Climate & Earth Systems | Nov 12, 2026 | 5 min read | By Bryan White

El Ni o Drought and Anthropogenic Warming Supercharged Indonesia's 2026 Peatland Fires, Attribution Study Confirms

Climate & Earth Systems * El Ni o * Wildfires

Between January and October 2026, nearly 2.88 million hectares of tropical forest, shrubland, and carbon -rich peatland burned across Sumatra, Kalimantan, and neighboring Indonesian islands, generating Indonesia's most severe wildfire and transboundary haze crisis in a decade [1, 2] . Toxic smoke plumes blanketed industrial and residential corridors across Indonesia, Malaysia, and Singapore, triggering hundreds of thousands of acute respiratory infections and forcing widespread school closures [1, 2] .

In an attribution assessment released in November 2026, climate scientists with the World Weather Attribution (WWA) initiative quantified the physical drivers behind the disaster [1, 2] . Their findings reveal a lethal compound interaction: a strong El Niño event suppressed seasonal rainfall by approximately 50% between July and October, while human-induced global warming added an extra 1.6 deg C of heat during the August-October peak fire window [1, 2] . As the researchers summarized the atmospheric dynamics, El Niño turned off the taps, but fossil-fuel emissions turned up the heat -- making the hot, desiccated fire-weather conditions roughly three times more likely than in a pre-industrial climate [1, 2] .

Walker Circulation Reversal: How El Niño Dries the Maritime Continent

Under normal climatological conditions, warm sea surface temperatures in the western Pacific Warm Pool drive vigorous atmospheric convection , rising moist air, and heavy monsoonal rainfall across the Indonesian archipelago [3] . During a strong El Niño phase of the El Niño-Southern Oscillation (ENSO), however, slackening easterly trade winds allow warm surface waters to surge eastward toward the central and eastern equatorial Pacific [3] :

* Atmospheric Subsidence and Monsoon Delay: As the locus of deep tropical convection shifts eastward into the central Pacific, the descending branch of the reorganized Walker Circulation settles directly over Indonesia and northern Australia. Persistent high-pressure subsidence suppresses cloud formation, delays the onset of the late-year wet monsoon, and reduces July-October precipitation by roughly half [1, 3] .

* Nonlinear Moisture Thresholds: As demonstrated by NASA and academic researchers analyzing the catastrophic 2015 fire season, Indonesian fire activity does not scale linearly with rainfall deficits [3] . Once cumulative dry-season precipitation drops below a critical hydrological threshold, soil moisture and fuel moisture collapse precipitously, causing burned area and smoke optical depth to spike exponentially [3] .

Vapor Pressure Deficit and the Thermal Multiplier of Climate Change

While El Niño supplied the precipitation deficit, anthropogenic climate change dramatically amplified atmospheric evaporative demand [1, 2] . Adding 1.6 deg C to peak dry-season air temperatures increases the saturation vapor pressure of the atmosphere exponentially according to the Clausius-Clapeyron relation [1] .

This elevated temperature widens the vapor pressure deficit (VPD) -- the gap between how much moisture the warm air can hold and how much moisture is actually present. Higher VPD accelerates moisture extraction from living vegetation canopies, leaf litter, and exposed surface soils, pre-conditioning the landscape for rapid ignition and sustained fire spread even before rainfall reaches historic lows [1, 2] . Furthermore, once widespread peat combustion injects dense plumes of light-absorbing organic aerosols into the lower troposphere , smoke haze suppresses surface solar heating while stabilizing the atmospheric boundary layer, creating a regional radiative feedback that further inhibits convective shower development [3] .

Peatland Geochemistry and Subterranean Smoldering Combustion

What transforms an Indonesian El Niño drought from a regional agricultural problem into a planetary carbon and public-health emergency is the unique biogeochemistry of tropical ombrotrophic peatlands [4] .

Across coastal Sumatra and southern Kalimantan, thousands of years of waterlogged plant debris have accumulated into peat domes up to 10 meters thick, storing tens of gigatons of terrestrial carbon [4] . Undisturbed peat swamp forests remain naturally saturated near the surface year-round and are almost completely fire-resistant. However, decades of industrial deforestation and canal drainage for agriculture and palm oil plantations have lowered regional water tables, exposing deep horizons of desiccated organic peat to atmospheric oxygen [1, 2, 4] .

* Low-Temperature Smoldering Dynamics: Unlike fast-moving, oxygen-rich flaming canopy fires, drained peat undergoes slow, flameless smoldering combustion that propagates horizontally and vertically beneath the soil surface for months [4] .

* Toxic Aerosol and Carbon Emissions: Because smoldering occurs at lower temperatures (typically 400 to 600 deg C) with incomplete oxidation, peat fires emit vastly higher ratios of hazardous fine particulate matter (PM 2.5), carbon monoxide (CO), methane (CH 4), polycyclic aromatic hydrocarbons, and volatile organic compounds per kilogram of fuel burned than flaming forest fires [3, 4] . As Susan Page and colleagues first quantified during the 1997 El Niño crisis, Indonesian peatland combustion can release carbon equivalent to 13% to 40% of mean annual global fossil-fuel emissions in a single severe season [4] .

Comparative Telemetry Across Major El Niño Fire Seasons

Comparing the 2026 fire season against earlier landmark El Niño events illustrates how anthropogenic warming shifts baseline fire severity upward even under similar ENSO forcing [1, 2, 3, 4] :

| Fire Season | | Primary Climate Driver | | Estimated Area Burned | | Key Physical & Biogeochemical Signature |

| 1997-1998 | | Super El Niño + Positive IOD | | ~4.5-5.0 million ha (est.) | | First satellite-quantified megafire peatland carbon pulse (0.81-2.57 Gt C released) [4] . |

| 2015 | | Strong El Niño + Positive IOD | | ~2.6 million ha | | Demonstrated sharp nonlinear fire/smoke amplification once dry-season rainfall fell below ~4 mm/day [3] . |

| 2026 | | Strong El Niño + +1.6 deg C Anthropogenic Warming | | ~2.88 million ha (Jan-Oct) | | ~50% Jul-Oct rainfall drop; climate change made extreme fire weather ~3x more likely [1, 2] . |

Hydrological Restoration as Fire Prevention

Because smoldering peat fires burn centimeters to meters underground, conventional firefighting methods -- such as aerial water bombing or emergency cloud seeding -- often fail to extinguish active subterranean fronts until sustained monsoon rains raise the water table [1, 4] .

Consequently, climate and peatland scientists emphasize that safeguarding Southeast Asia against future compounded El Niño extremes requires dual action: rapidly cutting global fossil-fuel emissions to arrest further VPD amplification, while aggressively restoring peatland hydrology through canal blocking, groundwater rewetting, and wet-tolerant paludiculture across degraded agricultural concessions [1, 2, 4] . Maintaining groundwater tables within 40 centimeters of the peat surface preserves capillary moisture up to the organic litter layer, sharply raising the thermal energy threshold required for sustained smoldering ignition and preventing centuries of sequestered carbon from entering the atmosphere during future ENSO cycles [3, 4] .

References & Primary Sources

* [1] World Weather Attribution (2026). El Ni o and human-induced climate change attribution analysis of Indonesia's 2026 wildfire and haze crisis. -- https://www.worldweatherattribution.org/

* [2] The Japan Times (2026). El Ni o, climate change supercharged Indonesia fires, study says. -- https://www.japantimes.co.jp/

* [3] Field, R. D., van der Werf, G. R., Fanin, T., Fetzer, E. J., Fuller, R., Jethva, H., Levy, R., Livesey, N. J., Luo, M., Torres, O., & Worden, H. M. (2016). Indonesian fire activity and smoke pollution in 2015 show persistent nonlinear sensitivity to El Ni o-induced drought. Proceedings of the National Academy of Sciences (PNAS), 113(33), 9204-9209. -- https://doi.org/10.1073/pnas.1524888113

* [4] Page, S. E., Siegert, F., Rieley, J. O., Boehm, H.-D. V., Jaya, A., & Limin, S. (2002). The amount of carbon released from peat and forest fires in Indonesia during 1997. Nature, 420, 61-65. -- https://doi.org/10.1038/nature01131