**Research challenges related to new extremes in California wildfires**

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Record levels of burning in 2018 and 2020 in California ecosystems pose immense challenges for mitigating and adapting to climate change, with recent fires contributing to massive economic losses and significant decreases in forest carbon stocks. The interplay of controls on increasing trends in burned area remains unclear, with past work identifying forest management, human-related ignition sources, and climate change as important drivers. To better understand the impacts of new extremes in fire weather on wildfires in the Sierra Nevada, here we quantified the sensitivity of wildfire occurrence and burned area to daily climate variables during 2001-2018. We find that the likelihood of ignition of a large wildfire increases non-linearly with daily mean temperature during summer, with a 1°C increase yielding a 19 - 22% increase in large fire occurrence. Area burned has a similar, non-linear sensitivity, with 1°C of warming yielding a 20% increase. Our analysis quantifies how increasing summer daily temperatures, including more frequent heat waves, influence the probability that wildfires will escape from human control. Combining this information with projections of future climate, we estimate that by the 2040s, the number of large fires will increase by 30 ± 7% and burned area will increase by 34 ± 7%, relative to a 2011-2018 baseline. These positive trends highlight the potential threat posed to fire management by hotter and drier summer weather. Leveraging recent initiatives by BER , we conclude by describing how artificial intelligence (AI) and high resolution climate modeling can contribute to improvements in fire prediction and help communities in the West adjust to a rapidly changing wildfire regime.