New satellite technology shows Amazon absorbing less carbon due to less rainfall

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Solimões, the section of the upper Amazon River. Image: Wikipedia.

(Phys.org) —A team of researchers in the U.S. with another member from Brazil has found that parts of the Amazon rainforest are receiving less rainfall than was received just a couple of decades ago, and because of that are less green. In their paper published in *Proceedings of the National Academy of Sciences*, the researchers discuss how new satellite technology has allowed for more accurately measuring rainfall amounts in the Amazon river basin which allows for noting changes in rainfall over multiple years.

The Amazon rainforest is a really important piece of Earth's carbon life cycle—scientists believe it's responsible for pulling in up to 25 percent of the total carbon from plants for the entire planet. For this reason, any drop in carbon absorption in the area is cause for concern.

Scientists have suspected for quite some time that the Amazon rainforest is absorbing less carbon dioxide than before, simply because it's not as big as it used to be—humans have cut down the forest in many places. Now it appears that the forest that remains is receiving less rain, which in turn is making it less green which means the trees that are there are pulling in less carbon dioxide from the air around them.

More specifically, the researchers found that the rainforest has received less rainfall starting around the year 2000, than it did before that time—some parts of the southern edges have seen as much as 25 percent less—an area roughly the size of California. That single area, the researchers have calculated, has been accounting for approximately half of the loss of carbon absorption by the rainforest overall.

Even more worrisome is that in normal dry year cycles, generally attributable to El Niño events, the reduction in carbon absorption can be equivalent to the entire amount absorbed by all the plants in Russia in a given year. Some climatologists have predicted that as the planet heats up, super El Niño events are likely to occur which could devastate parts of the rainforest. On the bright side, the same research has shown that La Niña events could have the opposite impact.

Their research is based, the team reports, on new satellite technology that allows for seeing how much green is occurring beneath cloud cover, allowing for better measurements of carbon absorption abilities of the plants below.

More information: Vegetation dynamics and rainfall sensitivity of the Amazon, *PNAS*, Thomas Hilker, DOI: 10.1073/pnas.1404870111

Abstract
We show that the vegetation canopy of the Amazon rainforest is highly sensitive to changes in precipitation patterns and that reduction in

rainfall since 2000 has diminished vegetation greenness across large parts of Amazonia. Large-scale directional declines in vegetation greenness may indicate decreases in carbon uptake and substantial changes in the energy balance of the Amazon. We use improved estimates of surface reflectance from satellite data to show a close link between reductions in annual precipitation, El Niño southern oscillation events, and photosynthetic activity across tropical and subtropical Amazonia. We report that, since the year 2000, precipitation has declined across 69% of the tropical evergreen forest (5.4 million km2) and across 80% of the subtropical grasslands (3.3 million km2). These reductions, which coincided with a decline in terrestrial water storage, account for about 55% of a satellite-observed widespread decline in the normalized difference vegetation index (NDVI). During El Niño events, NDVI was reduced about 16.6% across an area of up to 1.6 million km2 compared with average conditions. Several global circulation models suggest that a rise in equatorial sea surface temperature and related displacement of the intertropical convergence zone could lead to considerable drying of tropical forests in the 21st century. Our results provide evidence that persistent drying could degrade Amazonian forest canopies, which would have cascading effects on global carbon and climate dynamics.