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Increased concerns over fluvial carbon losses from deforested tropical peatlands

Over 20% more carbon could be being released by tropical peatlands than previously estimated, a new study suggests. The research highlights the large quantities of carbon lost to rivers from deforested and degraded peatlands in Indonesia, in addition to carbon released as CO_2 gas.

Peatlands are an important carbon store and the peat swamp forests of south-east Asia have experienced excessive damage from deforestation, drainage and fire, which all convert the stored carbon into CO_2. However, for tropical peatlands there is little consideration of the organic carbon lost to rivers and streams, known as fluvial organic carbon. Fluvial carbon is processed in the water column and emitted to the atmosphere as an indirect source of CO_2 or CH_4 (methane). Organic carbon in runoff can also have an impact on the quality of the water, changing its acidity, clarity and oxygen content. This in turn can affect habitats of valuable aquatic wildlife. Therefore maintaining carbon stocks in soil also has important biodiversity implications.

To quantify the effect of peatland degradation on fluvial organic carbon, the study monitored the amount of dissolved and particulate organic carbon in the water draining from both intact and degraded peat swamp forests in central Kalimantan, Indonesia. The peat swamp forests had been degraded by a failed agricultural project designed to convert the peatland into rice fields, and which had deforested and drained the land.

The level of carbon in the water draining from the peat swamp forests was measured over a year at weekly intervals. The results indicated that the channels draining the degraded forest contained about 55% more organic carbon in the water than the channels draining the intact forest.

The average loss from degraded peat swamp forests was calculated to be 97 grams of carbon per square metre of land per year (as opposed to 63 grams from the intact forest), and most of this was lost during the rainy season. Using carbon dating techniques, the organic carbon in intact peatland drainage water was found to be mainly from relatively recent plant growth. By contrast, the organic carbon from the water running off the disturbed peatlands mostly consisted of much older carbon that probably came from previously stable stores deep within the soil.

The researchers estimated that the total amount of carbon being lost from the peatlands, including the water-borne carbon loss, is 22% higher than other estimates which only consider carbon lost as CO_2 gas. Based on these figures and data on different land uses across southeast Asia, they then calculated that there has been a 45% increase in organic carbon lost to rivers in Borneo, Sumatra and the Malaysian peninsula (from 4.7 to 6.8 million tonnes of carbon per year) since 1990, owing to the conversion of peat swamp forests into disturbed degraded peatland.

For the whole of south-east Asia, peatland degradation was estimated to have produced a 32% increase in organic carbon lost to rivers. The study suggests that this may be an underestimate, because no data were available for the conversion of peatlands to industrial plantations, another important type of land use change.

The study's findings highlight the importance of incorporating losses of organic carbon to water in guidelines for measuring, reporting and verifying carbon emissions of various activities. This is particularly critical as, currently, the oil-palm biofuel industry contributes to regional forest destruction in south-east Asia and may be having a greater impact on carbon losses than previously thought.

It should also be noted that human-induced negative impacts on carbon balance are occurring in parts of Europe. For example, Scandinavian forestry practices, such as drainage, intensification of tree growth and removal of logging residues, have had impacts on the carbon stored in forest soils and the water quality in the vicinity of these forests.

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