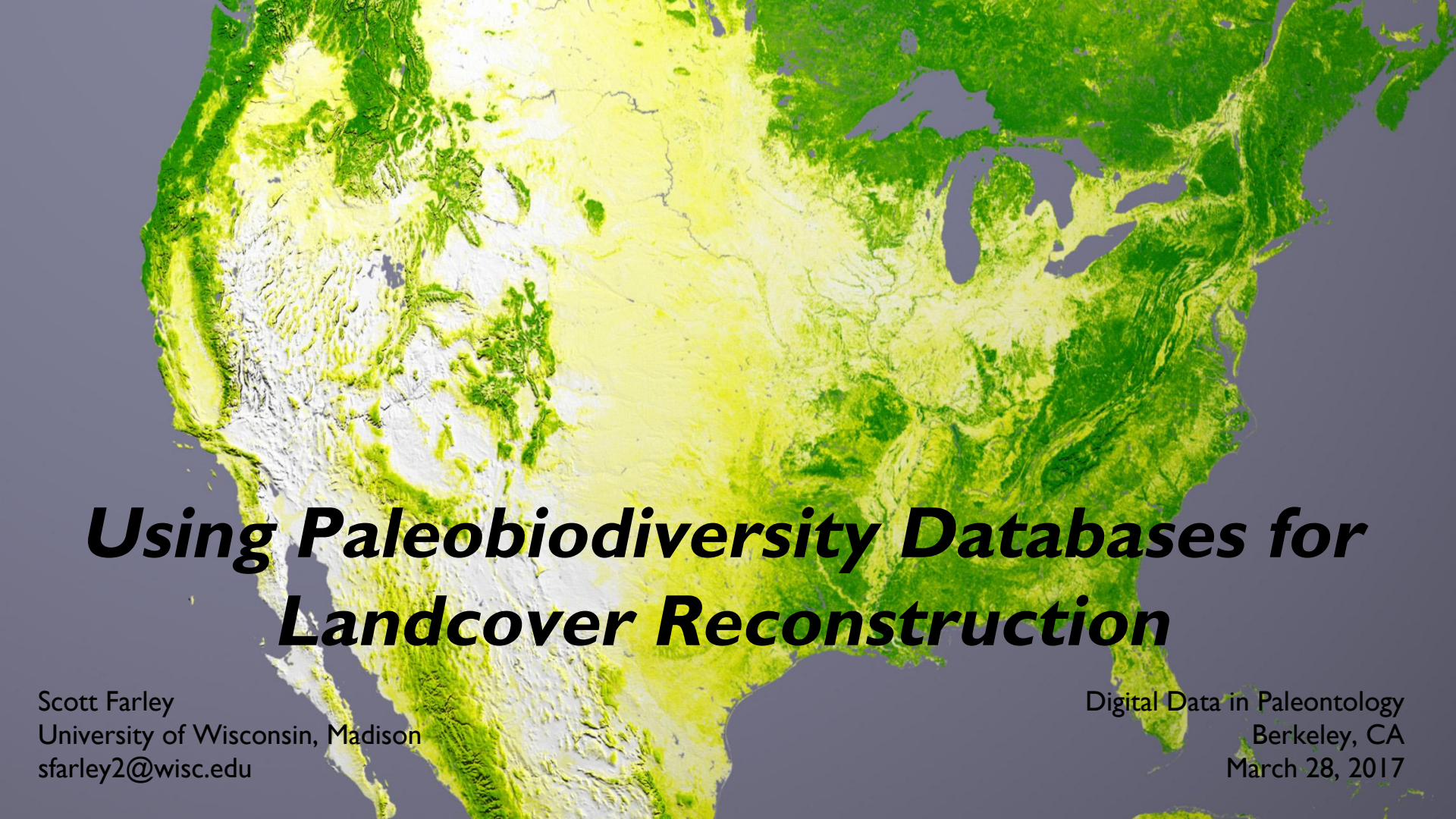

Using Paleobiodiversity Databases for Landcover Reconstruction

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University of Wisconsin, Madison
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Digital Data in Paleontology
Berkeley, CA
March 28, 2017

Paleobiodiversity Databases

Community efforts to collect, structure, store, and share occurrence data

...*what* was it?

...*when* was it?

...*where* was it?

Paleobiology Database

Neotoma

Paleobiodiversity Databases

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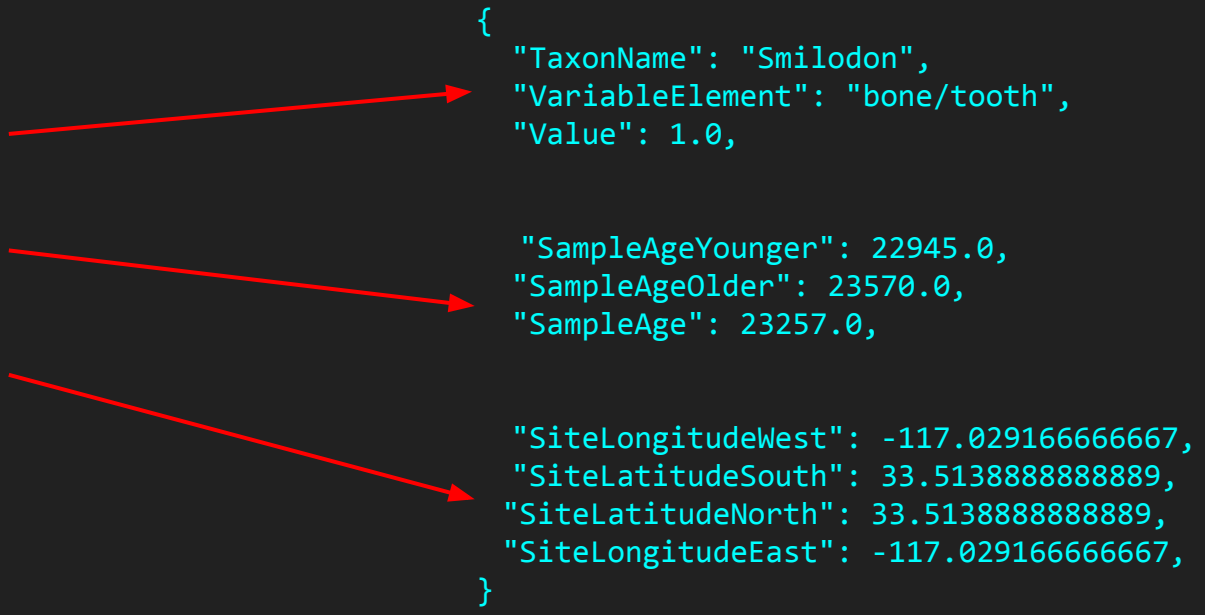


Example: Smilodon Record from Neotoma

Paleobiodiversity Databases

Not just the data...

- Software ecosystems:
  - data services (JSON, CSV)
  - language bindings (python libraries, R packages)
- Community Support

Paleobiodiversity Databases

Not just the data…

Makes modeling easy

Reconstructing paleo-landcover

Spatially continuous patterns of past terrestrial vegetation

Reconstructing paleo-landcover

Spatially continuous patterns of past terrestrial vegetation

Why?

- Ecological niche models
- Global climate model vegetation modules
- Land-atmosphere feedbacks
- Early human land use

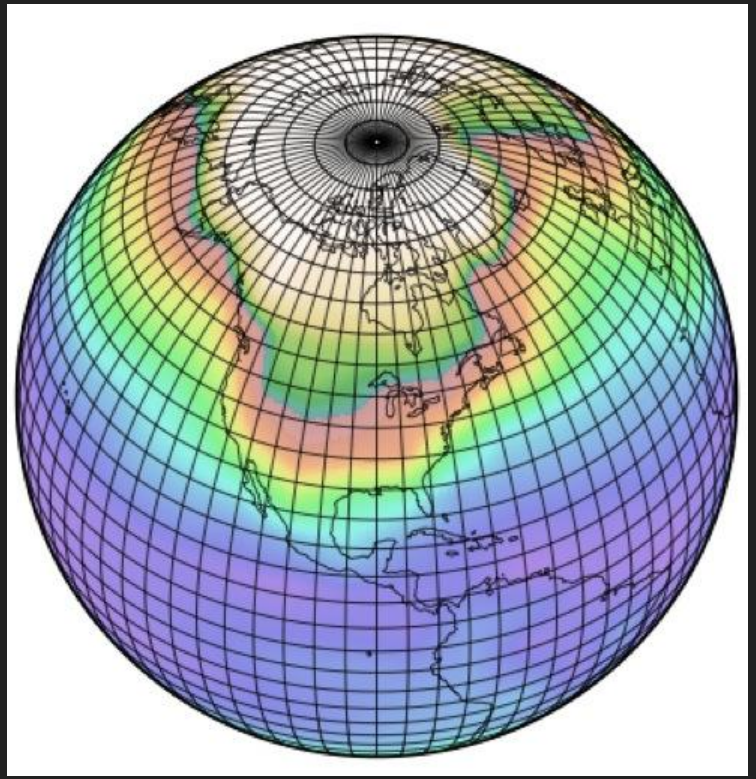


Photo: Carlton University

Reconstructing paleo-landcover

Spatially continuous patterns of past terrestrial vegetation

Why?

Since last glacial maximum (22kya)

What we want

Spatially continuous patterns of terrestrial vegetation

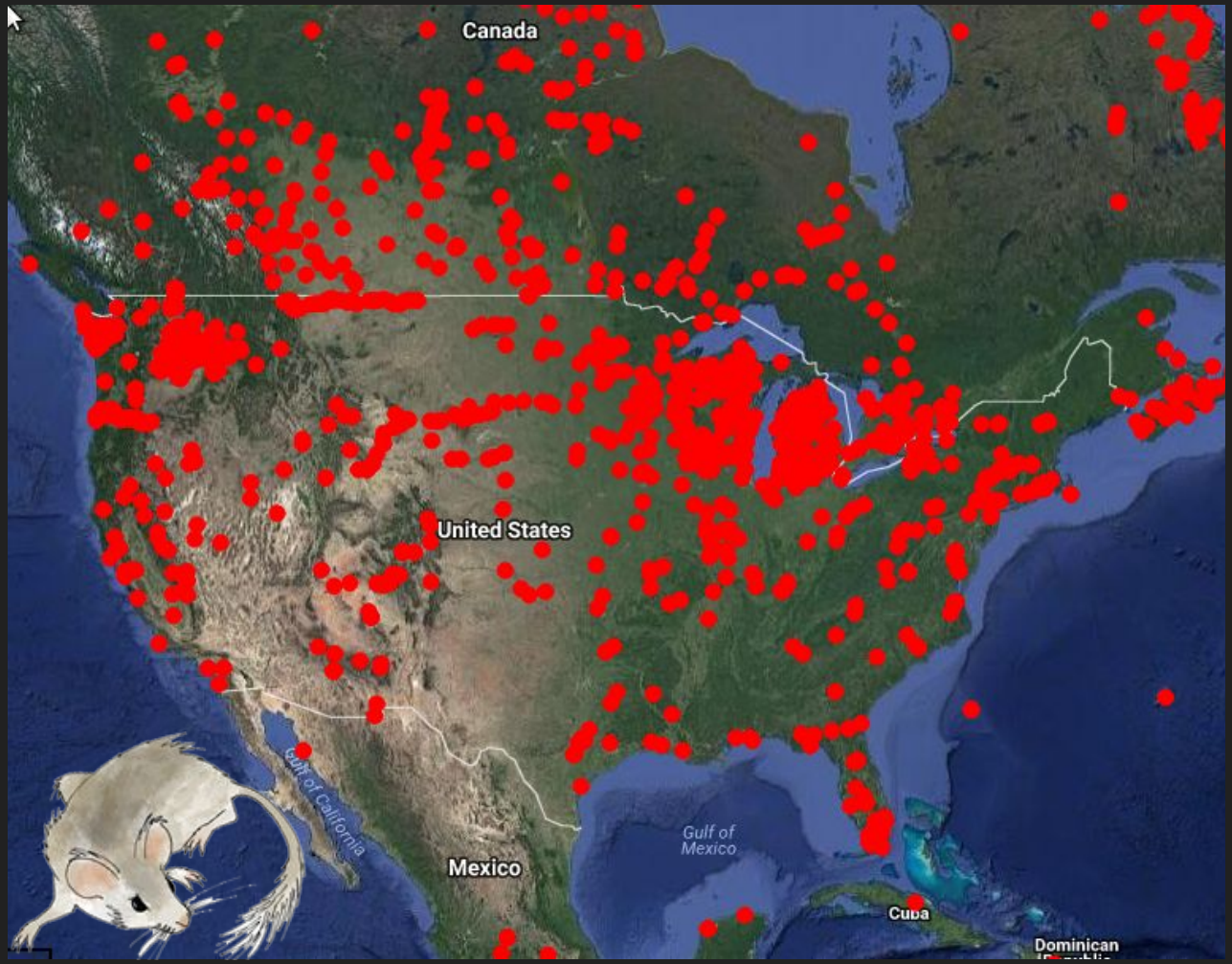


Figure: Neotoma Database

What we have

Spatiotemporally discrete records of local landcover signal

Potential Approaches

- Expert Interpretation / Assumptions

Potential Approaches

- Expert Interpretation / Assumptions
- Spatial Interpolation

Potential Approaches

- Expert Interpretation / Assumptions
- Spatial Interpolation
- Statistical Modeling / Machine Learning

In the past...

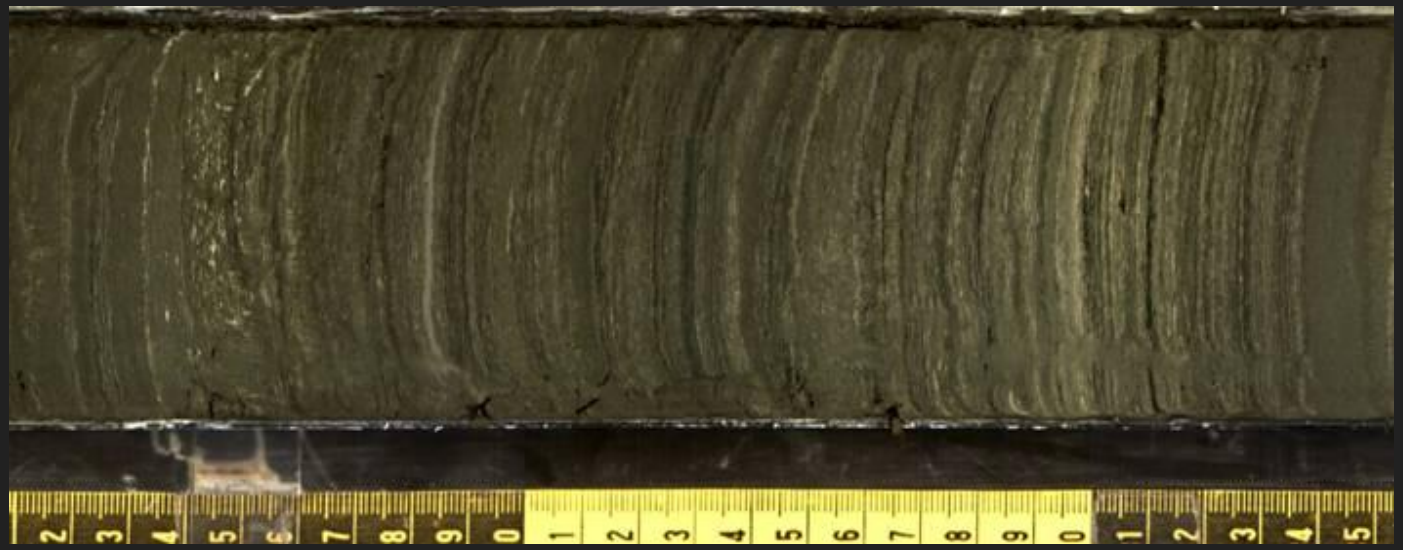
… vegetation cover is not observable (latent)

In the past...

… vegetation cover is not observable (latent)

but,

… pollen is.



Today...

We can observe both **cover**

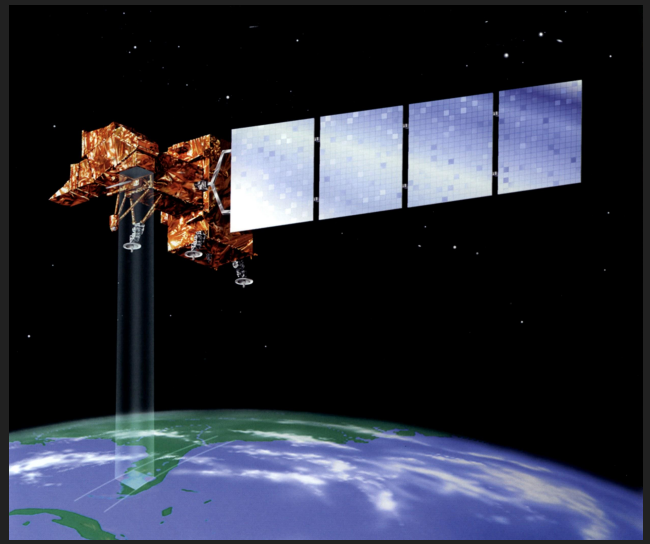


Photo: NASA

MODIS/Landsat/AVHRR

Today...

We can observe both **cover** and **pollen.**

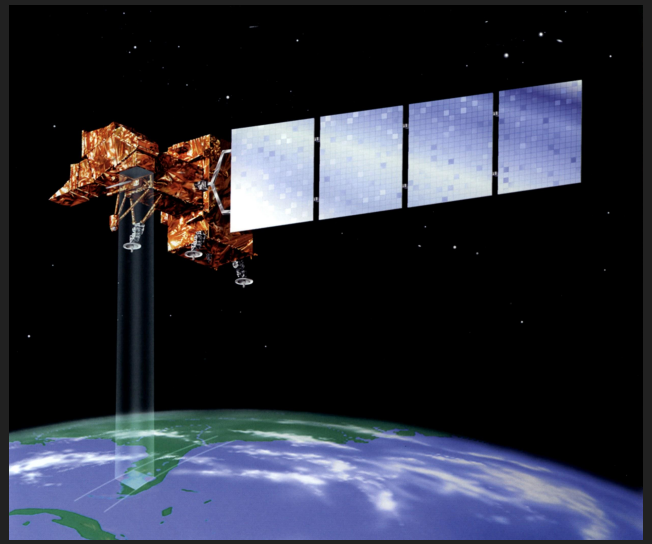


Photo: NASA

MODIS/Landsat/AVHRR

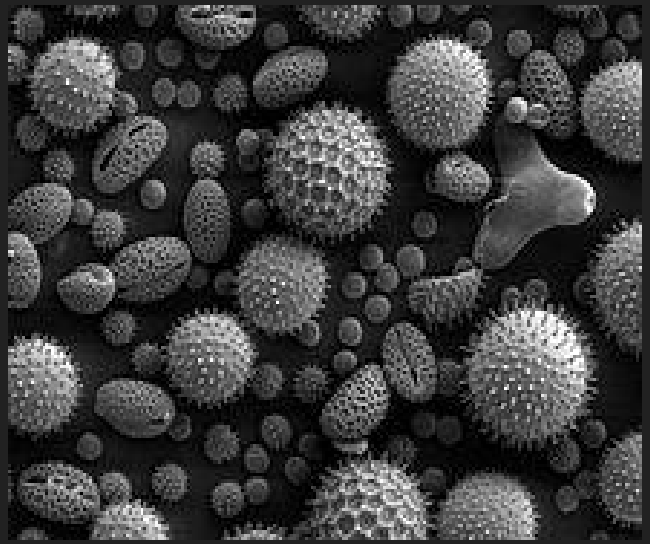
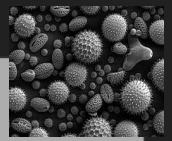


Photo: Wikimedia Commons

Modern Pollen Surface Samples

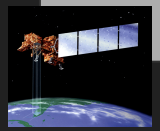
Calibration with modern data

Approximate the functional relationship between modern pollen spectra and modern land cover

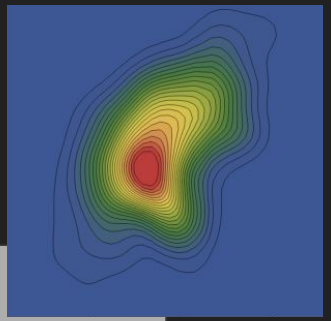


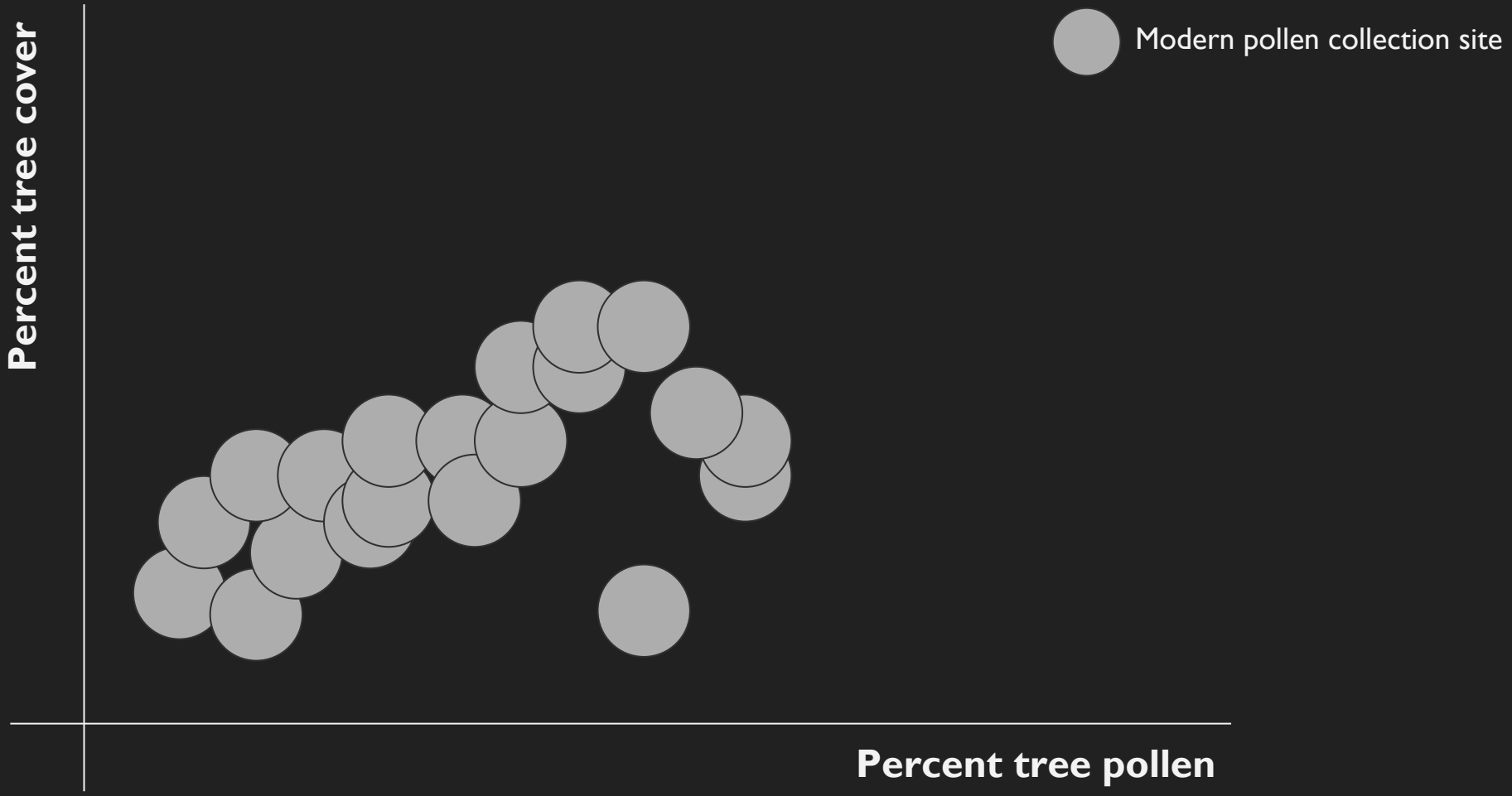
Modern Pollen Data

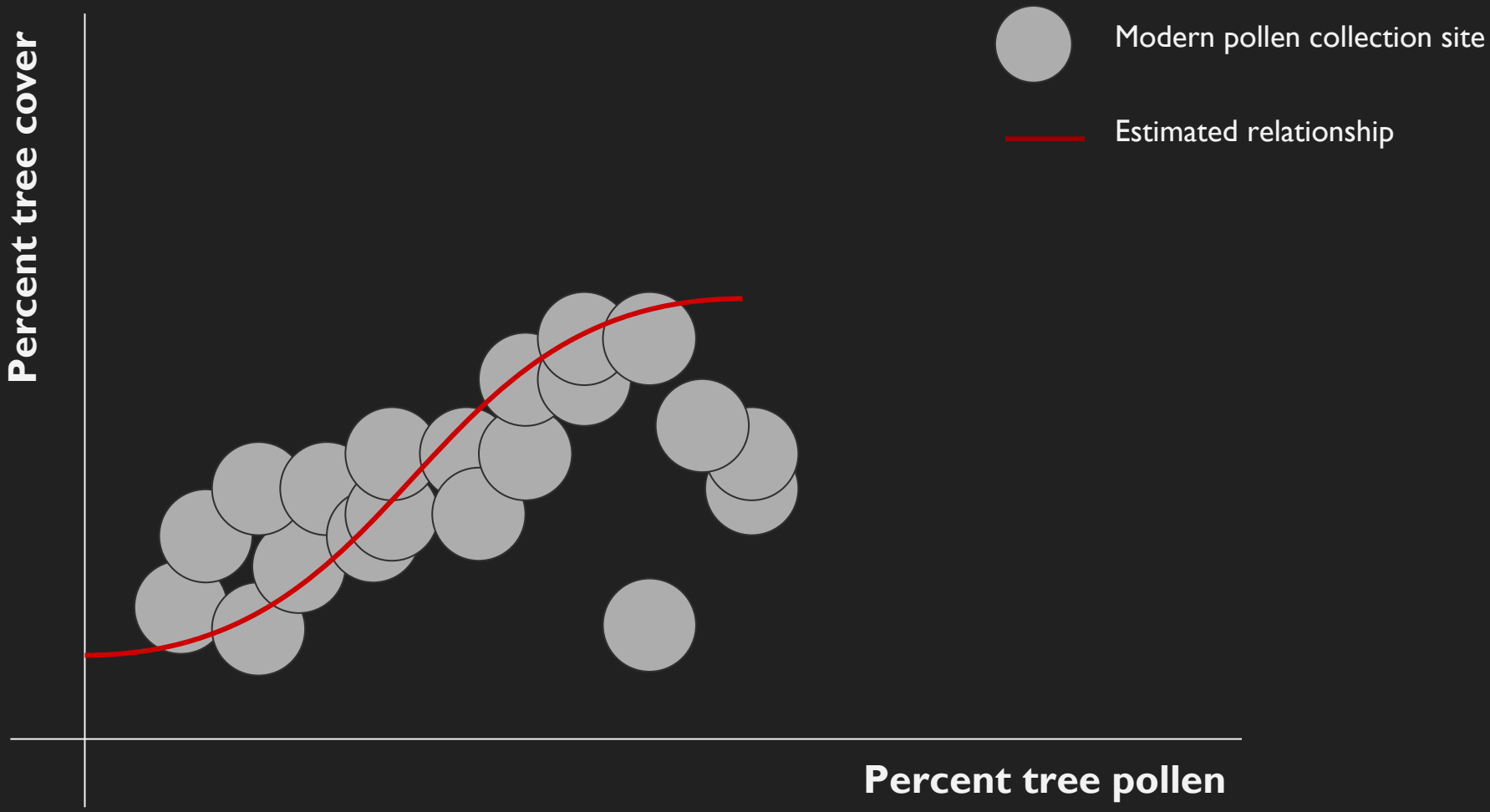
Remotely Sensed Landcover



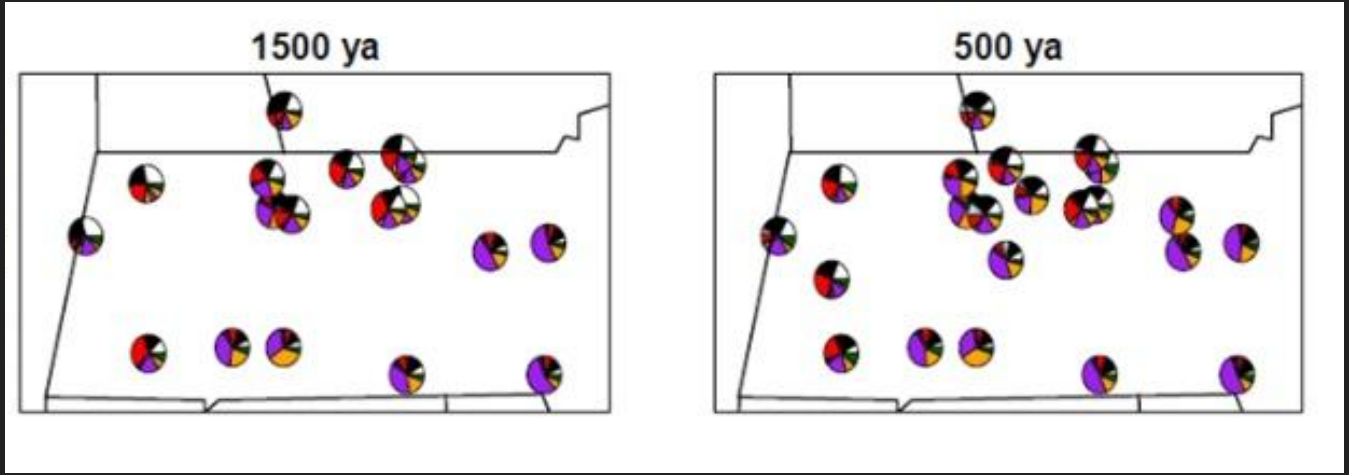
Hierarchical Bayesian Model




Modern pollen collection site
Percent tree cover
Percent tree pollen


Percent tree cover
Modern pollen collection site
Estimated relationship
Percent tree pollen

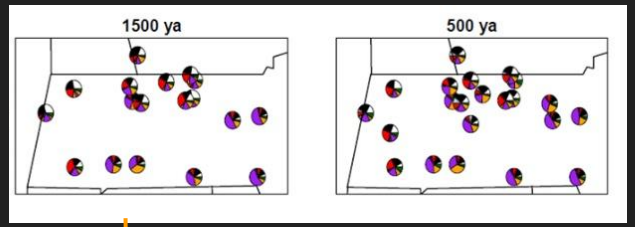
Apply relationship to fossil pollen records



Paleo-occurrence records

Figure: Paleon Project

Apply relationship to fossil pollen records



Calibrated model

Continuous estimates of paleo-landcover

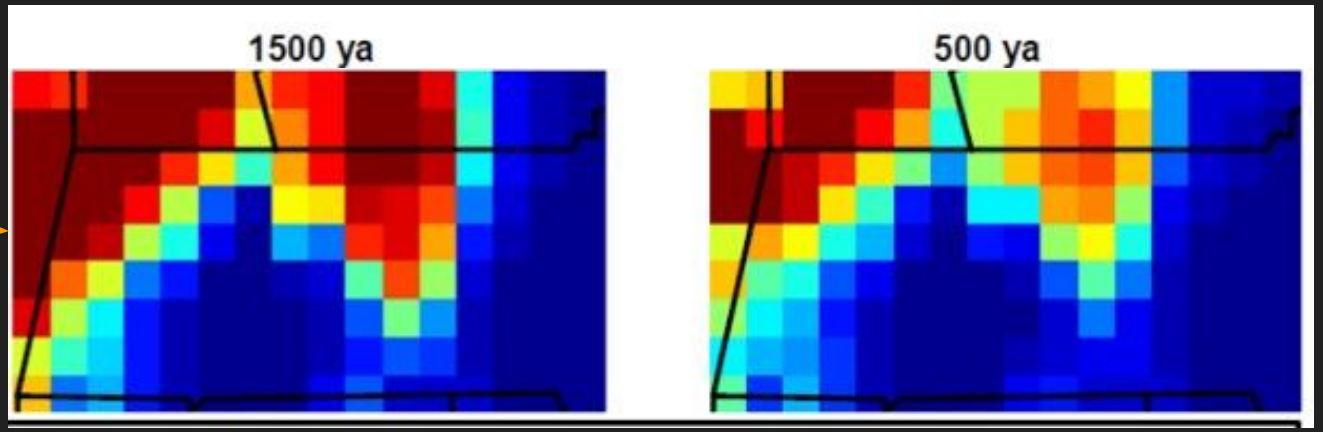
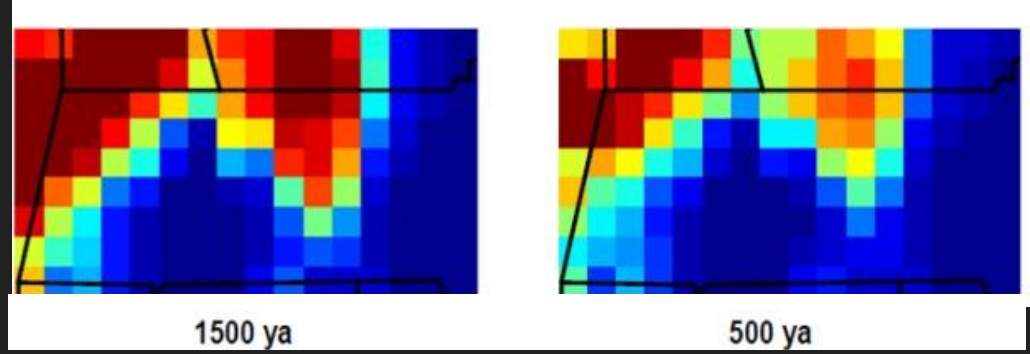


Figure: Paleon Project

Project Deliverables

Estimate:

- % Tree Cover
- % Broadleaf
- % Needleleaf



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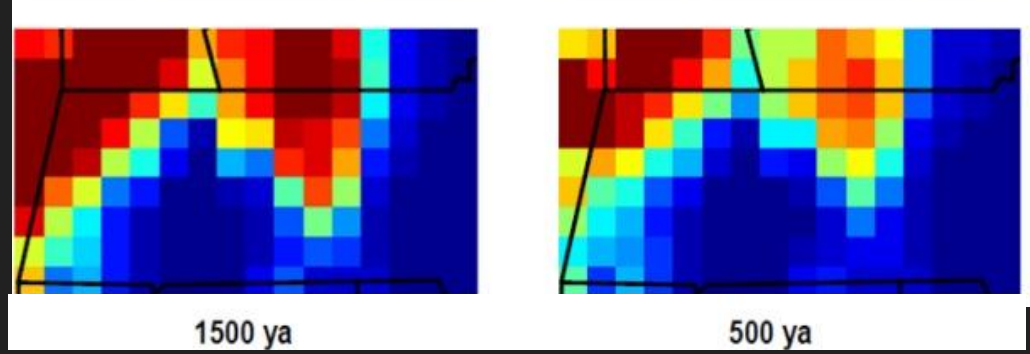

Spatial Extent: North America
Spatial Resolution: 800m

Temporal Extent: 22,000 years (LGM)
Temporal Resolution: 500 years

Figure: Paleon Project

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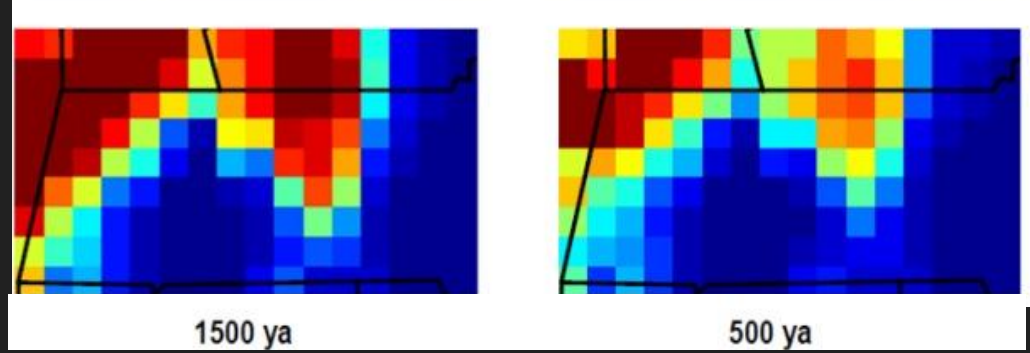

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Temporal Extent: 22,000 years (LGM)
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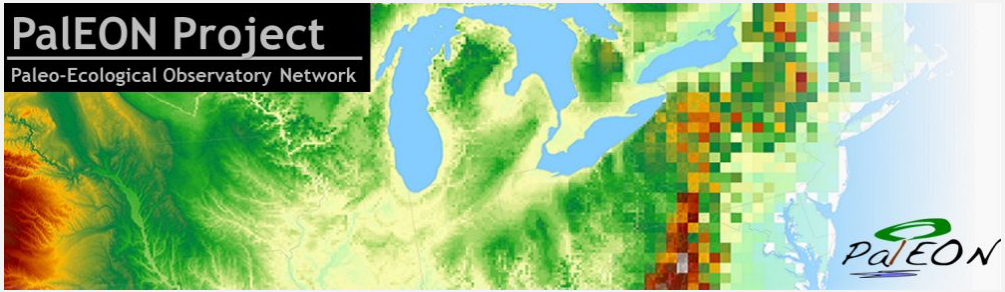
Share gridded **data-based reconstructions** via GitHub for downstream consumption.

Figure: Paleon Project

Thank you!

WISCONSIN
UNIVERSITY OF WISCONSIN–MADISON

DEPARTMENT OF GEOGRAPHY
University of Wisconsin-Madison



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