NASA Calculates a Carbon Budget for California

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(PhysOrg.com) -- While world organizations struggle to find a benchmark and tracking standards for greenhouse gas (GHG) emissions, NASA has been supporting California's new carbon emissions inventory report, using its satellite imaging data and computer models of the state's natural ecosystems.

Researchers report that in 2004, the state's natural ecosystems absorbed as much carbon dioxide from the atmosphere as fossil fuel carbons emitted into the atmosphere. They also discovered that during periods of above normal rainfall, ecosystems trapped significant amounts of carbon dioxide from the atmosphere in forests and soils. For these reasons, researchers suggest the ecosystems should be more extensively protected and conserved, and their emissions be monitored as closely as fossil fuel sources of GHG emissions. The results, based largely on a computer model called the NASA-Carnegie Ames Stanford Approach (CASA), will be presented this morning at the 2009 American Geophysical Union Fall meeting in San Francisco.

"One way to facilitate emissions reductions is by using regional and national carbon budgets," explained Christopher Potter, senior research scientist at NASA Ames Research Center, Moffett Field, Calif., and author of this study. "California's growing population and demand for all forms of energy make it essential to maintain an accurate and complete accounting of the state's greenhouse emissions inventory," Potter added.

California's population is more than 10 percent of the total population in

the United States, and produces 13 percent of the U.S. gross domestic product, according to 2000 U.S. Census Bureau data. Because of its large population, the state also contributes significantly to global GHG emissions. If California was a country, it would rank among the top 20 national GHG emitters worldwide.

The carbon budget of a region is determined by the amounts of carbon dioxide and methane gases absorbed or released by “green” vegetative ground cover, as observed by NASA satellites. These fluctuations are important to quantify, because they originate from both natural and anthropogenic processes.

In California, the main sources of carbon dioxide emissions are energy consumption in commercial, residential, industrial, and transportation sectors, production of cement and lime, and waste treatment. The main sources of methane emission are derived from landfills and agricultural (principally livestock-based) systems.

Scientists believe that California’s carbon budget is of special interest because the state may represent a U.S. national carbon budget; both have diversified lands, similar consumption of natural resources, and urban lifestyles. Other similarities include a mix of fossil fuel emissions, alternative energy sources, and ecosystem sinks.

Each year, California is required by law to compile a new carbon emission inventory, which is conducted by the California Energy Commission and California’s Air Resources Board. To refine the state’s emission inventory, NASA was asked to provide NASA satellite imaging data and carbon models. To locate the largest ecosystem sources and carbon sinks in California, scientists used the Moderate Resolution Imaging Spectroradiometer (MODIS) aboard the NASA Terra satellite. The vegetation “greenness” data from the MODIS sensor was directly downloaded into the CASA ecosystem simulation model. Scientists used

the data to estimate monthly variations in the accumulated biomass of wood and other plant materials, such as the accumulated dead leaf biomass transferred into soil carbon pools. Inventory data from the California Energy Commission also was used to model the carbon dioxide emissions from fossil fuel combustion and greenhouse gas emissions from agricultural lands throughout the state.

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