

New directions for fire research in the US Forest Service

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There is renewed interest in understanding fire behavior from the perspective of heat transfer near the limits of fire spread. Fire in natural fuels frequently exhibits thresholds of sustainable spread, in part because substantial horizontal gaps exist that separate patches of denser fuels. Such fuel structure occurs in some grasslands, but more commonly in shrub and tree canopies which are observed to impart sustainability thresholds for crown fires. New research is designed to delineate the role and scale of radiation versus convection in determining spread of fire in laboratory-scale experiments. The effects of slope, fuel depth, and wind are explored in determining spread thresholds for particular horizontal gaps. The results clearly indicate the critical role of flame contact (convection) to both pre-heating and ignition of fuel particles ahead of the burning zone. Other experiments have suggested a limited role for radiation in heating fine fuel because of convective cooling and that live foliage burns far differently than dead fuels because of the ways that water is held and released when rapidly heated. Collectively, these experiments may contribute to practical modeling of spread thresholds in live and dead fuel complexes that support crown fires.