

Drought Effects on Soil Solution Chemistry at Bavarian Level-II sites

Freiburg 19.11.04

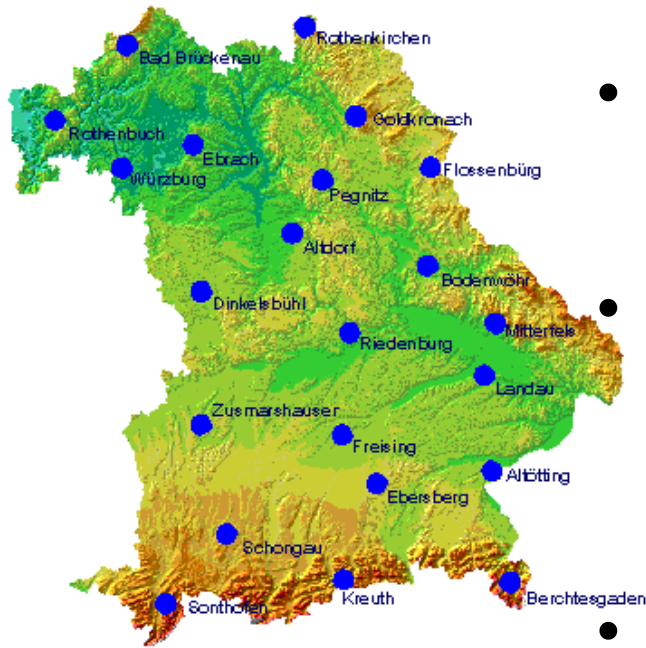
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Structure

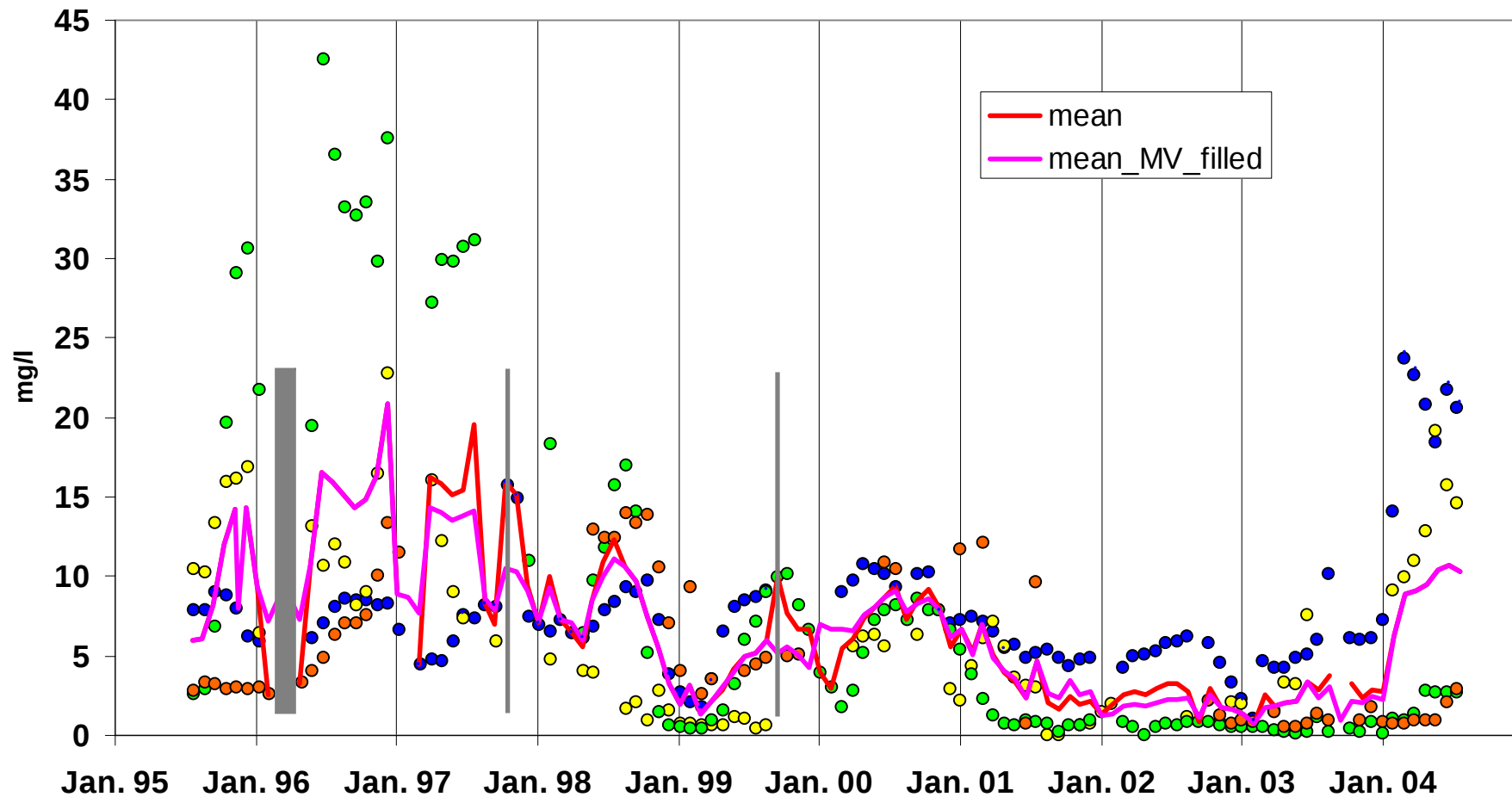
1. data base and methodical aspects (missing values)
2. possible reactions to drought
3. Drought effects on measured concentrations
4. Drought effects on fluxes (measured concentrations and modelled seepage [LWF-BROOK90])
5. Conclusions

Data base - Sampling



- 22 sites, 5 tree species
- forest floor : - 6 lysimeters per plot
 - 2-weekly samples
- Soil:
 - 4 suction cups at 4 depth
 - 20 - 120 (220) cm
 - 4-weekly samples
- Up to 13 years of sampling

Data base - Missing values

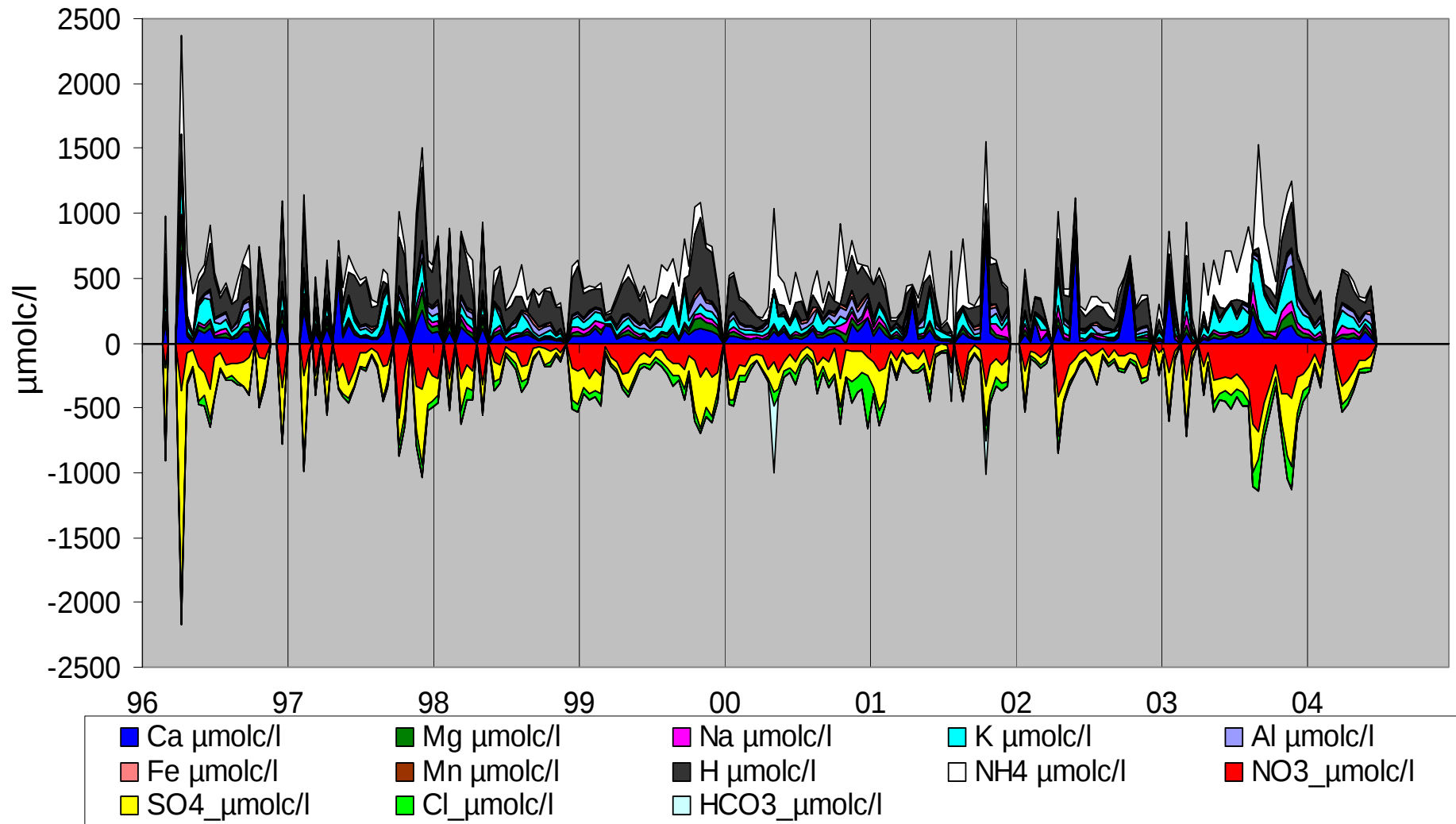


Spruce site Flossenbürg; depth 120 cm; nitrate concentration (mg/l)

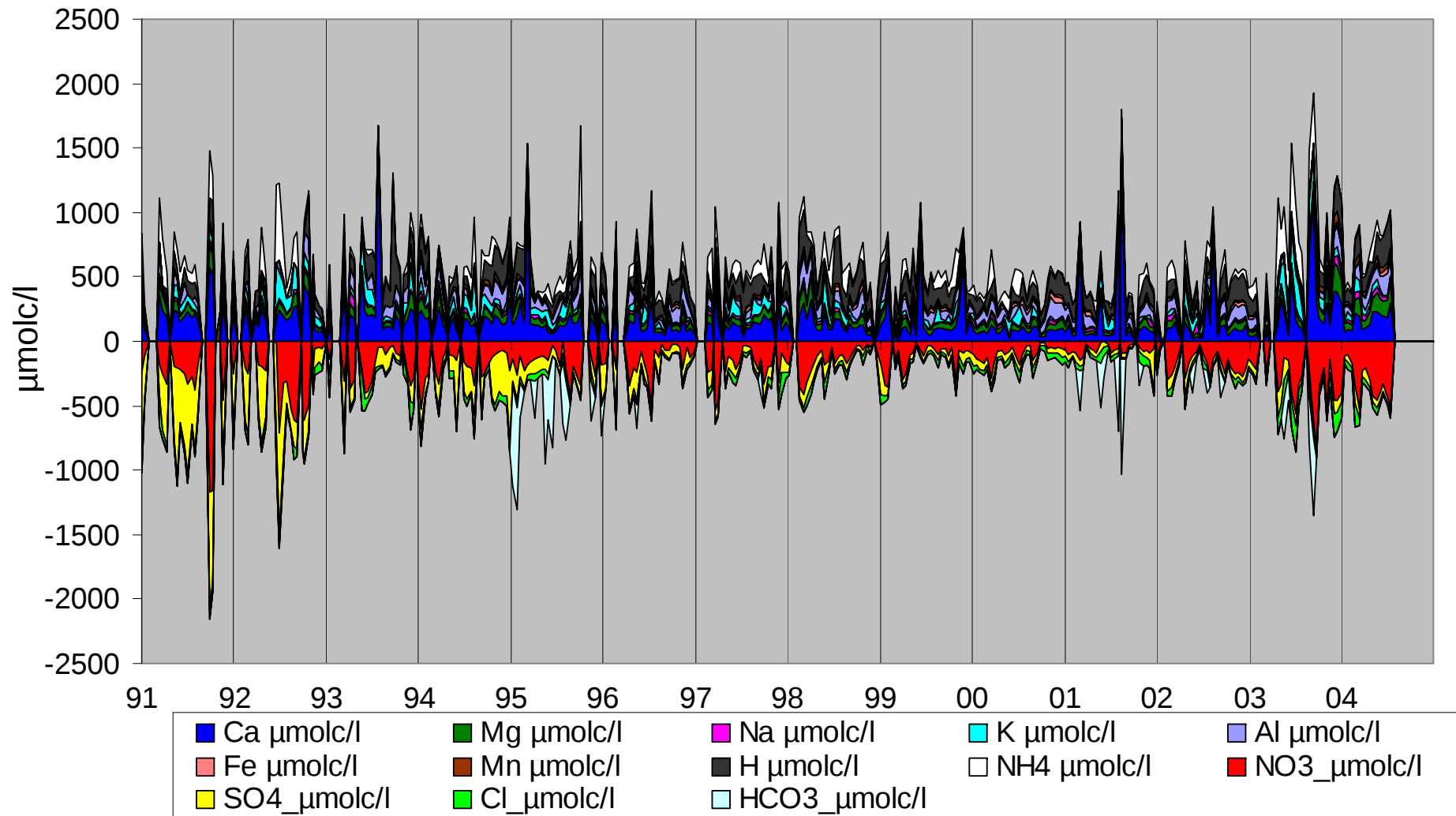
Possible effects of drought on soil solution

- Additional dead organic material by dying fine roots, microbial biomass and ground vegetation
- Increased mineralization due to increased soil temperatures
- Reduced seepage, transpiration and plant uptake
⇒ Increased concentrations during and after drought
⇒ Increased fluxes after rewetting

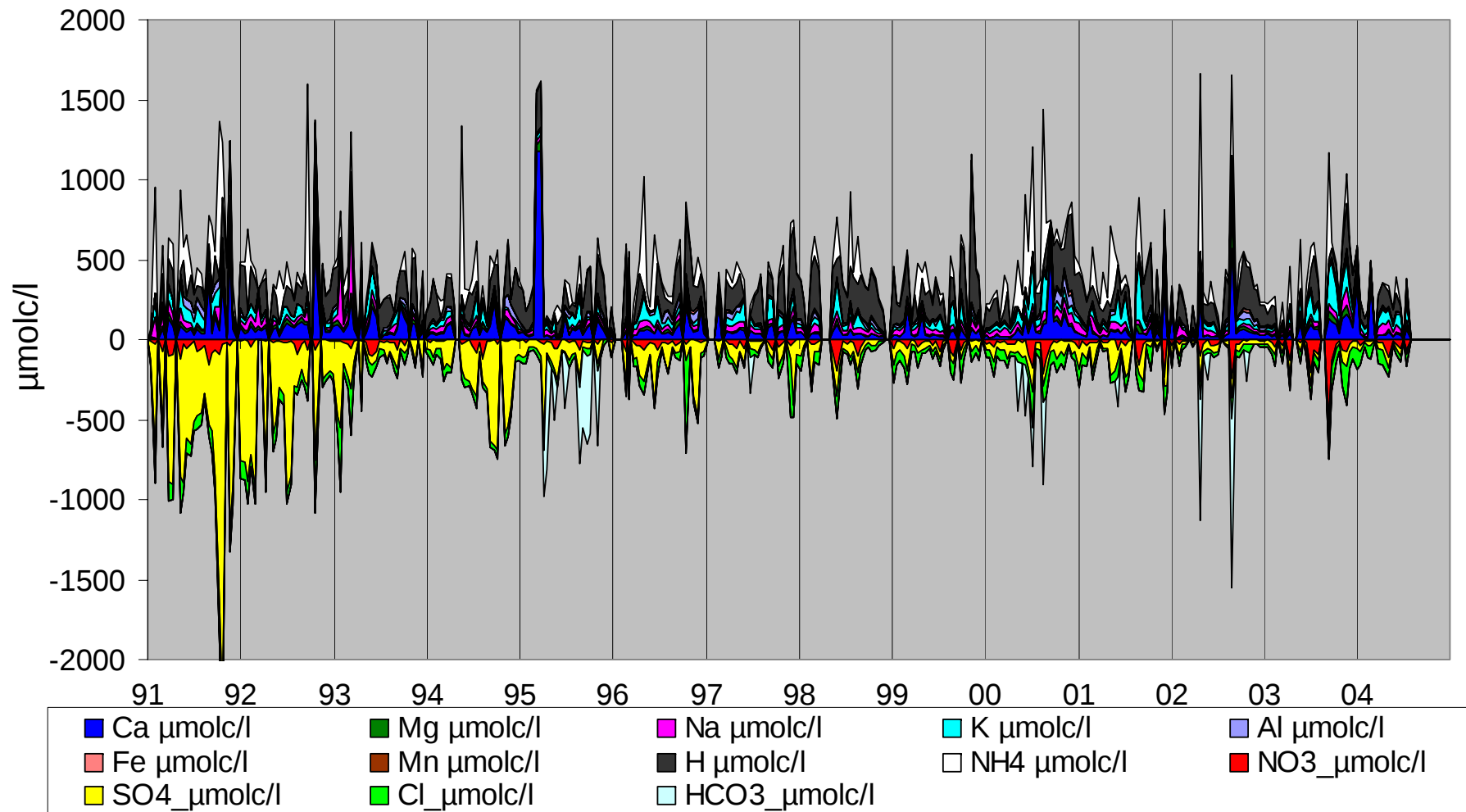
Time series ($\mu\text{molc/l}$): FLO forest floor



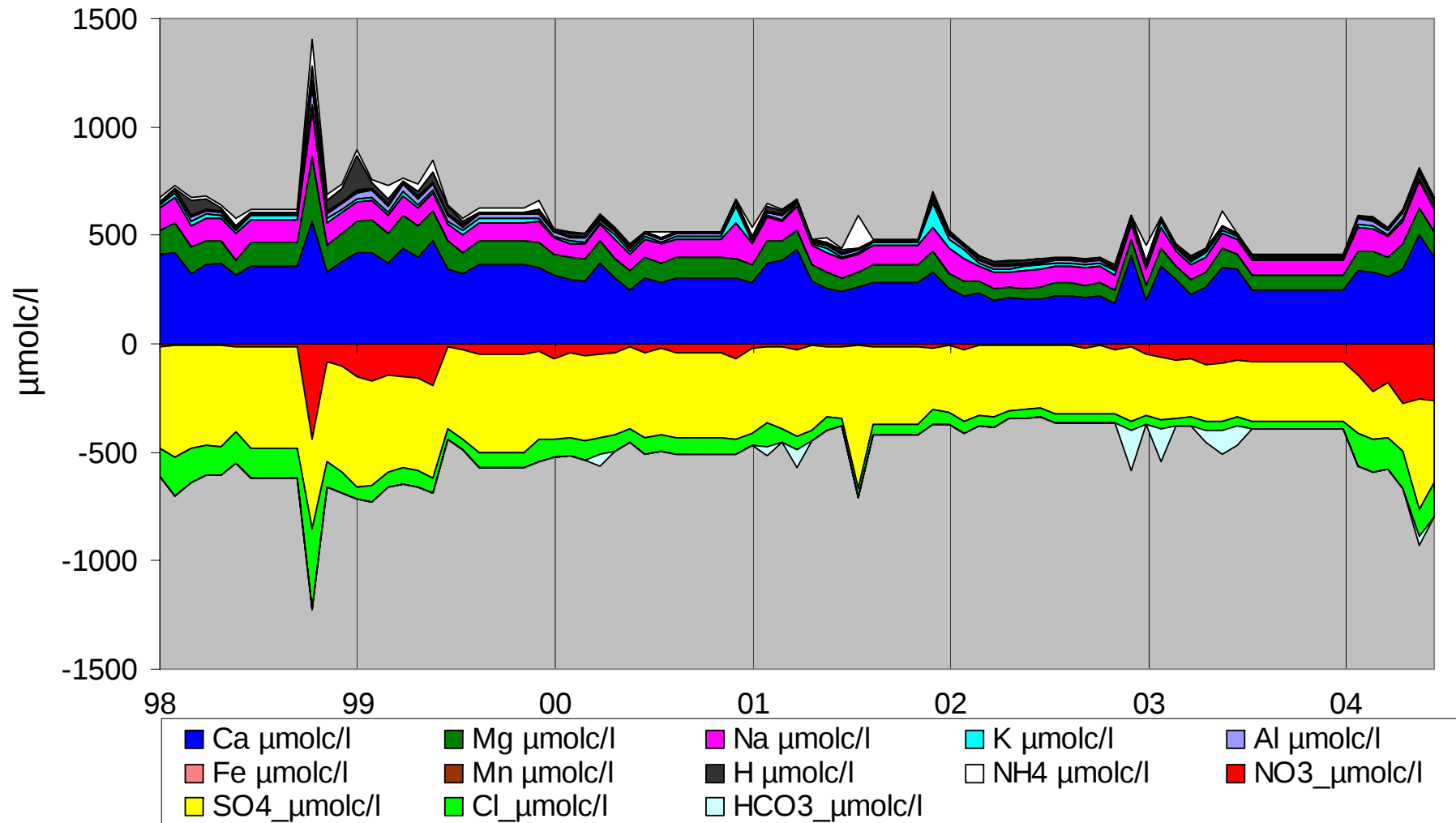
Time series ($\mu\text{molc/l}$): EBE forest floor



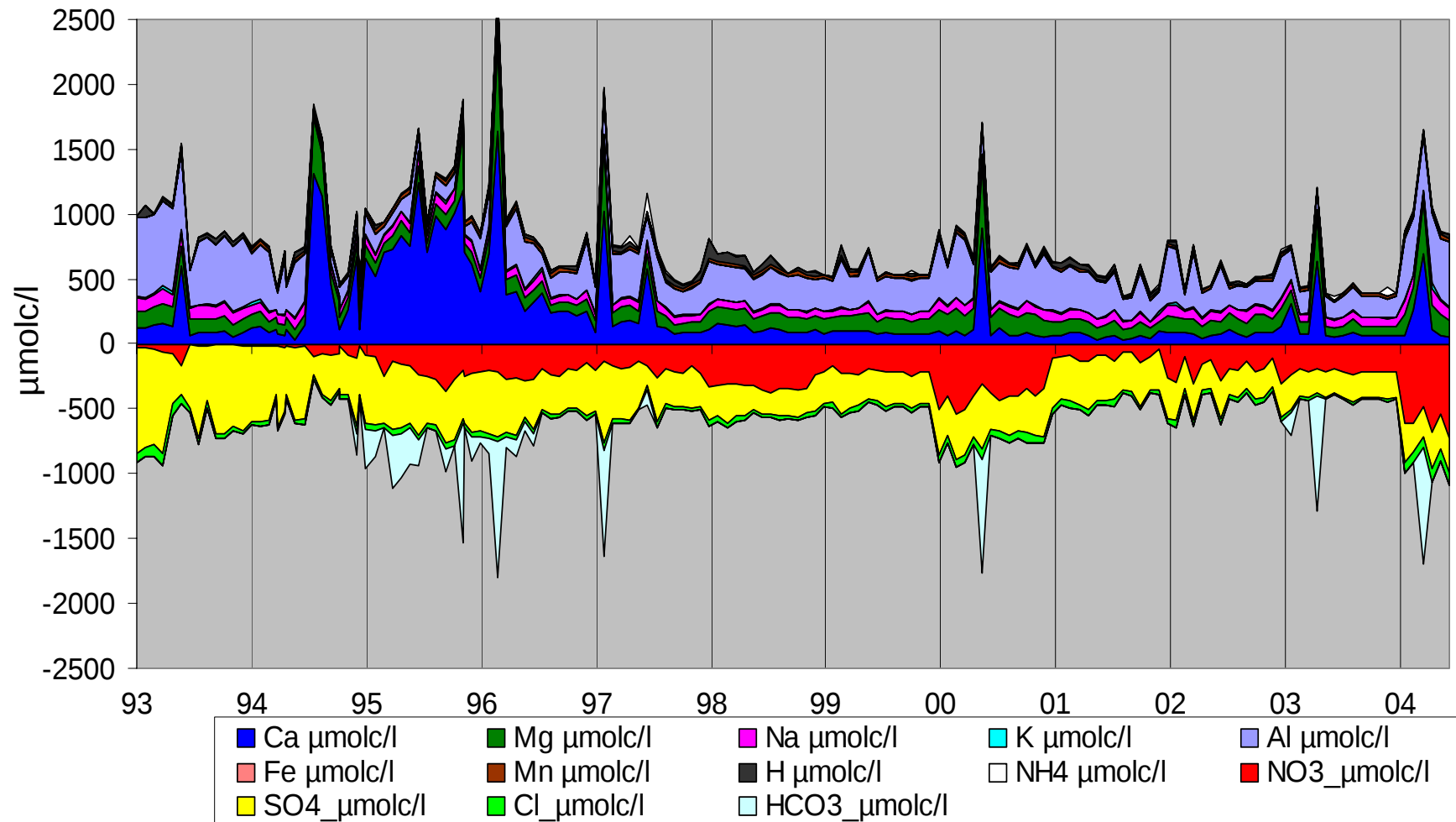
Time series ($\mu\text{molc/l}$): ALT forest floor



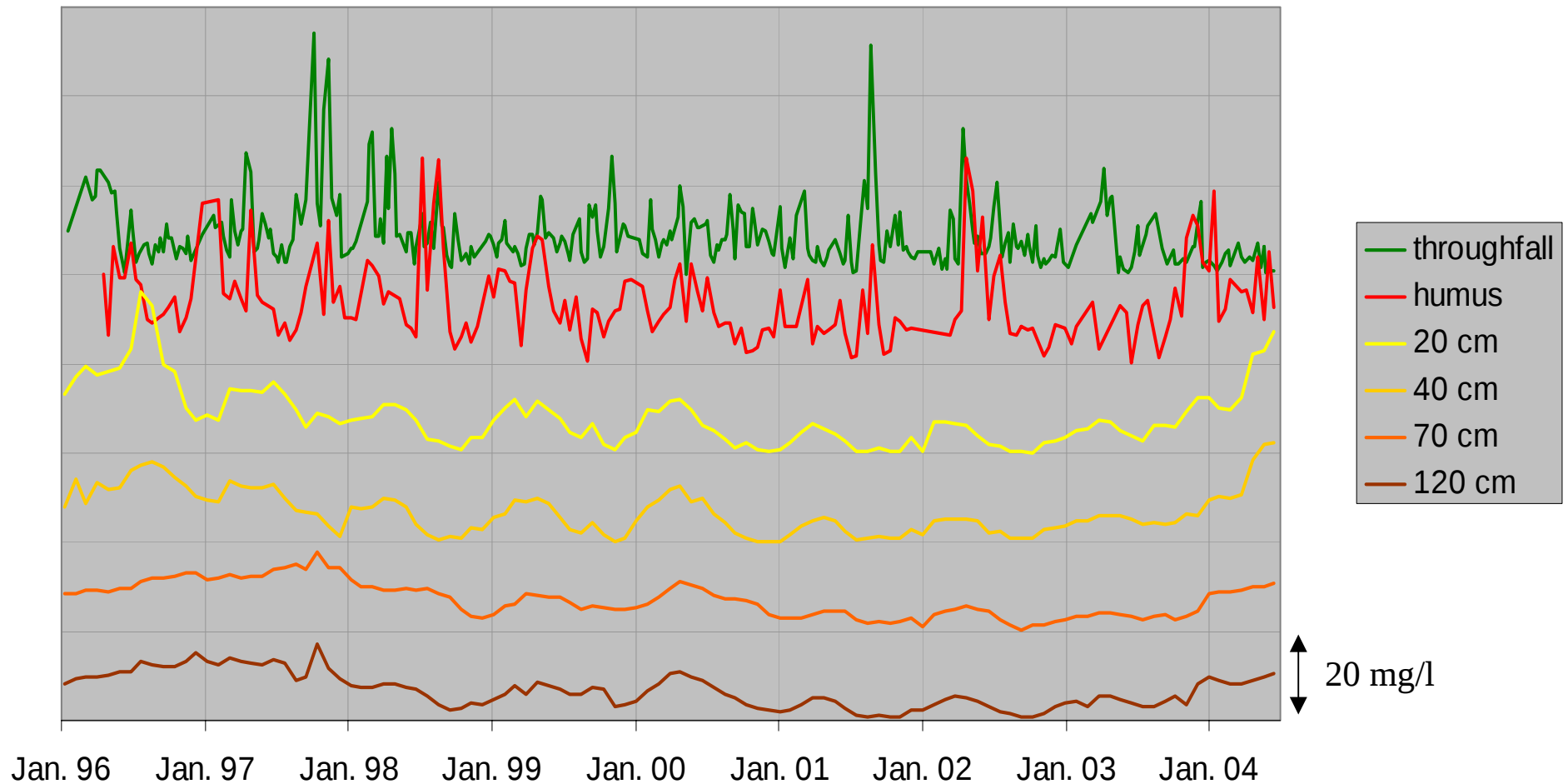
Time series WUE 30 cm depth



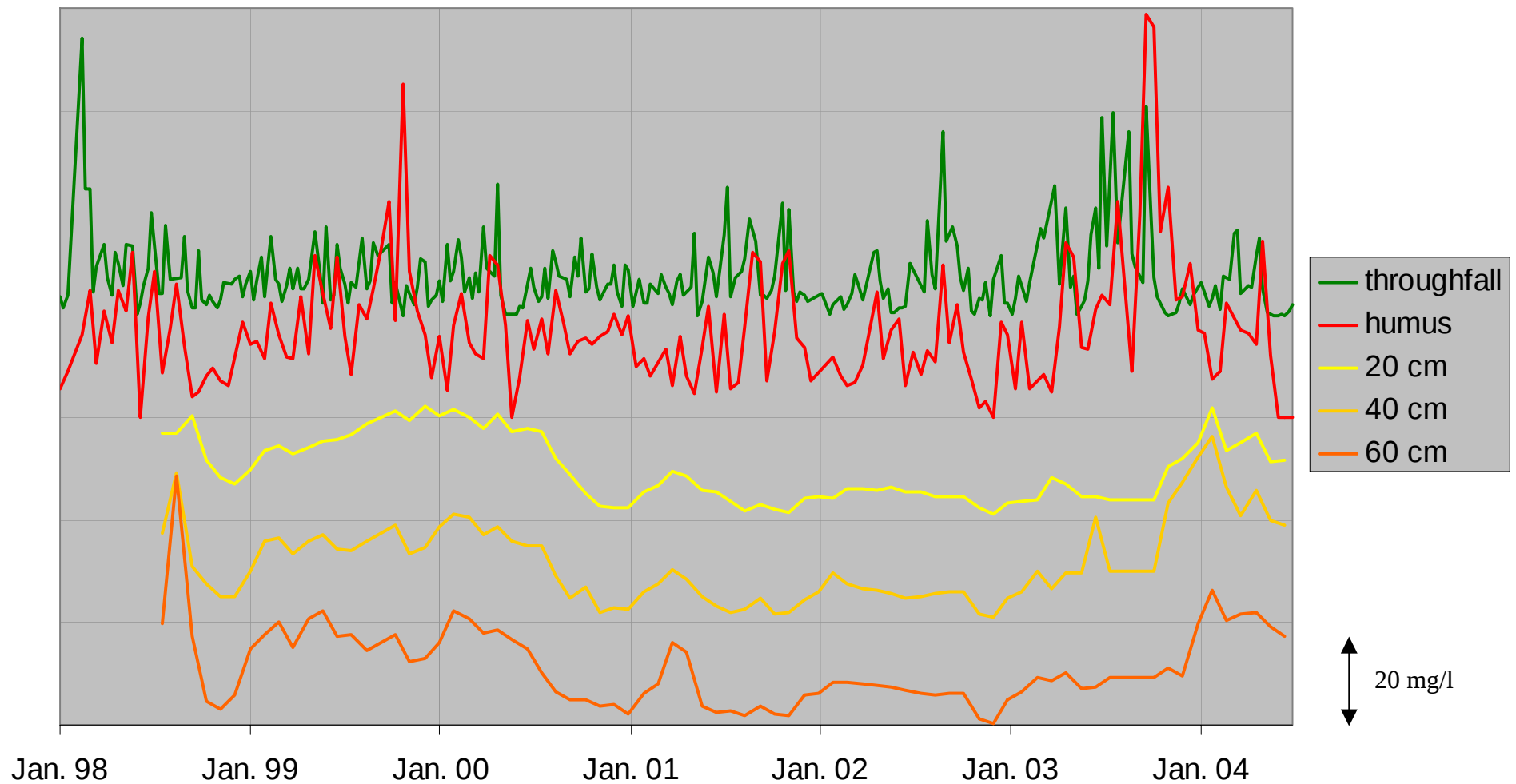
Time series AOE 30 cm depth



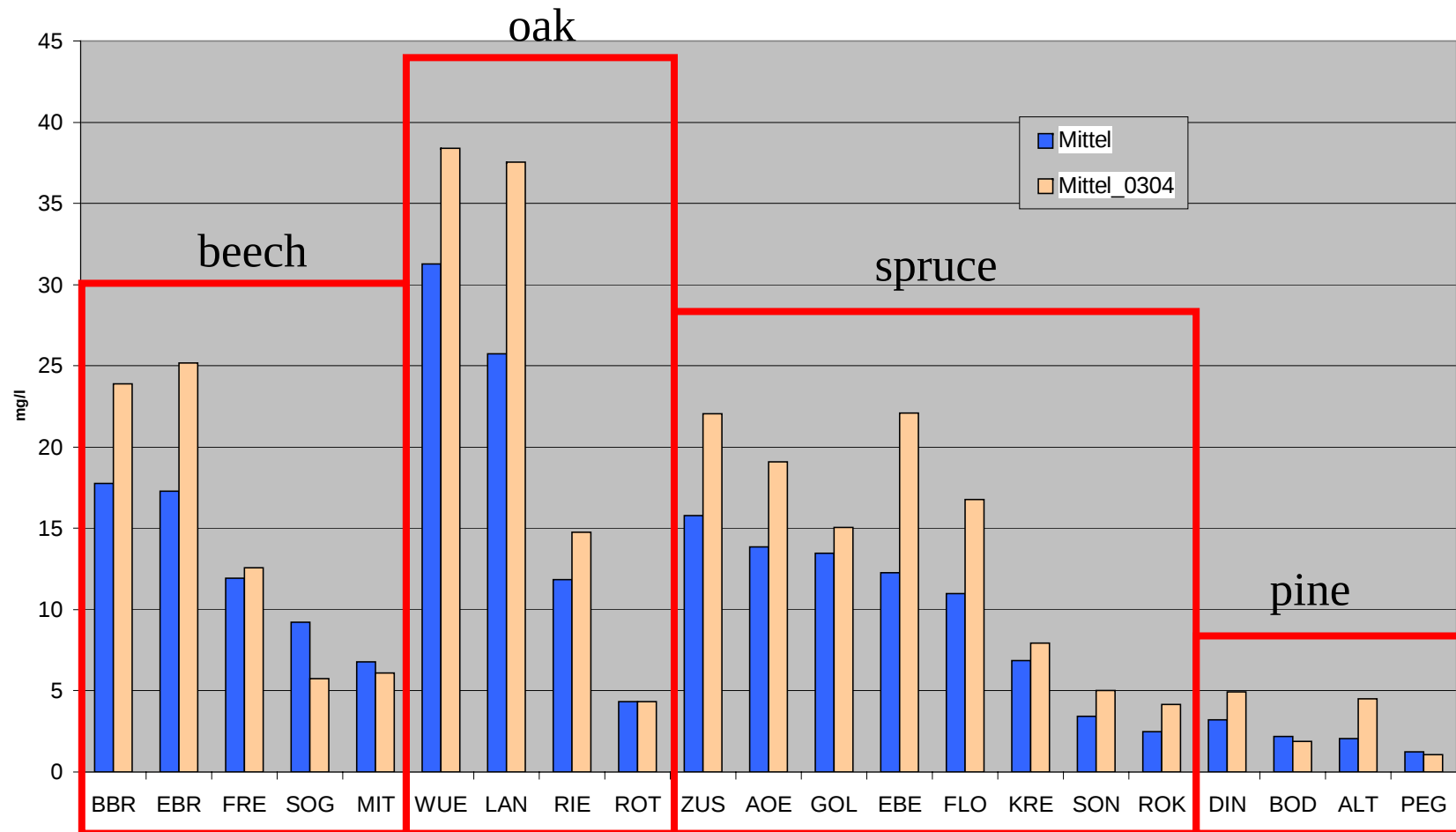
NO_3^- concentration at spruce site Goldkronach



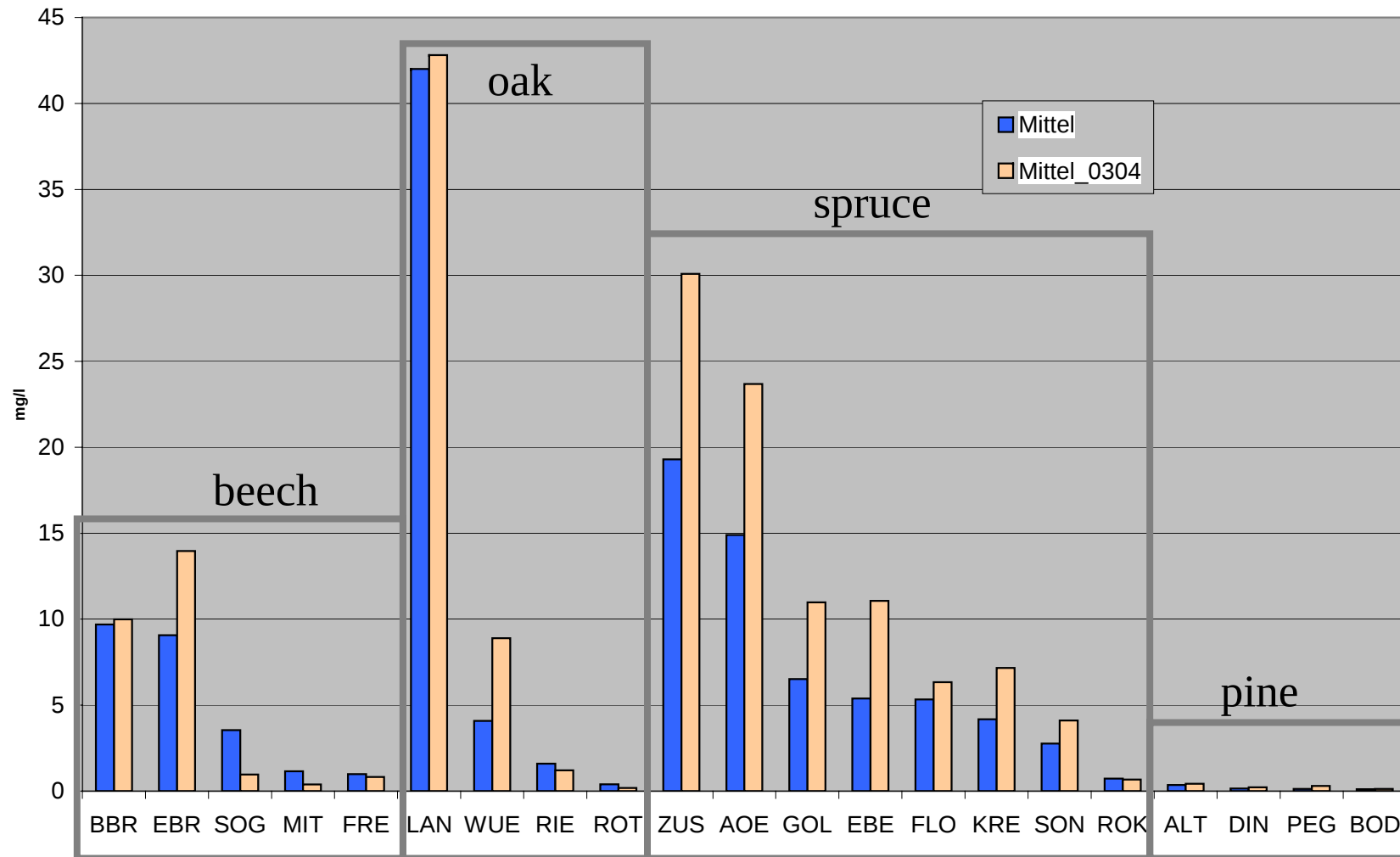
NO₃⁻ concentration at beech site Bad Brückenau



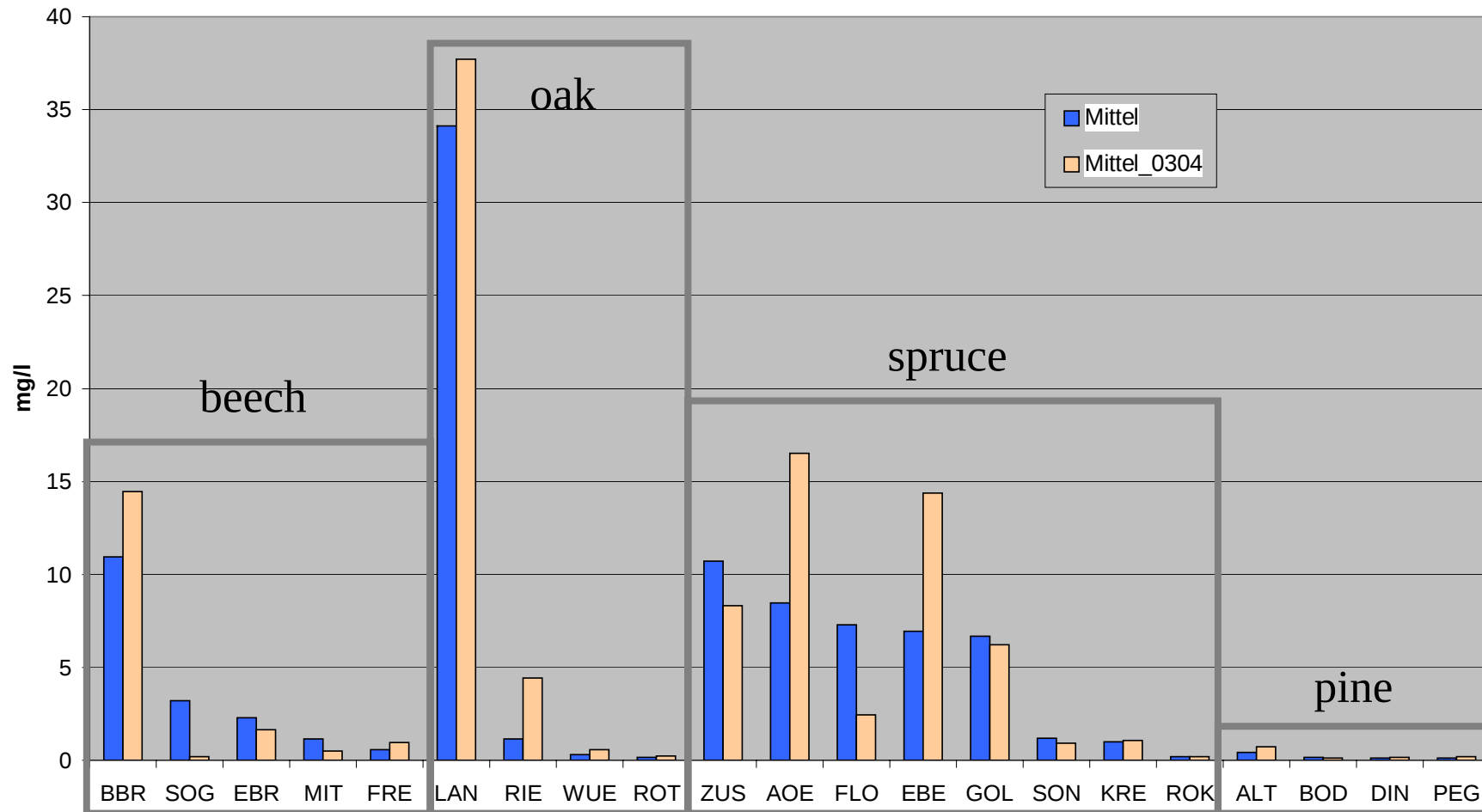
NO_3^- concentration (mg/l) in the forest floor: long-term average vs. 7/2003 - 6/2004 mean



NO₃⁻ concentration (mg/l) of the upper soil layer: long-term average vs. 7/2003 - 6/2004 mean



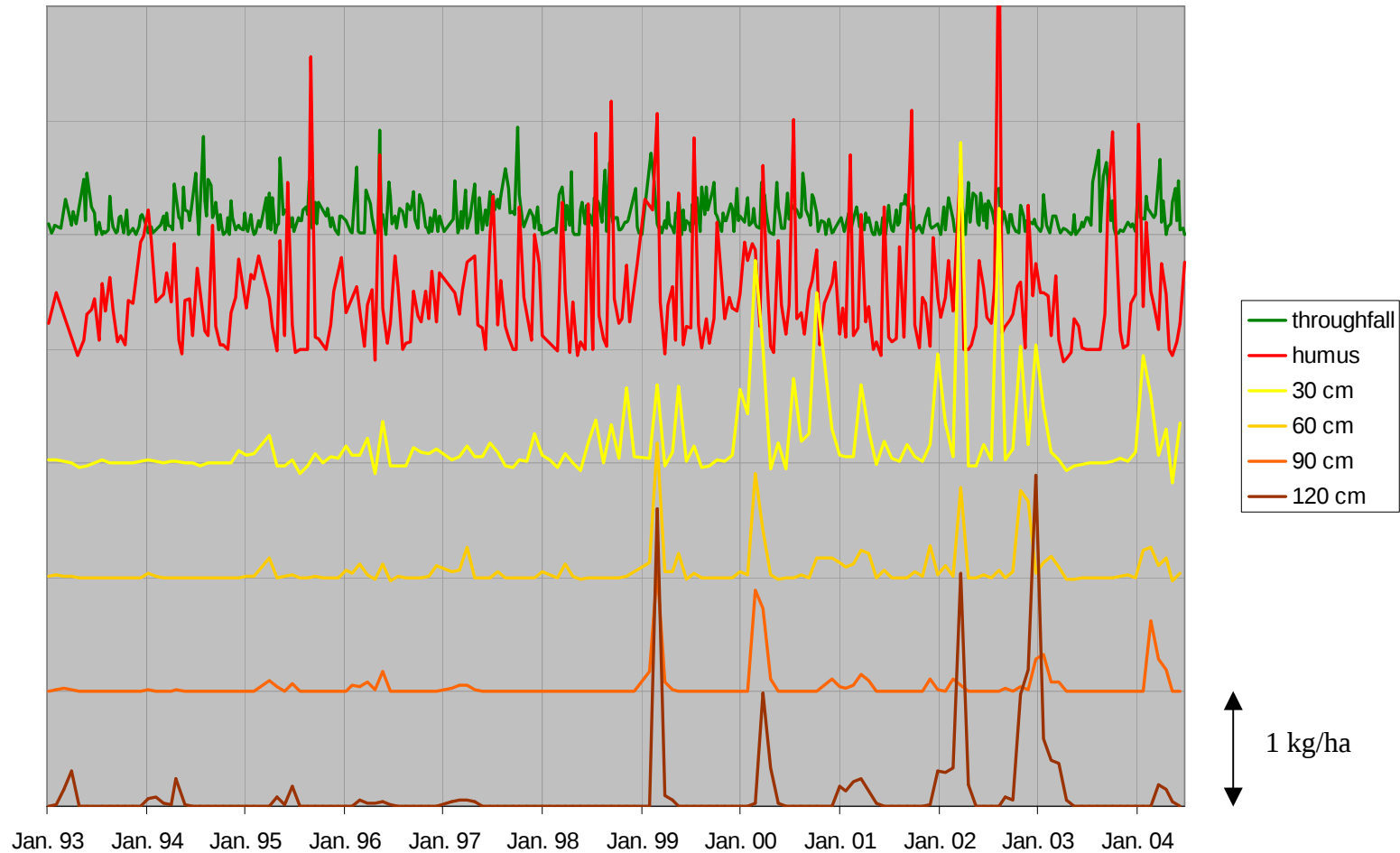
NO_3^- concentration (mg/l) of the subsoil: long-term average vs. 7/2003 - 6/2004 mean



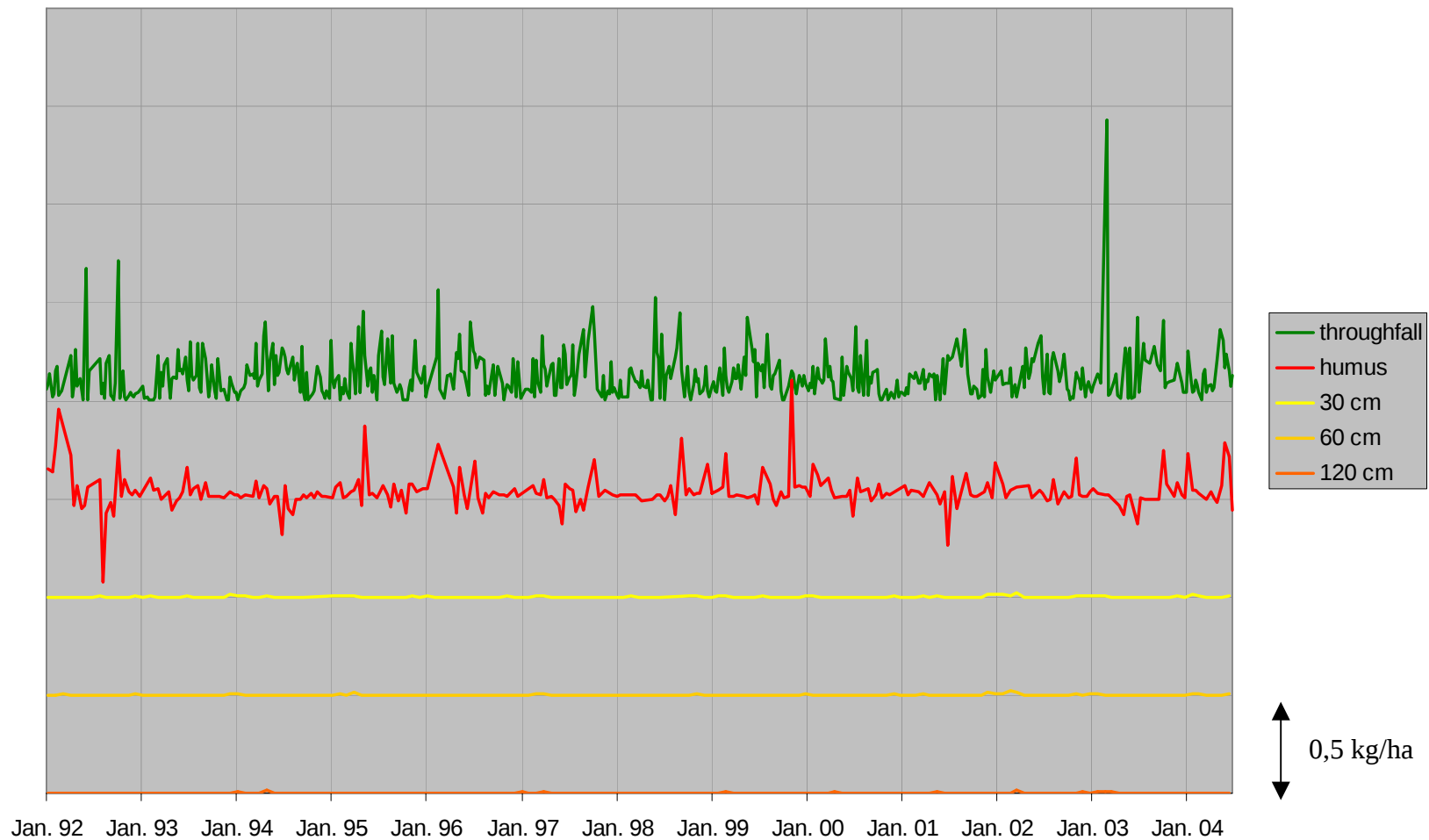
Deduction of element fluxes

- Forest floor: concentration of two-weekly samples and two-weekly modelled seepage sums (LWF-BROOK90)
- Mineral soil: concentration of 4-weekly samples and four-weekly modelled seepage sums (suction cups with one week of vacuum pressure)

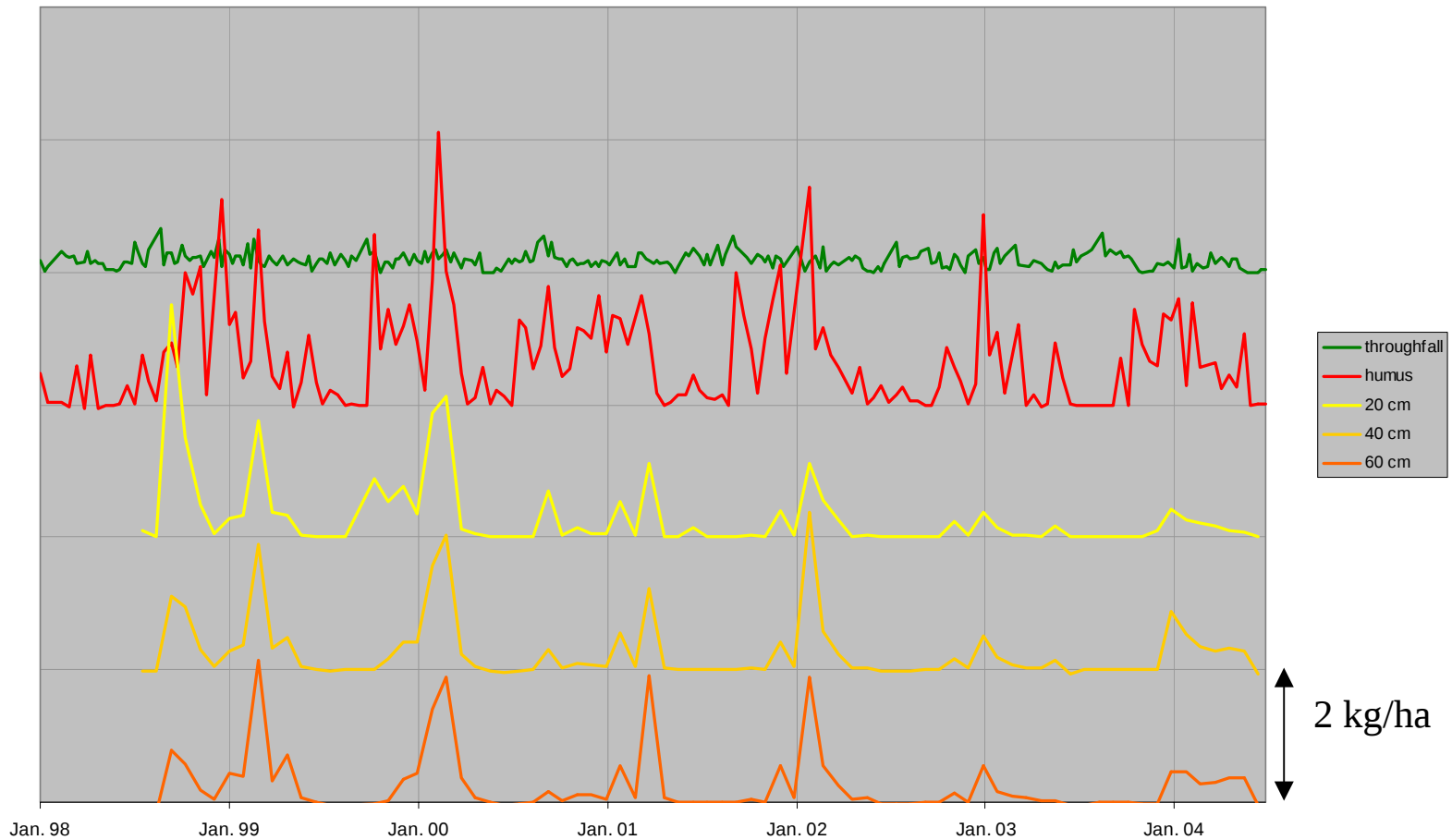
Time series NO_3^- -N kg/ha AOE



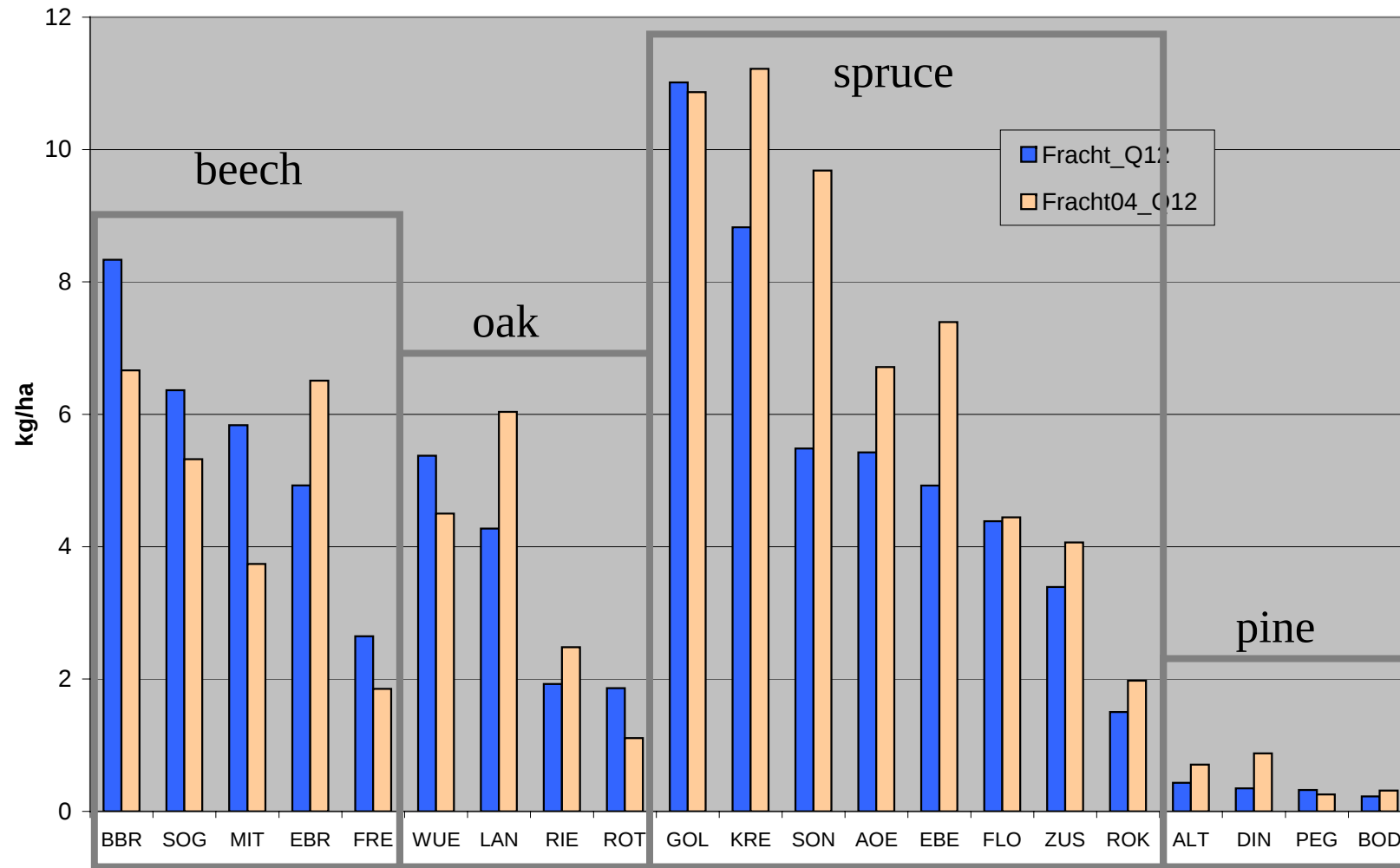
Time series NO_3^- -N kg/ha DIN



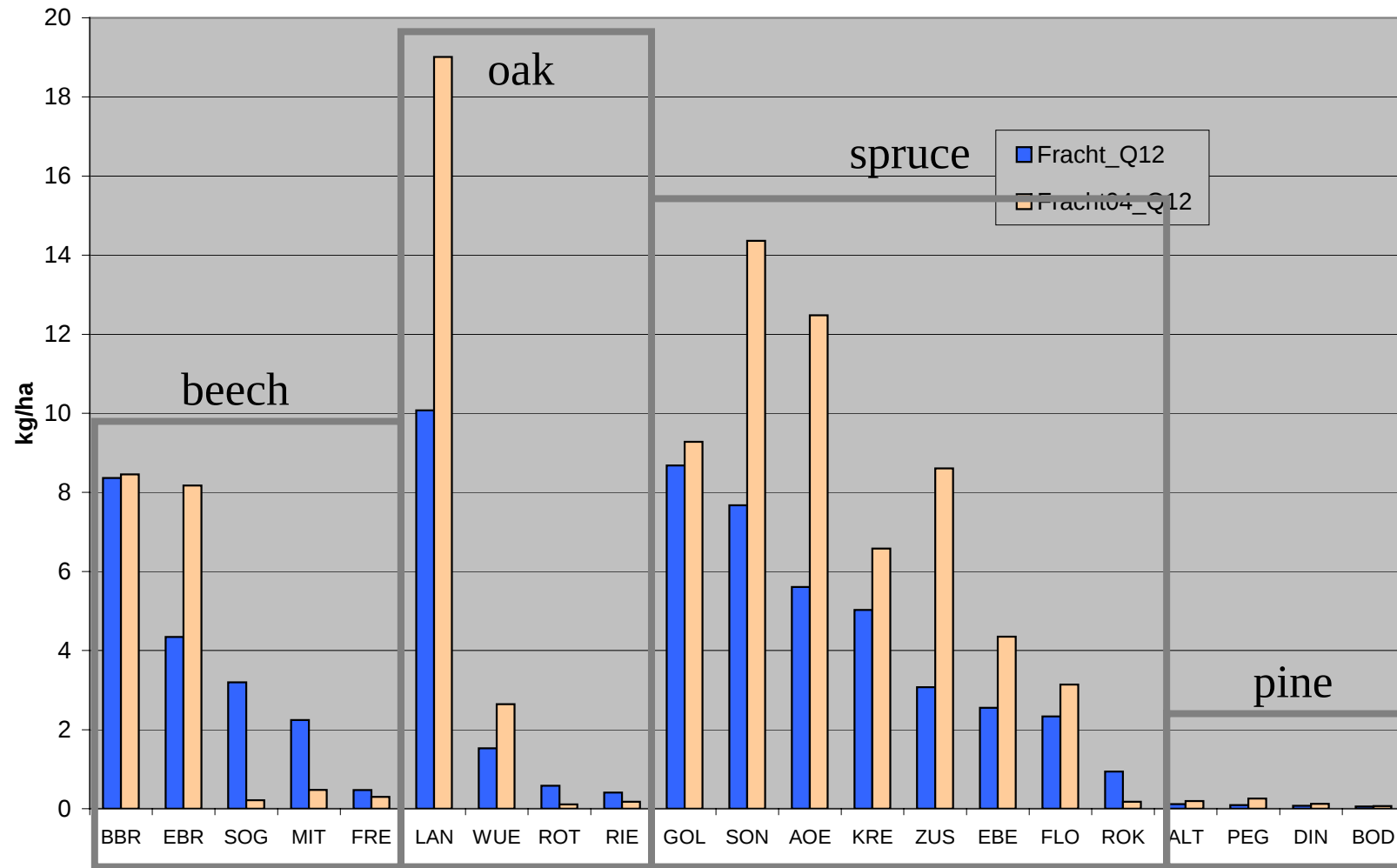
Time series NO_3^- -N kg/ha BBR



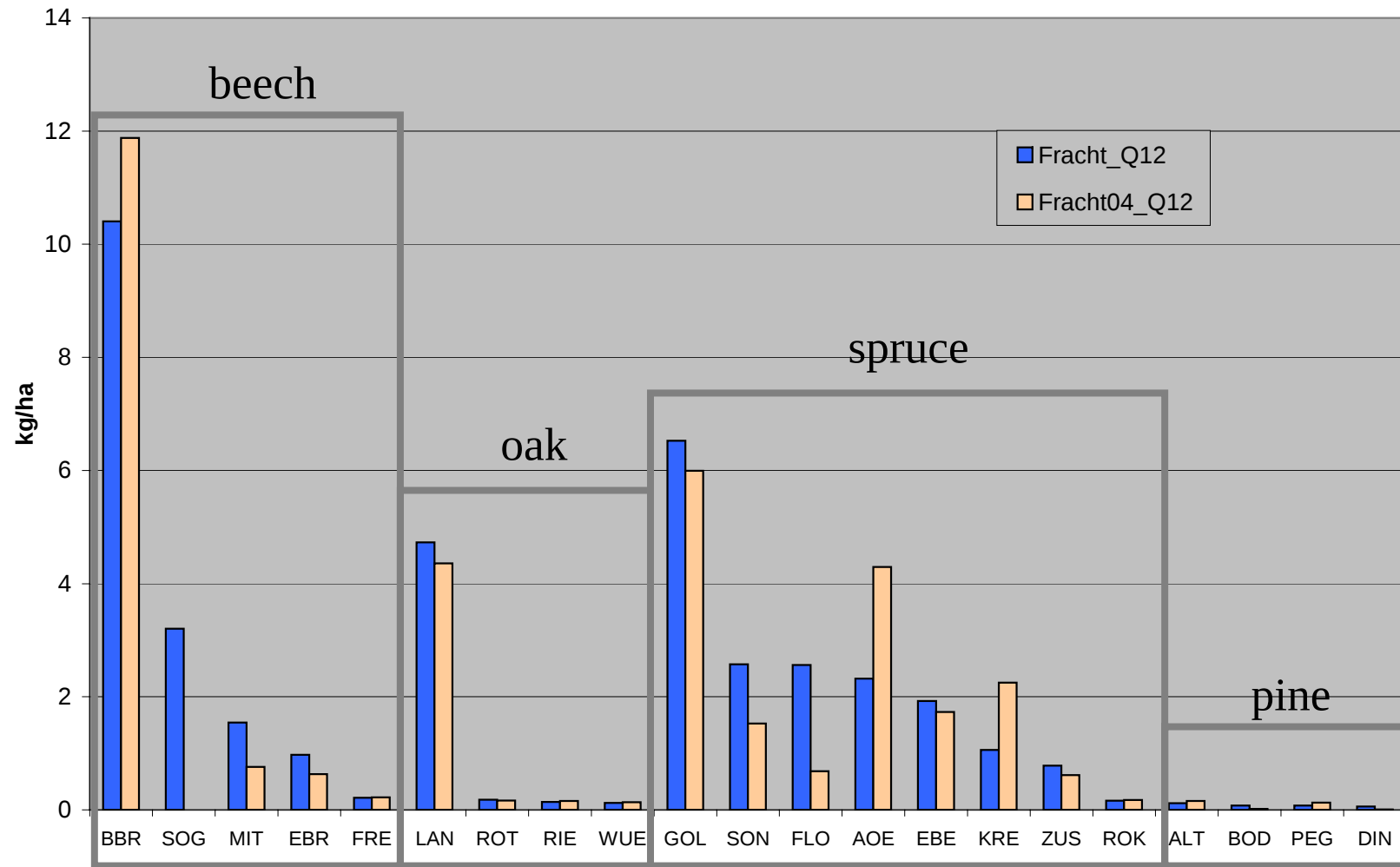
NO₃-N-fluxes in forest floor: sums of 1. and 2. quarter long-term average vs. 2004



NO₃-N-fluxes in upper soil layer: sums of 1. and 2. quarter long-term average vs. 2004



NO₃-N-fluxes deeper soil layer: sums of 1. and 2. quarter long-term average vs. 2004



Conclusions

- Increased concentrations during and after drought
- Increased fluxes after drought
- No leaching till June, 2004
- Spruce: reactions in all layers
- Pine: forest floor remains as a sink
- Oak and beech: indifferent reactions

Outlook

- Linking element concentrations and fluxes with soil temperatures and soil moisture
- Linking different fluxes (water, litter, uptake, leaching)
- Comparison of soil solution chemistry and tree nutrition