

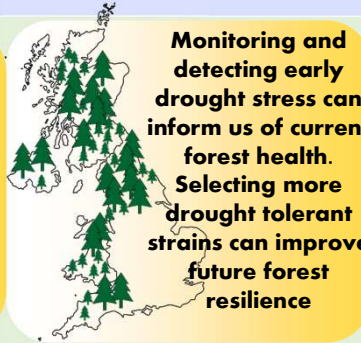
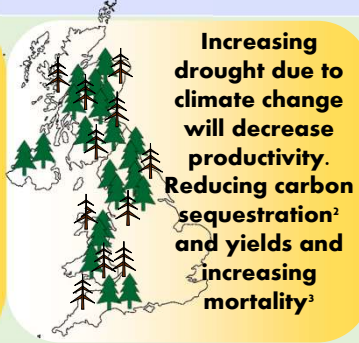
Early detection of drought stress in Sitka spruce (*Picea sitchensis*) using remotely sensed retrieval of photo protectant related indices

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Background



Aims

Expose breeding population *S. spruce* clones to drought

Identify vegetation indices sensitive to drought stress

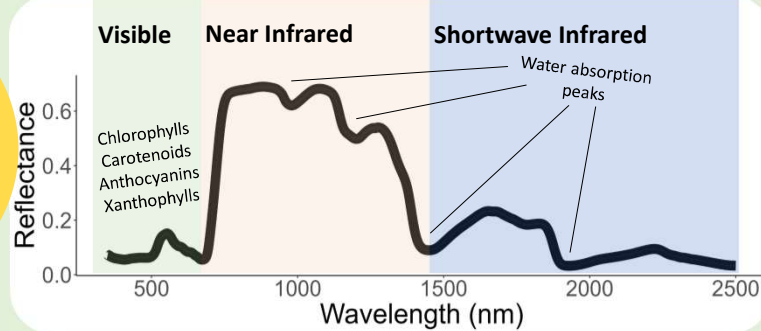
Compare drought tolerance of clones

Data collection



Hyperspectral spectroscopy

Light reflected from needles is recorded at high spectral resolution allowing non-destructive measurements of pigments, structural features and water content



Reflectance measurements are taken weekly for different spruce clones exposed to experimental drought for 50 days

Reflectance data is used to calculate vegetation indices sensitive to different biophysical traits

Reflectance spectra of Sitka spruce

The visible region is associated with pigment composition and the near infrared with structural features. Water absorption peaks are sensitive to needle water content

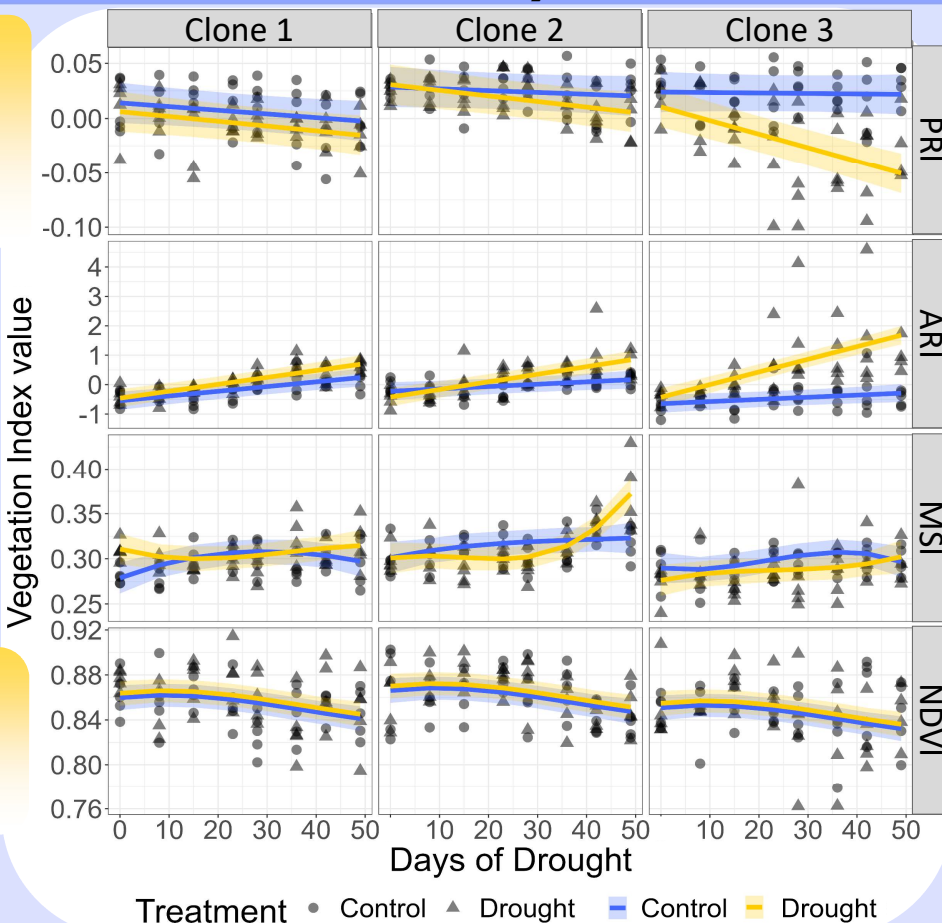
Key Results

PRI - Sensitive to the xanthophyll cycle and photosynthetic efficiency
Decreases under stress

ARI - Sensitive to anthocyanins
Increases under stress

MSI
Sensitive to foliar water content
Increases under stress

NDVI
Plant 'greenness'. Indicator of plant health
Decreases under stress



PRI and ARI are sensitive to drought

Photo protectant pigments in the needles dissipate excess energy when water availability is low and photosynthesis is compromised

Clones differ in stress response

Clone 3 has the strongest pigment response under stress. Suggesting a lower drought tolerance

Water content does not initially drop

MSI is similar between treatments through early drought as plants close stomata and hold onto existing water.

Rapid drop off in water content in clone 2 near end of drought

NDVI not sensitive to drought

NDVI is often used to indicate plant stress. However, it is not as sensitive as other indices to drought stress. Seasonal cycles cause a gradual drop of over the study period

Future

Apply drought sensitive indices to forest stands using airborne or satellite mounted sensors

Incorporate drought tolerance metrics into Sitka spruce breeding programmes