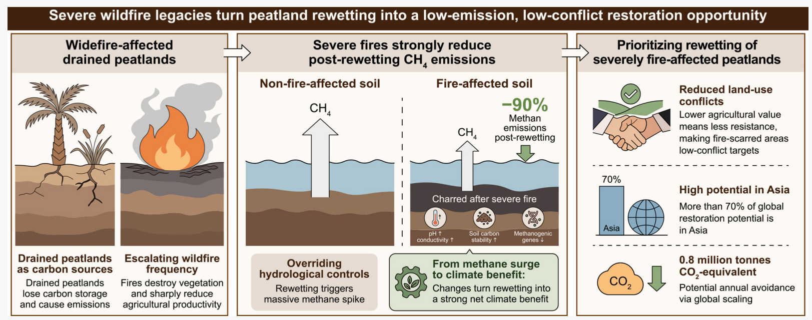
Rewetting severely wildfire-affected peatlands could deliver unexpected climate benefits



Severe wildfire legacies turn peatland rewetting into a low-emission, low-conflict restoration opportunity.

GA, UNITED STATES, August 10, 2026 /EINPresswire.com/ -- Peatlands store roughly one-quarter of global soil carbon, yet decades of drainage for agriculture have turned many into major carbon sources. Rewetting these lands restores their carbon-storing function but often triggers a surge in methane—a greenhouse gas far more potent than carbon dioxide. Now, researchers have found that severely burned peatlands, when rewetted, emit dramatically less methane than unburned or mildly burned ones, suggesting that areas already degraded by wildfire could become prime candidates for accelerated restoration.

Drained peatlands are increasingly vulnerable to wildfires as climate change intensifies droughts and lowers water tables. At the same time, rewetting—while effective at suppressing carbon dioxide release—frequently stimulates methane production, creating a climate trade-off that can delay net benefits for years or even decades. Farmers also resist rewetting on productive agricultural land, as it typically means lost income. Based on these challenges, there is an urgent need to understand how wildfire history influences greenhouse gas emissions from peatlands after rewetting—and whether fire-affected areas could offer a more feasible pathway for large-scale restoration.

A team from Aarhus University in Denmark reports these findings in Environmental Science and Ecotechnology, published on July 29, 2026. The researchers conducted a 90-day laboratory incubation experiment comparing drained peat soils with rewetted soils that were either unaffected by fire, mildly burned, or severely burned. They measured carbon dioxide and methane emissions, analyzed soil chemistry, and profiled microbial communities to uncover the mechanisms driving post-fire gas dynamics.

The results revealed a striking divergence. Rewetting unburned peat triggered a roughly 40-fold increase in methane emissions compared with drained soils—a well-known consequence of waterlogged, oxygen-free conditions that favor methane-producing microbes. Mildly burned soils produced even more methane, with emissions surging six times higher than unburned rewetted soils. But severely burned soils told a different story: their methane emissions remained low, statistically indistinguishable from drained controls—a 91% reduction compared with unburned rewetted soils.

What explains this stark difference? Severe fires fundamentally altered the peat itself. Fourier-transform infrared spectroscopy revealed that severely burned soils contained higher proportions of recalcitrant carbon compounds such as phenols and aromatics—forms that microbes struggle to break down. In contrast, mild fires did not substantially change carbon chemistry but may have released previously protected labile carbon by breaking down soil aggregates. The researchers also found that severe fires increased soil pH and electrical conductivity, both of which were negatively correlated with methane emissions. At the microbial level, the abundance of mcrA—a key gene for methane production—plummeted in severely burned soils, while methanogen communities flourished in mildly burned ones. "Severe fires essentially override the usual methane response you'd expect from rewetting," the authors said. "The heat transforms the peat into a less digestible form, and the microbial communities that produce methane simply don't recover quickly. This means that areas we might have written off as degraded could actually offer a climate advantage if we prioritize them for restoration."

Globally, the team estimates that more than 6 million hectares of peatlands burn each year, with 0.5 to 0.9 million hectares of that being degraded peatlands suitable for rewetting. Prioritizing these fire-affected areas could deliver methane mitigation of 0.1 to 0.8 million tonnes of carbon dioxide equivalent annually under a 100-year global warming potential framework. The numbers are modest relative to global emissions, but the real value lies in feasibility. Burned peatlands have already lost much of their agricultural value, reducing the land-use conflicts that have historically stalled restoration on productive farmland. "Wildfire does the hard work of making rewetting socially acceptable," the authors noted. "The land is less profitable for farming, so the opposition is lower. And biogeochemically, severe fires prime the soil to emit less methane after rewetting. It's a rare alignment of ecological and socioeconomic incentives."

References
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