

# Soil respiration from sub-arctic tree and shrub communities is driven by recent photosynthate

Tom Parker





# PrimeTime Project

Will more productive Arctic ecosystems sequester less soil carbon? A key role for priming in the rhizosphere ('PRIMETIME')

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UNIVERSITY of  
STIRLING



50 YEARS

MANCHESTER  
1824  
The University of Manchester

UNIVERSITY OF  
EXETER



THE UNIVERSITY  
of EDINBURGH



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With Special thanks to:

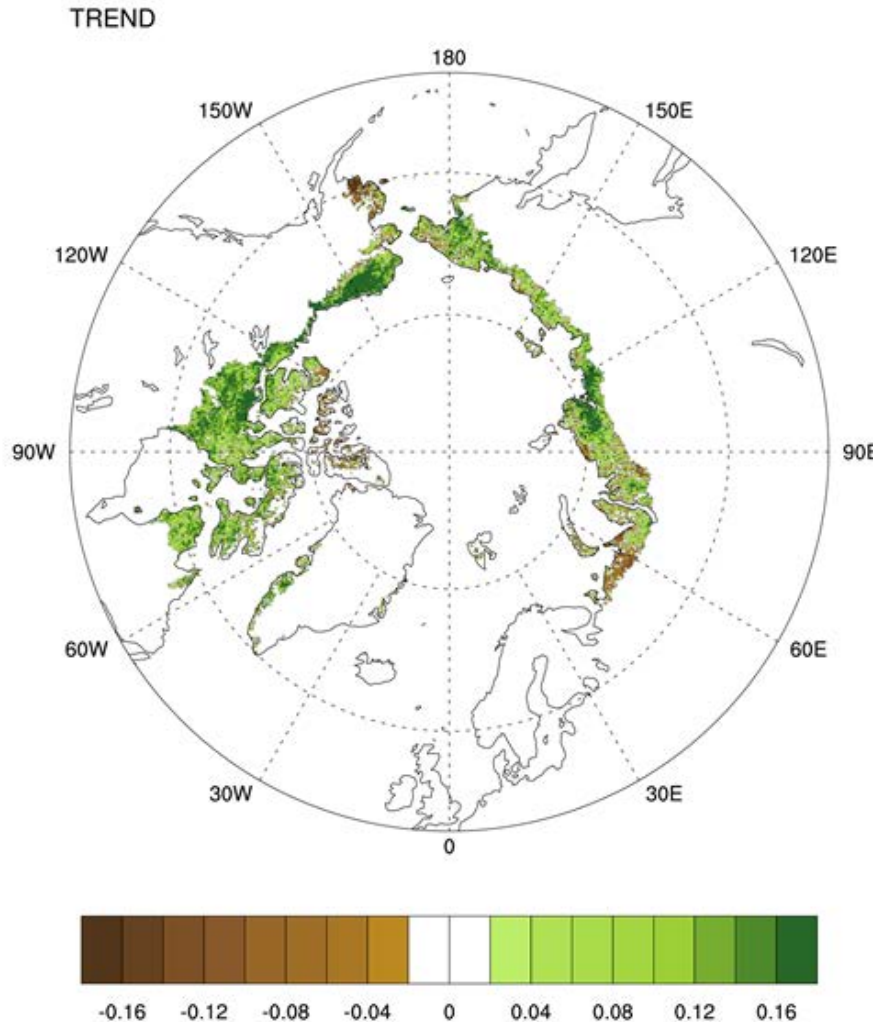
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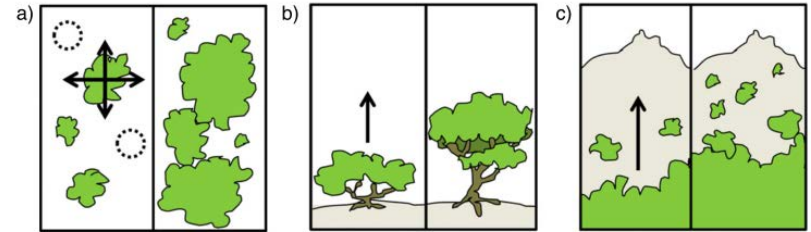
# Climate Change and Arctic Productivity

## Max-NDVI Mag trend 82-16

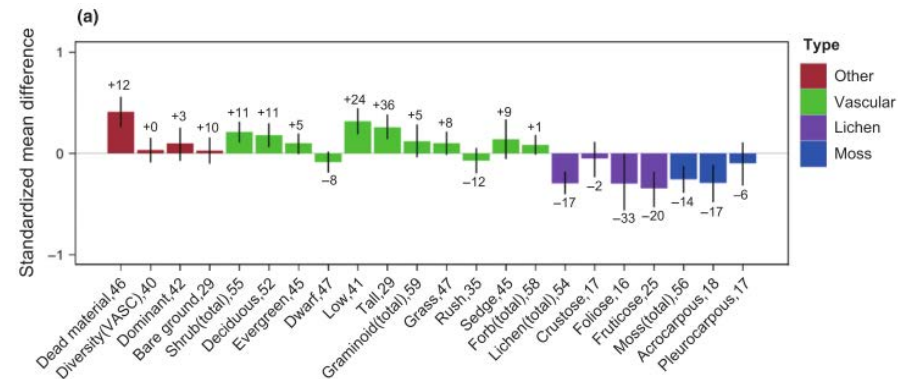


Arctic Report Card 2017

## Increasing dominance of Shrubs



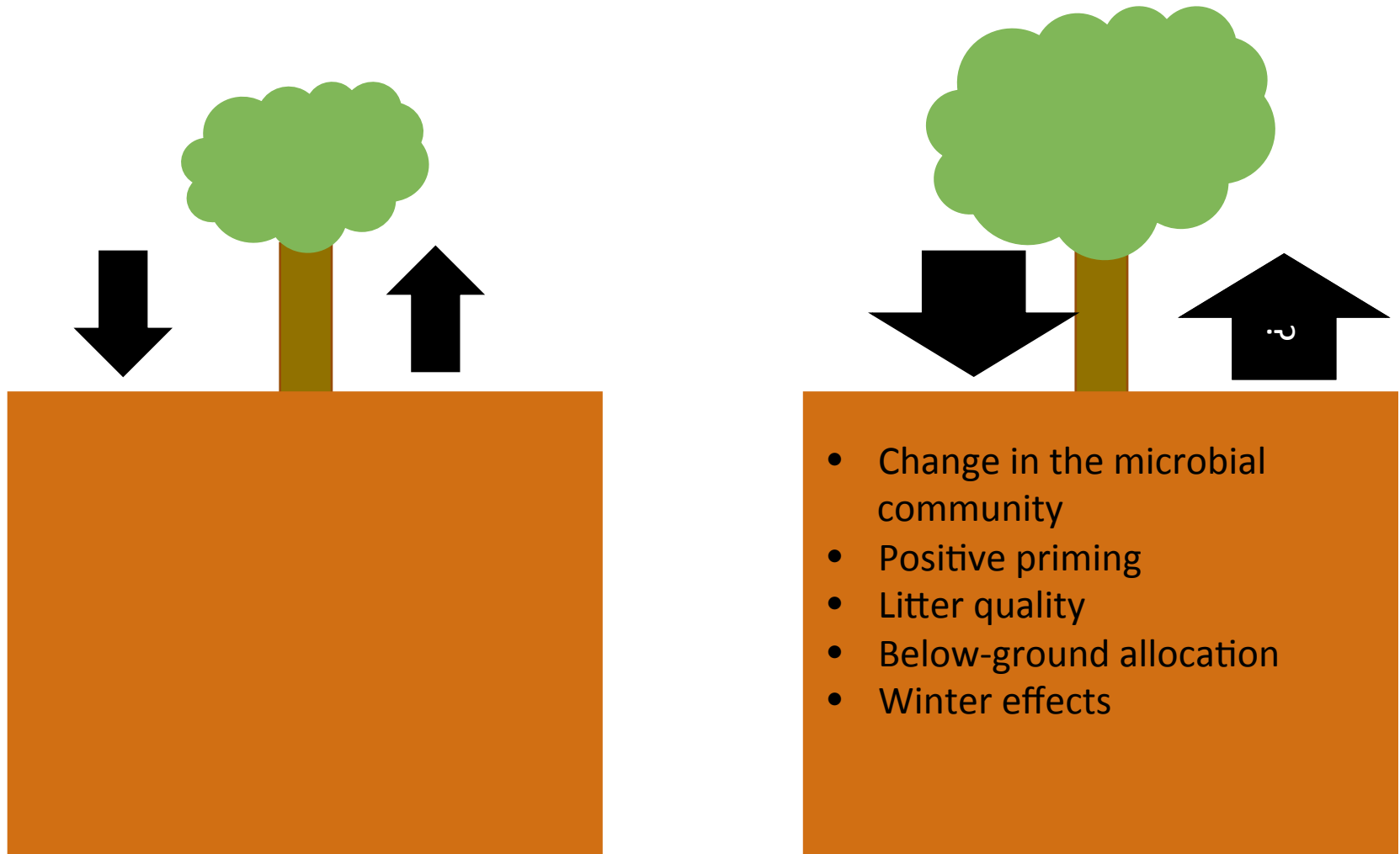
Myers-Smith *et al.* (2011)



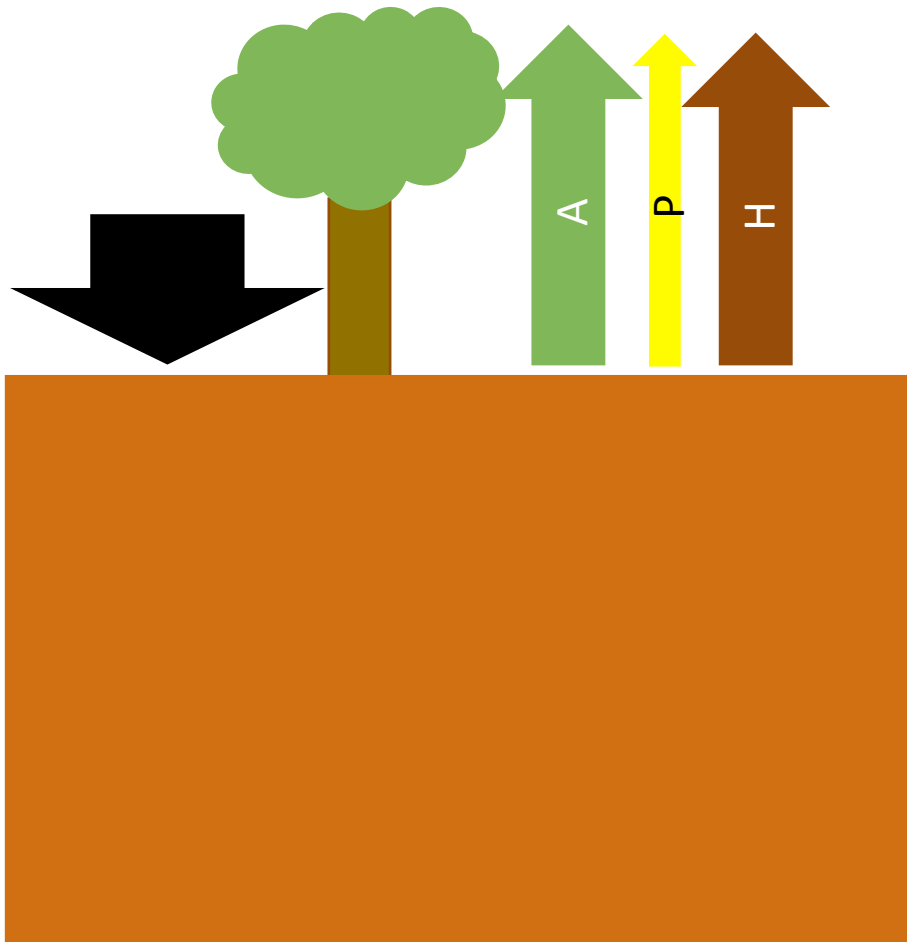
Elmendorf *et al.* (2012)

More carbon is entering the tundra ecosystem...

# Arctic Ecosystem Carbon: We need the other side of the equation



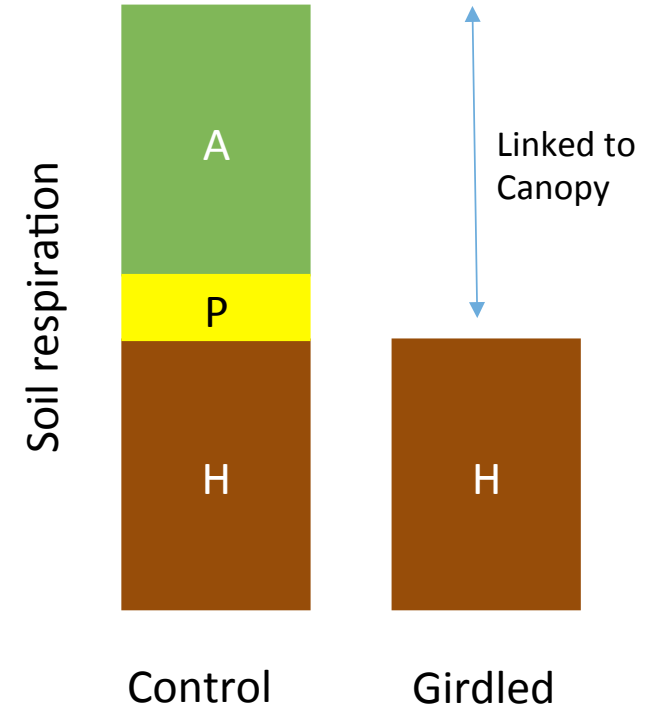
# Breaking down Soil Respiration in the Arctic: Some basic questions



- How much soil respiration is linked to shrub canopies?
- Is positive priming occurring in shrub-dominated soils?
- How quickly is carbon turned-over in shrub-soils?



# Girdling: Stop Canopy C by cutting the phloem



Every willow stem in a 2 m radius  
-Trenched around perimeter

Every Birch stem in a 10 m radius

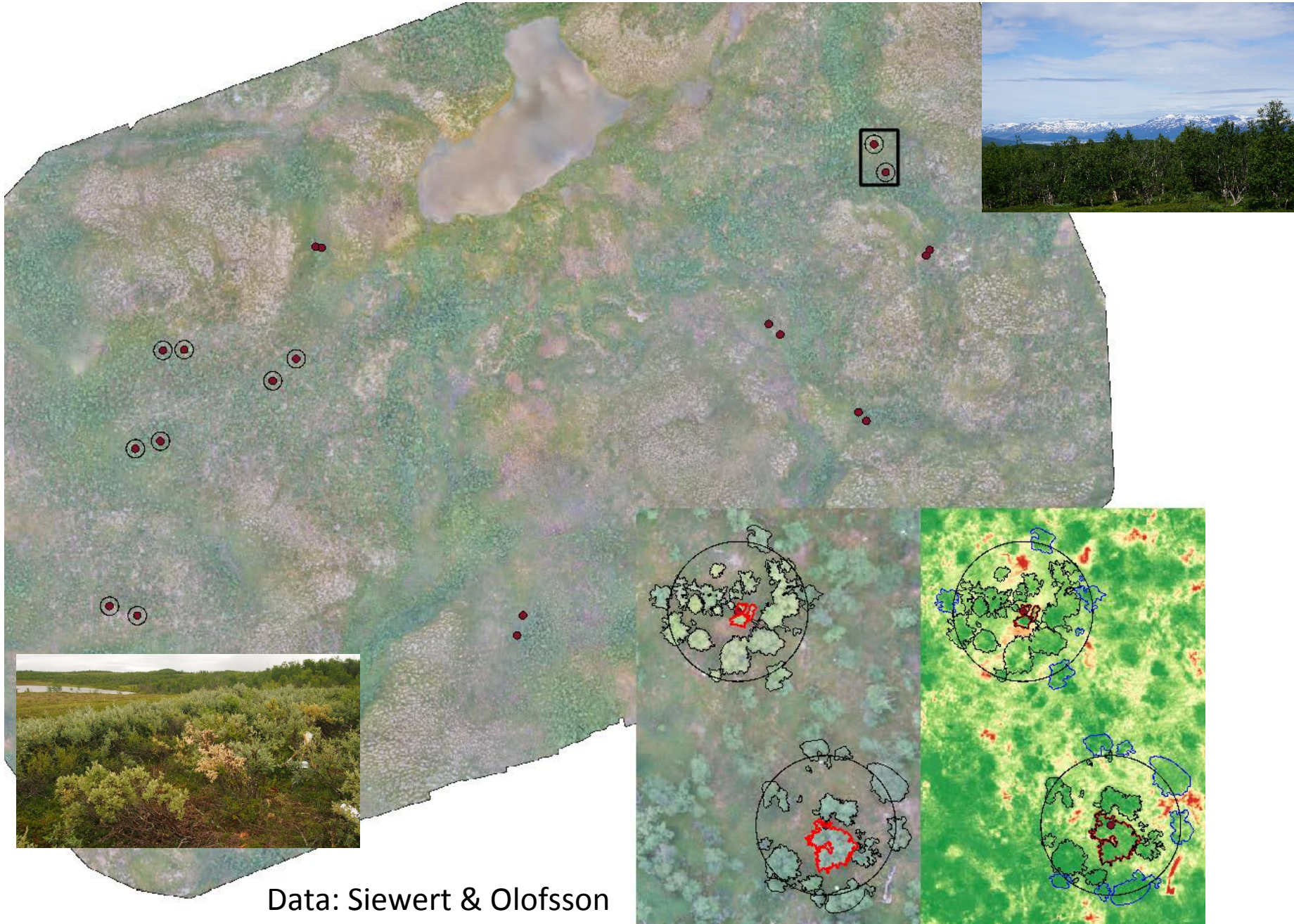


# Study Area: Abisko, Northern Sweden





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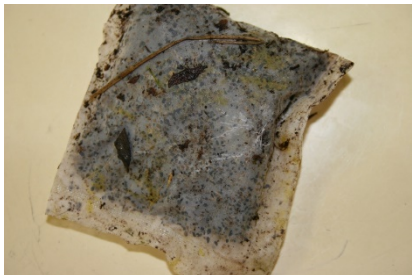
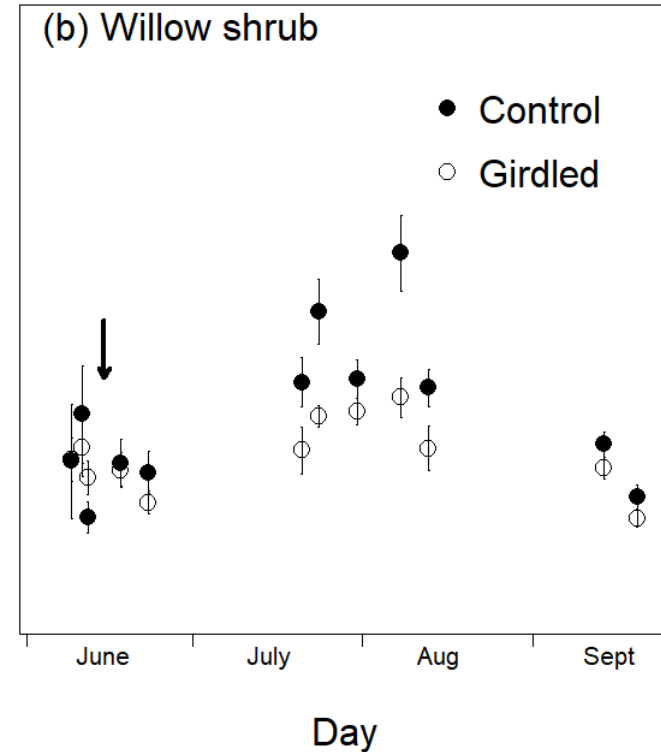
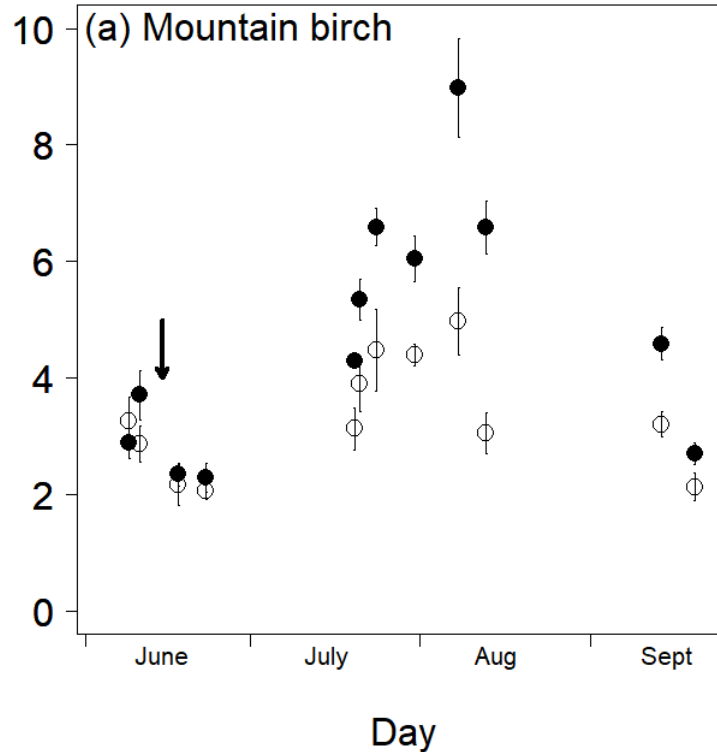
Data: Siewert & Olofsson



# Soil Respiration



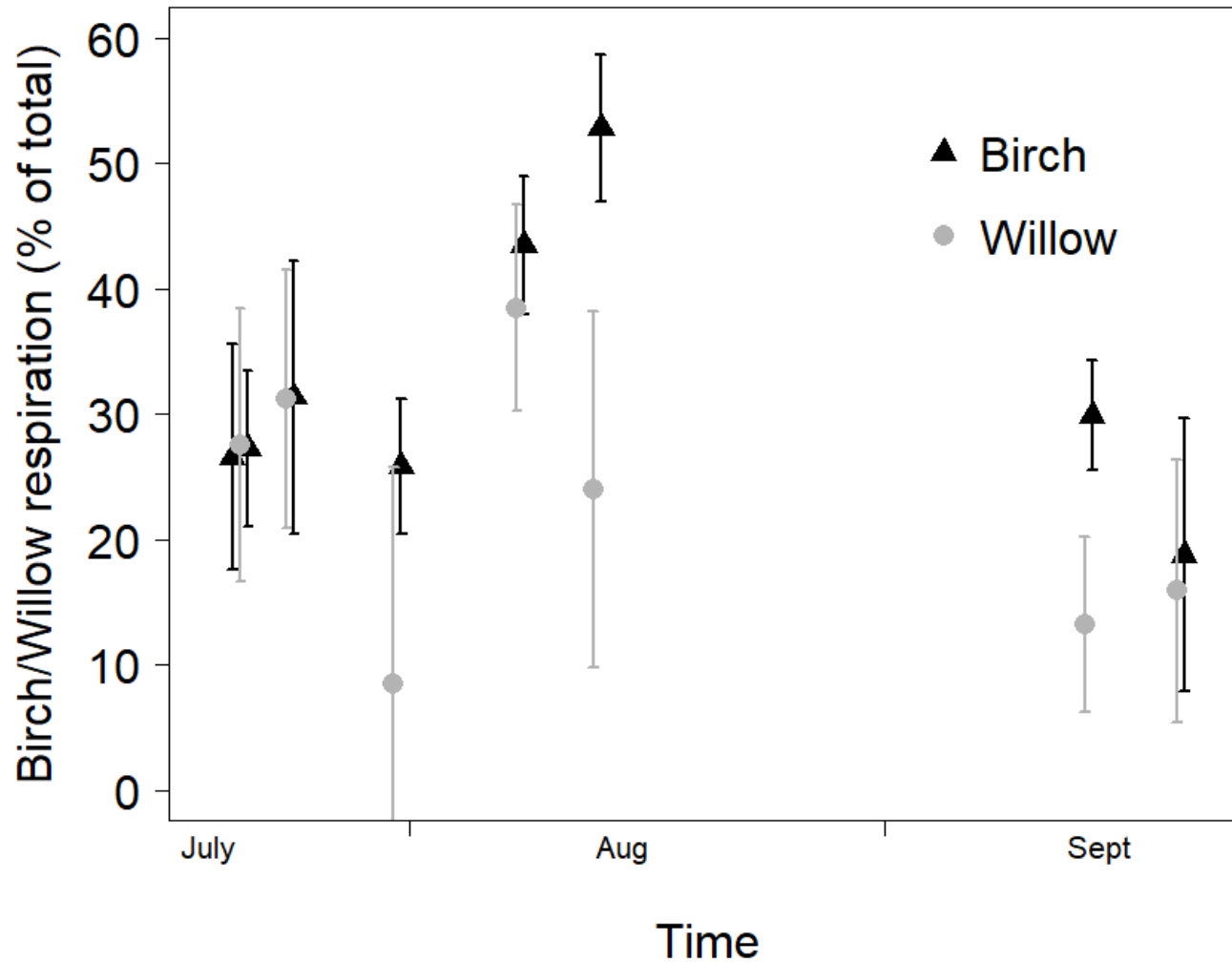
Soil respiration ( $\mu\text{mol CO}_2 \text{ m}^{-2} \text{ s}^{-1}$ )



Roots: -53 %  
Hyphae: -69 %

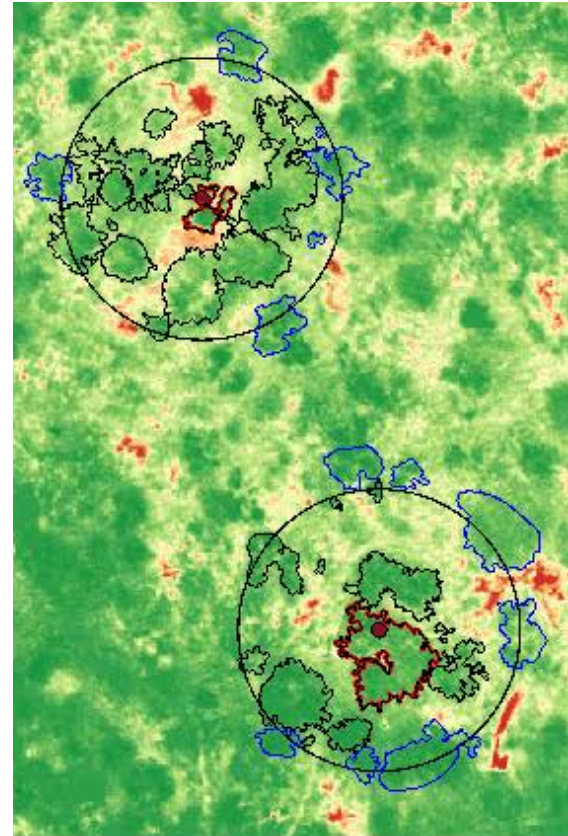
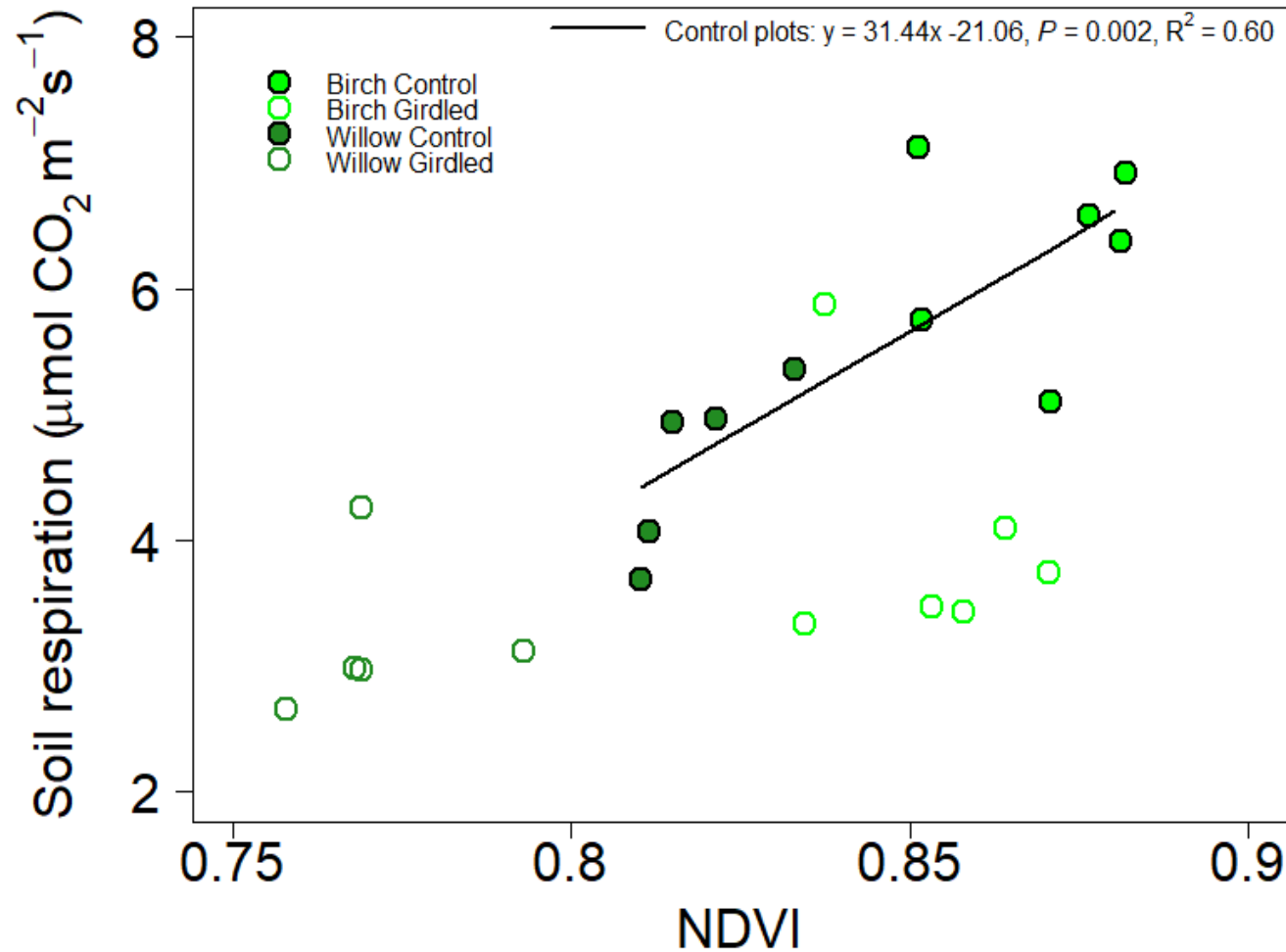
Roots: -33 %  
Hyphae: No change/  
undetectable

# Soil Respiration



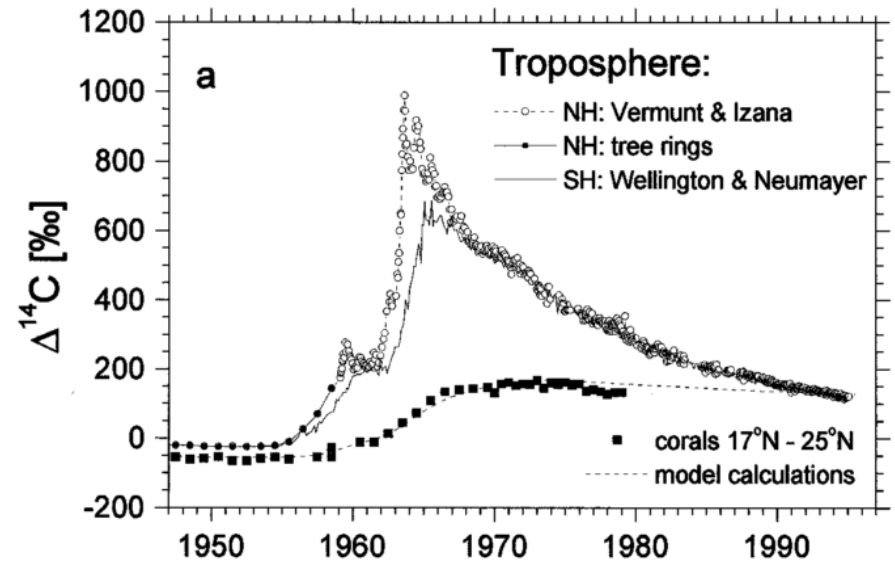


# NDVI and Soil Respiration



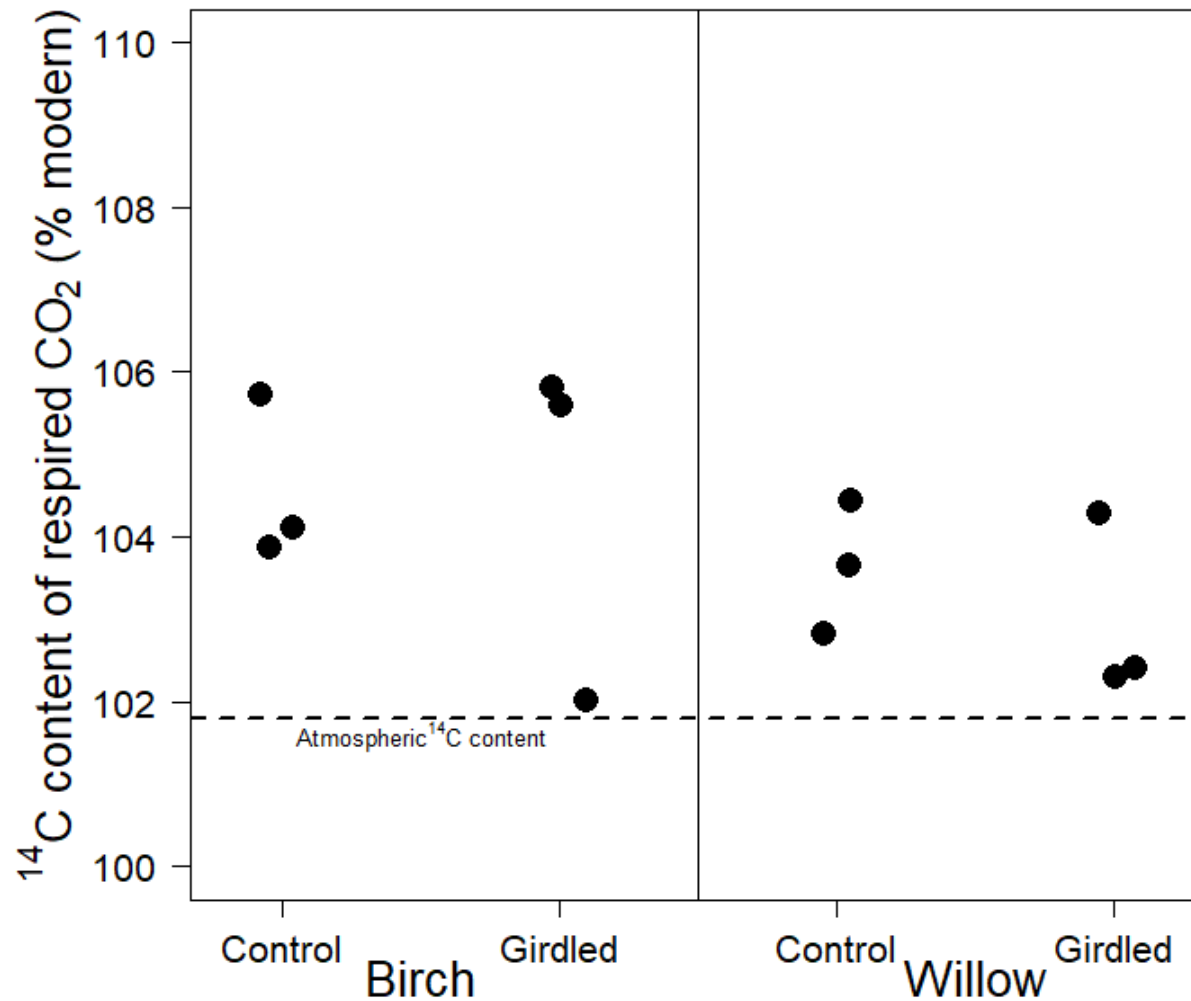


# $^{14}\text{CO}_2$ in girdled and control plots



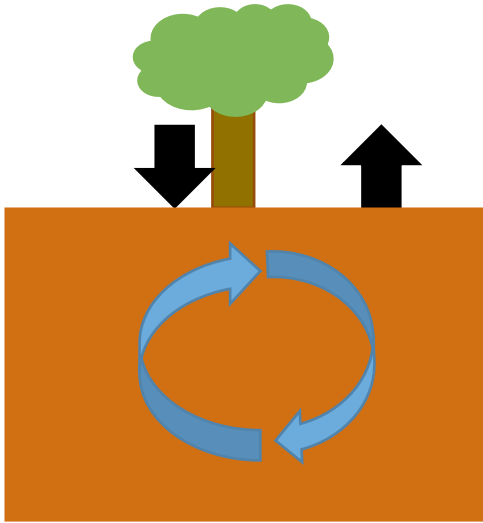


# $^{14}\text{C}$ Content of Respired C



Average carbon atom was fixed around 2010, even in girdled plots:

# Conclusions



- Soil respiration at the tree-line and in shrub communities is dominated by recent photosynthate from the canopy
- Turnover of soil C is dominated by recent inputs
- A greener Arctic may result in faster turnover of carbon, not sequestration *in the soil*

