



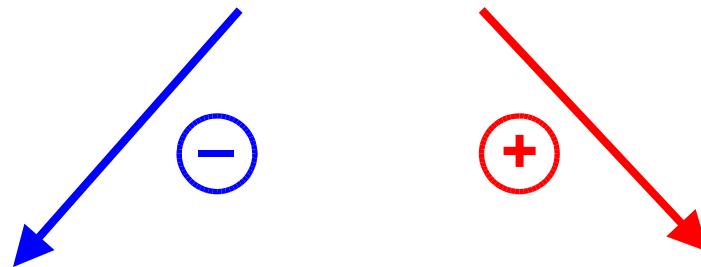
# Nitrogen nutrition of *Picea abies* in a mountain forest ecosystem subjected to experimentally increased N deposition

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## Manipulation of N deposition



# Alptal

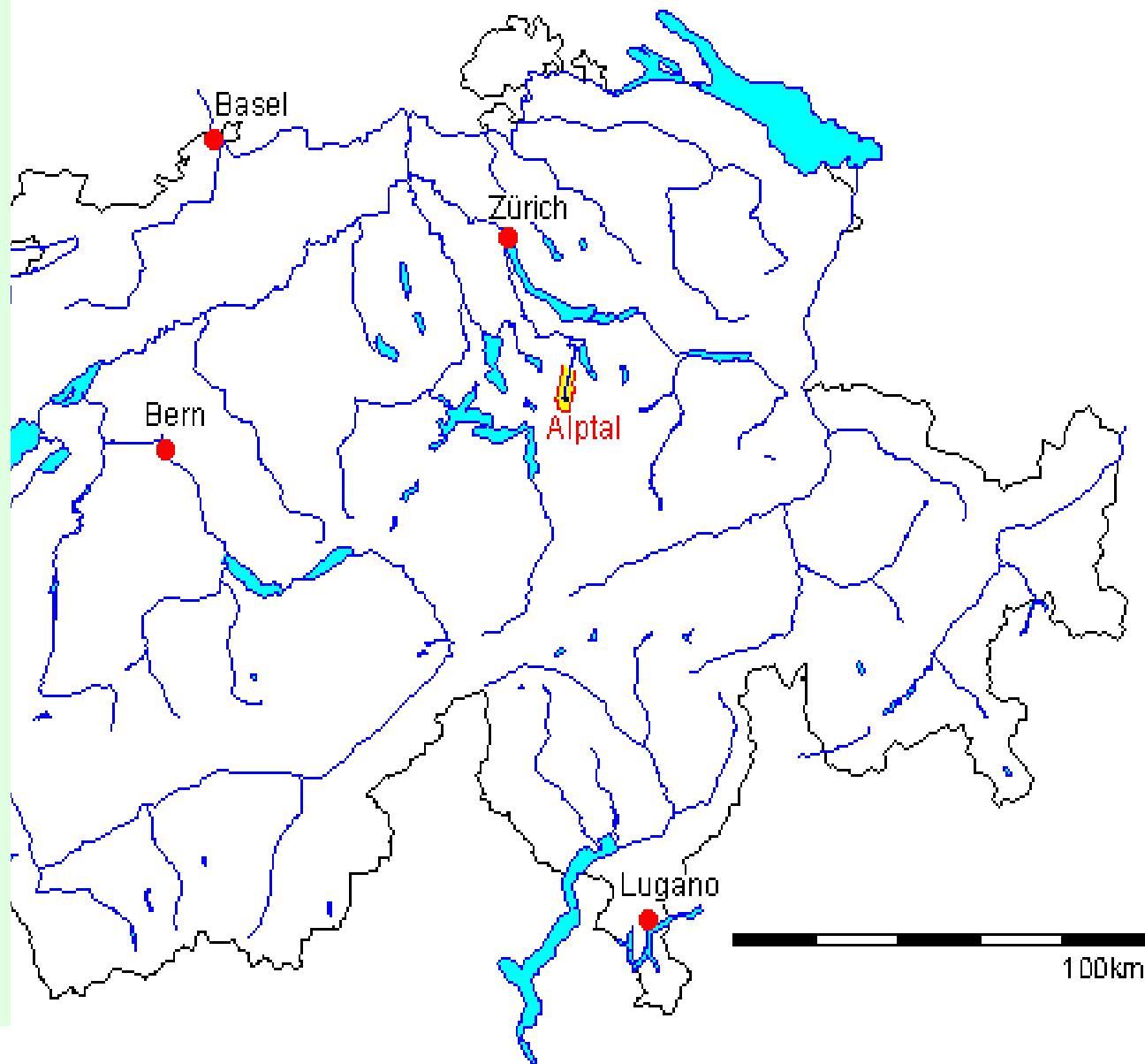
Altitude:  
1200 m

Geology and soils:  
Gleysol over Flysch

Vegetation:  
mosaic of forest and  
wetland patches

Precipitation:  
2300 mm/a  
(30% as snow)

Bulk N deposition:  
12 kg/ha/a  
 $(\text{NO}_3^- \approx \text{NH}_4^+)$







LF

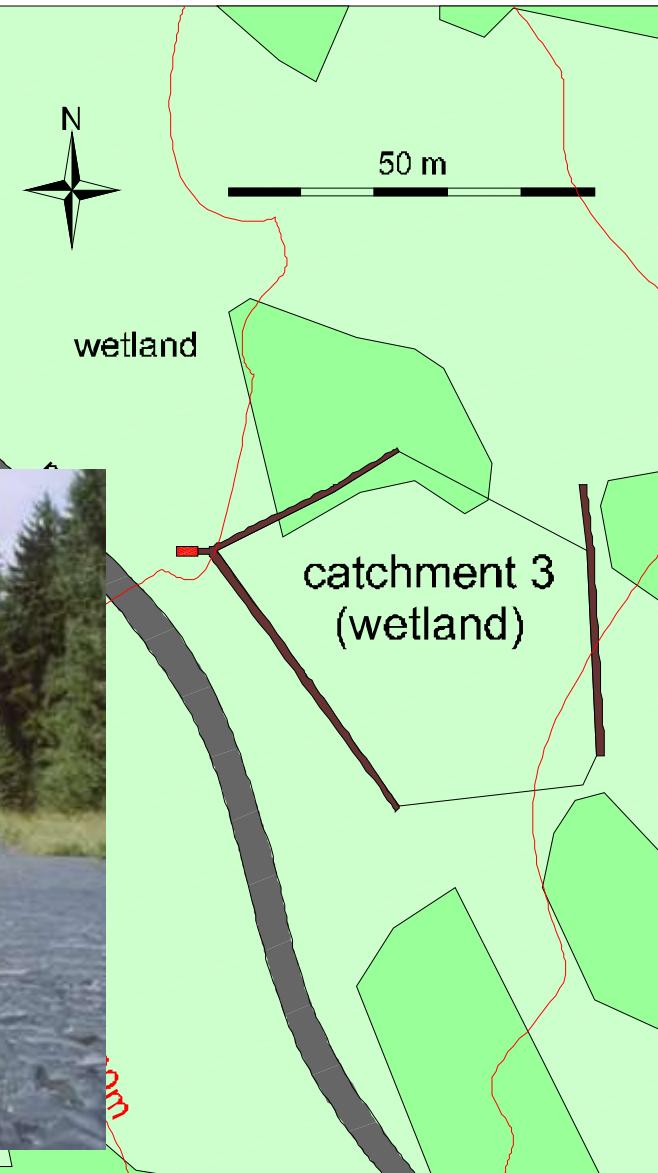
Aa

Gor

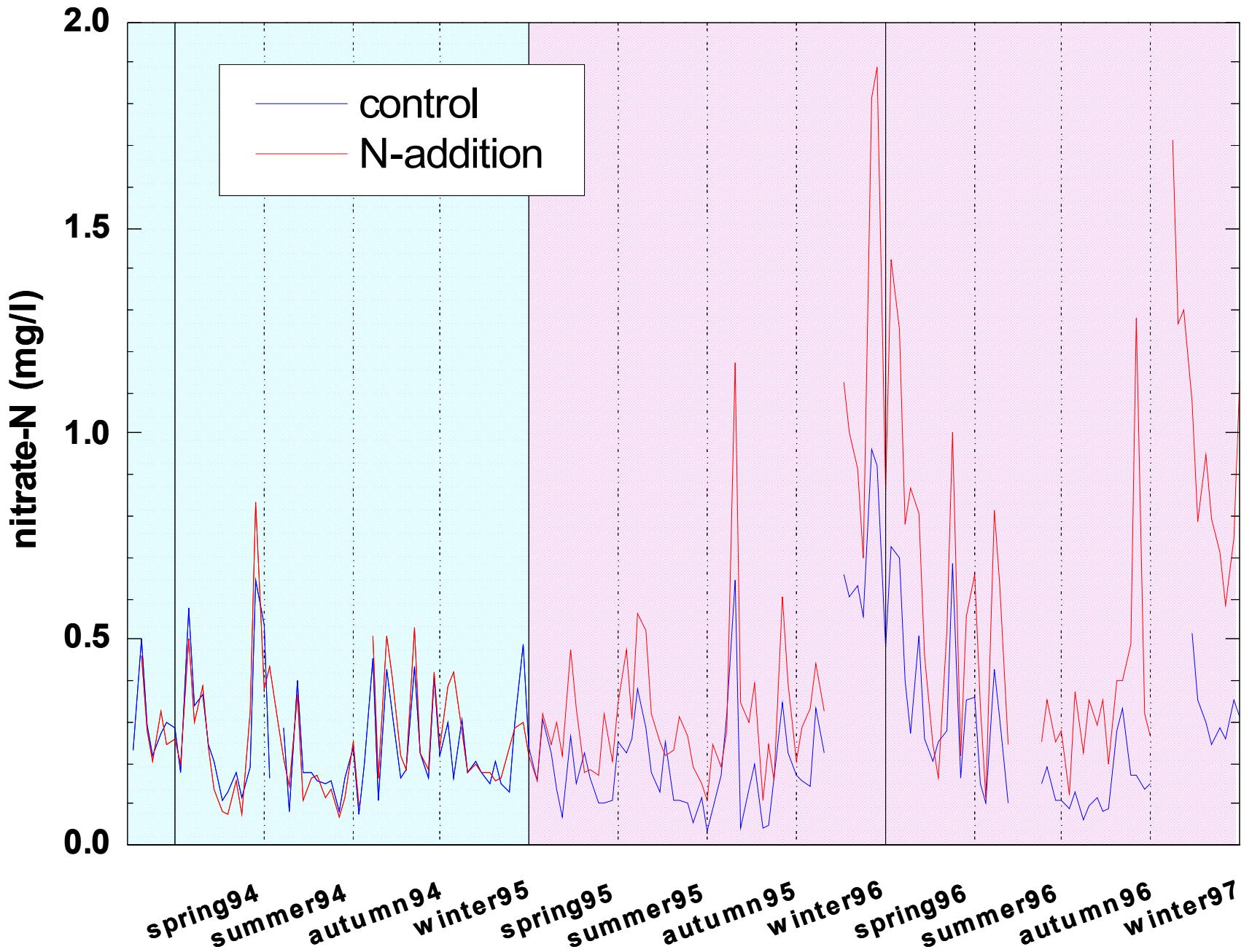
Gr



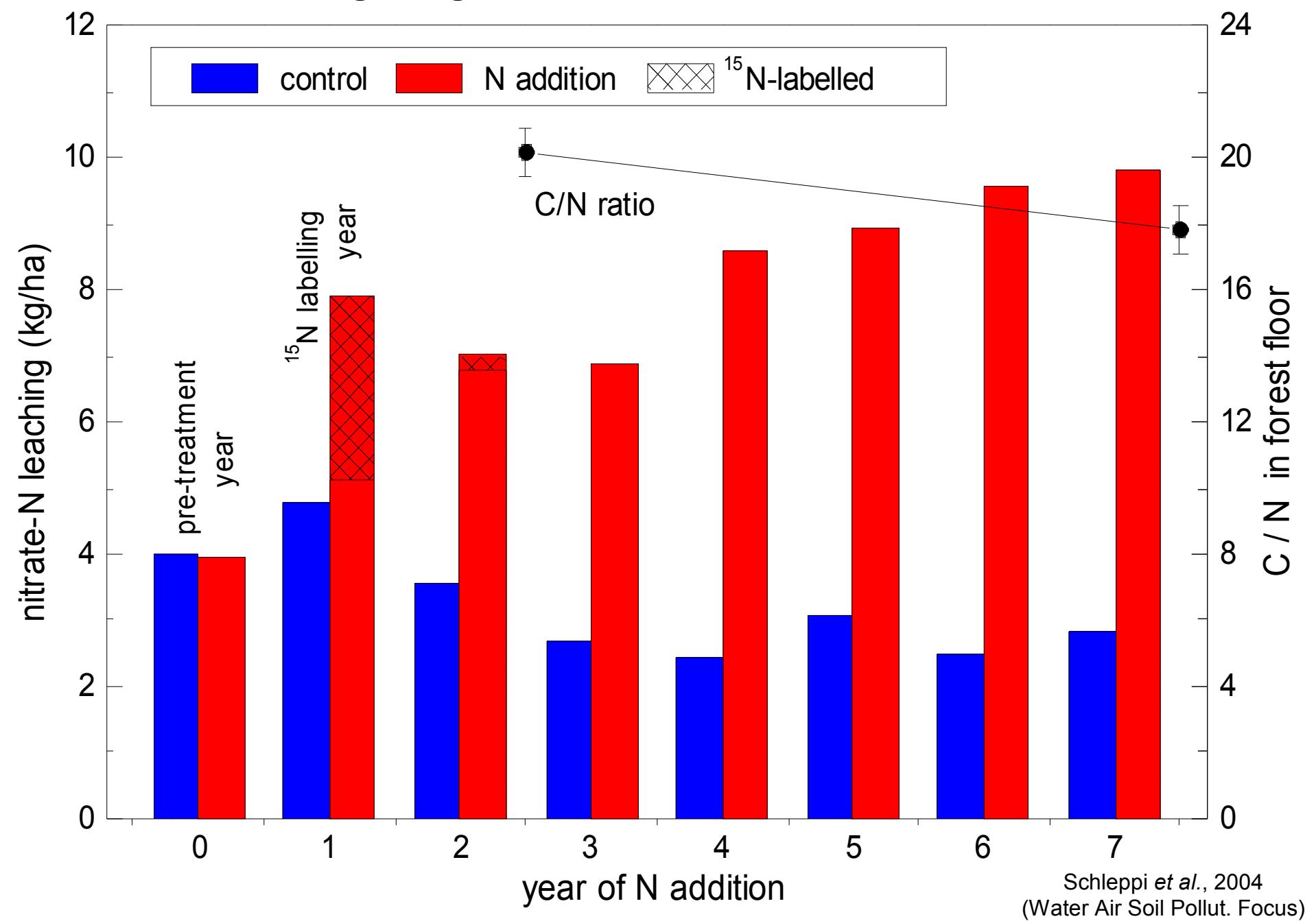
IRISALP



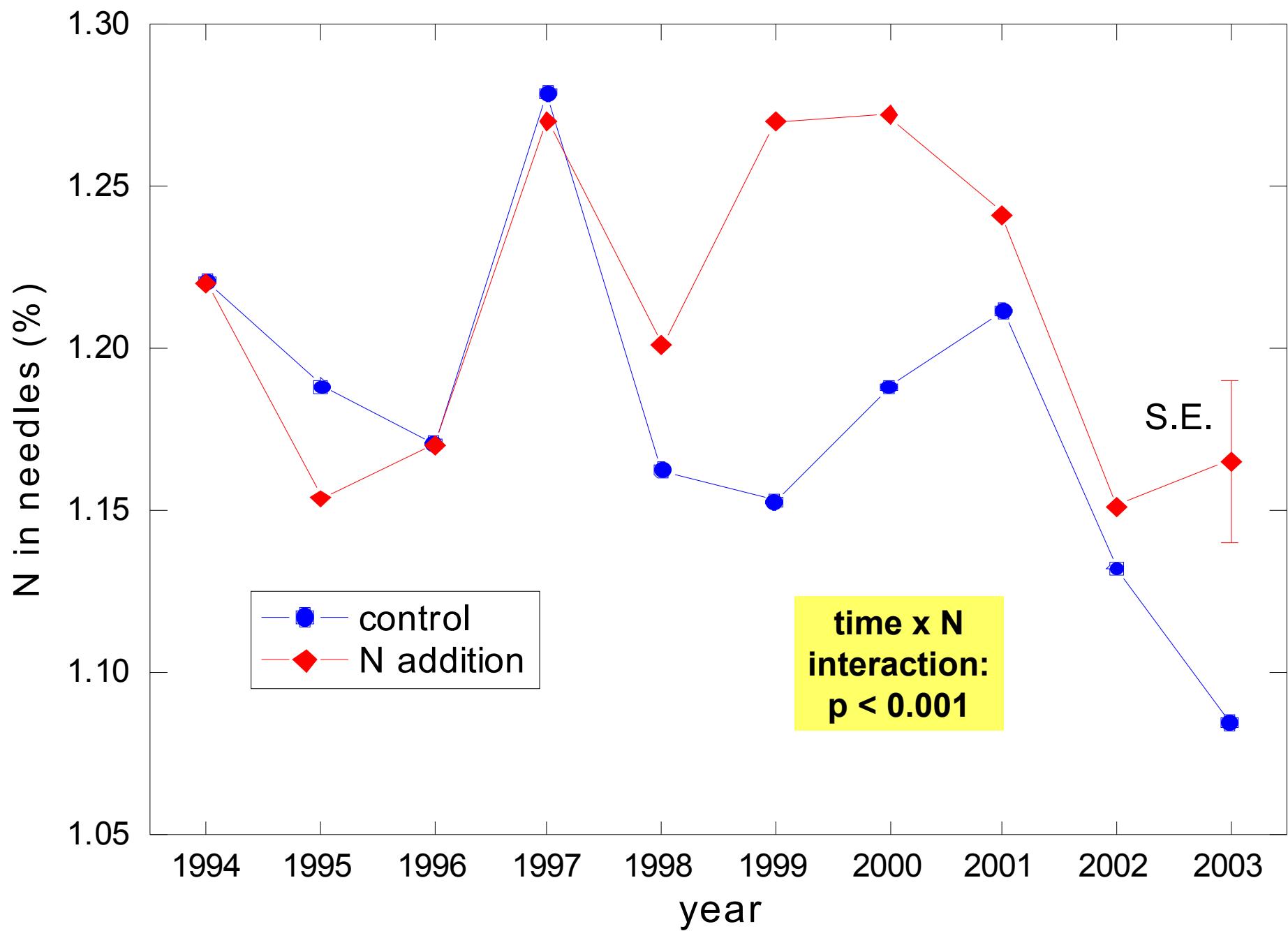
## Nitrate leaching: weekly concentrations



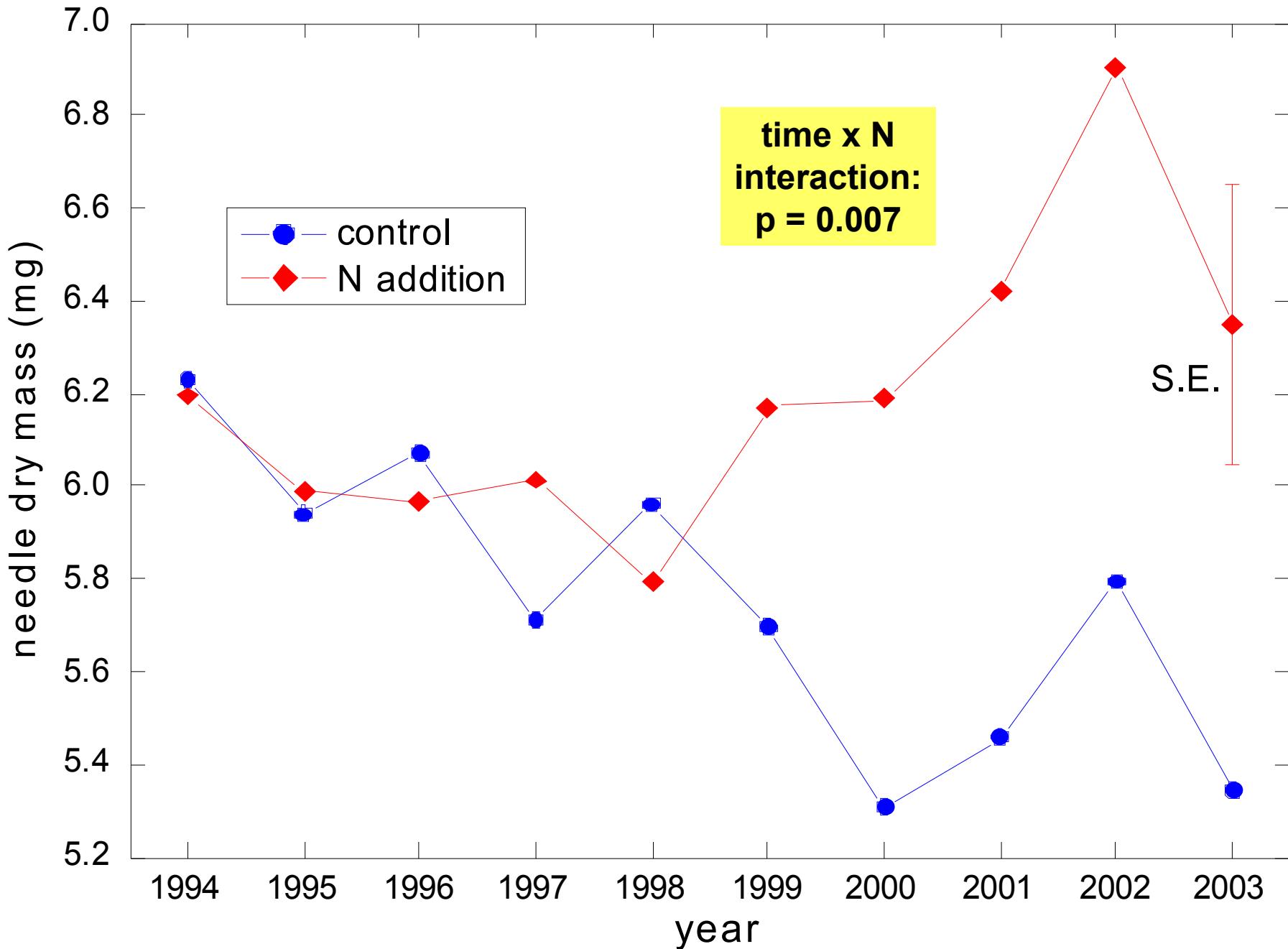
# Nitrate leaching: long-term effects



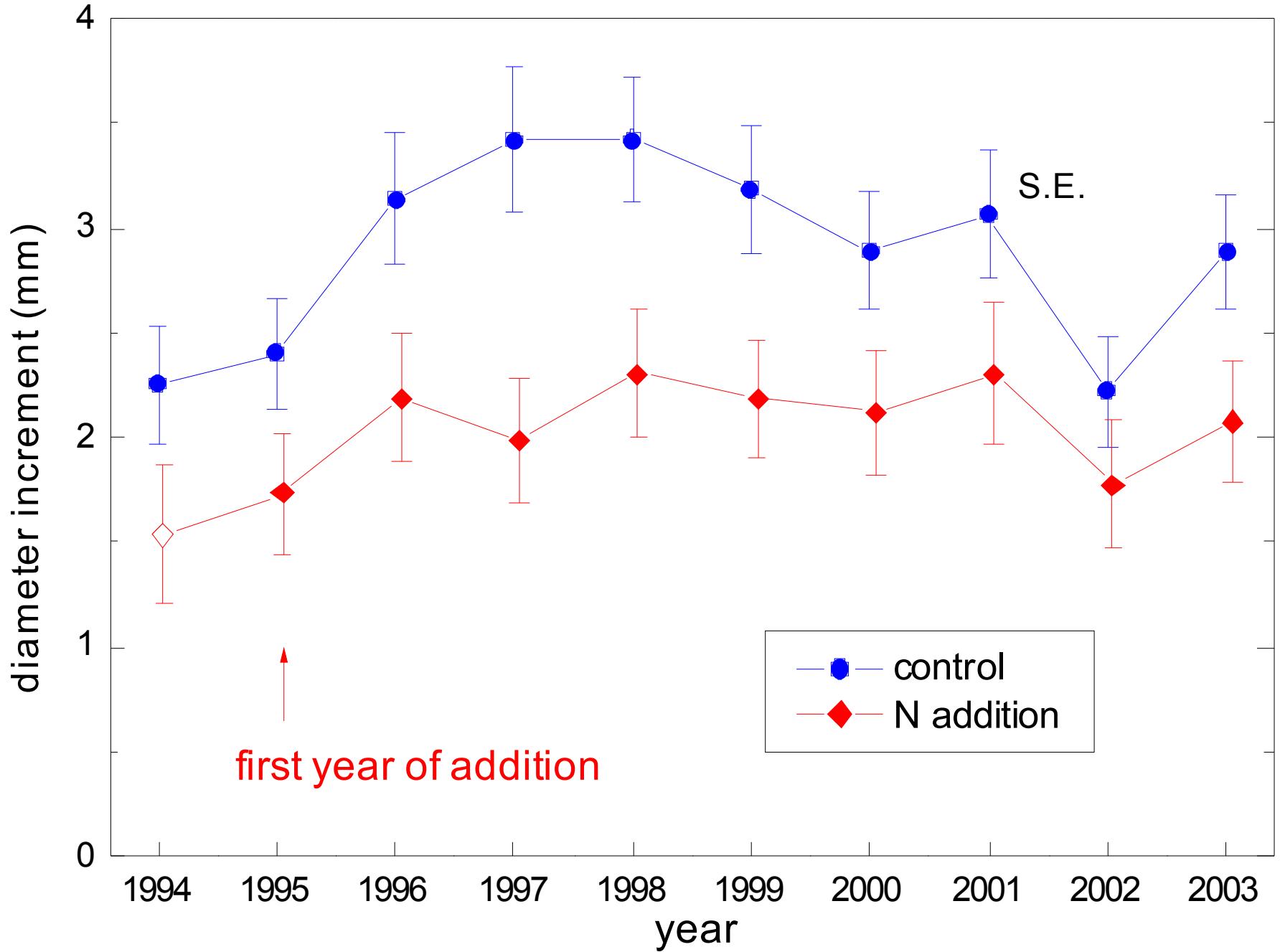
# N concentration in needles



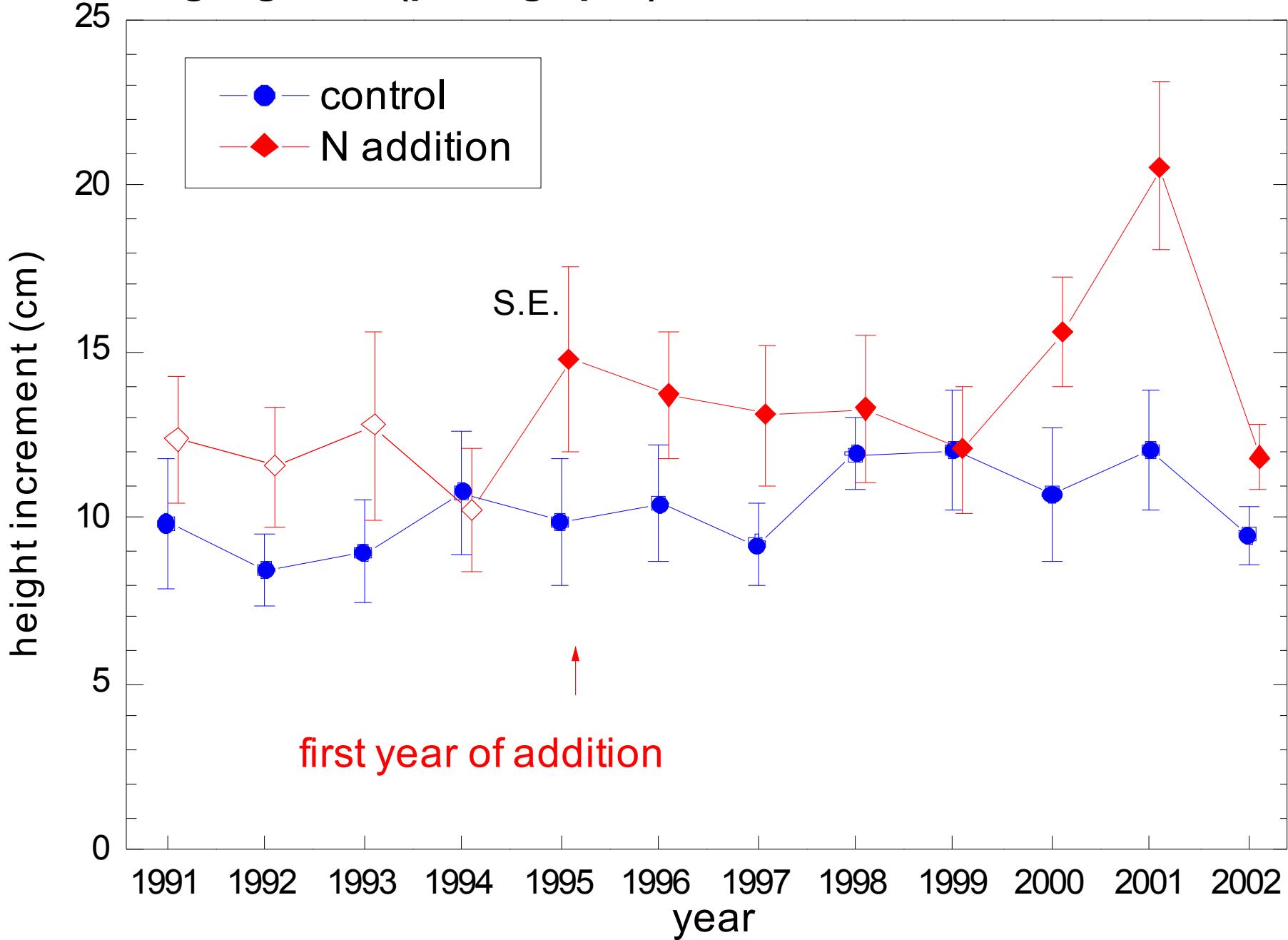
# Needle dry mass



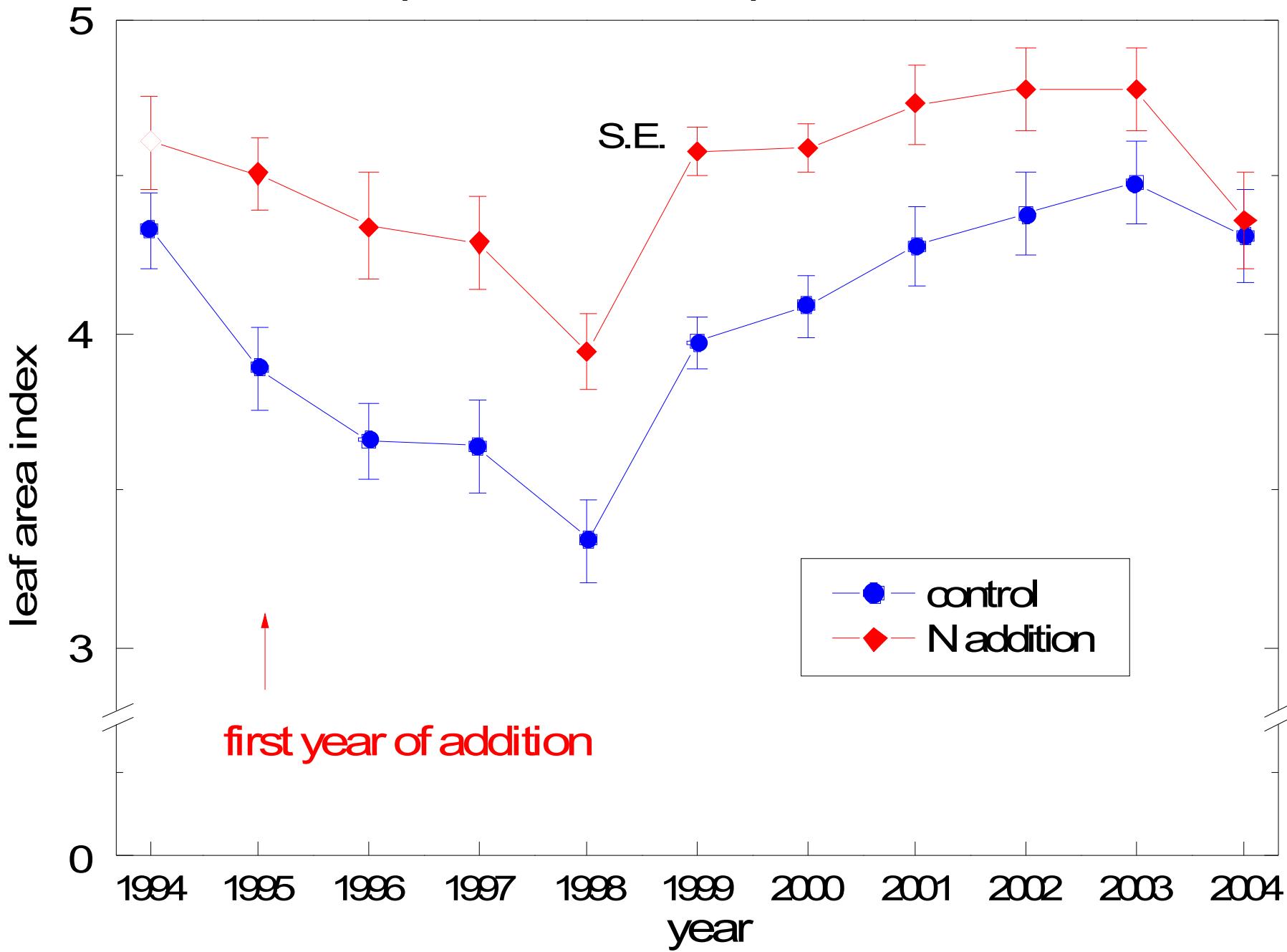
# Diameter growth (dendrometers)



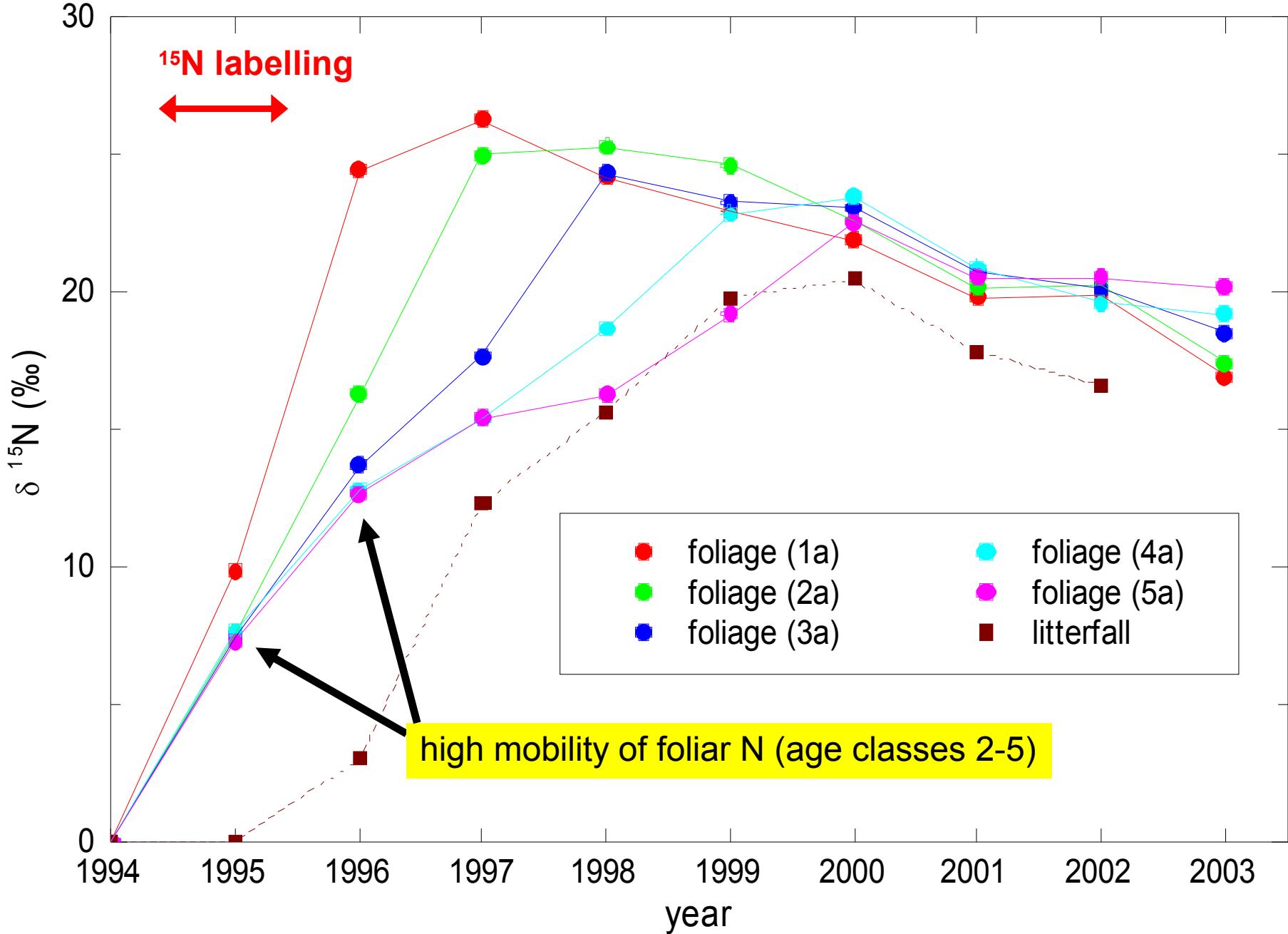
# Height growth (photographs)



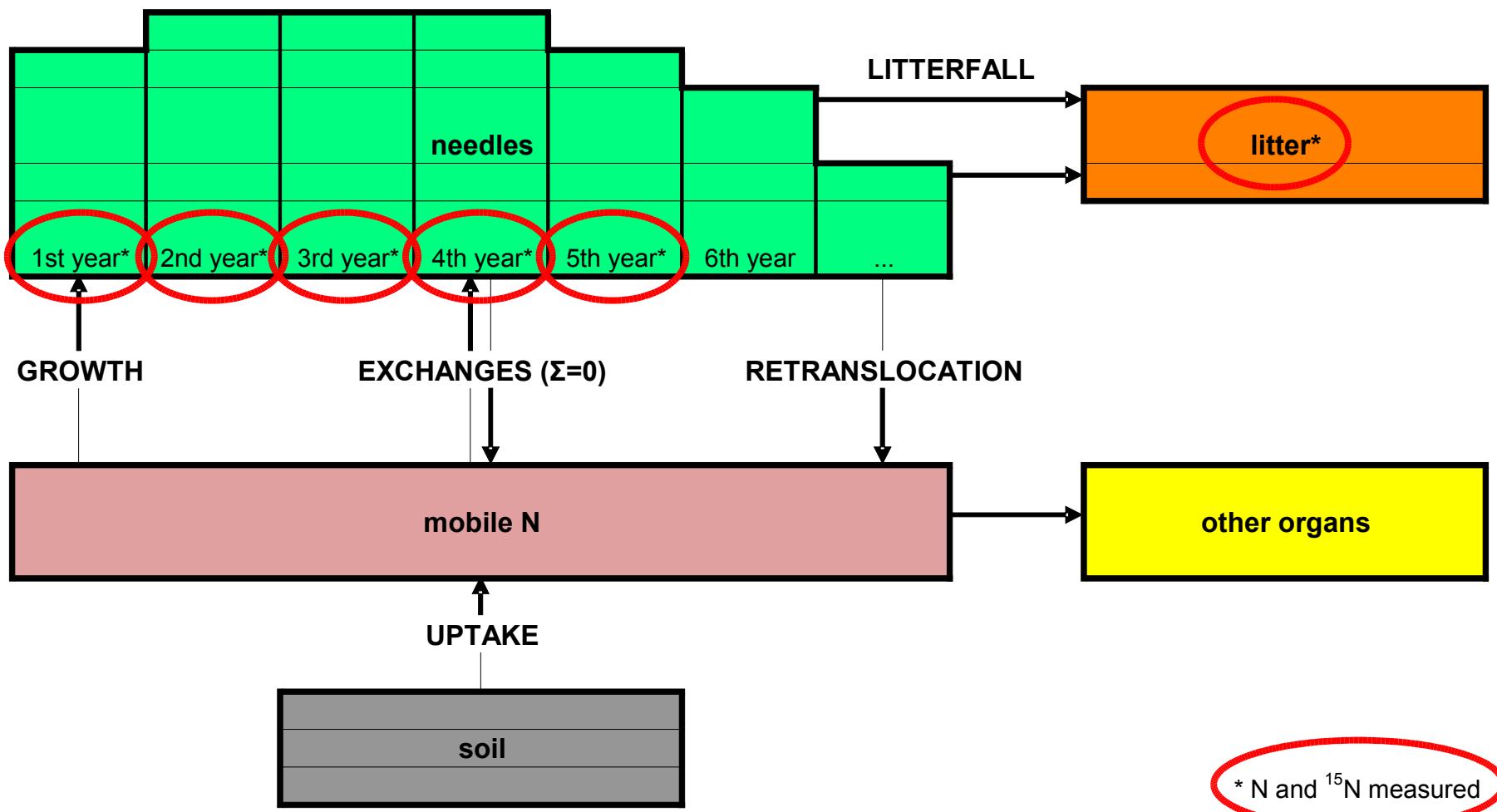
# Leaf area index (LAI-2000, corrected)



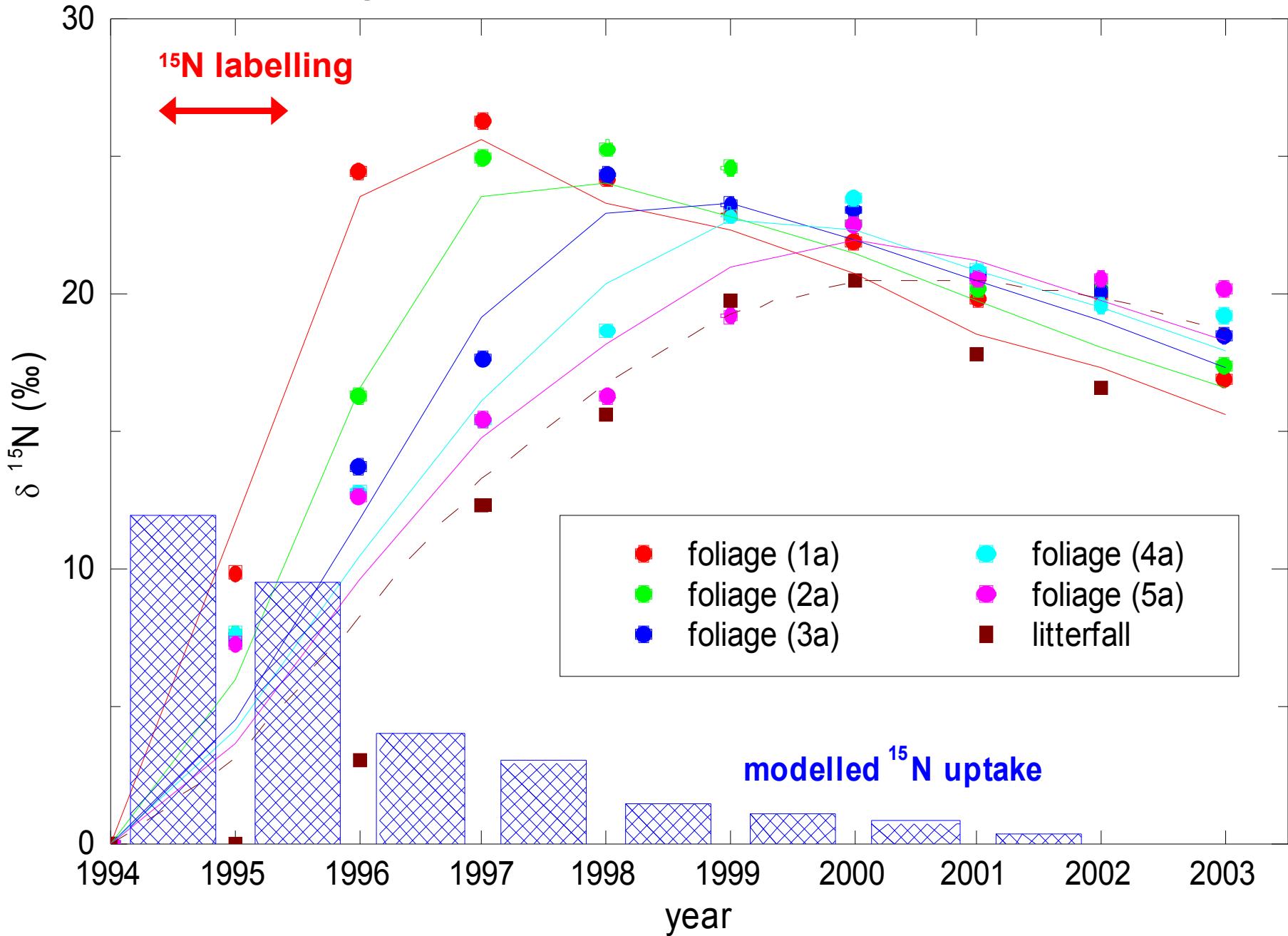
# $^{15}\text{N}$ in needle age classes and litter



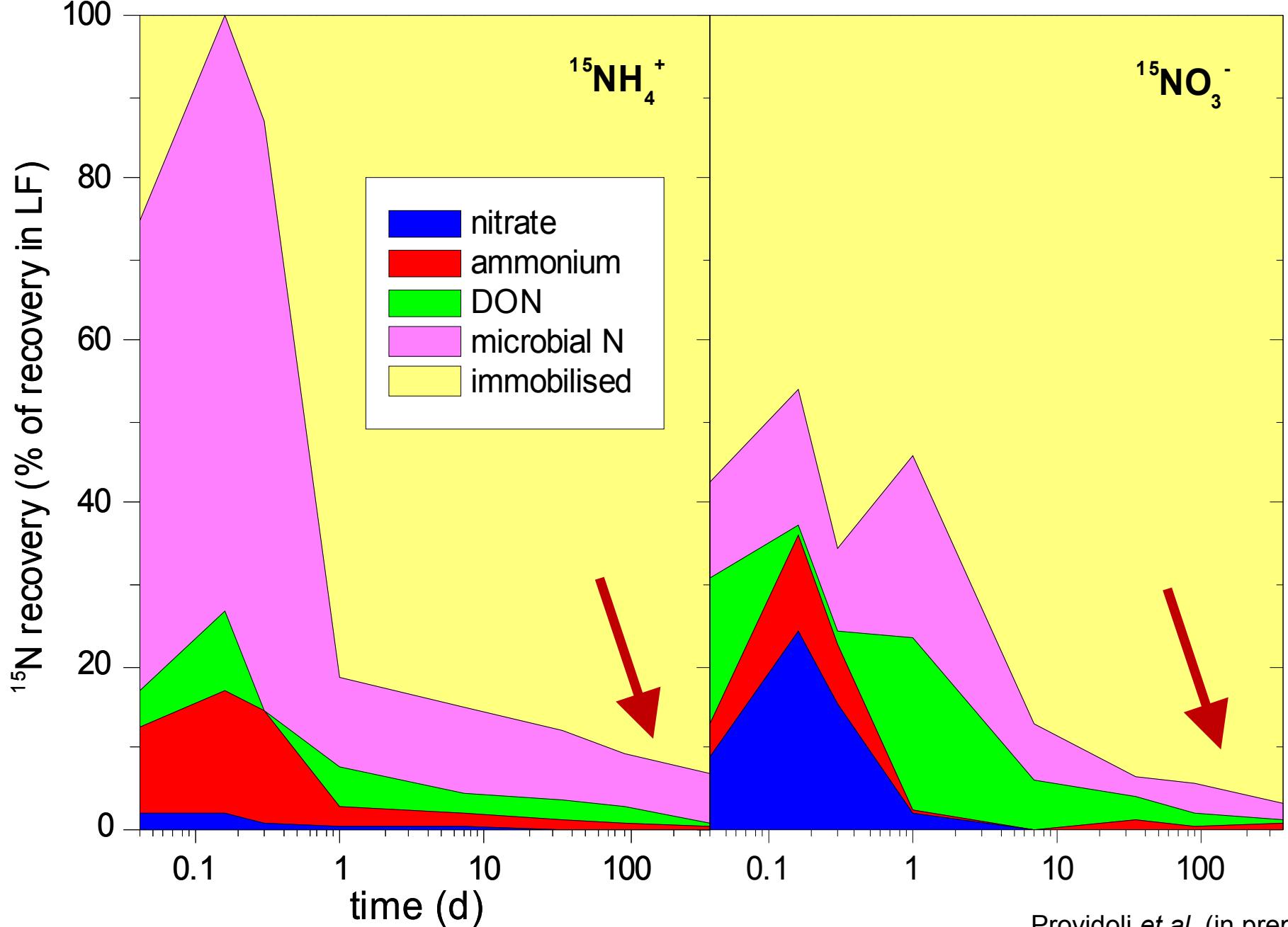
# Nitrogen uptake and redistribution model



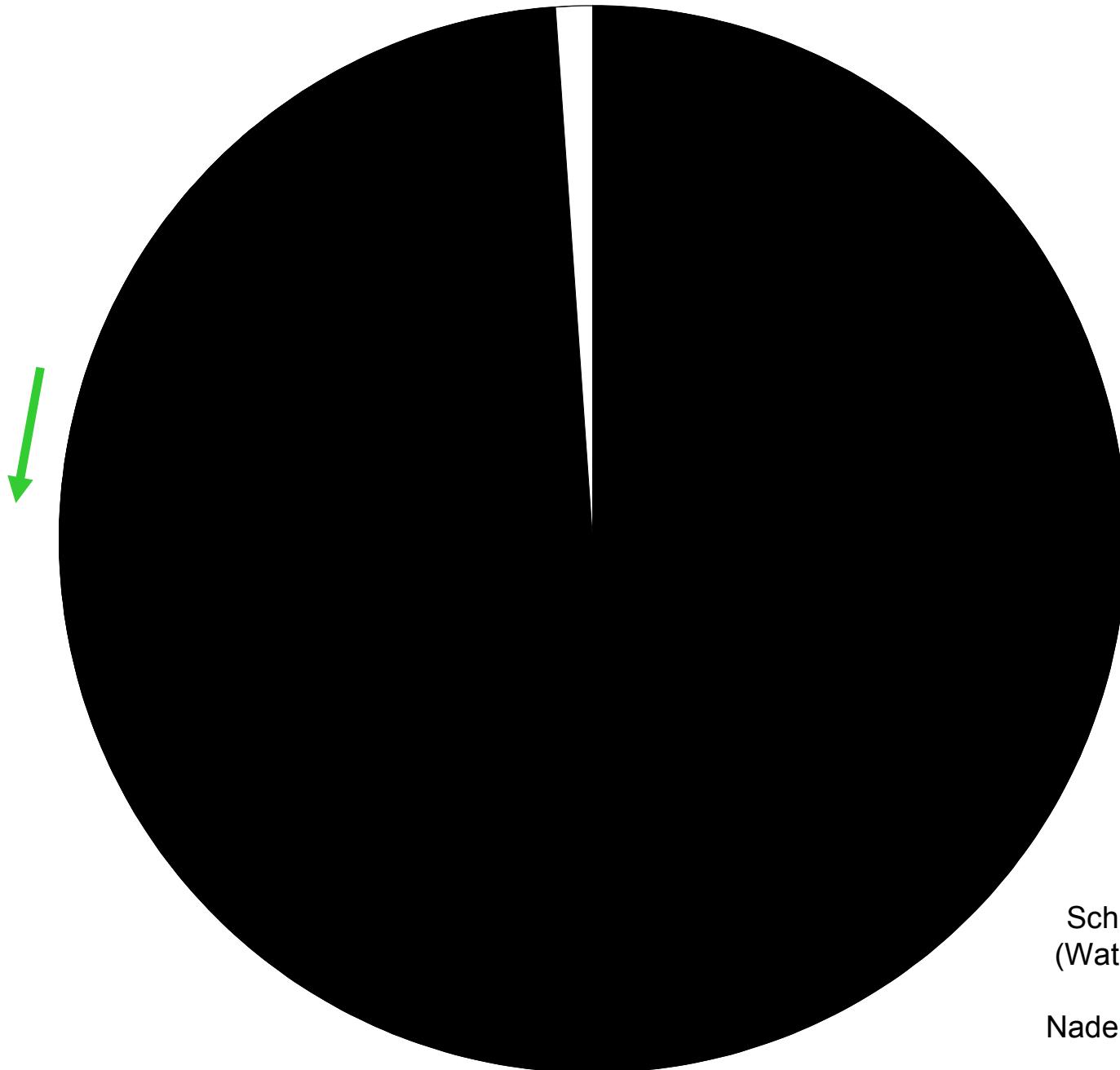
# $^{15}\text{N}$ in needle age classes and litter



# $^{15}\text{N}$ recovery in LF horizon



## Partitioning of $^{15}\text{N}$ after 7 years



Schleppi *et al.*, 1999  
(Water Air Soil Pollut.)

Nadelhoffer *et al.*, 1999  
(Nature)

# Conclusions

- N deposition mostly immobilised in the soil
- N extractable / leachable only in short term
- but uptake by trees continues a few years
- ~15% of N deposition taken up by trees
- high N mobility in 2-5 year-old needles
- diagnostic: effects on needles after ~5 years
- effects on canopy or bole growth: later ?

The background of the image is a scenic sunset over a mountainous landscape. The sky is filled with large, billowing clouds that are partially illuminated from behind by the setting sun, giving them a fiery orange and red glow. The mountains in the foreground are dark silhouettes against the bright sky. In the center-right, the sun is visible as a bright, glowing orb. The overall atmosphere is one of tranquility and natural beauty.

**THE END**