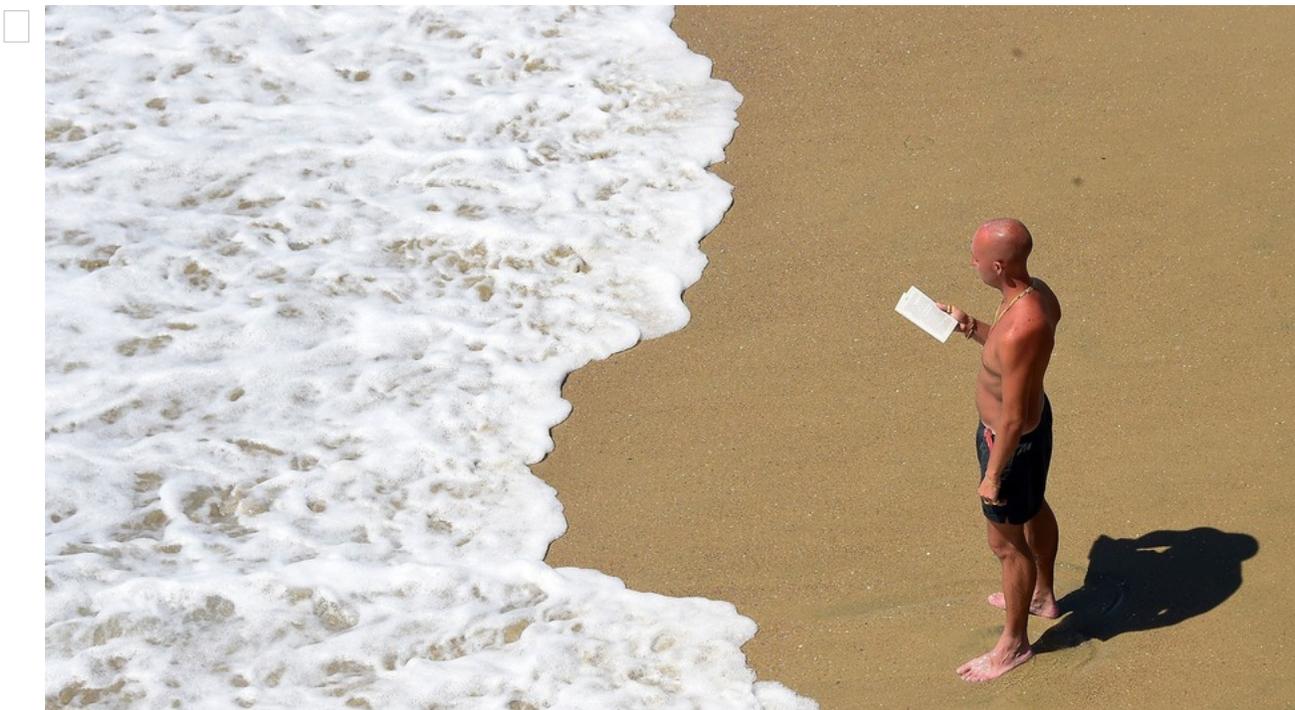


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## Heat stress from global warming may stifle economic growth, new studies show

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Waves wash ashore at Huntington Beach in California on September 10, 2015, amid a heat wave where temperatures reached triple digits in parts of Southern California.

IMAGE: FREDERIC J. BROWN/AFP/GETTY IMAGES

BY ANDREW FREEDMAN  
1 DAY AGO

Global warming poses a major economic risk worldwide due to increasing heat extremes, according to three new studies published in the past week alone.

Taken together, they add up to a warning that the world may not be able to adapt to rising temperatures simply by increasing the use of air conditioning, and in fact the costs of increased extreme heat events might be far higher than previously estimated.

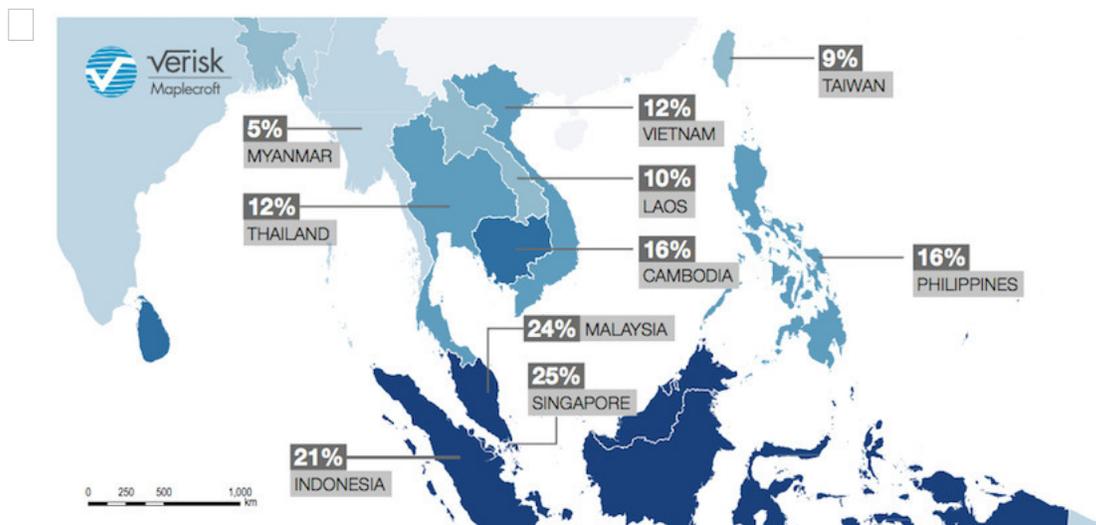
In the most recent study to be released, Verisk Maplecroft published a report on Wednesday pointing to two regions of the world its analysts say will experience more prevalent heat stress conditions during the next three decades: Southeast Asia and Central America. Heat stress acts as a depressant on human labor productivity, due to the risk of heat-related illnesses on particularly hot days. Thailand, in particular, is forecast to shift from "high risk" on the organization's

Heat stress from global warming may stifle economic growth, new studies show  
Heat Stress Index to "extreme risk" by the middle of the current century.

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Southeast Asian nations such as Thailand have become major high-tech manufacturing centers, meaning that a drop in productivity could affect the market for computer chips and other equipment.



Projected labor capacity reduction in Southeast Asia by 2045 due to heat stress.

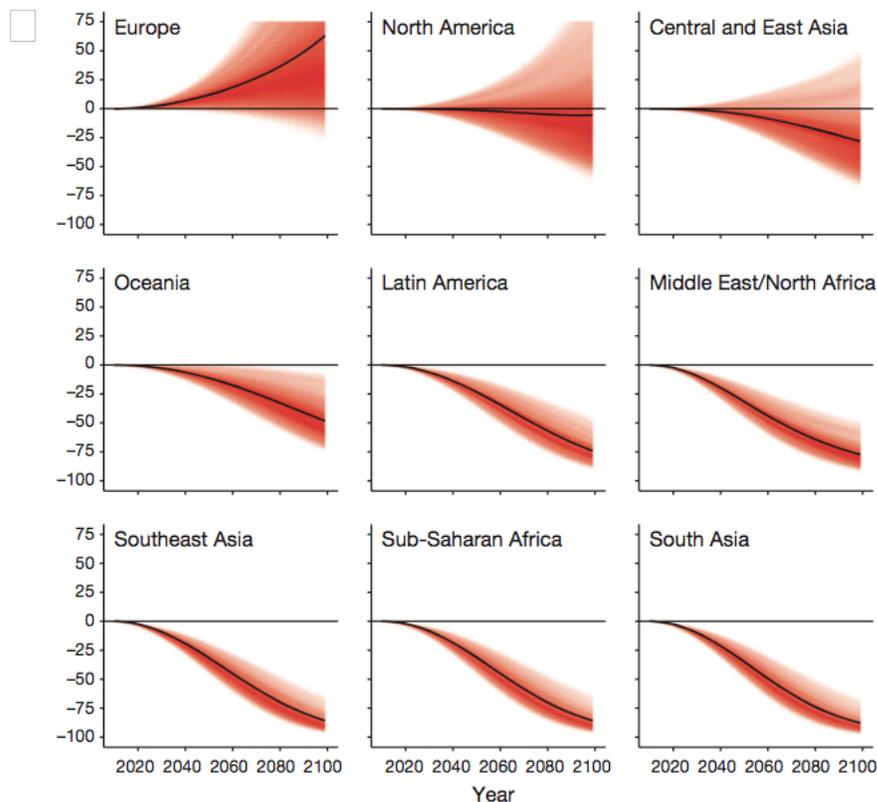
IMAGE: VERISK MAPLECROFT

"Climate change is being viewed increasingly through an economic lens, with a strong focus on the impacts on emerging markets," the report states. "Future increases in heat stress are expected to have a particularly negative impact on South East Asia's labor capacity. Many countries in this region have a limited financial and technical capacity to adapt to climate change impacts, which may deter some investment as the awareness of climate-related financial risks grows."

A key point in the Verisk Maplecroft report is that the same area of the world that is projected to have the most rapid economic growth in the future will also quickly run into headwinds from increases in heat stress. "The potential impact of increasing heat stress on labor capital in these regions has been largely overlooked," the report states.

The study predicts a 16% decrease in labor capacity due to heat stress across Southeast Asia, a greater plunge than in any other region, through the year 2045.

The Verisk Maplecroft study shows that within a generation, economies in Singapore, Malaysia, Indonesia and the Philippines could be as much as a quarter less productive, economically speaking, than they are today.



Change in GDP per capita under a business as usual emissions scenario, relative to a projection using constant 1980-2010 average temperatures.

IMAGE: BURKE ET AL./NATURE 2015.

"Incremental rises in global temperature and humidity due to climate change are likely to increase the number of working days exceeding safe levels of heat stress, which can cause absenteeism through dizziness, fatigue and nausea and even death in extreme cases," the report states.

Verisk Maplecroft estimates that Southeast Asia could lose 16% of current labor capacity due to rising heat stress over the next three decades. Singapore and Malaysia are predicted to experience the heaviest toll, with 25% and 24% decreases from current levels, respectively, while Indonesia could see a 21% drop, and Cambodia and the Philippines could drop 16%.

"Areas that are warm today will be warm in the future," said Richard Hewston, principal environmental analyst at Verisk Maplecroft, in an interview with *Mashable*.

The company found that the risk of lost labor capacity due to heat stress will be especially high in Kuala Lumpur, Singapore and Jakarta. Malaysia alone is home to 20 of the 50 global cities identified as losing the most labor capacity to heat stress, with 13 such cities located in Indonesia.

"Although heat stress conditions may be worse in Singapore, they're potentially in a better position to be dealing with those heat conditions in the future," Hewston said, noting the widespread use of air conditioning when compared to other southeast Asian nations like Cambodia and Thailand.

North American emissions



The study was based on computer model forecasts using a "business as usual" emissions scenario, in which the world takes little action to reduce greenhouse gas emissions through at least the mid-century, and calculated heat stress using a measurement of temperature and humidity known as the "wet bulb" temperature. This temperature measures the human body's ability to keep cool under particular conditions.

### 'Goldilocks temperature'

The Verisk research joins two other studies published in the past week showing that not only might increased heat stress have a much more significant economic impact than previously thought, such impacts may occur earlier than thought as well.

According to a study published in Nature on Oct. 21, economic productivity in all countries peaks when the average annual temperature is about 55 degrees Fahrenheit, or 13 degrees Celsius. Once temperatures go much above that, economic output drops at an increasingly steeper rate.

The study, produced by a team of researchers at Stanford University and University of California, Berkeley, found that unmitigated warming could reduce average global incomes by roughly 23% by the year 2100, while also widening global income inequality between rich and poor nations.

135 Years of Global Warming in 30 seconds



The study is noteworthy because it shows far higher economic losses from heat stress than previous studies had, which is due to its superior modeling of both climate and economic impacts, according to Solomon Hsiang, a co-author of the study and researcher at Stanford. The median losses in the new study, for example, are close to levels that well-known Yale environmental economist

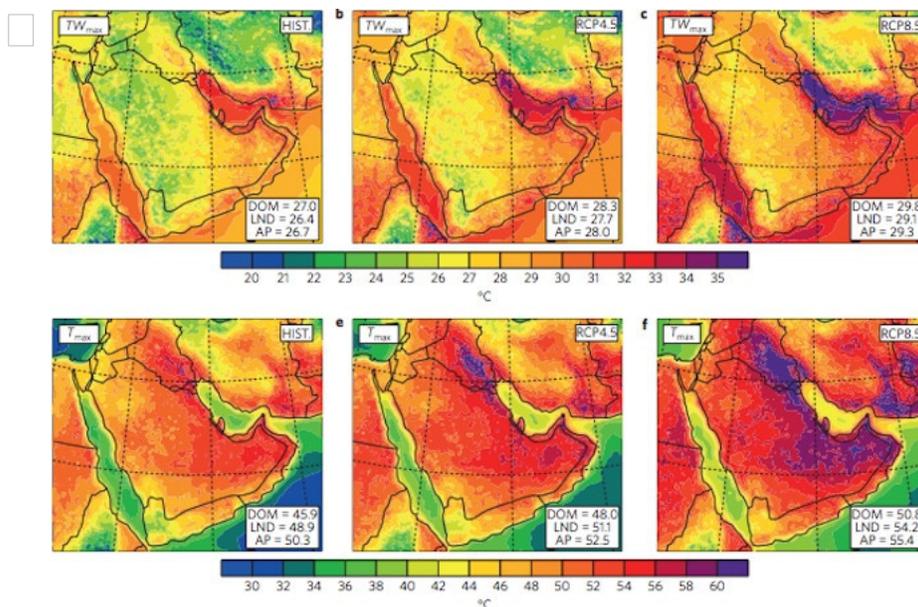
William Nordhaus views as a potentially catastrophic outlier scenario.

“We point out that old results were calibrated on studies in the 1990s,” Hsiang said in an interview. He said the new data shows that much higher costs are a middle-of-the-road result, not an outlier.

“What we found was climate change actually does affect growth,” he said.

“We’re just really good at doing stuff and producing things when the climate is reasonable,” he said. As was the case in the Verisk analysis, Hsiang and his colleagues found that countries that are already significantly above the 55-degree average annual temperature are the ones that will have the biggest drops in productivity as the climate continues to warm.

“The countries that are going to suffer the most are the ones that are the hottest today,” he said. “The poorer countries are the ones that are gonna lose the most and the very cold countries, those are among the countries that are going to benefit.”



### Spatial distributions of extreme wet bulb temperature and extreme temperature.

IMAGE: NATURE CLIMATE CHANGE

“It’s going to really reshape the structure of the global economy and how well-being is distributed around the planet.”

Yet another study, focused on the Middle East, found that parts of the region — including Doha, Dubai and the holy city of Mecca — could see extreme heat that would endanger public health for periods of time by the end of this century.

The heat wouldn’t render these areas uninhabitable over the long-term, however, but it could lead to significant short-term impacts on the scale of days to weeks.

This [study](#) was published in the journal *Nature Climate Change*.

The U.S. is not immune to these heat-related economic impacts, either. A [report released](#) in 2014 from the Rhodium Group found that, by 2050, the average American “will likely see” between 27 to 50 days with high temperatures exceeding 95 degrees Fahrenheit each year, which is three-times the average annual number seen during the past 30 years.

The study found that in parts of the U.S., especially the Southeast, there may be “several months of 95 degree Fahrenheit days” annually.

Such temperature spikes could dampen labor productivity as much as 3% by the end of the century for those working outside, including in construction and agriculture, the study found.

"Over the longer term, during portions of the year, extreme heat could surpass the threshold at which the human body can no longer maintain a normal core temperature without air conditioning," the study found. "During these periods, anyone whose job requires them to work outdoors, as well as anyone lacking access to air conditioning, will face severe health risks and potential death."

Hewston, of Verisk Maplecroft, said the three new studies (only two of which were published in peer-reviewed scientific journals), plus other earlier research, are "broadly in line," despite the different assumptions made in each study as well as the use of various scenarios that future greenhouse gas emissions may follow.

"We're seeing similar things in our data, some of the data vary slightly, [but] we're identifying similar hotspots," he said.

"The message is consistent, the data all aligns."

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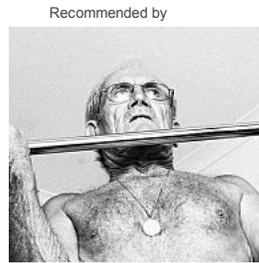
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