The effect of a compound drought and heatwave event on the coastal dune building grass *Elytrigia juncea*

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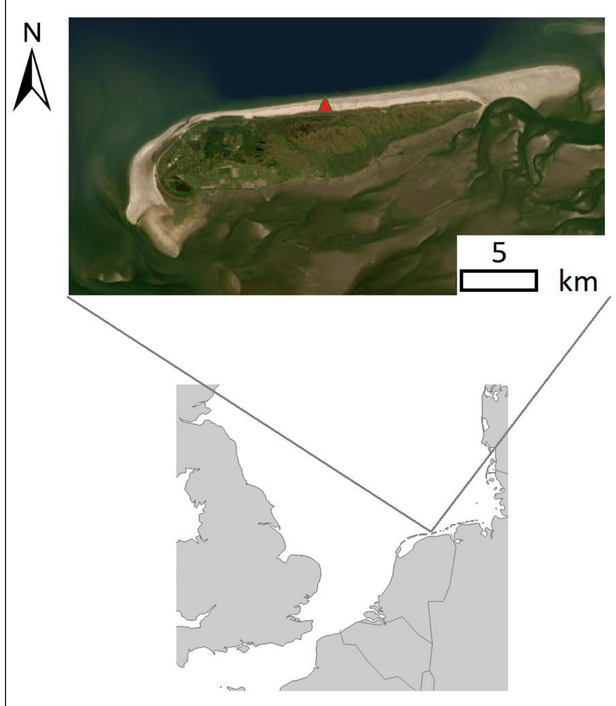
Introduction

Coastal dune systems are threatened by future climate change. On the one hand, sea level rise and increased storm frequency will lead to dune erosion. On the other hand, dune vegetation will experience more extreme drought and heatwave events. In the Netherlands the later typically occurs in summer, storms are more frequent in winter. Summer growth of dune building grasses is key for coastal dunes to develop and/or recover from winter erosion. In this study we investigate the effect of a compound drought and heatwave (CDHW) event on the pioneer dune grass *E.juncea (Sand couch)*. We hypothesize that this dune grass not only forms an embryonic dune to escape storm erosion, but also to secure fresh water availability. Depending on the patch size, storage can occur in the form of capillary hang water or a fresh water lens. We conducted a manipulative field experiment on the Dutch barrier island of Schiermonnikoog. This full-factorial experiment tested the effect of a 4-week CDHW event on *E.juncea* of two different patch sizes.

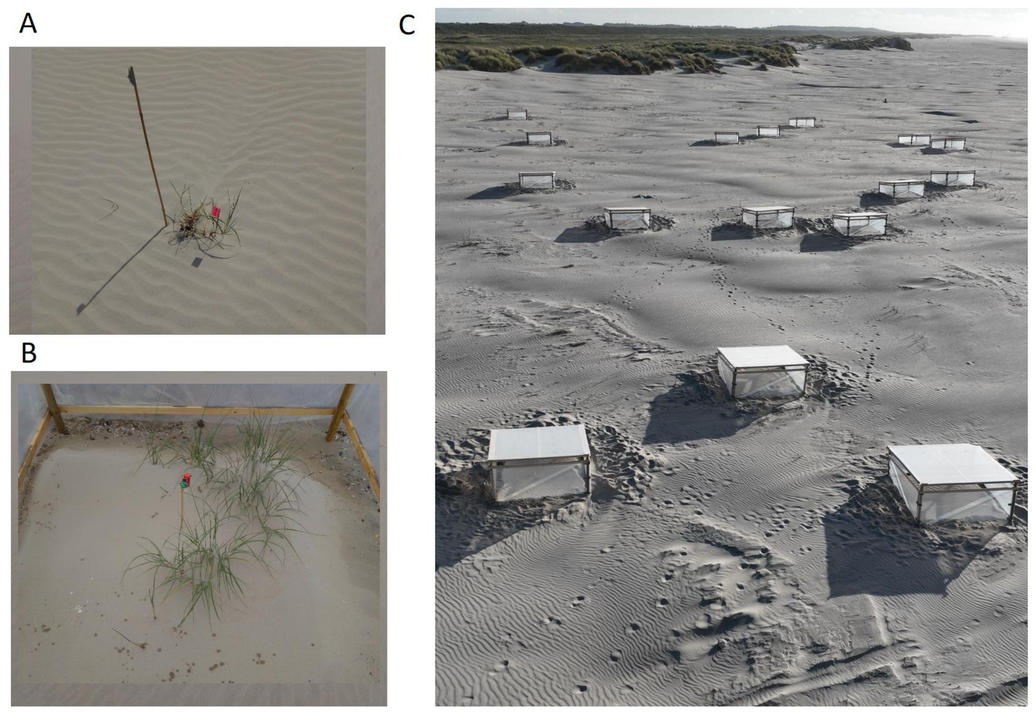
Experiment

Study area:



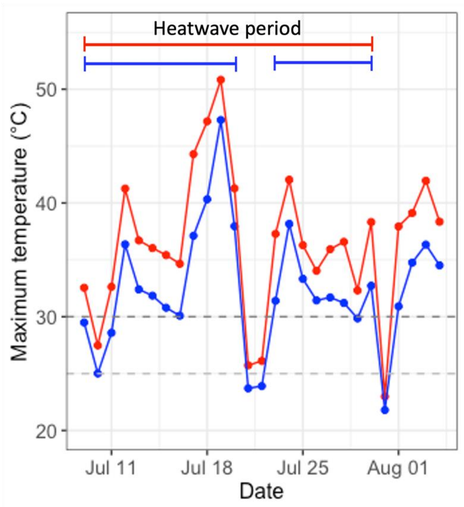
Remote beach on the barrier Island of Schiermonnikoog

Treatments:

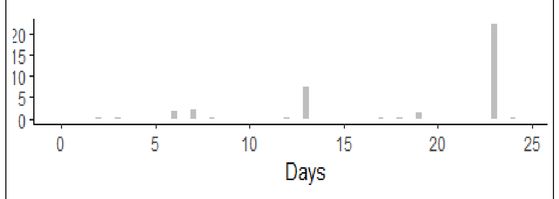


A) Small patch. B) Large patch. C) Greenhouses simulating CDHW event.

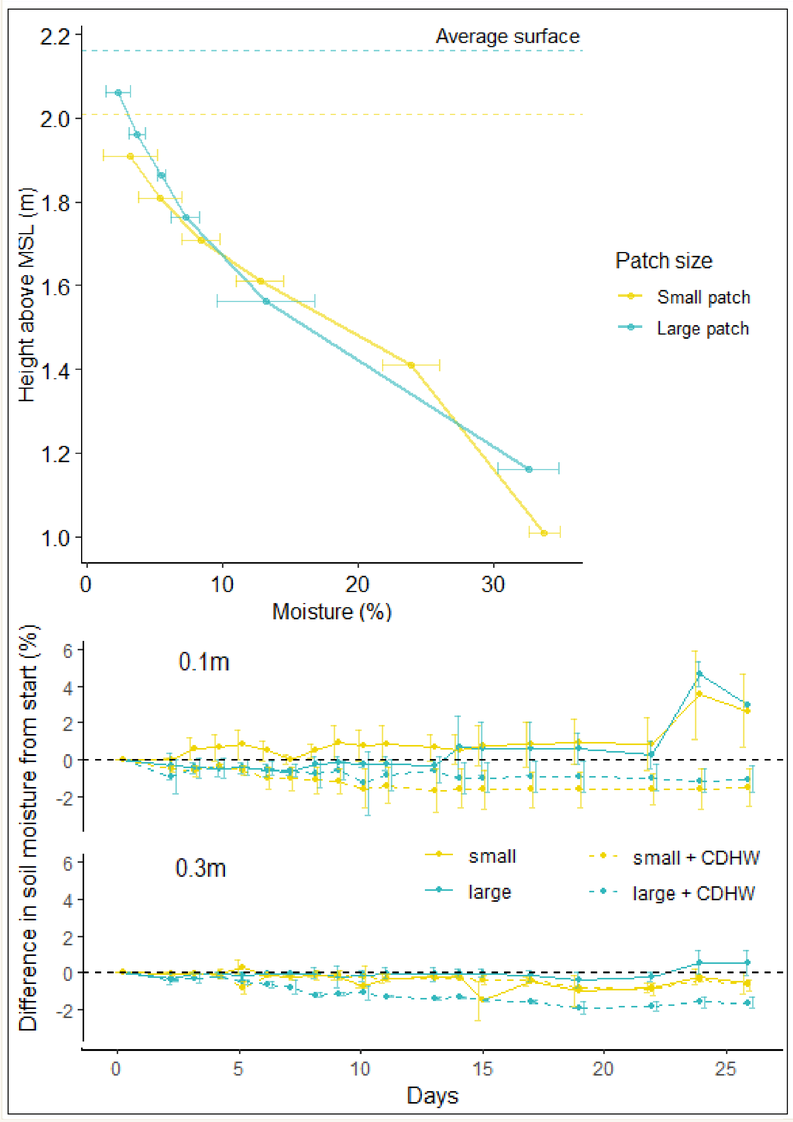
CDHW conditions



In short: Temperature measured within and outside the greenhouses (~50cm above surface) deviated in av max daily temp with 4°C. Greenhouses excluded 35.2 mm of rainfall.



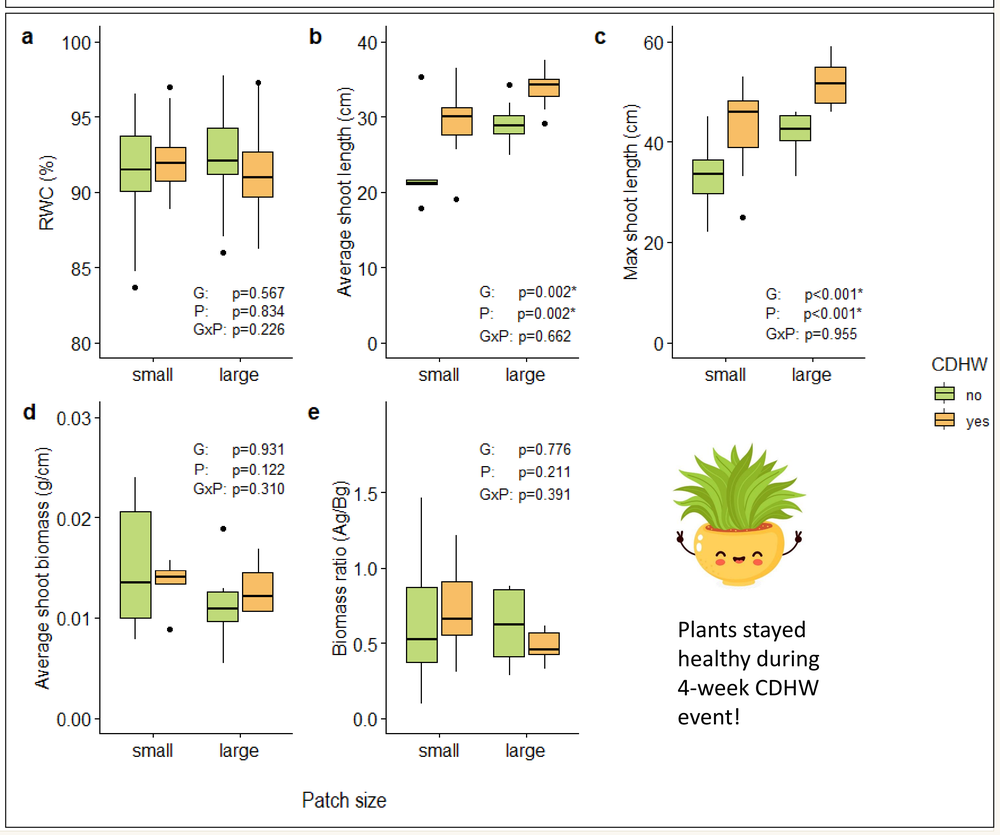
Results



In short:

Plant response - For both patch sizes plant health did not decline and we found a growth response to the CDHW treatment. Herein, most evident is an increase in average shoot length.

Soil moisture - condition across a 1m depth profile were not sign different at the start of the exp (based on patch type). Over time and in depth sufficient soil moisture was available to be non limiting.



Plants stayed healthy during 4-week CDHW event!

Discussion

The *E.juncea* patches showed no negative response to the CDHW event, on the contrary a significant increased growth, most evident for average shoot length, was found. A possible explanation of these results could lie in the availability of fresh soil moisture. Although, there was no sign of a freshwater storage present depending on patch size or vegetation presence, soil moisture was abundant over time and depths. This soil moisture availability could have mitigated the drought stress of the simulated CDHW event, and in combination with high temperatures and shelter from the greenhouse structure even stimulated plant growth. Our results show a high resistance of *E.juncea* to future CDHW events, however we recommend further studies with longer periods CDHW and different soil moisture availabilities. CDHW events will increase in Western Europe the coming decades, but so will overall precipitation. If dune systems are able to store precipitation in times of plenty, and vegetation can reach this water in times of drought, CDHW events might not form as big of a threat as expected on first sight.

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