

Carbon and nutrient dynamics in response to drought

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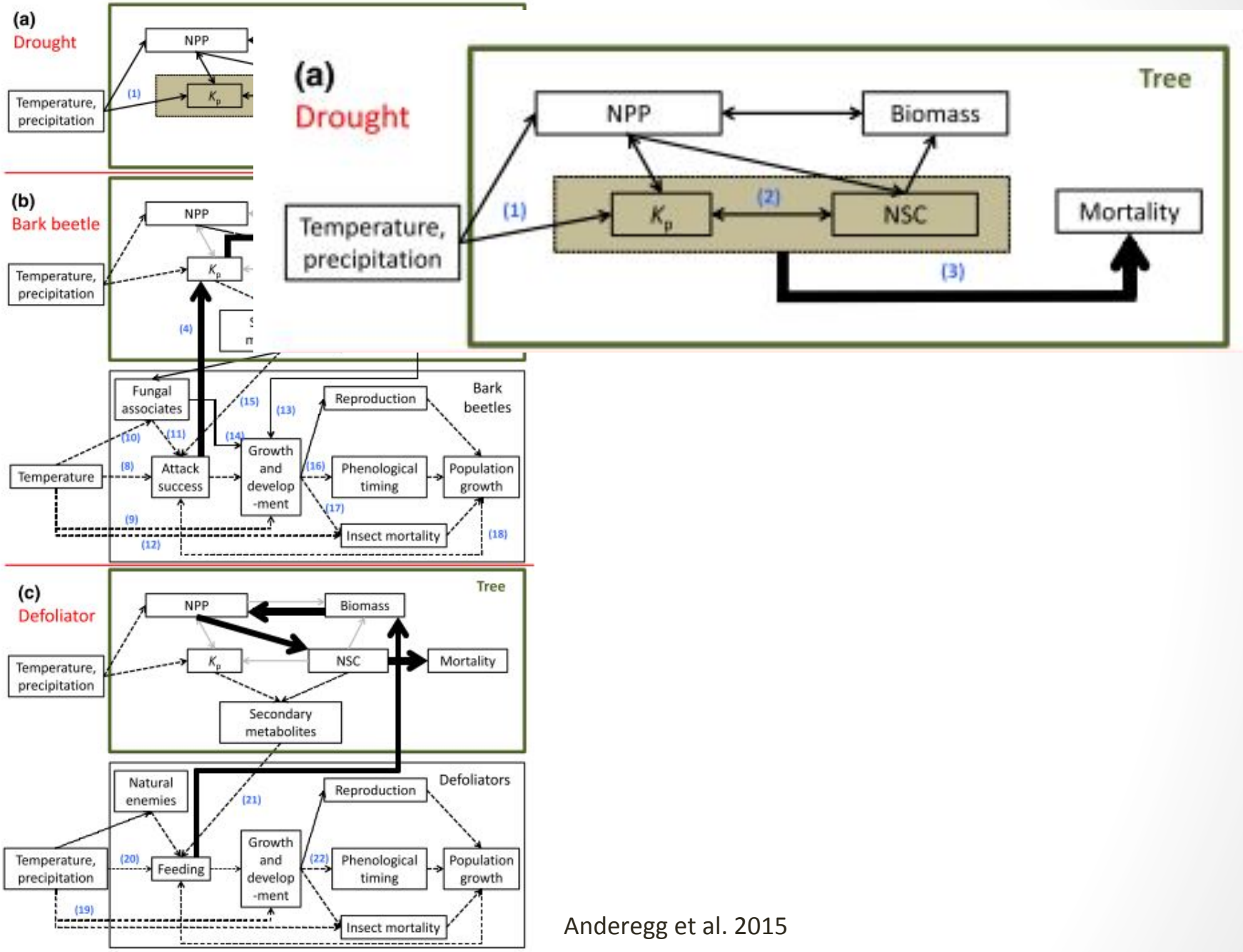
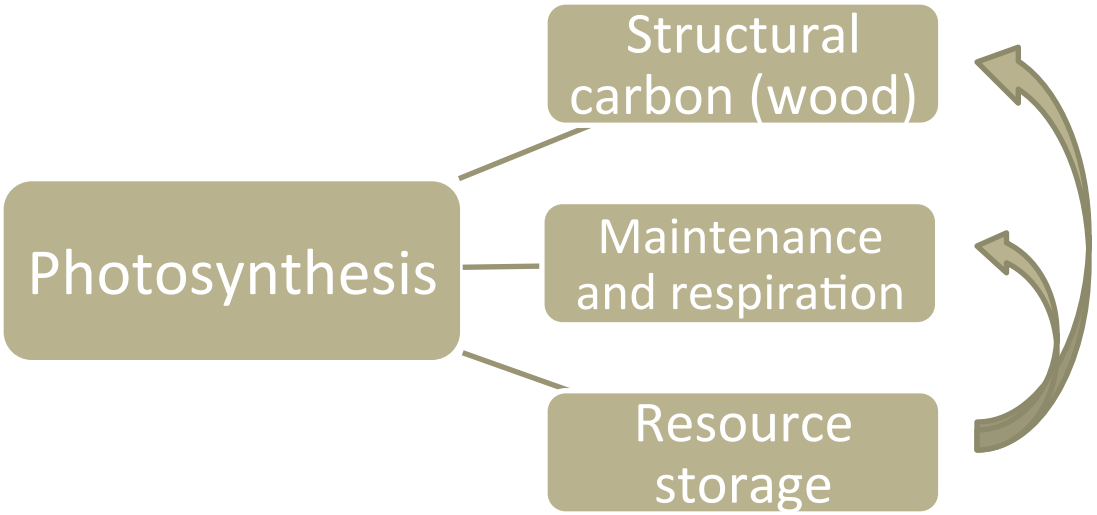


Anderegg et al. 2015

Non-structural carbohydrates (NSC)

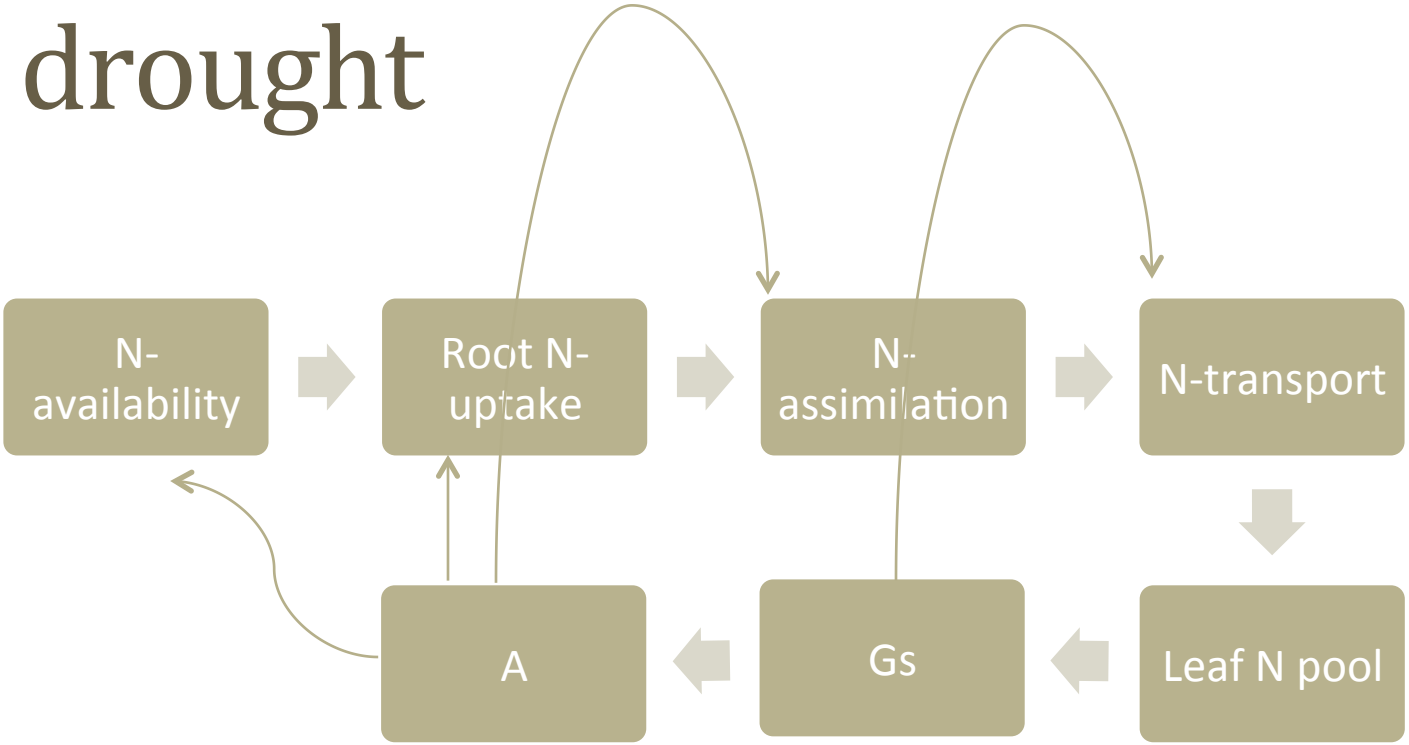
- Starch, soluble sugars and lipids
- Balance between C-gain and C-utilization



Problem

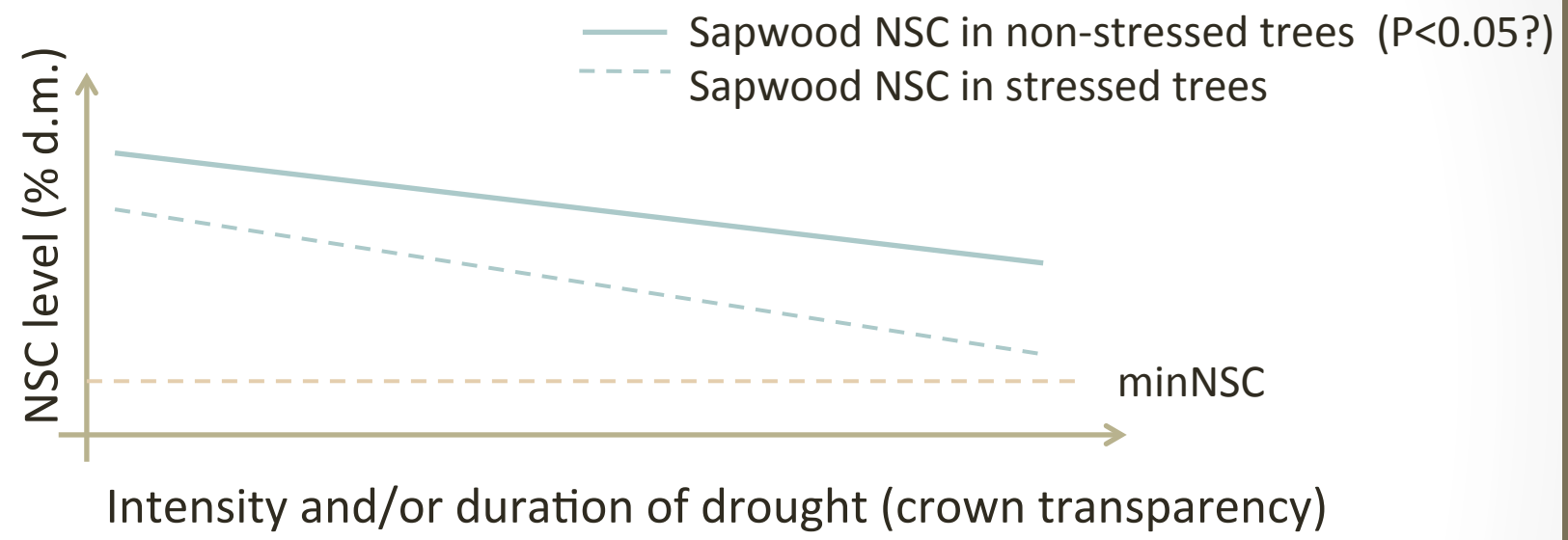
- Lack of agreement among studies on the effect of drought on NSC
  - Drought properties (frequency and intensity)
  - Tree size and age, tissues and species
  - Methodology
  - Nobody has ever found a total NSC depletion
  - Interaction with other (biotic) factors

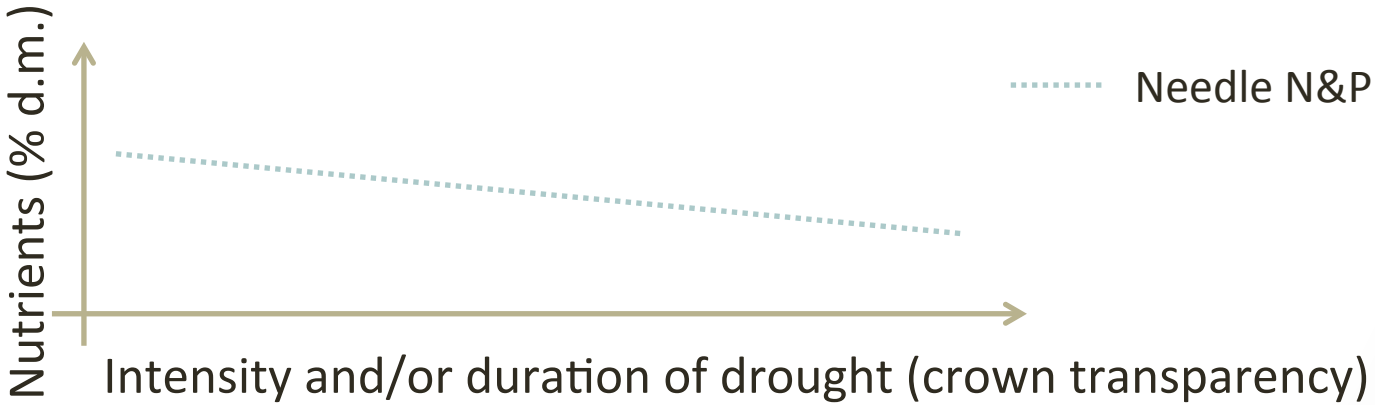
Interaction nutrients and drought

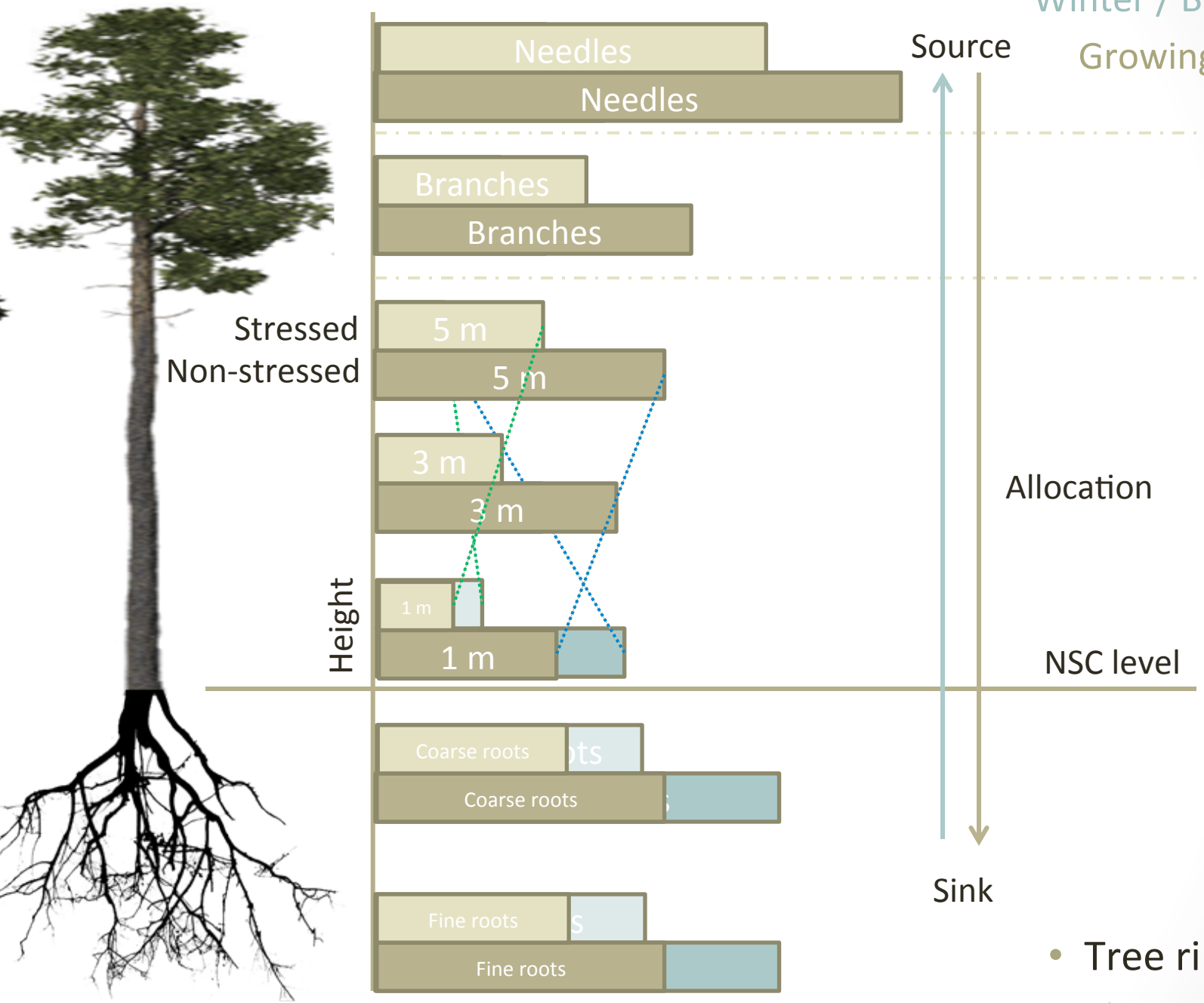


- Nitrogen: growth limiting factor
- Interaction between drought-induced C starvation and drought-induced impairment on the nutrient balance

NSC levels and spring growth







- Tree rings
- Shoot growth

Pfynwald

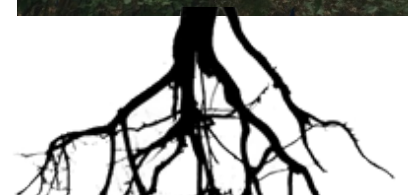
9 m + needles

7 m

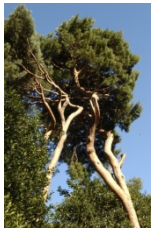
5 m

3 m

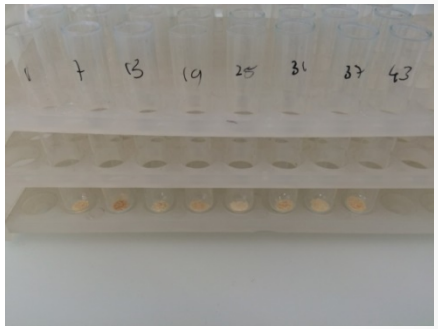
1 m



Coarse roots
Fine roots

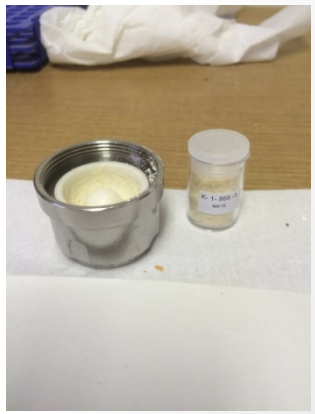


- February, June, October
- Transparency classes
- NSC analysis using an enzymatic method and spectrophotometer



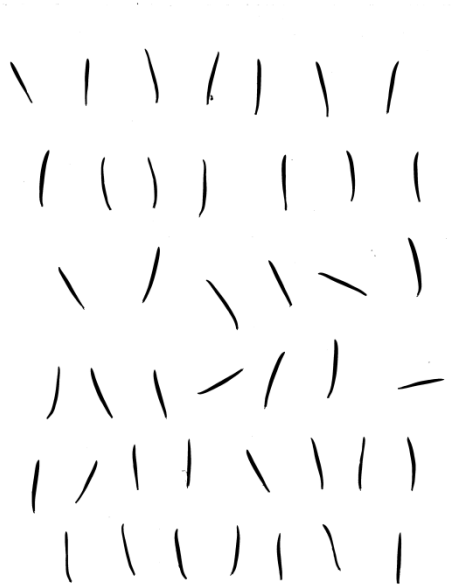
Measurements:

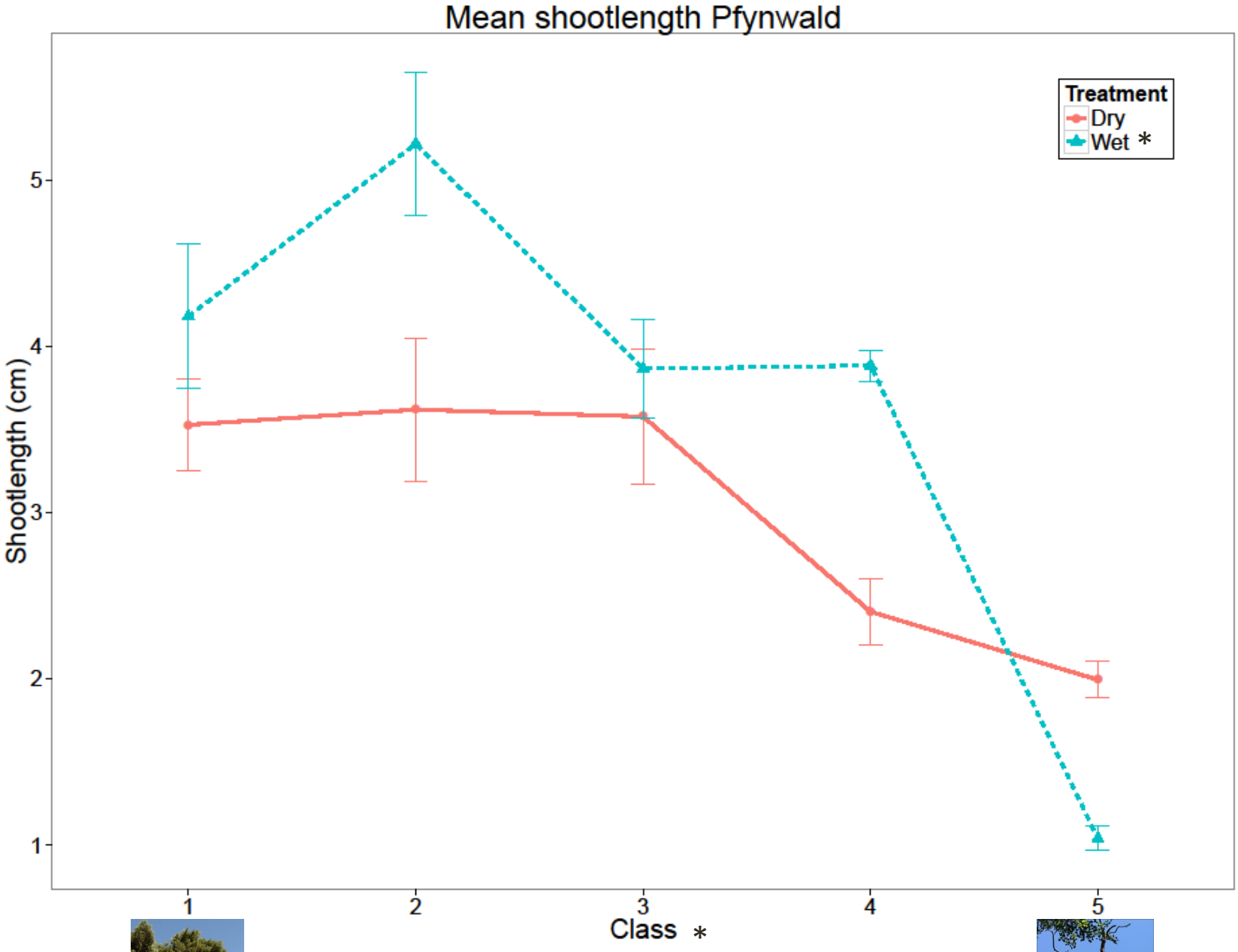
- Needle 13C
- % Phosphorus & Nitrogen
- Shoot growth
- Needle morphology
- Tree rings

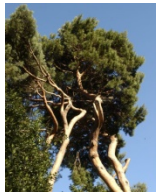


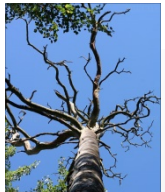
Results

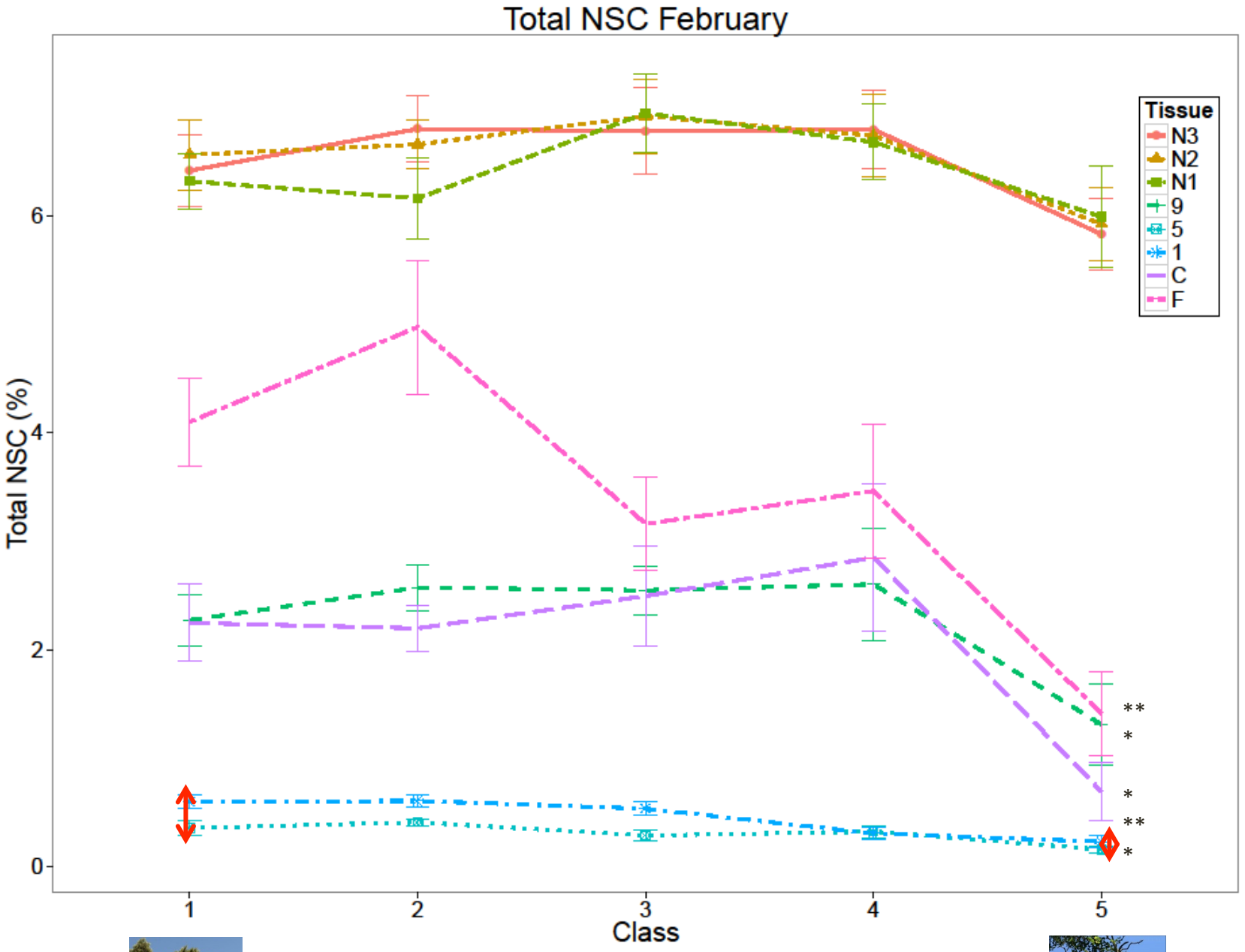
Needles of drought stressed trees are shorter, wider, but in general smaller than non-drought stressed trees.

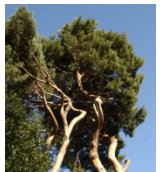



Mean shootlength Pfynwald
Treatment
Dry
Wet *
Shootlength (cm)
1
2
3
4
5
Class *



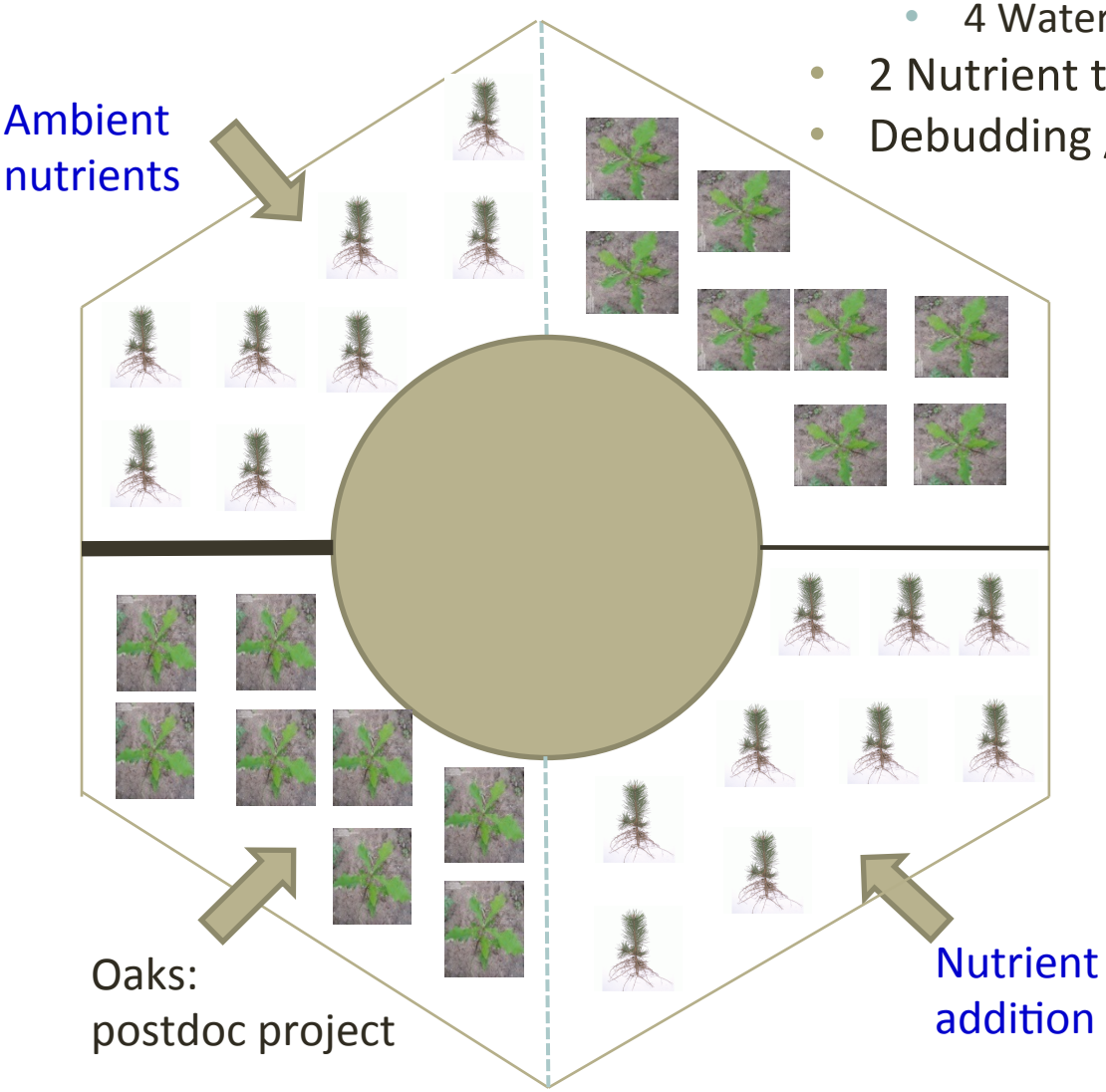



Total NSC February
Tissue
N3
N2
N1
9
5
1
C
F
Total NSC (%)
0
2
4
6
1
2
3
4
5
Class
**
*
*
**
*



MODOEKs

- 16 Open Top Chambers
  - 4 Water levels (n=4)
- 2 Nutrient treatments
- Debudding / Needle removal



- Measurements
  - NSC
  - Gas exchange
  - Treerings
  - Shoot growth
  - Root growth
  - Root respiration
  - ??

Thank you

Maihe Li
Arthur Gessler
Andreas Rigling
Marcus Schaub
Günter Hoch
Ansgar Kahmen

Peter Bleuler
Matthias Arend
Anton Burkhart
Gardeners
Zivis and interns