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Characterizing the lifetime phases of wildland fires from the Sioux Lookout District in Ontario, Canada by utilizing mixed effects multi-state modelling techniques

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Abstract

Wildland fires can be viewed as having a "lifetime" that consists of several sequential phases. The specific sequence of phases can vary depending on how a fire is responded to (e.g., full suppression or monitoring) by a fire management agency. We investigate the lifetime distributions of these various phases for wildland fires from a study area consisting of a response sector in Ontario's Northwest Fire Region. The progression of phases from ignition to being under control are examined using multi-state models and contrasted with models that only consider a single endpoint. Several fixed and random effects are incorporated into the models, including fire weather variables, the number of fires on the landscape, seasonality, and a shared fire-specific random effect across transitions. We identify the utility of multi-state modelling approaches for understanding the factors that drive progression through all the phases of a fire as well as those that only influence specific phases.

Keywords: fire lifetime, multi-state models