



# Explaining Wildfires Through Curvature

In the summer of 2023, hundreds of wildfires in Canada sent smoke drifting down the North American continent, resulting in dangerous levels of air pollution in New York, Columbus, and other cities. The East Coast was finally tasting the horrific effects of wildfires. In Australia, where wildfires are a concern year-round, residents have already battled those effects for years.

Researchers in Australia have long tried to model these wildfires, hoping to learn information that can help with firefighting policy. Mathematicians like Jason Sharples and Valentina Wheeler are joining the effort. In 2012, Sharples and Wheeler began studying a particularly dangerous phenomenon: When two wildfires meet, they create a new V-shaped fire whose pointed tip races along to catch up with the two branches of the V, moving faster than either of the fires alone. This is exactly what happens in a mathematical process known as mean curvature flow. Mean curvature flow is a process in which a shape smooths out its boundaries over time. Just as with wildfires, pointed corners and sharp bumps will change the fastest.

Wheeler, Sharples, and colleagues modeled fires as curvature flows, using equations that specify how curvature affects the way a wildfire front changes in time and space. Though curvature information cannot explain everything about wildfires, it's one simple and effective tool for a problem that will only become more pressing as the climate evolves.



*Wind tunnel fires meeting at an apex. Photo courtesy of Dr. Andrew L. Sullivan for Commonwealth Scientific and Industrial Research Organization.*

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