Holocene vegetation change and turnovers of treeline forming species

Siberian treeline forests

- *Larix sibirica*, *Larix gmelinii*, *Larix cajanderi* - distributed from west to east (Fig 1a).
- Larch species separated geographically and ecologically.
- Future and past northward treeline shift & species distribution changes (Fig 1b).

- Investigate species-specific responses and competitive dynamics for more realistic projections.

Approaches

- Lake sediment cores: ancient DNA & pollen
  - DNA metabarcoding / pollen
  - mt-DNA marker
  - overall vegetation discrimination of Larix species
  - nucleolar organizer region (NOR) proxy for *L. sibirica* vs. *L. gmelinii*.

- Modelling: incorporate the two species *L. sibirica* and *L. gmelinii* into the larch population dynamics model LAVESI (see poster by Kruse et al.)

<table>
<thead>
<tr>
<th>Larix sibirica</th>
<th>Larix gmelinii</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minimal thawing depth</td>
<td>100 cm</td>
</tr>
<tr>
<td>Endured winter temperatures</td>
<td>-33 °C</td>
</tr>
<tr>
<td>Growth rate</td>
<td>1.08 mm/year</td>
</tr>
<tr>
<td>Seed weight</td>
<td>10 mg</td>
</tr>
<tr>
<td>Seed dispersal distance</td>
<td>Low</td>
</tr>
<tr>
<td>Longevity of seeds in the soil</td>
<td>10 years</td>
</tr>
</tbody>
</table>

Modelling

Simulated current populations

- different points - different insertion of the species
- larger points - more trees/ha.
- simulations mostly reflect real distribution

Temporal distribution of trees

- at CH06, CH12 and Khatanga North
- insertion of both species.
- Southern population dominated by *L. gmelinii*
- Northern populations experience serial local extinctions and turnovers with cooling temperature.

Turnover rates

- at CH06
- simulations run starting with population of *L. sibirica*
- insertion of different numbers of seeds, both species.
- Rapid species turnover simulated

Conclusions

- Congruent picture from ancient DNA and model simulations.
- Contrary to expectations, *Larix sibirica* occurs frequently at northern sites.
- Competitive interactions very important at higher stand densities.