

Undergrowth removal in Salgesch: a complementary experiment on the responses of low elevation pine forests to changed land use in a warmer climate

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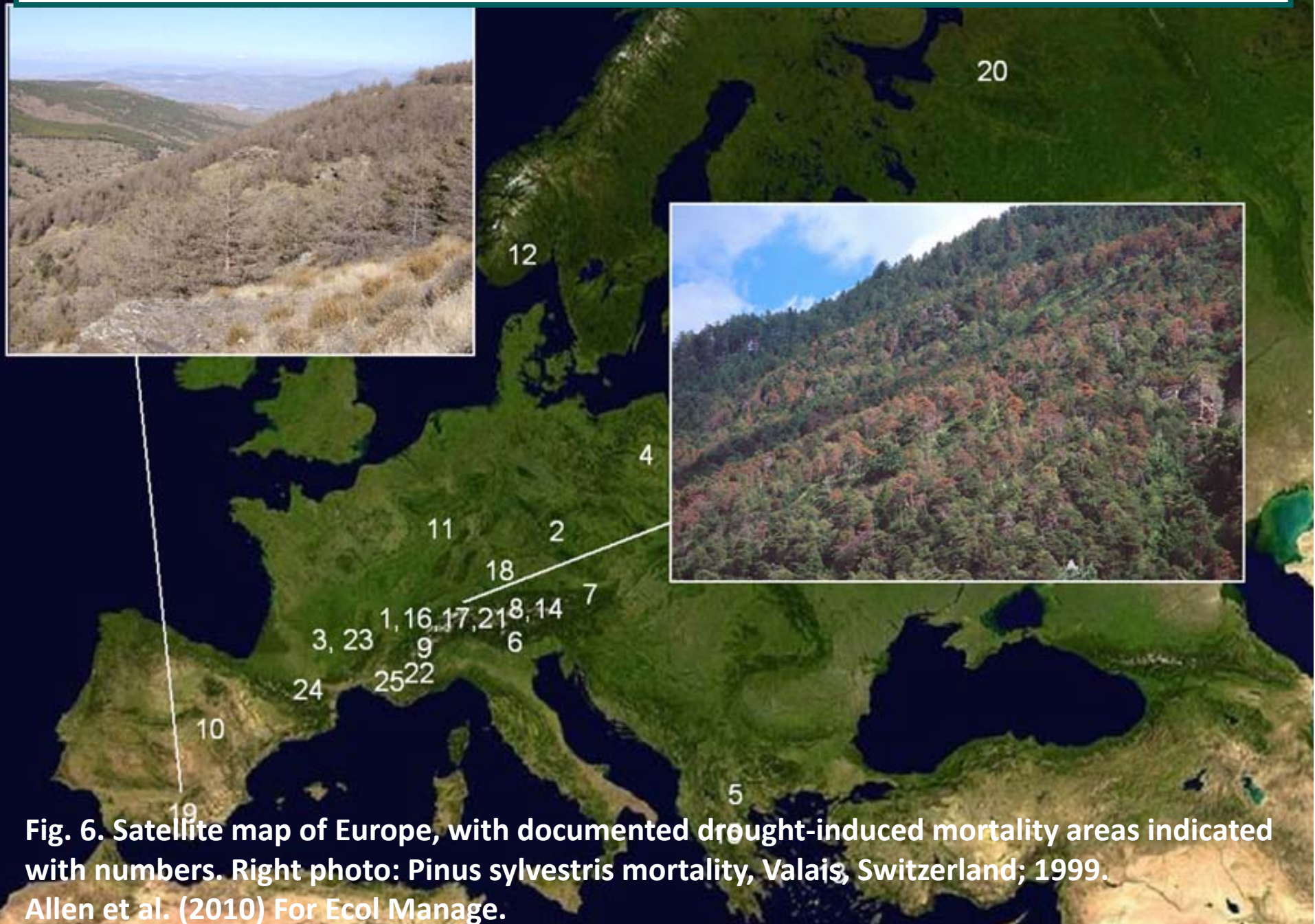


Undergrowth removal in Salgesch: a complementary experiment on the responses of low elevation pine forests to changed land use in a warmer climate

Topics

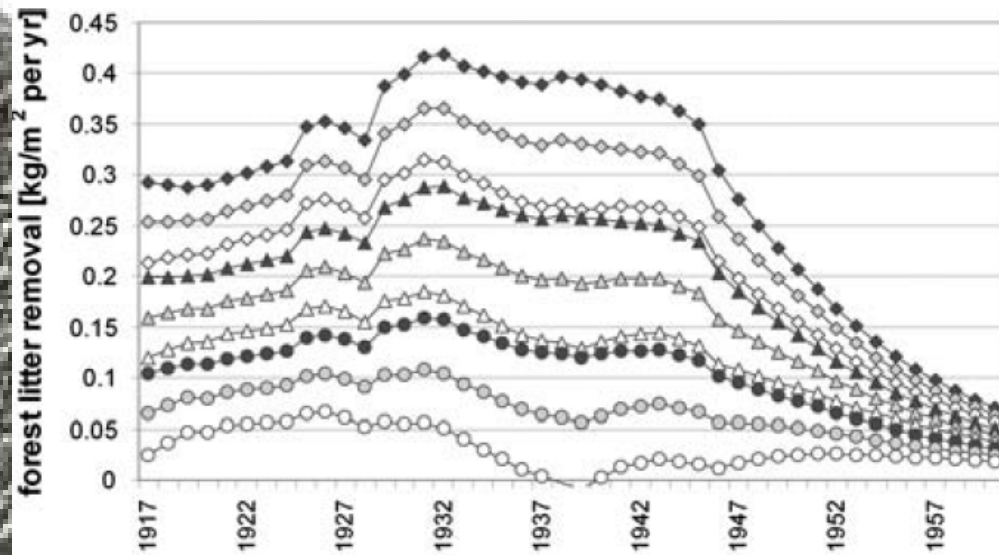
- Change in the climate *versus* land use in the Central Alps of Switzerland
- Effects of understory removal on pine tree vitality: the Salgesch experiment
- Site responses
- Responses in pine trees
- (Preliminary) conclusions

Change in the climate *versus* land use in the Central Alps of Switzerland (I)



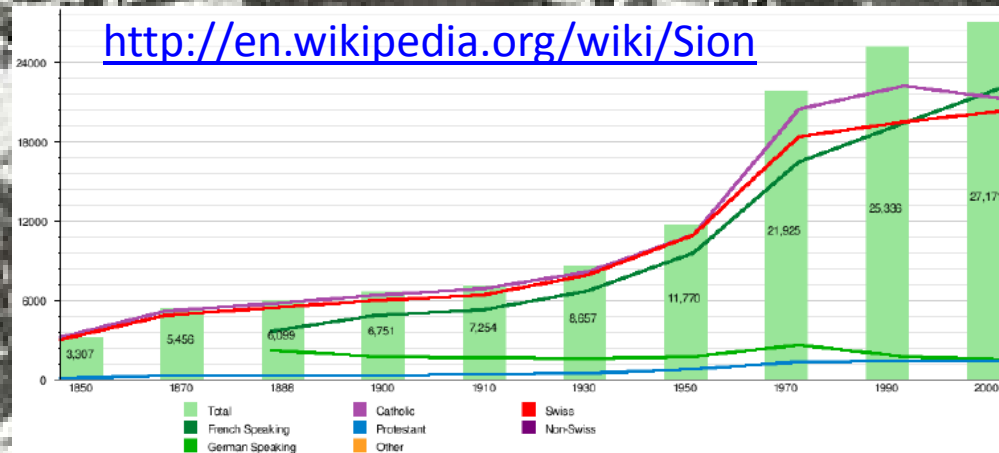
Change in the climate *versus* land use in the Central Alps of Switzerland (II)

Gimmler et al. (2008) Ecosystems



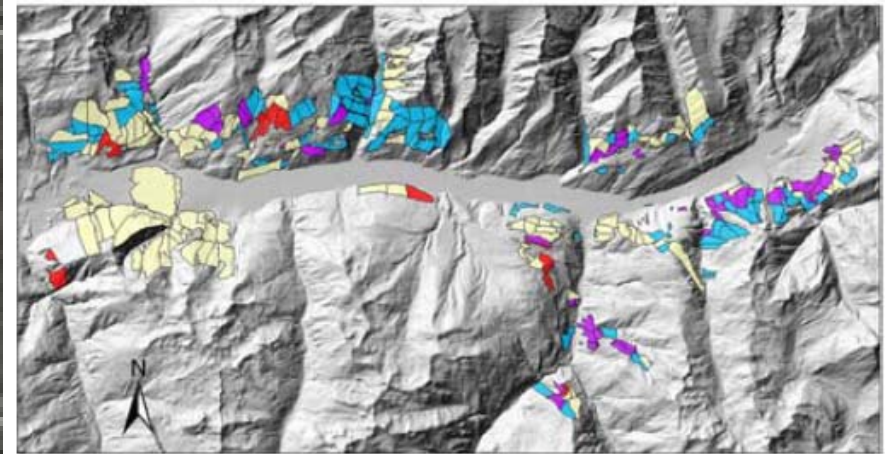
Reconstruction of biomass removal due to forest litter collecting for the period 1917–1960 for different estimates of litter demand per large animal unit and straw production rates.

<http://en.wikipedia.org/wiki/Sion>

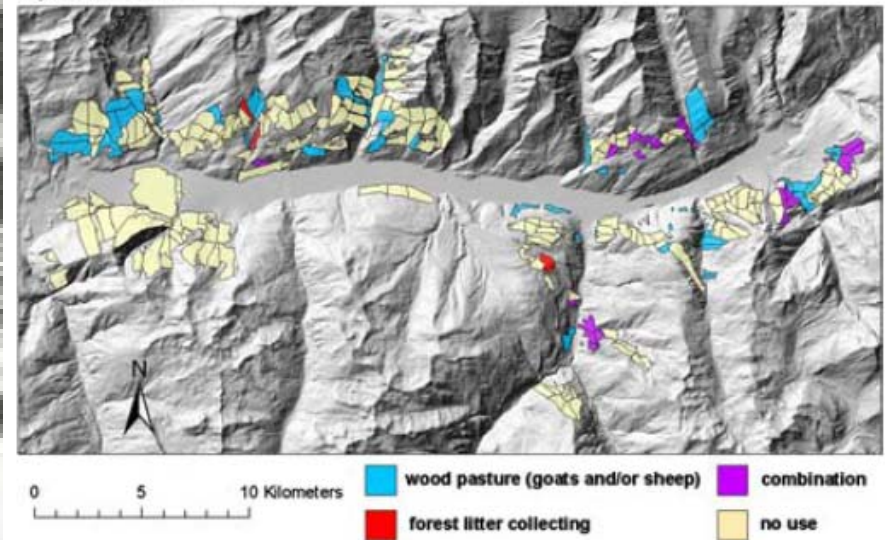


Population increase in the city of Sion, capital of Valais.

a) before 1930



b) after 1930



Spatiotemporal distribution of wood pasture and forest litter collecting in the upper central Valais before and after 1930.

Effects of understory removal on pine tree vitality: the Salgesch experiment (I)

Assessments:

Crown condition:

- Leaf area index
- Shoot & needle growth
- Male and female flowers
- Needle anatomy

Tree ecophysiology & growth:

- Stem growth
- Sap flow

Vegetation relevés

Soil assessments:

- Soil profile
- Respiration
- Mineralisation
- 3 depths: temperature, water content

Not shown



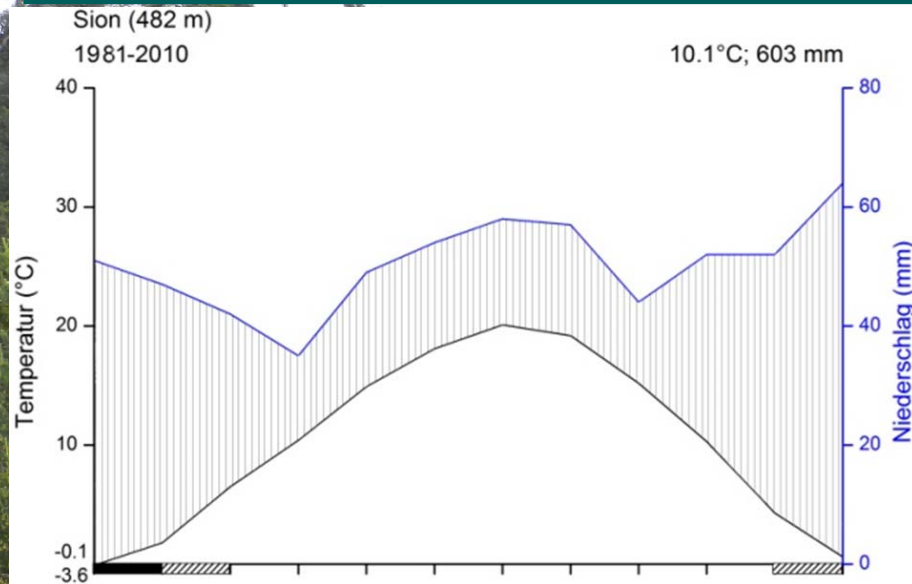
Control



Understory removal

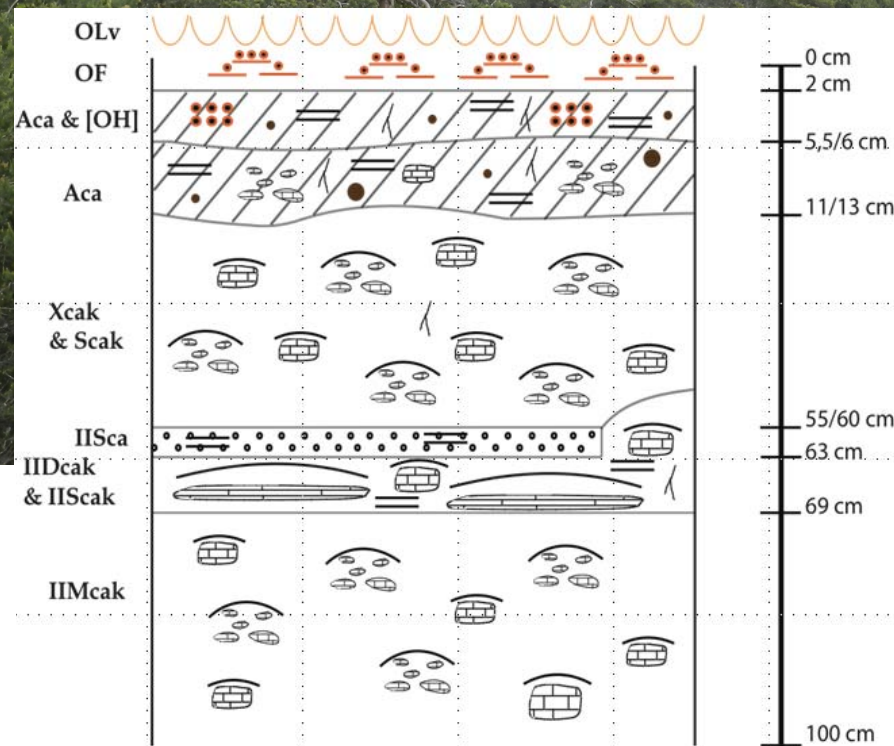
5 m circular plot arranged in pairs (N = 6), with or without understory removal
Plot centered on one dominant pine tree (*P. Sylvestris*) 120-160 year-old
Experiment started in 2010.

Effects of understory removal on pine tree vitality: the Salgesch experiment (II)

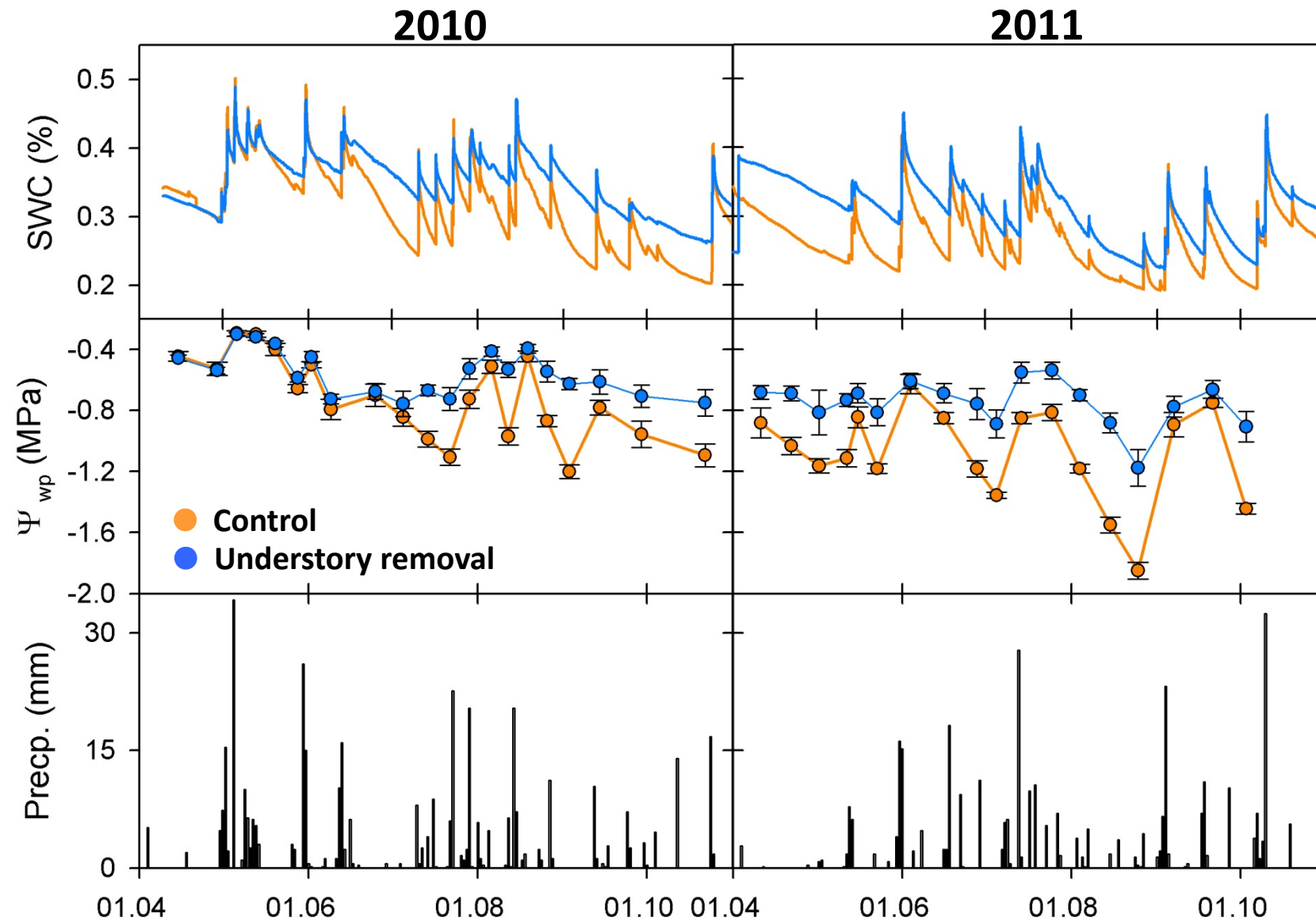


Climatic diagram of Sion, Valais (about 15 km west of study site). Continental climate. Driest region of Switzerland.

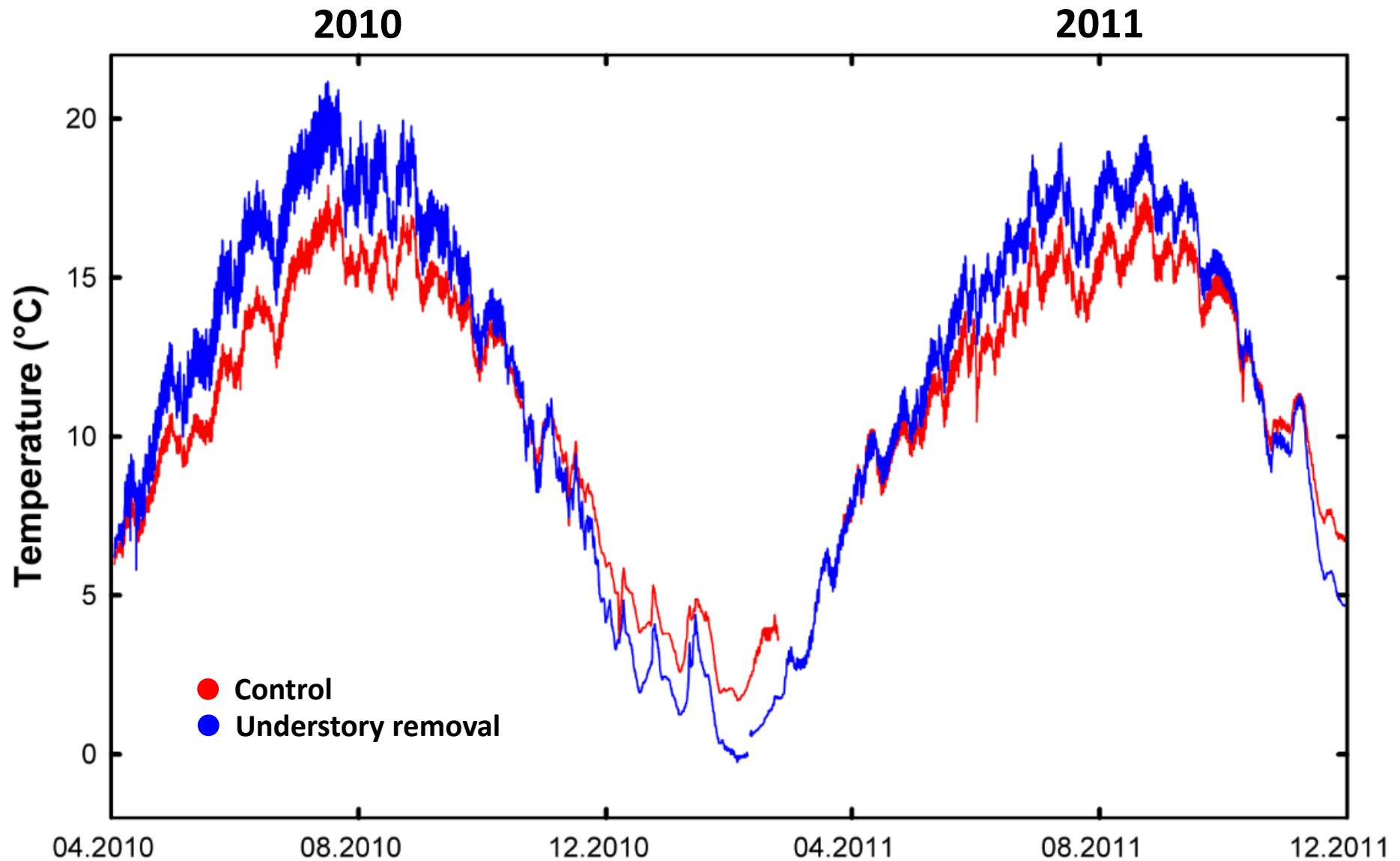
40 to 100 cm-deep dry, calcareous and polyphasic soils (Calcosols) derived from mostly colluvial material, with occasional occurrence of a 60-80 cm-deep loess horizon.



Site responses (I): increase in the soil water content (30 cm depth)

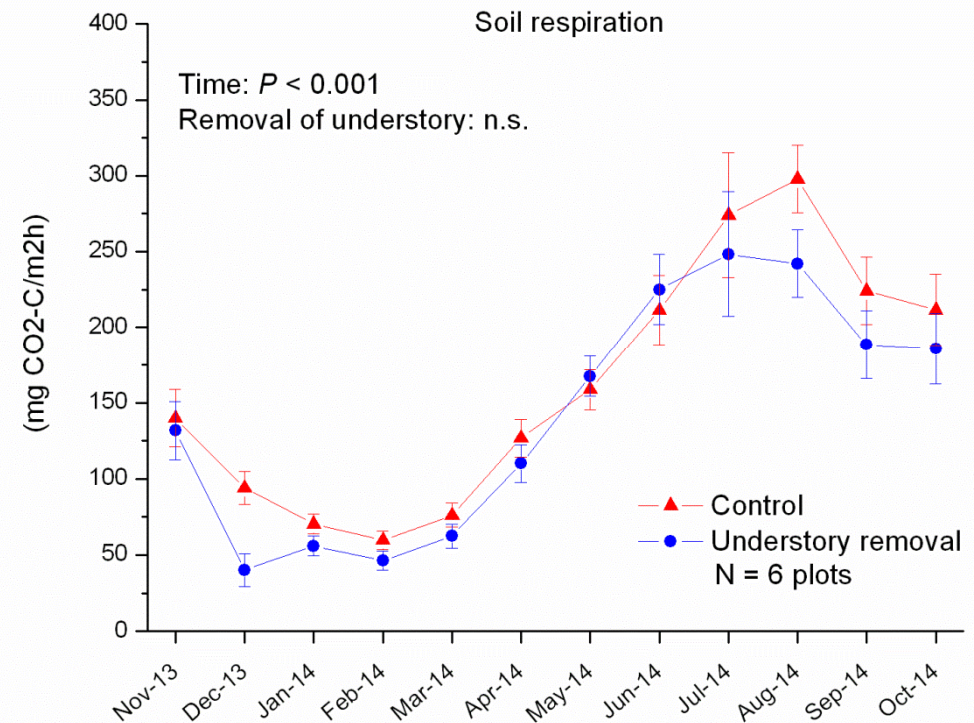
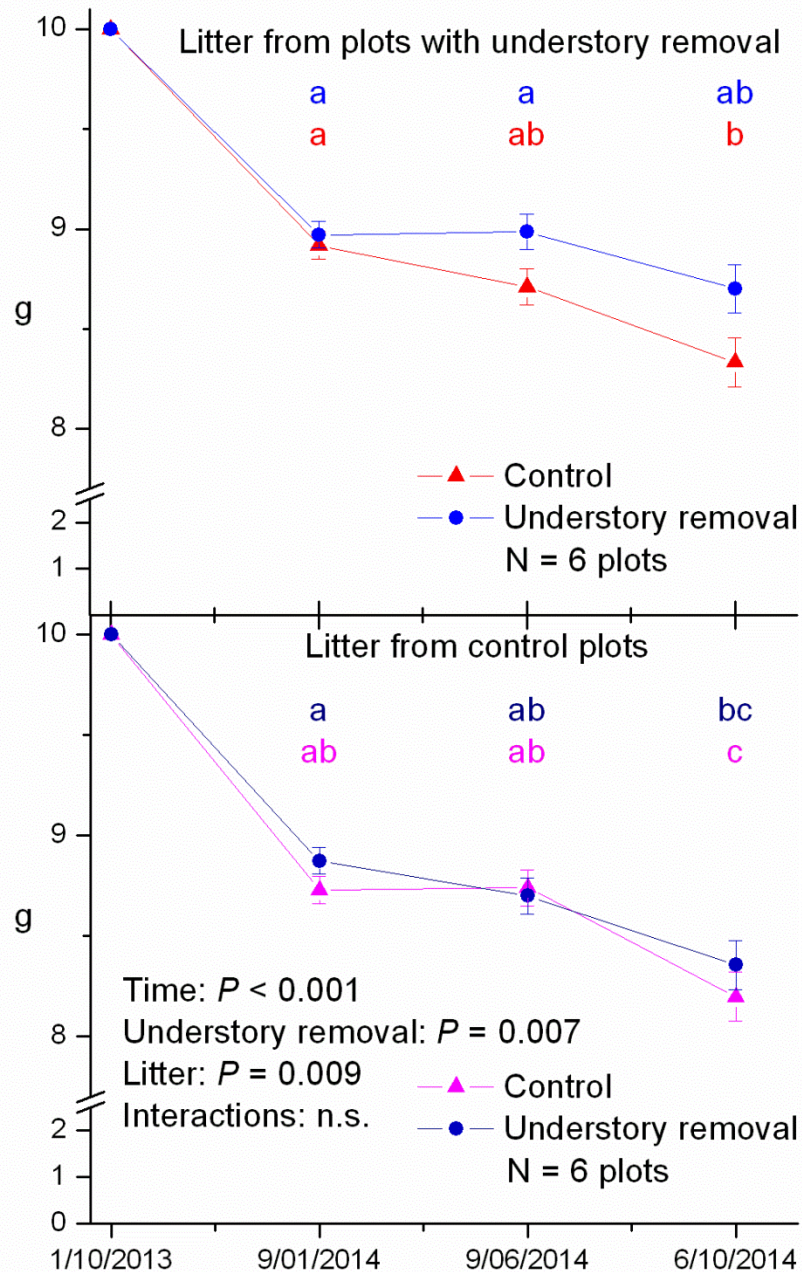


Site responses (II): increase in the soil temperature (30 cm depth)

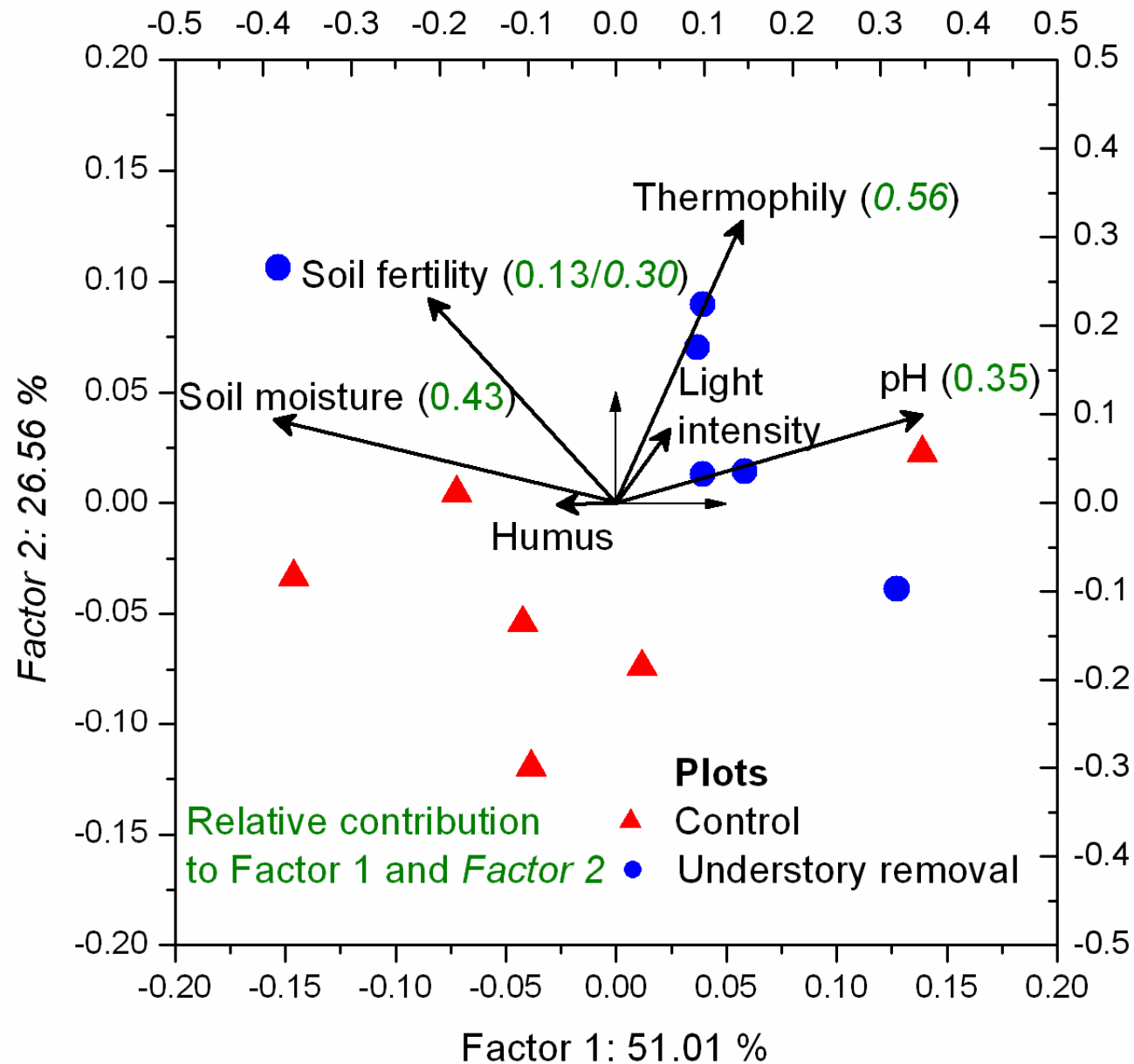


Site responses (III): lower biological activity in the soil

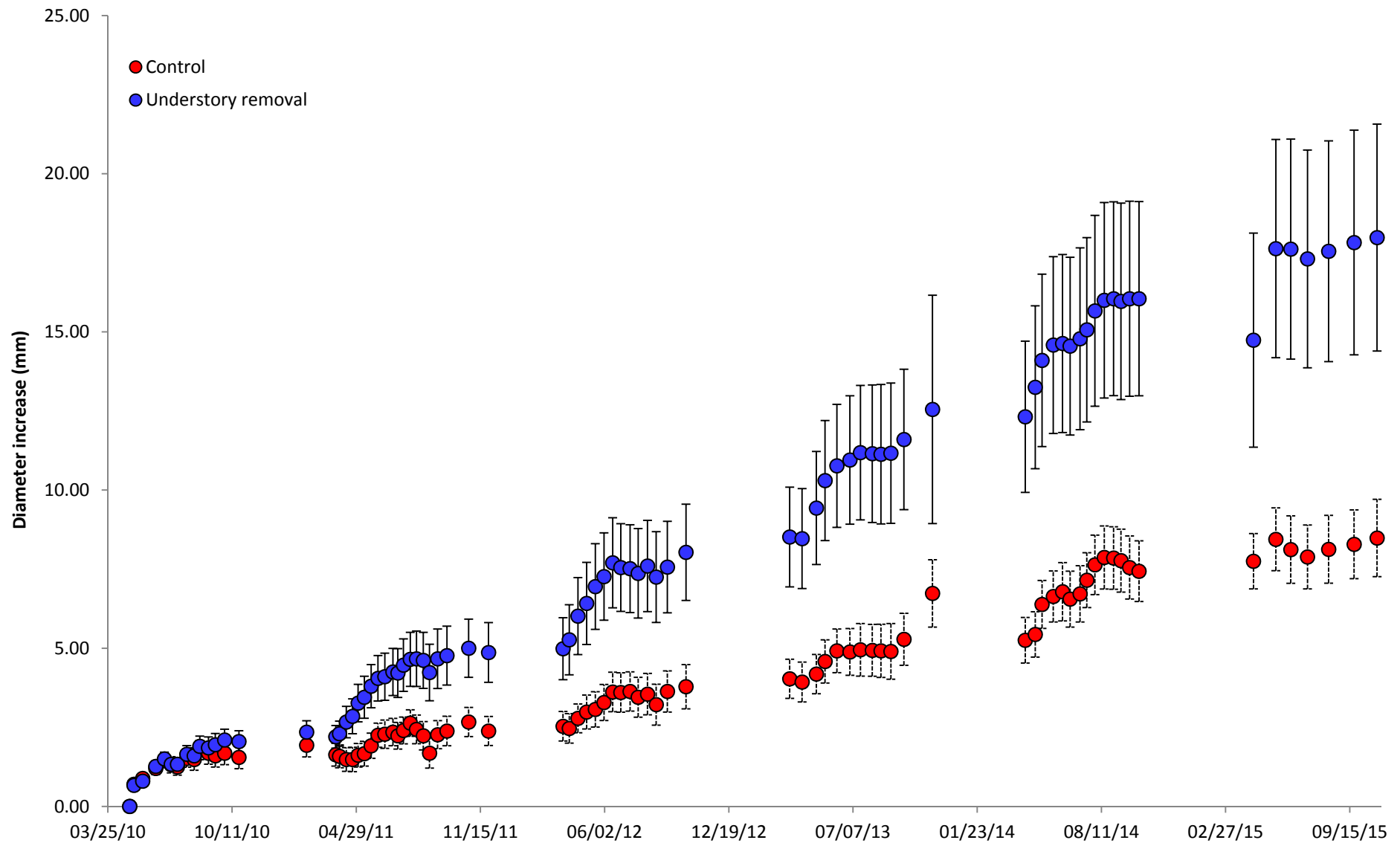
Mineralisation of forest litter



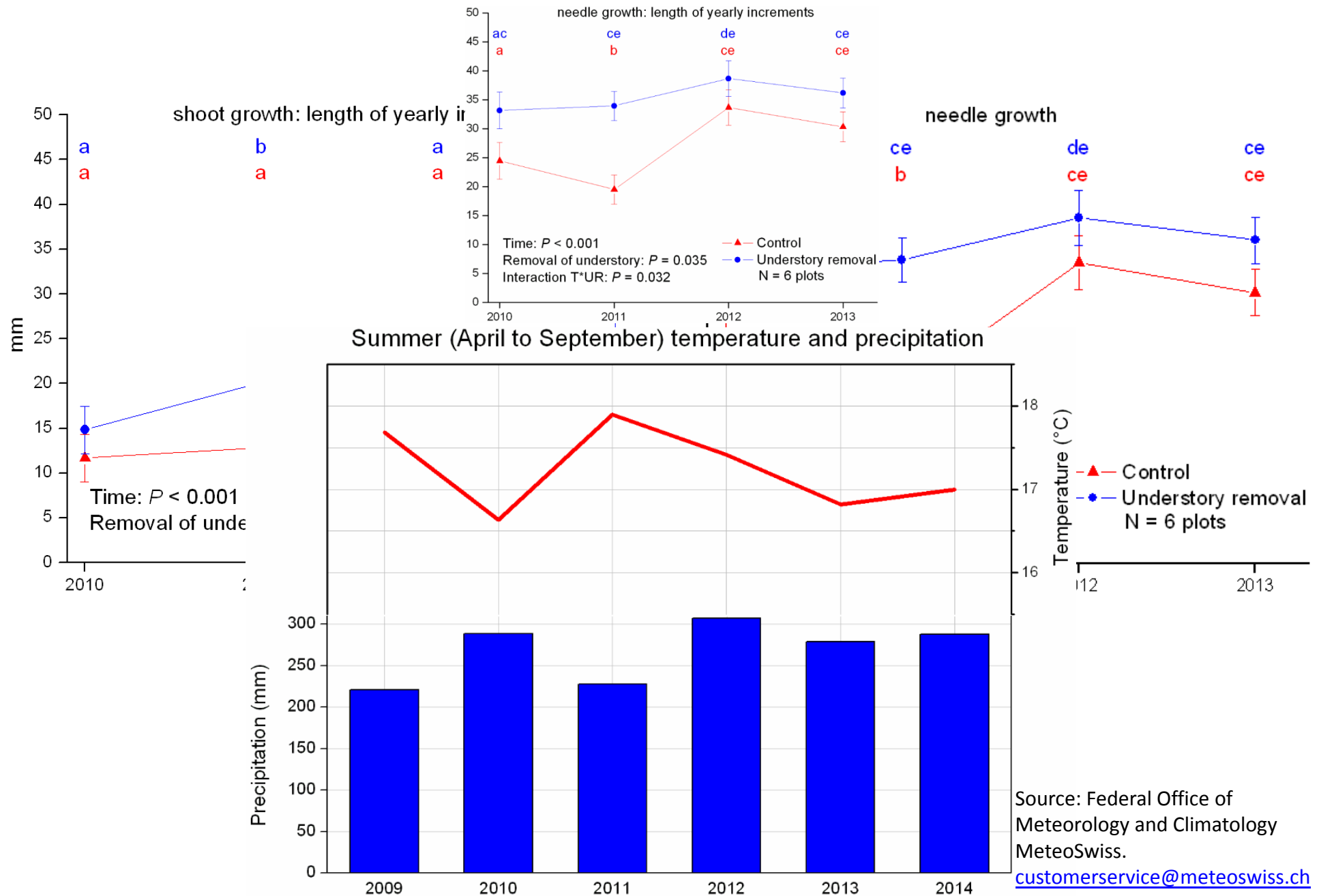
Site responses (IV): increase in the frequency of the more xerothermophilous herbaceous species



Response in pine trees (I): stem growth



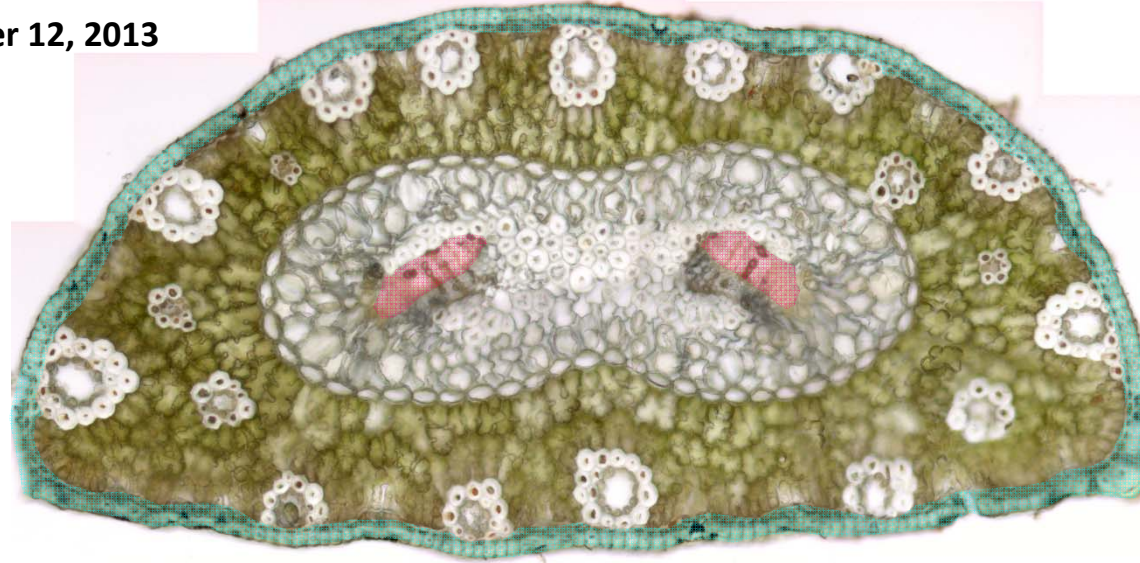
Response in pine trees (III): shoot and needle growth



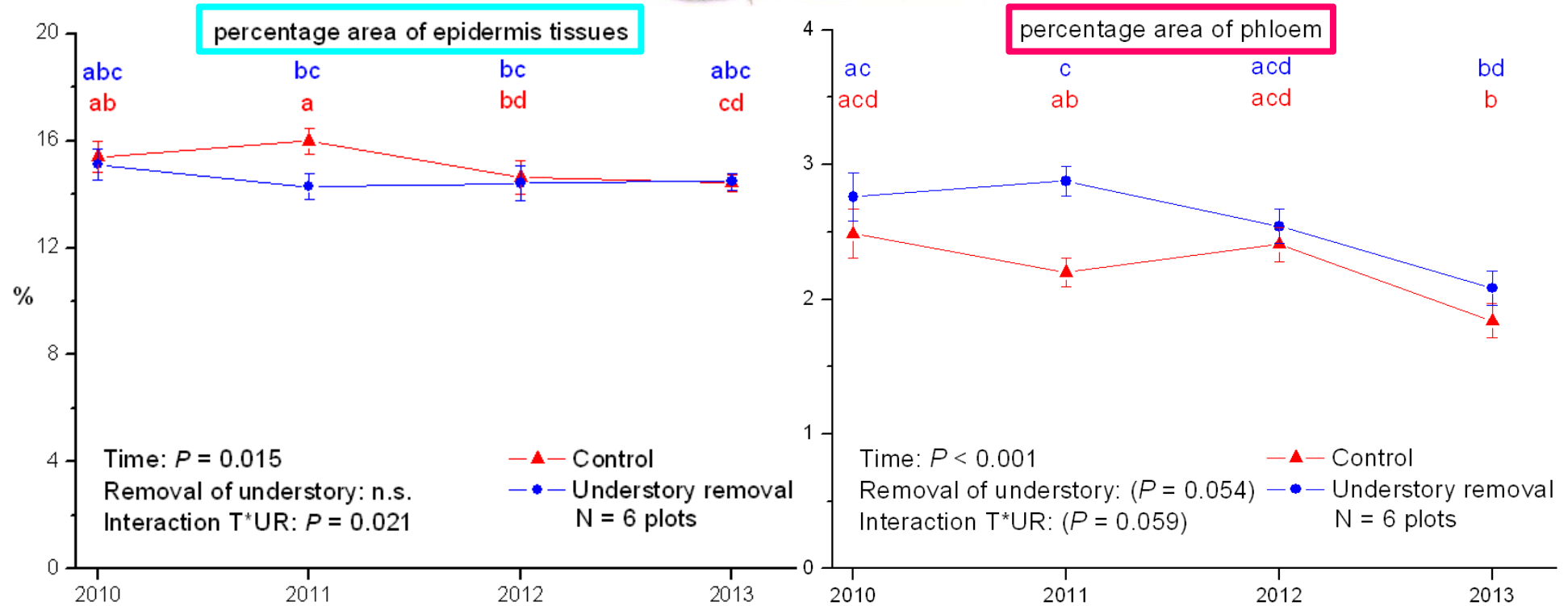
Response in pine trees (III): needle histology

sampling date: October 12, 2013

epidermis &
hypodermis

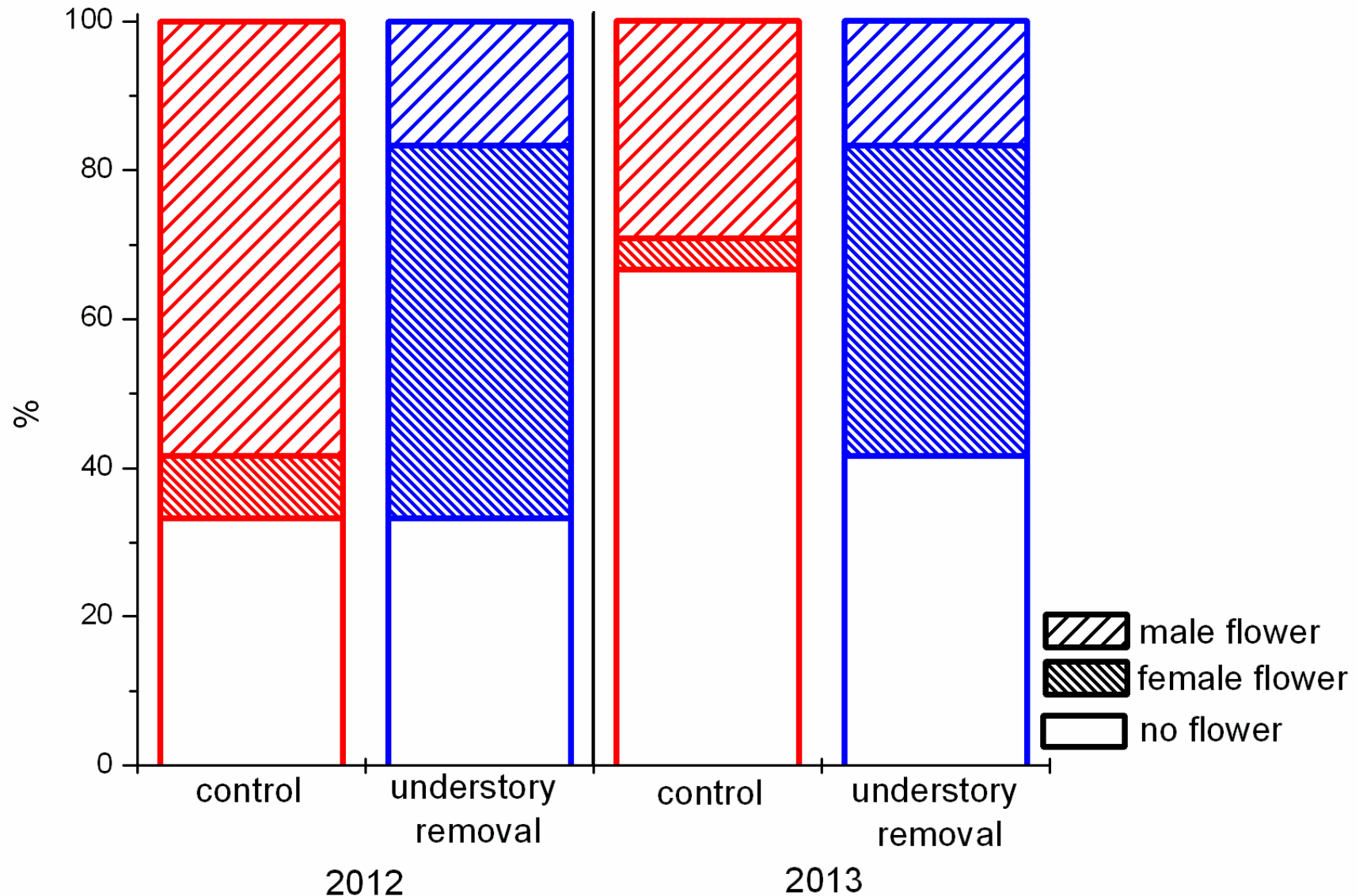


phloem



Response in pine trees (III): fructification

Percentage of yearly shoots with flowers in plots with or without understory



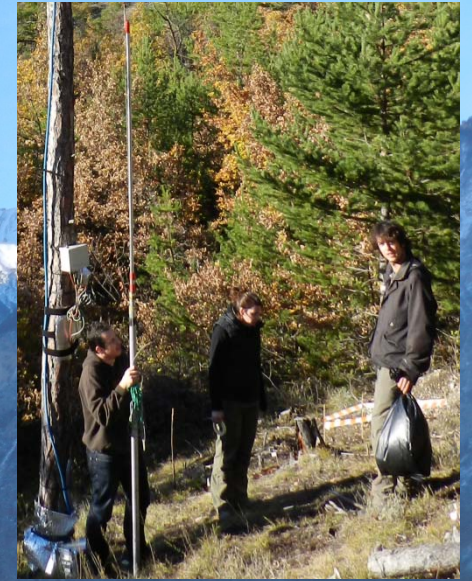
A few (preliminary) conclusions

- In response to understory removal, the water availability, primarily in deeper soil horizons, was increased
- The understory removal caused an increase in site temperature and xericity
- The understory removal caused a stem growth release in dominant pines, fueled by higher water availability
- Within foliage, the pines from plots where the understory was removed have primarily responded with more fructifications
- Our findings suggest that changes in land use are an indirect cause for declining vitality in dominant pine stands at low elevation. Competition with thriving understory has been especially detrimental during dry years, in the context of a steadily warmer climate

Next steps:

- Assess the longer term responses
- Further document the interactions between drought and competition

Past land-use within pine stands close to WSL, Canton of Zurich, 1814



*Thank you for your
attention!*

