

Forests of the Tasmanian *E. delegatensis* subspecies are more resilient to a single high-severity fire than the mainland Australian subspecies.

Recovery strategies of *Eucalyptus delegatensis* subsp. *tasmaniensis* after the 2016 fires in Central Tasmania

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This study has found that forests of the Tasmanian *E. delegatensis* subspecies are more resilient (able to return to pre-disturbance conditions) to a single high-severity fire than the obligate-seeder subspecies in the Australian mainland.

Introduction

In January 2016, lightning storms in Tasmania started hundreds of natural fires. The extremely dry conditions and the adverse weather allowed the fires to enter large areas of mature forests of *Eucalyptus delegatensis* subsp. *tasmaniensis*, endemic to the island. The objective of this research is to investigate the effects of fire severity and logging history on the mortality and recovery of this species, and to compare these post-fire recovery responses to the mainland Australian subspecies, the obligate-seeder *Eucalyptus delegatensis* subsp. *delegatensis*. This study enables consideration of the vulnerabilities of the Tasmanian subspecies to fire disturbances and logging in a warmer climate.

Methods

We collected post-fire survival and regeneration data of *Eucalyptus delegatensis* subsp. *tasmaniensis* forests in summer 2018 in the Central Plateau of Tasmania. We established 82 transects (0.1 ha each), in long-unburnt forests and forests burnt by the 2016 fires, to assess the effects of fire on *E. delegatensis* trees. In each transect, we measured the diameter of *E. delegatensis* trees, assessed the status of the tree (live undamaged, epicormic resprouting, basal resprouting or dead) and classified the transect by its fire severity: unburnt, low-severity (fire scarring on the stem and/or lower canopy burnt) and high-severity (full canopy burnt). We used model selection to analyse tree survival, vegetative regeneration and seedling recruitment depending on understorey type, fire severity, logging intensity and tree size (diameter).

Results

Fire severity affected tree survival: 36% of trees were alive in high-severity transects versus 84% in unburnt transects. The main fire-recovery strategy was epicormic resprouting, with < 1% of all trees recovering only through basal resprouting. Fire severity had an impact on epicormic resprouting, with 99%, 70% and 4% of live stems after the fire resprouting, respectively, in high-severity, low-severity and unburnt transects (Figure 1). Tree size influenced tree survival: trees < 20-cm diameter suffered the most fire-induced mortality (Figure 2). Seedling recruitment was uncommon and, when seedlings were present, their densities were low: median = 400 and maximum = 4·10⁴ seedlings · ha⁻¹.

Discussion

This study highlights that mature forests of *E. delegatensis* in Tasmania are more resilient to a single high-severity fire than their mainland counterparts, as they can recover more quickly through epicormic resprouting. However, logging reduces this resilience for several decades because it makes the regrowth (< 20-cm diameter) more susceptible to fire kill. It is difficult to predict how the Tasmanian *E. delegatensis* subspecies will respond to an increased frequency of high-severity fires associated with a projected drier climate. This fire risk could be mitigated by maintaining multi-aged forest structures. Silvicultural approaches based on variable retention and uneven-aged treatments can be used to retain biodiversity, increase natural regeneration from in-situ resources and secure ecosystem function.

Tables and figures

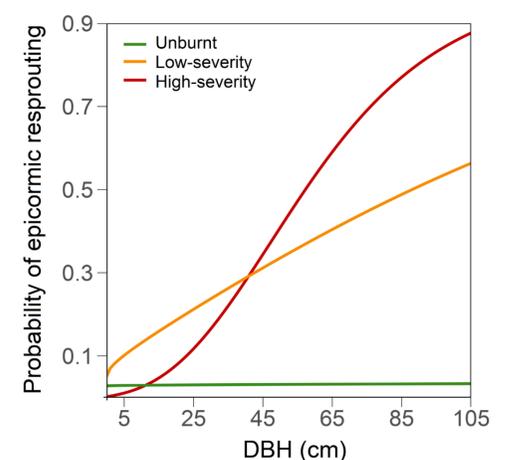


Figure 1. Probability of epicormic resprouting according to fire severity and tree diameter.

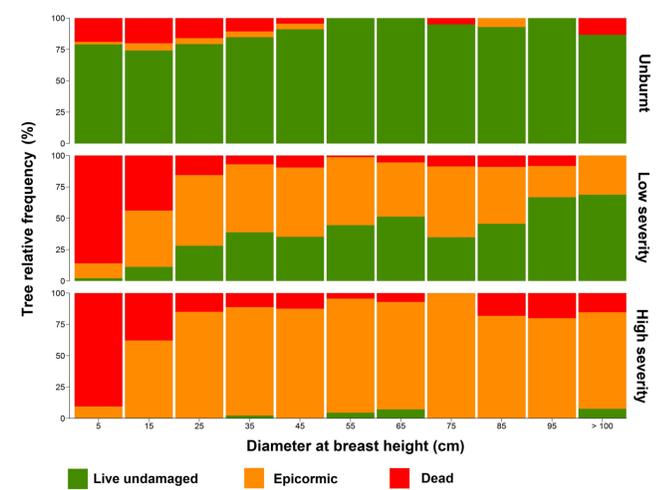


Figure 2. Status of *E. delegatensis* trees by fire severity and diameter. "Live undamaged" are undamaged, live trees. "Epicormic" are stems with live epicormic resprouts. "Dead" are trees where the main stem is dead, and there are neither live basal nor live epicormic resprouts. Trees are binned in 10-cm diameter classes, with the midpoint of the class shown on the x-axis (diameters > 100 cm are binned into one class).