

# Plasticity in a changing world: A comparison of phenotypic variability in *Boechnera stricta* across time and space

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## Question

What strategies does *B. stricta* use to cope with environmental change over time and space?

## Introduction

Plasticity is the ability to change phenotype in response to environment. In an increasingly unpredictable climate, plasticity may enhance plant survival in the short term by allowing plants to cope with rapid shifts in water availability and temperature.

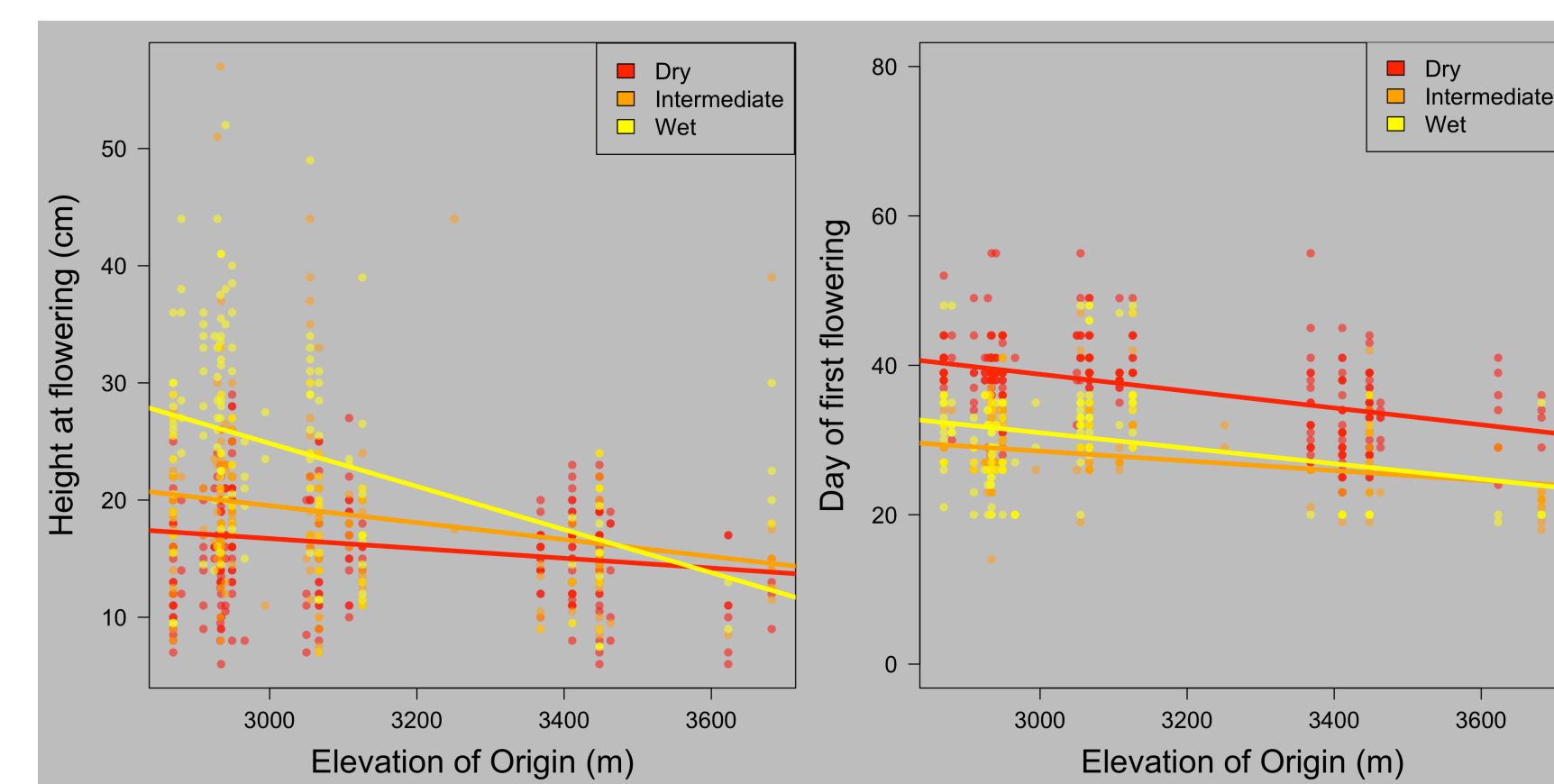
## Materials and methods

We collected individuals of *Boechnera stricta*, a native perennial mustard, from 24 populations across the species range and planted them into two common gardens at 2890 and 3153m, respectively. We examined plasticity over time across a drought gradient from 2012-2014, where 2012 was the driest season. We examined spatial plasticity across the two common gardens. We standardized day of flowering by snowmelt date and estimated water use efficiency by  $\delta^{13}\text{C}$ , the proportion of inner leaf to atmospheric  $\text{CO}_2$ . Trait differences were analyzed in an ANCOVA framework between elevation of origin and year or garden.

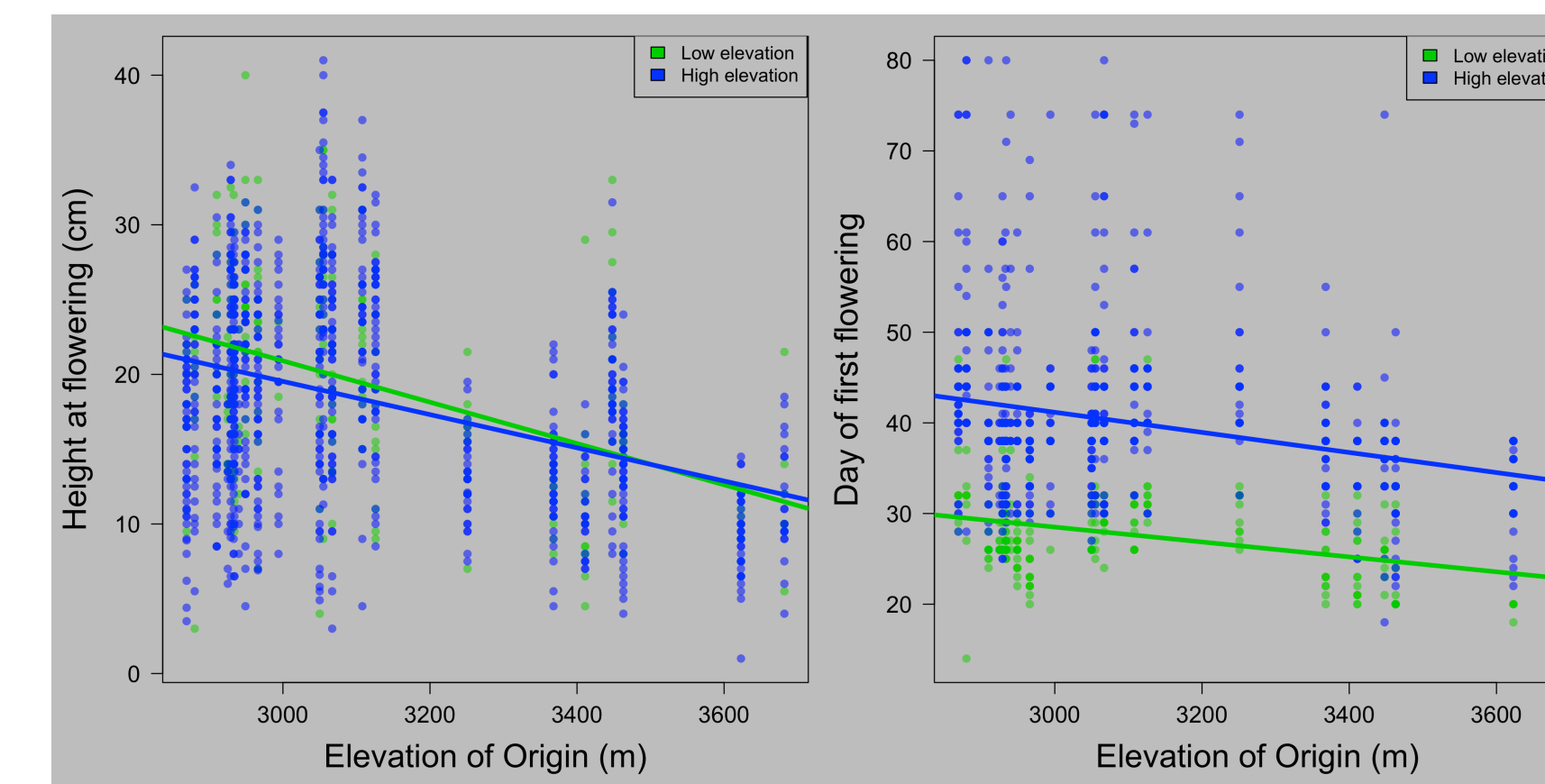


## Key Results

### Does *B. stricta* exhibit plasticity in phenological traits over time and space?



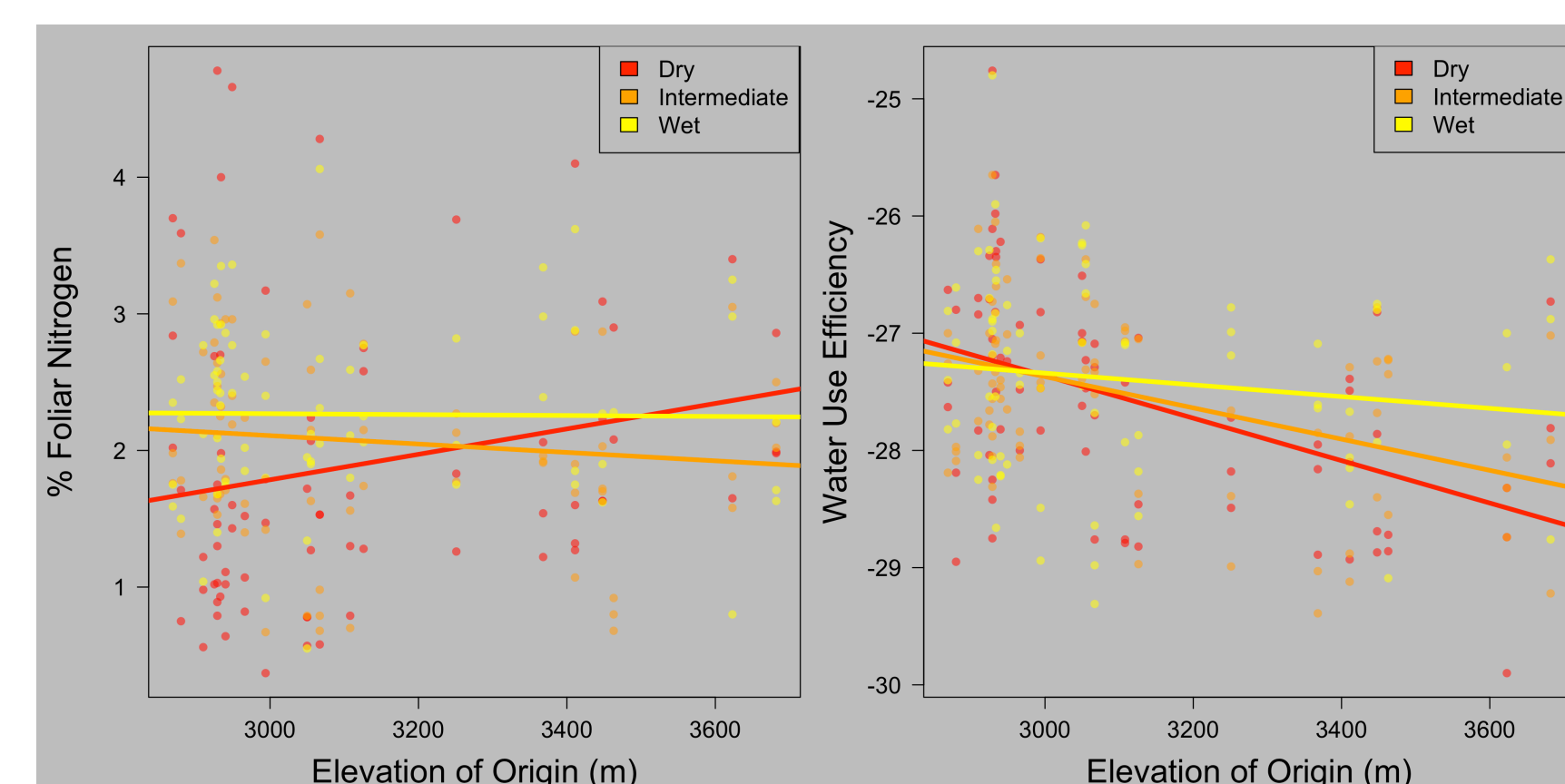
**Figure 1.** Height at flowering and day of first flowering exhibit both plasticity and genetic control. Clines change over time, indicating plasticity.



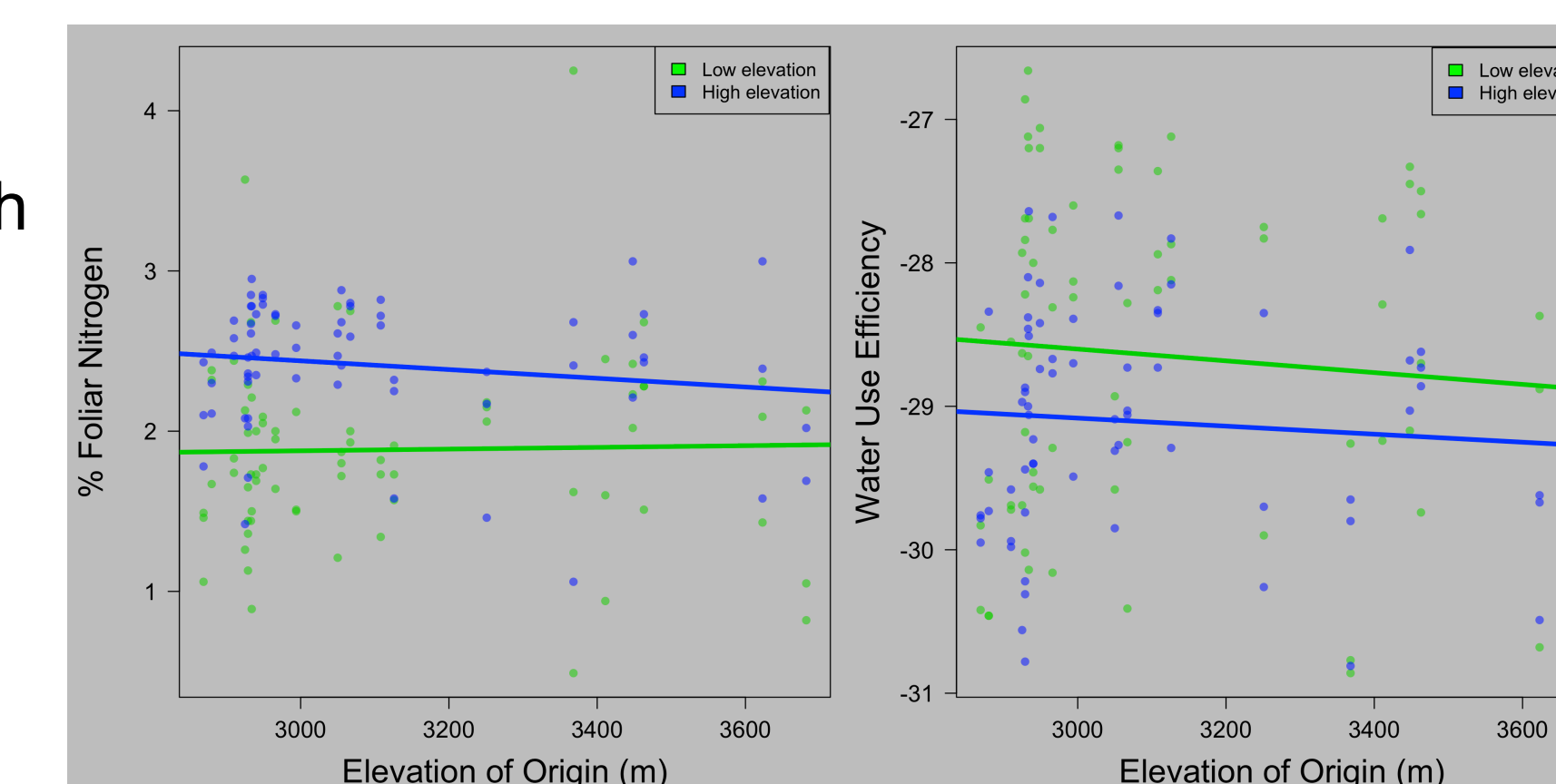
**Figure 2.** Height at flowering and day of first flowering exhibit both plasticity and genetic control. Clines change between gardens for height but are consistent for first flowering.

Phenological traits are determined by genes (genetic control) and environment (plasticity), where genotypes from low and high elevations of origin respond differently to changes in environment over time and space.

### Does *B. stricta* exhibit plasticity in physiological traits over time and space?



**Figure 3.** Foliar N and WUE exhibit both plasticity and genetic control. Clines change over time, indicating plasticity.



**Figure 4.** Foliar N and WUE exhibit plasticity over space. These clines are consistent between gardens.

Photosynthetic rate, estimated by foliar N, is determined by environment (plasticity) over both space and time. Water use efficiency is plastic over space but genetically controlled over time.

## Take Home

*B. stricta* exhibits plasticity in phenology and physiology over both time and space, though some genotypes are more plastic than others. Plasticity will play an important role in enhancing survival in the midst of unpredictable climatic change.



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