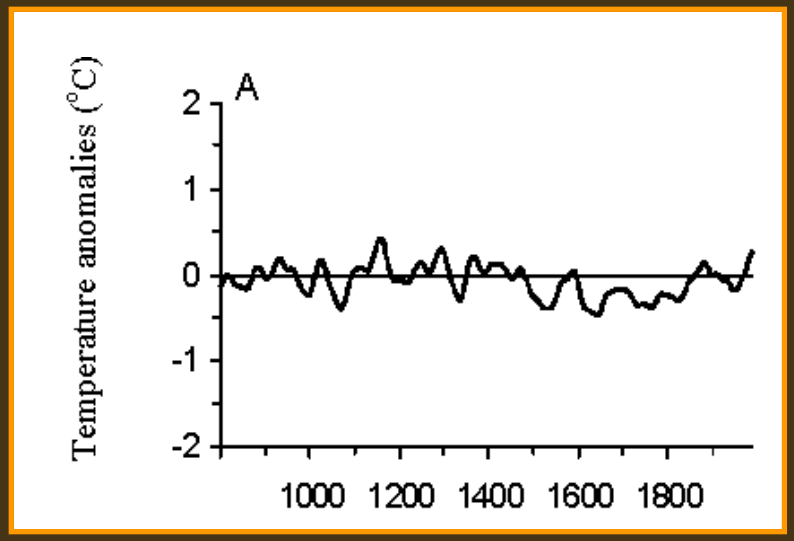
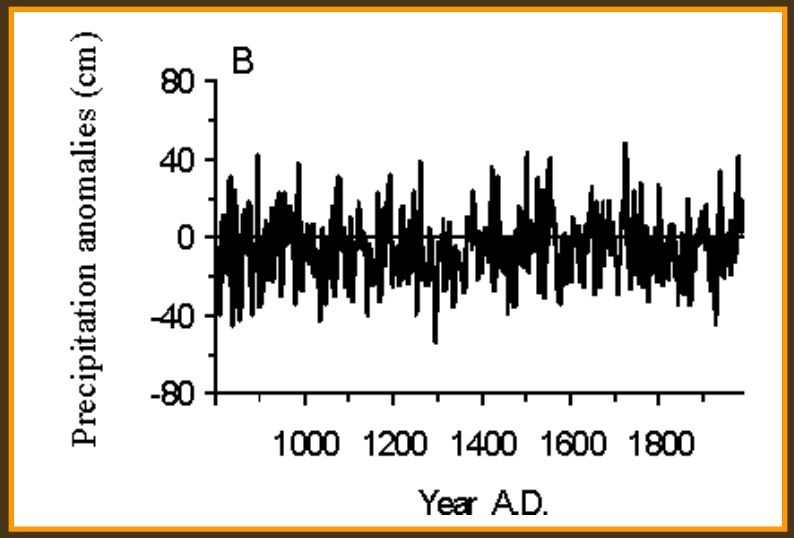
SNGCP: Treeline Research

Andy Bunn and Lisa Graumlich

Reconstructions

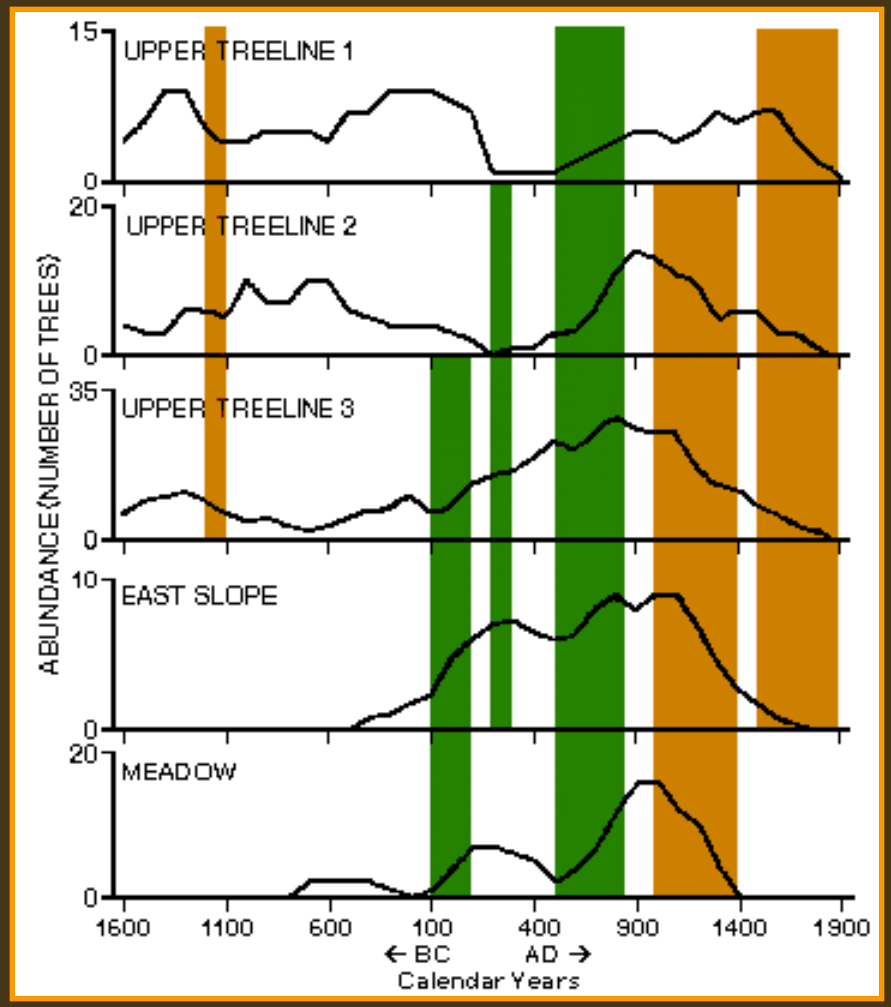




Graumlich (1993) *Ecology*

Hughes and Graumlich (1996) *NATO ASI*

Treeline population processes



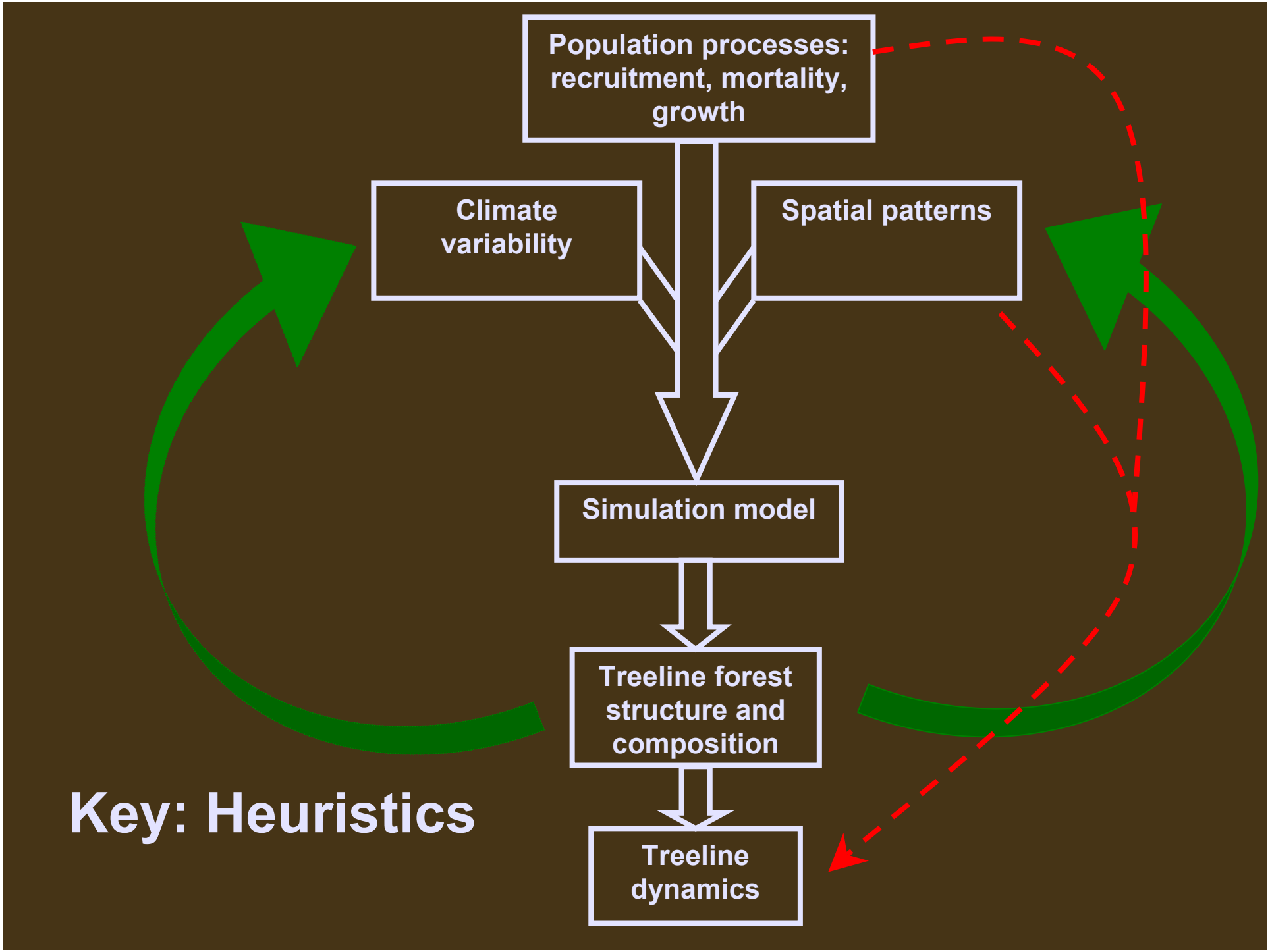
Lloyd and Graumlich (1997) *Ecology*

Lloyd (1997) *Can J For Res*

Lloyd (1998) *Ecoscience*

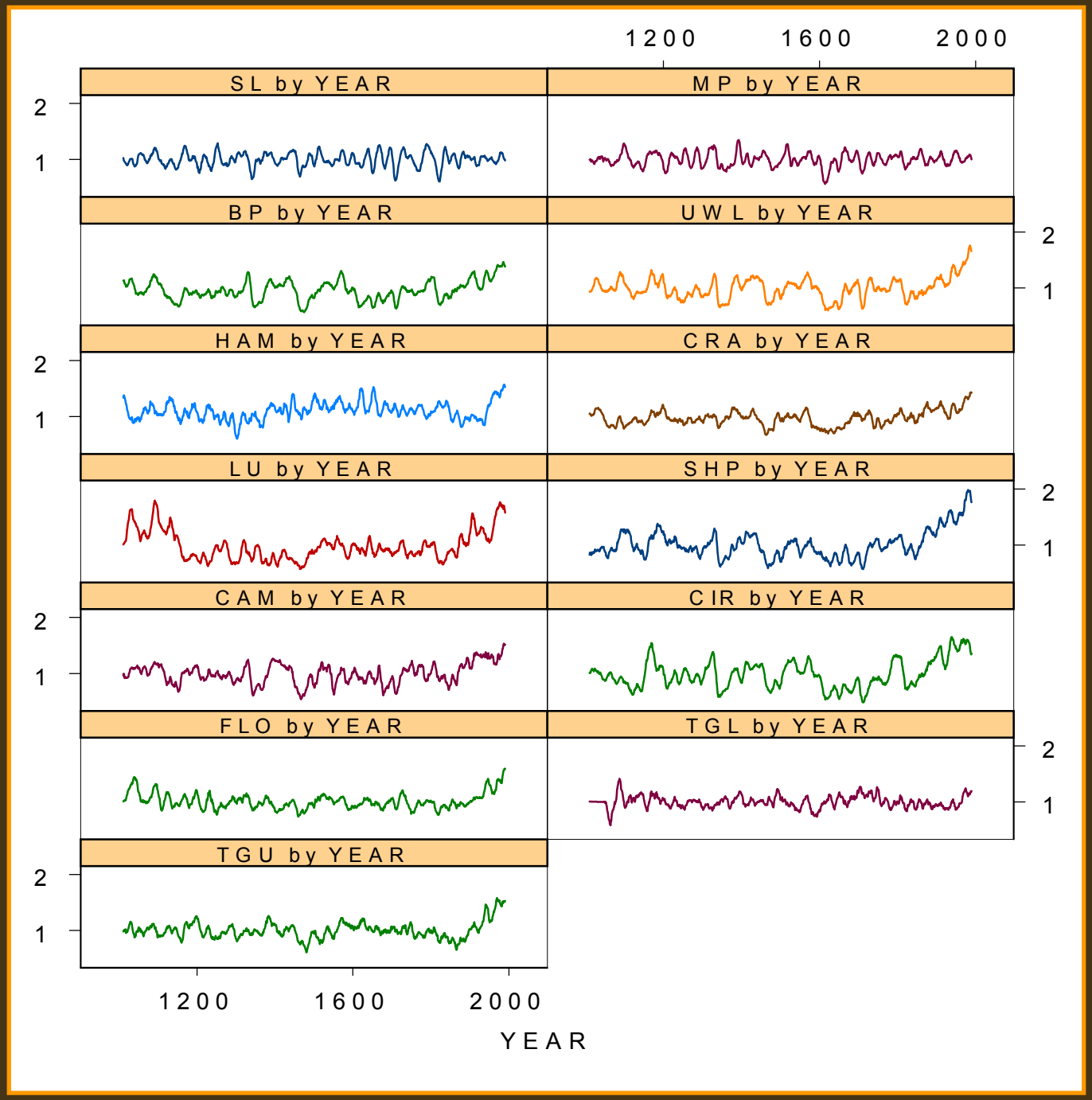
What we know

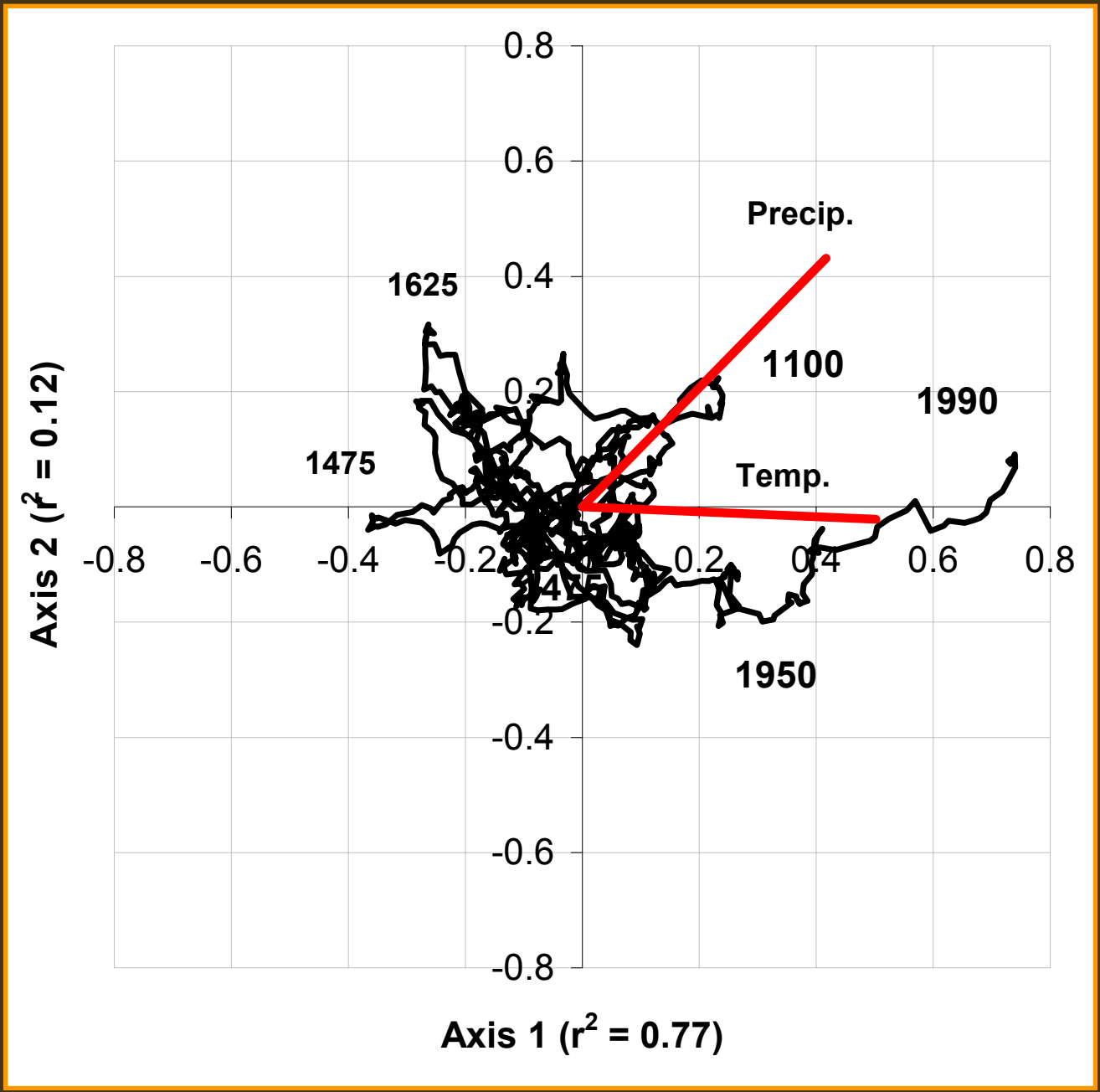
- We know *when* treeline changes
- We know something about *where*
- We know little about *how*
- Until now:
  - Exquisite temporal data
  - Mediocre spatial data
  - Poor understanding of scale

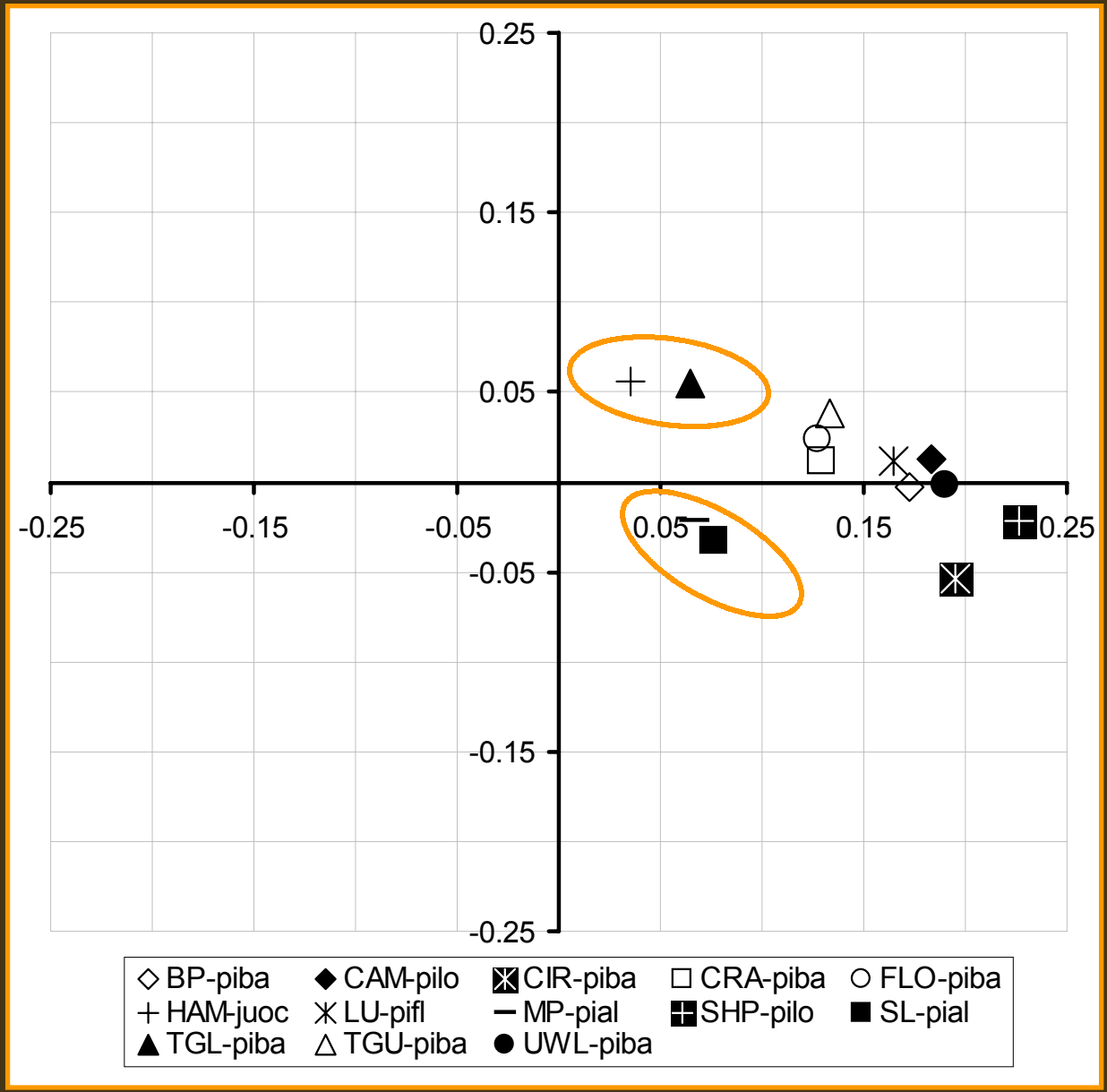

Population processes: recruitment, mortality, growth
Climate variability
Spatial patterns
Simulation model
Treeline forest structure and composition
Treeline dynamics
Key: Heuristics

Regional records

Multi-species millennial length records of climate variability

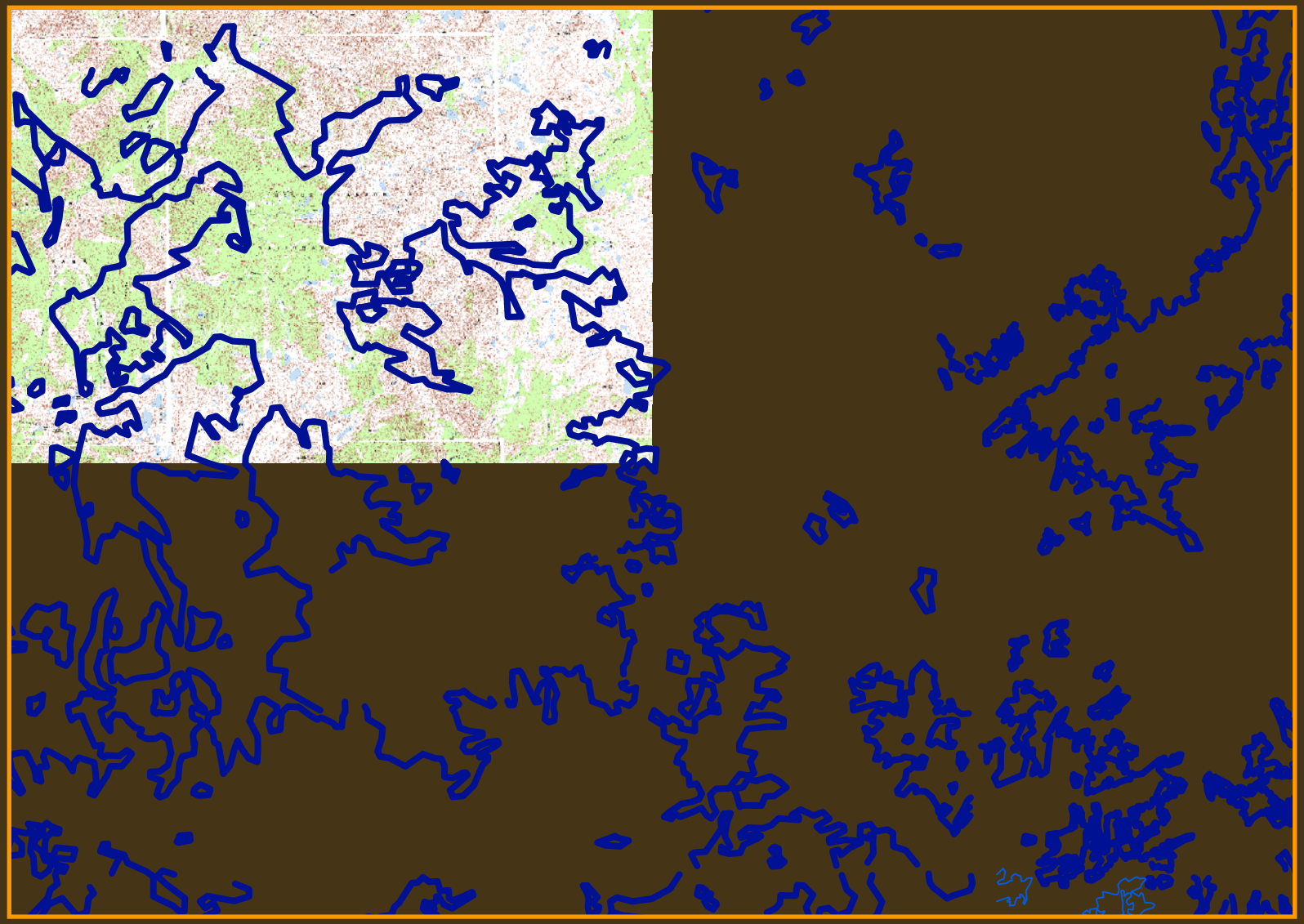

SL by YEAR
MP by YEAR
BP by YEAR
UWL by YEAR
HAM by YEAR
CRA by YEAR
LU by YEAR
SHP by YEAR
CAM by YEAR
CIR by YEAR
FLO by YEAR
TGL by YEAR
TGU by YEAR
1200
1600
2000
1
2
YEAR


0.8
0.6
0.4
0.2
-0.2
-0.4
-0.6
-0.8
-0.8
-0.6
-0.4
-0.2
0.2
0.4
0.6
0.8
Precip.
Temp.
1625
1100
1990
1475
1950
Axis 2 (r^2 = 0.12)
Axis 1 (r^2 = 0.77)

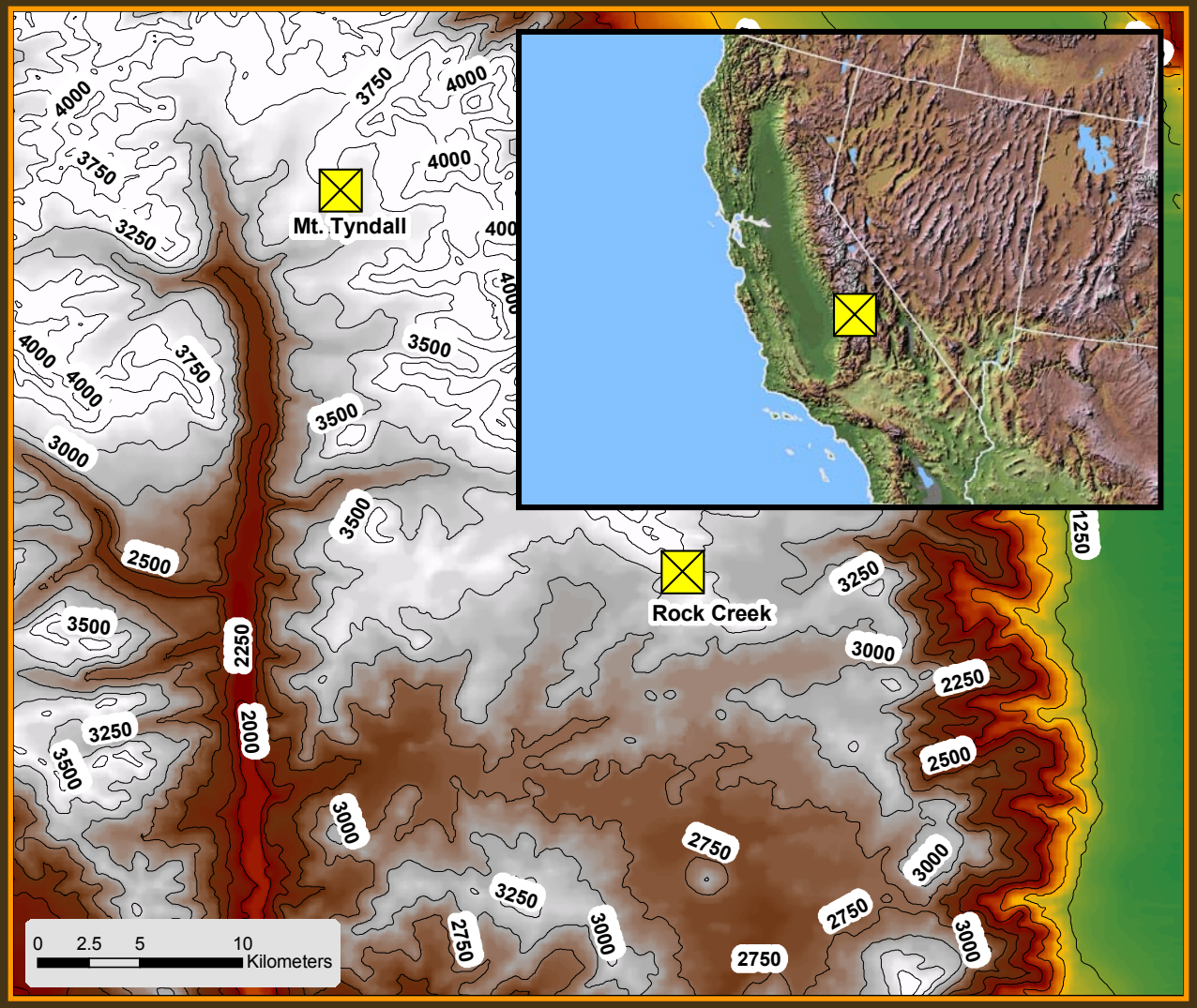


Bunn, Urban, and Graumlich (*in review*)

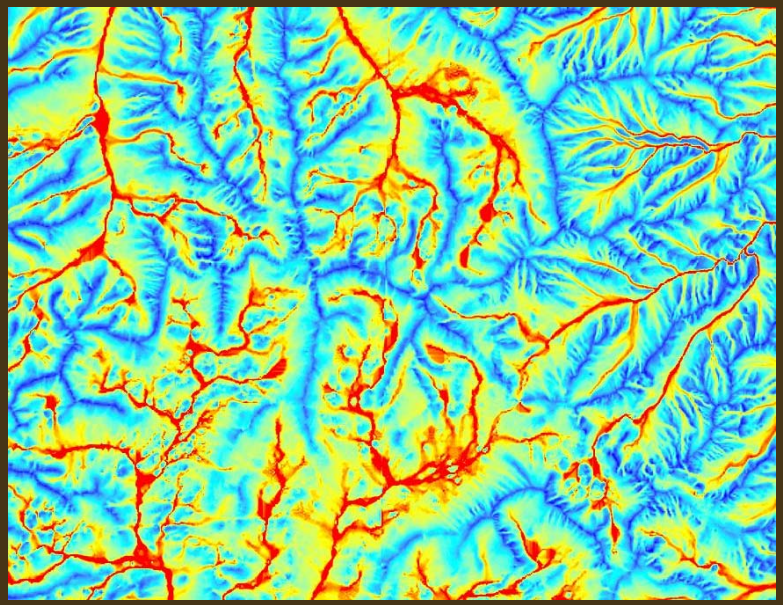
Regional spatial data

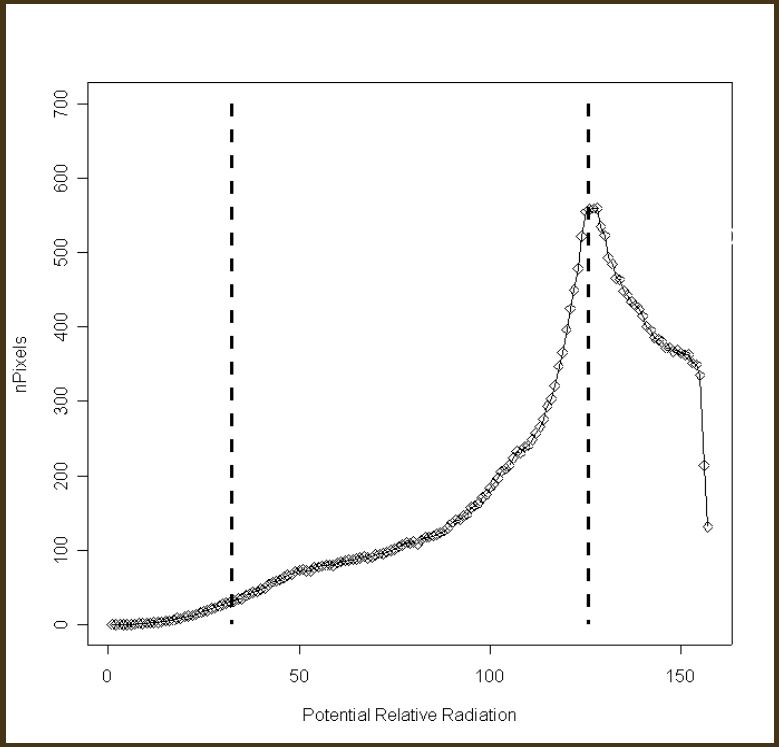


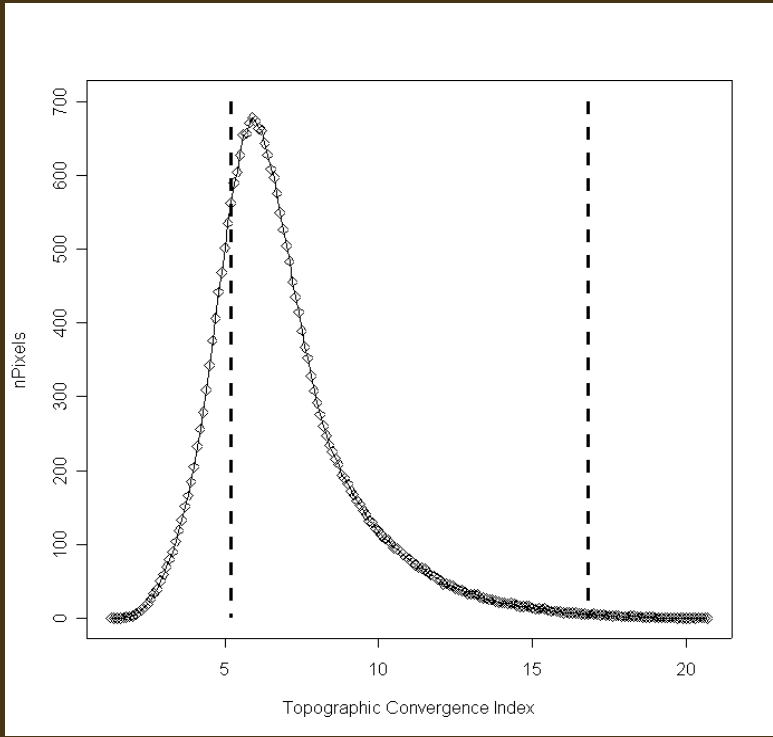
Hectare scale variation



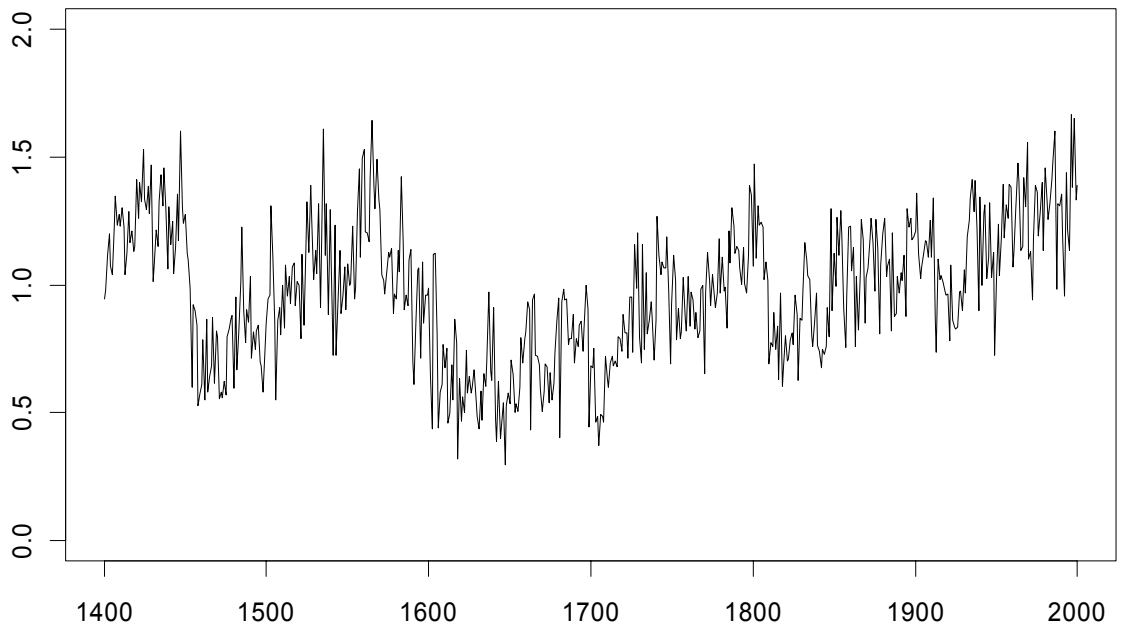
Impact of the physical template



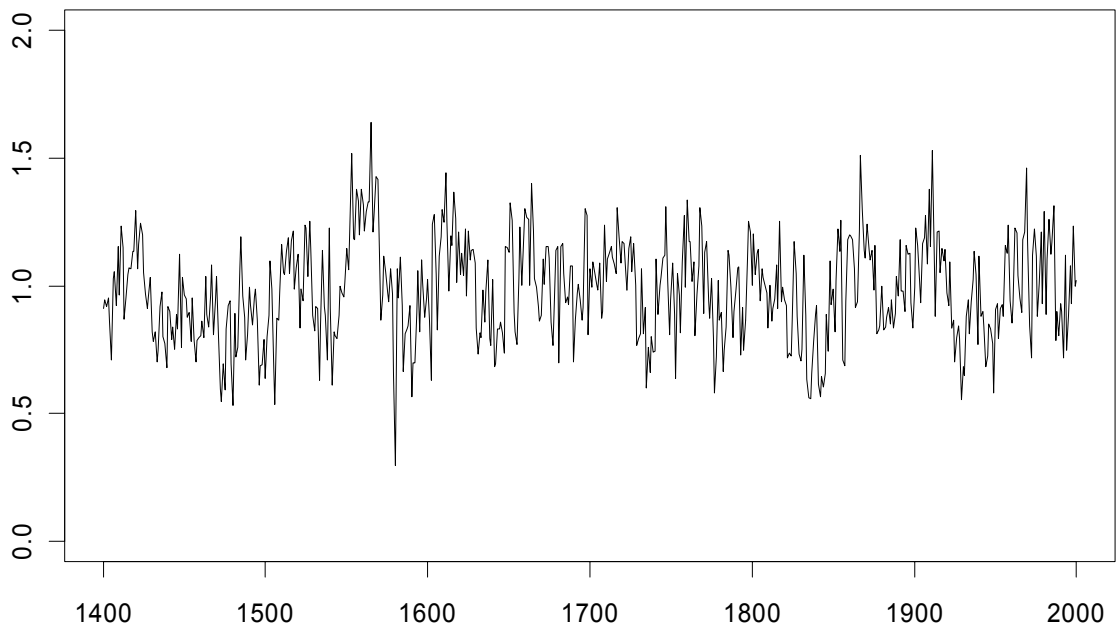

nPixels
0
100
200
300
400
500
600
700
0
50
100
150
Potential Relative Radiation


nPixels
0
100
200
300
400
500
600
700
5
10
15
20
Topographic Convergence Index

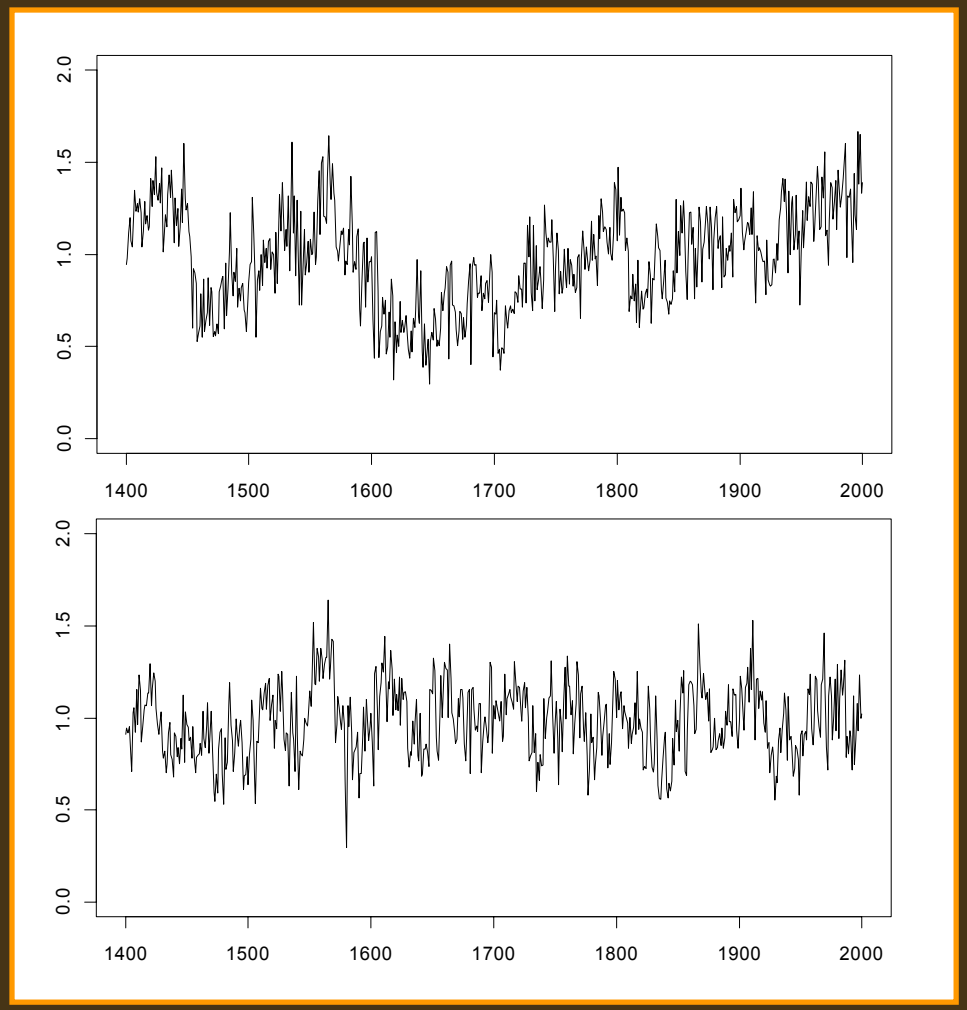
Wet and Bright

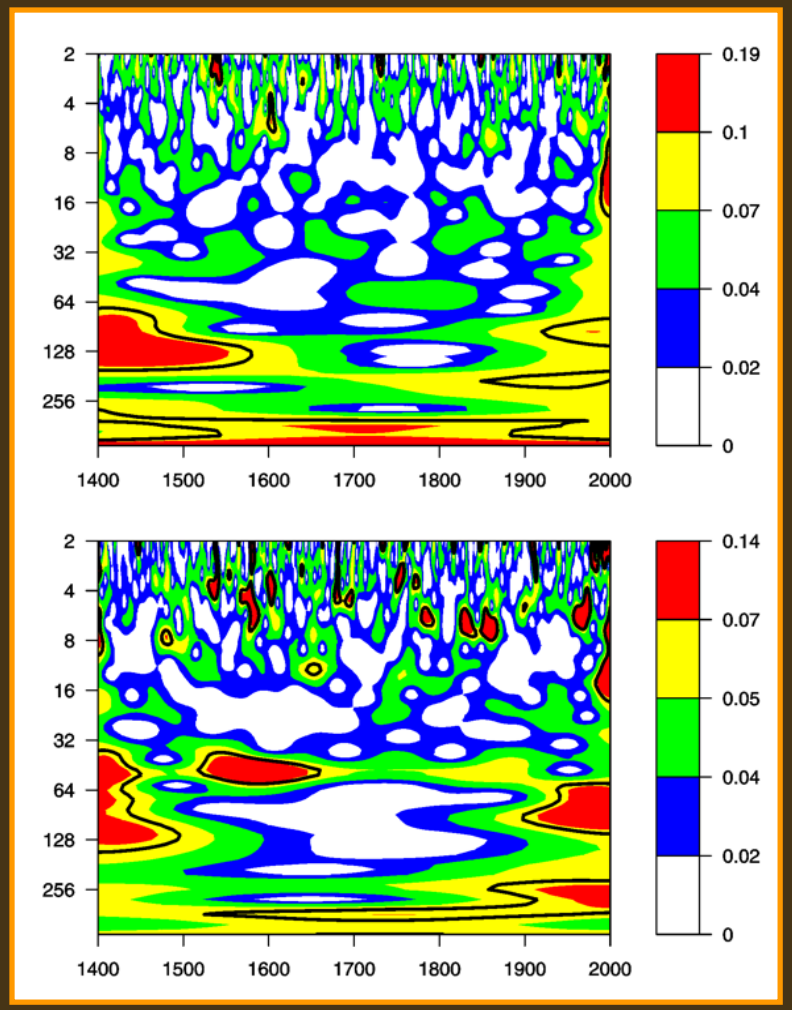


Dry and Dark



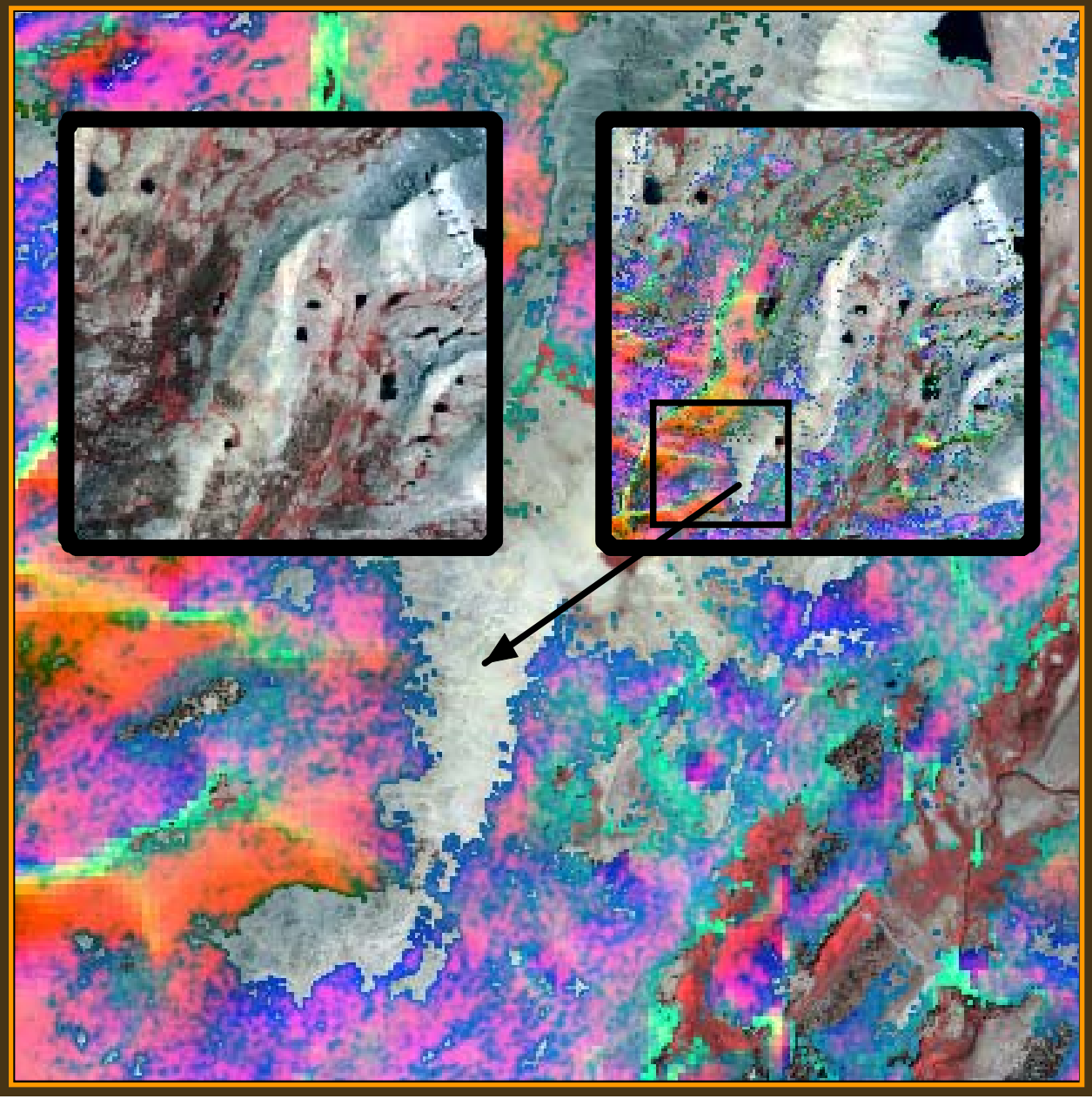
Wavelet power spectra



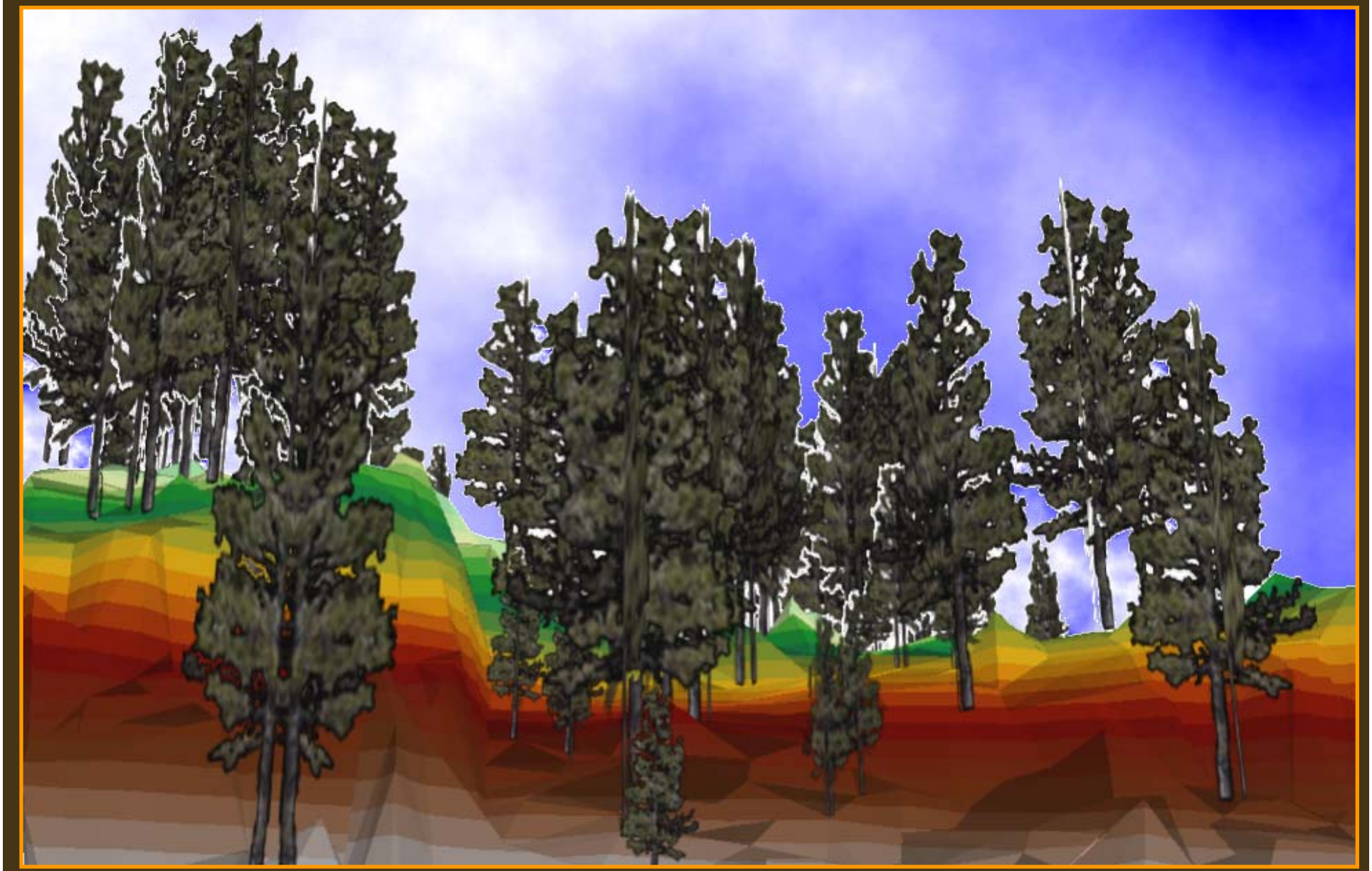


Bunn and Graumlich (*in review*)

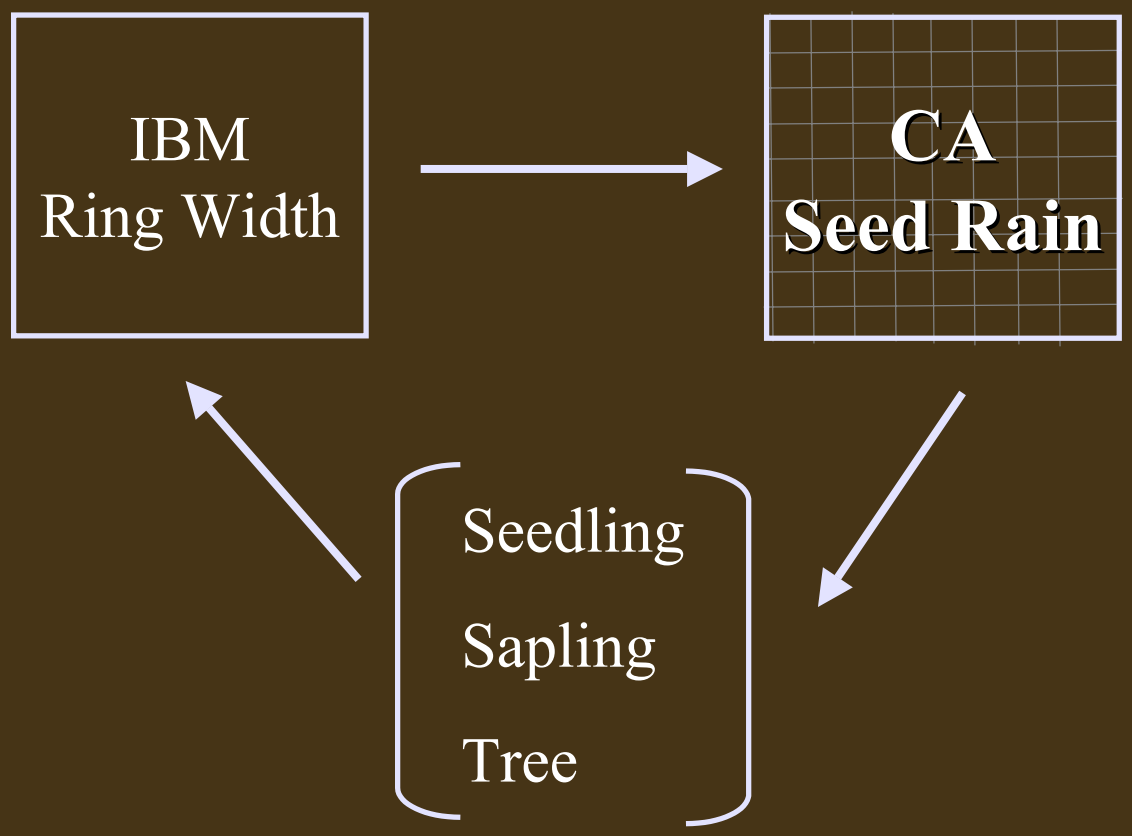
Process Models

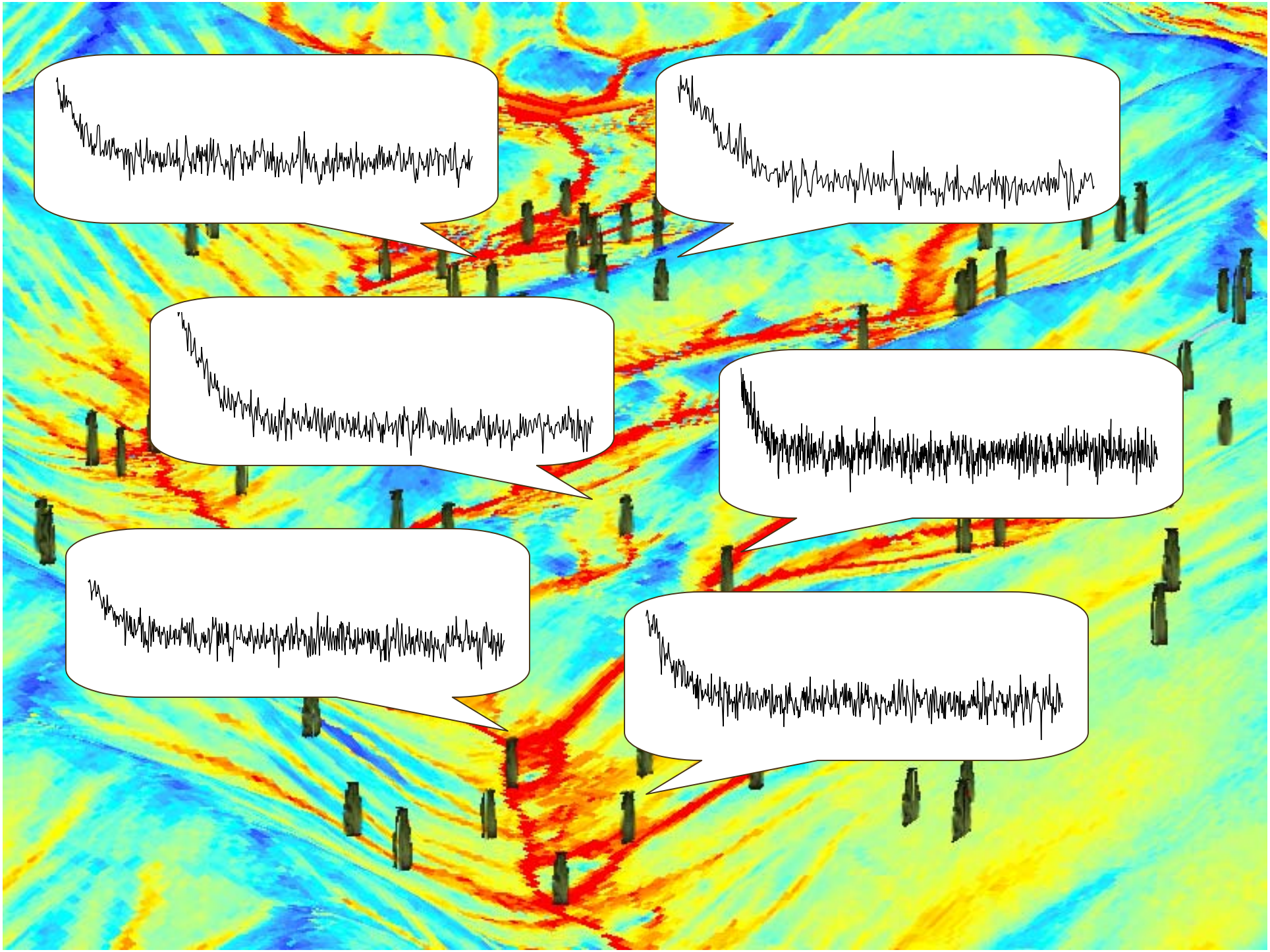


Meter scale

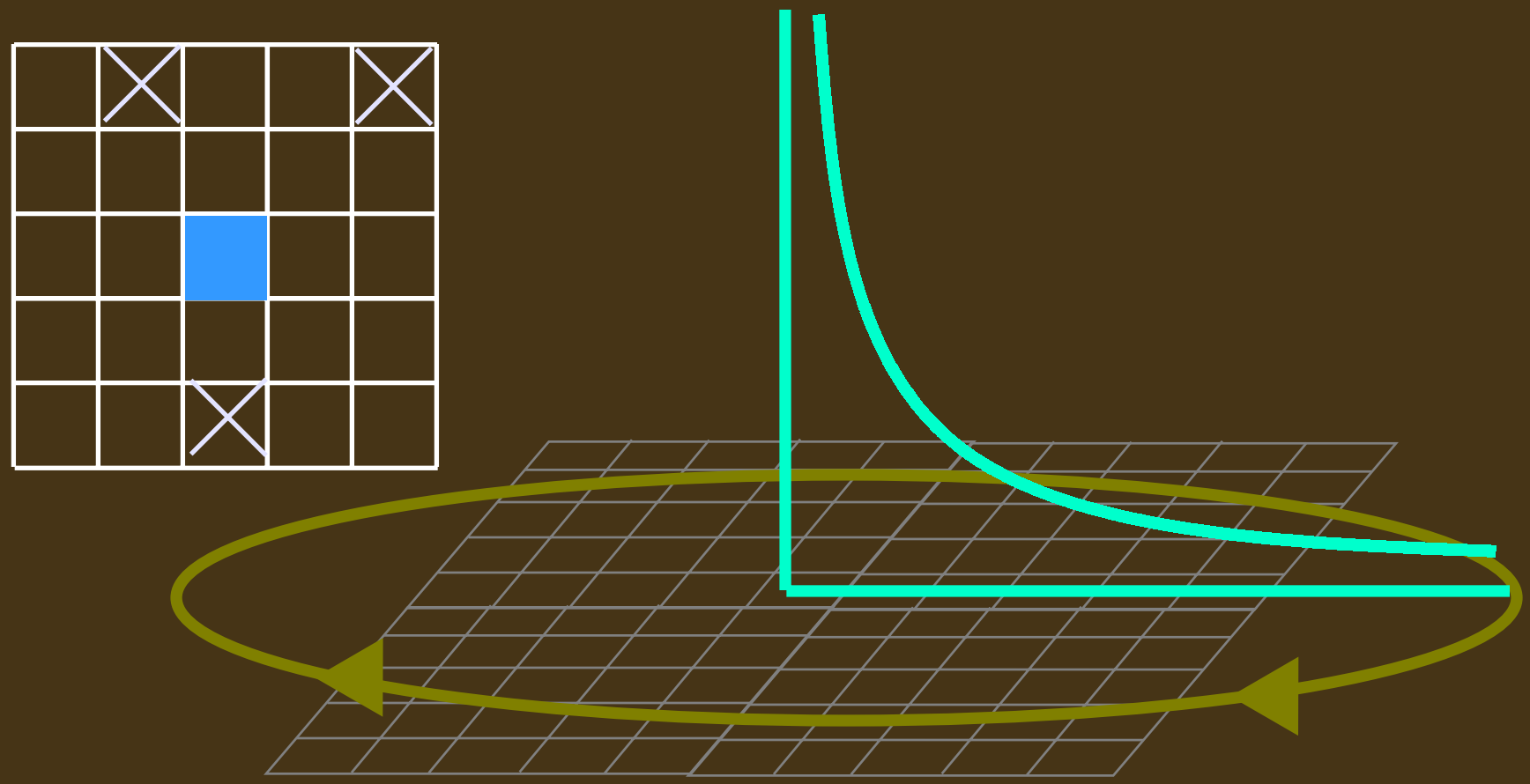


Modeling framework

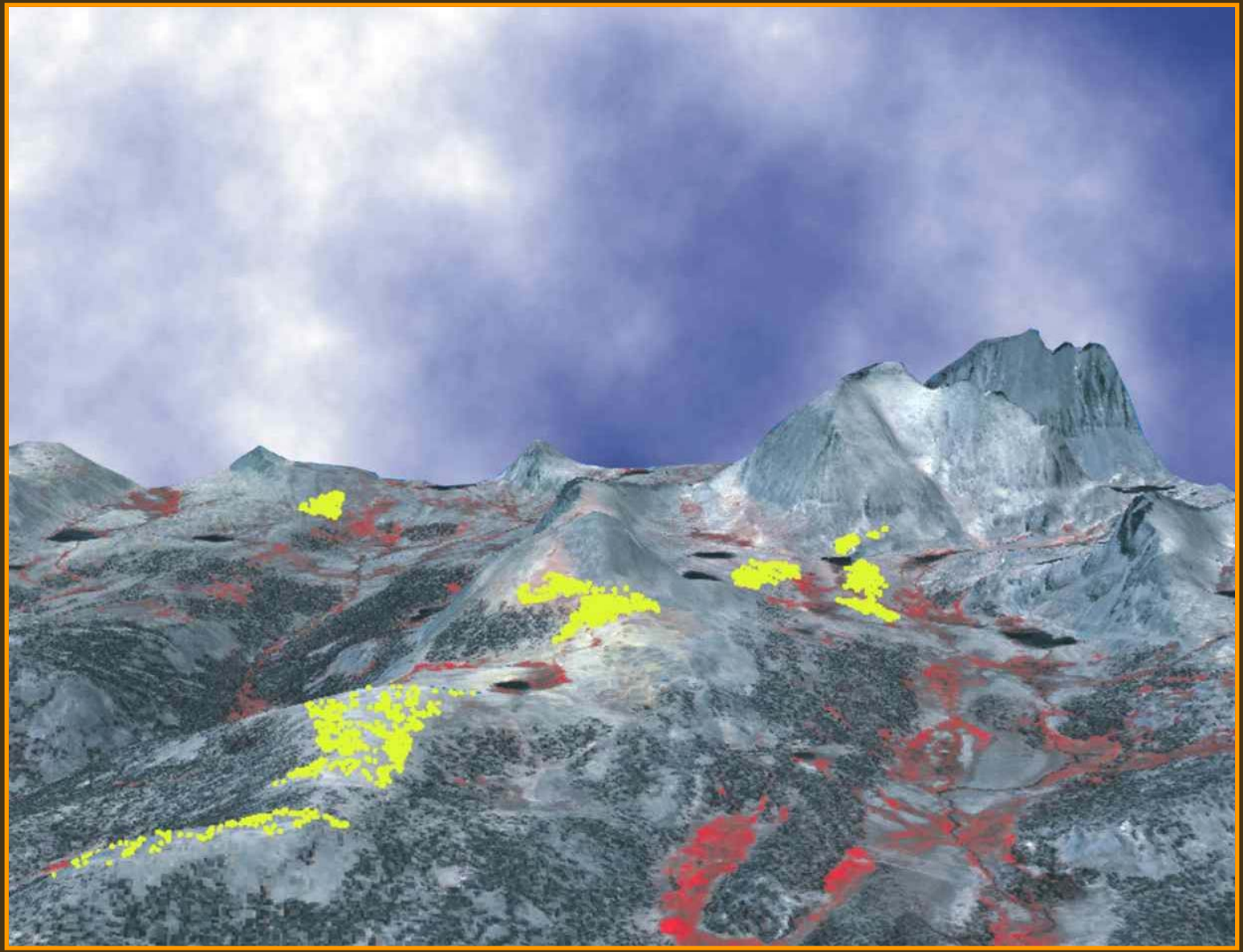




Seedling model



Validation data



Prospectus

- Past work
  - Climate reconstructions
  - Population processes
- Present work:
  - Spatial and temporal understanding across scales
  - Mechanistic model that answers “how”