

# N-addition to the Alptal forest: some new results from an old paired-catchment experiment

**Patrick Schleppi**<sup>1</sup>, Frank Hagedorn<sup>1</sup>, Manfred Stähli<sup>1</sup>, Peter Waldner<sup>1</sup>, Ilja van Meerveld<sup>2</sup>, Victor Gauthier<sup>2</sup>, Marco Lehmann<sup>1</sup>, James Kirchner<sup>1,3</sup>

<sup>1</sup> Swiss Federal Institute for Forest, Snow and Landscape Research (WSL), Birmensdorf, Switzerland

<sup>2</sup> Department of geography, University of Zurich, Zurich, Switzerland

<sup>3</sup> Swiss Federal Institute of Technology (ETH), Zurich, Switzerland



# We live in an N-rich world...

## Global transformation of $N_2$ into reactive N ( $N_r$ )

Natural:

113 Mt a<sup>-1</sup>

Anthropogenic:

191 Mt a<sup>-1</sup>

synthetic fertilisers

N-fixing crops

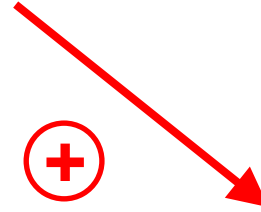
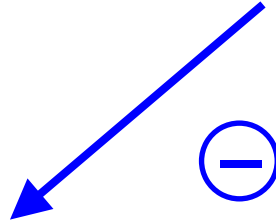
combustion

Vitousek et al. 1997, Sutton et al. 2011

... in which every second human  
life depends on anthropogenic  $N_r$

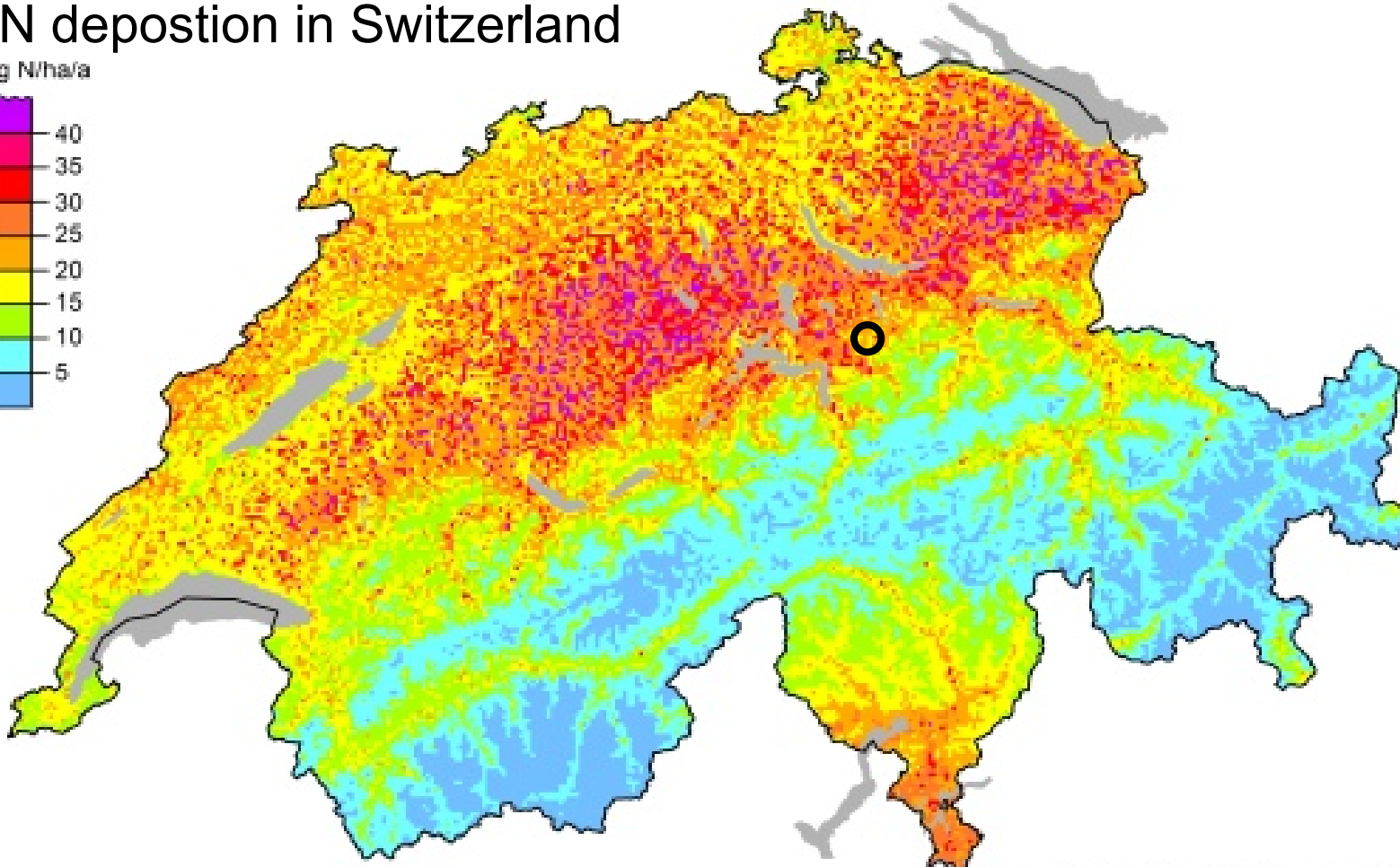
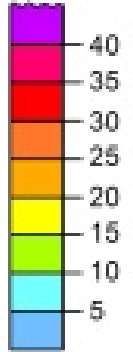
# NITREX

## Manipulation der N Deposition



# N deposition in Switzerland

kg N/ha/a



## Alptal

Elevation:

1200 m

Geology and soils:

Gleysol over Flysch

Vegetation:

mosaic of forest and wetland patches

Trees:

*Picea abies*,

*Abies alba*

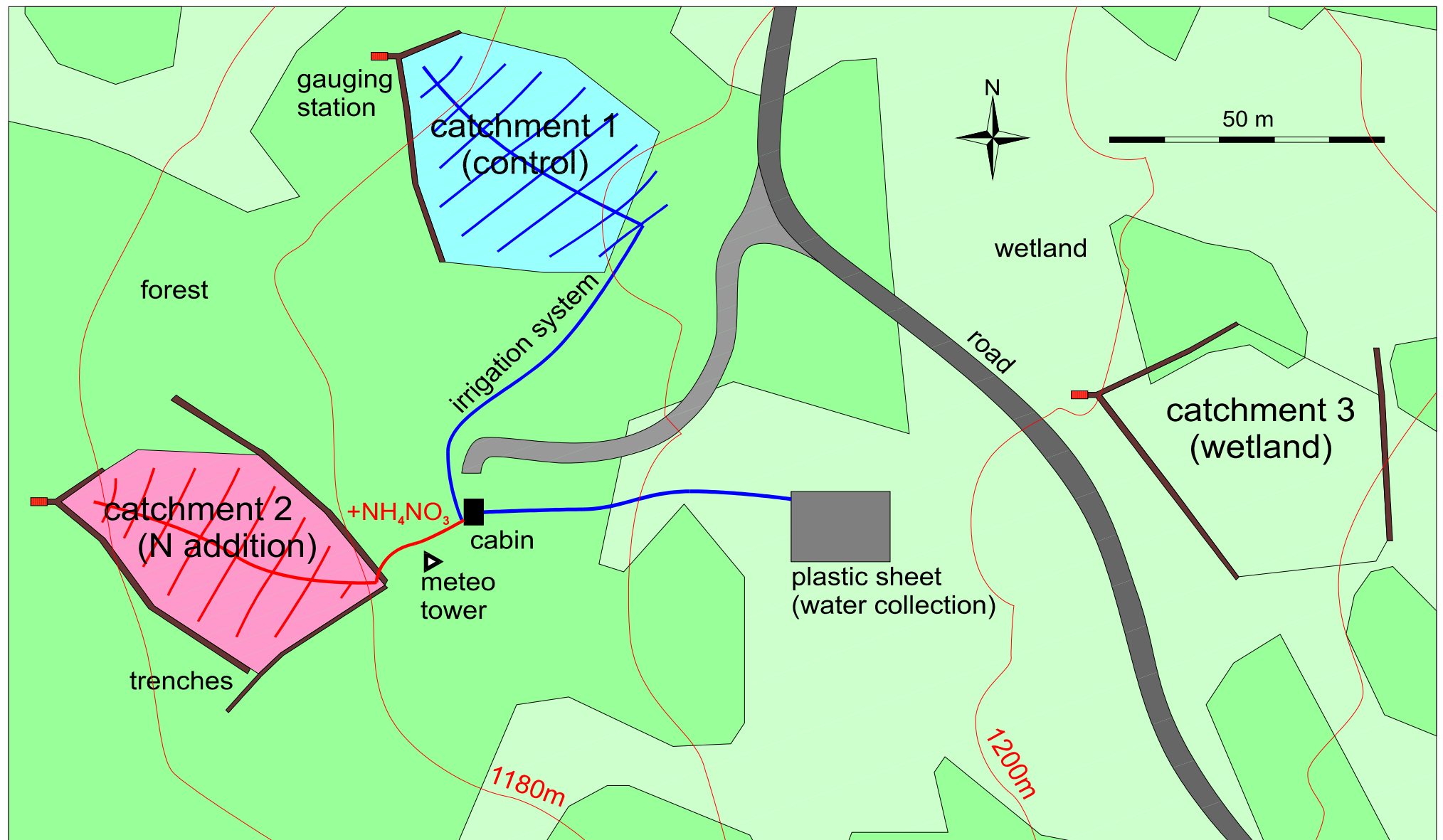
Precipitation:

2300 mm/y

(30% as snow)

Temperature:

6°C average





gaging  
on

catchment  
(control)



land

50 m



irrigation system

road

catchment 3  
(wetland)



catchment 2  
(N addition)

trenches

+NH<sub>4</sub>NO<sub>3</sub>

cabin

plastic sheet  
(water collection)





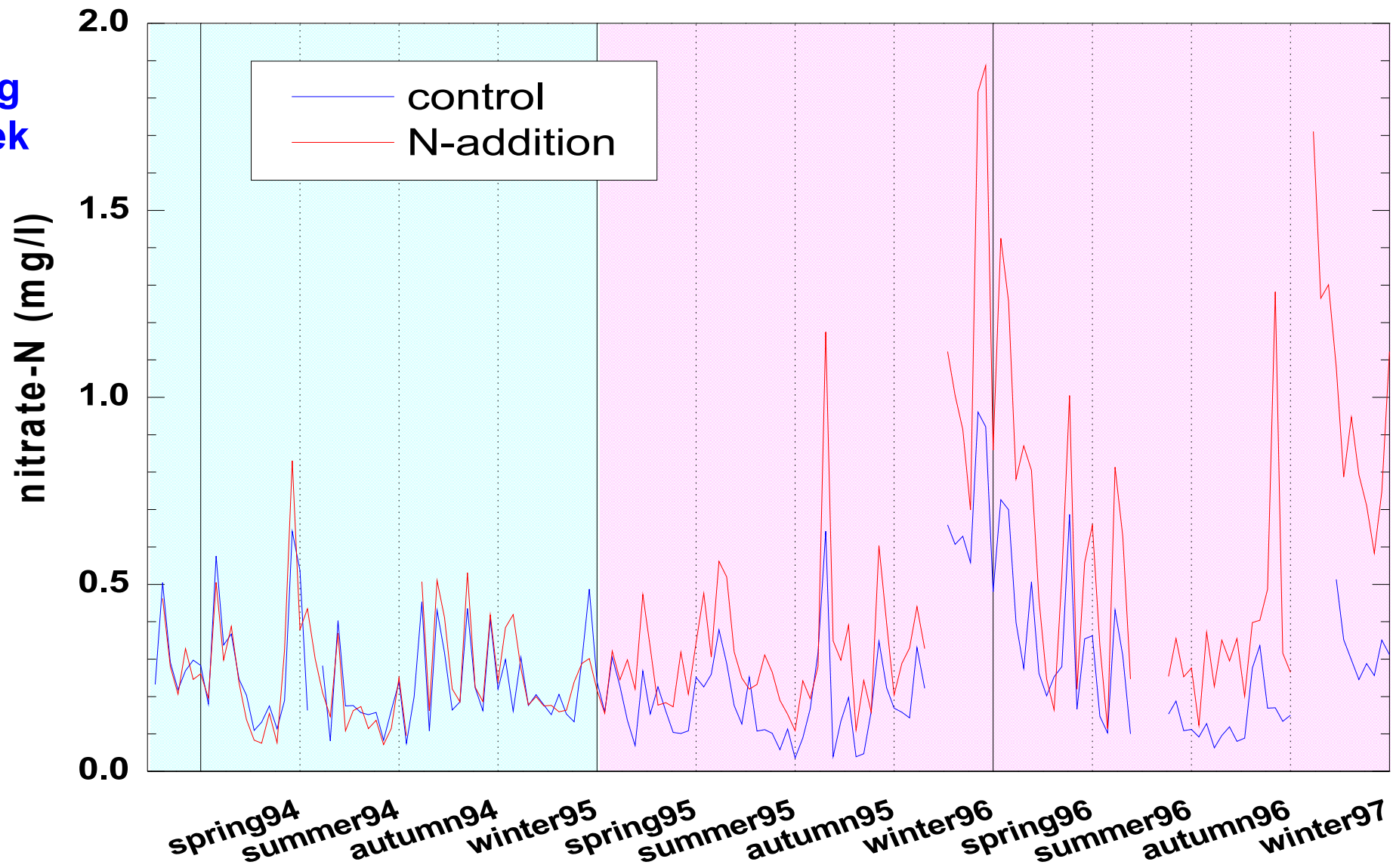
LF

Aa

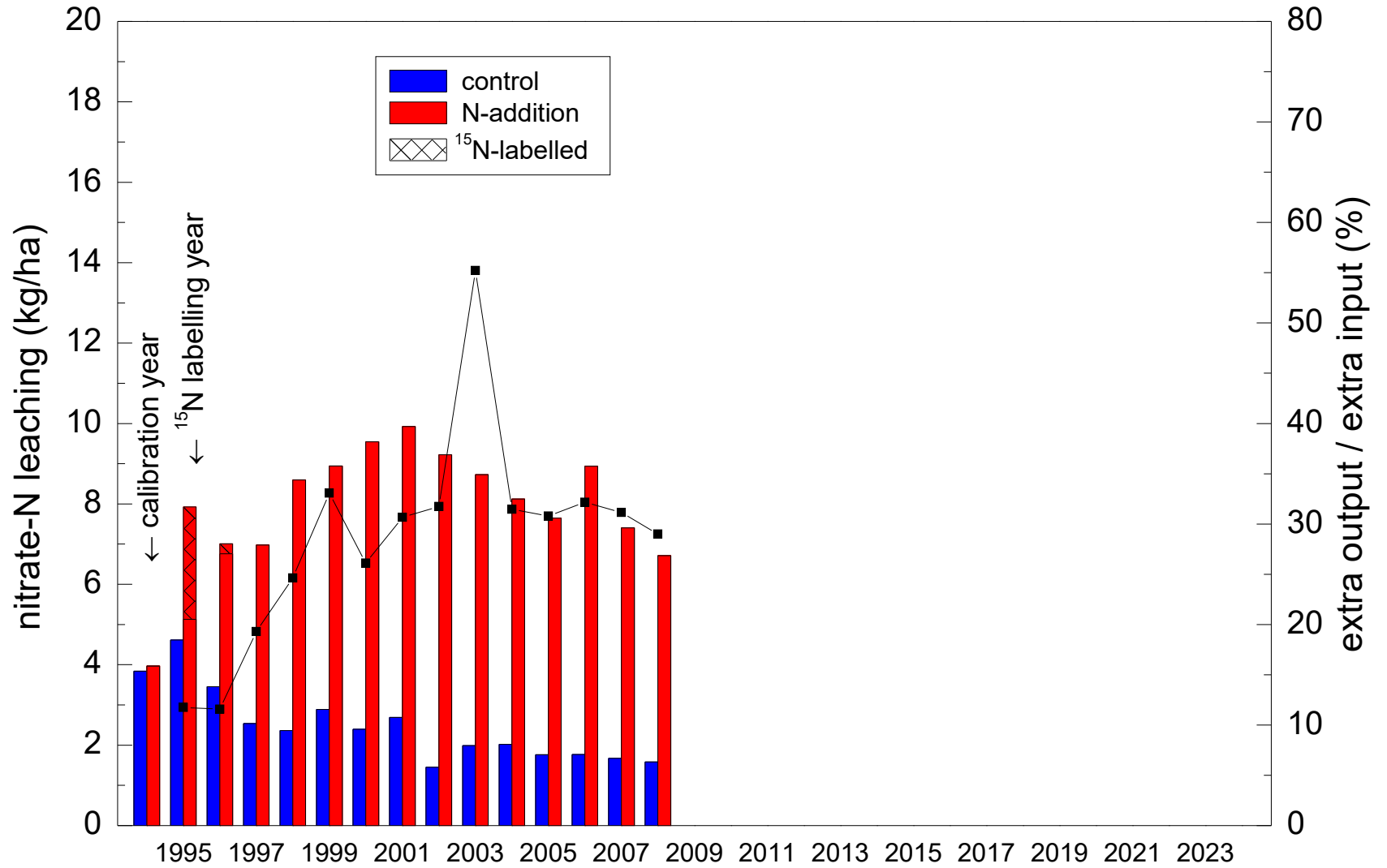
Gor

Gr

# Nitrate leaching per week



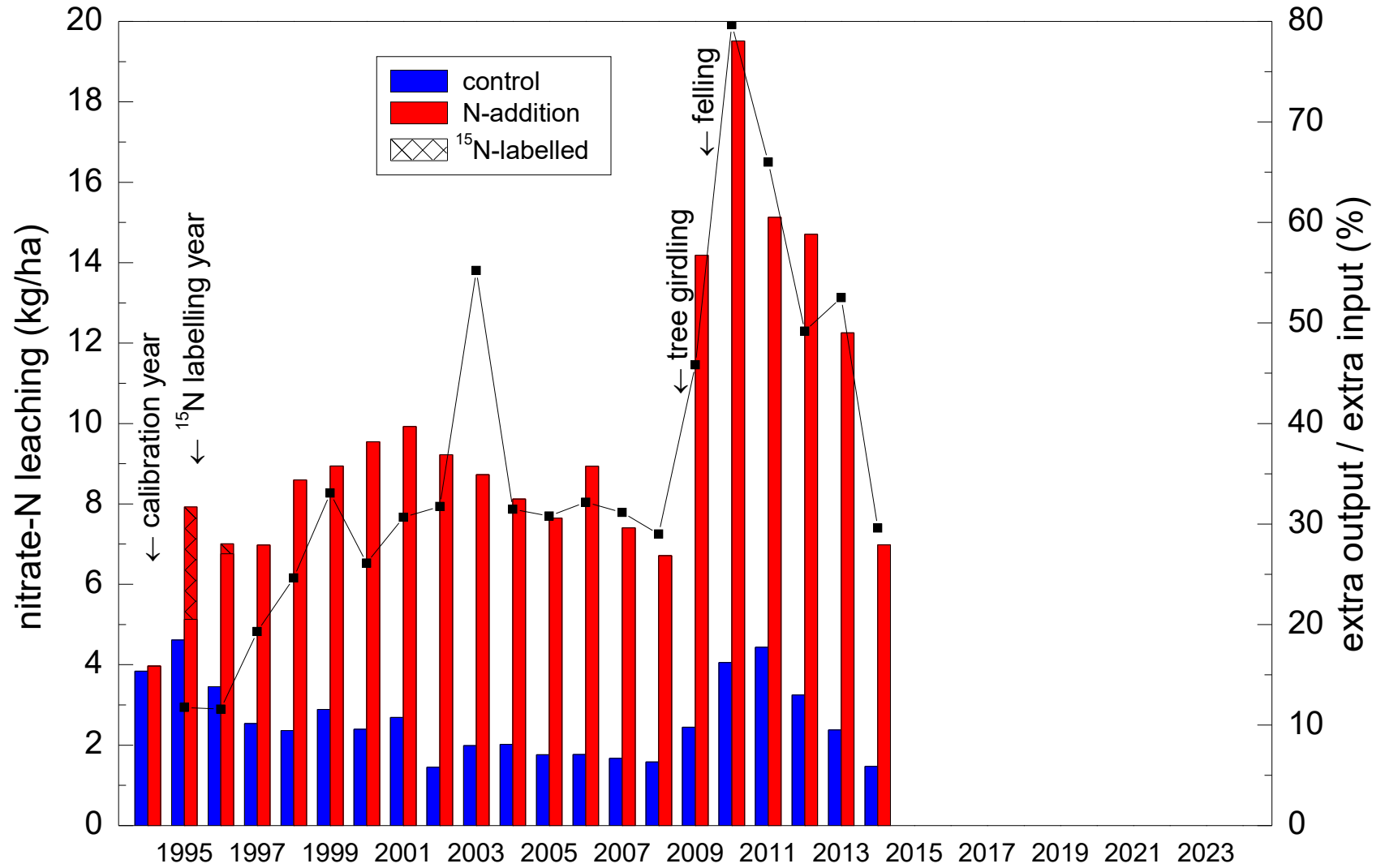
# Nitrate leaching



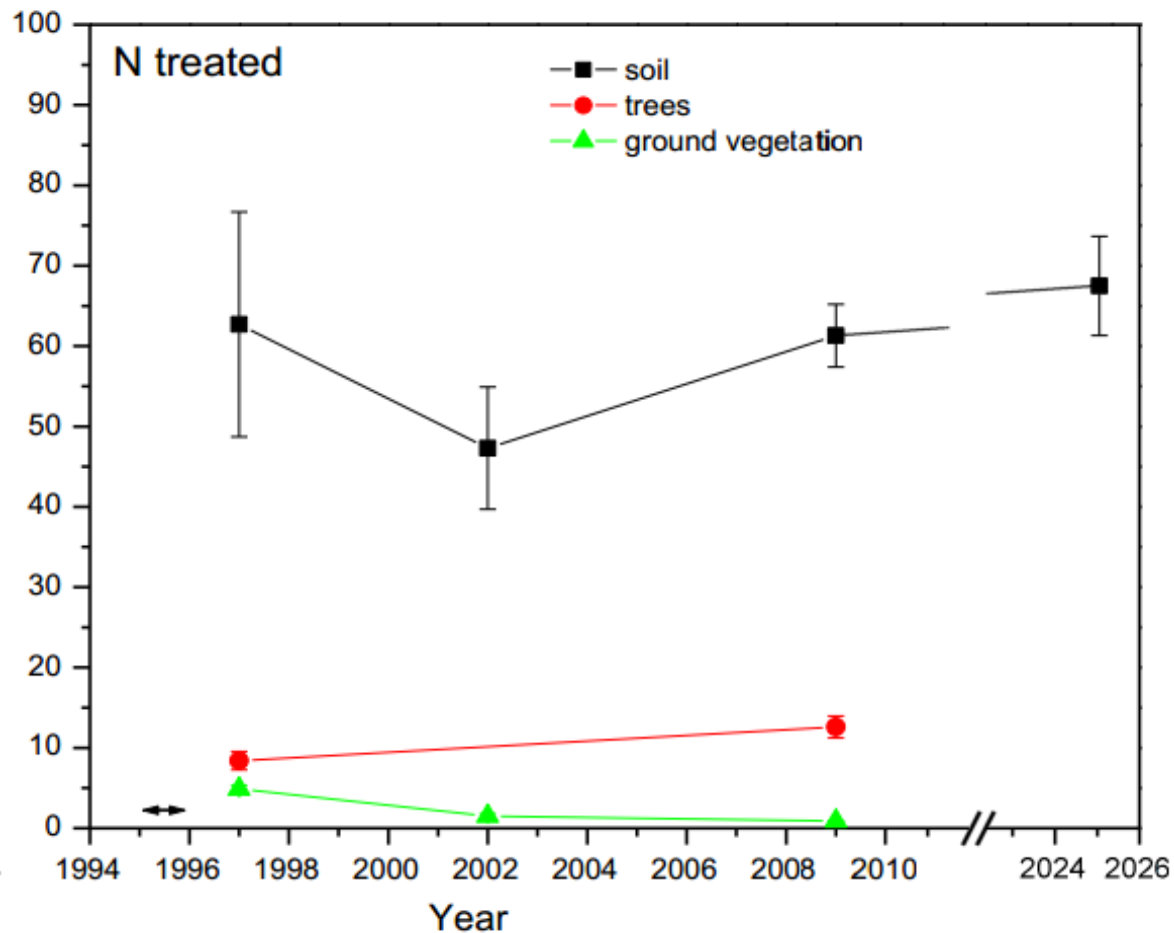
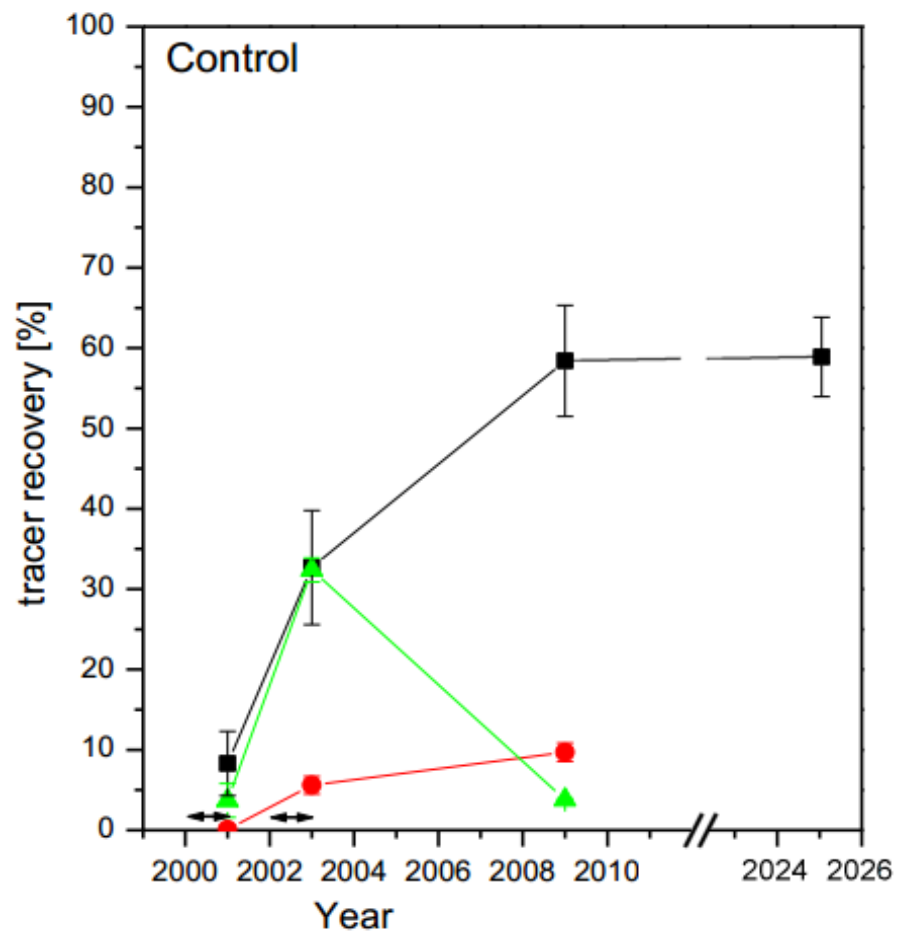
## Tree girdling, then felling: effects on nitrate leaching and on greenhouse gases



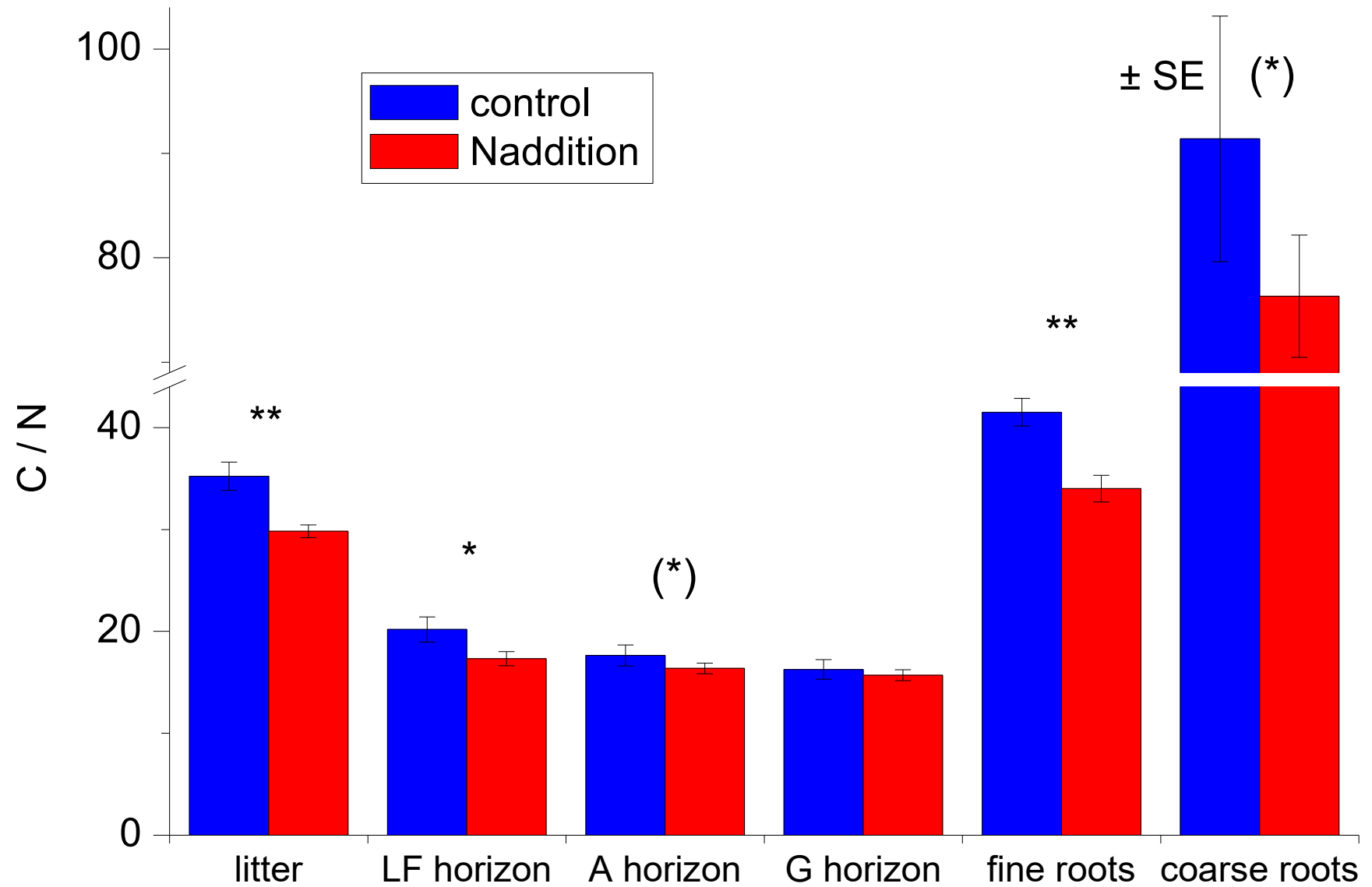
# Nitrate leaching



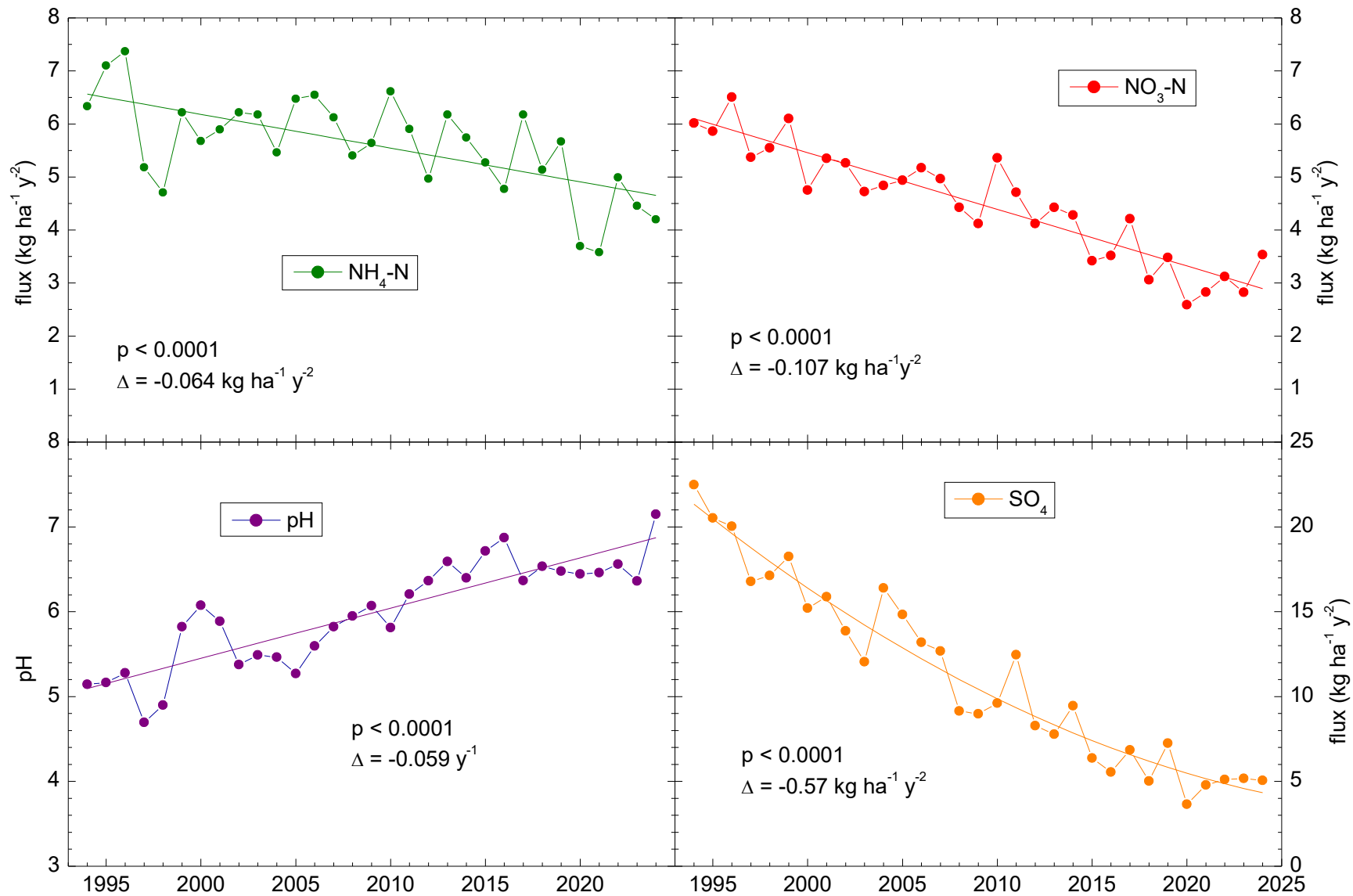
## Long-term $^{15}\text{N}$ fate



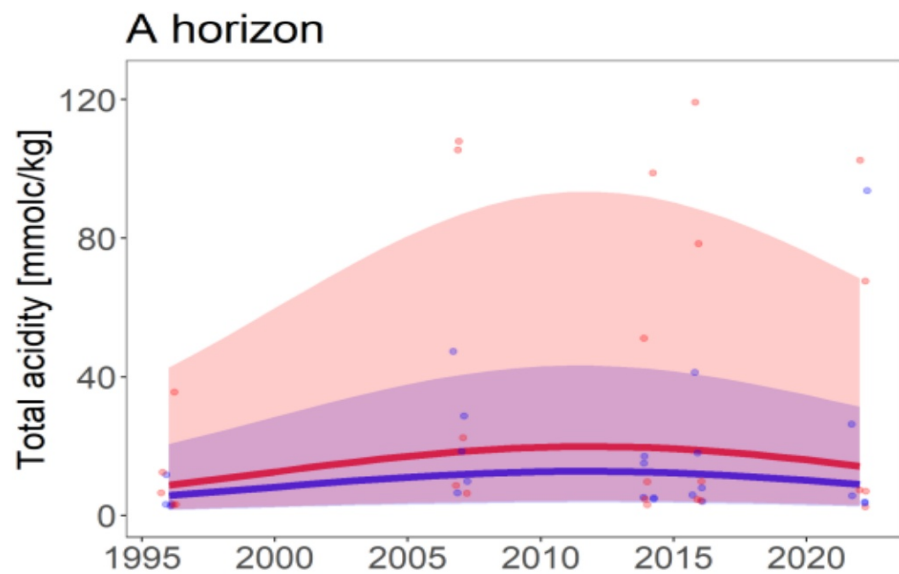
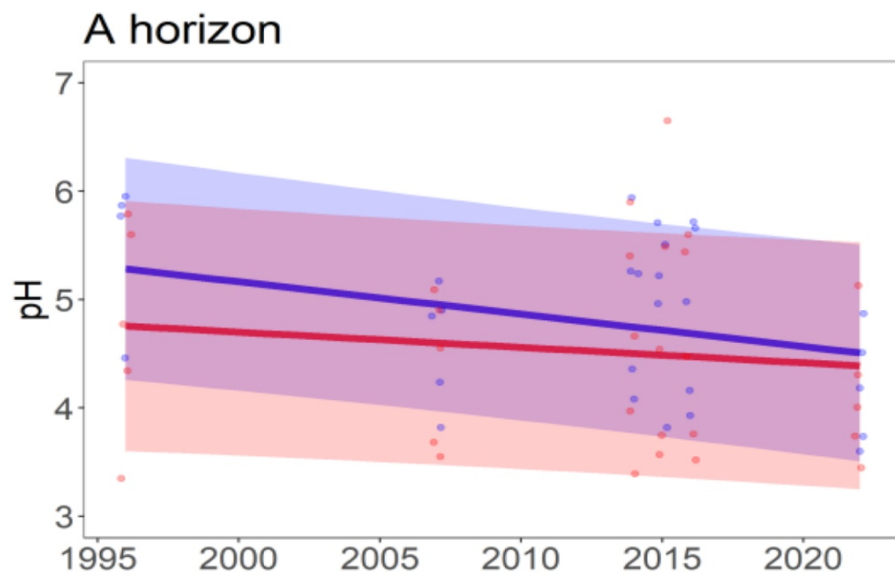
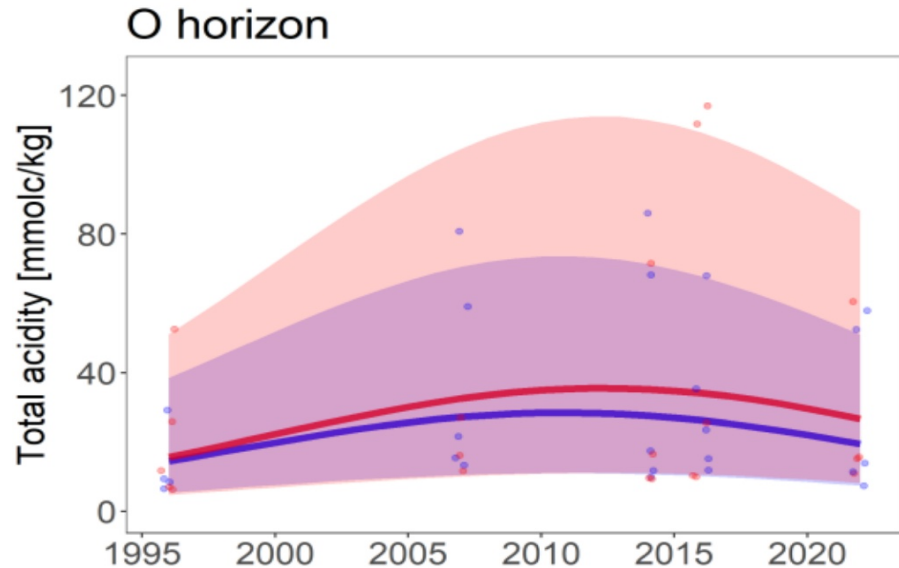
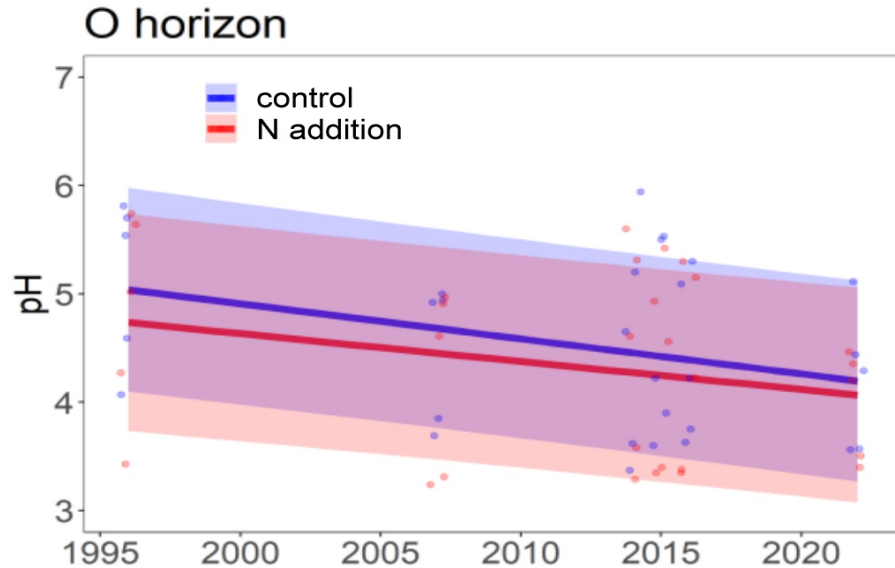
C / N  
ratio  
2005



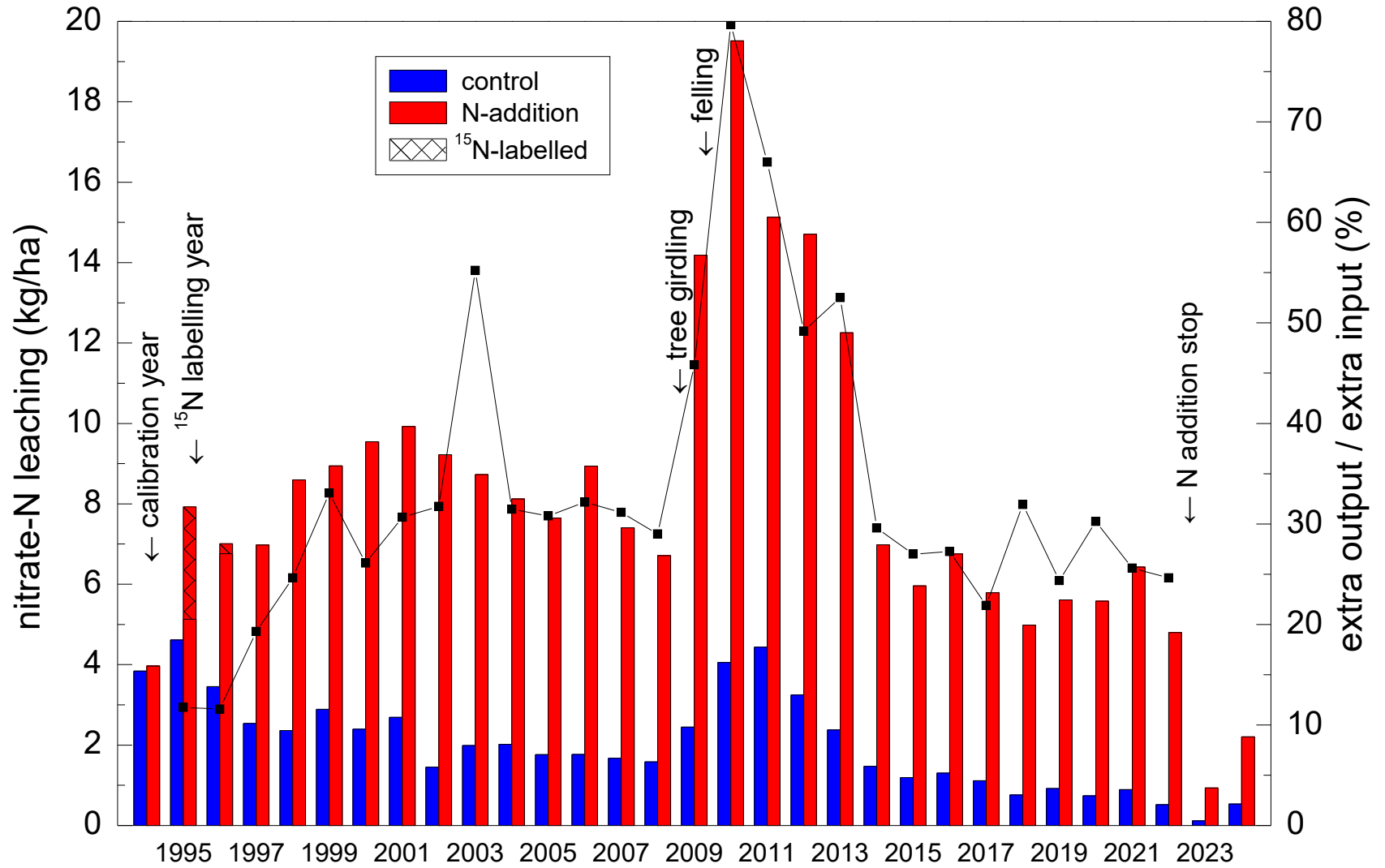
# Bulk deposition Alptal



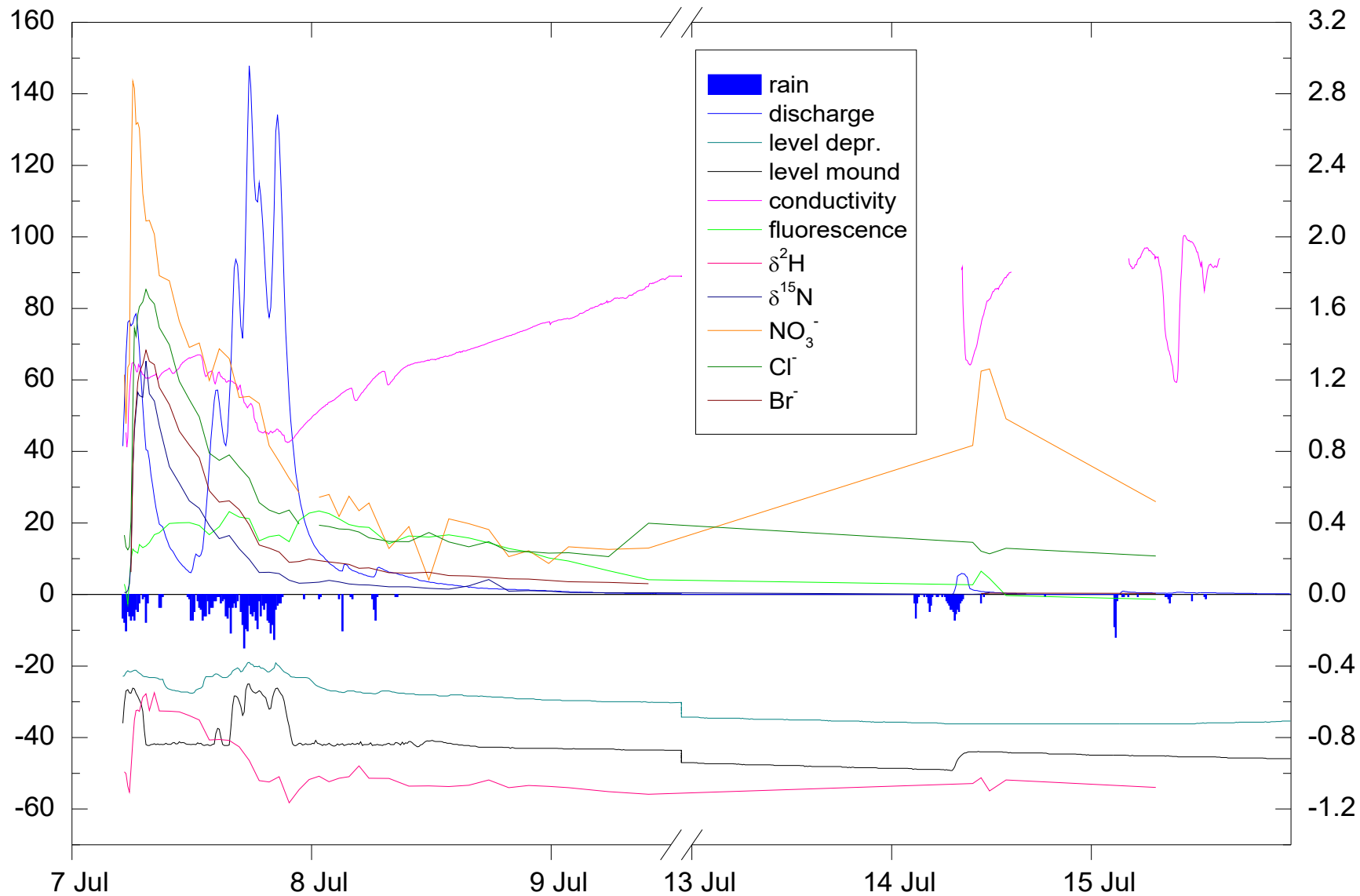
# Soil pH and acidity



# Nitrate leaching



# Multi-tracer "cocktail" experiment



# Multi-tracer "cocktail" experiment

