

Exploring the impact of biological fire prevention forest belts on forest and grassland fire risks in the China Mongolia border based on the Burn-p3 model

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Abstract: In recent years, large-scale fires have occurred frequently worldwide, posing a significant threat to human life and the environment. As a green and manageable fire-blocking measure, biological firebreaks have been increasingly applied in forest fire management. However, research on biological firebreaks mainly focuses on the selection of tree species for biological firebreaks and the configuration of planting space, while lacking quantitative assessment of their fire-blocking effects. Thus, studying the fire-blocking efficacy of biological firebreaks is of great value and significance for fire prevention and resistance, economic development, and ecological security. This study selects the biological firebreaks in the border area between China and Mongolia as the research area. Based on field investigations, historical fire data, and high-resolution remote sensing data, the Burn-P3 model is utilized to analyze the influences of different densities and widths of biological firebreaks on forest flammability and fire behavior at the landscape scale. The aim is to quantitatively evaluate the fire-blocking efficacy of the existing biological firebreaks in the border area between China and Mongolia and propose corresponding construction parameters and improvement suggestions, with the expectation of providing a scientific basis for the fire management strategies in the border area between China and Mongolia. The simulation results indicate that: (1) The biological firebreaks in the border area between China and Mongolia can effectively reduce the probability of fire occurrence, the spread speed, and the fire intensity. (2) Under the existing construction density scenario of biological firebreaks, as the width of biological firebreaks increases, the probability of fire occurrence, the spread speed, and the fire intensity all show a decreasing trend, suggesting that the widening of biological firebreaks enhances the fire-blocking efficacy.