Exponent®

THOUGHT LEADERSHIP

PUBLISHED 2Q 2021

Wildfire Modeling, Before and After

How computational wildfire modeling can help mitigate facility and liability risks

June 10, 2021

Large-scale wildfires can devastate facilities and high-value assets located in the wildland urban interface (WUI). A report published in 2018 estimated that the 2017 wildfire season in California alone cost $100 billion. Over 85% of costs were associated with environmental cleanup, lost business and tax revenue, and property and infrastructure repairs. Facilities in the WUI are at varying degrees of wildfire risk depending on localized topography, weather patterns, and vegetation conditions. This explains why an ignition at a particular location coupled with the right prevailing conditions may result in rapid wildland fire spread, while an ignition a few miles away may result in significantly different rates of fire spread and damage risk.

Owners and operators of facilities and high-value assets in the WUI are increasingly recognizing the need to understand their localized wildfire risk and invest in mitigation efforts where appropriate. Modern cloud computing permits massive simulations of wildland fire spread from specific locations under assumed ambient conditions. At a reasonable cost, large-scale computational wildfire modeling can help facilities quantify and reduce the likelihood of ignition from their own assets or harden specific locations against wildland fires caused externally. In the unfortunate event of a fire, these models can also help facilities assess equipment damage and other liabilities.

Mitigating Localized Risks of Fire Ignition and Spread

By efficiently evaluating wildfire risks from localized ignitions, modern cloud computing enables facility owners to focus preventive measures on specific locations and assets that face the highest risk of ignition or damage. For example, imagine that a company is building a new facility in a high wildfire threat area. Computational wildfire modeling can highlight the most likely approach direction of a potential wildfire and the area of the planned facility likely to bear the brunt of it. Armed with this insight, the company might consider placing a parking lot on that side of the facility to make a defensible space for the assets it wishes to protect.

Further computational wildfire modeling can also inform the heat load coming from the approach direction and provide quantitative estimates of the defensible space needed.

In addition, facility owners and operators can use computational wildfire modeling to determine where best to focus resources for preventing fire spread. For example, imagine a utility company has one transmission tower located in the midst of a densely forested mountain range and another located three miles away in relatively sparse vegetation. Modeling tools can predict at both tower locations the rate of fire spread under the specific fuel loads and prevailing wind conditions. If a fire at one location is more likely to spread to nearby populations or infrastructure, the company might want to focus its limited preventive resources there.

Assessing Asset Damage and Liability Post-Fire

Post-fire computational modeling can help facility owners and operators assess the scope and scale of damage. Because heat load damage is not always visible, wildfire modeling tools can help facilities identify assets that may need to be assessed or replaced to maintain the safety and continuity of operations. Given the increasing body of research on the negative effects of smoke plumes from wildland fires, owners and operators can use

wildfire modeling tools to understand the directionality of post-fire ash and particulates, how that directionality affects facilities, and whether additional liabilities may need to be addressed. Data from simulation, satellite, and distributed air quality measurement tools can also be incorporated after the event to determine where smoke and ash may have had the greatest effect.

How Exponent Can Help

Exponent's multi-disciplinary team of fire and thermal scientists, meteorologists, Geographic Information Systems experts, metallurgists, geologists, and structural engineers combines decades of wildland fire investigation and wildfire modeling experience with the technical expertise needed to perform and correctly interpret the results of modern cloud computing simulations. This comprehensive expertise enables us to rigorously inform model inputs, critically assess and validate model results, and develop effective strategies for risk mitigation in the real world. We can help facility owners and operators in industries susceptible to wildland fires reduce the likelihood of ignition from assets, limit fire spread, and assess damages and liabilities post-fire.

Reeve Dunne, Ph.D., P.E.
Thermal Sciences
Managing Engineer
Menlo Park
rdunne@exponent.com | (650) 688-7238

Abid Kemal, Ph.D.
Thermal Sciences
Principal
Menlo Park
akemal@exponent.com | (650) 688-7181