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Exceedances of critical limits of nitrogen in European soils

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The project coordination centre is situated at the Institute for World Forestry, Hamburg, Germany.



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Methods
Collector: lysimeter



- In total > 2000 lysimeters in more than 300 plots
- Different kind of forests on different kind of soils → different critical limits on different plots

Table 5-1: Specific critical limits for nitrogen concentration in soil solution in different forest types (UNECE, 2007)

Effect	Chemical Criterion	Receptor
Nutrient imbalances	> 0.2 mg N / 1 soil solution	Coniferous forests
	> 0.4 mg N / 1 soil solution	Deciduous forests
Elevated N leaching / N saturation	> 1 mg N / 1 soil solution	All forest types
Reduced fine root biomass / root length	1 – 3 mg N / 1 soil solution	All forest types
Enhanced sensitivity to frost and fungal diseases	3 – 5 mg N / 1 soil solution	All forest types

- In total > 2000 lysimeters in more than 300 plots
- Different kind of forests on different kind of soils → different critical limits on different plots
- Maps represent frequency of exceedances of critical limits (instead of absolute concentrations)
- Lysimeters on different depths on different soil types →
 - Aggregation into three classes:
 - Organic layer (7% of the samplers)
 - Mineral topsoil (0-40 cm depth, 51%)
 - Mineral subsoil (>40 cm, 42 %)



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Results

CLimE for: nutrient imbalances (>0.2 / 0.4 mg^l-1)



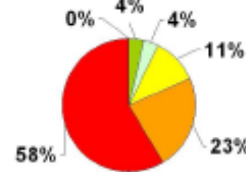
proportion, e.g.
<5% or ≥95%, of
the measurements
that have exceeded
the CLimE



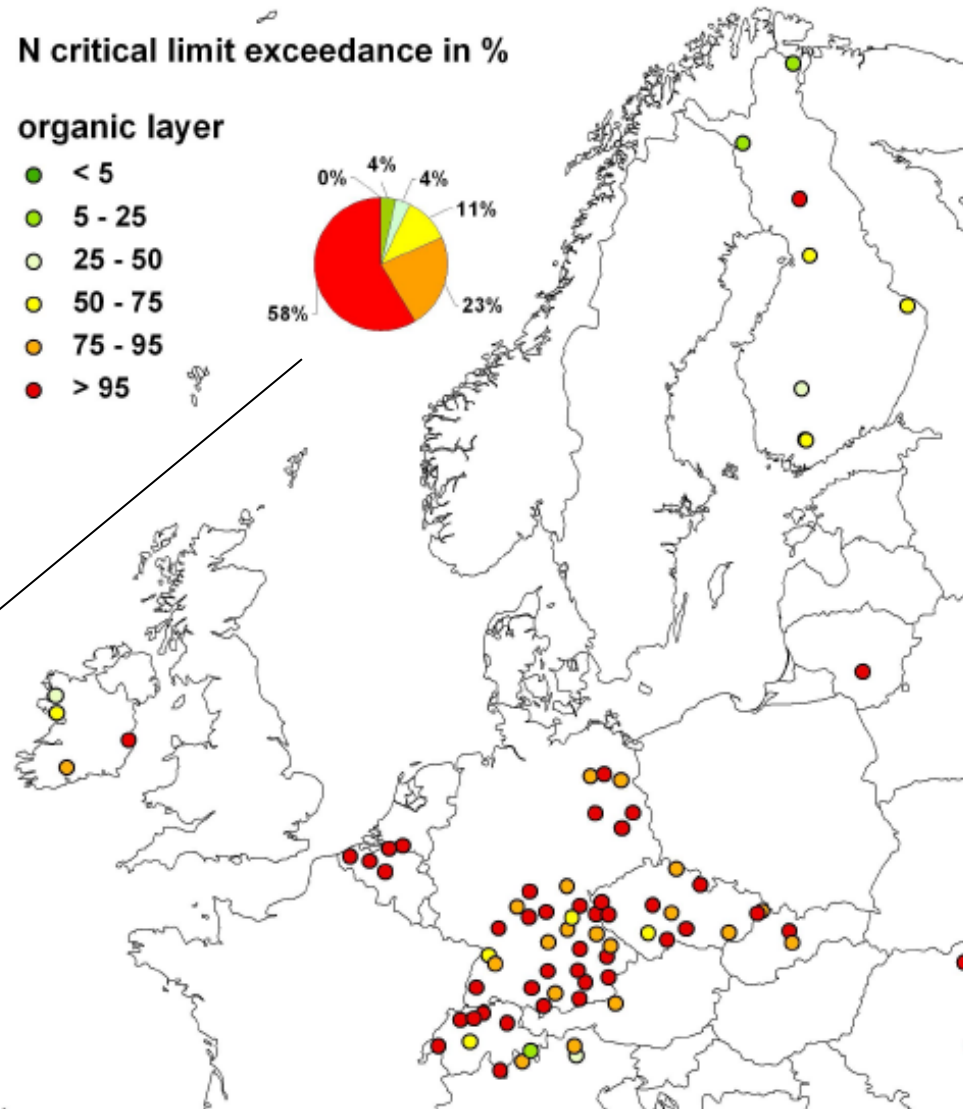
N critical limit exceedance in %

organic layer

- < 5
- 5 - 25
- 25 - 50
- 50 - 75
- 75 - 95
- > 95



proportion of the
plots that belong
to the six
categories

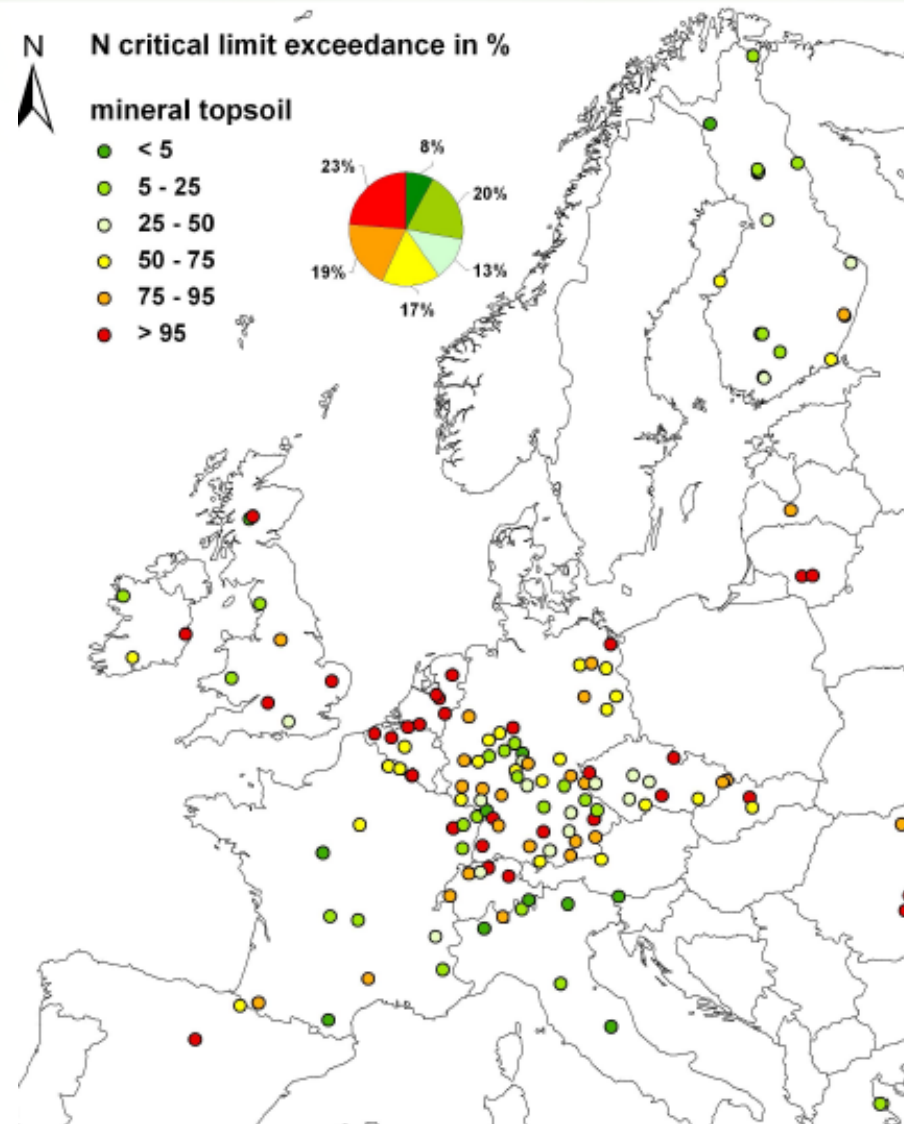




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Results

CLimE for: nutrient imbalances (>0.2 / 0.4 mg^l-1)

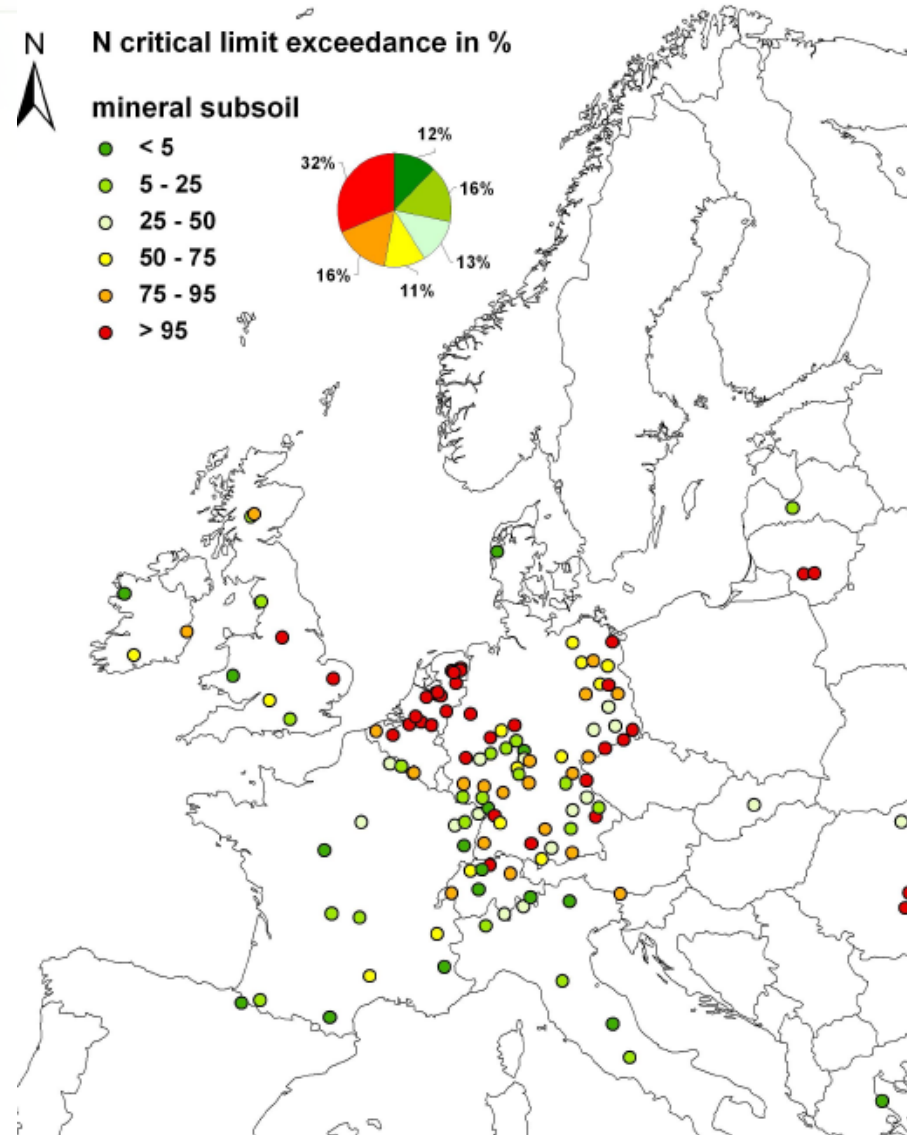




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Results

CLimE for: nutrient imbalances (>0.2 / 0.4 mg l⁻¹)





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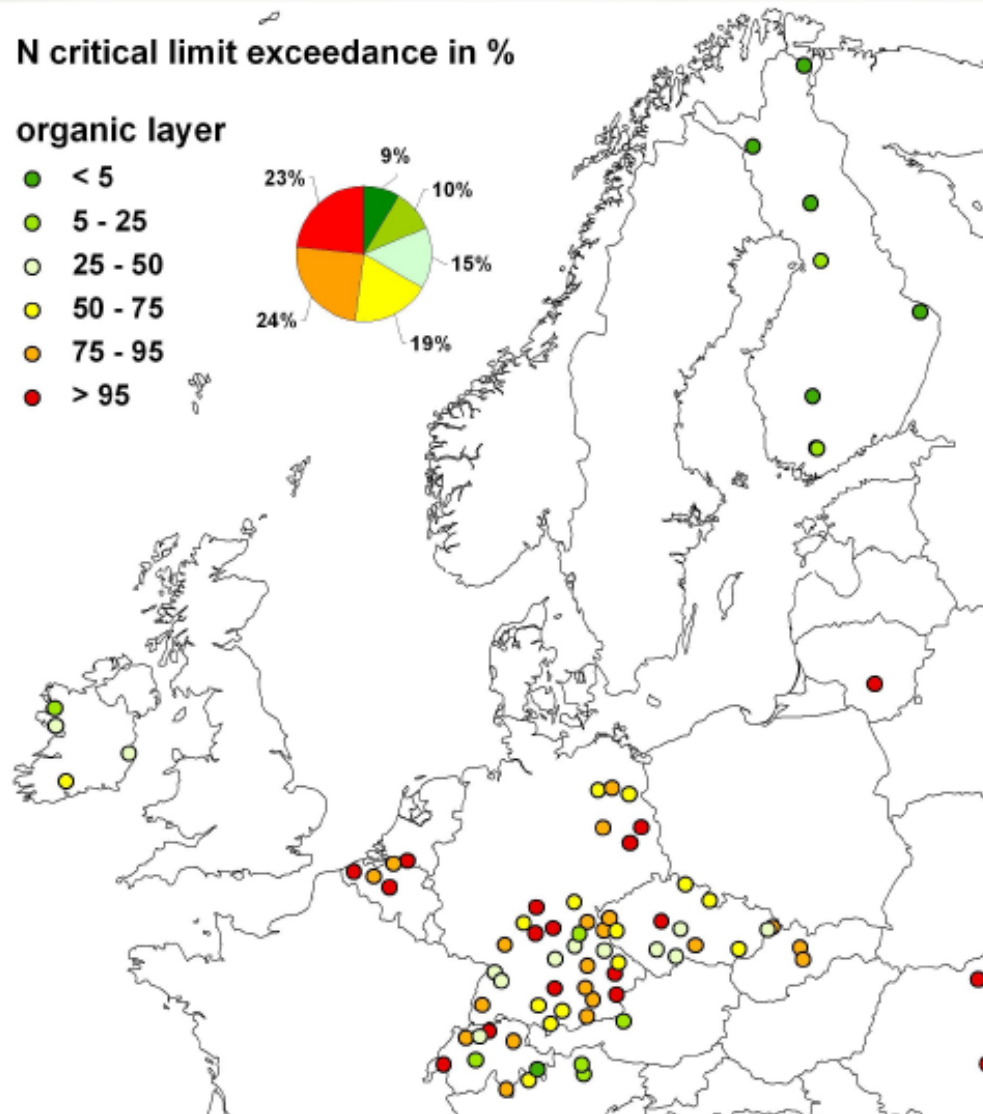
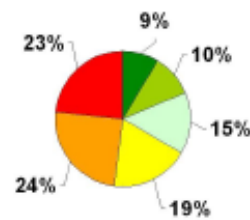
CLimE for: N leaching / saturation (>1 mg^l-1)



N critical limit exceedance in %

organic layer

- < 5
- 5 - 25
- 25 - 50
- 50 - 75
- 75 - 95
- > 95

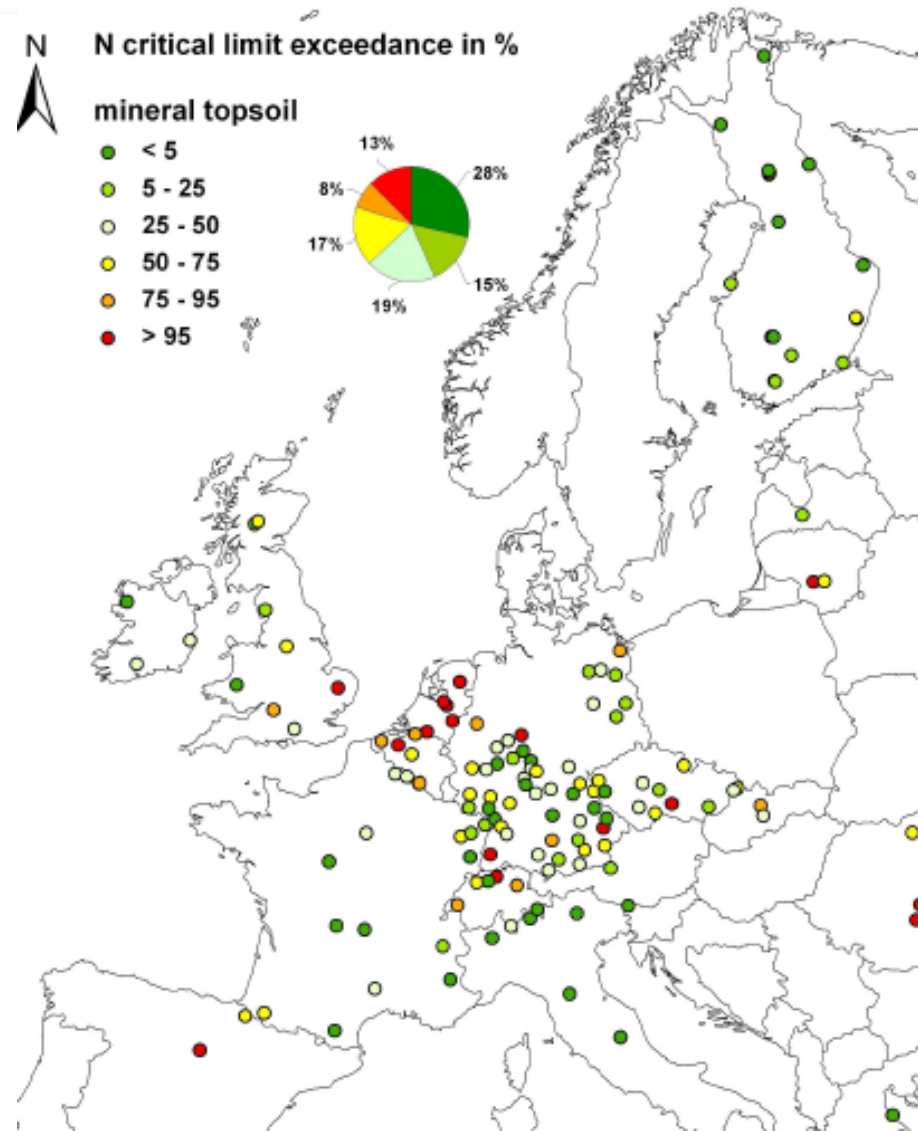




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CLimE for: N leaching / saturation (>1 mg l⁻¹)

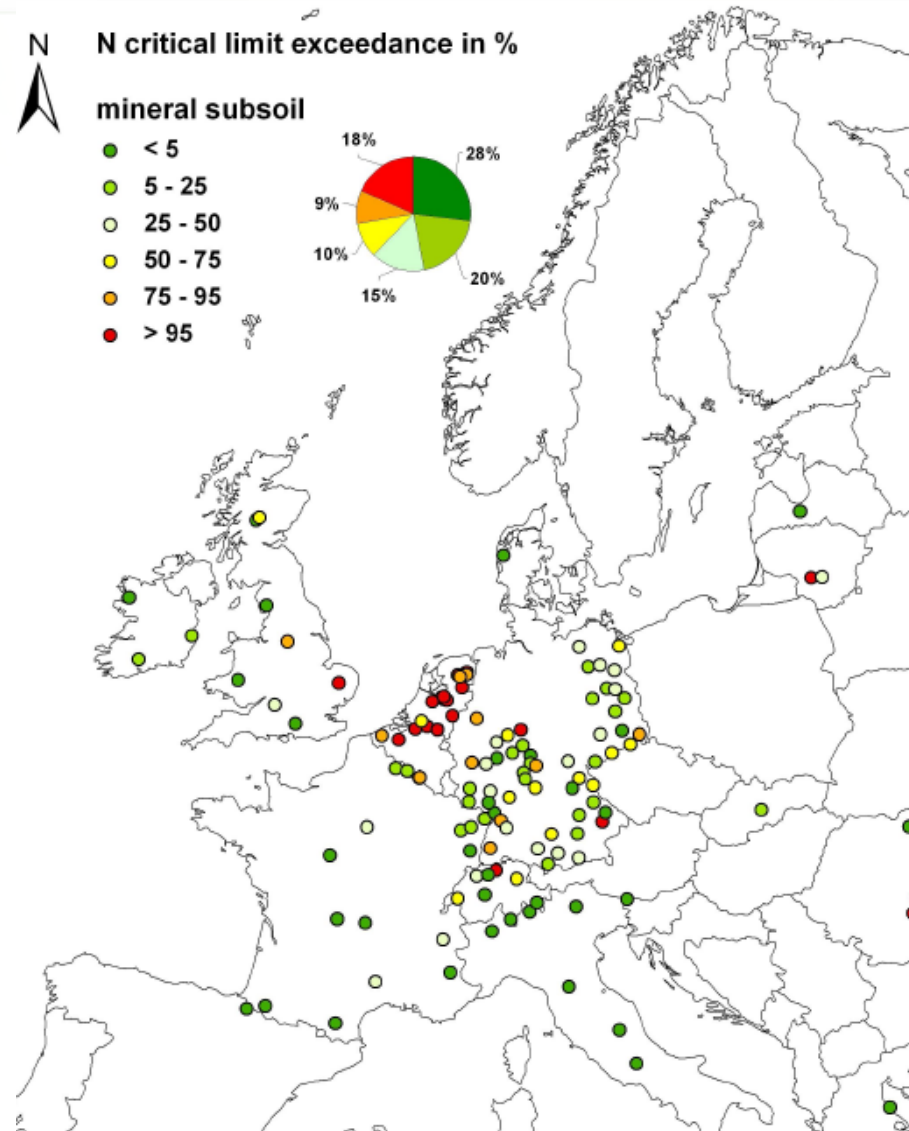




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CLimE for: N leaching / saturation (>1 mg l⁻¹)





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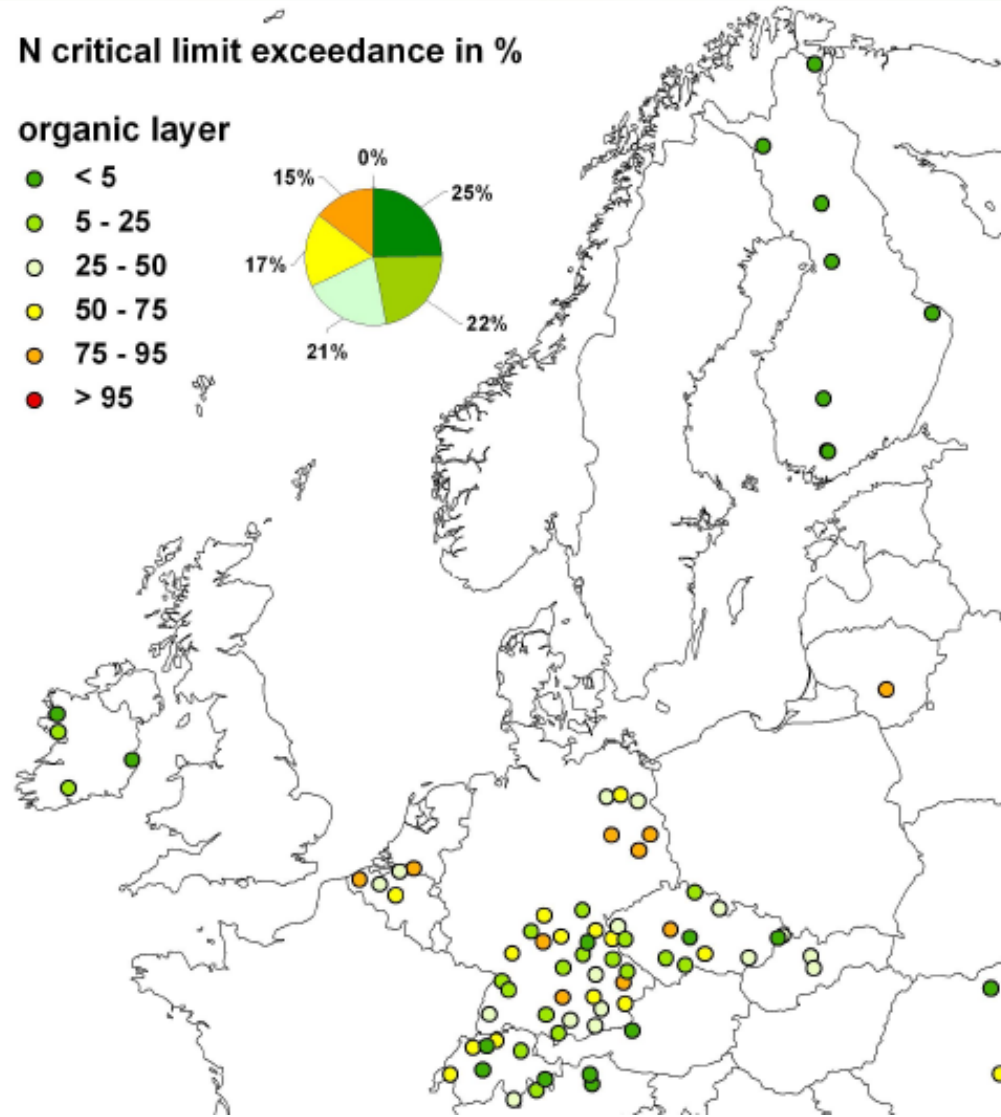
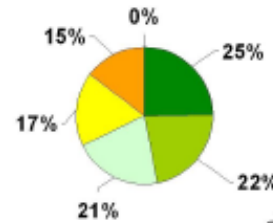
CLimE for: reduced fine root biomass (>1-3 mg l⁻¹)



N critical limit exceedance in %

organic layer

- < 5
- 5 - 25
- 25 - 50
- 50 - 75
- 75 - 95
- > 95

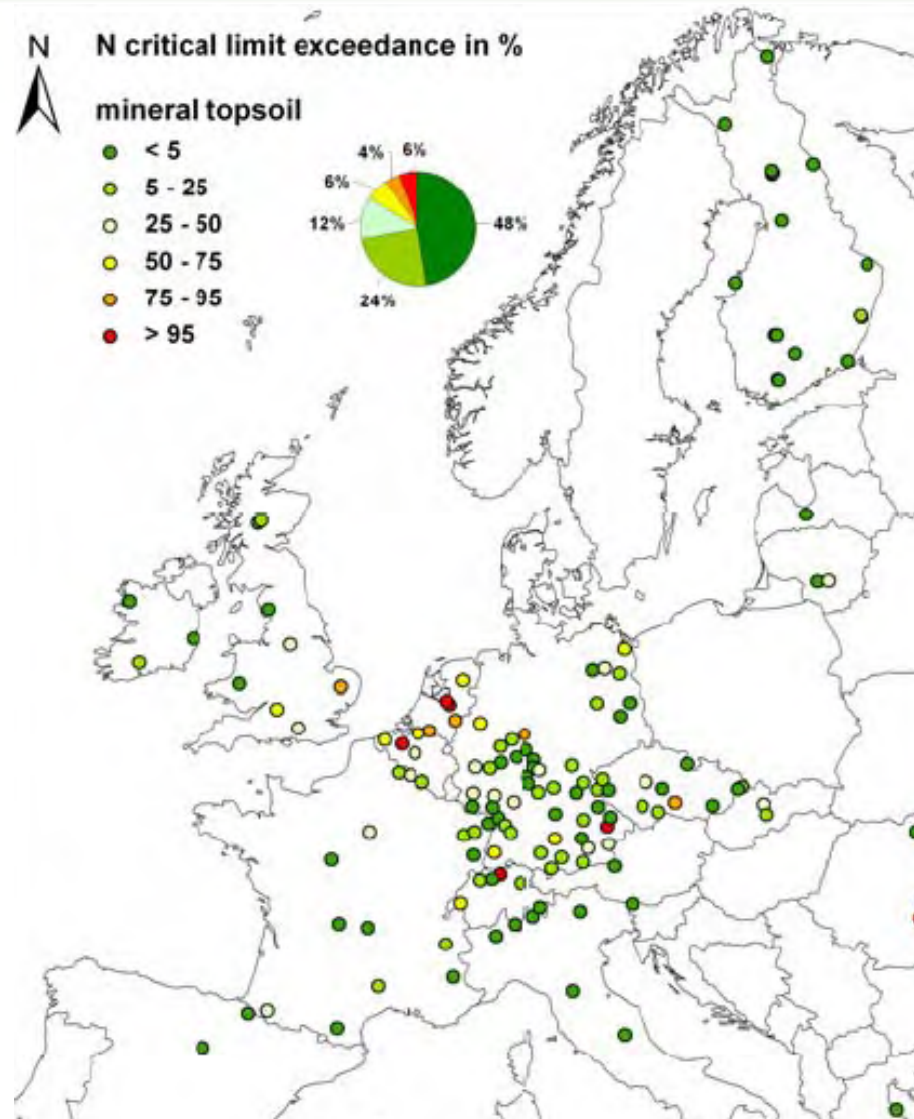




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Results

ClimE for: reduced fine root biomass (>1-3 mg l⁻¹)

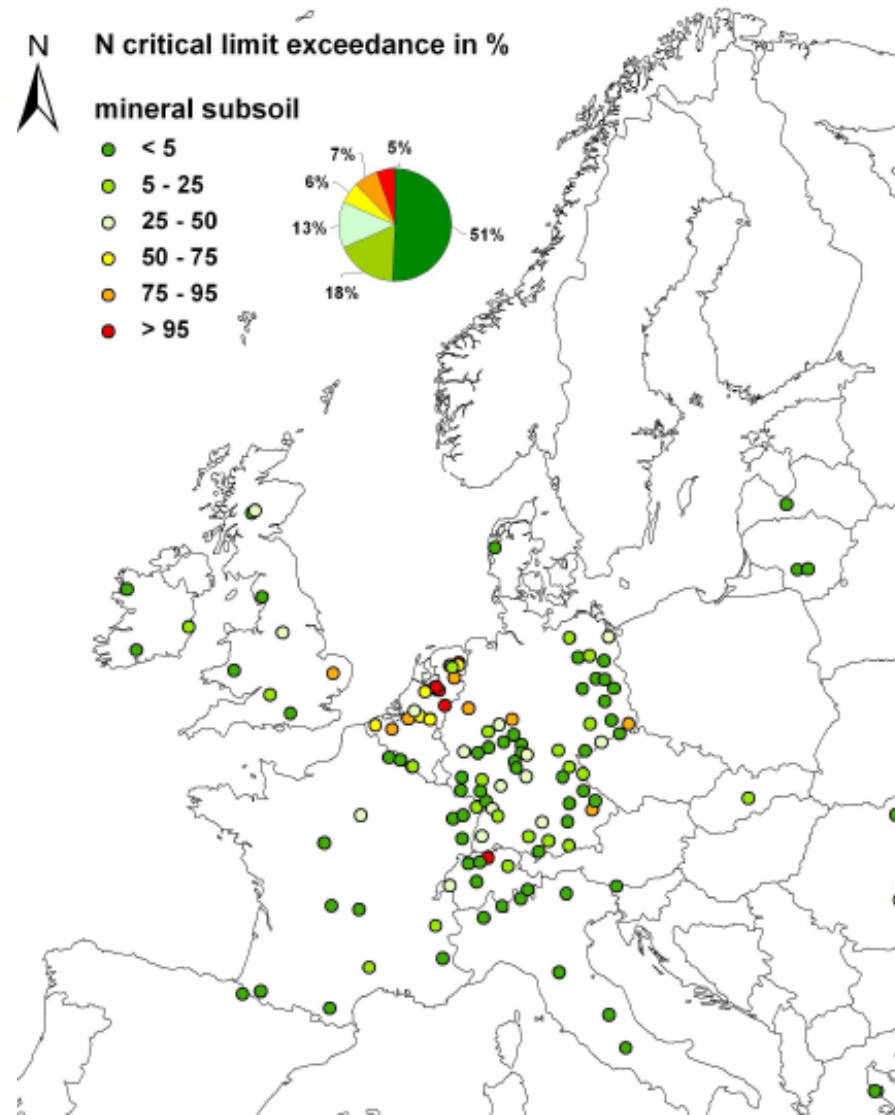




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Results

ClimE for: reduced fine root biomass (>1-3 mg l⁻¹)





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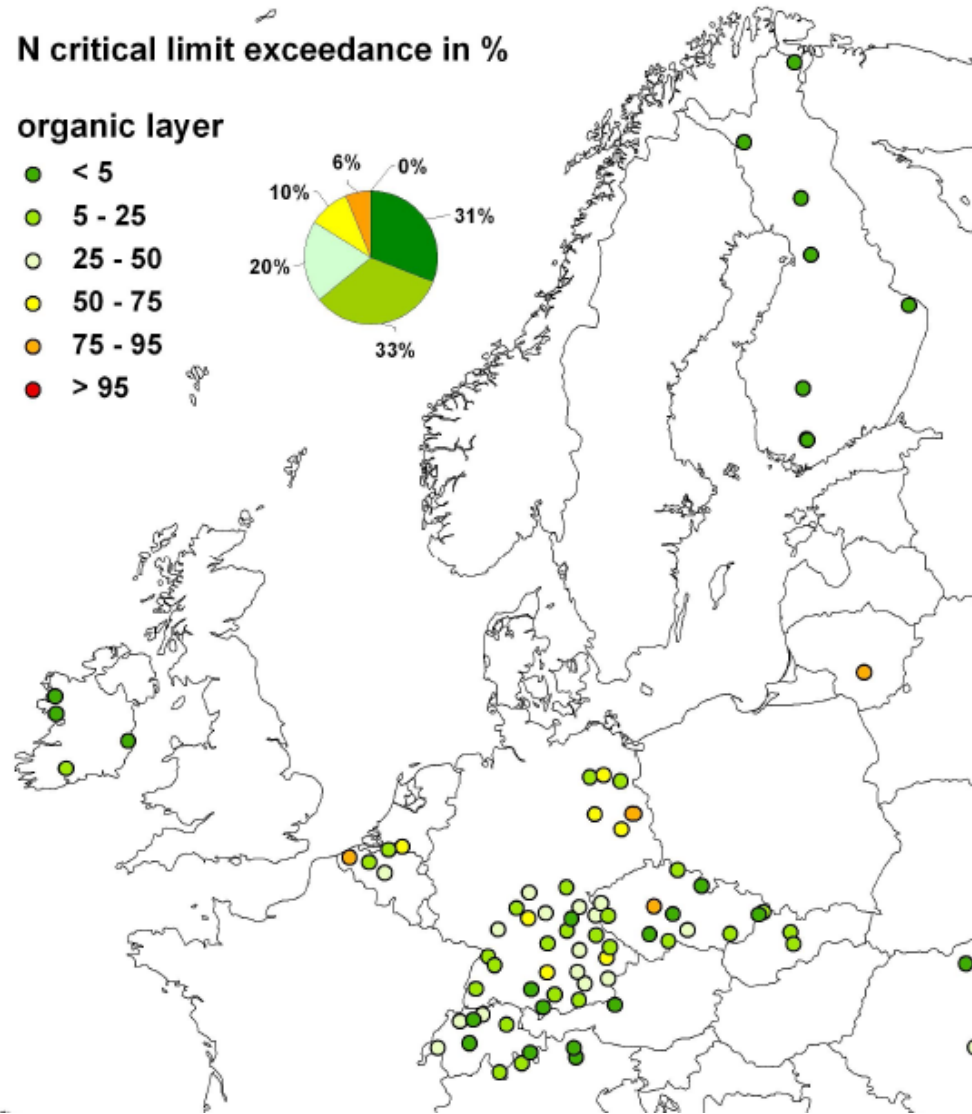
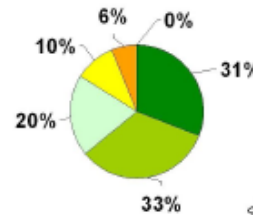
CLimE for: enhanced sensitivity to frost and fungi (>3-5 mg/l-1)



N critical limit exceedance in %

organic layer

- < 5
- 5 - 25
- 25 - 50
- 50 - 75
- 75 - 95
- > 95

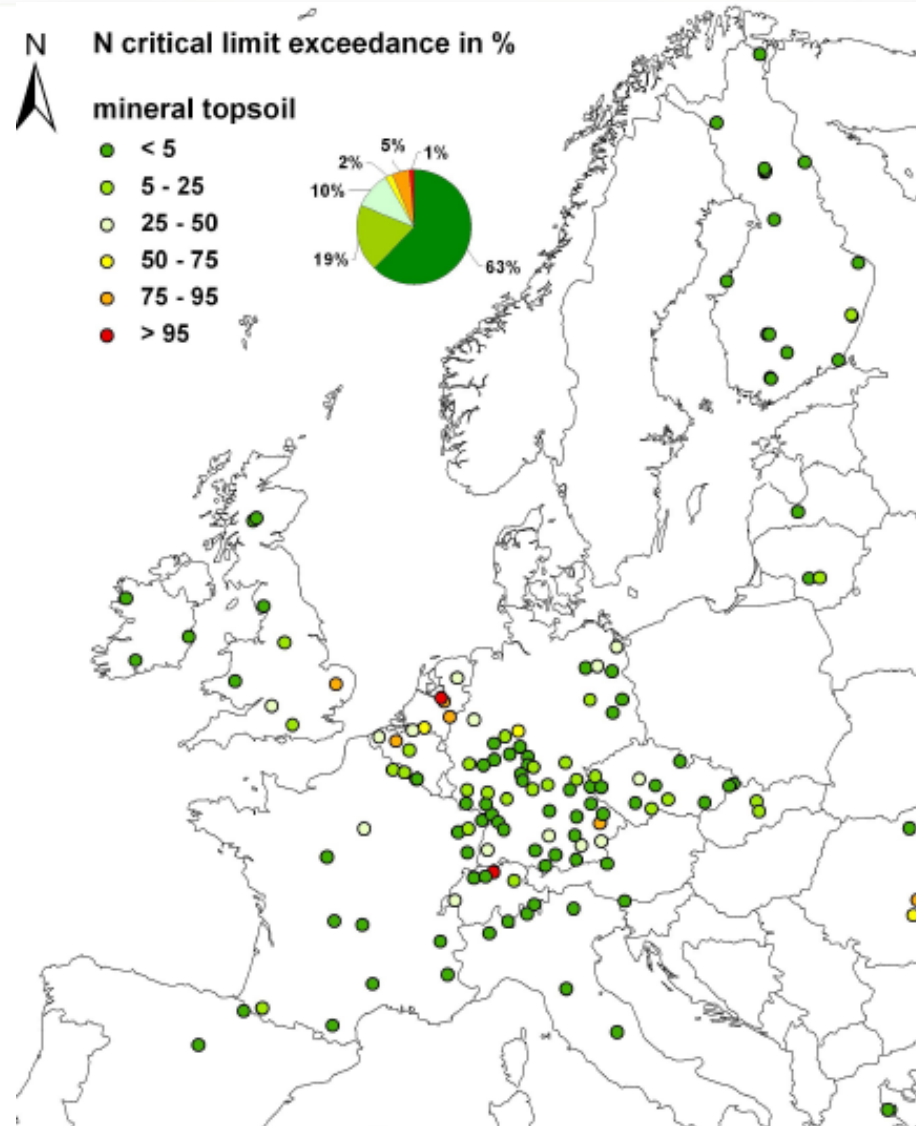




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CLimE for: enhanced sensitivity to frost and fungi (>3-5 mg l⁻¹)

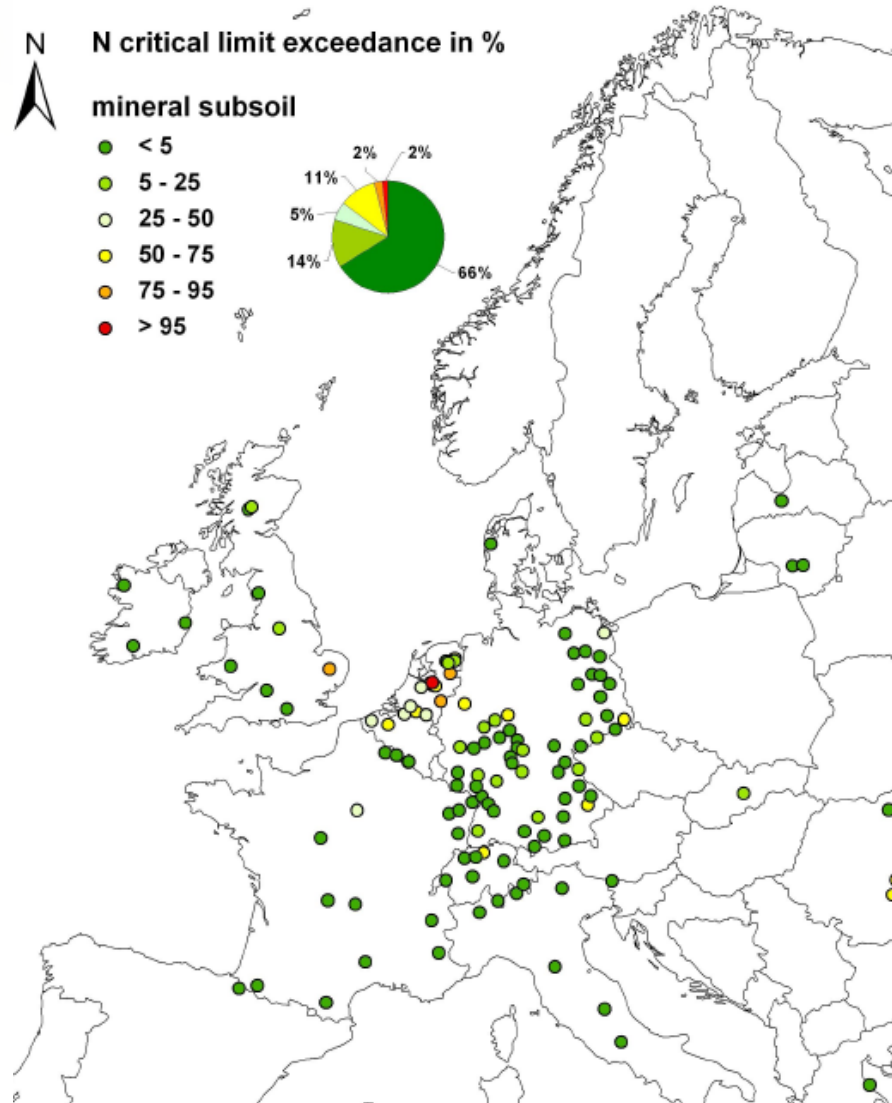




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CLimE for: enhanced sensitivity to frost and fungi (>3-5 mg/l-1)



- In large parts of Europe CLimE for nutrient imbalances and for N leaching found even in mineral subsoil (> 40 cm deep)
 - Only inorganic N was studied (nitrate & ammonium), including organic N might reveal much more worrying picture
 - Where in Europe?
 - What is the role of organic N?
- Needs in-depth investigations e.g. in FutMon core-plots



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Thank you for your attention!