SEVERITY OF SHORT-INTERVAL REBURN MEDIATES COMPOSITIONAL SHIFTS IN FIRE-ADAPTED MONTANE SHRUBLANDS

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**Introduction**

Fire regimes in the northwestern United States have been dramatically impacted by changing climatic patterns and the consequences of past fire exclusion (Agee 1993, Schoennagel et al. 2017). Recent studies have documented increases in the frequency, severity and extent of wildfires as well as changes in the spatial patterns of burn area (Westerling et al. 2006, Miller et al. 2009, Stevens et al. 2017). In regions where past natural and anthropogenic fires were of mixed or low severity, the increased incidence of large, stand replacing wildfires is well outside of the historic range of variability (Taylor 2000, Hessburg et al. 2005, Mallek et al. 2013). This departure from historic norms [Higher incidence of wildfire on the landscape] has, in turn, resulted in increased occurrence of reburns, where wildfires burn inside of the boundaries of previous fires. This phenomenon is concerning to land managers, due to the largely unknown ecological ramifications, and have recently become a focus of fire research.

Although some authors have found that previous wildfires limited the extent and severity of reburns (Parks et al. 2014, Stevens‐Rumann and Morgan 2016), other studies have observed self-reinforcing effects of repeated wildfires (Collins et al. 2009, Coppoletta et al. 2016, Harvey et al. 2016, Lauvaux et al. 2016): these effects were often mitigated by initial fire severity and fire interval. Initial fire severity, time since fire and vegetation are frequently cited as the most important determinants of reburn outcomes (Harvey et al. 2016, Grabinski et al. 2017, Harris and Taylor 2017). High-severity wildfires can alter successional pathways, especially in naive ecosystems, such that conversions to alternative vegetative states occur. Examples of these type conversions exist in a variety of ecosystems (Odion et al. 2010, Knox and Clarke 2012, Collins and Roller 2013). The legacies of these extreme events can exhibit strong temporal persistence, influencing not only post-fire vegetation and fuels, but even promoting (pushing the system towards) the creation of novel fire regimes. This shift occurs via positive feedbacks, where initial high severity begets subsequent high severity, fueled in large part by fire-mediated vegetative state shifts. Some authors have proposed that frequent, severe reburns advance ecological thresholds, beyond which vegetation is permanently altered and previous ecosystems are unlikely to return (Falk 2013, Tepley et al. 2017, Stevens‐Rumann et al. 2018).

These post-fire state shifts and feedbacks have been observed when stand-replacing wildfires facilitate the conversion of dry mixed-conifer forests of northeastern California to montane chaparral shrublands (Collins and Roller 2013, Coppoletta et al. 2016, Lauvaux et al. 2016). In this fire-prone region, irregular vegetative patterns resulting from mixed-severity fires historically created gaps and clearings where shrub communities could persist. Decades of fire exclusion facilitated the invasion of conifer forests into these gaps, reducing the extent of chaparral ecosystems. These communities are composed of species that are highly tolerant of severe disturbance by fire, and display varying adaptive strategies that allow for post-fire dominance through rapid recolonization and regeneration.

While many studies have examined fire-mediated shifts from forest to chaparral-dominated landscapes, and the self-reinforcing nature of these vegetative changes, information is lacking as to how repeated wildfires influence species composition, especially where high-severity fire is self-perpetuating.

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