How wildfires trap carbon for centuries to millennia

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Charcoal produced by wildfires could trap carbon for hundreds of years and help mitigate climate change, according to new research published today.

The extensive and unprecedented outbreak of wildfires in the arctic and the vast amounts of CO_2 they are emitting have been hitting the headlines across the world.

But a new *Nature Geoscience* study quantifies the important role that charcoal plays in helping to compensate for carbon emissions from fires. And the research team say that this charcoal could effectively 'lock away' a considerable amount of carbon for years to come.

In an average year, wildfires around the world burn an area equivalent to the size of India and emit more carbon dioxide to the atmosphere than global road, rail, shipping and air transport combined.

As vegetation in burned areas regrows, it draws CO_2 back out of the atmosphere through photosynthesis. This is part of the normal fire-recovery cycle, which can take less than a year in grasslands or decades in fire-adapted forests.

In extreme cases, such as arctic or tropical peatlands, full recovery may not occur for centuries.

This recovery of vegetation is important because carbon that is not re-captured stays in the atmosphere and contributes to climate change.

Deforestation fires are a particularly important contributor to climate change as these result in a long-term loss of carbon to the atmosphere.

Now, a new study by researchers at Swansea University and Vrije Universiteit Amsterdam has quantified the important role that charcoal created by fires—known as pyrogenic carbon—plays in helping to compensate for carbon emissions.

Lead author Dr. Matthew Jones, who recently joined the UEA's School

of Environmental Sciences from Swansea Univsersity, said: "CO_2 emitted during fires is normally sequestered again as vegetation regrows, and researchers generally consider wildfires to be carbon neutral events once full biomass recovery has occurred.

"However, in a fire some of the vegetation is not consumed by burning, but instead transformed to charcoal. This carbon-rich material can be stored in soils and oceans over very long time periods.

"We have combined field studies, satellite data, and modelling to better quantify the amount of carbon that is placed into storage by fires at the global scale."

The paper, which was co-authored by Dr. Cristina Santin and Prof Stefan Doerr, from Swansea University, and Prof Guido van der Werf, of Vrije Universiteit Amsterdam, explained that, as well as emitting CO_2 to the atmosphere, landscape fires also transfer a significant fraction of affected vegetation carbon to charcoal and other charred materials.

The researchers say this pyrogenic carbon needs to be considered in global fire emission models.

Dr. Jones said: "Our results show that, globally, the production of pyrogenic carbon is equivalent to 12 percent of CO_2 emissions from fires and can be considered a significant buffer for landscape fire emissions.

"Climate warming is expected to increase the prevalence of wildfires in many regions, particularly in forests. This may lead to an overall increase in atmospheric CO_2 emissions from wildfires, but also an increase in pyrogenic carbon storage. If vegetation is allowed to recover naturally then the emitted CO_2 will be recaptured by regrowth in future decades, leaving behind an additional stock of pyrogenic carbon in soils, lakes and

oceans.

"We expect any additional pyrogenic carbon to be trapped for a period of centuries to millennia, and although it will eventually return to the atmosphere as charcoal degrades, it is locked away and unable to affect our climate in the meantime.

"This brings some good news, although rising CO_2 emissions caused by human activity, including deforestation and some peatland fires, continue to pose a serious threat to global climate."

There are still important questions to be answered about how a warmer, more drought-prone climate will affect the global extent of wildfires in the future.For example, will there be more fire in arctic peatlands as we are experiencing this summer, and what proportion of CO_2 emissions will be recaptured by future vegetation regrowth?

But this new research shows that pyrogenic carbon production should be considered as a significant product of fires and an important element of the global carbon cycle.Global fire emissions buffered by the production of pyrogenic carbon is published in the journal *Nature Geoscience*.

More information: Matthew W. Jones et al. Global fire emissions buffered by the production of pyrogenic carbon. *Nature Geoscience* (2019)

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