Scientists trace the human role in Indonesian forest fires

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Fire and smoke from a burning peat forest on Pedang Island in Riau Province, Sumatra, Indonesia. The island is covered by forested peat up to 15 meters in depth. The excessive smoke is a common feature once the fire consumes the above-ground material and burns into the peat, which remains moist, but just dry enough to smolder. The photo was taken in July 1991 during the El Nino-induced dry season. The forest was slashed before burning. Intact forest on peat rarely burns. Riau province currently has the highest rate of deforestation in Indonesia. Photo by Michael Brady, Canadian Forest Service.

Severe fires in Indonesia - responsible for some of the worst air quality conditions worldwide - are linked not only to drought, but also to changes in land use and population density, according to a new study in *Nature Geoscience* led by Robert Field of the University of Toronto.

"During the late 1970s, Indonesian Borneo changed from being highly

fire-resistant to highly fire-prone during drought years, marking the period when one of the world's great tropical forests became one of the world's largest sources of pollution," says Field, a PhD student of atmospheric physics. "Ultimately, this abrupt transition can be attributed to rapid increases in deforestation and population growth. The resulting occurrences of haze currently rank among the world's worst air pollution episodes, and are a singularly large source of greenhouse gas emissions."

Sumatra has suffered from large fires at least since the 1960s, but Indonesian Borneo seems to have been resistant to large fires - even in dry years - until population density and deforestation increased substantially and land use changed from small-scale subsistence agriculture to large-scale industrial agriculture and agro-forestry.

"We've had a good understanding of fire events since the mid 1990s, but little before this due to the absence of fire data from satellites," says Field, who collaborated with Guido van der Werf of VU University Amsterdam and Sam Shen of San Diego State University. "However, one of the major impacts of large-scale fires is a reduction in visibility due to the smoke produced. Visibility is recorded several times a day at airports in the region, and these records proved to be an excellent indicator of severe fire activity. We were able to piece together visibility observations back to the 1960s, and hence develop a longer term record of the fires."

Having a long-term record of the fires allowed the scientists to better understand their causes. "Using weather records, we were able to estimate the specific rainfall level below which large fires have occurred in the previous two decades. In turn, we found that the rainfall over Indonesia was influenced equally by the Indian Ocean Dipole and the El Niño Southern Oscillation phenomena. Hopefully, this information can be used to better anticipate and prevent future haze disasters in Indonesia."

Field says that there is a direct link between the increased prevalence of severe fires and haze disasters and the man-made change in land use. "The visibility record also showed, quite strikingly, the impact of human settlement on a previously pristine tropical forest. This should give pause to further agro-forestry expansion in Indonesia, particularly for oil palm as a source of biofuel."

More information: "Human amplification of drought-induced biomass burning in Indonesia since 1960", March issue of *Nature Geoscience*, available online February 22.

Source: University of Toronto