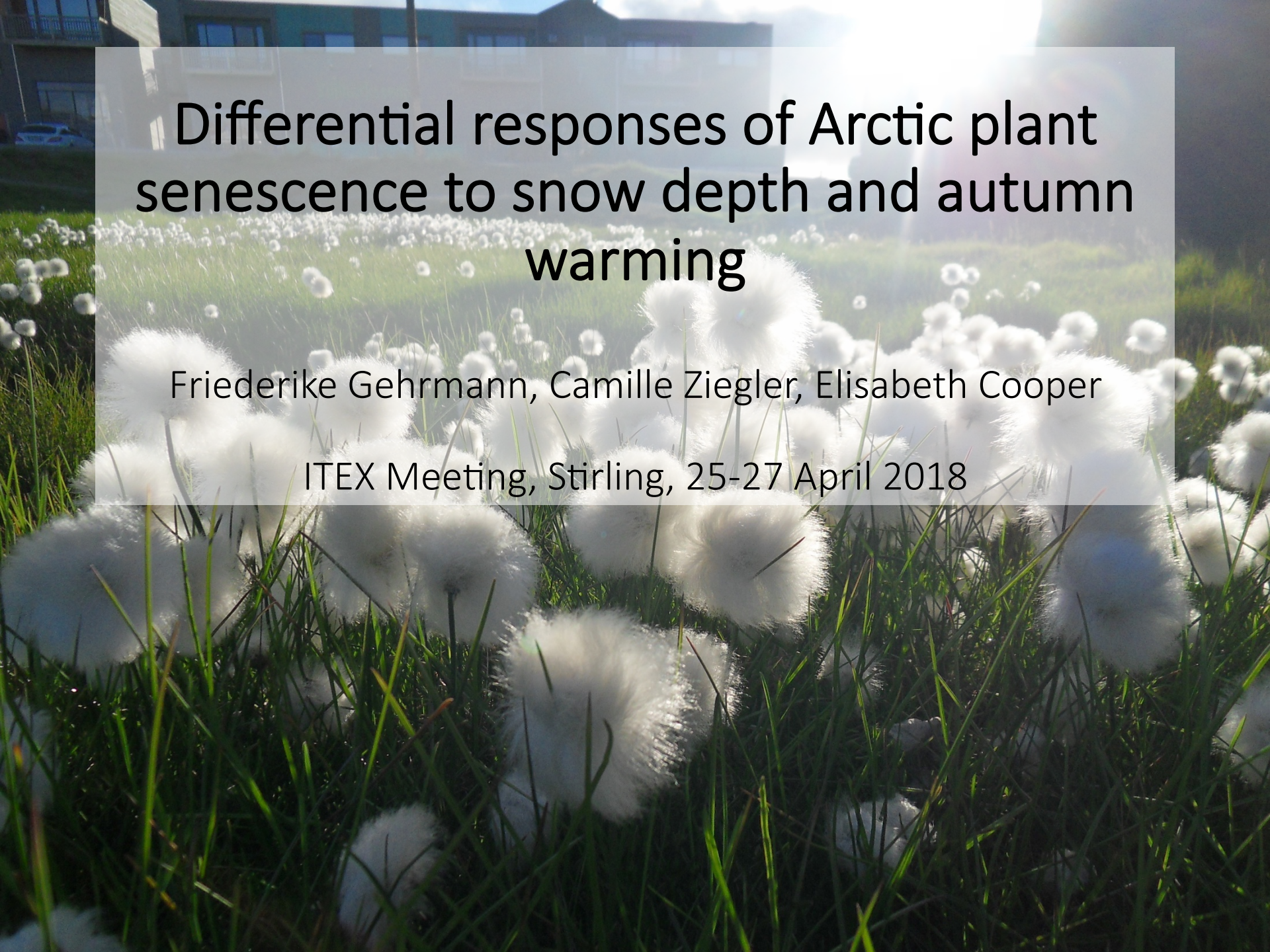
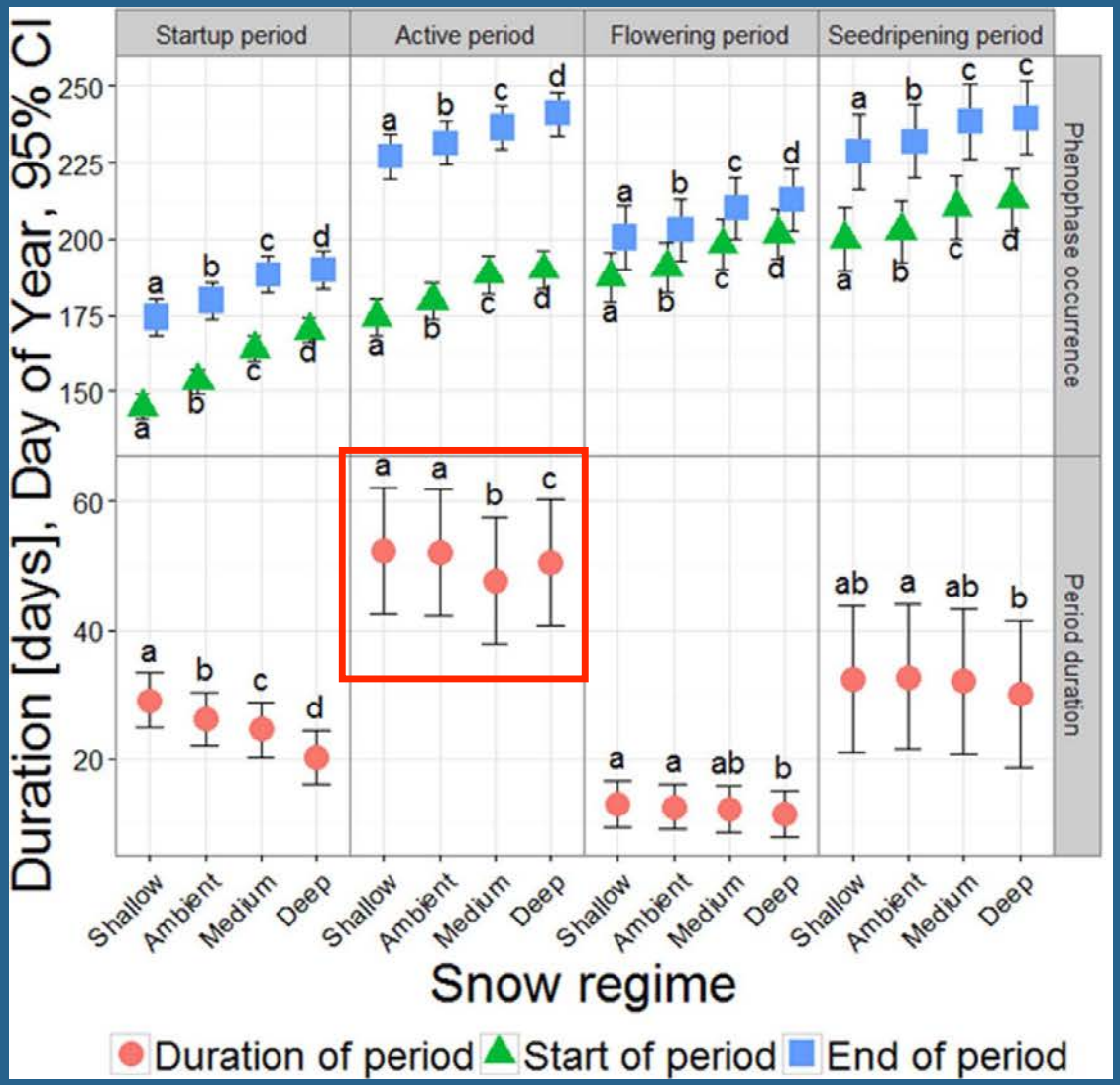


Differential responses of Arctic plant senescence to snow depth and autumn warming

Friederike Gehrmann, Camille Ziegler, Elisabeth Cooper

ITEX Meeting, Stirling, 25-27 April 2018

Snow and phenology



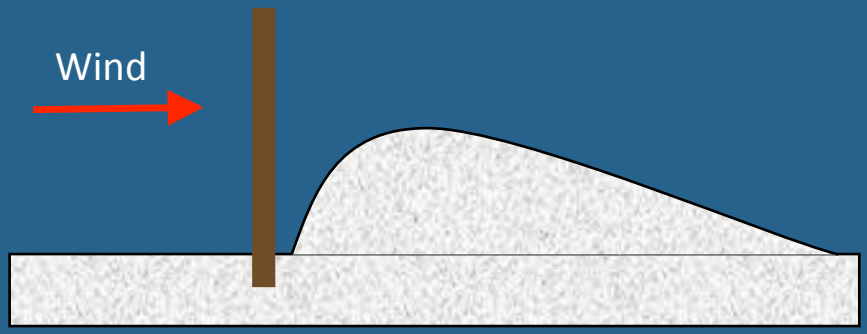
Bud green to senescence takes the same amount of time across snow treatments

Semenchuk et al. 2016, Environ. Res. Lett.

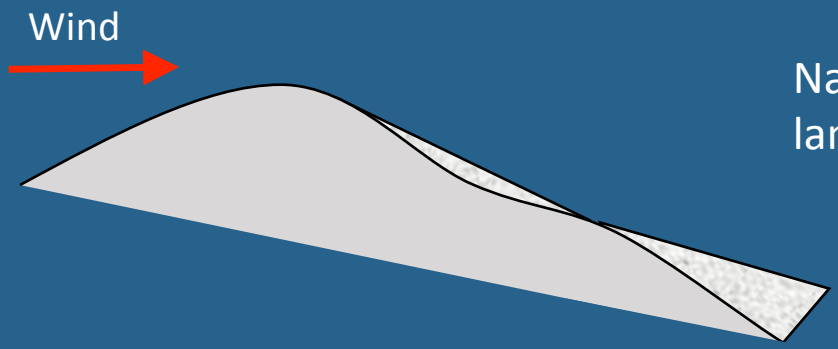
Research questions

- How does experimentally manipulated snow depth affect autumn senescence in High Arctic plants?
- Is the effect similar along a natural snow depth gradient?
- Does autumn warming affect senescence timing and does this effect vary with snow depth?

Snow gradients



Experimental gradient: Snow fence causes snow drift behind fence and creates a gradient of snow depths.



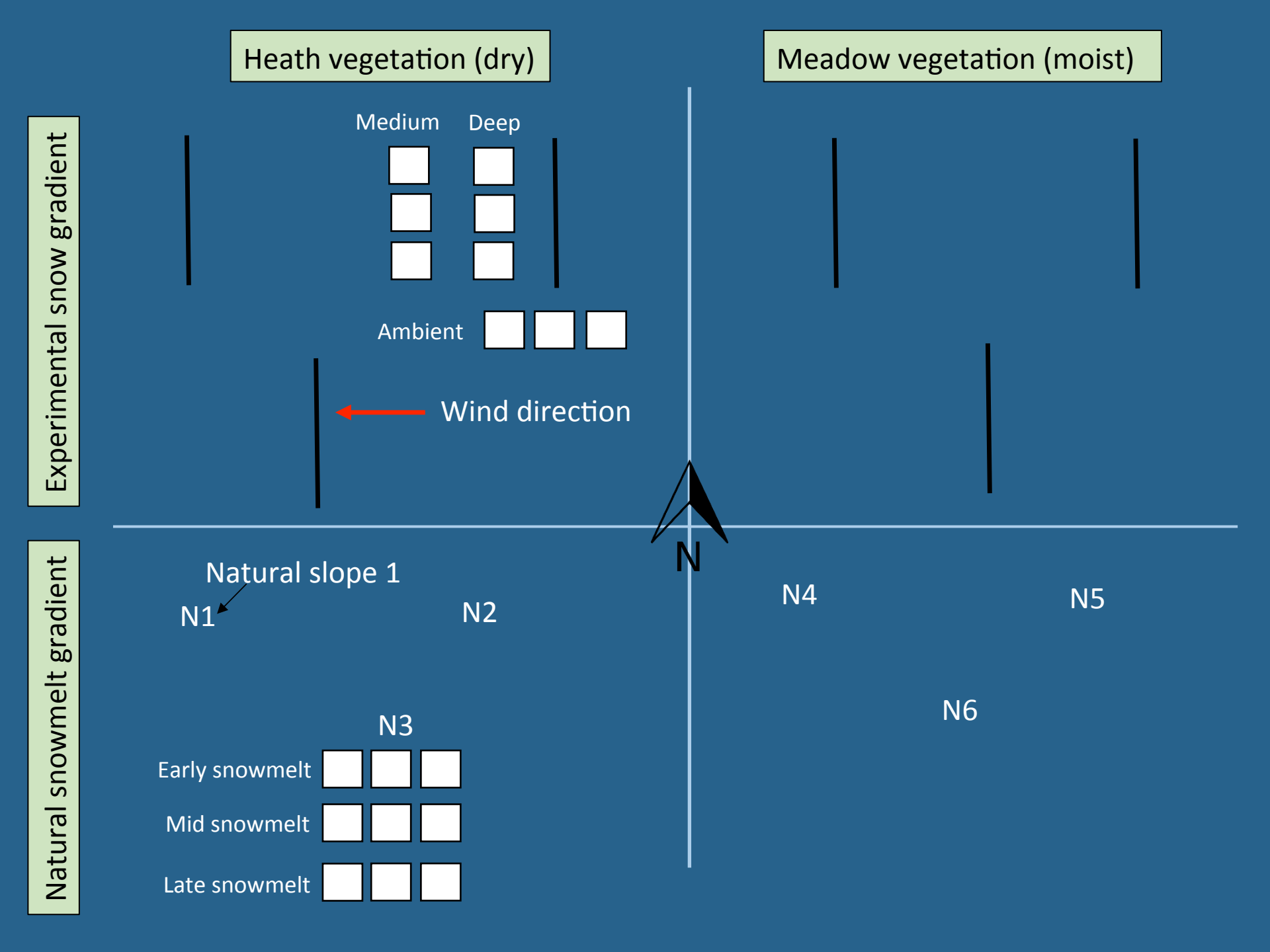
Natural gradient: Elevation gradients in the landscape create slopes with ridges.


Wind

Location

©User:NordNordWest/Wikimedia Commons/CC BY-SA 3.0

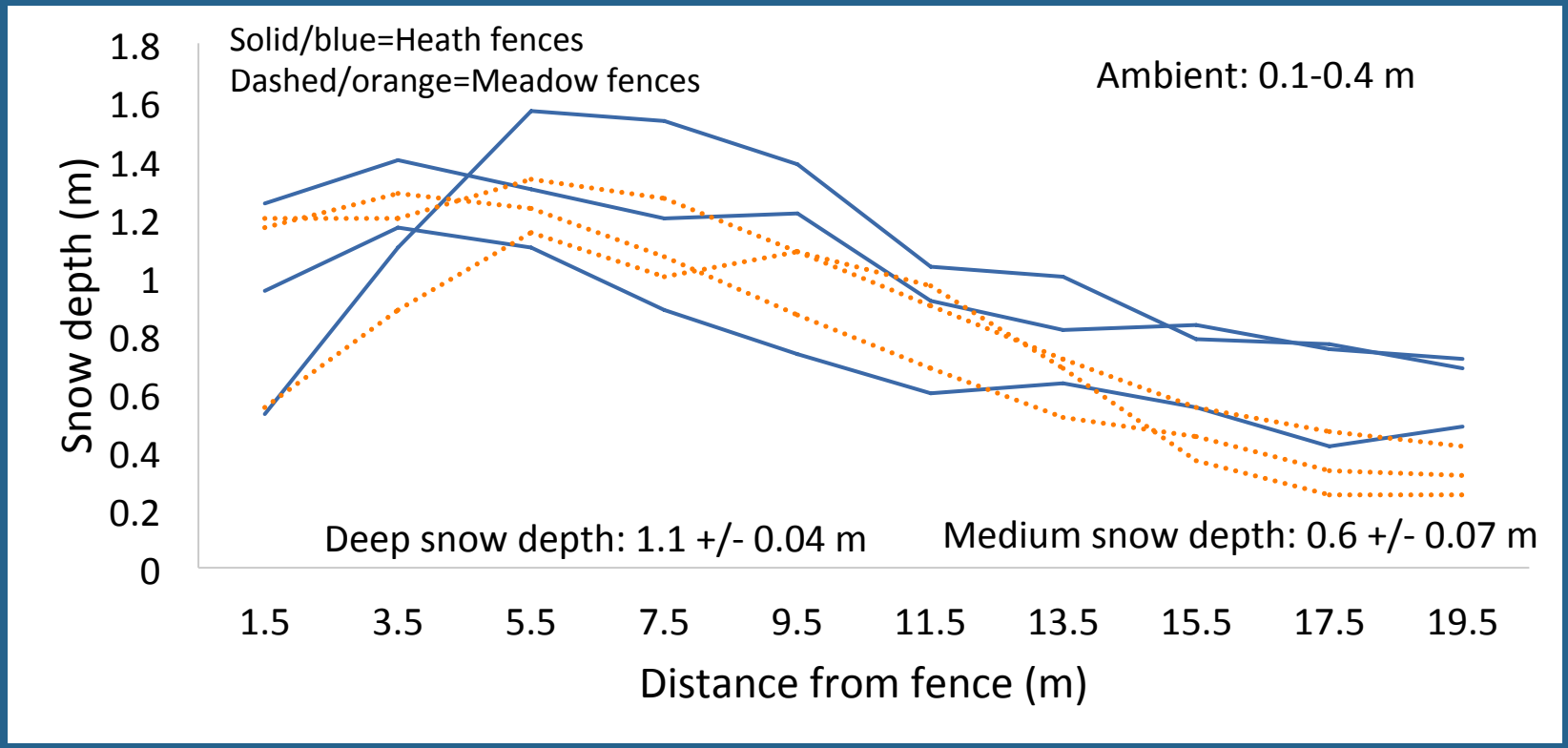
E. Cooper


Heath vegetation (dry)
Meadow vegetation (moist)
Experimental snow gradient
Medium
Deep
Ambient
Wind direction
N
Natural slope 1
N1
N2
N3
N4
N5
N6
Natural snowmelt gradient
Early snowmelt
Mid snowmelt
Late snowmelt

Snowmelt timing 2016

Gradient	Vegetation	Ambient/Early	Medium/Mid	Deep/Late
Experimental	Heath	26 May 2016 (147)	5 June 2016 (157)	12 June 2016 (164)
	Meadow	24 May 2016 (145)	04 June 2016 (156)	10 June 2016 (162)
Natural	Heath	May/June	Early June	Mid June
	Meadow	Late May	Early June	Early/Mid June

Snow depth – experimental gradient



Snow depth – natural gradient

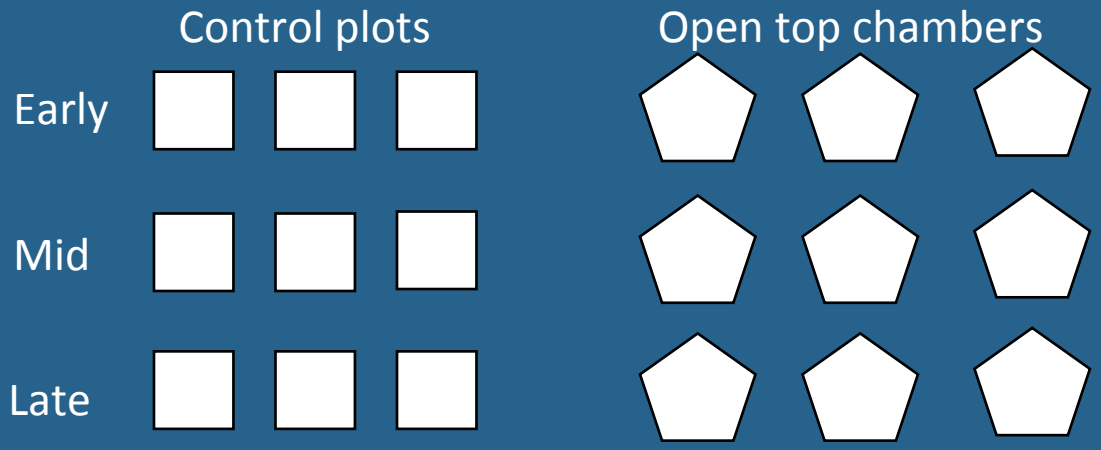
Early: 0-0.1 m

Mid: 0.1-0.2 m

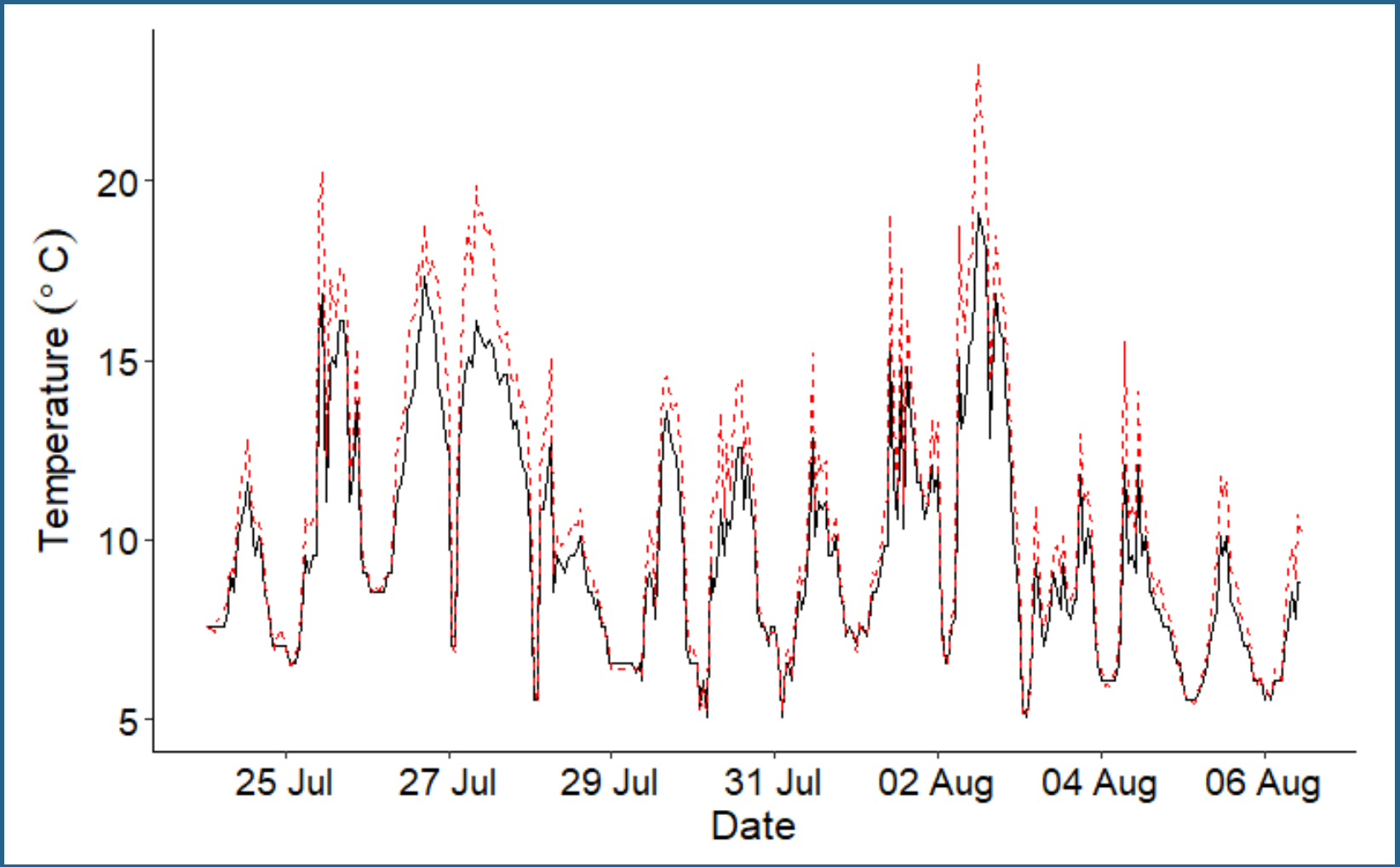
Late: 0.3-0.5 m

Warming experiment

- Selected one slope (natural gradient) in the heath site
- Placed three open top chambers within each of the three snowmelt categories



Temperature in OTC



Observations of senescence

- 19 July 2016 – 6 August 2016
- every other day
- in OTCs: July 20th and July 23rd, then every other day
- 5 shoots per plot

Beginning of colour change was observed

Plant species

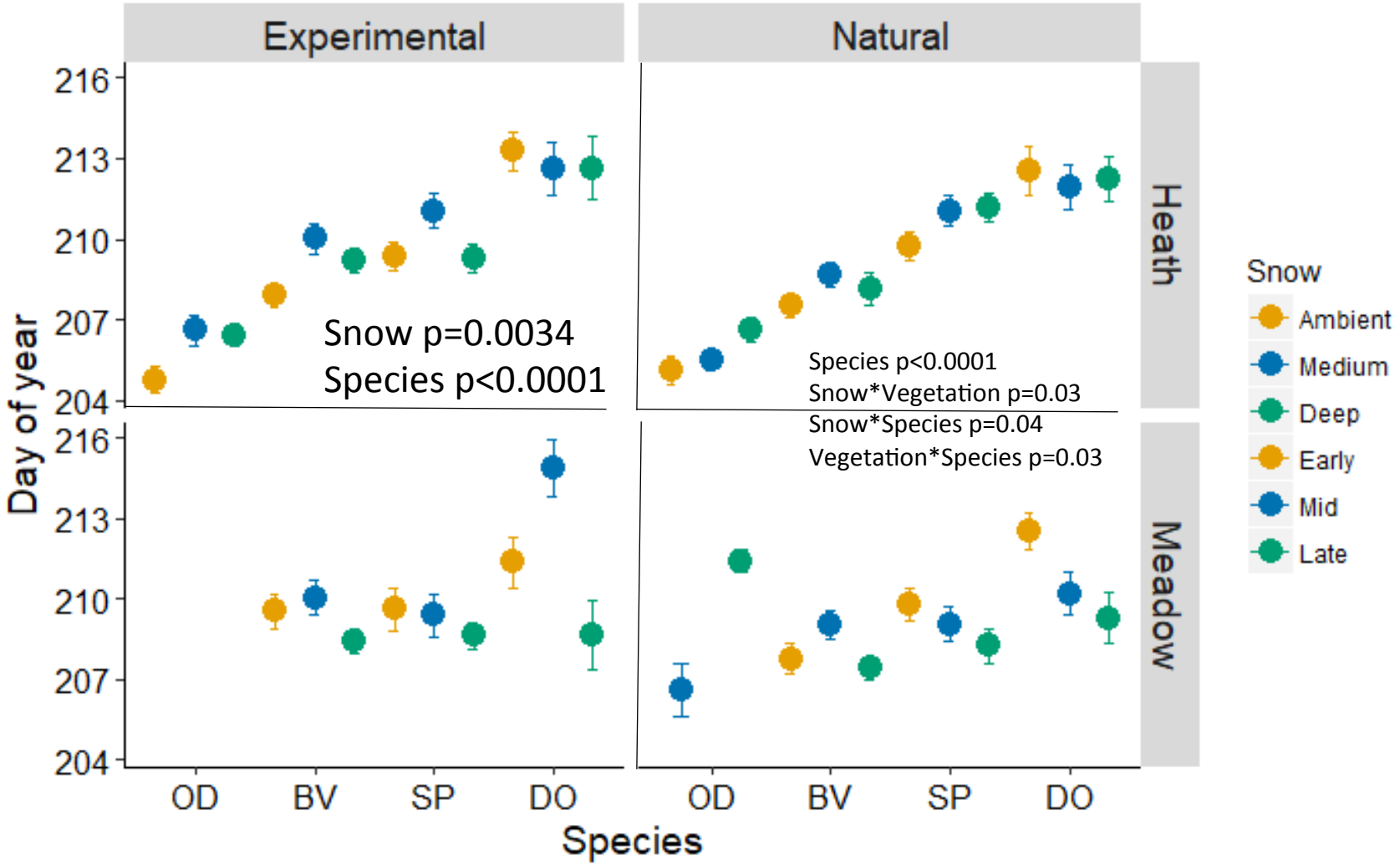
Salix polaris (SP)

Oxyria digyna (OD)

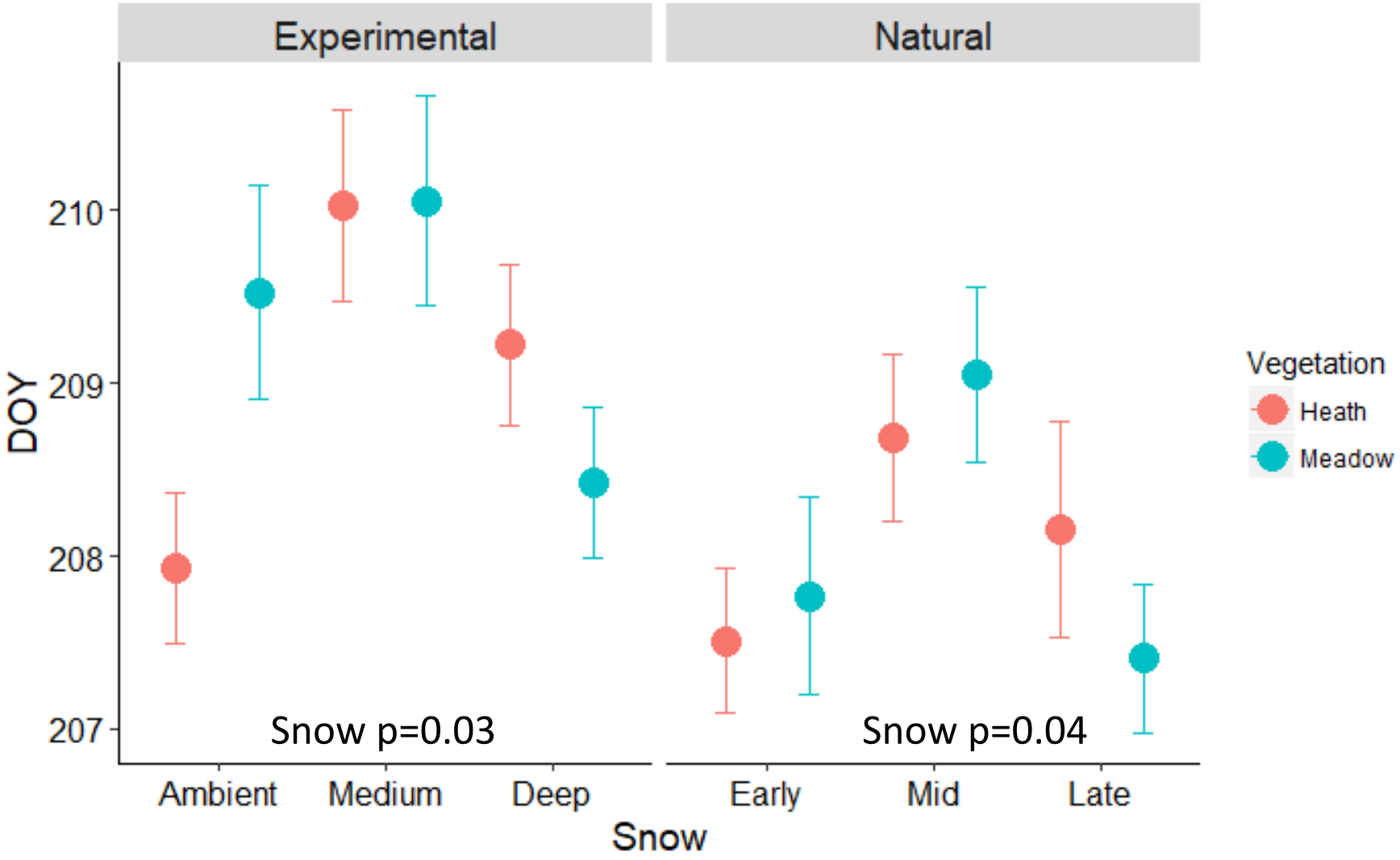
Bistorta vivipara (BV)

Dryas octopetala (DO)

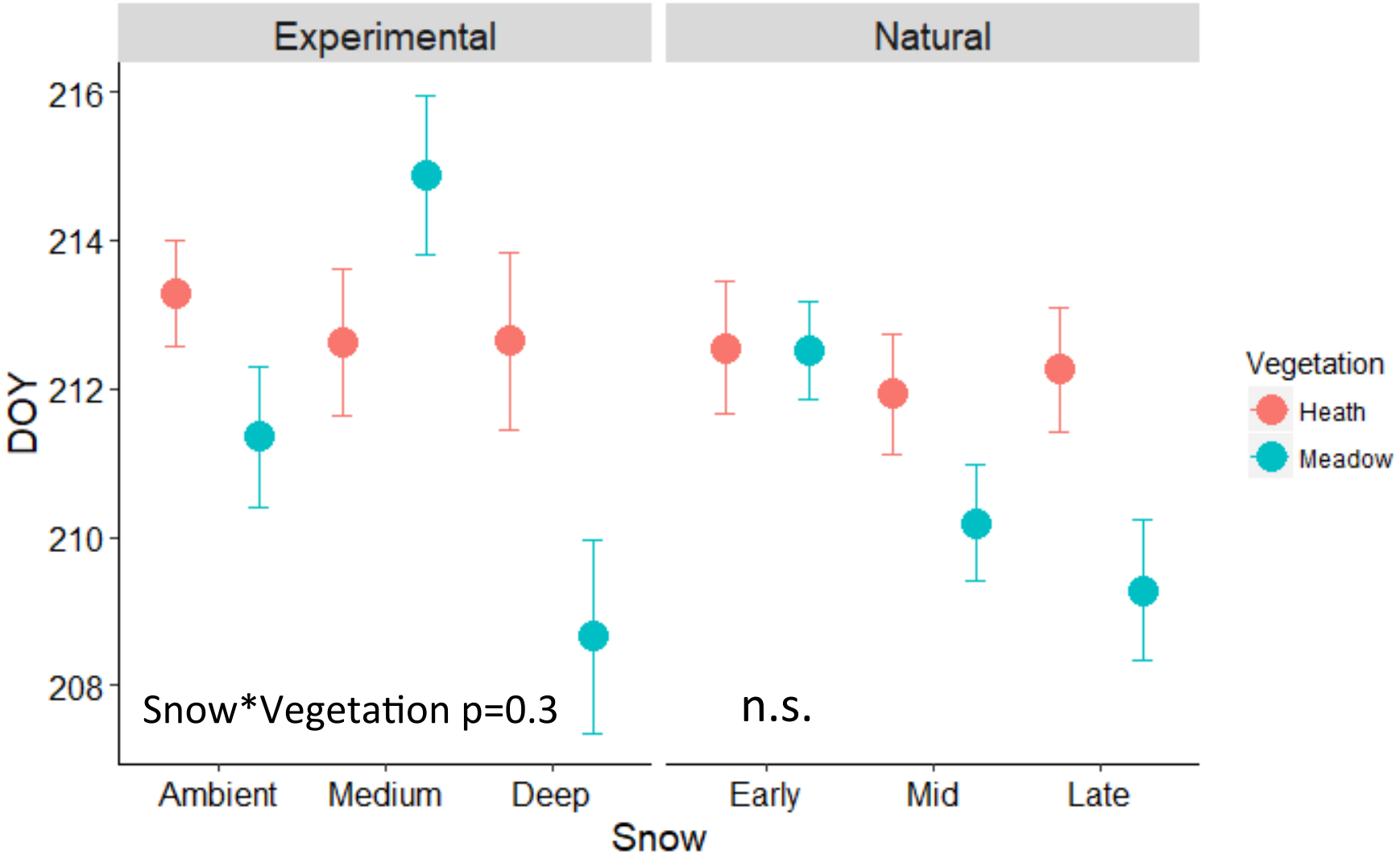
Effect of snow on senescence timing



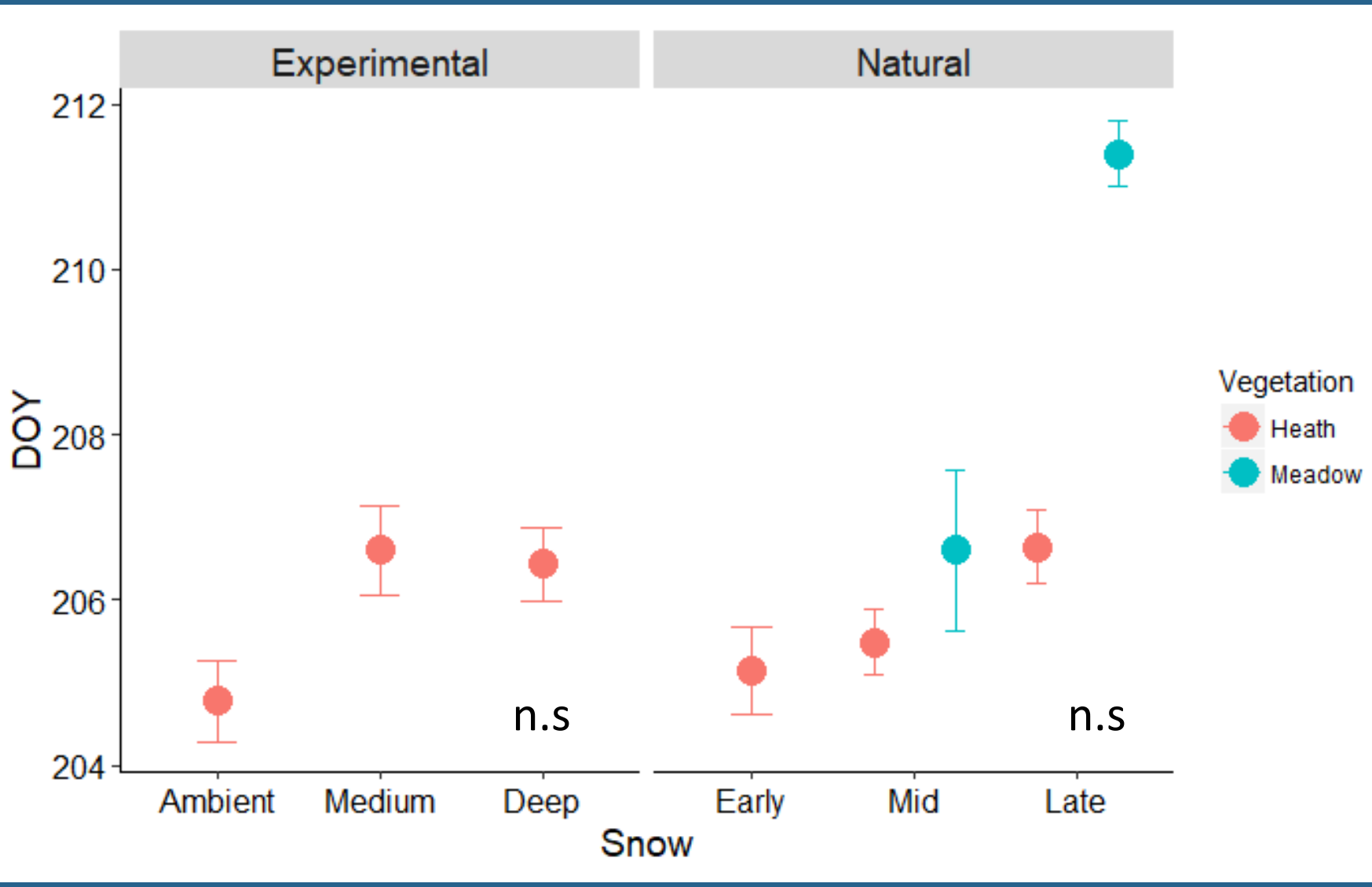
Timing of senescence in *B. vivipara*



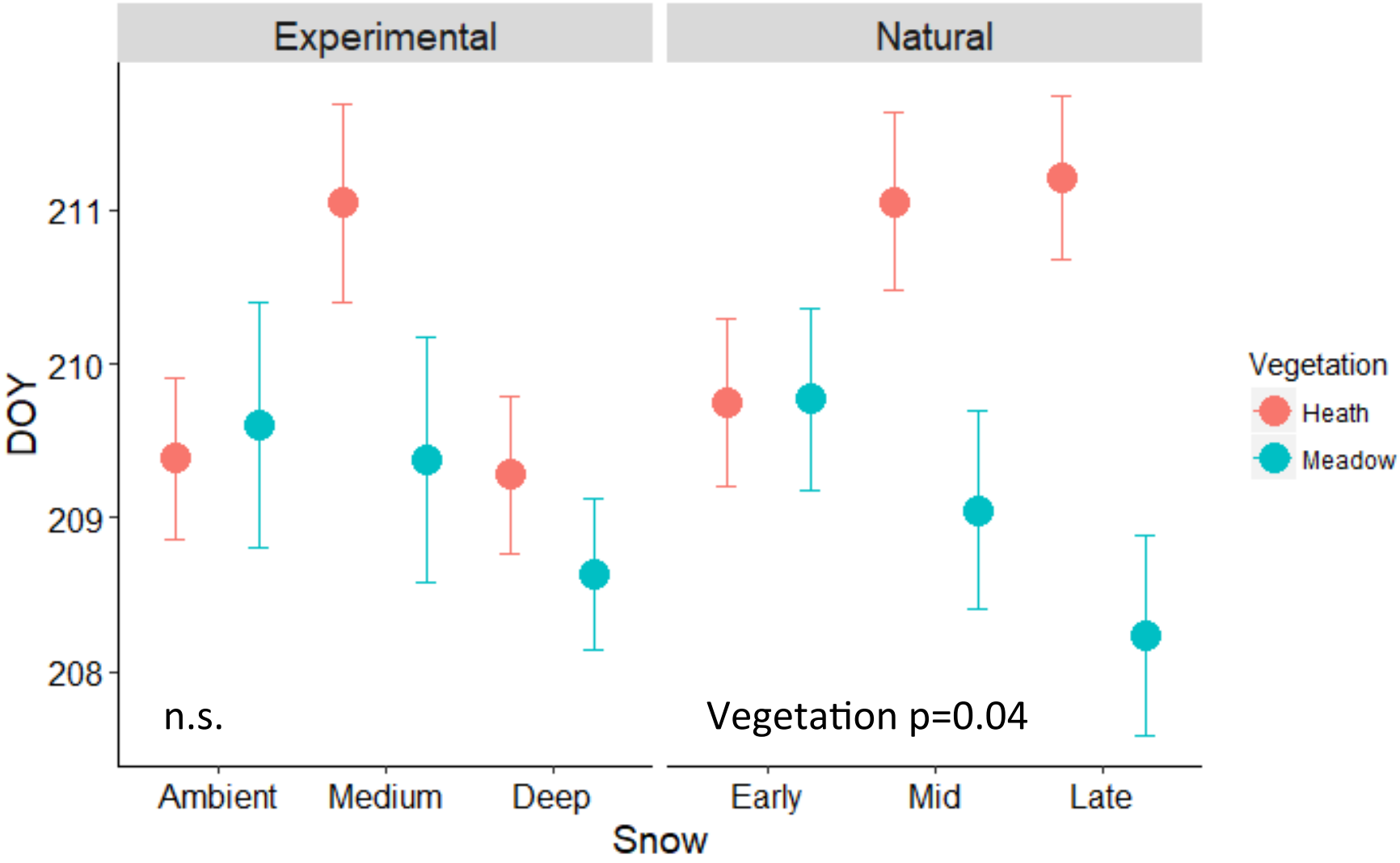
Timing of senescence in *D. octopetala*



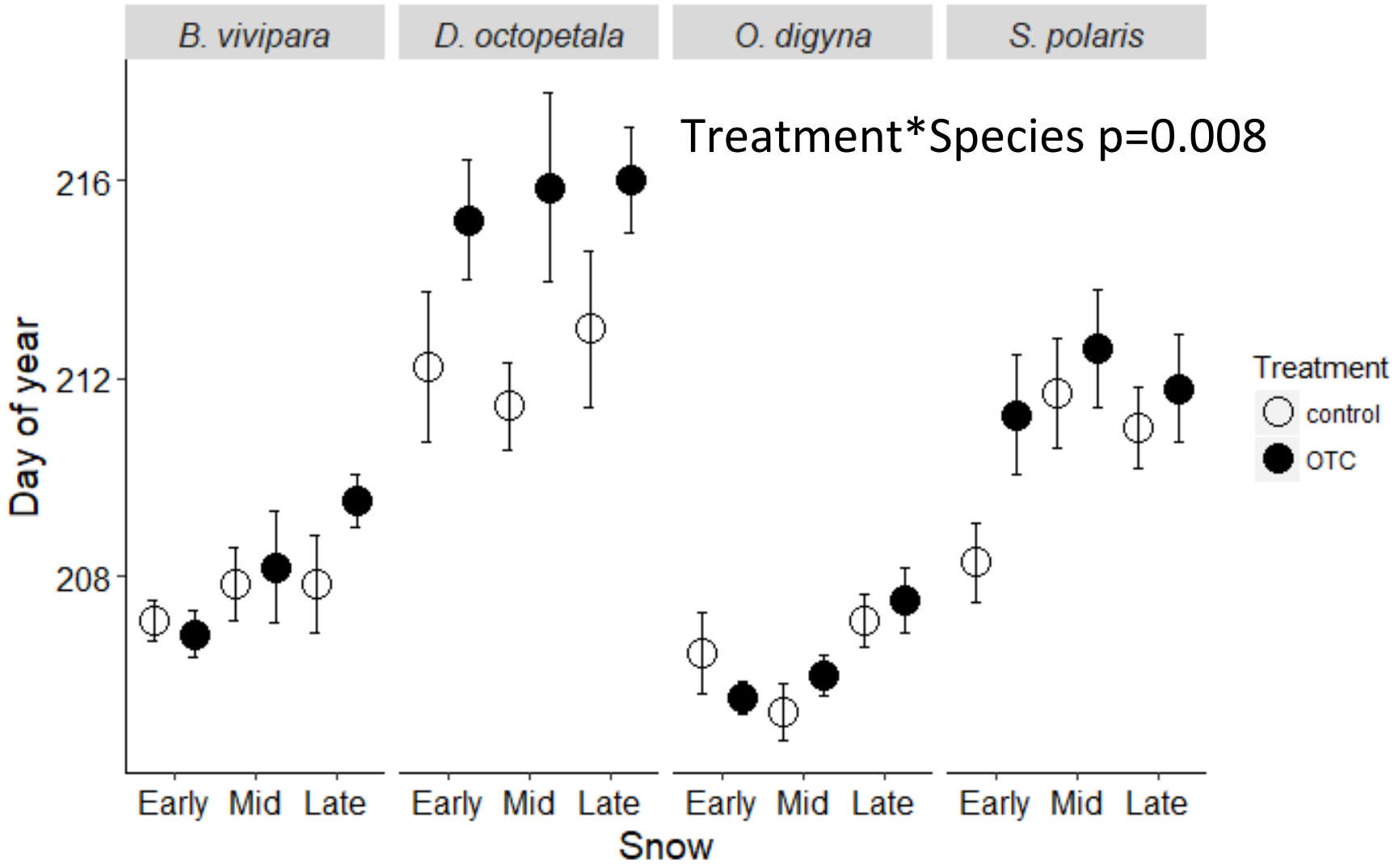
Timing of senescence in *O. digyna*



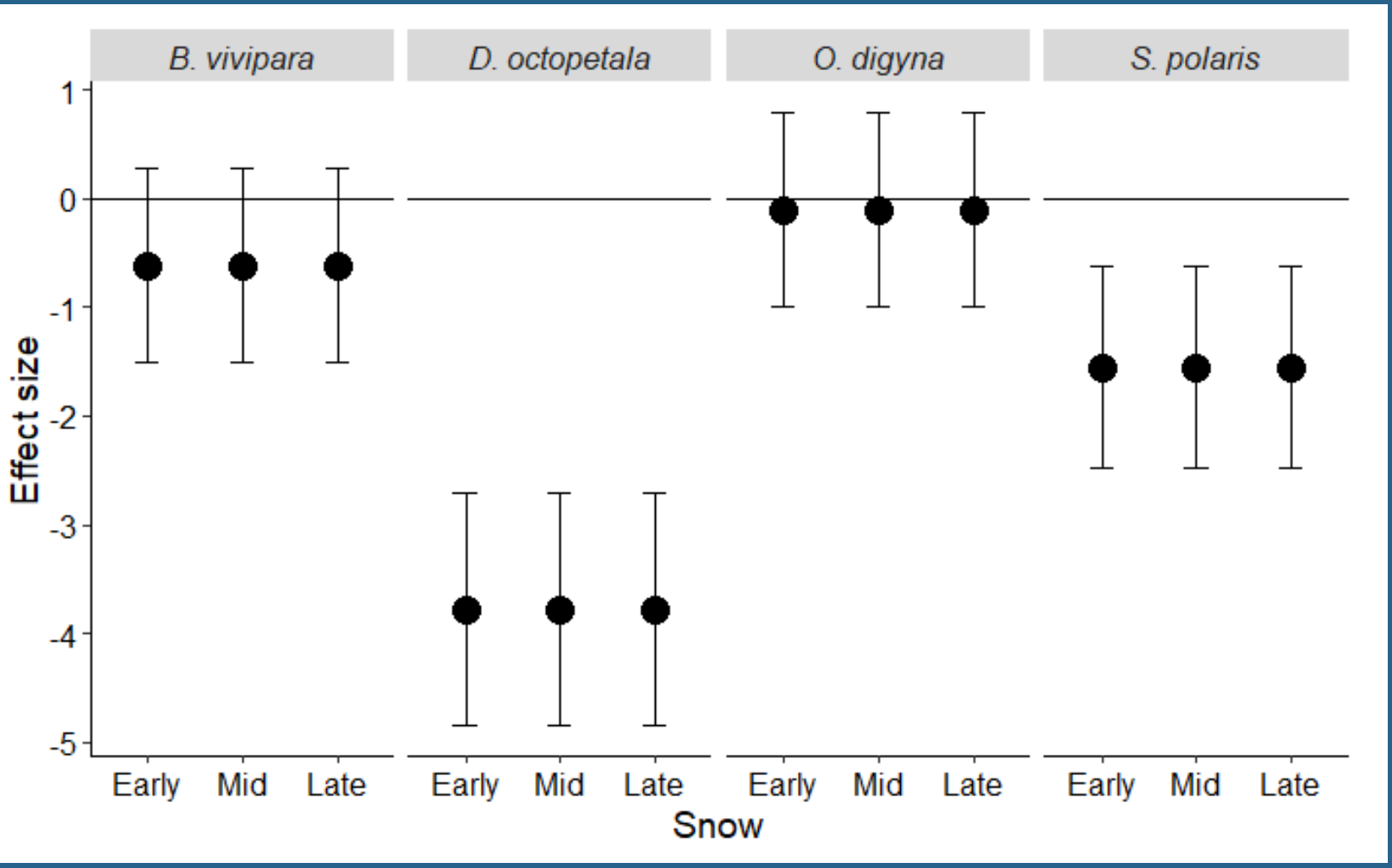
Timing of senescence in *S. polaris*



Effect of OTC treatment on senescence timing



Effect size of OTC treatment on senescence timing

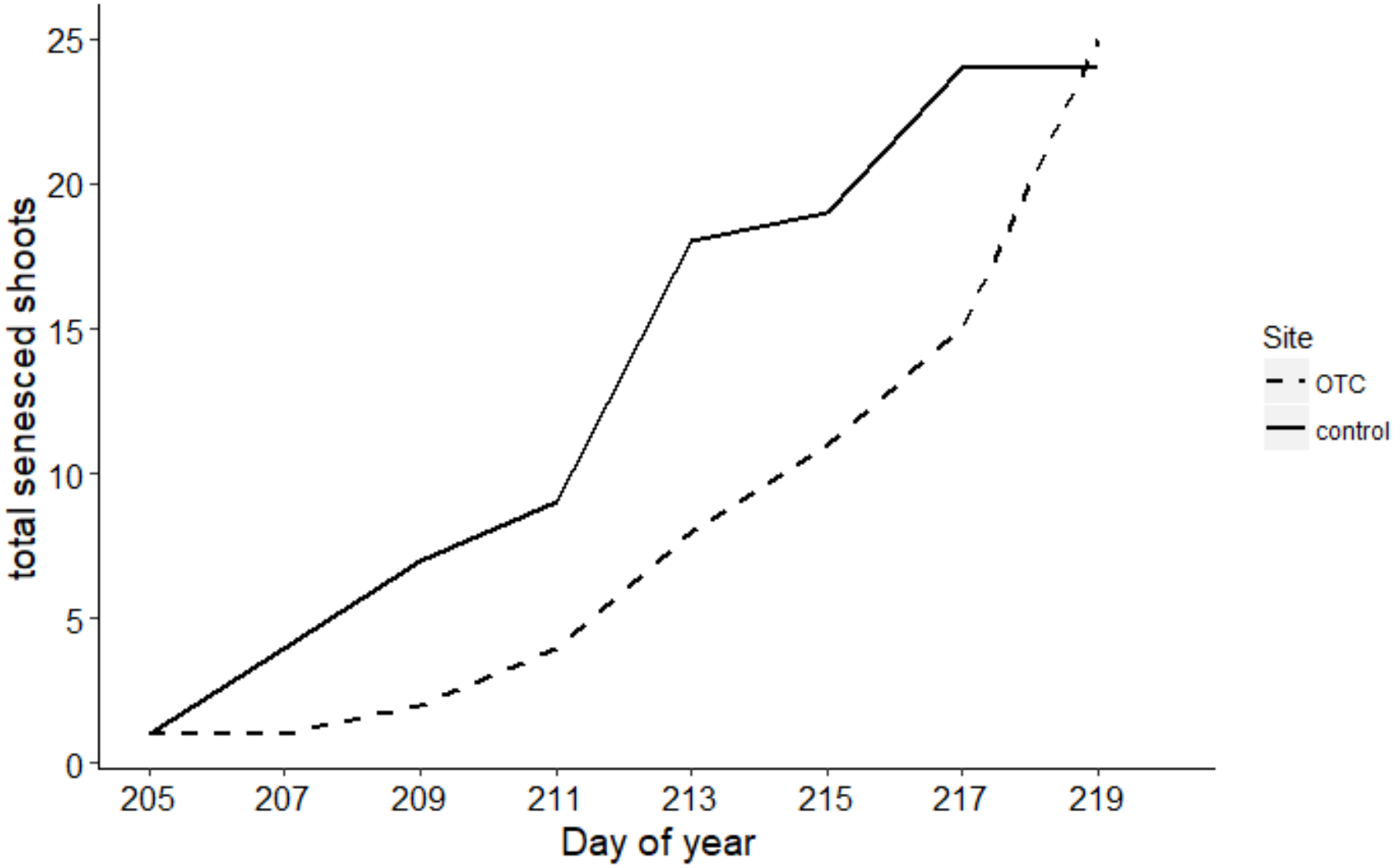


Effect size of warming treatment (control DOY-warming DOY) in days with standard errors from the model.

Negative value: delayed senescence in warming treatment.

SP was not significant even if it doesn't cross the 0 line.

Progression of senescence in *D. octopetala*



Conclusions

- Effect of snow varies between experimental and natural gradient → gradient is not the same
- The effect of snow depth and snowmelt timing varies by species
- Medium snow depth optimal conditions?
- OTC treatment delays senescence by 4 days in *D. octopetala* → total season length ~6-6.5 weeks (Semenchuk et al. 2016, Environ. Res. Lett.)
- Caveats: short study, only considered onset of senescence

Acknowledgements

Elisabeth Cooper, UiT

Camille Ziegler, INRA

Plant Ecophysiology and Climate Change Research Group

Supervisors:
Timo Saarinen
Heikki Hänninen

UNIVERSITY OF HELSINKI

Organismal and Evolutionary Biology Research Programme

The Research Council of Norway

DPPS

ViPS