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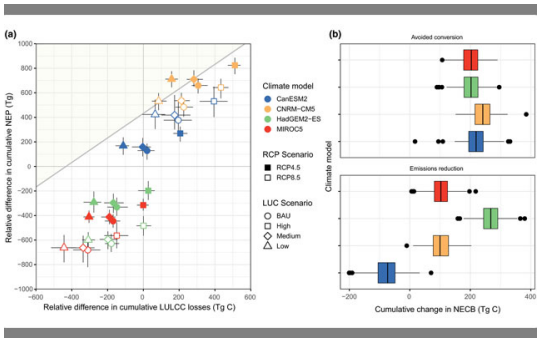
# SDSC's Comet Supercomputer Helps Researchers Predict Carbon Dioxide Levels

## Study points to changes in California's land-use since mid-1800s

The *Global Change Biology Journal* earlier this year published findings related to the Effects of 21st Century Climate, Land Use, and Disturbances on Ecosystem Carbon Balance in California after using the San Diego Supercomputer Center's *Comet* supercomputer to create simulations of various global climate, land-use, and emissions models.




*SDSC's* Comet *simulations show the relative effects of climate change (y-axis, increasing from top to bottom) and land-use and disturbances (x-axis, increasing from left to right) for 32 scenario simulations for the period 2017-2100. Shaded area represents area within the plot space where ecosystems were estimated to be a net carbon sink over the projected period. Error bars represent the Monte Carlo confidence intervals calculated for each scenario.* Benjamin Sleeter, USGS/Seattle WA

Their conclusion? The amount of carbon held in the Earth's terrestrial ecosystems is likely to decline by approximately 10 percent through the year 2100.

"Since 1850, land-use change has added nearly half as much carbon to the atmosphere as fossil fuel emissions and has exerted a dominant influence on the storage of carbon in terrestrial ecosystems," said Benjamin Sleeter, lead author of the study and a research geographer with the US Geological Survey (USGS) in Seattle, WA. "Our research presented the foundation to help assess how and where to implement changes to the way we manage our natural landscapes in our state and beyond."

These disturbed ecosystems discussed in the study refer to California's forests, shrublands, grasslands, and soils. When carbon dioxide – absorbed by vegetation and stored as carbon in the form of branches, trunks, roots, and in soil – is released back to the atmosphere, it can contribute to the acceleration of climate change. While this cycle of absorption and release is a very natural process, the researchers said that humans have accelerated the releases and slowed the absorption.

Sleeter said that he and his colleagues used *Comet* to investigate this notion in an objective light. That is, using USGS sources, they created simulations of a combination of four global climate models, four land use models, and two emissions models.

“Access to *Comet* allowed us to perform a rigorous uncertainty assessment by running four of the 32 scenarios many times,” said Sleeter. “We discovered that no matter how we ran the calculations, carbon dioxide will decline by nearly 10 percent within the next 80 years unless we work with policy-makers to promote both reduced land development and global climate action.”

While the four models were representative of all 32 scenarios, the results would likely be different if all 32 models were assessed, explained Sleeter. “More importantly, our framework didn’t include variability in key parameters, such as changes in vegetation type, which may result from the coupled effects of climate change and high-severity fire.”

The researchers plan to address these issues in subsequent studies.

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