International Mountain Conference 2019, Innsbruck

A multi-year field experiment for studying the importance of different abiotic and biotic drivers of tree seedling recruitment in an alpine treeline ecotone

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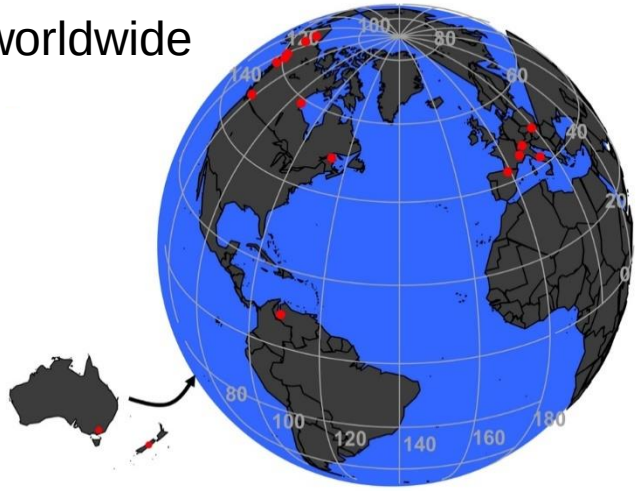
Global Treeline Range Expansion Experiment Initiative (G-TREE)

- Globally distributed multi-year field experiments to test multiple drivers of seedling recruitment at treelines
- Common experimental protocol
- Research aims:
  - Disentangling seed vs. substrate limitations
  - Predictions for future treeline expansion

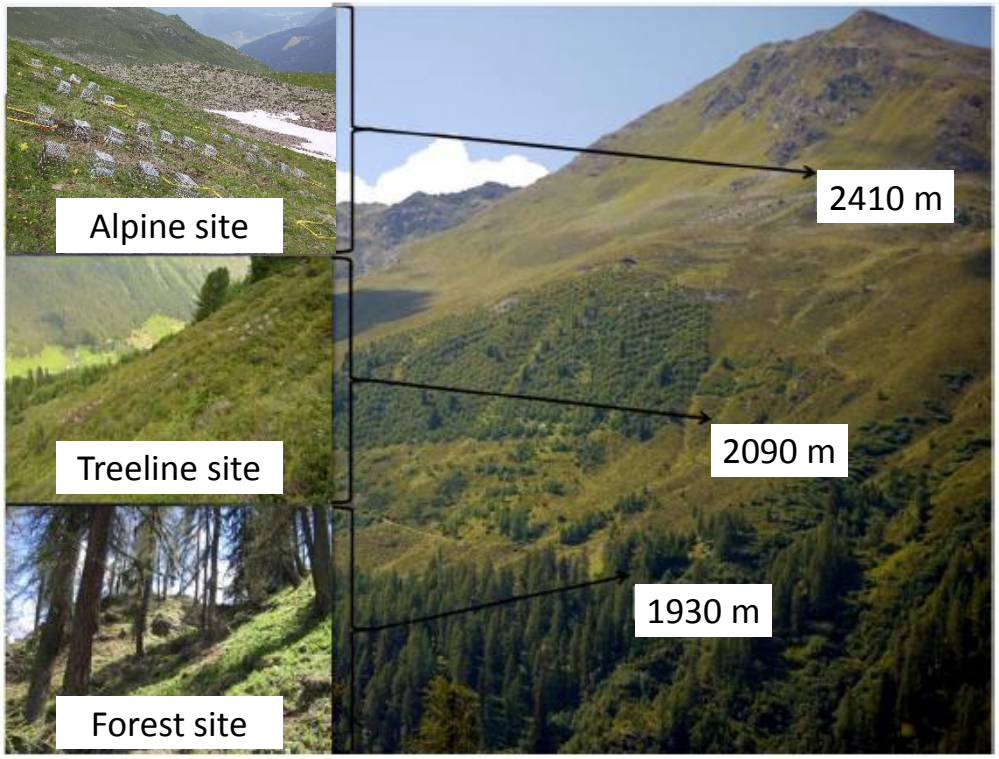
16 sites worldwide



http://treelineresearch.com/

Swiss G-TREE experiment

Experimental sites near Davos, Switzerland (established in 2013)



Study species

Picea abies

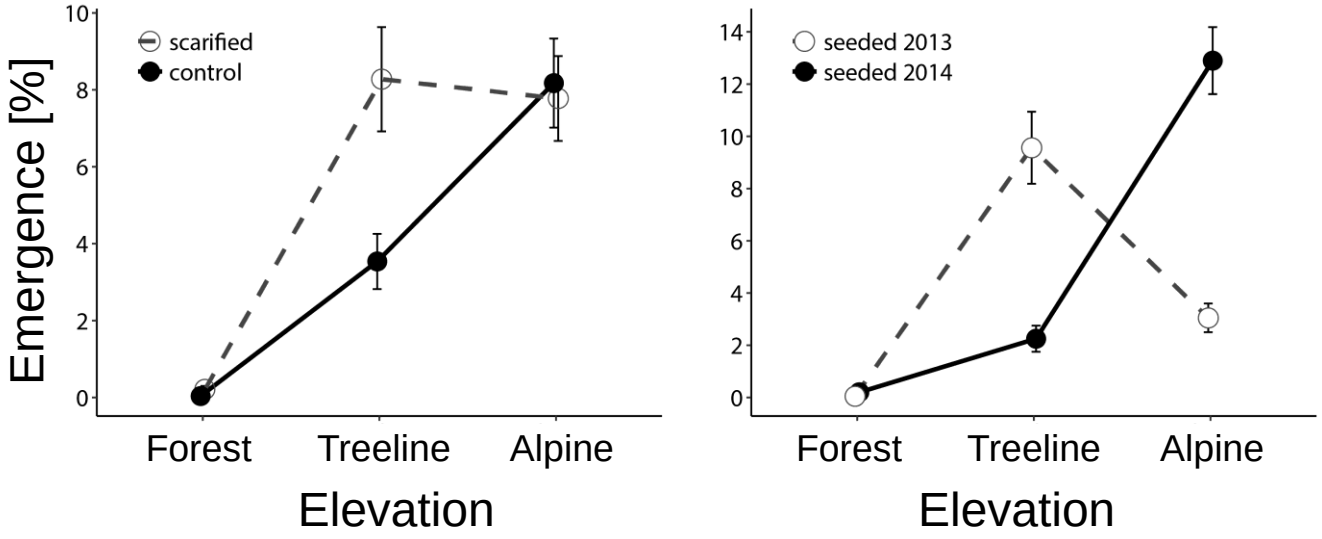
Larix decidua

- low and high elevation provenances of both species

Treatments

- seeding (2013 and 2014)
- soil scarification
- herbivore exclosures

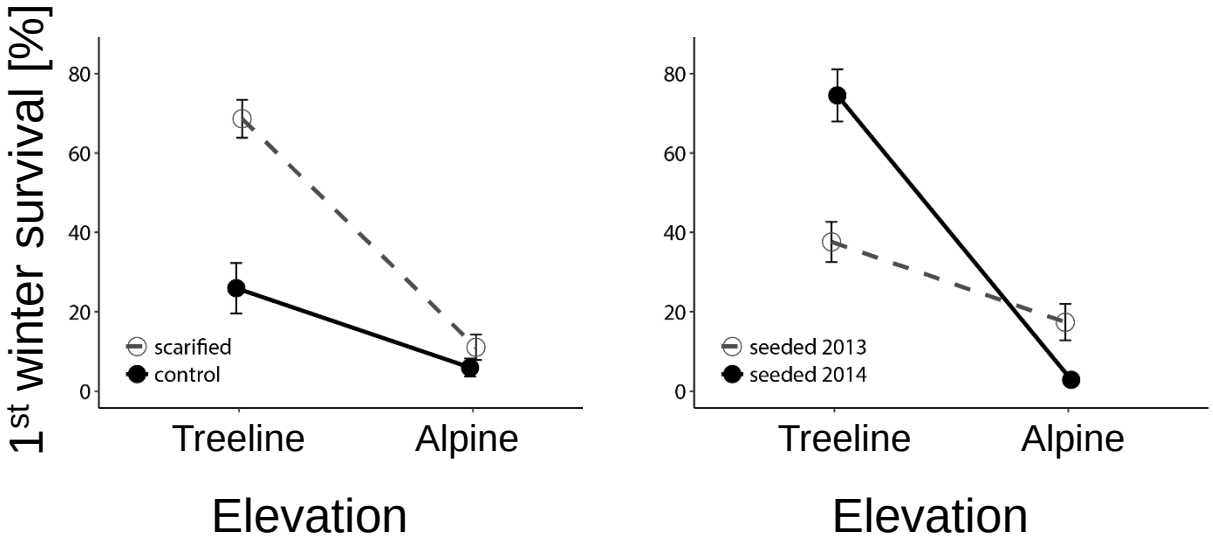
Seedling emergence



- No natural recruitment at and above treeline
- Emergence increased with elevation but varied with seeding year
- Dwarf shrubs and dense understorey vegetation reduced emergence

Frei *et al.* (2018) *SciRep*

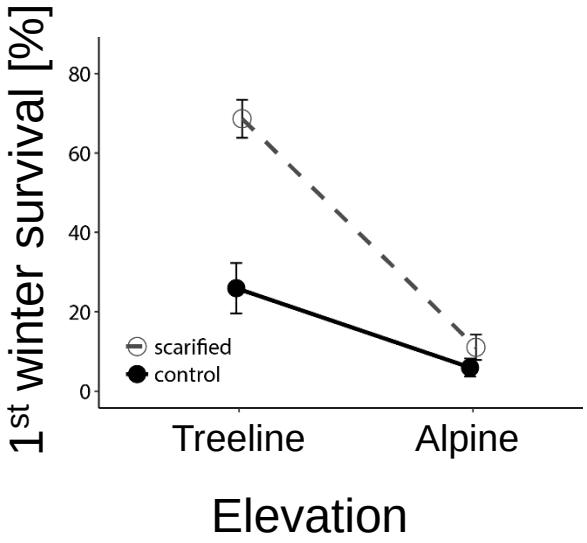
Seedling survival

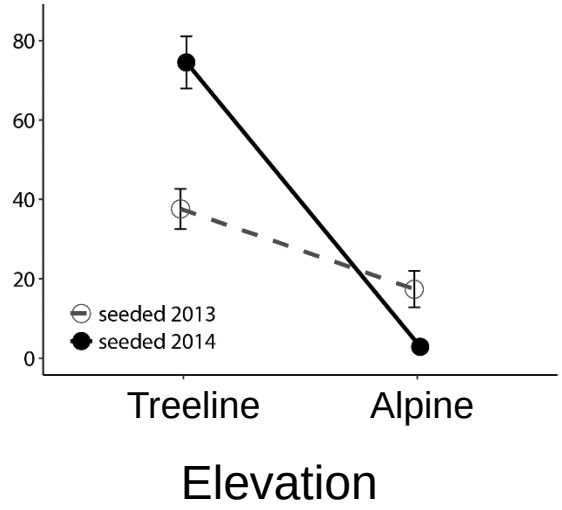


- Winter survival was higher at treeline than at the alpine site but with larger differences between sites in 2014
- Higher survival on scarified plots
- 1st winter survival is a bottleneck for recruitment

Frei *et al.* (2018) *SciRep*

Seedling survival





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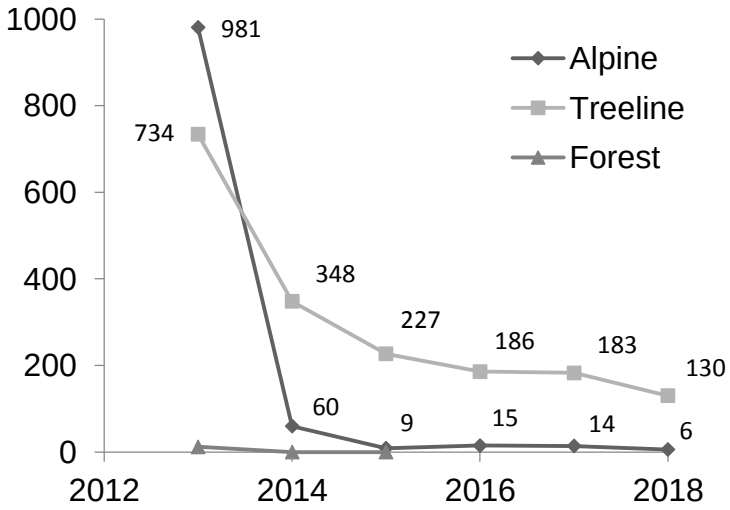

Synthesis

- Tree seedlings can emerge and establish at and well above the current treeline when viable seeds reach suitable microsites for germination
- Multiple abiotic and biotic drivers shape early seedling recruitment in the treeline ecotone
- Global results support findings of the Swiss study: strong seed and substrate limitations at treelines worldwide

Acknowledgements

G-TREE partners, Eva Bianchi, Melissa Dawes, Martin Heggli, Alessio Pataglia, Ueli Schmid, Moritz Wanner, Lea Voegele, Sonja Wipf, Giulietta Bernareggi, Werkstatt SLF, Alpgenossenschaft Davos, field crews 2013-2018