

Australian rainforests are becoming a net source of carbon emissions

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A team of international scientists led by researchers from Australian universities has found the first evidence that woody biomass in tropical rainforests is acting as a long-term source of carbon dioxide. This has global implications.

The study, titled “Aboveground biomass in Australian tropical forests now a net carbon source,” published in the leading scientific journal *Nature*, found that a critical component of rainforest ecosystems is emitting more carbon dioxide into the atmosphere than it is absorbing.

The researchers, led by Hannah Carle from Western Sydney University, analysed 49 years’ worth of data collected from 20 tropical rainforest sites in northeast Queensland, including near Cooktown, Cairns and Mackay. The dataset is currently the largest available inventory of Australian tropical forests—over 10,000 trees from 474 different species.

Tropical rainforests are the most biodiverse terrestrial ecosystems on earth, covering less than 10 percent of the world’s land surface, yet containing over half of the earth’s plant and animal species. One of the most valuable ecosystem services that rainforests provide is carbon sequestration—the absorption of carbon dioxide from the atmosphere, thereby removing its ability to act as a greenhouse gas and contribute to global warming.

A 2021 study led by NASA scientists estimated that from 2000 to 2019 tropical rainforests acted as a net “carbon sink,” absorbing 410 million tonnes more carbon per year than they emitted. That team found that live woody biomass—the roots, wood, bark and leaves of living trees—was responsible for 80 percent of the carbon sequestration effect. The rest came from other components of the ecosystem, such as soil and dead organic matter.

The new research conducted by Dr Carle’s team

however, found that live woody biomass “in Australian tropical forests now loses more carbon to the atmosphere on an annual basis than it absorbs.” Moreover, this “shift” from carbon sink to carbon source likely occurred around 25 years ago, at the turn of the century.

From the sites analysed, woody biomass, referred to as aboveground biomass (AGB) in the paper, absorbed an average of 620kg of carbon per hectare annually from 1971 to 2000. However, from 2010 to 2019, the AGB at those same sites emitted 930kg of carbon per hectare annually. Not only has woody biomass switched from absorbing to emitting carbon; it is now emitting even more carbon than it historically has absorbed.

The team conservatively estimated that the net carbon absorption of AGB was decreasing by 41kg of carbon per hectare per year. Because woody biomass plays such a central role in sequestering and storing carbon, Australian wet rainforests could entirely become carbon sources in the near future.

The study found that an increase in tree mortality, without a corresponding increase in growth by surviving trees, was the main driver behind the trend. Tropical rainforests in Australia are experiencing tree mortality rates twice as high as compared to the 1970s. This was the finding of a study published earlier this year using the same monitoring sites as the new research.

The principal drivers of the increased death rates of rainforest trees are increased vapour pressure deficit (an increased atmospheric “demand” for water from plants which can cause water deficits) and increased atmosphere temperature. Both these effects are largely driven by climate change.

In addition, the new paper found that cyclones, which

are increasing in severity under climate change (including in northern Queensland), played a significant role in tree mortality. The study found that “the carbon sink capacity of woody AGB was markedly depressed in the 6 years following a cyclone” and that cyclones “increased the mortality rate above background levels by 19 percent.”

The study’s findings “suggest the potential for a similar response to climate change by woody aboveground biomass in moist tropical forests globally, which could culminate in a long-term switch from carbon sinks to carbon sources.”

This study builds on earlier findings that demonstrated a similar long-term decrease in carbon absorption from rainforests on other continents. In 2021, a paper was published that showed a long-term decline of the carbon-absorbing function of the Amazon rainforest, with southeastern Amazonia in particular even acting overall as a net carbon source. This was determined to be due to increased tree mortality from a combination of intensified dry seasons and deforestation.

Other research internationally has found that extreme climate conditions such as droughts, which caused large-scale tree mortality in tropical forests, have had temporary but significant impacts on the carbon sink capacity of AGB.

Of particular note were major droughts in 2005 and 2010 in South America which temporarily reversed the long-term forest carbon sink of the Amazon rainforest, as well as El Niño season droughts which temporarily halted biomass carbon sinks in Borneo during 1997-98, and South American forests during 2015-16.

The new study, however, is the first to report a long-term reversal of AGB in tropical rainforests from carbon sinks to carbon emitters. It thus adds another strong piece of evidence suggesting that forest ecosystems globally could potentially become net sources of carbon dioxide in the near future, especially in the absence of rapid and major reductions in greenhouse gas emissions. This could contribute to a dangerous feedback loop—as rainforests decrease carbon absorption as a result of climate change, that will in turn lead to higher carbon dioxide levels in the atmosphere, further exacerbating global warming.

More research is needed to get a full, global picture of this danger, in particular focusing on rainforests on

other continents and investigating the role of other components of the ecosystem, such as the soil. Nevertheless, enough evidence is presented here for the authors to conclude their paper by declaring that “action on climate change must be a key priority if we are to safeguard the carbon sink capacity of tropical forests.”

Governments the world over are ignoring the continued accumulation of evidence demonstrating the need for urgent action on climate change. This includes the Albanese Labor government in Australia, which recently issued a totally inadequate target of a 62-70 percent reduction in domestic greenhouse gas emissions relative to 2005 levels by 2035 and has approved over 30 new fossil fuel projects since May 2022.

The warnings issued by scientists will not be heeded by capitalist governments anywhere. Acting in the interests of big business, they defend not the health of the planet but the profit dictates of the capitalist system, which is causing the world to warm to such a degree that one of the most productive ecosystems on the planet is beginning to contribute to the climate crisis itself.

It is ever clearer that this descent into ecological collapse can be halted only with a socialist perspective, taken up by the international working class and principled scientists everywhere in the world.



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