

Response to fire cues

Germination and emergence of Australian alpine seeds

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Introduction

In fire prone ecosystems, some species have adapted to increase their germination in response to fire, taking advantage of the post-fire environment.

Fire stimulated germination is a well-studied strategy in Australia, yet it has never been investigated in Australia's alpine flora.

Unlike other alpine communities across the globe, the **Australian Alps experience widespread fires every 50 – 150 years.**

This evolutionary timescale of fire suggests that alpine seed may respond to fire cues.



The Australian Alps are a highly diverse bioregion with many endemic alpine specialists.

This study aimed to provide some of the first insights into the effect of fire on:

1. Alpine seed germination
2. Seedling emergence from the alpine soil seed bank

Soil seed bank experiment

Methods

Soil samples were collected one year post-fire from six burnt and unburnt sites at subalpine elevations. Sites were paired based on elevation.

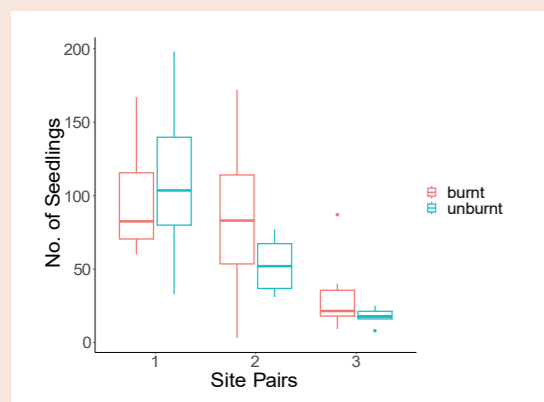
Soil samples were spread onto trays and placed in a glasshouse.

Emerging seedlings were marked and identified.

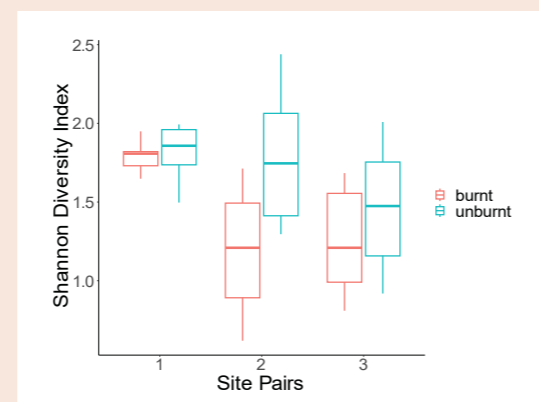
Seedlings of each morphotype were potted for identification.

Results

a) Abundance of seedlings



b) Diversity of seedlings



Burnt soil seed banks did not differ in the number of emergent seedlings, and produced a lower diversity of seedlings, compared to unburnt seed banks.

Why study alpine seed and fire?

Recurrent fire in an alpine environment is globally unusual.

Fire cues may facilitate the germination of some difficult to germinate Australian alpine species.

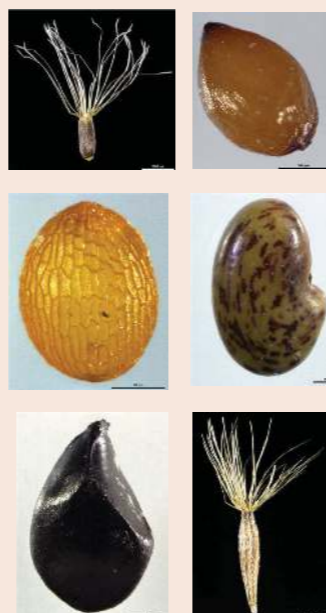
Studies in ecosystems where fire is infrequent provide insight into the evolutionary origins of fire-cued germination.

Future directions

Further investigation is required to examine relationships between germination and emergence and to confirm the trends presented in this study.

Soil seed bank sampling should incorporate higher elevations and various fire frequencies and regimes.

Fire appears to increase germination in some alpine species. Germination testing with a wider range of species may reveal effective germination techniques.



Alpine seeds

Questions and hypotheses

How does fire in the Australian Alps affect...

... seedling emergence?

Do burnt soil seed banks produce a greater
a) abundance of seedlings?
b) diversity of seedlings?

... seed germination?

Does heat and smoke increase the
a) final % germination?
b) germination rate?
Does smoke* heat have a greater effect compared to these cues acting alone?



Soil seed bank experiment.

We hypothesise that burnt soil seed banks will produce a greater abundance and diversity of seedlings.

We hypothesise that some alpine species will increase their germination in response to fire cues, particularly with the combination of heat and smoke.



Lab germination experiment.

Lab germination experiment

Methods

21 alpine species were selected to represent a variety of families, lifeforms, regeneration and germination strategies. Seed was obtained from the National Seed Bank, ACT.

Seeds were subjected to heat and smoke factorial treatments.

All seeds were subjected to temperatures mimicking an alpine year for 14 weeks to account for those species that require stratification.

Results

When averaged across 21 alpine species **smoke significantly increased final germination.**

Fire-cued germination is less prevalent in alpine species compared to those found in frequently burnt ecosystems. It may therefore represent a trait that has been retained from surrounding flora rather than a direct adaptation to fire in the Alps.

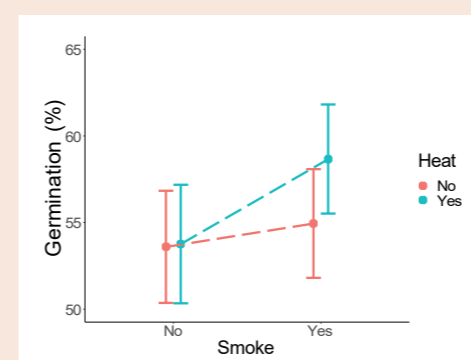
Fire-cued germination does occur among Australian alpine species.

An interesting find

Epacris paludosa, a shrub found in boggy areas, responded particularly well to smoke. This is common in the *Epacris* genus and may represent the retention of an evolutionary trait.



Circles indicate germinated seeds.



Average final germination of 21 alpine species subjected to factorial heat and smoke treatments.



Epacris paludosa

Acknowledgments

Staff and volunteers at the National Seed Bank. Australian Mountain Research Facility staff, volunteers and summer students. Plant Services - ANU. Nicotra Lab - ANU. For help with seedling identification: Brendan Lepschi, Neville Walsh, Keith McDougall.

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