

Half U.S. Climate Warming Due to Land Use Changes

COLLEGE PARK, Maryland, May 28, 2003 (ENS) - The growth of cities and industrial agriculture is responsible for more of the rise in temperature across the United States than scientists previously believed, according to a new study by scientists at the University of Maryland. They found that land use changes may account for up to half of the observed surface global warming.

Meteorologists Dr. Eugenia Kalnay and Dr. Ming Cai have found evidence that the observed temperature increase of 0.13 degrees Celsius (.234 degrees Fahrenheit) over the past 50 years has been influenced by changes in land use.

"Our estimates are that land use changes in the United States since the 1960s resulted in a rise of over 0.2 degrees Fahrenheit (F) in the mean surface temperature, an estimate twice as high as those of previous studies," said Kalnay. "We expect to extend our study to obtain global results later this year," she said.

Dr. Eugenia Kalnay is working to determine the effect of urbanization and land use on climate change. (Photo courtesy U. Maryland)

A Distinguished Professor of meteorology at the university and a Member of the National Academy of Engineering, Kalnay served as director of the Environmental Modeling Center of the National Centers for Environmental Prediction of the National Weather Service from 1987 through 1997. There she led the development of ensemble forecasts and other modeling improvements at the National Weather Service that made possible accurate three and five day forecasts.

Kalnay and Cai estimated the impact of land use effects by comparing trends in surface temperature measurements taken at 1,982 surface weather stations around the country with trends based on data from satellite and weather balloons from the U.S. National Centers for Environmental Prediction and the National Center for Atmospheric Research.

Over the past century, the Earth has warmed by about one degree Fahrenheit, and scientists expect the average global temperature to increase an additional two to six degrees F over the next 100 years.

Most scientists think the global warming trend is mainly the result of human activities, such as the emission of greenhouse gases from power plants, manufacturing, cars and trucks. Land use change has been seen as a smaller factor in this trend.

"The larger effect found in this study is likely because our method covers all changes in land use. Previous methods for estimating the impact of land use change relied on measures - population counts or satellite measures of light at night - that only provide an indication of the effects of urbanization, but not of other changes in land use," said Kalnay.

Harvesting corn in the Mt. Horeb area of Wisconsin (Photo by Bob Allen courtesy NREL)

The effects of land conversion to agriculture has not been taken into account in previous studies. But the comparison of urban and rural weather stations, without including agricultural effects, would underestimate the total impact of land use changes, Kalnay and Cai write in their paper. The well known "urban heat island" effect actually takes place at nighttime, the two scientists write, "when buildings and streets release the solar heating absorbed during the day."

At the time of maximum temperature, the urban effect is one of slight cooling due to shading, aerosols, and to thermal inertia differences between city and country that are not currently well understood, they write.

The effect of agricultural development, increasing evaporation during the day, also would tend to decrease the maximum temperature, but "irrigation would increase the heat capacity of the soil, thus increasing the minimum temperature," they state.

They conclude that, "Both urbanization and agriculture effects could be consistent with the general increase in the minimum temperature and slight decrease in the maximum temperature."

The actual changes in temperature may appear small, but when small changes in the average temperature last for a long time, they can cause dramatic changes in the climate, the scientists say. At the peak of the last Ice Age, 18,000 years ago, the average temperature was only seven degrees F colder than today, and glaciers covered much of North America.

Drs. Cai and Kalnay's study, "Estimating the Impact of Urbanization and Land Use on US Surface Temperature Trends: Preliminary Report," will be published in Thursday's issue of the journal "Nature."

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