Modeling Fire Ignition Probability in the Wildland-Urban Interface: Focusing on Power Infrastructures and Surrounding Environment

Seulbi Lee, Ph.D.[1] and Youngjib Ham, Ph.D., A.M.ASCE[2]

[1]Department of Architectural and Urban Systems Engineering, Ewha Womans University, 52 Ewhayeodae-Gil, Seodaemun-Gu, Seoul 03760, Republic of Korea; e-mail: lee130@ewha.ac.kr
[2]Department of Construction Science, Texas A&M University, 3137 TAMU, College Station, TX, 77843, United States; e-mail: yham@tamu.edu

ABSTRACT

Wildfire caused by faults in power distribution infrastructures is a typical threat in the Wildland-Urban Interface (WUI) area. With advanced sensing technologies and deep learning approaches, several machine vision-based surveillance methods have been developed to determine the contact point of power distribution infrastructures and vegetation. However, there is still room for improvement, especially in terms of dealing with uncertainty associated with the risk of failures by a sudden gust of wind that does not reflect historical patterns. In this regard, this research aims to assess the impact of wind on wildfire ignition probability. This research evaluates the likelihood of fire ignition that could be induced by tree encroachment into the minimum vegetation clearance distance zone surrounding power lines. The result would be expressed as a set of coefficients that describe the effect of wind on reducing the ambient air temperature and arc duration and enlarging the interface area. As a proof of concept, the wildfire risk variance following wind speed is analyzed based on the point cloud data of power grids. Possible applications of this research include identifying the potential fire ignition sources near power lines, and ultimately, this research can be used to advance probabilistic analysis for supporting decision-makings to explore how vulnerable environment interacts with the associated urban infrastructure.