TECHNISCHE UNIVERSITÄT DRESDEN

Faculty of Forest-, Geo-, Hydroscience, Institut of General Ecology and Environmental Protection

Silicon availability modifies the C:N:P stoichiometry and contents of carbon compounds in grasses

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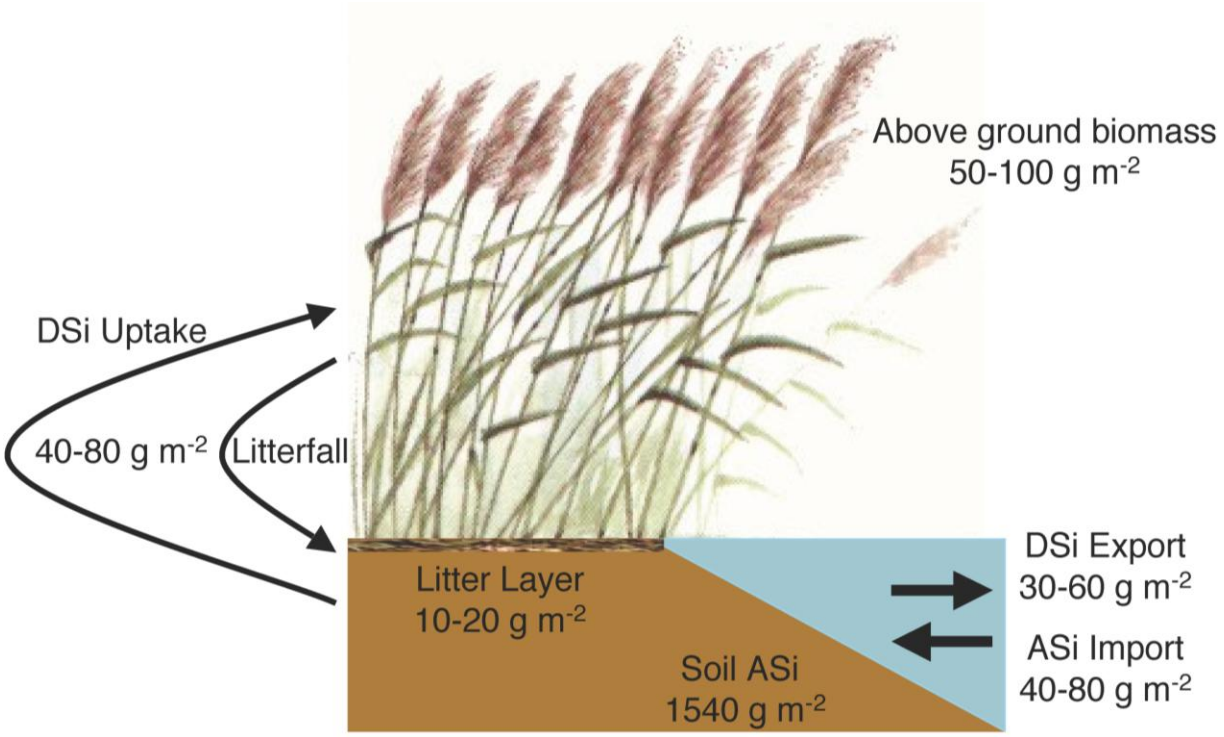
Orlando, 4. June 2012

Silicon as beneficial for grasses

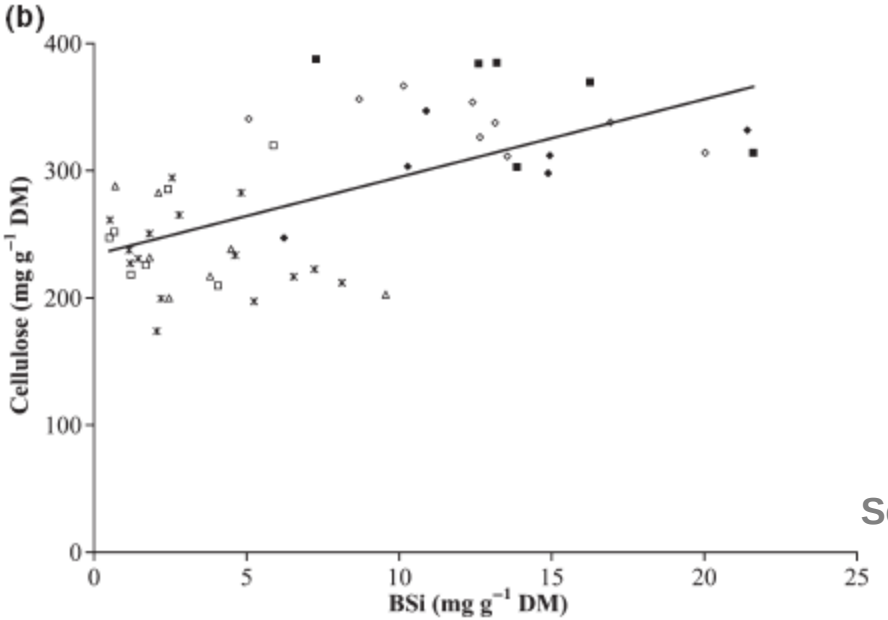
- against drought stress
- for pathogen resistance
- may substitute carbon compounds

Silica cycle by *Phragmites australis*



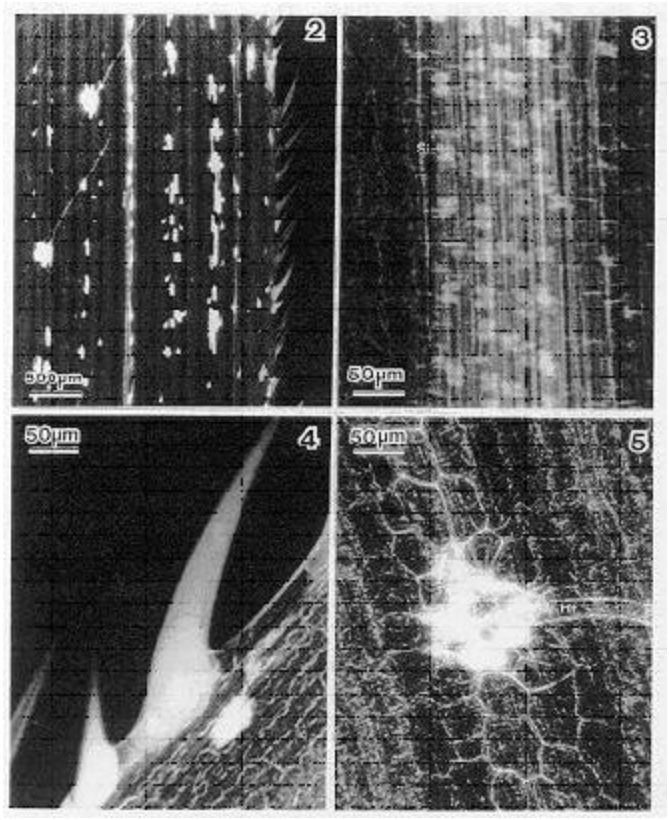
Struyf & Conley, Front. Ecol. Environ., 2009

Relastionship between Silicon and Cellulose in wetland plant species



Schoelynck et al., New Phyt, 2010

Silicon on the leaf surface



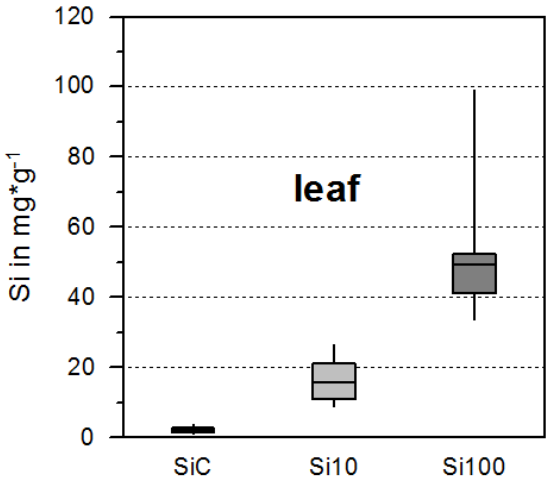
Open questions

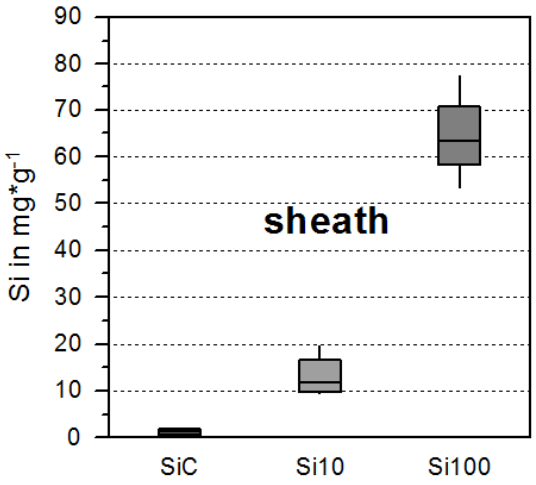
- What impact has silicon availability on cellulose, lignin and phenol content in the different plant tissues?
- Is the C:N:P stoichiometry altered by silicon?
- Is silicon affecting the carbon cycle?

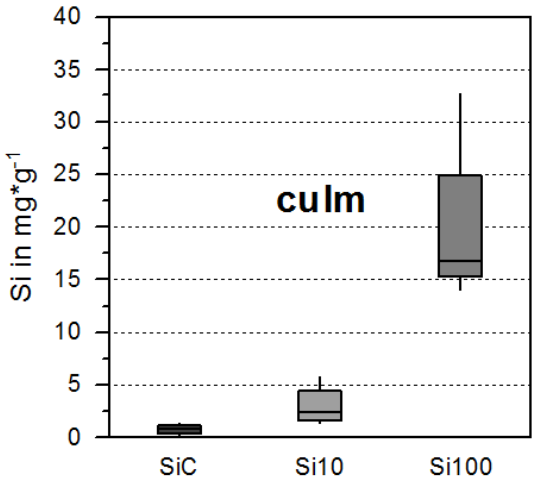
Experimental design

- pot experiment (n=12) using Phragmites
- 3 different treatments (each 3 rhizomes, 1 kg peat (10% Si), nutrients with weak nitrogen limitation, pH=5.3)
- Si-C → without silicon addition per pot
- Si-10 → with 10g silica addition per pot (nano-silica)
- Si-100 → with 100g silica addition per pot

Silicon content in the different tissues

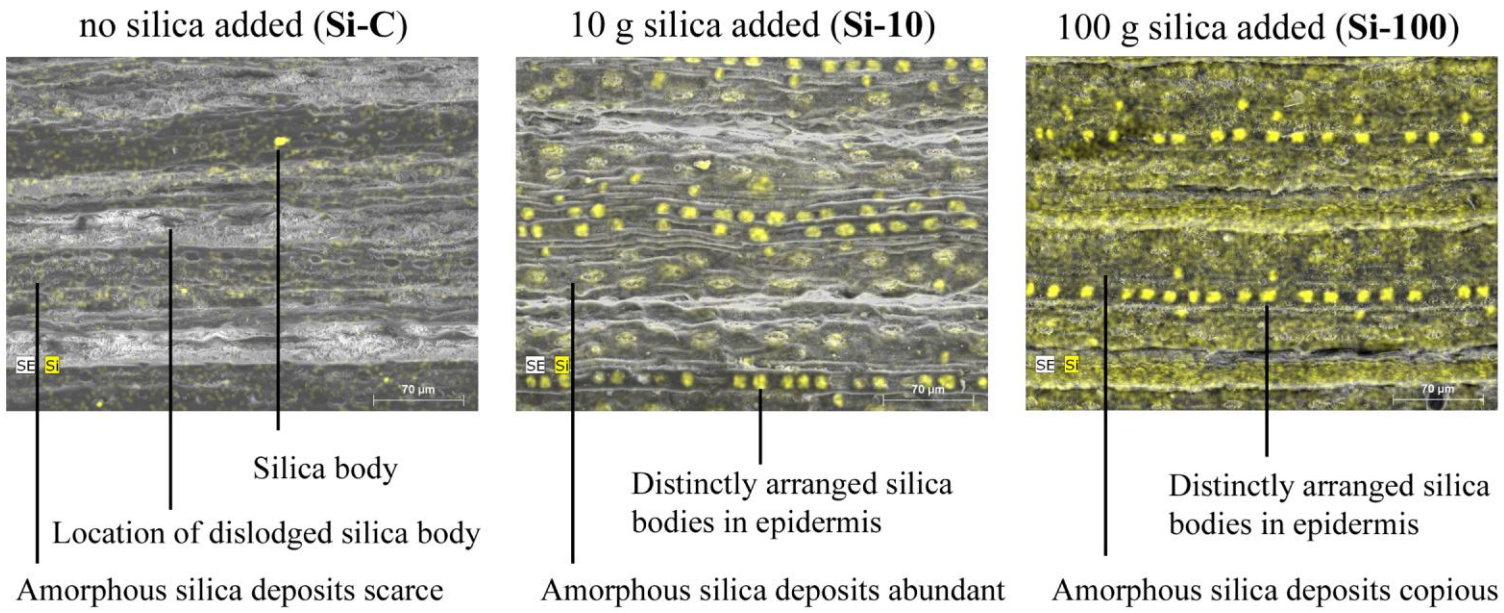






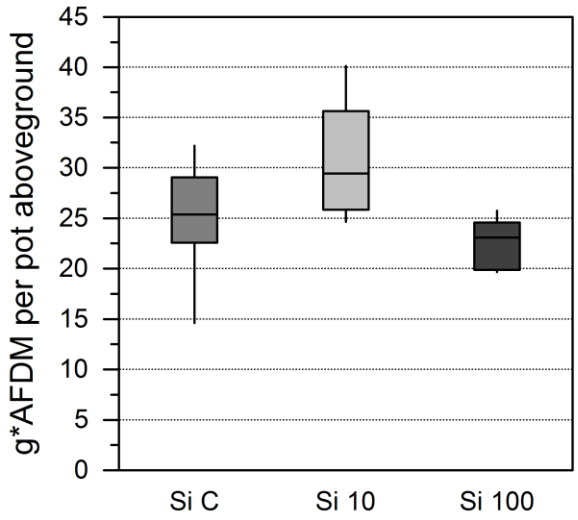
→ Significant differences in silicon content of the different tissues between the different treatments

Distribution of silica bodies and amorphous silica deposits in and on leaf blades of *P. australis*



Schaller et al. 2012 Plant Biology 14: 392-396

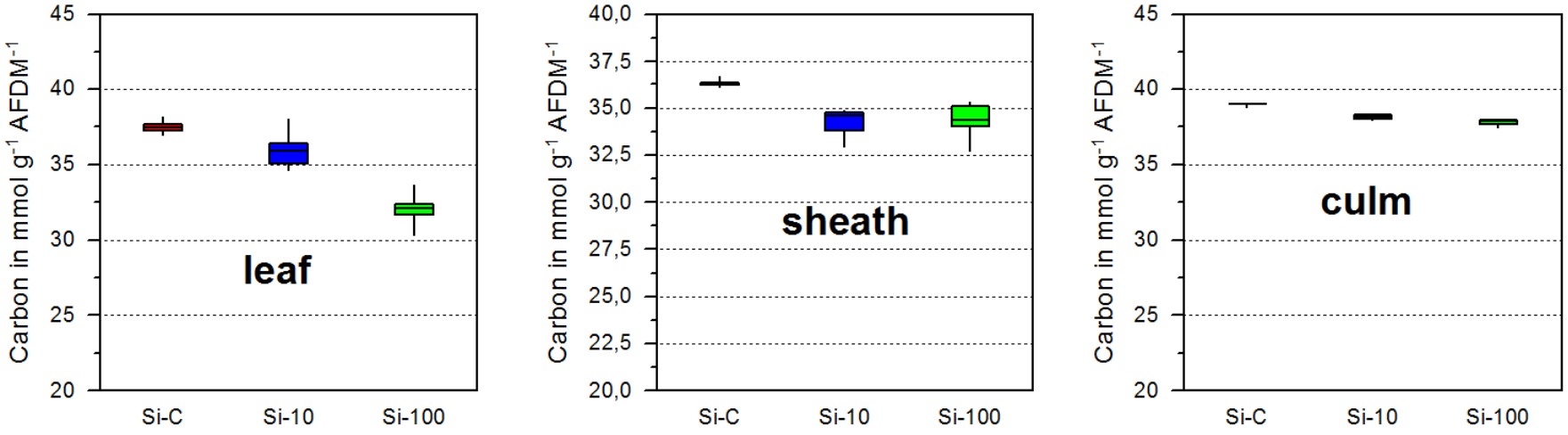
Variation in aboveground biomass of *P. australis* after one growing season



→ Significantly less biomass production in treatment Si-100 compared with Si-10

Schaller et al. 2012 Plant Biology 14: 392-396

Carbon content in the different tissues



→ **Significant carbon substitution by silicon**

Schaller et al. 2012 Plant Biology 14: 392-396

Effect of silicon availability on C:N:P stoichiometry

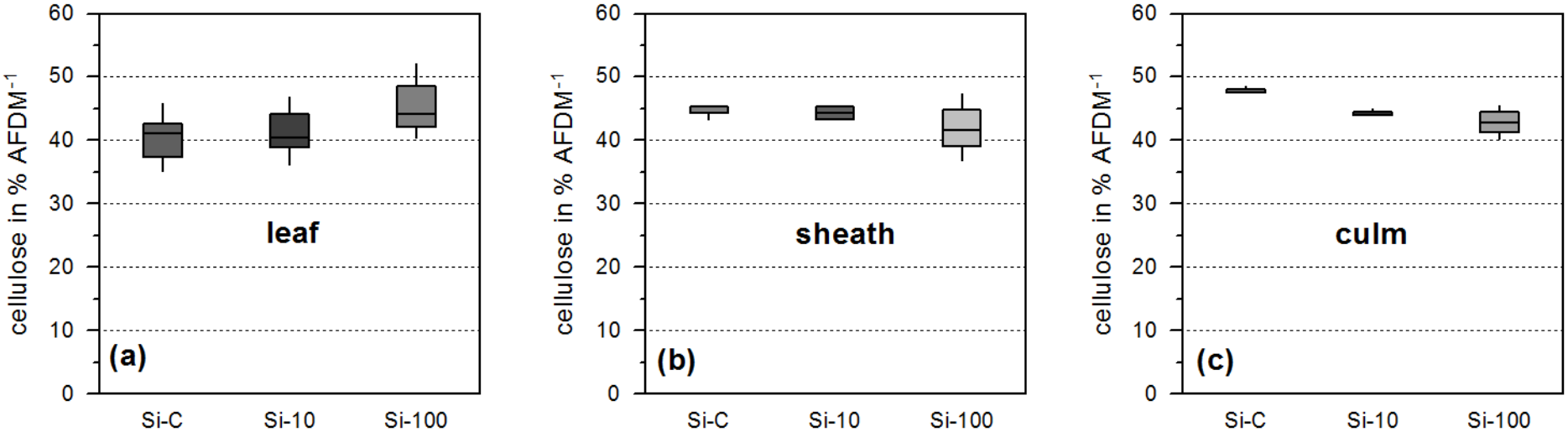
Ratio	Treatment	Leaf	Sheath	Culm
C : N : P	Si-C	2214 : 26 : 1	6363 : 47 - 1	37900 : 190 : 1
C : N : P	Si-10	1088 : 13 : 1	4270 : 34 :1	31800 : 100 : 1
C : N : P	Si-100	2915 : 34 : 1	5208 : 40 : 1	37900 : 163 : 1

Experiment was conducted under slightly nitrogen deficiency!!

➢**altered N : P ratios, whereas C : N ratios changed only slightly**

Schaller et al. 2012 Plant Biology 14: 392-396

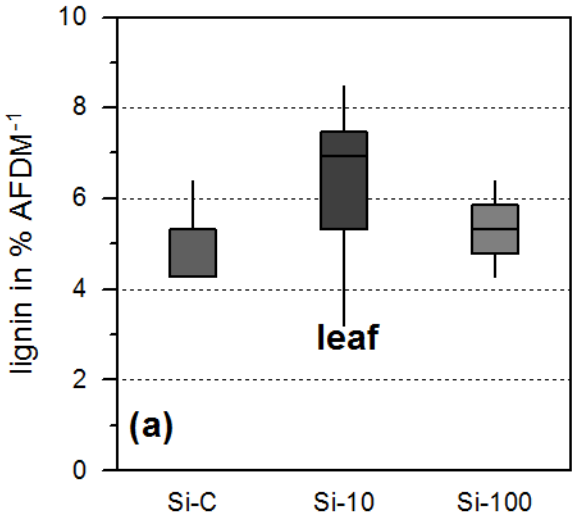
Cellulose content in % ash free dry mass (AFDM) in different plant tissues

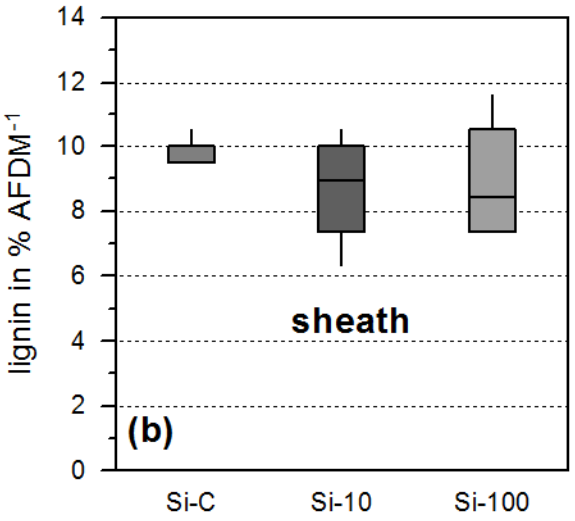


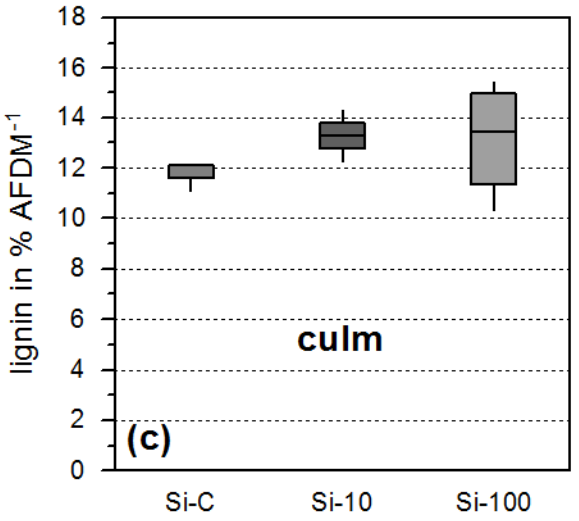
*** Significant differences in leaves between Si-C and Si-100; and for culm between Si-C and both Si-10 and Si-100**

Schaller et al. 2012 Environ. Exp. Botany 77(3): 283-287

Lignin content in % ash free dry mass (AFDM) in different plant tissues



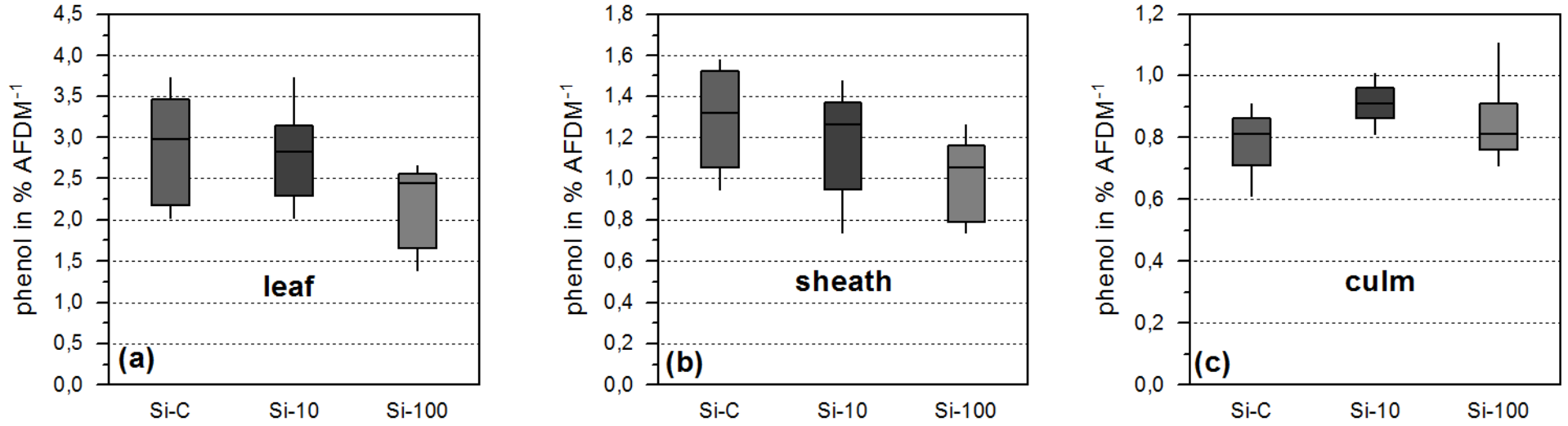




→ **No strong effects**

Schaller et al. 2012 Environ. Exp. Botany 77(3): 283-287

Phenol content in % ash free dry mass (AFDM) in different plant tissues

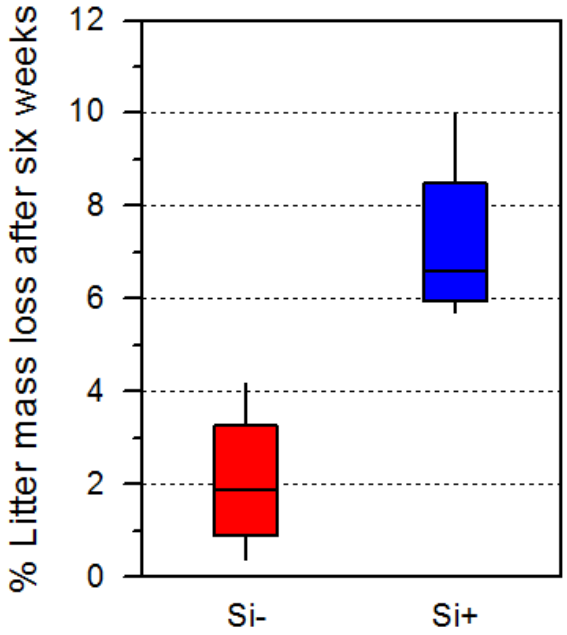


*** Significant differences for leaves between Si-100 and both Si-C and Si-10, and for culm between Si-C and Si-10**

Schaller et al. 2012 Environ. Exp. Botany 77(3): 283-287

Impact on carbon cycling

- Revealed from a leaf litter decomposition experiment with two different types (Si-rich and Si-poor)



Schaller and Struyf submitted

Conclusion

- **silicon availability affects the C:N:P stoichiometry**
- **N : P ratios were altered, whereas C : N ratios changed only slightly**
- **silicon surplus changed the plant cellulose and phenol content differing between the tissues**

- **silicon is very important for the terrestrial and semi-terrestrial carbon turnover**

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Thank you for your attention!