

# How Trees are Climbing Mountains

### Introduction

Climate change is a worldwide issue with far reaching implications. The gradual increase in average temperatures, as well as the increasing frequency of extreme weather events (storms, droughts, floods) means the climate envelope of many species is shifting.

This is typically shown by species moving towards the poles or higher elevations in search of cooler temperatures.

Plants are unable to physically move in response to a changing environment like animals can. In a study based in Oman, researchers investigated why the population of an evergreen tree (*Juniperus seravschanica*) seemed to be moving up the mountainside.



## Methods

In order to conduct an experiment, you need to ensure you have rigorous methods.

## Location

Jabal Shams, Oman

## Populations

Low altitude (2100 - 2220m)

Mid altitude (2300 - 2400m)

High altitude (2500 - 2570m)

## Seed collection

Cones and their seeds were collected by hand. The seeds were soaked in water and only the ones that floated were kept.

## Tree growing

Trees were either grown at one of the three altitudes on the mountain in small plots, or grown at the Oman Botanic Garden for two or five years before being transplanted onto the mountain.



## Experiment 1

### How does altitude affect seed production and viability

The number of healthy seeds with a viable embryo was counted alongside unviable and insect damaged seeds across each of the three elevations.

## Findings



High altitude trees produced more seeds per cone.



Altitude didn't affect seed viability.



Insect damage was minimal across all altitudes

## Experiment 2

### How does temperature and elevation affect germination in the lab

Seeds were exposed to 15°C or 25 C and then monitored for germination success.

## Findings



15°C led to a higher germination success.



Seeds from higher altitudes had greater germination success.



It took longer for seeds to germinate at 15°C



### Experiment 3

**How well do planted seeds grow on the mountain?**

Seeds from mid altitude were planted in plots at low, mid, and high altitude. They were either watered with 2L every 15 days, every 30 days, or not at all (rain only)

### Findings



All seeds failed and no trees grew. This was thought to be due to bad weather eroding the soil and washing away many seeds.

### Experiment 4

**How well do 5-year old lab grown trees establish on the mountain?**

Trees grown for 5 years in a controlled environment were planted in plots at low, mid, and high altitude. Trees were watered with 10L every 15 days, 30 days, or not at all (rain only).

### Findings



Trees survived at a high rate across all plots!



Plants growth decreased with increasing altitude.



## Experiment 5

### How well do 2-year old lab grown trees establish on the mountain?

Trees grown for 2 years in a controlled environment were planted in plots at low, mid, and high altitude. Trees were watered with 2L every 15 days, 30 days, or not at all (rain only).

## Findings



Young trees survived best at the high altitude.



More frequent watering increased plant survival at low altitude.



Chlorophyll levels in the summer were much higher in the high altitude trees compared to low altitude trees.

## What does this mean?

Despite grown trees producing healthy seeds at all altitudes, the cooler environment of higher altitudes increased the likelihood of the seeds germinating. This combined with young trees surviving at a higher rate at high altitudes indicates that the population of *Juniperus seravschanica* will naturally move higher as temperatures continue to increase, and water availability becomes more unpredictable. To protect this population, using drought/heat tolerant nursery grown trees is a potential step to ensure the species survival.

Al Farsi KAA, Lupton D, Hitchmough JD, and Cameron RWF (2017) How fast can conifers climb mountains? Investigating the effects of a changing climate on the viability of *Juniperus seravschanica* within the mountains of Oman, and developing a conservation strategy for this tree species. *Journal of Arid Environments* 147: 46-53. IF 2.8, 2021 Internal REF score 3.5