Ongoing applications of REVEALS and LOVE in Denmark and North Germany

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**Before LRA: Model calibration**
Pollen productivity and relevant source area are estimated from the calibration dataset using the ERV model.

**LRA step 1: REVEALS**
(Regional Estimates of Vegetation from Large Sites)
Fossil pollen spectra are corrected for differences in pollen dispersal and productivity among species, so regional vegetation composition can be estimated.

**LRA step 2: LOVE**
(Local vegetation Estimates)
The LOVE model calculates background pollen loading using regional vegetation, source area, pollen dispersal and productivity. The background pollen can then be subtracted from the pollen signal and local vegetation estimated.
REVEALS for part of VR Landclim project

- Germany north of 51°
- Denmark
- 106 sites
  - 22 bogs (cores)
  - 84 lakes
    - 42 single samples
    - 42 lake cores
- Divided into regions
  - Some areas lacking in sites
- REVEALS run with LANDCLIM standard settings for PPEs etc.
Example: PFT GL in Gridcells for Landclim and LUCCI time slices

- 0-100 BP
- 100-350 BP
- 350-700 BP
- 2700-3200 BP
- 5700-6200 BP

Legend:
- 0-10%
- 10-20%
- 20-30%
- 30-40%
- 40-50%
- 50-60%
- 60-70%
REVEALing more from the same sites

• Extra time slices:
  – Before, during and after 8.2 event
  – Before and after 6000 BP tile slice
  – 1500-2000 BP

• Different groupings of taxa and single types

• Different mapping/visualitation approach
  – Spatial representativity of pollen sites?
Spatial representativity of pollen sites

Pollen data from a single site:
• Probably doesn’t reflect the average within a square cell
• Does reflect pollen dispersal to the site
  – Distance weighted view of surrounding vegetation
    • Nearby vegetation better reflected than far away
  – Within a certain distance
    • Depending on pollen type
      – We think REVEALS takes care of that bias
    • Depending on size of site
      – ”Regional” for “large sites”
      – Best to average over several sites, especially if small
• Gridding based on inverse distance weighting intrapolation between single sites
  – Incorporates some of these properties
  – Simple to do (as a starting point)
  – Gives “wrong” result for areas far from sites
Example: *Calluna vulgaris*

- Overall patterns clear
- Danger of overinterpreting single sites
- Interpolation over areas without sites
  - Probably wrong!
- Best guess?
- But at least we can show where the sites are to evaluate
Example: Crops
Secale + Cerealia

- Early signal in central Germany
- Very low values in early periods
- Much higher last 700 years
  - Higher SE than NW
PCA of results from single sites

All sites, all time slices

- East Denmark
- Eastern Jutland and Schleswig-Holstein
- Western Jutland and German west coast
- Coastal eastern Germany
- Inland eastern Germany
- Harz region
PCA of results from single sites

Trajectories for selected sites
- Avnsø (East Denmark)
- St. Økssø (Eastern Jutland)
- Flögeln (German west coast)
- Wustrow See (Coastal EG)
- Belau See (Inland EG)
- Juessee (Harz region)
PCA of results from single sites

Lakes vs bogs

Tendency towards more Calluna in bogs
- but there are also more bogs in western region
Lakes vs bogs

- Smaller regions where data from both are present (Germany)
- Difference in SW
  - But both lakes and bogs there high values
- Higher variability for bogs
Lakes vs bogs

- Consistently higher and much more variable for bogs
- Decided to exclude from reconstruction of total landscape openness
Openness (Excluding Cyperaceae)

Before and early agriculture: High openness east and west. Why?

• Soils?
• Climate?
Environmental data

- Soil surface texture
  - European soil database
  - Simplified to midpoint % clay and sand for each class
  - Average in 30 km circle around each site extracted
- Distance to coast
- Distance to North Sea
- Type of site
RDA, time slice 7500-8000 BP

- Type of site (lake/bog) treated as covariable
- Forward selection, permutation tests

### Sand included in model

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<th>Unique effect</th>
<th>Significance</th>
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<tr>
<td>Dist coast</td>
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<tr>
<td>Area of site</td>
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</table>

Distance to North Sea included:
No other variables significant
RDA, time slice 7500-8000 BP

- Explains 29.5% of variation
- Openness (supplementary)
  - Poss. related to sand
  - Neg. related to “continentality”
RDA, time slice 350-100 BP

- Dist. to north sea and percent clay selected
- Explains 27.6 % of variation
- Openness (supplementary)
  - Neg. related to clay and to “continentality”
Sites on Funen

Map showing locations of Sarup Sø, Arreskov Sø, and Gudme Sø on Funen Island.
REVEALS
Arreskov Sø

- Largest lake on the island of Funen, 3.17 km²
- 7.4 m sediment core
- Low res. pollen diagram
- $^{14}$C and $^{210}$Pb dates.
- Used for REVEALS reconstruction
Arreskov Sø
Reveals reconstruction, ca. 8000 BP to present
Sarup Sø

- 3.6 ha (ca. 100 m radius)
- Partly laminated
- Pollendata by Peter Rasmussen (and Bent Odgaard)
- Reconstruction across neolithic landnam

Photo: Ole Bennike, GEUS
Sarup Sø, reconstructed vegetation composition
Sarup Sø, reconstructed vegetation composition

Still very little Cerealia
Acknowledgements

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