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In the fight against climate change, plants are the lonely-only defenders

Satellite data and models show global warming could be 20-25% higher were it not for the carbon trapping and cooling effect of a greening Earth during the past 40 years. Stopping deforestation and ecologically sensible large-scale tree planting could be one simple, but not sufficient, defense against climate change.

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Boston—A new study reports continued climate altering carbon emissions and intensive land use have inadvertently greened half of the Earth's vegetated lands. Green leaves convert sunlight to sugars, thus providing food, fiber and fuel, while replacing carbon dioxide in the air with water vapor. The removal of heat-trapping CO_2 and evapo-transpiration of H_2O cools the Earth's surface. Global greening since the early 1980s may have thus reduced global warming, possibly by as much as 0.2 to 0.25°C, reports the study "*Characteristics, drivers and feedbacks of global greening*" published in the inaugural issue of the journal *Nature Reviews Earth and Environment*.

This comprehensive study, based on a review of over 250 published articles and new results from multiple satellites, model studies and field observations, details the geography, causes and consequences of global greening. "This phenomenal greening, together with global warming, sea-level rise and sea-ice decline, represents highly credible evidence of anthropogenic climate change" write the lead authors Shilong Piao and Xuhui Wang of the Sino-French Institute for Earth System Science in the College of Urban and Environmental Sciences at Peking University, PRC.

Near-daily observations since the early 1980s from NASA and NOAA satellites reveal vast expanses of the Earth's vegetated lands from the Arctic to the temperate latitudes exhibiting vigorous greening tendencies, as previously reported by Prof. Ranga Myneni and his PhD students, Taejin Park and Chi Chen, of Boston University, USA. Notably, the NASA MODIS sensors observed pronounced greening during the 21st century in the most populous and developing countries, China and India. Even regions far, far removed from human reach have not escaped global warming and greening trends. "Svalbard in the high-arctic, for example, has seen a 30% increase in greenness concurrent with an increase in mean summer temperature from 2.9 to 4.7°C between 1986 and 2015" said co-author Dr. Rama Nemani of NASA's Ames Research Center, USA.

The reasons for global greening vary – intensive use of land for farming, large-scale planting of trees, a warmer and wetter northly clime, re-wilding of abandoned lands, recovery from past disturbances – but seems chiefly due to CO_2 fertilization. "It is ironic that the very same carbon emissions responsible for harmful changes to climate are also fertilizing plant growth, which in turn is somewhat moderating global warming" said co-author Dr. Jarle Bjerke of the Norwegian Institute for Nature Research, Norway.

Carbon emissions from fossil fuel use and tropical deforestation added 160 ppm of CO_2 to the atmosphere during the past 40 years. About 40 ppm of which diffused passively into the oceans and another 50 ppm was actively taken up by plants. The 70 ppm remaining in the atmosphere, together with other greenhouse gases, is responsible for the observed 1°C warming over land since the early 1980s. "Plants are actively defending against the dangers of carbon pollution by not only sequestering carbon on land but also by wetting the atmosphere through transpiration of ground water and evaporation of precipitation intercepted by their bodies" said co-author Dr. Philippe Ciais, associate director of the Laboratory of Climate and Environmental Sciences, Gif-sur-Yvette, France. He added "stopping deforestation and sustainable, ecologically sensible afforestation could be one of the simplest and cost-effective, though not sufficient, defenses against climate change."

It is not easy to accurately estimate the cooling benefit from global greening because of the complex inter-connected nature of the climate system. Cooling from carbon sequestration and increased evapo-transpiration could amount to 0.2 to 0.25°C during this 40-year period. "This un-intended benefit of global greening, and its potential transitory nature, suggests how much more daunting, and urgent, is the stated goal of keeping global warming to below 1.5 to 2°C, especially given the trajectory of carbon emissions and history of inaction during the past decades" said Dr. Hans Tømmervik of the Norwegian Institute for Nature Research, Norway.

Read the paper at Nature Reviews Earth and Environment:
https://www.nature.com/articles/s43017-019-0001-x

For graphics and additional information:
http://sites.bu.edu/cliveg/

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