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Soil scarification induced nitrate leaching through podzolic soil at a clear-cut area

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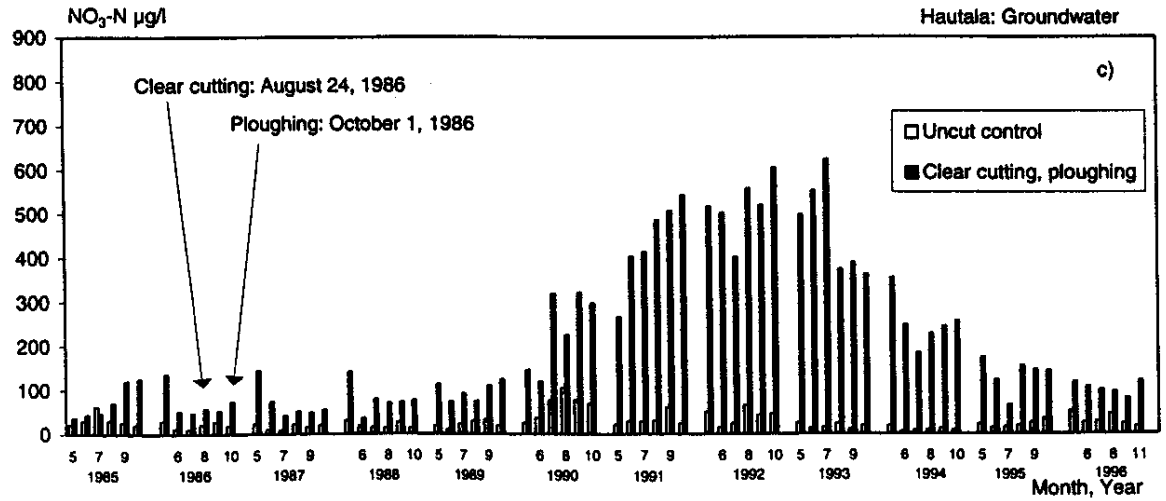
Background

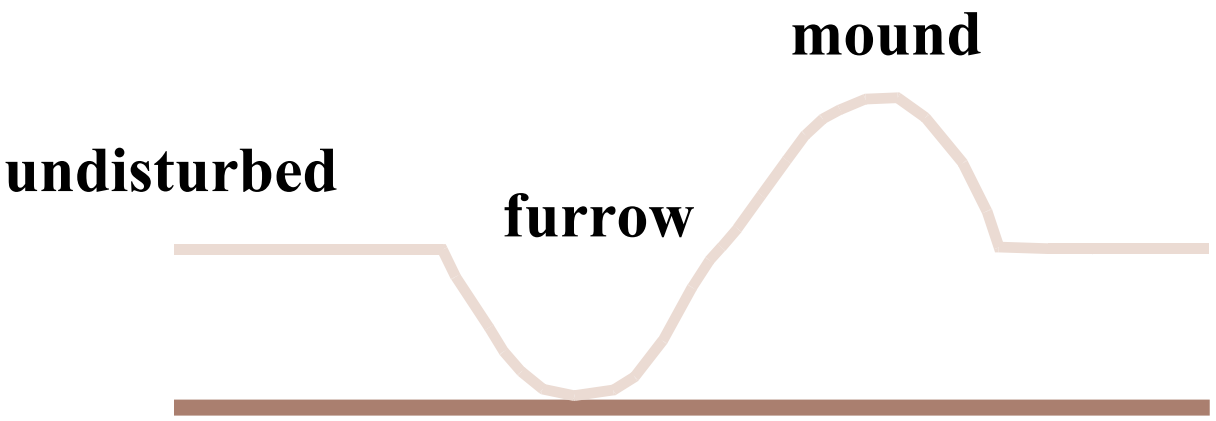
- N is a limiting nutrient also in water ecosystems
- previous studies: increased and long lasting leaching of NO_3 after forestry operations



Kubin 1998

Aims

- ✓ is NO_3 leaching induced by soil scarification
- ✓ which surfaces are ”key” places
- ✓ how large is the flux through the soil profile



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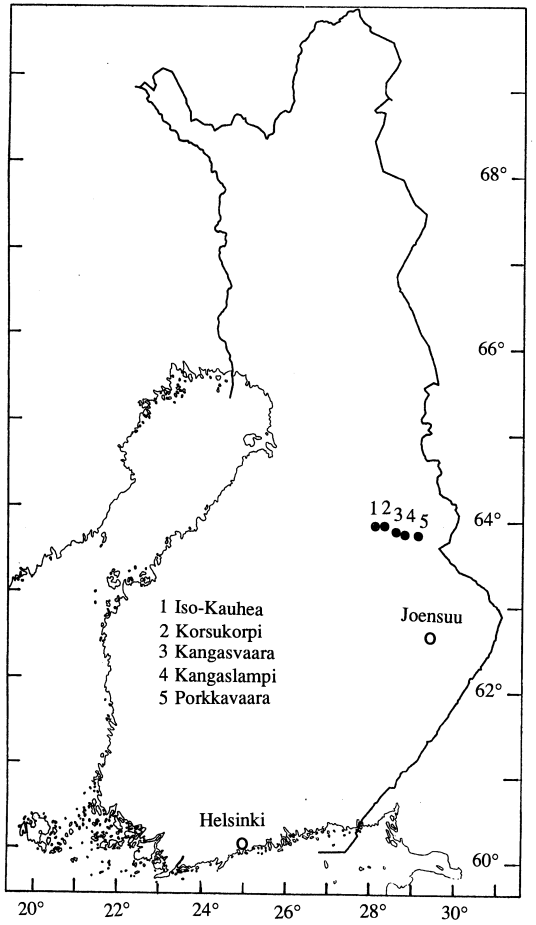
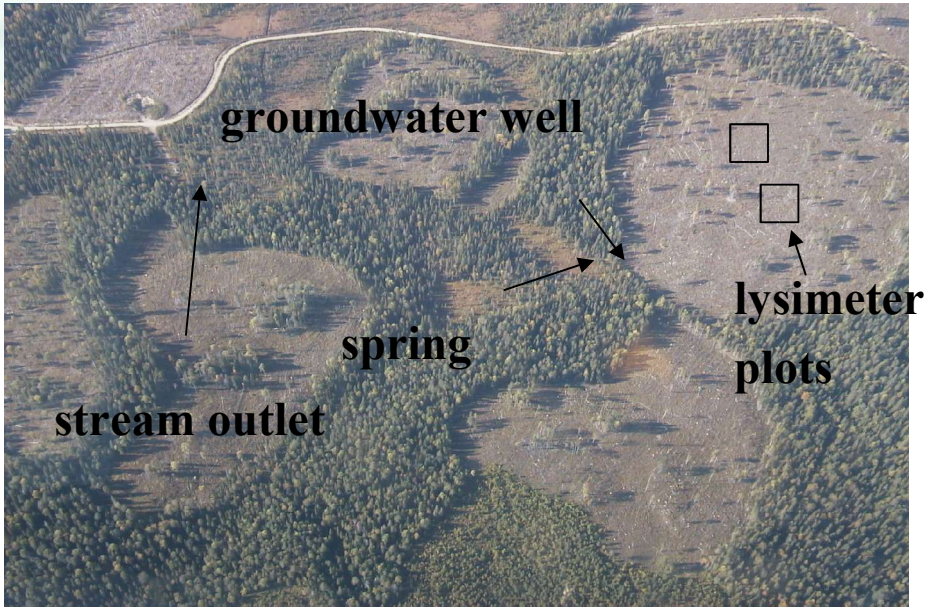
Study area Kangasvaara
220 m a.s.l





Climatic properties 1971-2000:

- annual precipitation 564 mm (40 % as snow)
- mean annual temperature +1.9 °C
- temperature sum 1055 °C (>+5 °C)

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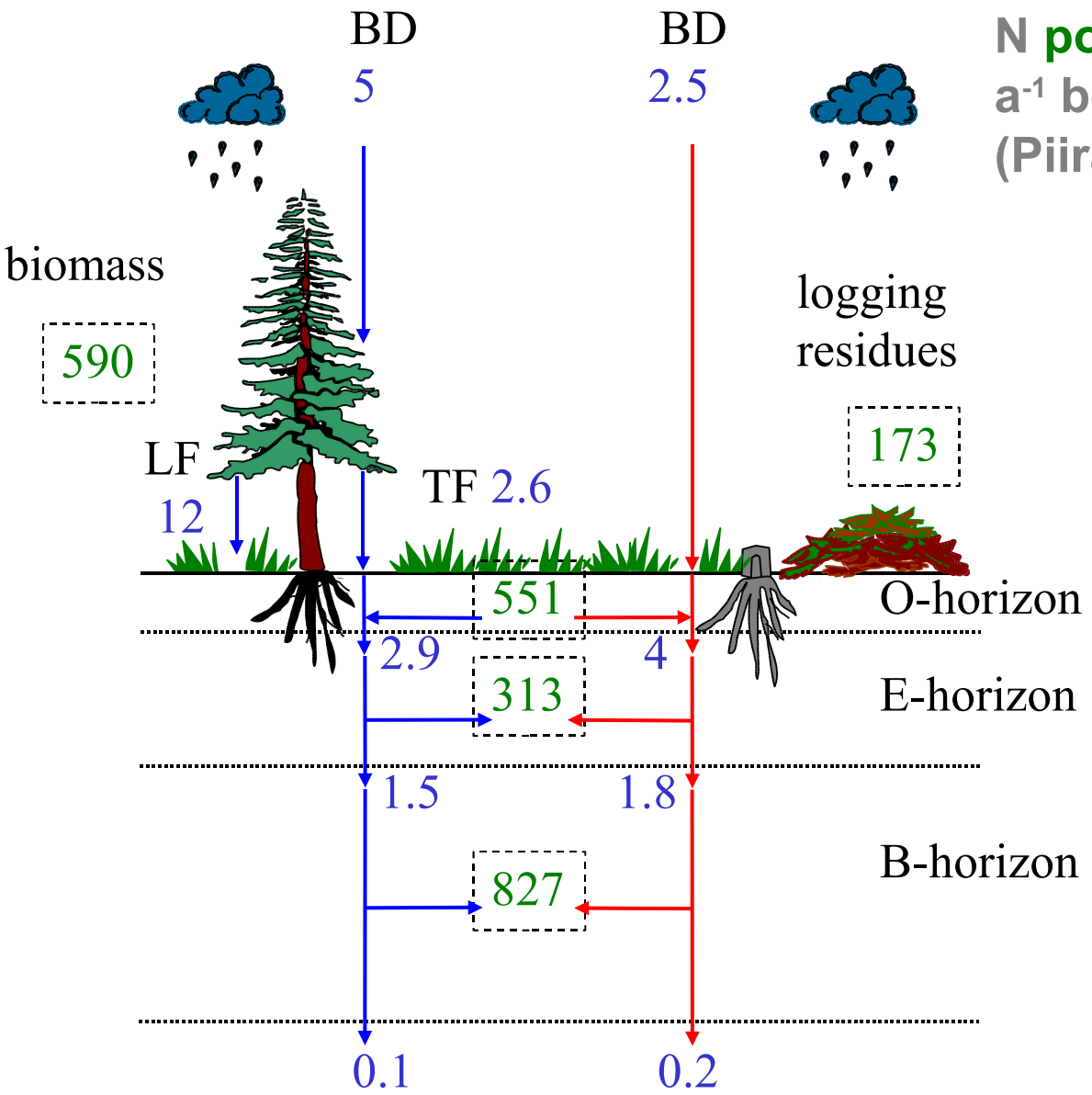


N pools and fluxes kg ha^{-1} a^{-1} before soil scarification (Piirainen et al. 2002)

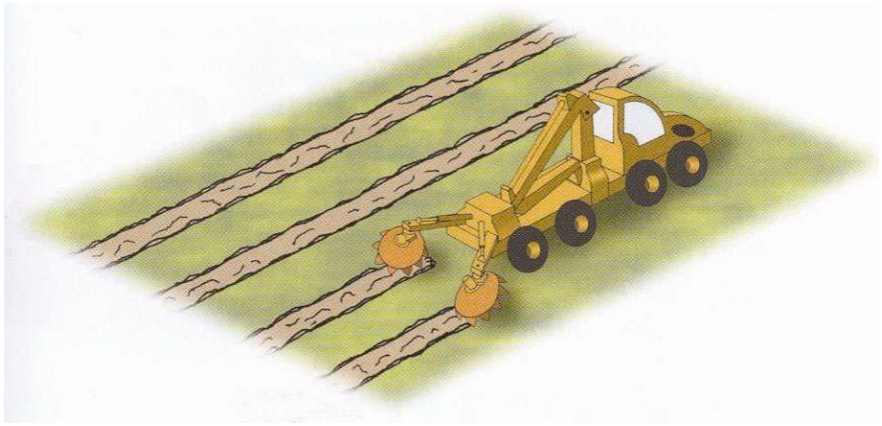
Forestry operations

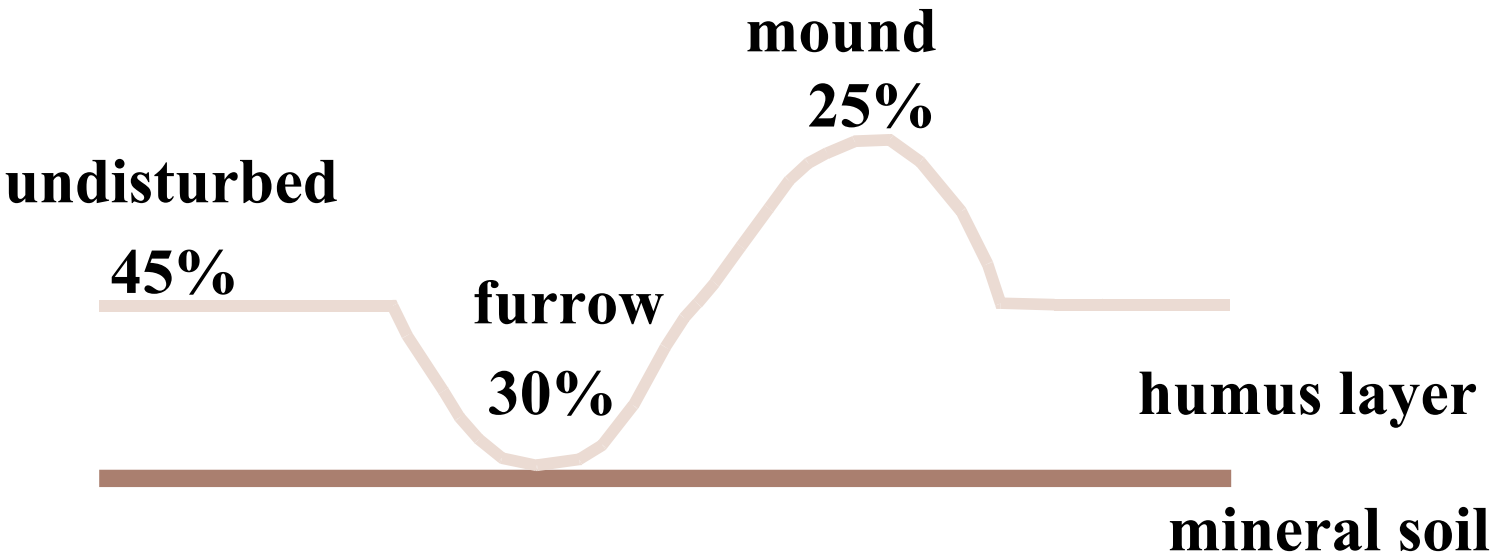
- stem only clear-cutting on September 1996
- soil scarification on August 1998
- pine planting on June 1999

Study methods

- zero tension lysimeters installed under the O-, E- and B-horizons on mound, furrow and undisturbed surfaces (9 subplots on both sample plots)
- soil water collecting in 1999-2003
- spring water sampling in one spring
- ground water sampling in one well

soil surface after scarification





NO_3-N µg L^{-1}

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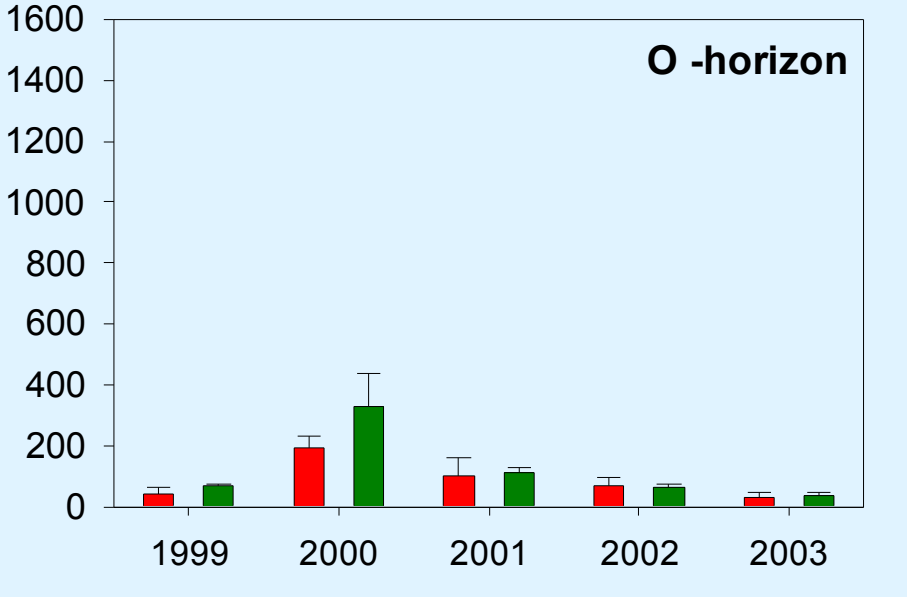

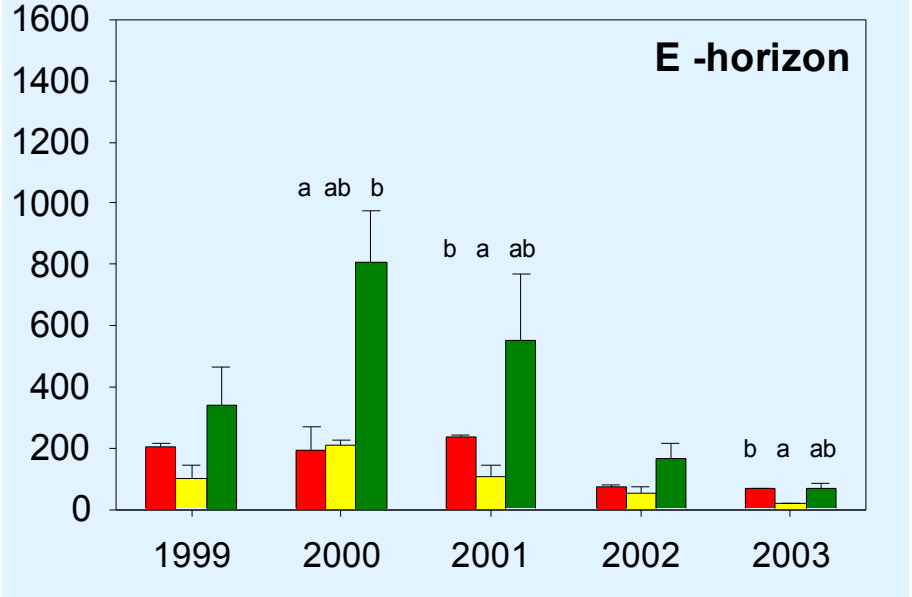

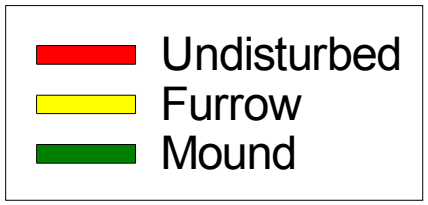

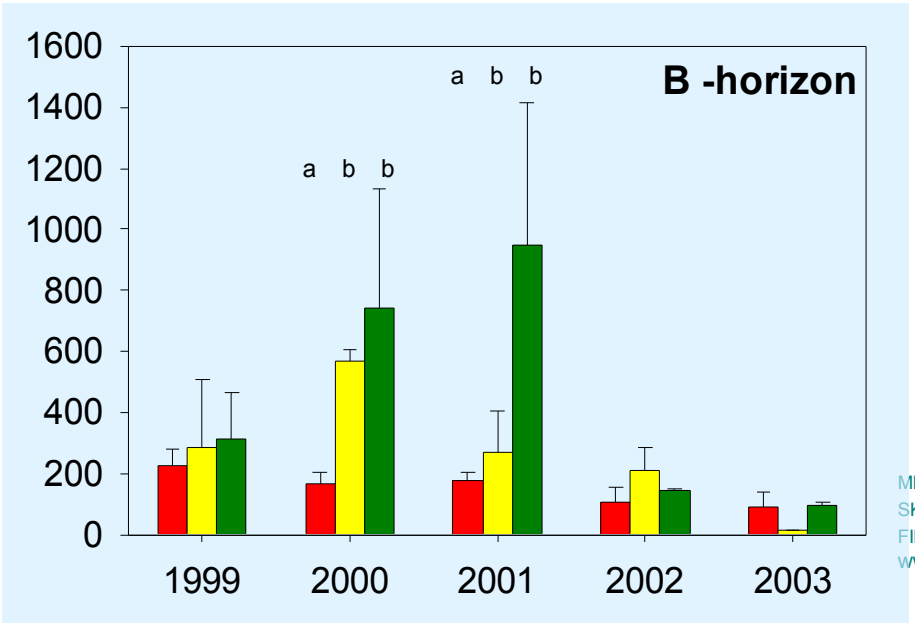

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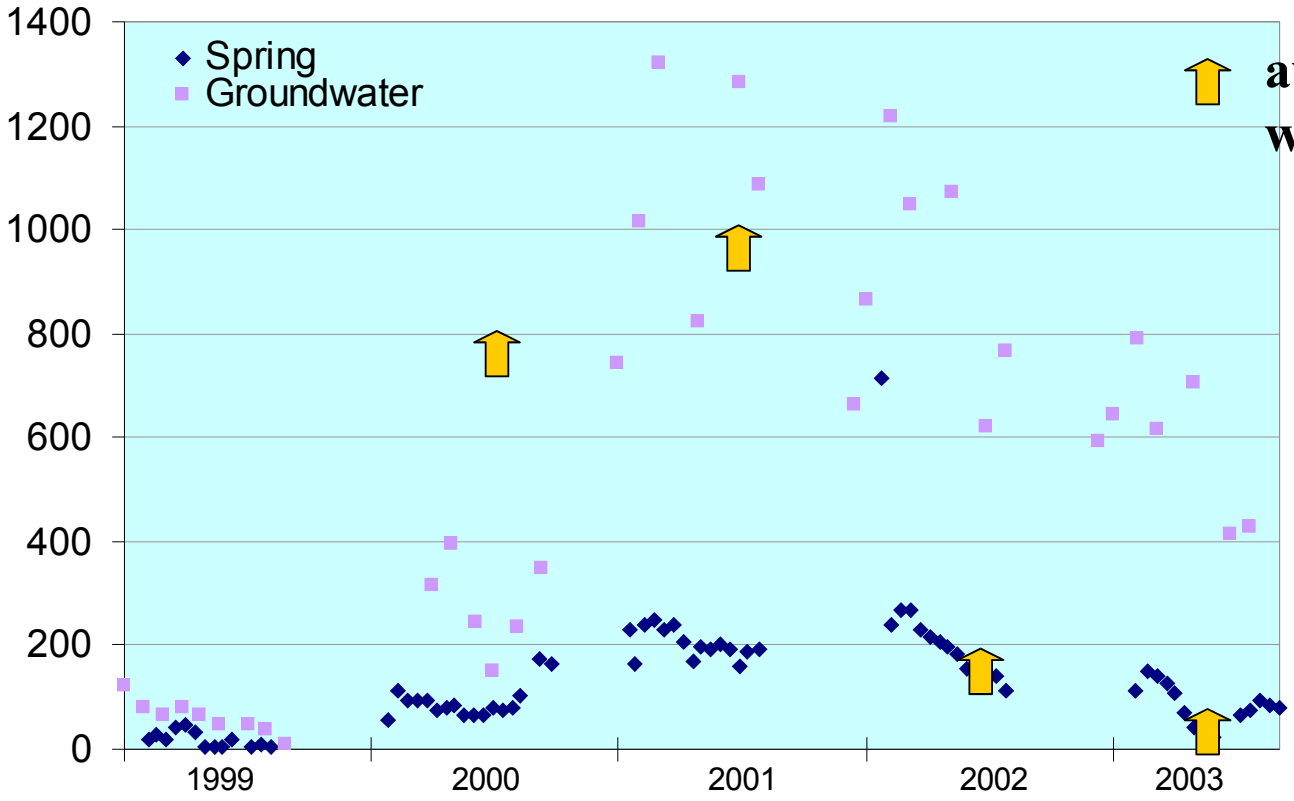
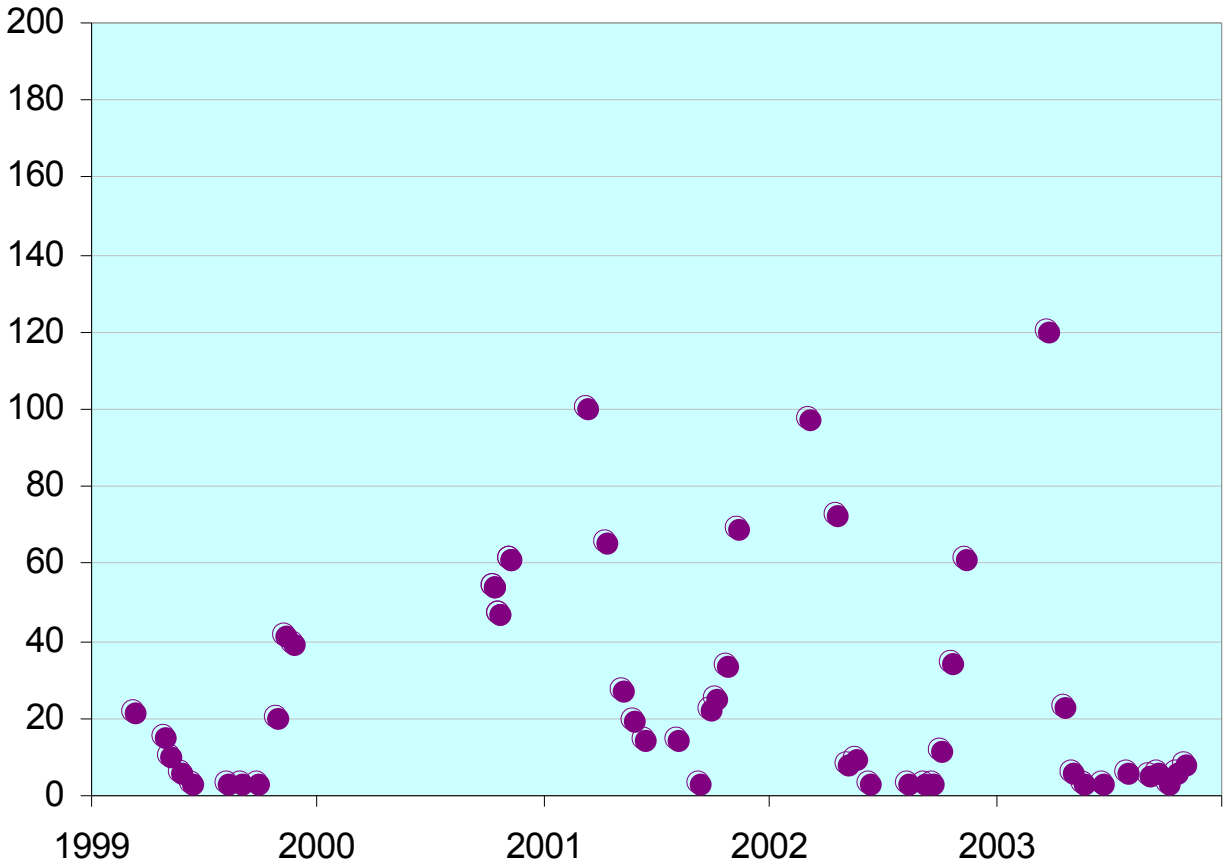


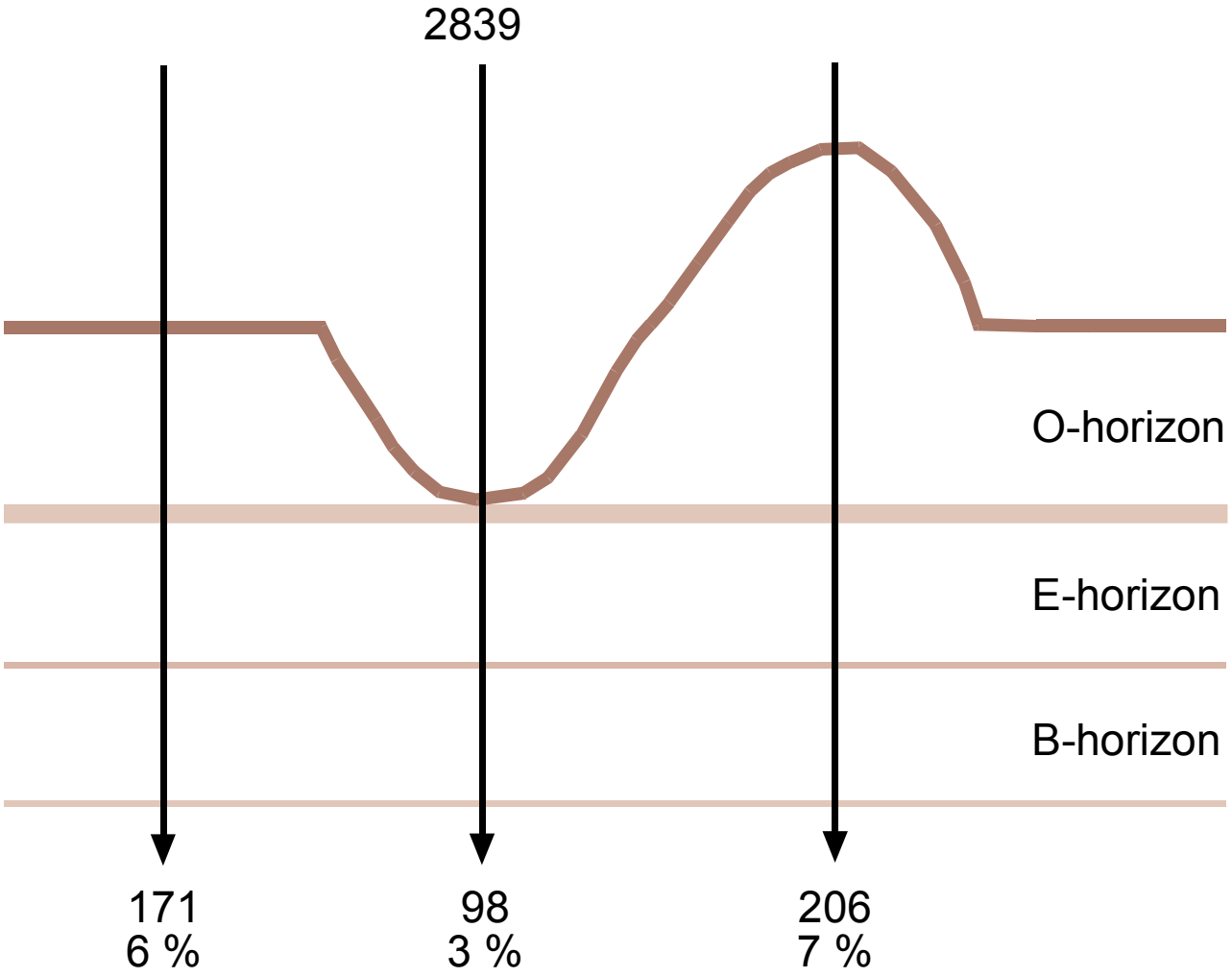
EU criterion for drinking water: <11 200 µg L^{-1}

NO_3-N conc. in stream µg L^{-1}

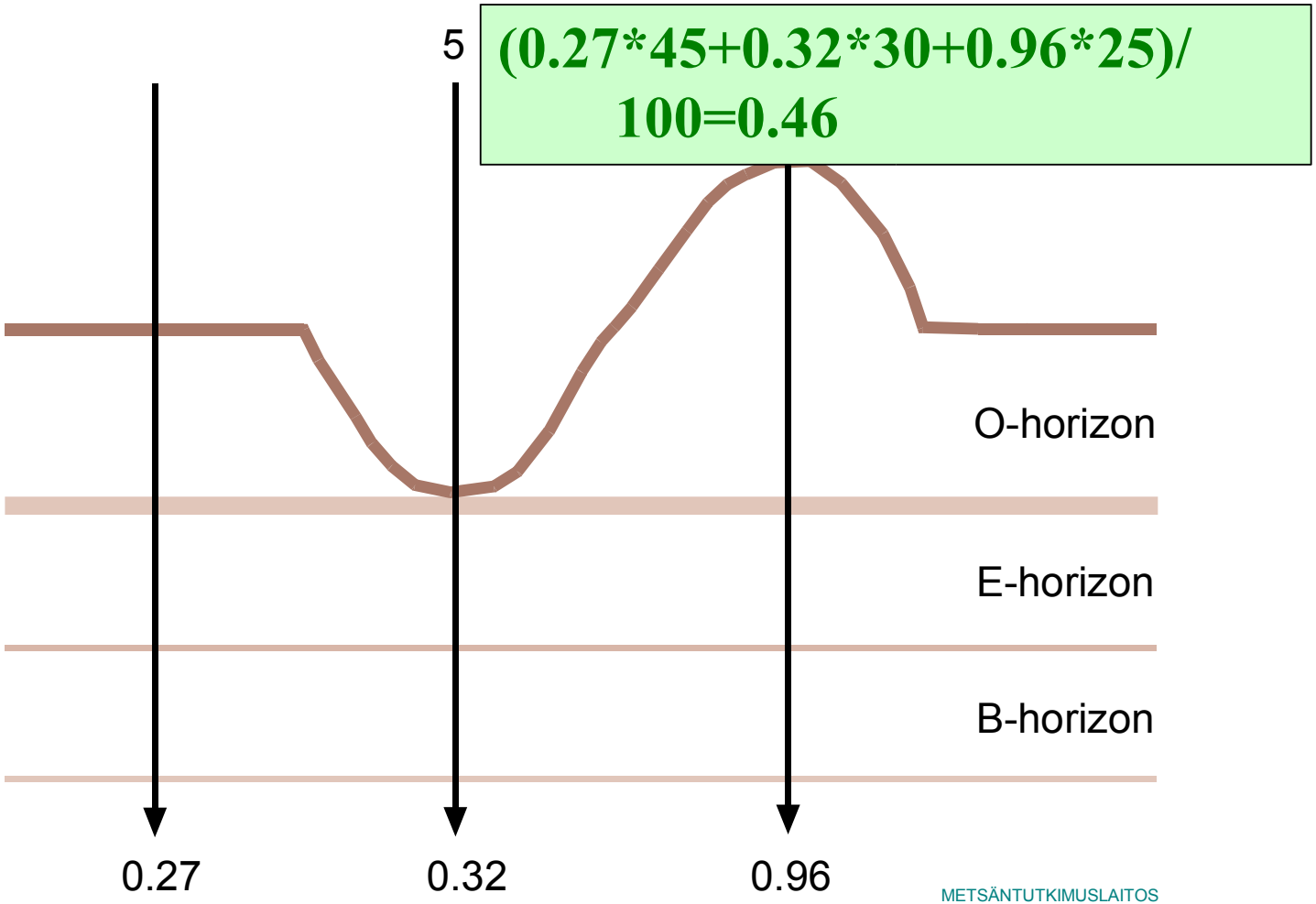


Ahtiainen et al. unpublished data

Sum of water flux, mm, in 1999-2003



Sum of NO_3-N flux, kg ha^{-1}, in 1999-2003



Conclusions

- soil scarification induces nitrate formation especially in mounds
  - ✓ logging residues
  - ✓ temperature
  - ✓ moisture
- the influence is short-termed (3-4 years) to soil percolate quality
- contamination of groundwater is delayed and lasts longer
- if the proportion of scarified surface is small the leaching of NO_3-N is also small from the whole managed area
- conclusion are valid only for N-limited forest ecosystems