EGU21-12237, updated on 19 Jun 2021
https://doi.org/10.5194/egusphere-egu21-12237
EGU General Assembly 2021


# Identifying key drivers of peat-fires across Kalimantan's ex-Mega Rice Project area using machine learning

**Alexander Horton**[1], Vili Virkki[1], Anu Lounela[2], Jukka Miettinen[3], and Matti Kummu[1]
[1]Water and Development Research Group, Department of Built Environment, Aalto University, Finland
[2]Development Studies, Social and Cultural Anthropology, University of Helsinki, Finland
[3]VTT Technical Research Centre of Finland Ltd., P.O. Box 1000, FI-02044 VTT, Finland

Throughout Indonesia - ecological degradation, agricultural expansion, and the digging of draining canals has compromised the integrity and functioning of large swathes of peatland forest, leaving behind a fragmented landscape of scrubland, successional forest, and newly established plantations. These landscapes are susceptible to extensive and intensive wildfires that rage out of control each year. One of the most affected regions is the ex-Mega Rice Project (EMRP) area in Central Kalimantan on the island of Borneo, where 1 million ha of peatland forest were cleared and 4000 km of canals were dug between 1996-1998, in an attempt to initiate large scale industrial rice cultivation. This led to disturbances to the underlying hydrology, the local ecology, and the ability of the local population to maintain a livelihood, who's efforts are thwarted each year but the returning wildfires.

Directing fire prevention and mitigation efforts requires a detailed understanding of the main drivers of fire distribution and the conditions of initiation. To this end, we have developed a fire susceptibility model using machine learning (XGBoost random forest) that characterises the relationships between key predictor variables and the distribution of historic fire locations. Using the model, we determine the relative importance of each predictor variable in controlling the initiation and spread of fires. We included land-cover classifications, a forest clearance index, vegetation indices , drought indexes, distances to infrastructure , topography, and peat depth, as well as the Oceanic Niño Index (ONI). The model was trained to separate burnt areas from not burnt areas using point samples of predictor variables taken from both, and then tested by applying the model across the entire study area for all years. The model performance consistently scores highly in both accuracy and precision across all years (>0.75 and >0.68 respectively), though recall metrics are much lower (>0.25).

Our results confirm the anthropogenic dependence of extreme fire events in the region, with the distance to settlements, and distance to canals consistently weighted as some of the most important driving factors within the model structure. In combination, the vegetation indices were the strongest indicators of fire prevalence. Ours is the first analysis in the region to encompass the full range of driving factors within a single model that captures the inter-annual variation as well as the spatial distribution of peatland fires. Our results can be used to target the root causes of

fire initiation and propagation to better construct regulation and rehabilitation efforts to mitigate future wildfires.