius to about 2 degrees Celsius for an average increase of 1.2 degrees Celsius in the summertime.

"We know that certain parts of the Arctic are warming pretty substantially and more so than in other regions around the globe," Epstein said. "This is significant because conditions in the Arctic affect

global atmosphere conditions. The Arctic is dominated by snow and ice, and if this condition were to change, even subtly, there is potential for further change to the global climate."

Source: University of Virginia