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Rocky Mountain Research Station
Science You Can Use *(in 5 minutes)*
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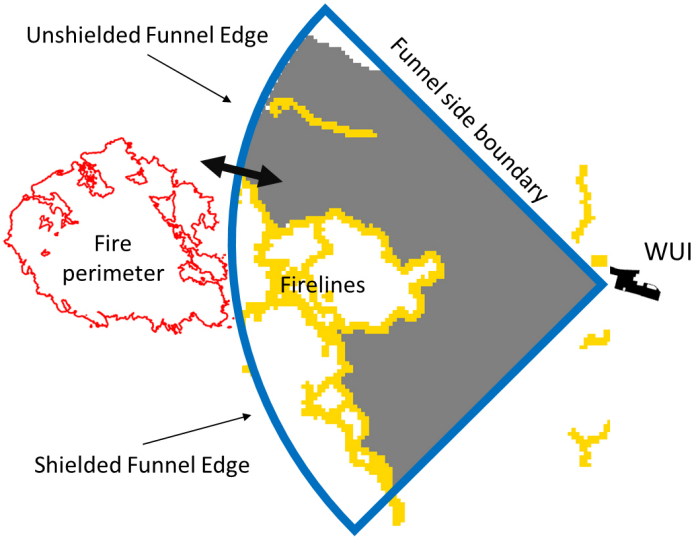
# **Funnel Focal Analysis:** Exploring risks in the wildland urban interface

In the western United States, wildfire activity has increased the exposure of communities to fires that can devastate lives and destroy homes and businesses. As fires encroach on urban areas, protecting communities from wildfire impacts is a top priority for fire managers. Scientists studying wildland fire in the wildland urban interface (WUI) are particularly interested in using historical data and analytic models to understand how to reduce risks to the WUI.

Researchers from the Rocky Mountain Research Station and Colorado State University have developed a new method to assess how wind, terrain conditions, and fireline construction interact with a fire perimeter and a WUI. The result of this research is the creation of a WUI fire exposure probability. "The objective of the research is to guide fire management operations in a way that is the most beneficial, the most efficient, and the most effective, while acknowledging operational limitations," says Jesse Young, Research Economist and Forester with the Rocky Mountain Research Station.

Yu Wei, Professor at Colorado State University, led a team that collected spatial data about fire perimeters, firelines, and nearby parcels of land classified as WUI locations for 11 large wildland fires in the western United States from 2017 to 2018. "We used historical fire records to build a model to identify the most important factors that influence the fire risk to a community," says Wei.

The data collection effort led to a model that uses fixed-shape "funnels" to analyze and compare landscape features between wildland fires and WUI locations.




*The funnel focal analysis approach provides a snapshot in time of the landscape between a wildland urban interface and an approaching fire perimeter. Figure provided by Yu Wei.*

The quarter-circle-shaped funnels define the terrain where a wildland fire may spread and encounter a WUI location. The team analyzed how firelines built in each funnel could protect WUI locations from an approaching fire.

Young explains: "As fires increase in size, alternative fireline production strategies can be used when assessing the estimated probability of WUI exposure, informing decision-making. If we have a strong wind, and the fire escapes initial attack, where do we deploy our resources to ensure the highest likelihood of reducing subsequent WUI exposure? Coupled with weather forecasts, fire managers could use future deployments of this model to design scenarios that better

inform the potential outcomes of their decisions, helping to guide an efficient use of fire management resources."

Future applications of this model as the science progresses will involve daily or sub daily fire progressions tracked with satellites or infrared flights, combined with PODs (Potential Operational Delineation) networks and forecasted weather to inform how the placement of fireline operations may alter fire progression and the subsequent exposure to WUI.

## KEY FINDINGS

- Researchers are continuously exploring other focal analyses approaches to better quantify WUI fire risk. This approach sets up a framework to explore how spatially explicit historical fire and weather data can be used to support this type of analysis. This research effort can help inform fire managers of the importance of different factors influencing WUI fire risk during a large fire event.
- Strong wind gusts are a complicated and highly variable factor influencing WUI fire risk exposure. Higher gust speeds may result in more severe fire behavior as well as associated firefighter safety concerns that can limit effective fireline construction and use.
- Terrain and fuel may also greatly impact wind directions and speeds, which may have both positive and negative impacts on fire suppression.

## FURTHER READING

Wei, Yu, Benjamin Gannon, Jesse Young, Erin Belval, Matthew Thompson, Christopher O'Connor, and David Calkin. Estimating WUI exposure probability to a nearby wildfire. Fire Ecology 19, no. 1 (2023): 1-18.

## CONTRIBUTORS AND WRITER

**Jesse Young** is a Research Economist and Forester with the Rocky Mountain Research Station.

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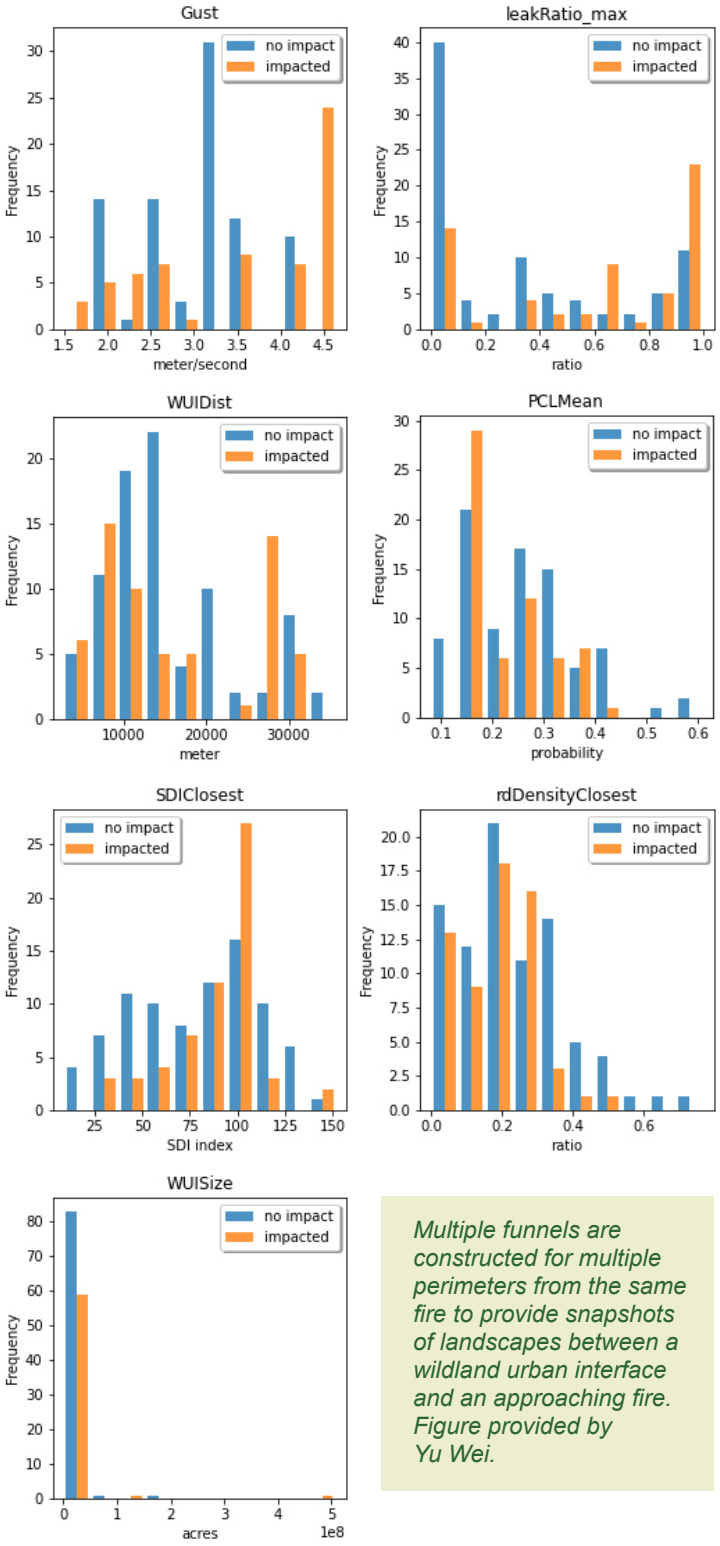


*Multiple funnels are constructed for multiple perimeters from the same fire to provide snapshots of landscapes between a wildland urban interface and an approaching fire. Figure provided by Yu Wei.*

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