Enhancing Wildfire Resilience in the Rail Industry: Developing a Community Resilience Extreme Events Portal (CREEP)

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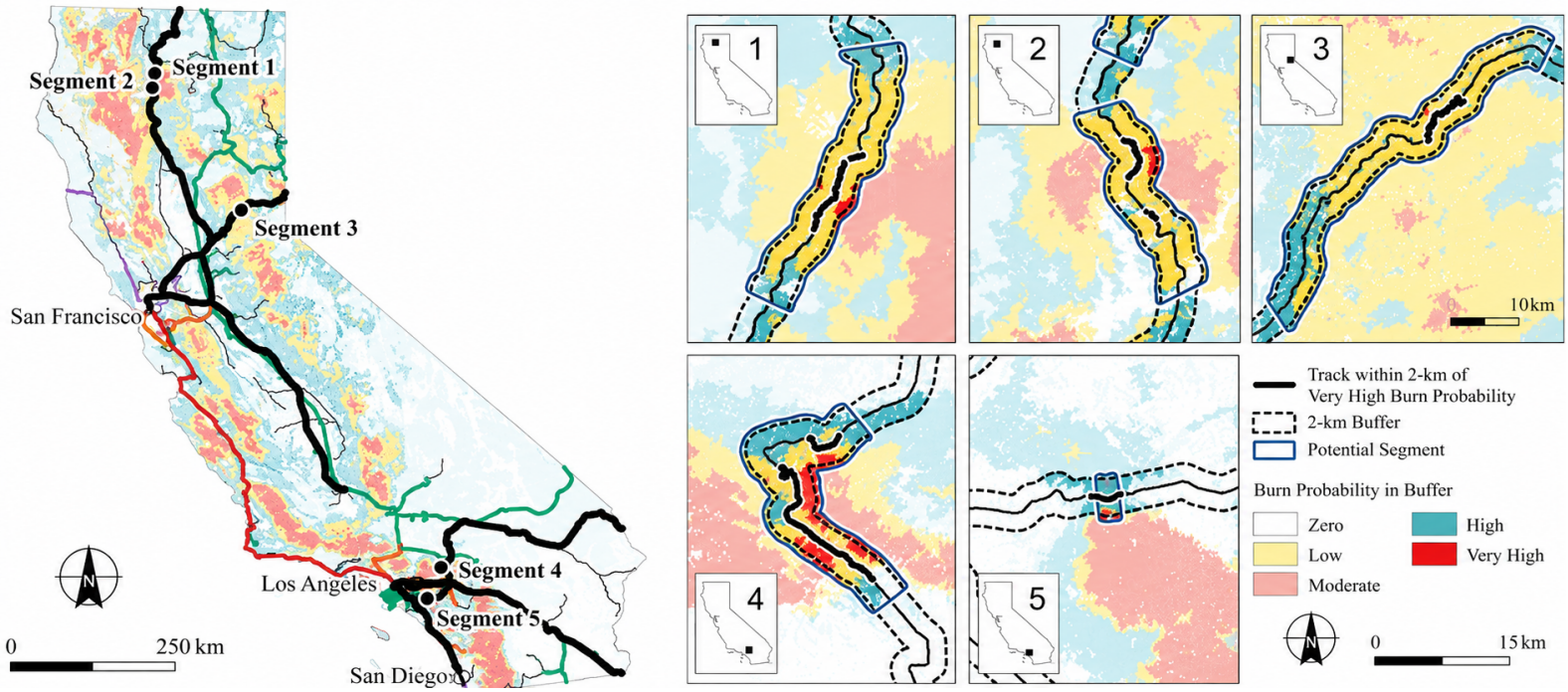

The Community Resilience Extreme Events Portal (CREEP) was developed to help railway operators and emergency managers better understand and mitigate the threat of wildfire to rail infrastructure and operations. Funded by the Federal Railroad Administration's CRISI Program and led by the University of Hawai'i in partnership with the Pacific Disaster Center and Haley & Aldrich, Inc., the project delivers a centralized, data-driven platform for visualizing wildfire vulnerability across California's Class I freight and passenger rail lines. CREEP uses publicly available datasets and stakeholder input to support risk communication and mitigation prioritization. This report documents the development of the vulnerability assessment framework, stakeholder engagement, and integration into the DisasterAware platform.

Study Methods

The study was conducted in two phases. Phase I focused on foundational research, stakeholder engagement, and a proof-of-concept study. A literature review identified existing methodologies for assessing wildfire risk and infrastructure vulnerability, which guided the development of a vulnerability assessment framework. Stakeholder engagement consisted of a series of three semi-structured interviews with representatives from rail operators such as Amtrak, Norfolk Southern, and Canadian National Railway. A proof-of-concept study involved the development of a methodology that was used to identify high-hazard Class I freight and passenger rail segments in California based primarily on their proximity to high-probability burn zones.

Phase II involved the development of the complete vulnerability assessment framework, which defines vulnerability as a function of exposure, sensitivity, and adaptive capacity. Each component was quantified using indicators derived from publicly

available datasets. Exposure included wildfire indices and ignition sources; sensitivity focused on the presence of critical assets near the rail line; and adaptive capacity reflected firefighting response capabilities. The framework was integrated into the Pacific Disaster Center's DisasterAWARE platform to increase accessibility and operational utility. Additional stakeholder feedback was collected in a series of working sessions and a follow-up survey to inform future refinements to the framework, such as moving beyond mitigation and planning towards a more dynamic, operational tool that supports real-time monitoring and coordination.

Findings

The final CREEP product demonstrated that wildfire vulnerability can be effectively assessed and visualized across the California rail network using publicly available data. The segmentation of rail lines into 1-kilometer units enabled relative comparisons of rail vulnerabilities, as well as prioritization of mitigation measures on a fine scale. Stakeholders found the portal's features useful, with support for its strategic capabilities, such as vulnerability ratings and sensitivity layers.

CREEP helps railroads and emergency managers increase resilience to wildfire threats by visualizing railway vulnerability, prioritizing mitigation, and improving coordination.

Survey responses indicated interest in incorporating historical wildfire impact data, including infrastructure damage and operational shutdowns, to validate the results and support planning. Respondents ranked exposure, burn probability, sensitivity, wildland-urban interface, and critical infrastructure layers as most important. Participants also shared the need for mobile-friendly tools, real-time weather monitoring, and improved coordination with rail operators. Furthermore, the integration of the framework into the DisasterAware platform allows users to layer vulnerability data with asset locations and other hazard information, which helps to support early warning and alert capabilities. Overall, the findings support the portal's potential to improve the rail industry's resilience to wildfire, as well as stakeholder's ability to communicate risk.

Policy Recommendations

To maximize the impact of the CREEP portal, future efforts should focus on expanding geographic coverage, refining vulnerability metrics, providing resources to remote rail corridors in areas with limited infrastructure and/or emergency response capabilities, and integrating with existing systems. In addition, incorporating historical wildfire damage and operational disruption data may help validate the framework's findings, and improving mobile accessibility and providing real time weather updates could improve the practical application of the portal for first responders and emergency managers.

Rail operators should engage more directly with emergency services to improve interoperability and joint planning. Training on NIMS and ICS protocols, along with shared use of tools like CREEP, can strengthen coordination during large-scale incidents. Federal and state agencies may consider the development of datasets for infrastructure sensitivity and emergency response capacity. Overall, CREEP provides an opportunity to increase the resilience and adaptability of the rail system as wildfire hazards become more frequent and severe.

About the Authors

Dr. Karl Kim is an urban planning professor at the University of Hawaii, who has over 40 years of experience in transportation planning and safety.

To Learn More

For more details about the study, download the full report at transweb.sjsu.edu/project/2416.1.html

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