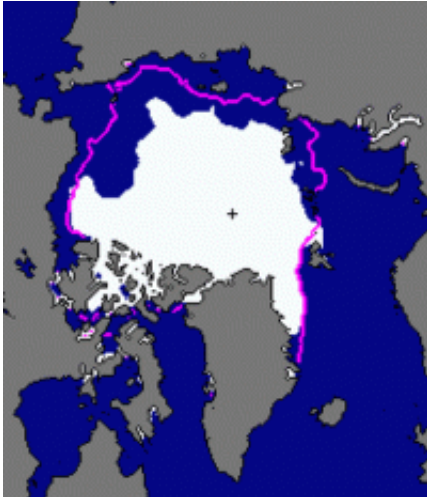


Climate 'Tipping Points' May Arrive Without Warning, Says Top Forecaster

9 February 2010



This graphic shows the extent of Arctic sea ice in September 2009 (in white) compared with the median ice extent for September from 1979 to 2000 (in magenta). (U.S. National Snow and Ice Data Center/map)

(PhysOrg.com) -- A new University of California, Davis, study by a top ecological forecaster says it is harder than experts thought to predict when sudden shifts in Earth's natural systems will occur -- a worrisome finding for scientists trying to identify the tipping points that could push climate change into an irreparable global disaster.

"Many scientists are looking for the warning signs that herald sudden changes in natural systems, in hopes of forestalling those changes, or improving our preparations for them," said UC Davis theoretical ecologist Alan Hastings. "Our new study found, unfortunately, that regime shifts with potentially large consequences can happen without warning -- systems can 'tip' precipitously.

"This means that some effects of global climate change on ecosystems can be seen only once the effects are dramatic. By that point returning the

system to a desirable state will be difficult, if not impossible."

The current study focuses on models from ecology, but its findings may be applicable to other complex systems, especially ones involving human dynamics such as harvesting of [fish stocks](#) or financial markets.

Hastings, a professor in the UC Davis Department of Environmental Science and Policy, is one of the world's top experts in using mathematical models (sets of equations) to understand natural systems. His current studies range from researching the dynamics of salmon and cod populations to modeling plant and animal species' response to global [climate change](#).

In 2006, Hastings received the Robert H. MacArthur Award, the highest honor given by the Ecological Society of America.

Hastings' collaborator and co-author on the new study, Derin Wysham, was previously a postdoctoral scholar at UC Davis and is now a research scientist in the Department of Computational and Systems Biology at the John Innes Center in Norwich, England.

Scientists widely agree that [global climate change](#) is already causing major environmental effects, such as changes in the frequency and intensity of precipitation, droughts, heat waves and wildfires; rising sea level; water shortages in arid regions; new and larger pest outbreaks afflicting crops and forests; and expanding ranges for tropical pathogens that cause human illness.

And they fear that worse is in store. As U.S. presidential science adviser John Holdren (not an author of the new UC Davis study) recently told a congressional committee: "Climate scientists worry about 'tipping points' ... thresholds beyond which a small additional increase in average temperature or

some associated climate variable results in major changes to the affected system."

Among the [tipping points](#) Holdren listed were: the complete disappearance of Arctic sea ice in summer, leading to drastic changes in ocean circulation and [climate](#) patterns across the whole Northern Hemisphere; acceleration of ice loss from the Greenland and Antarctic ice sheets, driving rates of sea-level increase to 6 feet or more per century; and ocean acidification from carbon dioxide absorption, causing massive disruption in ocean food webs.

More information: The study, "Regime shifts in ecological systems can occur with no warning," was published online today by the journal *Ecology Letters*, in its Early View feature: www3.interscience.wiley.com/jo.../123276879/abstract .

Provided by University of California - Davis

APA citation: Climate 'Tipping Points' May Arrive Without Warning, Says Top Forecaster (2010, February 9) retrieved 18 October 2019 from <https://phys.org/news/2010-02-climate.html>

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