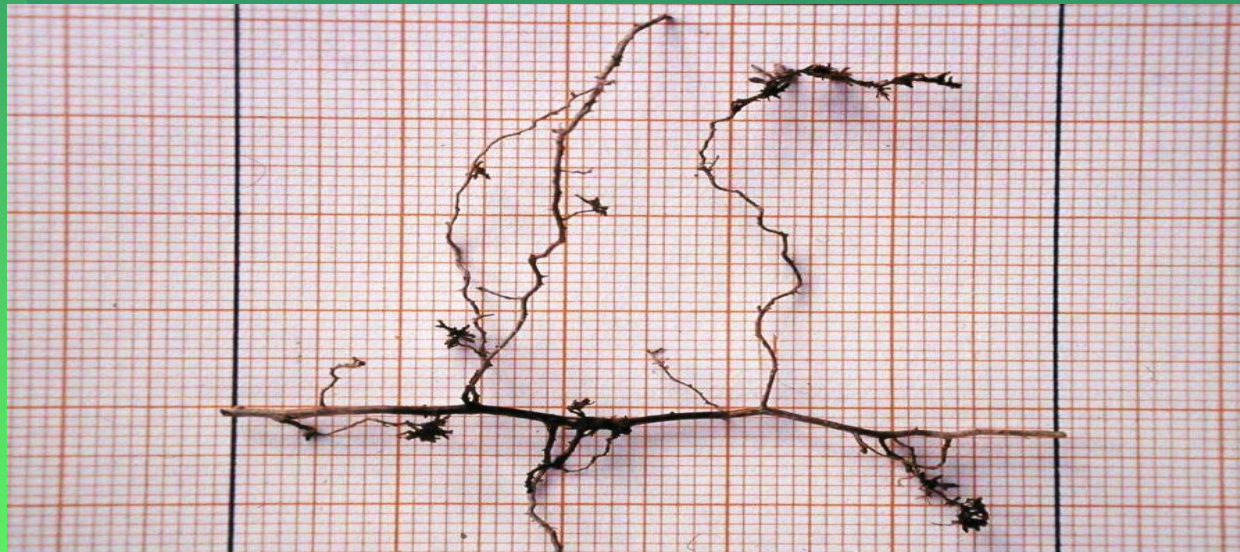


# ALUMINIUM SPECIES

## and their potential toxicity to Norway spruce and European beech stands in the Czech Republic.



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# Why Aluminium is of interest in the central European forest soils?

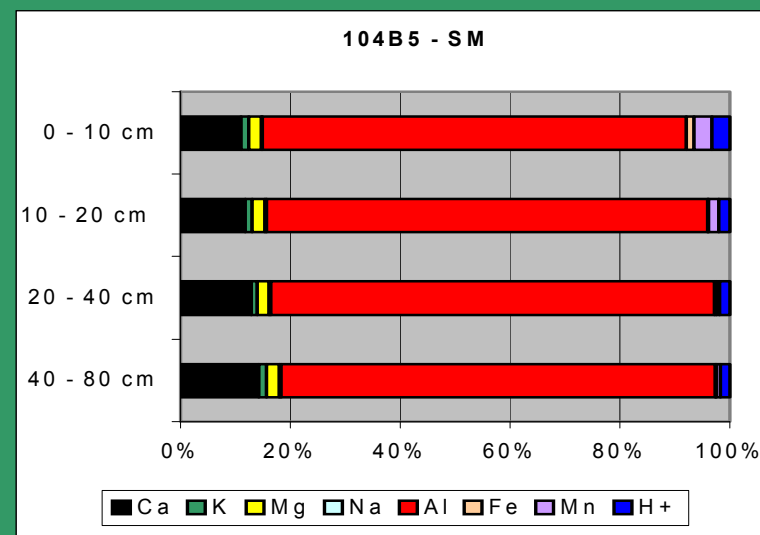
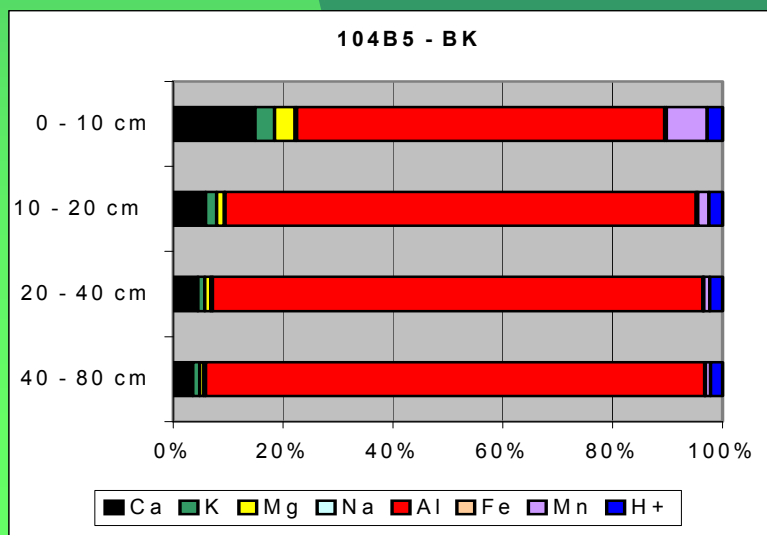
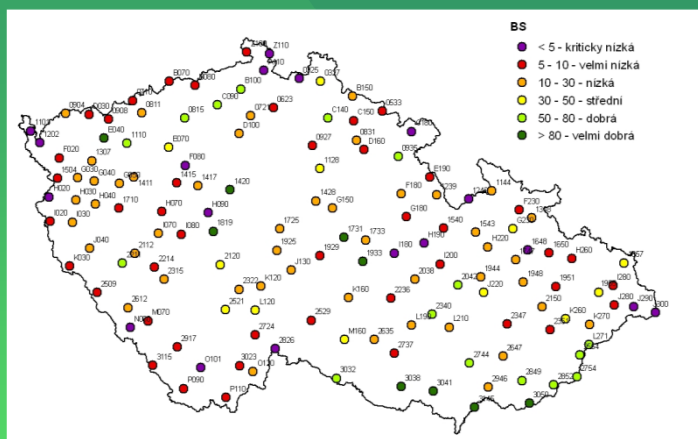
Mostly acidic bedrock

+

Extreme acidic deposition

=

Strongly depleted forest soils with low base saturation



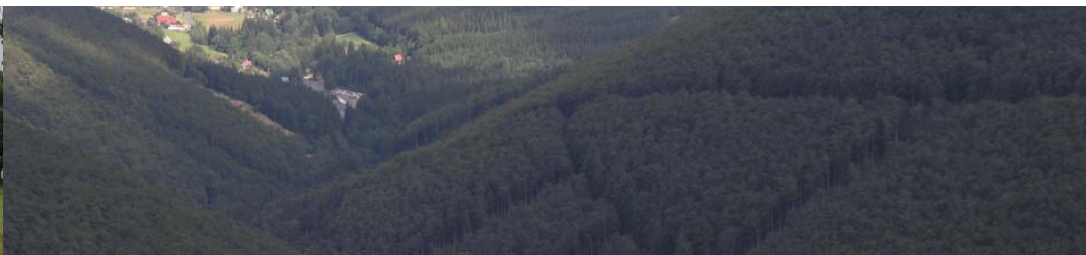
## Aluminium toxicity:



exchangeable Al in barium chloride?



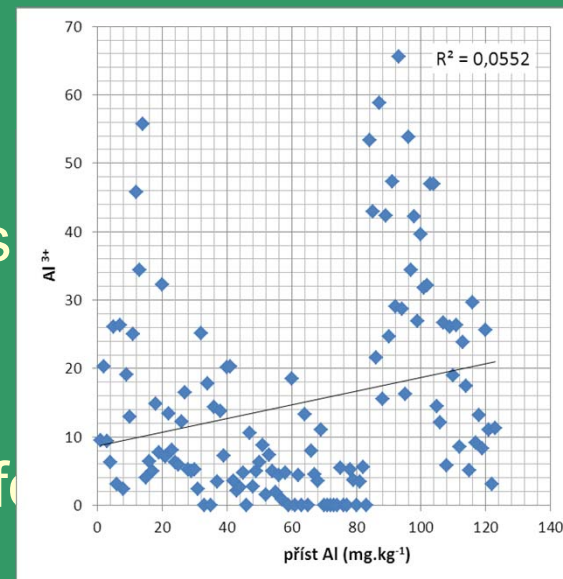




## Questions:

- Allow the „standard“ analyses of forest soils risk of Aluminium toxicity?
- Is aluminium toxicity (one of) driving factor for the Czech Republic?
- Is there any difference between Norway spruce and European beech regarding to the Al toxicity?

Answer 1:

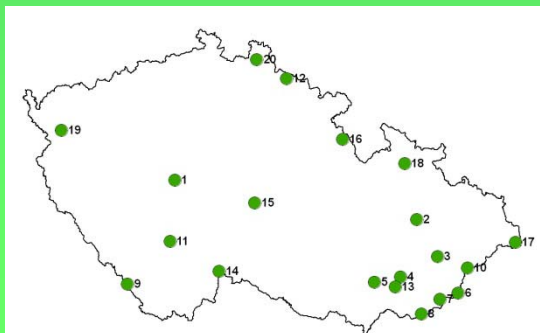
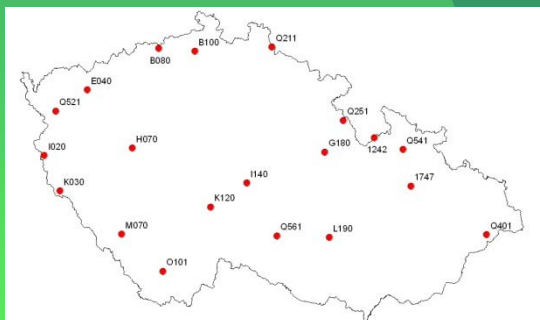


# Methods



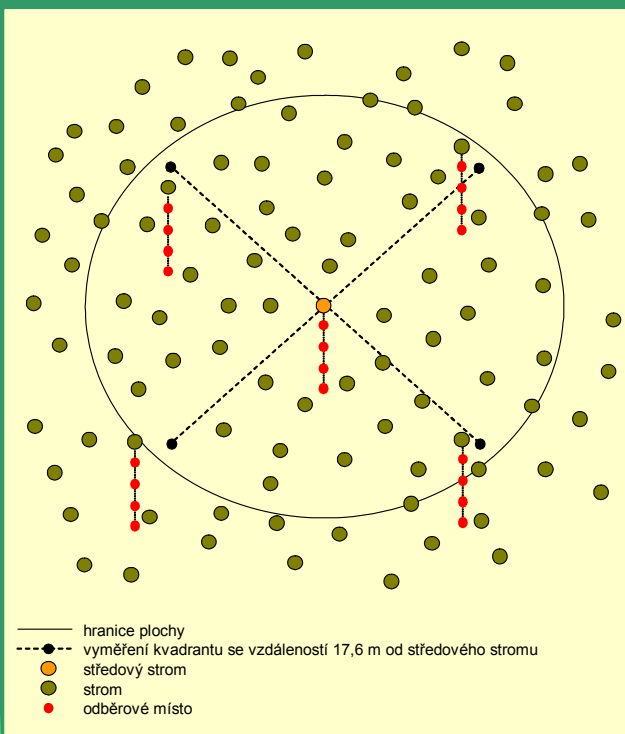
## Plots:

ICP Forests monitoring  
20 for N. spruce,  
20 E. beech



## Root sampling:

20 pits per plot  
NS: 2 horizons (20cm)  
EB: 4 horizons (40cm)



## Root analysis:

- Amount
- Vitality
- Ca, K, Mg, Al content
- Ca/Al molar ratio

## Soil analyses:

BioSoil data  
+ analyses of archived  
samples for Al species

## Stand:

Defoliation for  
individual species

# Correlative analysis- parameters

## Roots:

- Vitality
- Amount
- Ca/Al
- Ca, K, Mg  
(individual layers)

## Soil chemistry:

- pH
- Ntot
- Exch. Ca, K, Mg, A
- $\text{Al}^{3+}$ ,  $\text{Al}(\text{X})^{1+}$ ,  $\text{Al}(\text{Y})^{2+}$   
(layers M10, M12, M24)

## Forest stand:

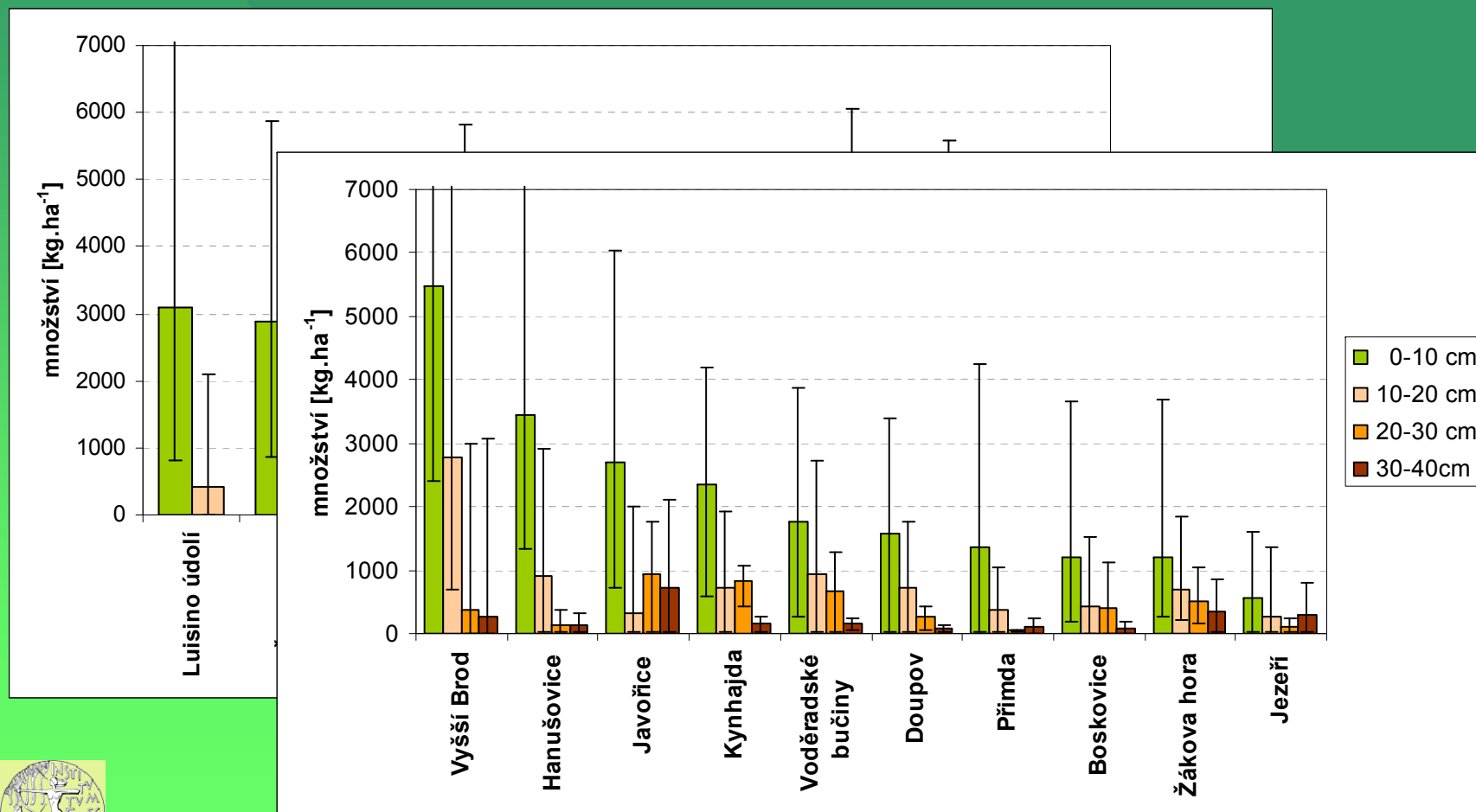
Defoliation for:

- N. Spruce
- E. beech

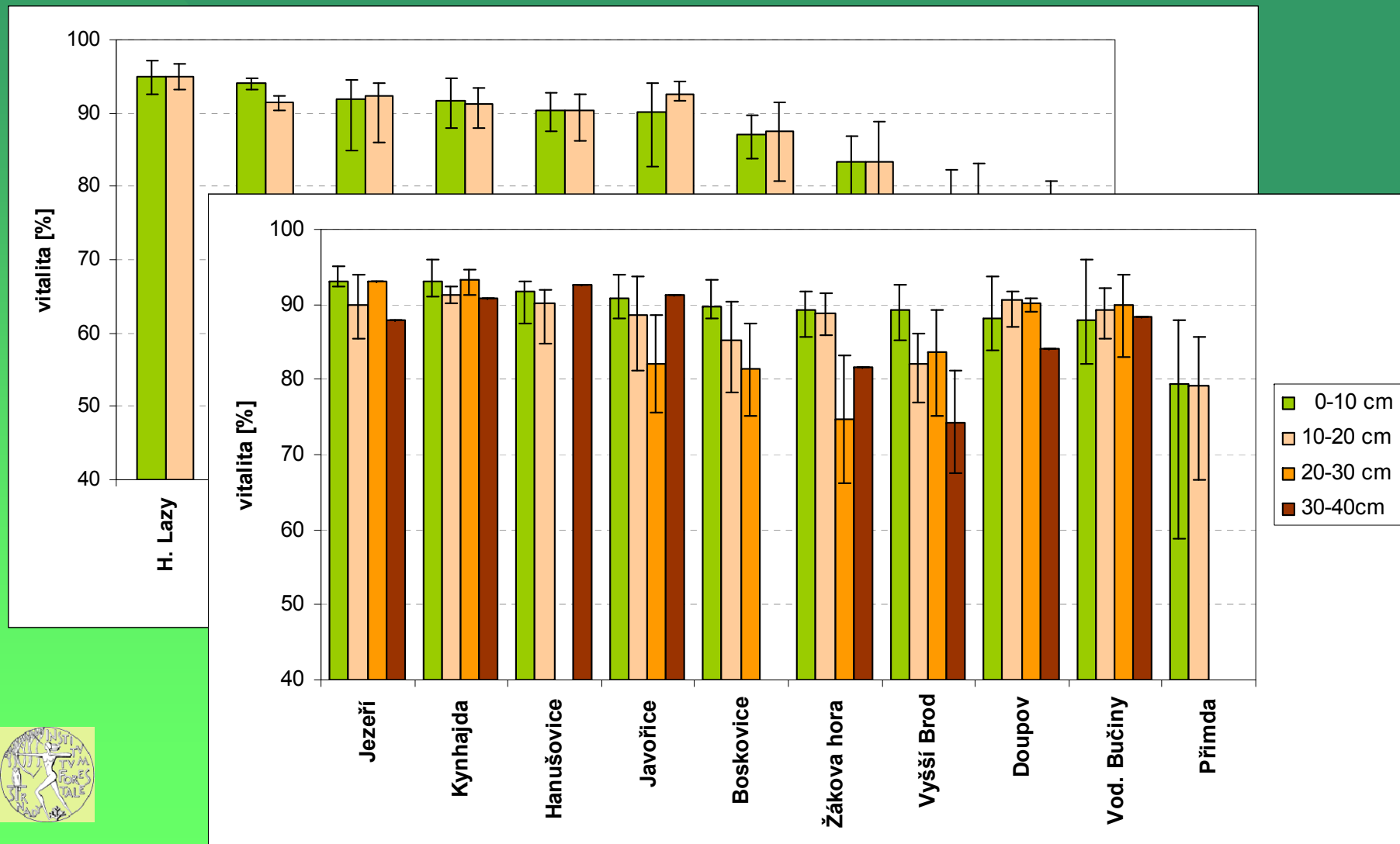


# Results:

## 1. Amount of fine roots decreased with the soil depth



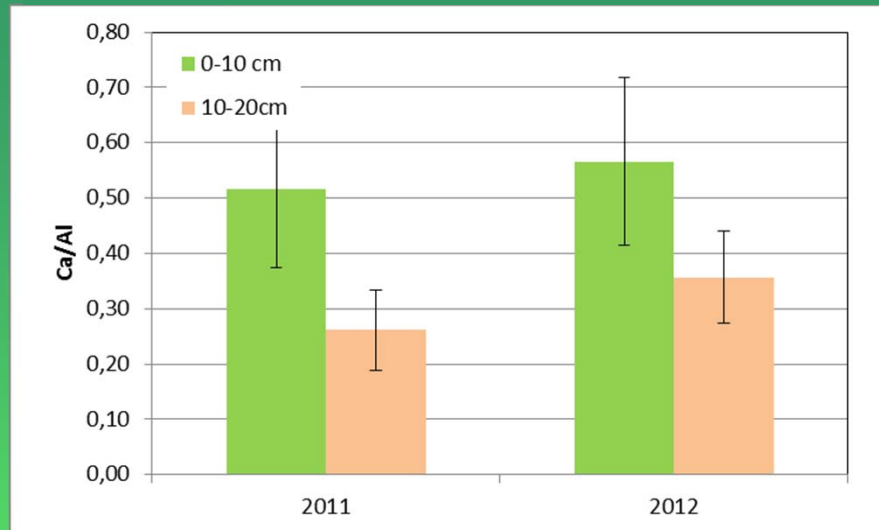
## 2. Vitality of roots was high, no clear relationship with soil depth



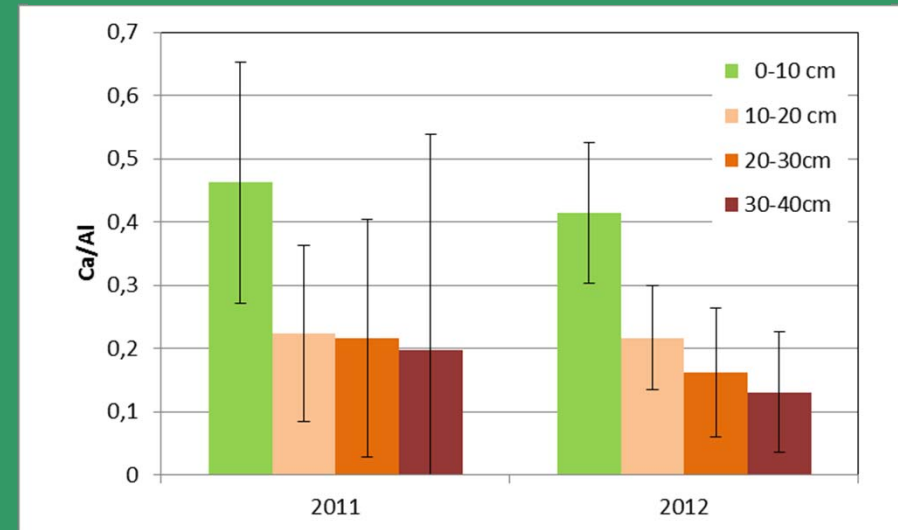


### 3. Root Ca/Al ratio is more convenient in the upper soil layers

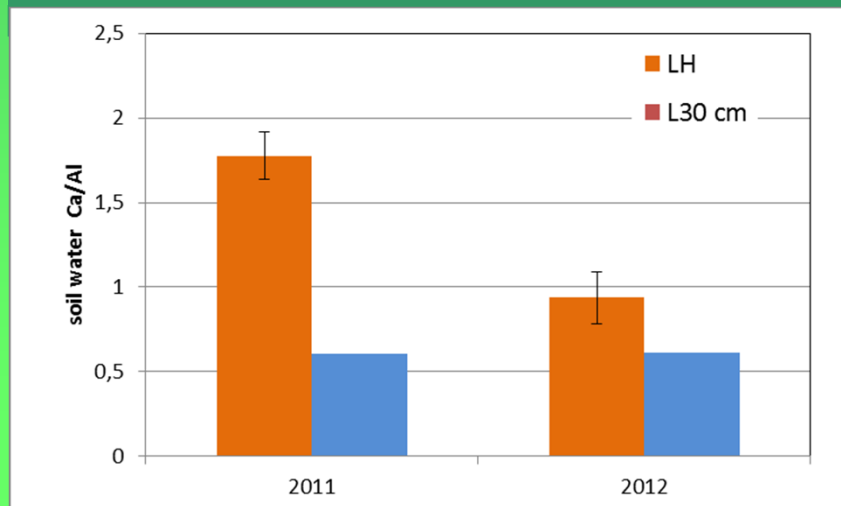
#### Norway spruce



#### European beech

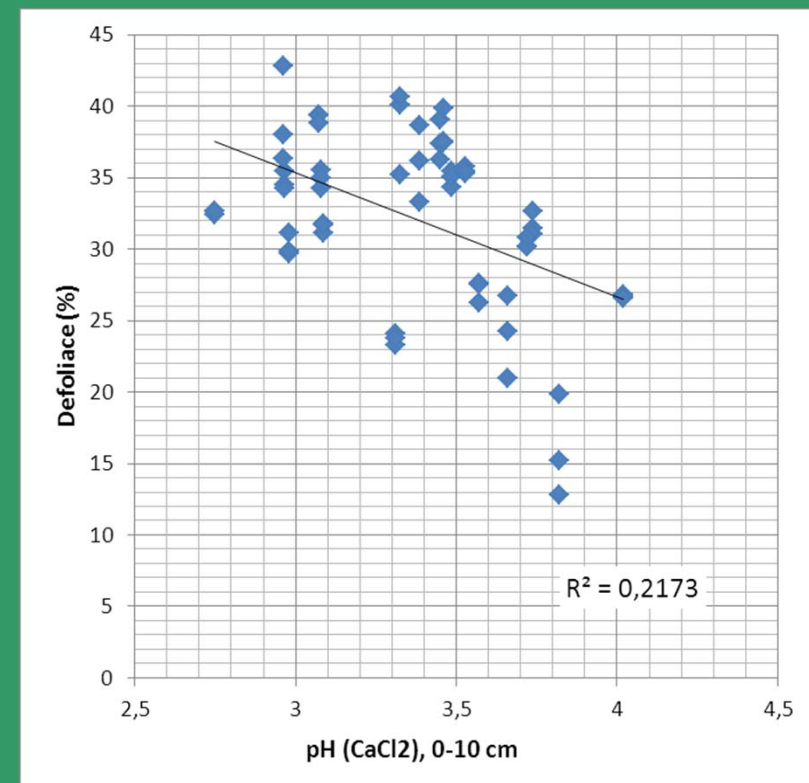
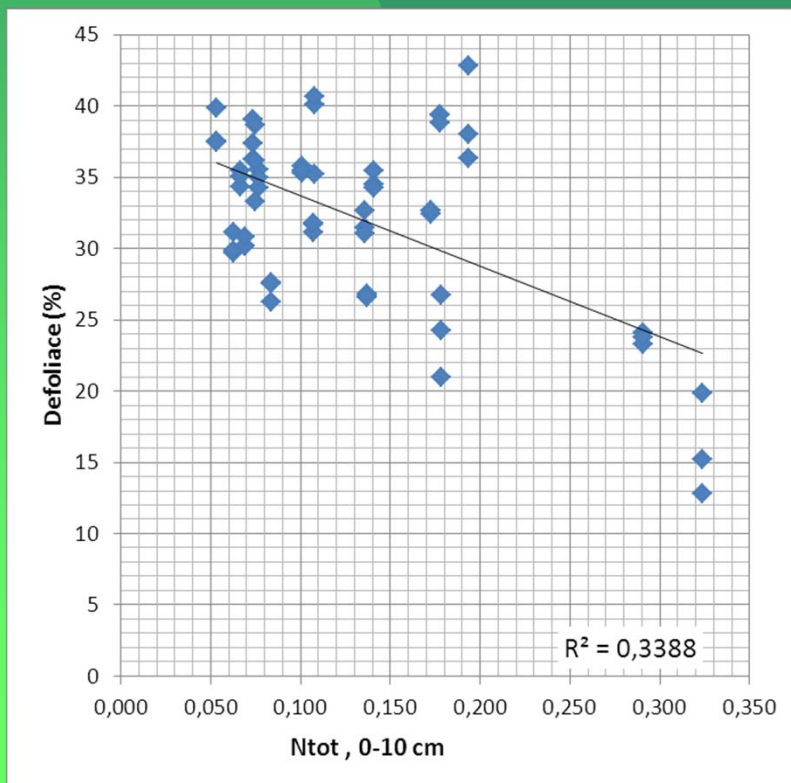


#### N. spruce soil solution Ca/Al



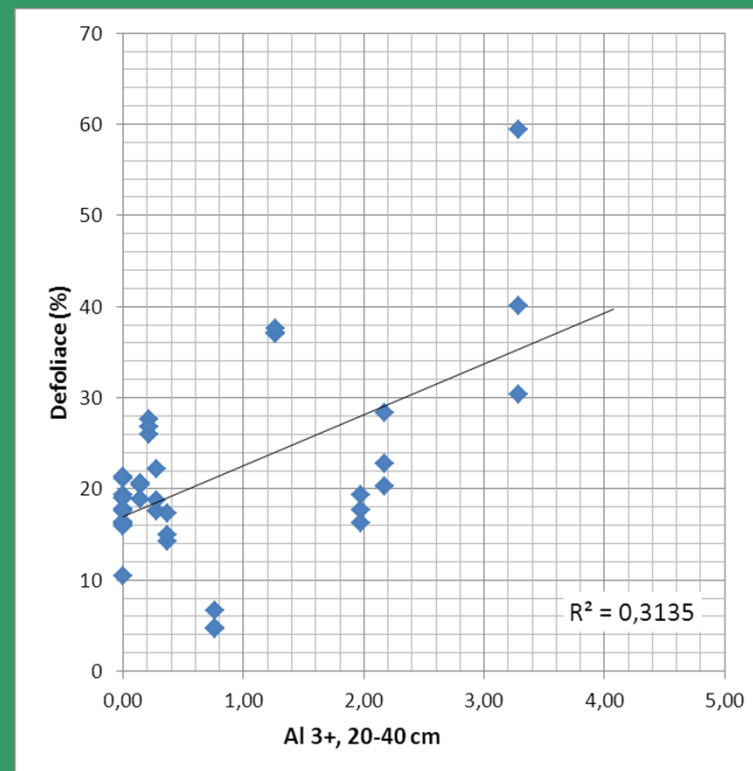
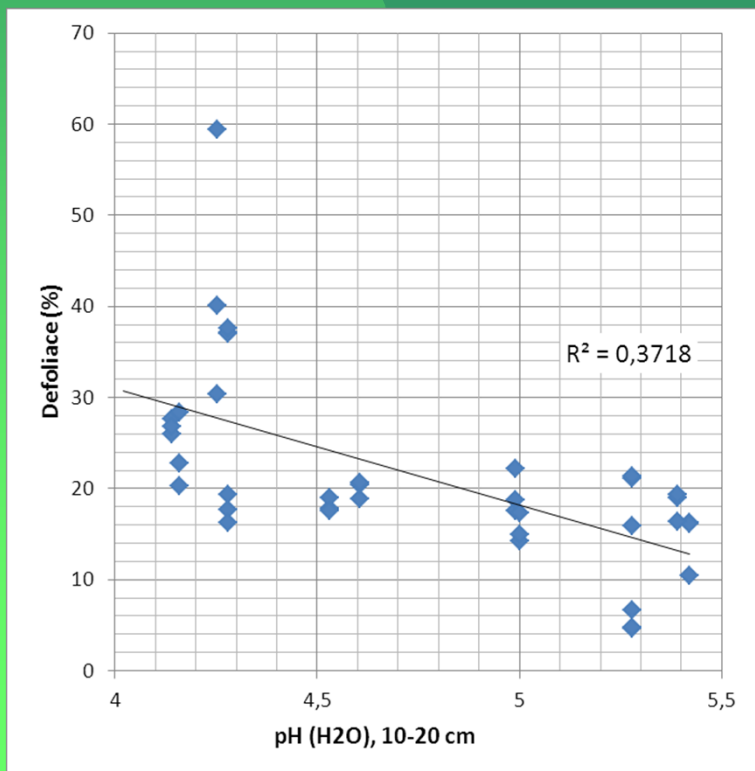
## Results of partial correlations - N. spruce

**Fine root amount** (+) pH, Ca (20 cm), (-)K,  
**Fine root vitality** (+) C, N, pH, Mg (-)K,  
**Defoliation** (-) pH, N, Mg, Ca



## Results of partial correlations - E. beech

<b>Fine root amount</b>	(+) defoliation	(-) pH, Mg, K
<b>Fine root vitality</b>	(+) C, N, pH, Mg	(-) Mn, Al <sup>3+</sup>
<b>Defoliation</b>	(+) Al <sup>3+</sup>	(-) pH, Ca, Mg



## Conclusions:

- **Norway spruce** defoliation - influenced by nutrients supply (N, base cations) in the upper layers of soil profile.
  - Majority of **NS** fine roots is located at the border layer between organic layer and mineral soil → sensitive to drought, nutrition; **no effect of  $Al^{3+}$**
- 
- **European beech** defoliation - influenced by base cations supply; **adverse effect of  $Al^{3+}$**  proven
  - **EB** has significant proportion of fine roots in deeper soil horizons - larger pool for nutrition and water supply, higher concentration of  **$Al^{3+}$**



Thank you for your attention !

