



LANDCLIM project



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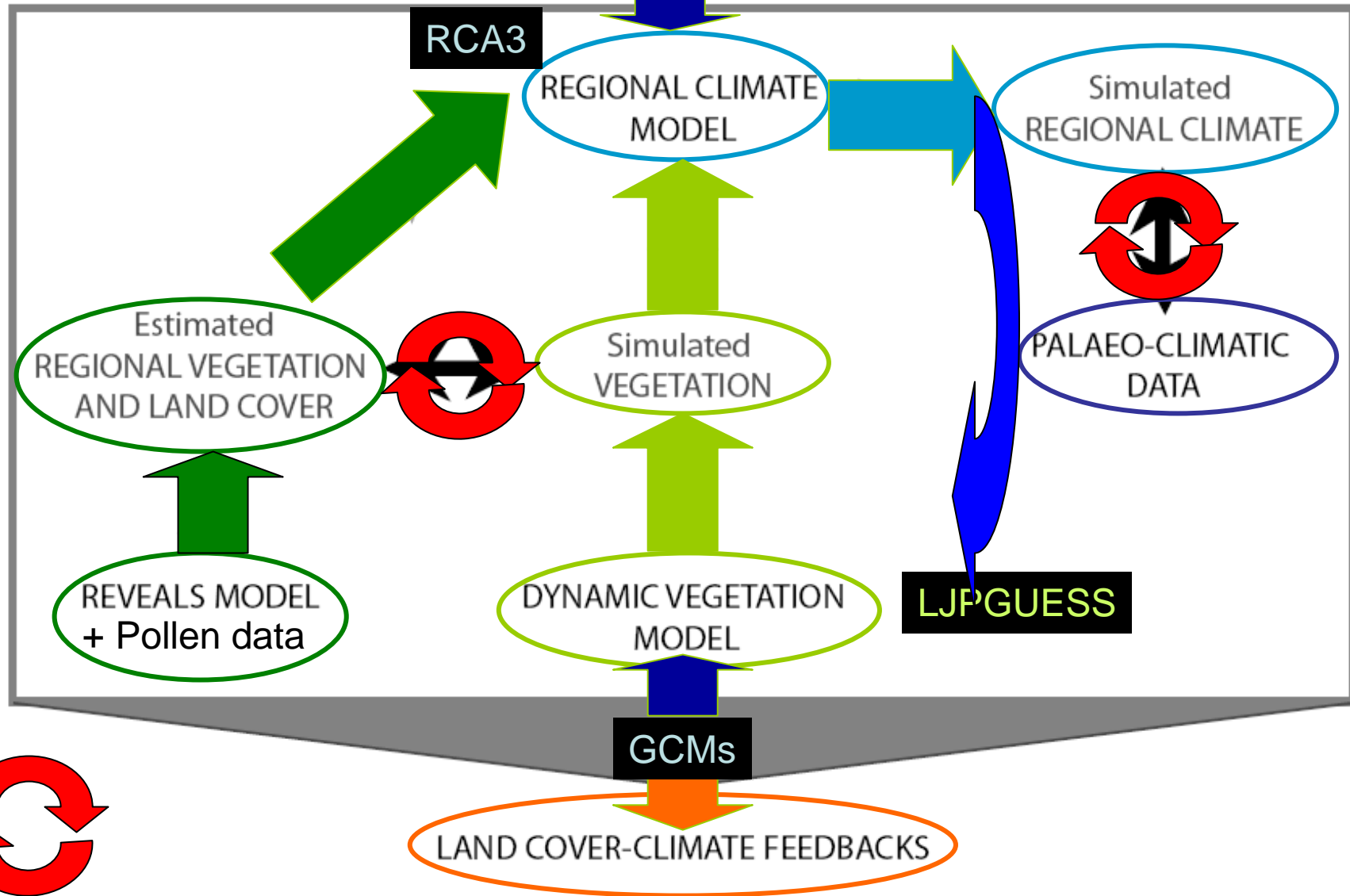
⁵ University of Plymouth, Plymouth, UK

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Swedish project: LANDCLIM 6000-200

- LANDCLIM 6000-200 is a contribution to the IGBP-PAGES-Focus 4 PHAROS programme (www.pages.unibe.ch/science/focus4.html).
- The overall objective is to
 - better understand vegetation/land use-climate interactions on long time scales, and
 - to evaluate and fine-tune the regional climate model RCA3, the dynamic vegetation model (LPJGuess), and the coupled RCA3-LPJGuess model for better analysis of future climate change

Proposed scheme of GCMs model-data comparison

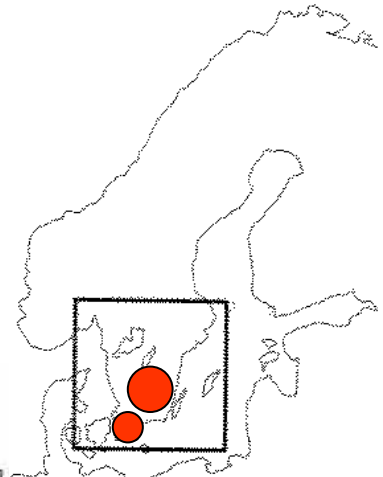


Model-data comparison

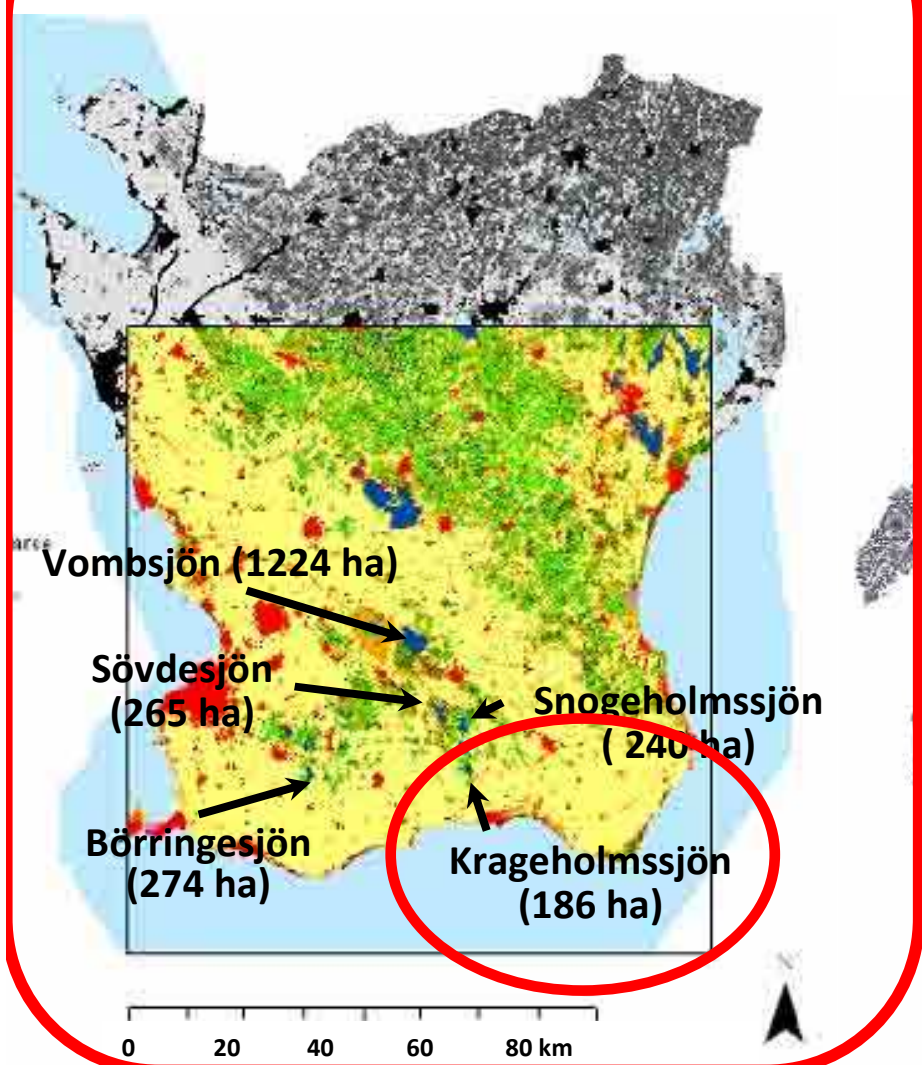
Gaillard et al. 2010, Clim Past

Testing REVEALS in southern Sweden

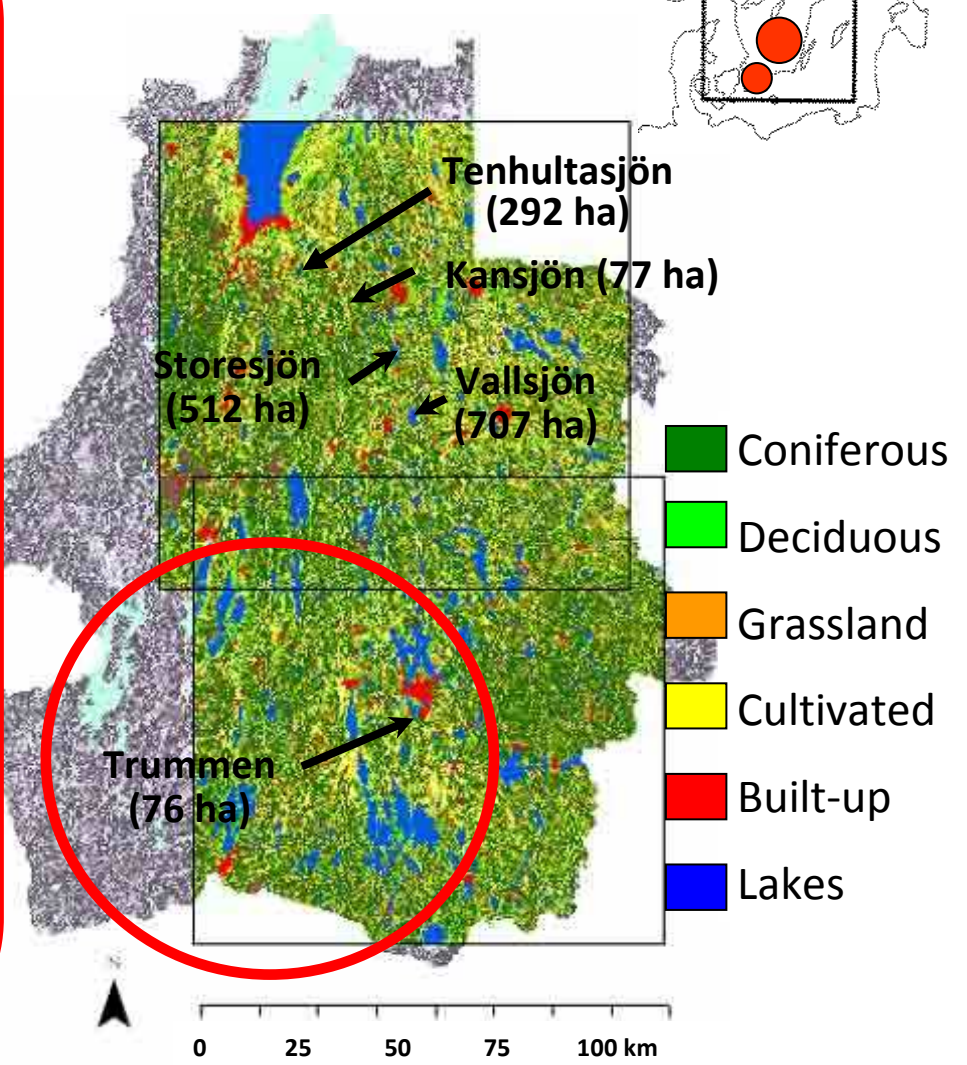
Hellman et al. 2008a,b (JQS, VHA)



Skåne



Småland

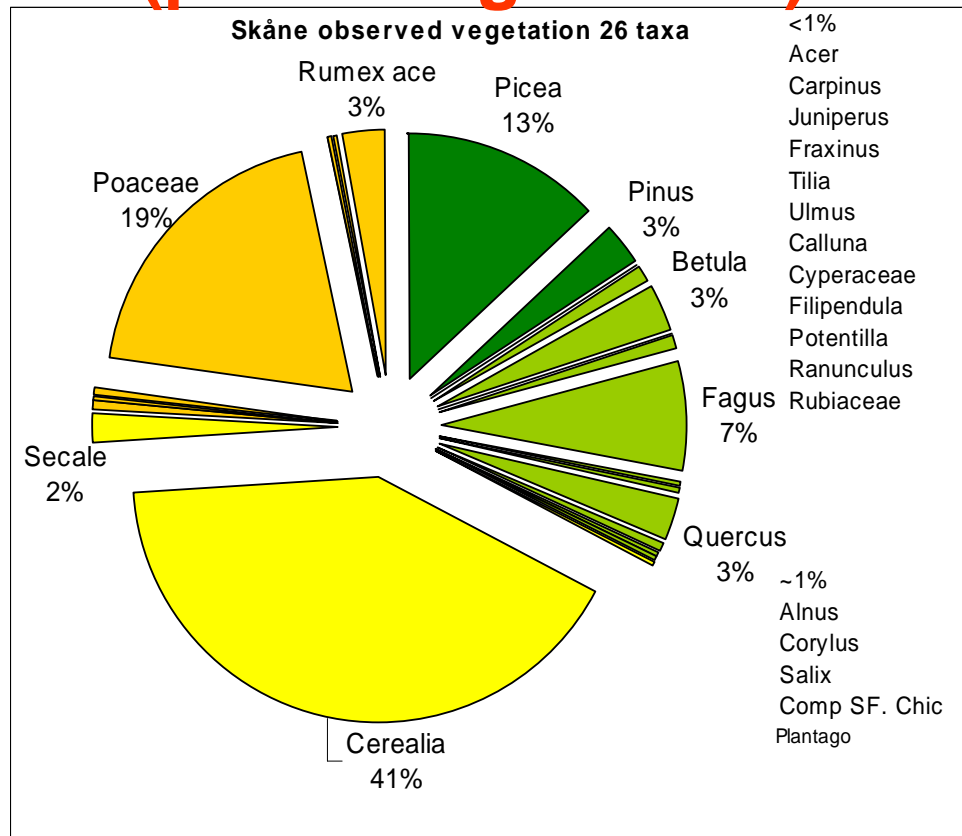


- Coniferous
- Deciduous
- Grassland
- Cultivated
- Built-up
- Lakes

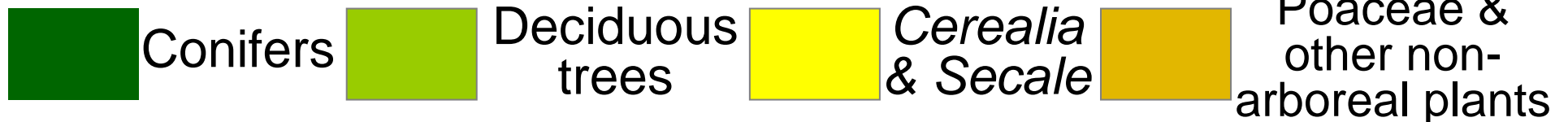
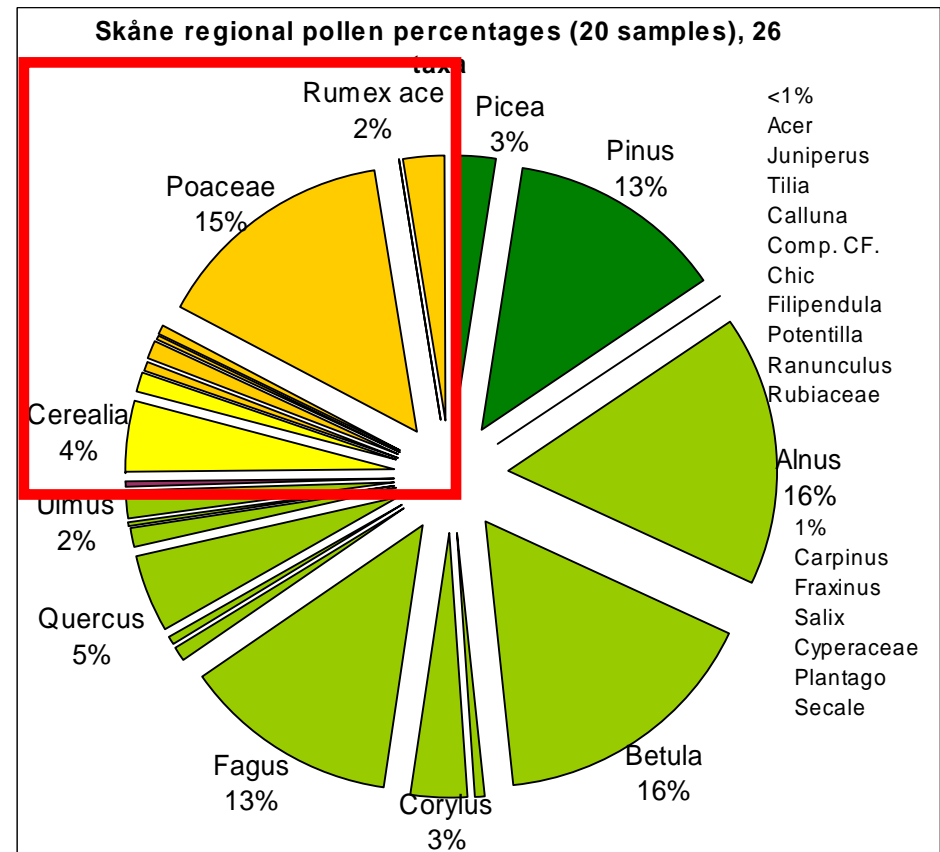
Results Sweden: Skåne (Open Landscape)

Gaillard et al. 2010, Clim Past

Observed vegetation (percentage cover)



Pollen Percentages

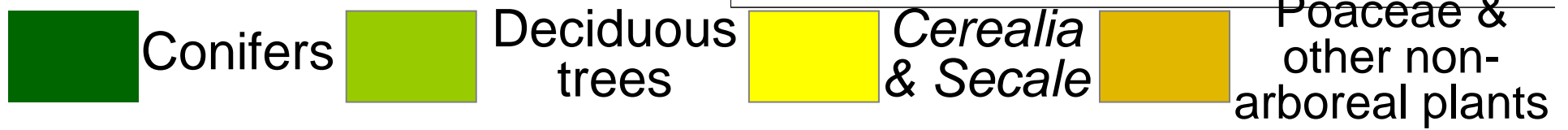
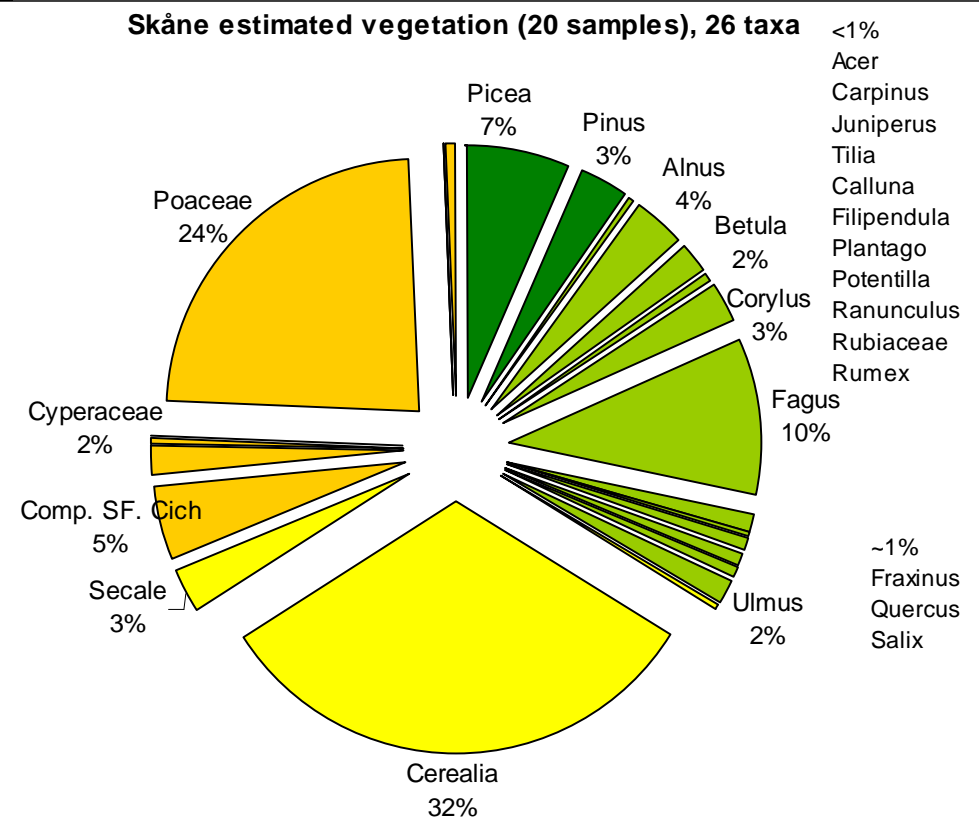
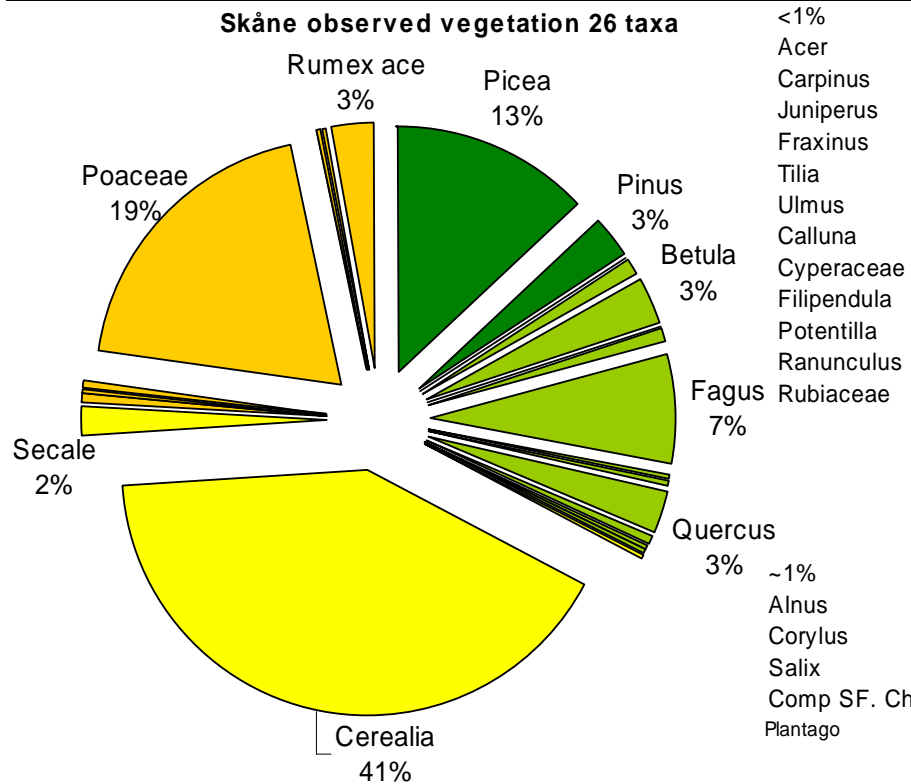


Results Sweden: Skåne (Open Landscape)

Gaillard et al. 2010, Clim Past

Observed vegetation (percentage cover)

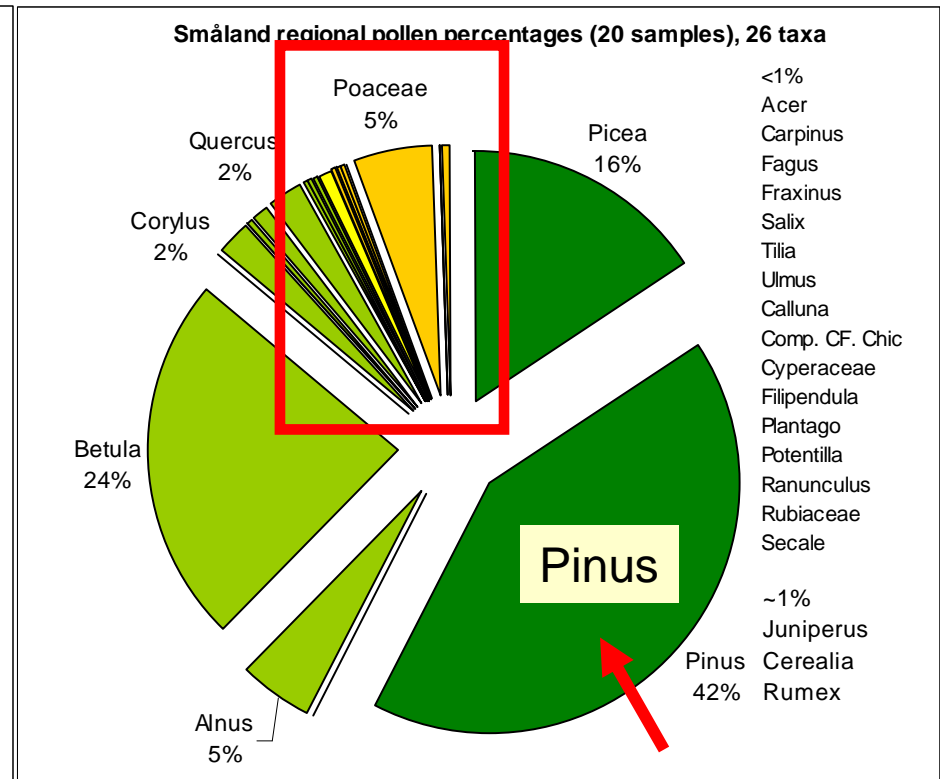
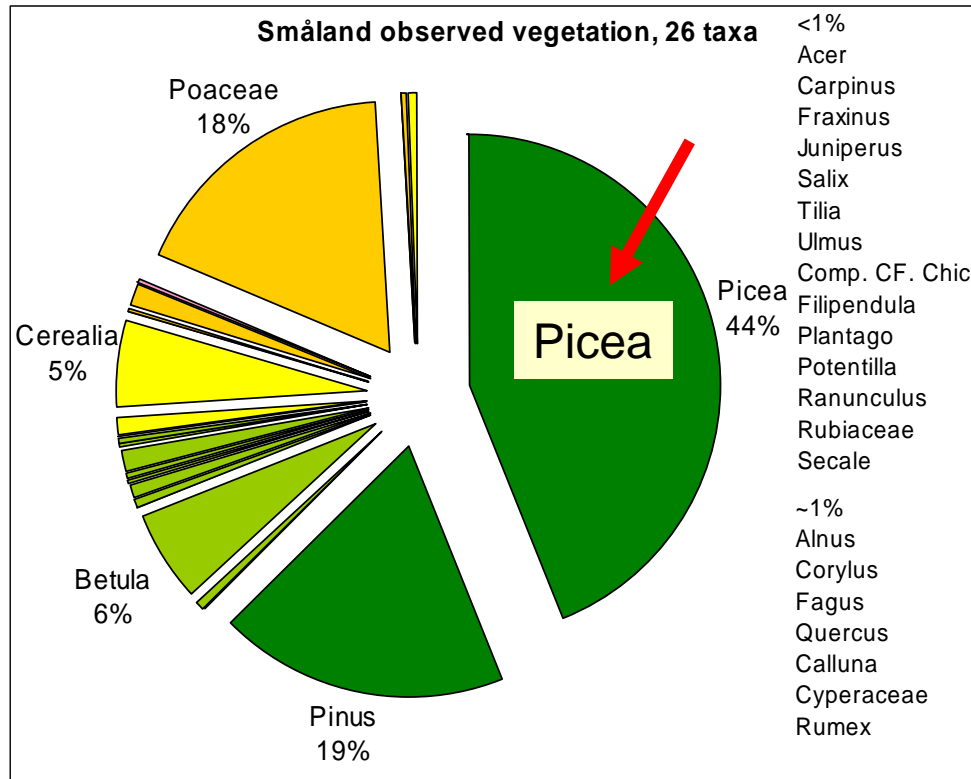
Estimated vegetation using REVEALS



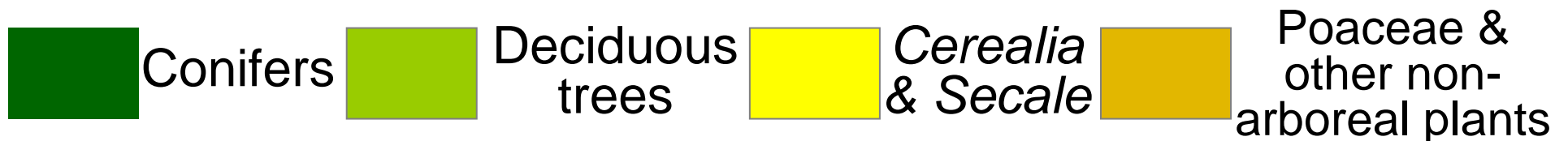
Results Sweden: Småland (Semi-open Landscape)

Observed vegetation (percentage cover)

Pollen percentages



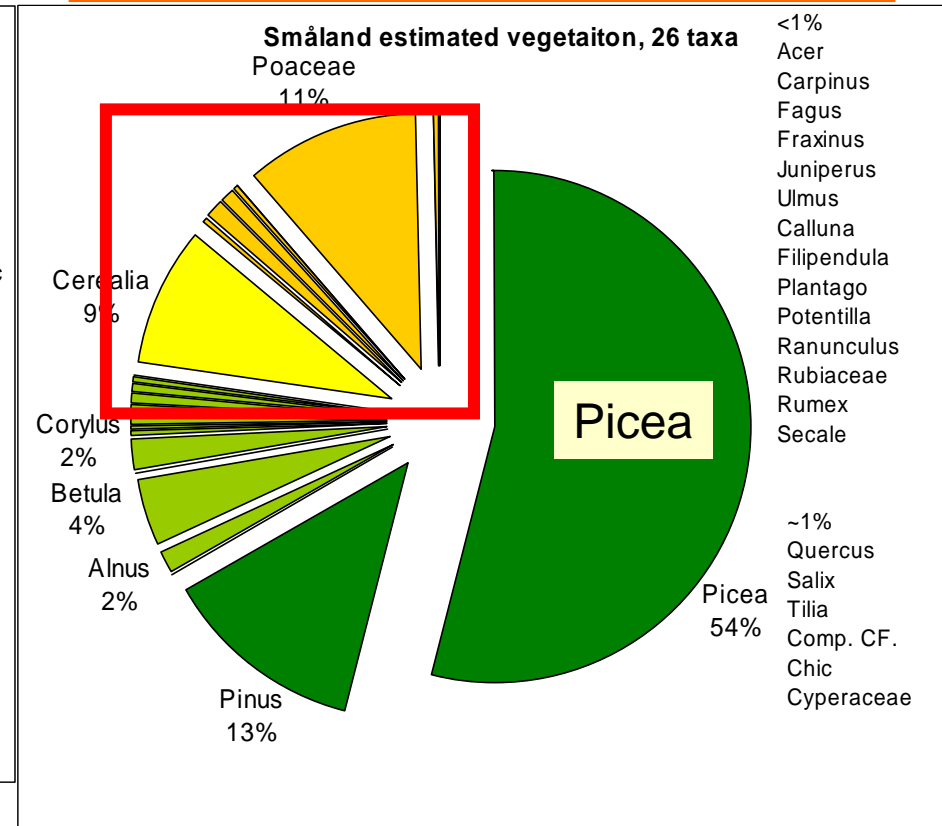
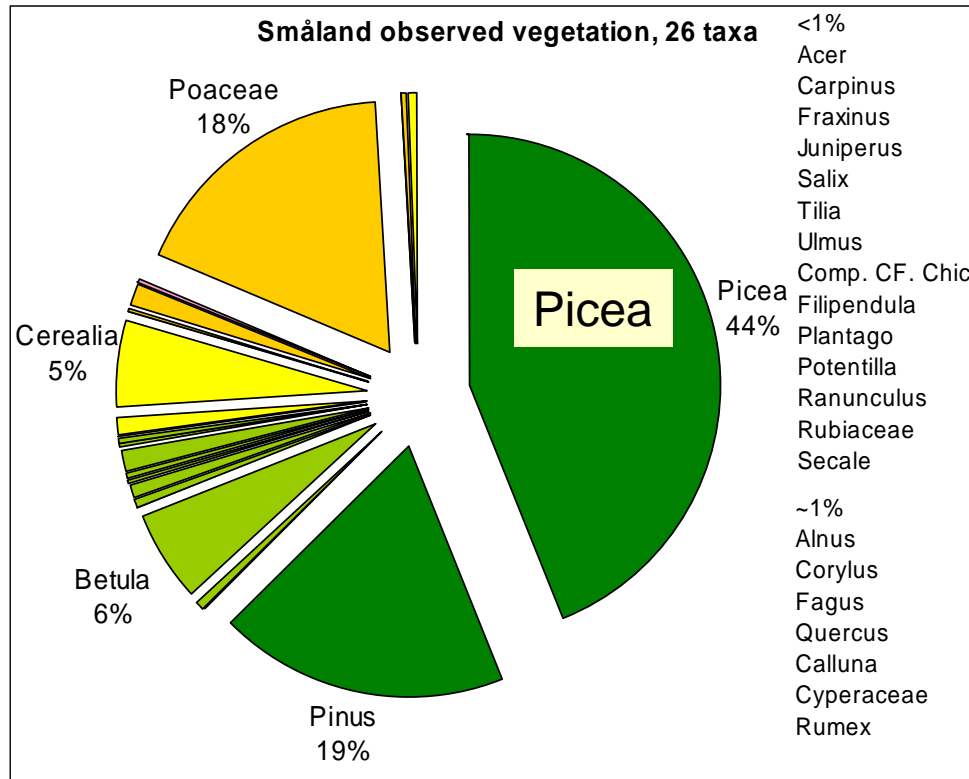
Hellman, Gaillard et al. 2008, JQS



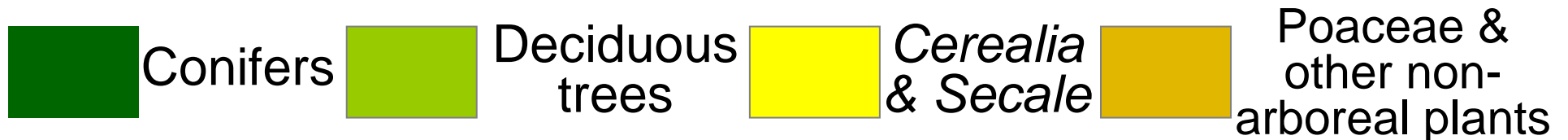
Results Sweden: Småland (Semi-open Landscape)

Observed vegetation (percentage cover)

Estimated vegetation using REVEALS

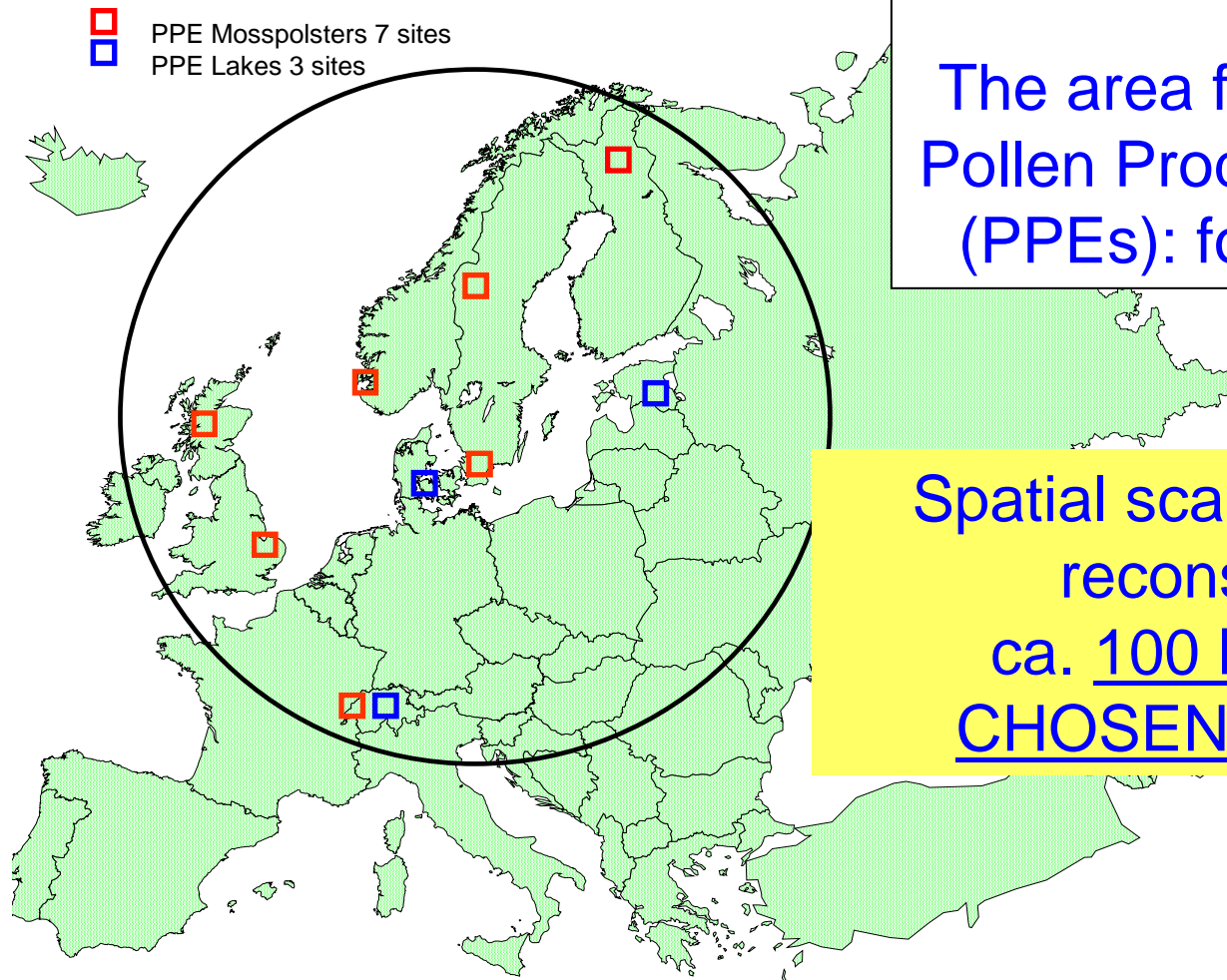


Hellman, Gaillard et al. 2008, JQS



The LANDCLIM project

North-western and Western Europe North of the Alps



Study area

The area for which we have
Pollen Productivity Estimates
(PPEs): for 34 taxa in total

Spatial scale of REVEALS
reconstructions:
ca. 100 km x 100 km
CHOSEN GRID: 1° x 1°

Responsibles for data collecting and REVEALS runs

Coordinator: **MJ Gaillard**

Gaillard et al. 2010, Clim Past

Model development and programs: **Shinya Sugita**

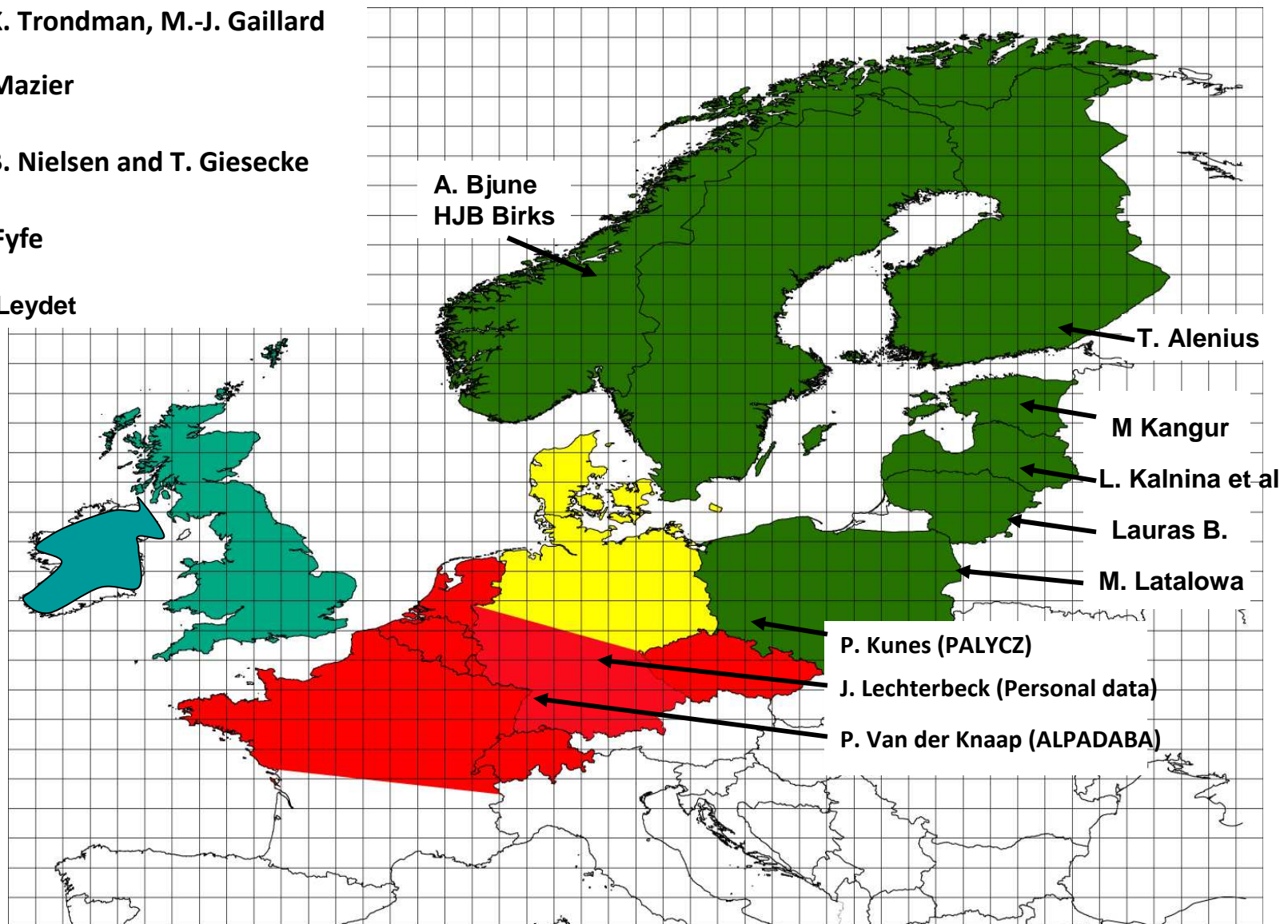
 A.K. Trondman, M.-J. Gaillard

 F. Mazier

 A.B. Nielsen and T. Giesecke

 R. Fyfe

EPD: M. Leydet



REVEALS runs - PROTOCOL

In order to lower the number of REVEALS runs, maximize the number of pollen records used, and ensure good-quality REVEALS reconstructions:

Test of the effect of different input data on the REVEALS estimates using the pollen data base from the Czech Republic (Kunes et al.), using the Spearman rank correlation test (Mazier et al. in prep.)

Note: The Spearman rank corr. test compares the ranking of PFTs abundance, it does not compare absolute values.

What pollen records? What taxa? How many taxa?

What PPEs?

-Bogs or lakes?

-Large or/and small sites?

-Chronology:

-how many dates used for the age-depth model?

-All taxa with PPEs or selected taxa?

-All PPEs (means) or selected PPEs?

RESULTS: IN GENERAL, THERE ARE NO
SIGNIFICANT DIFFERENCES BETWEEN
THE REVEALS ESTIMATES IN TERMS OF
TAXA RANKING USING THE DIFFERENT
ALTERNATIVES

Mazier et al. in prep

FIRST "PRODUCT"

Trondman et al. Unpublished, in prep. 2011

- 25 selected taxa (true entomophilous taxa excluded)
- Lakes and bogs
- small (≤ 10 ha) and large sites ($\geq 50-100$ ha), i.e. ALL SITES
- ≥ 3 dates for age-depth chronology
- For each taxon, mean of all PPEs available in the study area

PROTOCOL: 1st "product"

- 1) PPEs for 36 taxa, 25 selected taxa;
- 2) for each taxon: 1-6 PPE values; use the mean value

Reference taxon	Generally > 95% of total sum of terrestrial taxa
Gramineae GRASSES	
Herb taxa	
Apiaceae	
Artemisia DRY MEADOWS, WEED	
<i>Calluna vulgaris</i> HEATHER - FOREST UNDERSTOREY, BOGS or HEATHS (PASTURELANDS)	
Cerealia-t CEREALS (AGRICULTURE)	
Comp. SF. Cichorioideae	
Cyperaceae SEDGES – MEADOWS (WET, FRESH, DRY), FENS or BOGS	
<i>Empetrum</i>	
Ericaceae	
<i>Filipendula</i> FRESH, WET MEADOWS	
<i>Leucanthemum</i> (<i>Anthemis</i> -t)	
<i>Plantago lanceolata</i> MEADOWS, PASURELANDS, WEED	
<i>Plantago media</i>	
<i>Plantago montana</i>	
<i>Potentilla</i> -t	
<i>Ranunculus acris</i> -t	
Rubiaceae	
<i>Rumex acetosa</i> -t MEADOWS, PASTURELANDS, WEED	
<i>Secale</i> -t RYE (AGRICULTURE)	
<i>Trollius</i>	
<i>Vaccinium</i>	

Tree Taxa
<i>Abies</i> FIR
<i>Acer</i>
<i>Alnus</i> ALDER
<i>Betula</i> BIRCH
<i>Carpinus</i> HORNBEAM
<i>Corylus</i> HAZEL
<i>Fagus</i> BEECH
<i>Fraxinus</i> ASH
<i>Juniperus</i> JUNIPER
<i>Picea</i> SPRUCE
<i>Pinus</i> PINE
<i>Quercus</i> OAK
<i>Salix</i> WILLOW
<i>Tilia</i> LINDEN
<i>Ulmus</i> ELM

3) Time periods

Two priorities within the project:

Priority 1

- “The Time-window sites” – for comparison with climate model (VR LANDCLIM project) + other purposes (LUCCI, Lund, Anna Broström)

0-100 cal BP; 1850-x AD

modern time-window

100-350 cal BP; 1600-1850 AD

200 cal BP time-window

350-700 cal BP; 1250-1600 AD

600 cal BP time-window

2700-3200 cal BP; 1250-750 BC

3000 cal BP time-window

5700-6200 cal BP; 4250-3750 BC

6000 cal BP time-window

Priority 2

- “The Holocene trajectories” – for comparison with vegetation model

10 selected target areas in the study region, covering the entire **Holocene** (or at least the last 7000 years)

4) Plant Functional Types (PFTs)

REVEALS estimates are calculated for 25 taxa; they are then grouped into
 - 10 PFTs (**LPJGUESS**), and 3 broad plant groups (**RCA3**)

Land-cover types	PFT	PFT definition	Plant taxa/Pollen-morphological types	FS (m/s)	PPE.St2
Ever-green	TBE1	Shade-tolerant evergreen trees	<i>Picea</i>	0.056	2.62 ± 0.12
	TBE2	Shade-tolerant evergreen trees	<i>Abies</i>	0.120	6.88 ± 1.44
	IBE	Shade-intolerant evergreen trees	<i>Pinus</i>	0.031	6.38 ± 0.45
	TSE	Tall shrub evergreen trees	<i>Juniperus</i>	0.016	2.07 ± 0.04
Summer-green	IBS	Shade-intolerant summergreen trees	<i>Alnus</i>	0.021	9.07 ± 0.10
			<i>Betula</i>	0.024	3.09 ± 0.27
			<i>Corylus</i>	0.025	1.99 ± 0.19
			<i>Fraxinus</i>	0.022	1.03 ± 0.11
			<i>Quercus</i>	0.035	5.83 ± 0.15
	TBS	Shade-tolerant summergreen trees	<i>Carpinus</i>	0.042	3.55 ± 0.43
			<i>Fagus</i>	0.057	2.35 ± 0.11
<i>Tilia</i>			0.032	0.80 ± 0.03	
	<i>Ulmus</i>	0.032	1.27 ± 0.05		
TSD	Tall shrub summergreen trees	<i>Salix</i>	0.022	1.22 ± 0.11	
Open-land	LSE	Low evergreen shrub	<i>Calluna vulgaris</i>	0.038	0.82 ± 0.02
	GL	Grassland - all herbs	<i>Artemisia</i>	0.025	3.48 ± 0.20
			Cyperaceae	0.035	0.87 ± 0.06
			<i>Filipendula</i>	0.006	2.81 ± 0.43
			Gramineae	0.035	1.00 ± 0.00
			<i>Plantago lanceolata</i>	0.029	1.04 ± 0.09
			<i>Plantago media</i>	0.024	1.27 ± 0.18
			<i>Plantago montana</i>	0.030	0.74 ± 0.13
			<i>Rumex acetosa</i> -t	0.018	2.14 ± 0.28
	AL	Agricultural land - cereals	Cerealia-t	0.060	1.85 ± 0.38
<i>Secale</i> -t			0.060	3.02 ± 0.05	

10 PFTs (Plant Functional Type) and corresponding pollen morphological types (25 taxa).

Uncertainties and problems to think about

- Uncertainties:
 - 1-2 small sites in one grid cell: very uncertain reconstruction
 - Large bogs: vegetation growing on the bog may strongly bias the reconstruction
- Problems:
 - Open land PFTS: many taxa may belong to natural or human-induced vegetation types
 - Gramineae
 - Cyperaceae
 - *Calluna*

TBE1– Shade-tolerant evergreen trees (*Picea*)

ONE EXAMPLE of map of REVEALS estimates for spruce –
Trondman et al unpublished, in prep 2011

TBE 1 0-100 cal BP



TBE 1 100-350 cal BP



TBE 1 350-700 cal BP



TBE 1 2700-3200 cal BP



TBE 1 5700-6200 cal BP



TBE1 cover %



Collaboration with ALCC modellers

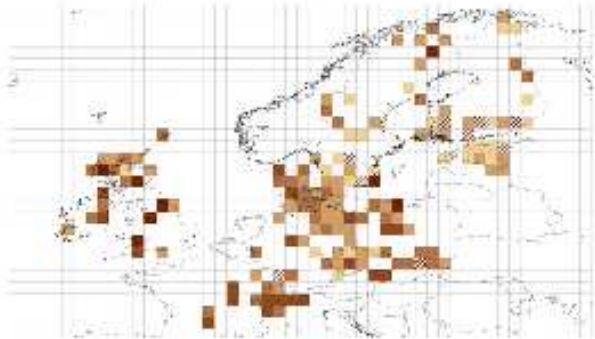
- Gaillard et al. 2010, *Clim Past* (reprints)
- With Jed Kaplan (start 17th of January!)
 - Compare ALCC and REVEALS estimates in NW Europe at the large spatial scale 100 km x 100 km: project started
 - Compare ALCC and LOVE estimates in southern Sweden at the small spatial scale ca. 500 m to 5 km radius (= relevant source area of pollen (RSAP), depending on the site and structure/grain of vegetation): future project

GL + AL

Sum of PFTs GL and AL: for comparison with Kaplan et al. 2009
UNPUBLISHED, in prep 2011

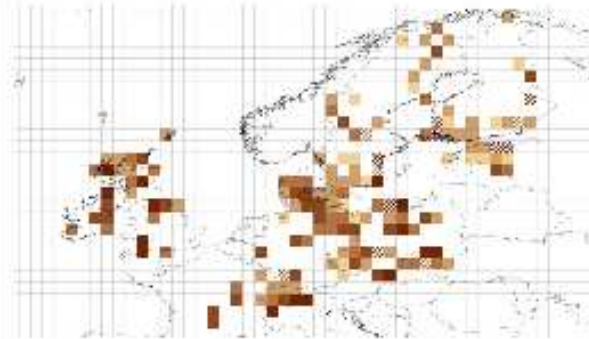
AD 1850-1950

GL&AL 0-100 cal BP



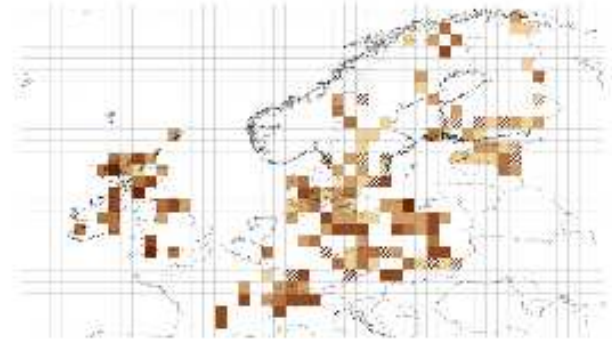
AD 1550-1850

GL&AL 100-350 cal BP

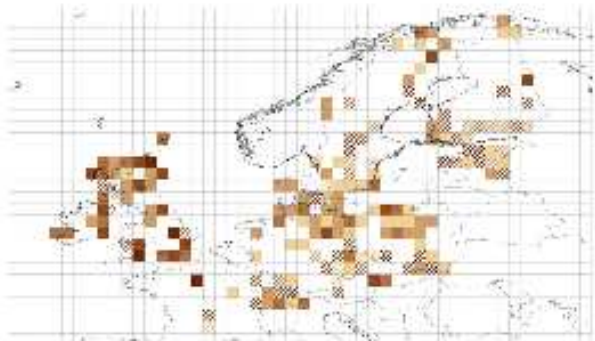


AD 1250-1550

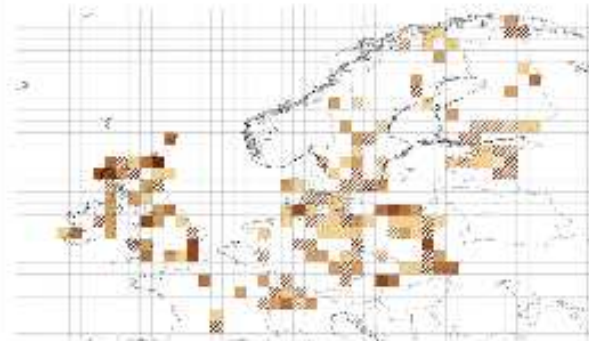
GL&AL 350-700 cal BP



GL&AL 2700-3200 cal BP 1000 BC



GL&AL 5700-6200 cal BP 4000 BC

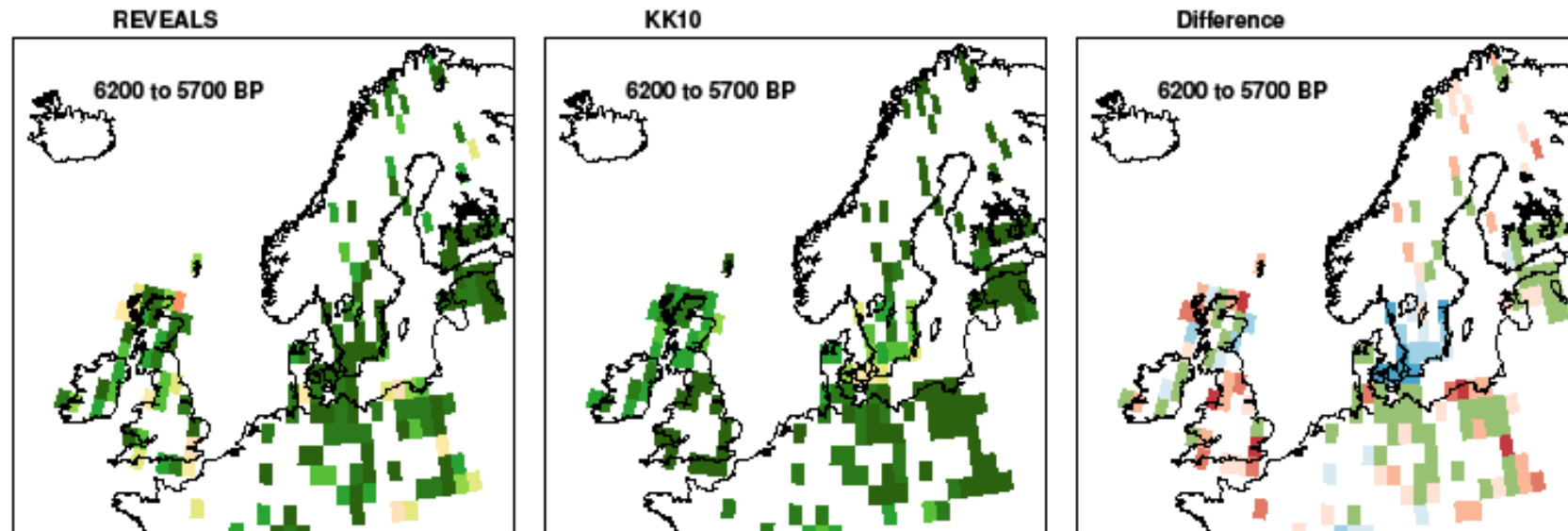


GL+AL cover %

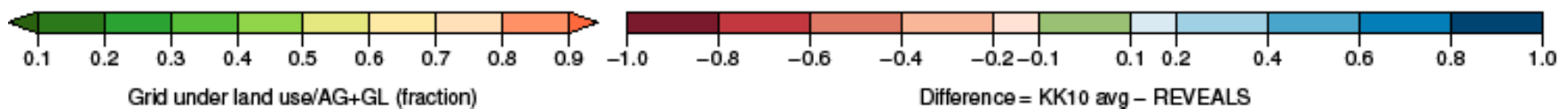
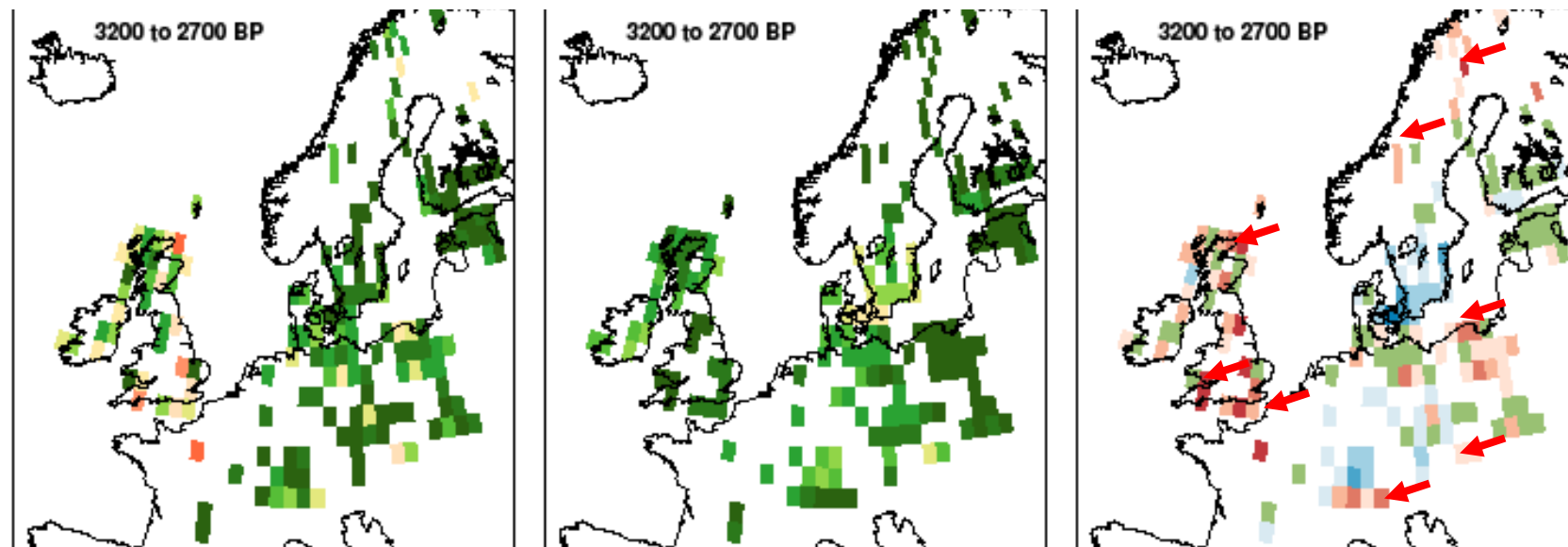


REVEALS reconstruction -Europe - all results

LANDCLIM v 17 Jan 2011



EXAMPLES of COMPARISON Kaplan's KK10 scenarios and REVEALS estimates
 Kaplan et al. unpublished, in prep 2011



Conclusions

- The various spatially explicit descriptions of past natural and human-induced land-cover available to date exhibit very large discrepancies
- First pollen-based land-cover reconstructions are now available for many areas of W Europe N of the Alps (LANDCLIM research project)
- The advantage of REVEALS reconstructions is that they provide cover of **plant taxa** rather than forest, crop-pasture, or crop fractions
- The REVEALS estimates are an important step forward to validate the ALCC scenarios
- A first comparison with Kaplan's scenarios show a fairly good agreement between REVEALS estimates and the modeled ALC
- Next steps: model-data comparison using the REVEALS estimates; comparison with LPJGuess runs, use in the RCA3 runs.