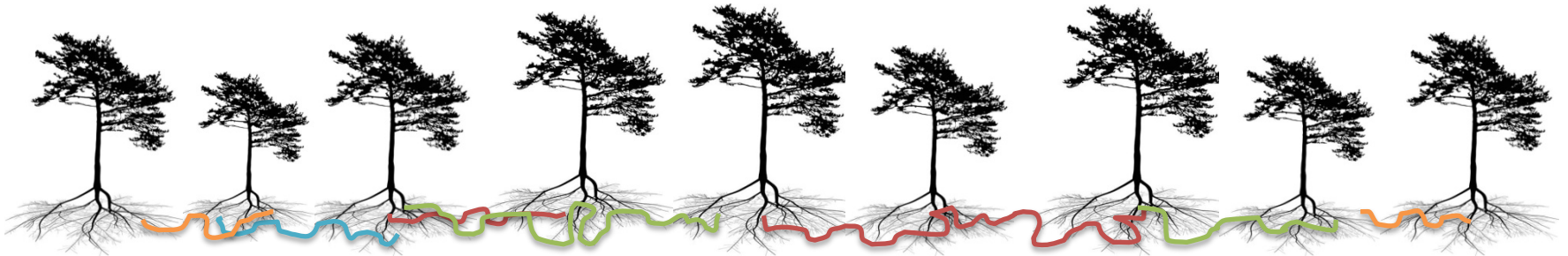


# **Ectomycorrhizal-networks and the influence of irrigation**



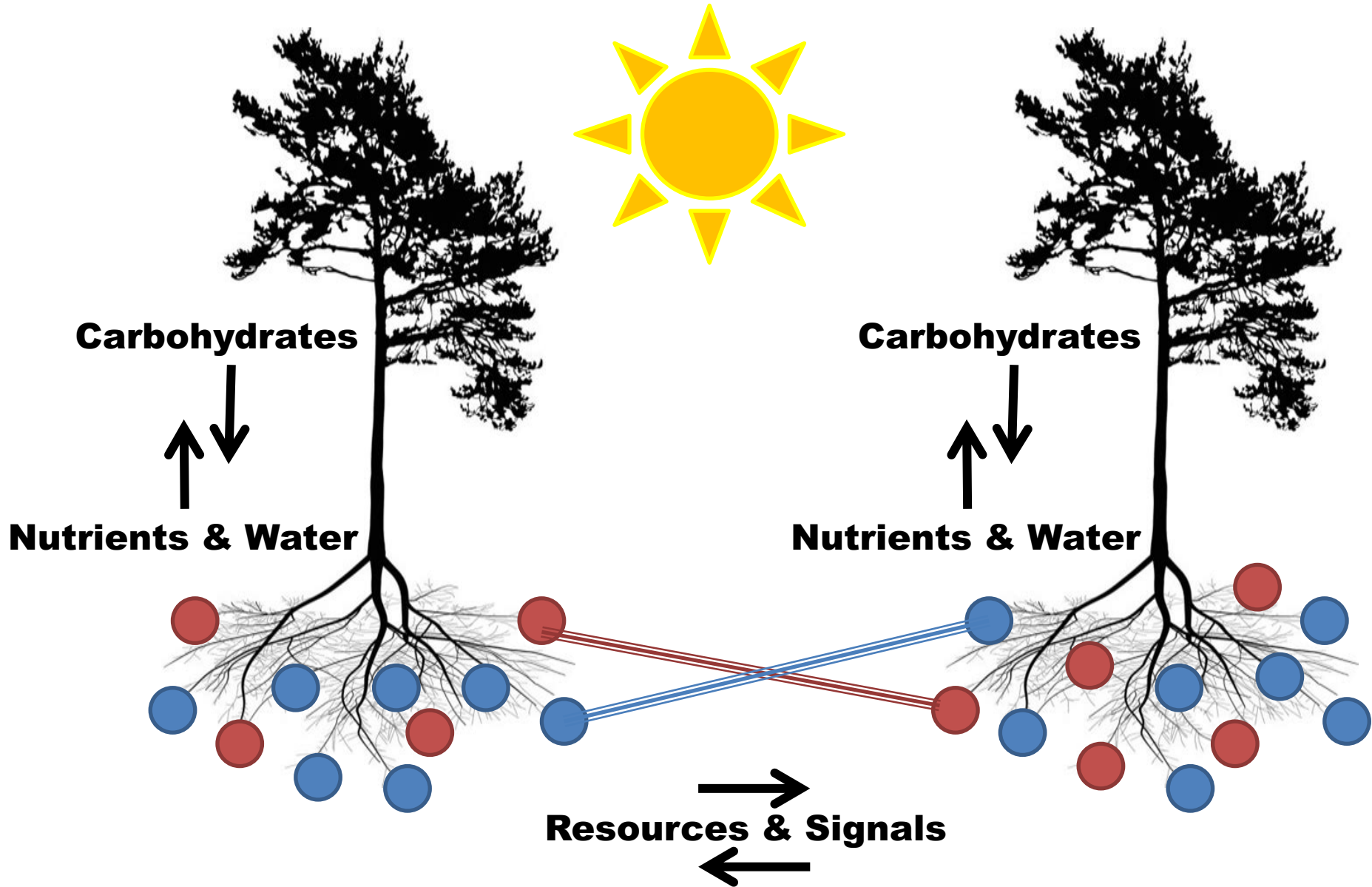
**Master-Thesis in Environmental Science  
by Heidi Mathys**

**Department of Environmental System Science ETH Zürich**

**Supervised by  
Dr. Martina Peter and Dr. Thomas Niklaus Sieber**

**September 2020**

# Introduction



# Questioning

## **Existence of an ECM network:**

- In which nodes of the potential ECM network could the tracer be found?
- Can these findings confirm the presence of an ECM network?
- What role does water availability play in the transfer of carbon across MN?

## **The role of *C. geophilum*:**

- Does *C. geophilum* play an active role in a potential ECM network, especially during drought?
- Is the tracer in *C. geophilum* detected more frequently and in larger quantities under dry conditions than under irrigation?

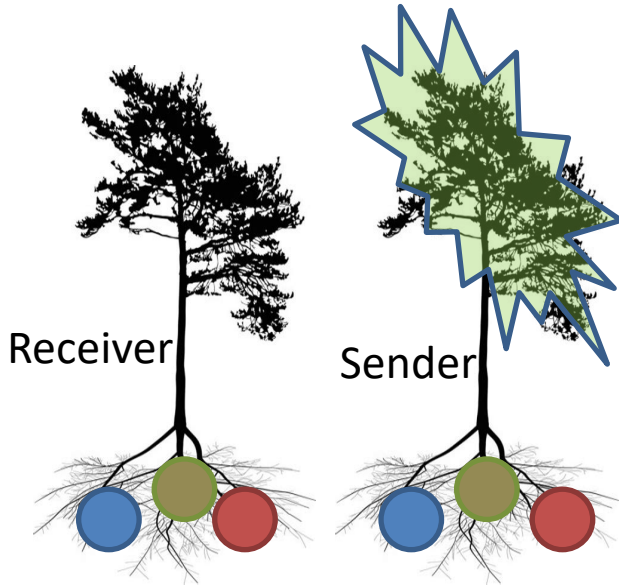
## **Consequence for the forest ecosystem:**

- What role do ECM networks play in the dying pine forest in Valais?

# Methods

## Junctions of the potential ECM-Network

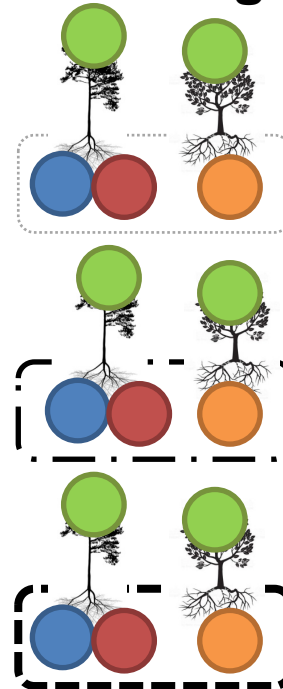
### Adult Scots Pines



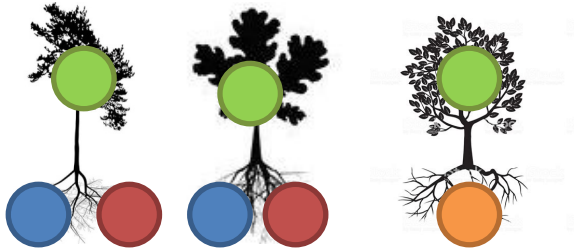
### ECM-Fruitbodies



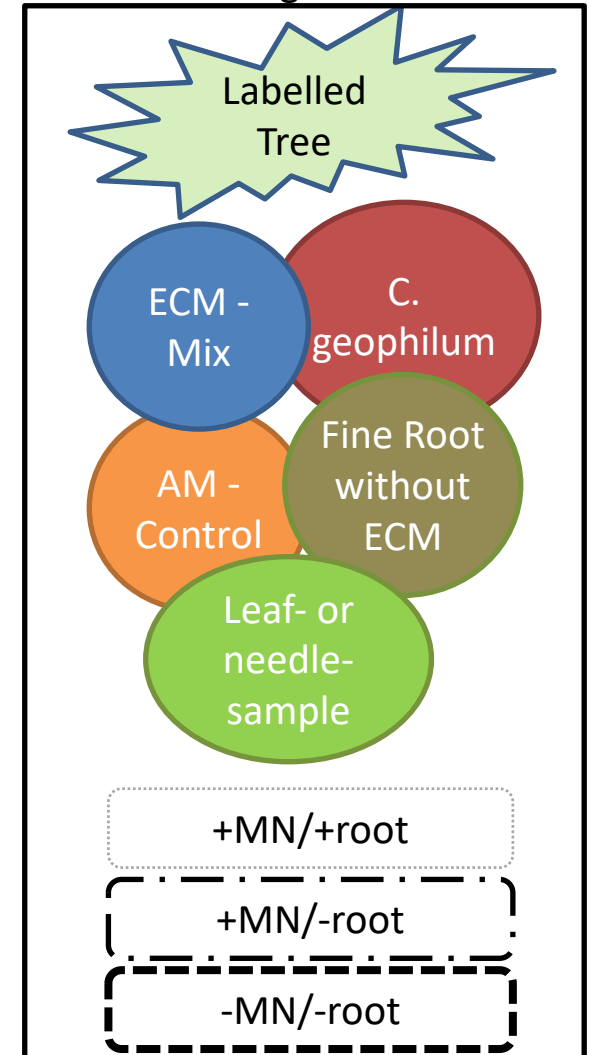
### Seedlings in Mesh-bags



### Natural Regeneration

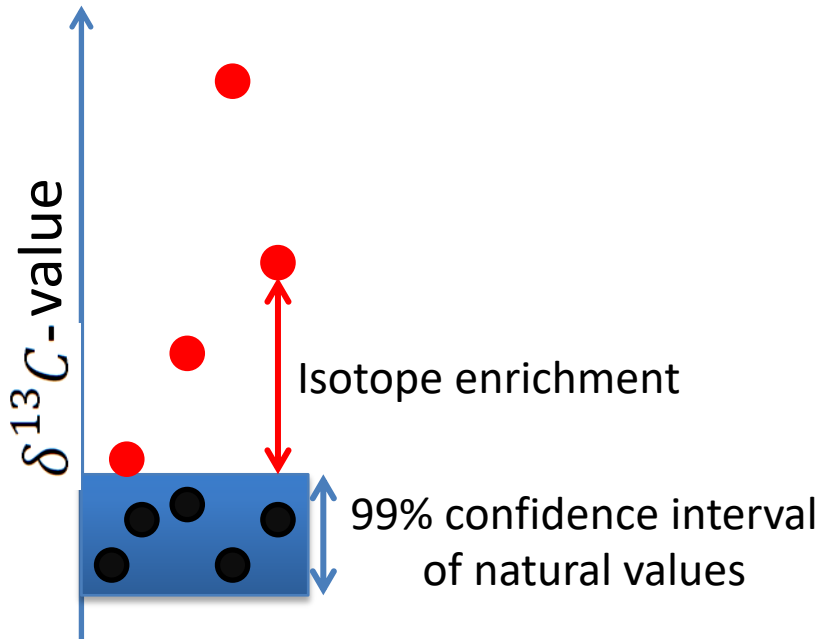


### Legend



# Methods

## isotope enrichment



### Binary consideration

- Considering all samples.
- Is there an isotope enrichment, yes or no?

### Quantitative consideration

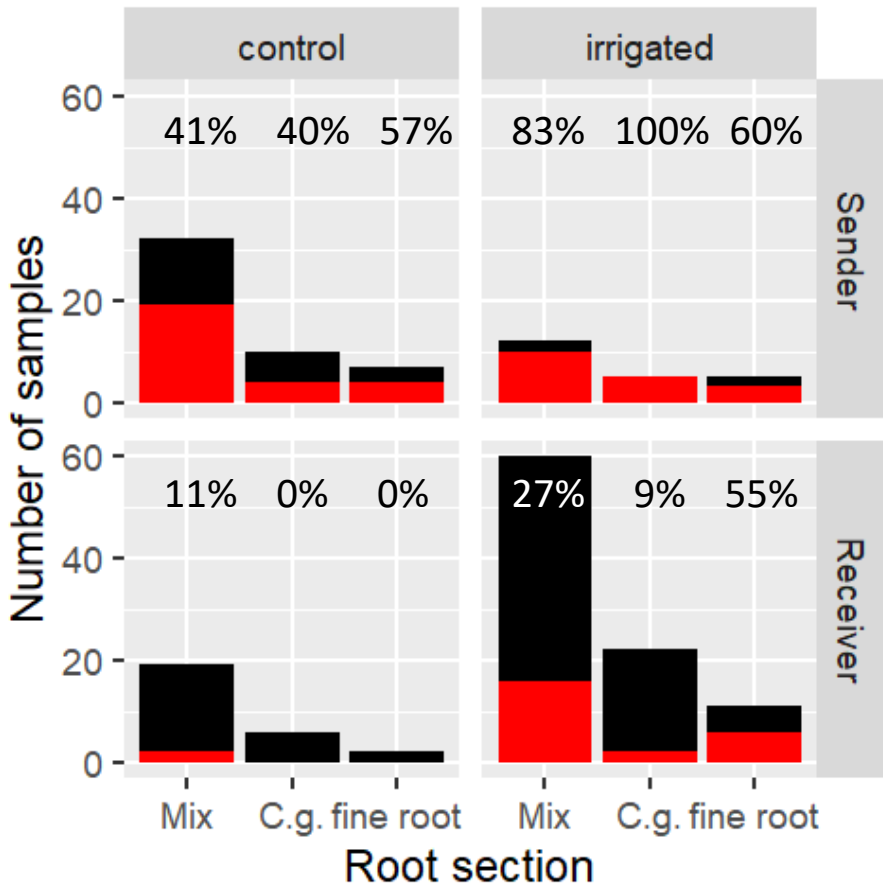
- Considering only the enriched samples.
- What are the amount of the enrichments?

# Results

## Adult Scots Pine

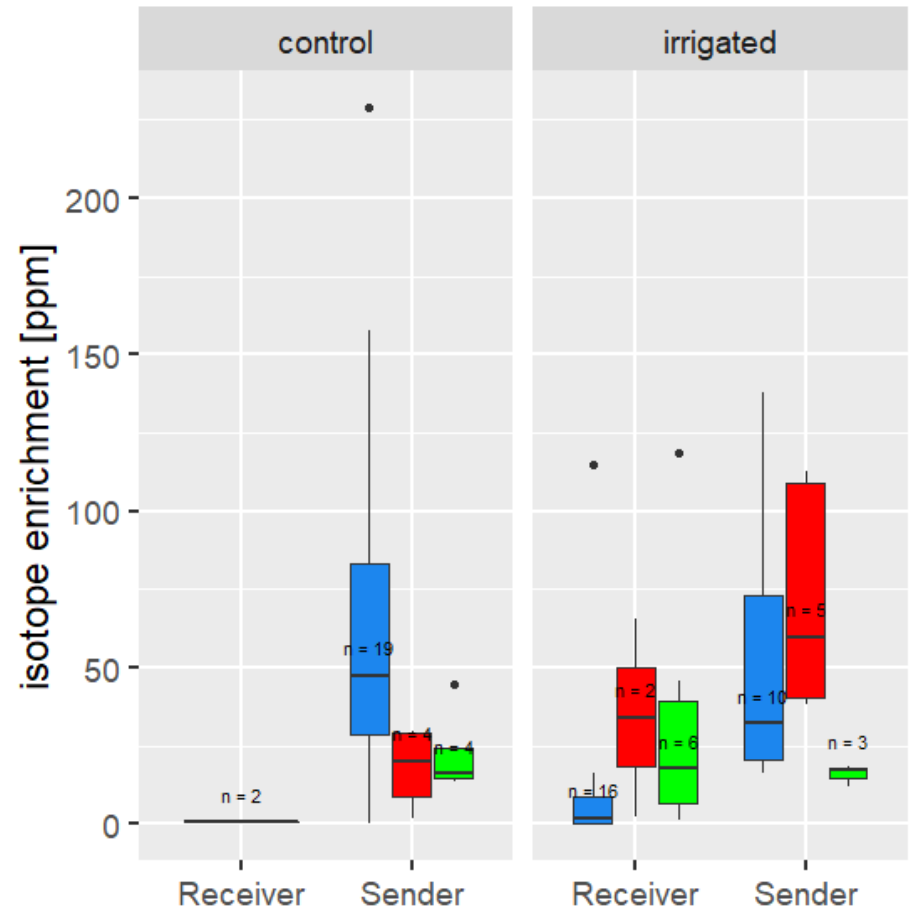
### Binary consideration

binary isotope enrichment  no  yes



### Quantitative consideration

root section  ECM-Mix  C.geo.  fine root

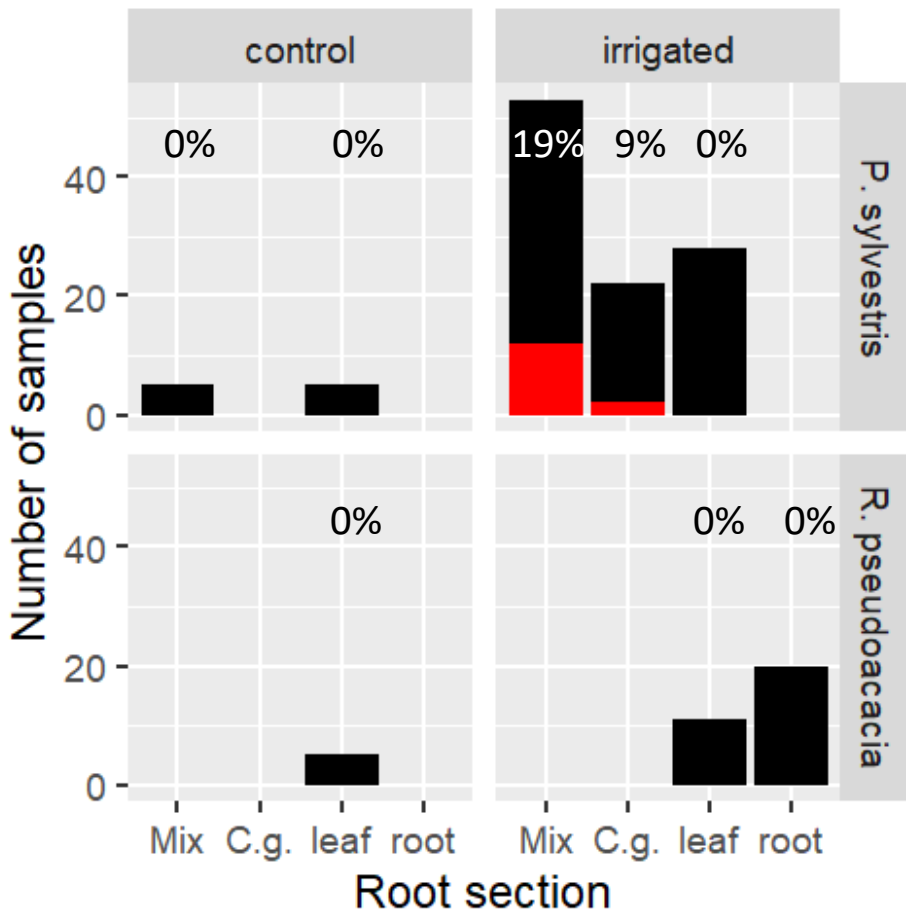


# Results

## Seedlings in Mesh-Bags

### Binary consideration

binary isotope enrichment  no  yes

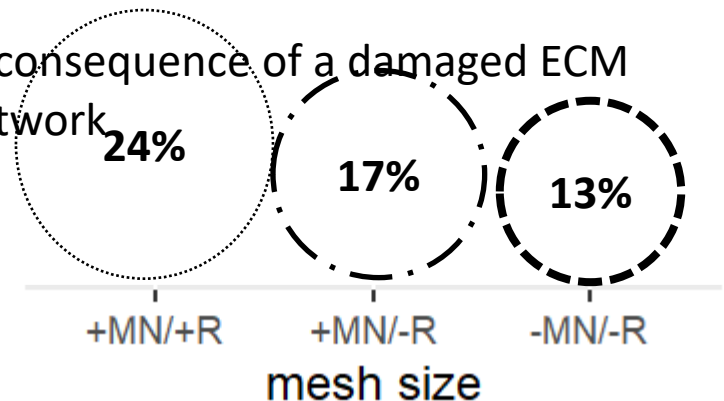


### Mesh-bag influence on the isotope enrichment in irrigated scots pine seedlings

➤ no intact ECM network under control condition?

➤ almost binary consideration in the control plots

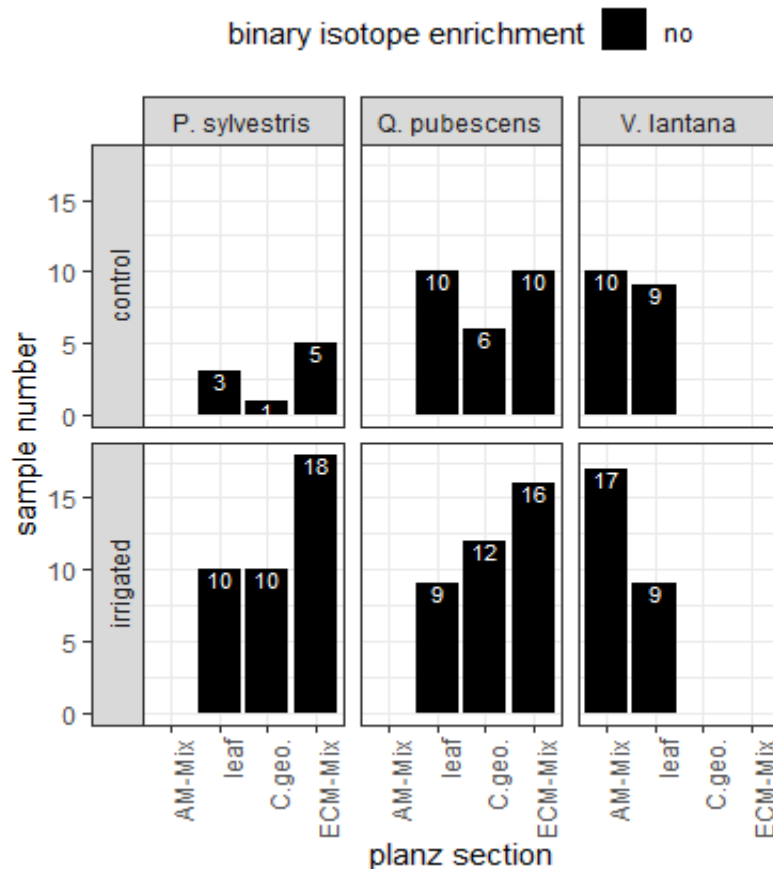
➤ consequence of a damaged ECM network



# Results

## Natural Regeneration

### Binary consideration



### Possible explanation: source-sink theory

- Resources flow from the source to places with the greatest deficit (Simard et al. 2015)
- Young seedlings represent a strong sink (Nara, 2015)



# Conclusion

## Existence of an ECM network:

- Tracer transfer almost exclusively under irrigation
- Tracer transfer to
  - non-gassed, adult *P. sylvestris*
  - irrigated *P. sylvestris* seedlings in mesh bags
  - ECM fungal fruiting bodies
- Mesh-bags indicate important role of fungi.
- NO tracer transfer to
  - AM-controls
  - leafs (no air transport)
  - natural regeneration

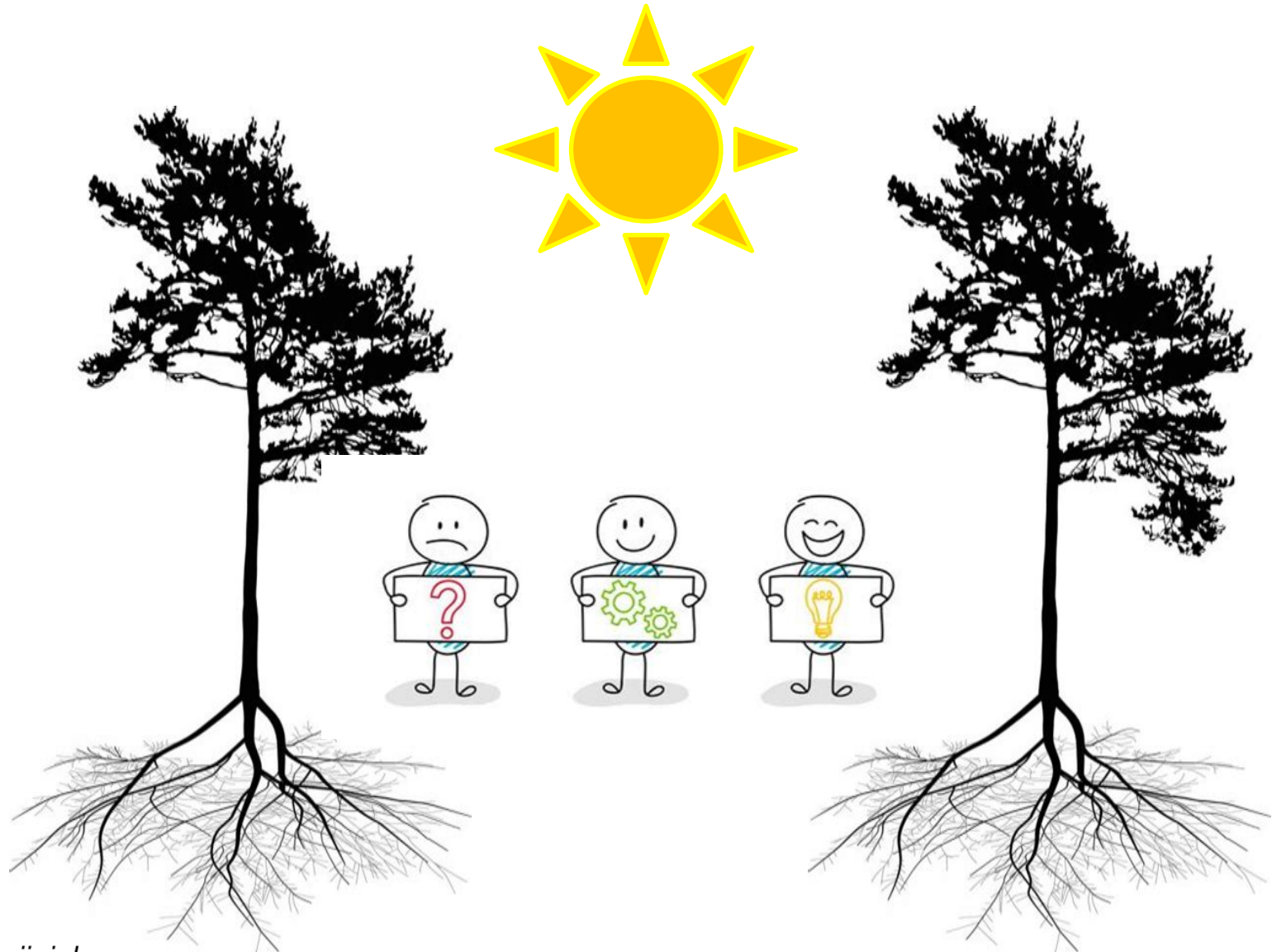
## The role of *C. geophilum*:

- Significant enhancement of isotope enrichment in irrigated plots
- Under certain drought stress *C. geophilum* plays an important role

## Consequence for the forest ecosystem:

- Natural drought seems to inhibit an intact ECM network
- Possible explanatory step in the causal chain of drought-induced pine death in Valais

# Questions and Discussion



# Literatur

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