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Optimizing Fire Preparedness: A Forward-looking Analysis for 2030 in Boca do Acre Region, Brazilian Amazon

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The Amazon Rainforest, crucial for climate regulation, carbon and water cycles, and biodiversity preservation, faces escalating threats from heightened forest degradation, including disturbances from fire and logging. In 2020, Brazil was responsible for a concerning 70% of the active fire hotspots detected in the Amazon, signaling a notable 60% increase compared to 2019. This surge has pushed the region into an extreme fire situation. Urgent and effective interventions are imperative to mitigate these extremes, ensuring the preservation of the Amazon and global climate stability. The study focuses on the Boca do Acre region in the southwest Amazon, one of the most recent hotspots of deforestation and forest degradation in the Amazon. We project the suitability of fire for 2030, following the timeframe set by the United Nations for the implementation of actions aimed at creating a better world for all peoples and nations through the Agenda 2030. Using the MAXENT algorithm within the R software, we conducted a detailed analysis exclusively within the non-forest land-use class on a 5 km x 5 km grid. Burned area data from products Fire CCI (250m), MapBiomas Fire (30m), and MODIS MCD64 (500m) were used to study fire occurrence across the study area. The chosen baseline year is 2014, representing the last year of historical data before the influence of different Shared Socioeconomic Pathways (SSPs) on IPCC models (1-2.6 and 3-7.0). The statistic involves the use of specifically selected variables, determined by their performance in correlation tests and principal component analysis. These variables encompass the percentage of forested areas, agriculture, pasture, and a 1000 m buffer

along the region's roads. Additionally, factors such as the percentage of conservation unit occupancy, indigenous lands, and medium-sized properties (400-1000 ha) in the Rural Environmental Registry (CAR), along with precipitation values during dry months, are taken into account. Model validation incorporates AUC analysis, where the model must exhibit performance greater than 0.7, background analysis with the same curve behavior, false positive rate (FPR), accuracy evaluation, and sensitivity analysis. Following this process, we project the feasibility of fire for 2030. Results consistently demonstrate high performance, with AUC values surpassing 0.7 and pixel-to-pixel accuracy ranging from 60% to 90%, lower FRP values, and higher sensitivity values. Projected results indicate an increased susceptibility to fires that spread in the region, especially under less sustainable scenarios, emphasizing the urgency of preventive measures before 2030. Projections reveal an advancement in fire suitability, particularly in the SSP 3-7.0 scenario, with a significant increase in non-forest areas. However, as the scenario worsens, areas prone to fires that spread decrease due to the advancement of agricultural and pasture areas, underscoring the need for more sustainable practices. In conclusion, this study holds promise as a management tool for decision-makers, offering valuable insights for the development of mitigation and adaptation measures to climate change in the Boca do Acre region. These contributions are essential for preserving this vital ecosystem, highlighting the importance of implementing effective strategies.