

The Millbrook Independent

VOICE OF THE MILLBROOK REGION

Citizen Scientist

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August 8, 2017

In the politically-charged world of climate change, an important paper appeared in *Science* last month, written by Solomon Hsiang and 11 others, assessing the regional impacts of the projected changes in climate on the economic productivity within the U.S. The work was comprehensive, including impacts on crops, mortality, crime, labor supply, and demand for electricity. To some extent, the assessment was conservative; the impacts on mortality, as a proxy for our health, did not appear to include the impacts of arachnid- and insect-borne diseases, such as Lyme disease, Zika and West Nile Virus, which are spreading northward in a warming climate. The economic impacts did not include the impacts of increased ocean acidity on the coastal fisheries in different regions. Nevertheless, the work provides some fascinating new insights.

Despite experimental evidence for beneficial effects of higher CO₂ on plant growth, this analysis suggests that agricultural yields will decline in warmer temperatures—albeit more slowly when climate change was accompanied by high CO₂. We can anticipate food will cost more. Mortality and demand for electricity increase sharply with rising temperatures. Not good if you are poor or elderly. Apparently, the presumed benefits of warmer wintertime temperatures on health are overcome by increased mortality during summertime heat. The rising demand for electricity is driven by demand for air conditioning.

For me, the real surprise was the differential regional impacts on our economy. The Deep South (Texas and Oklahoma east to the Carolinas and Florida) will suffer the most, with 20 percent or more decline in Gross Domestic Product (GDP) by century's end. These regions will suffer the greatest rise in heat-related mortality, energy consumption, and sea-level rise, and coastal flooding.

The Midwest is not far behind in GDP losses, but there are also some putative “winners” in the economic scenario—New England and the northern tier of states from Washington to Minnesota. Mortality declines and crop yields increase in this region.

Overall, the impacts of climate change are likely to cause a 1.2% decline in GDP across the U.S. per one degree rise in temperature (C) and to increase income disparity. The losses are greatest where current elected officials are least concerned and most likely to deny the reality of human-induced climate change.

I suppose I shouldn't have been surprised when about a month later, the *Wall Street Journal* (31 July) carried an editorial “Climate Change Isn't the End of the World.” Ignoring the work

in *Science*, two members of conservative think tanks, David Henderson (Hoover Institution) and John Cochrane (The Cato Institute) argue that losses of 10% GDP over a century amount to only 0.1%/yr, which humans can easily accommodate through adaptation, substitution and migration. They argue that there are far greater problems that weigh on us each day—disease, terrorism, war, and famine.

Notwithstanding that several studies link increasing disease, terrorism and famine to changing (warming) climate, what Henderson and Cochrane ignore are changes that are permanent, such as species extinctions, and tipping points in the climate system, such as melting of Arctic sea ice, that are likely to push the Earth's climate system into rapid, irreversible trajectories. Mass human migrations have a track record of social disruption.

In a delightful little book, *You Can't Eat GNP*, published in 2000, Eric Davidson argues that economics cannot guide the path to all environmental solutions. The book should be read by Henderson, Cochrane and all elected officials who deny the reality of climate-change science. And, for the staunch advocates of economics, the paper by Solomon Hsiang and his team provides a sobering new analysis of what we face.