The biogeochemistry in Swedish forests

Evaluation of carbon, nitrogen, base cations and water processes
Modelling vs. measurements

ForSAFE

Scenarios and projections
The model: ForSAFE

Light Climate

Dry and wet deposition

Tree growth

ET

Uptake

Litter

Decomposition

Nutrients

Weathering

Water

Soil solution

Nutrients

Water
Throughfall monitoring network (SWETHRO)

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Air conc.</th>
<th>Deposition</th>
<th>Soil water</th>
<th>Mineral soil</th>
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Source: Phil-Karlsson et al. 2011, modified
Comparison

Site
Västra Torup (13.51 E, 56.135 N)
Spruce dominated forest in Southern Sweden

SWETHRO network:
Measurement of tree biomass and soil water chemistry are compared to model results

ForSAFE inputs
Climate data: historical data derived from SMHI stations
the future scenario follows SRES A2 emissions story-line
Atm. deposition: N and S deposition → European Monitoring and Evaluation Programme (EMEP)
Cl and base cations (Na, Ca, Mg, K) → SWETHRO
Management: clearcut over a 100 y rotation period,
thinnings and residues left on site
Soil data: texture and chemistry of mineral soil from the site
Comparison

Total tree biomass

pH

CI

SO4-S

NO3-N

Bc (Ca, K, Mg)
Comparison: soil solution

- pH
- SO4
- Cl
- NO3
- Bc
- Na
- Al-tot
Future scenarios: climate

- **Total NPP**
  - Baseline T
  - T+

- **N leaching**
  - Baseline T
  - T+

- **Total SOC**
  - Baseline T
  - T+

- **Soil moisture**
  - Baseline T
  - T+
Future scenarios: management

1) Only stem are removed after harvesting (S)
2) Stem and branches are removed (S&B)
3) Whole tree harvesting (roots included, WT)
Conclusions

Comparison: good agreement between model results and measurements (trends)

Biogeochemical models can help to:
- Better understand processes
- Identify knowledge gaps
- Predict effects of different scenarios

→ Perform integrated assessment of different ecosystem services
Thank you!

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More...

Biogeochemical modelling of N leaching from south Swedish forest soils – is there a need to consider P cycling?