

## Solar Insolation for Civilizations

25Feb07 [www.BillHowell.ca](http://www.BillHowell.ca)

Based on Laskar et al, and Solanki, Taping

Laskar solar insolation results assume  $1368 \text{ Wm}^{-2}$

Not included yet!! - Sunspot data from 1890 to 2005 on the same basis as Solanki's data

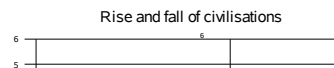
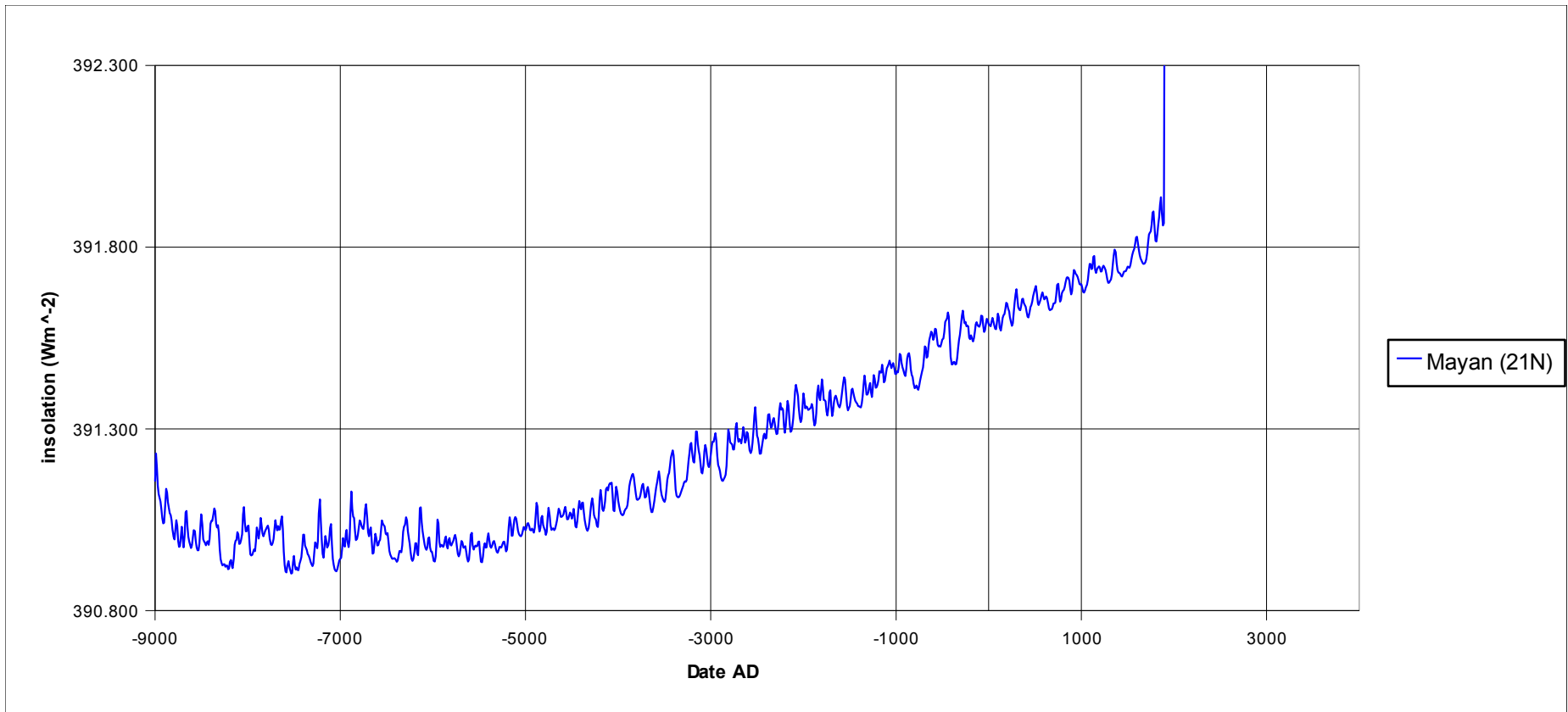
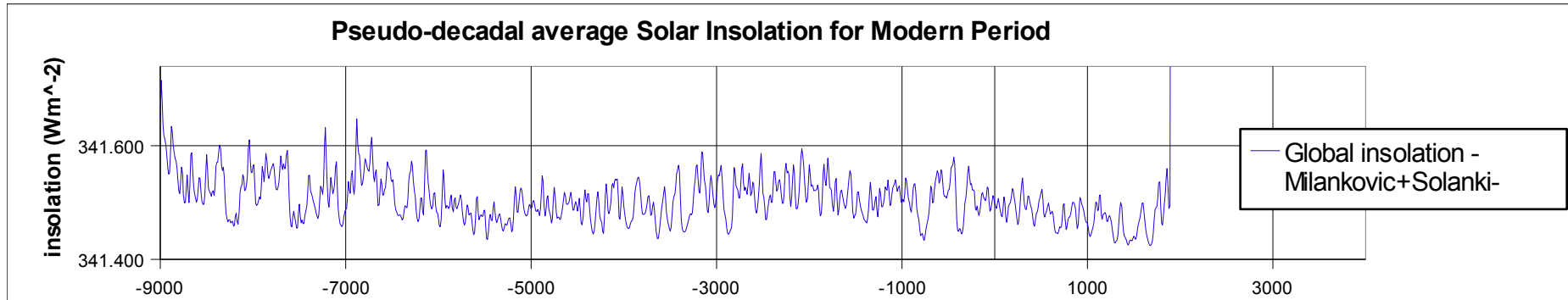
Not included yet!! - Irradiance scenarios into the future based on Charbonneau's chaotic model (infinitely many scenarios)

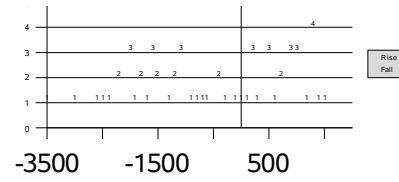
Not included yet!! - verification/ correction of irradiance from sunspots model based on Tapping et al

Howell's QNial program has a less accurate interpolation routine than Laskar et al (Howell's not used yet)

WARNINGS: (1) Likely error that the insolation curve is shifted 85-years to left due to misinterpretation of Solanki's data table. (2) The sunspot variances as shown through insolation have been exaggerated to show what the Hale 11-year half-cycle peaks and troughs would look like (no galactic ray-cloud impact!!). This would skew energy perspectives, but may give an idea of shorter-term shocks as experienced by civilisations.

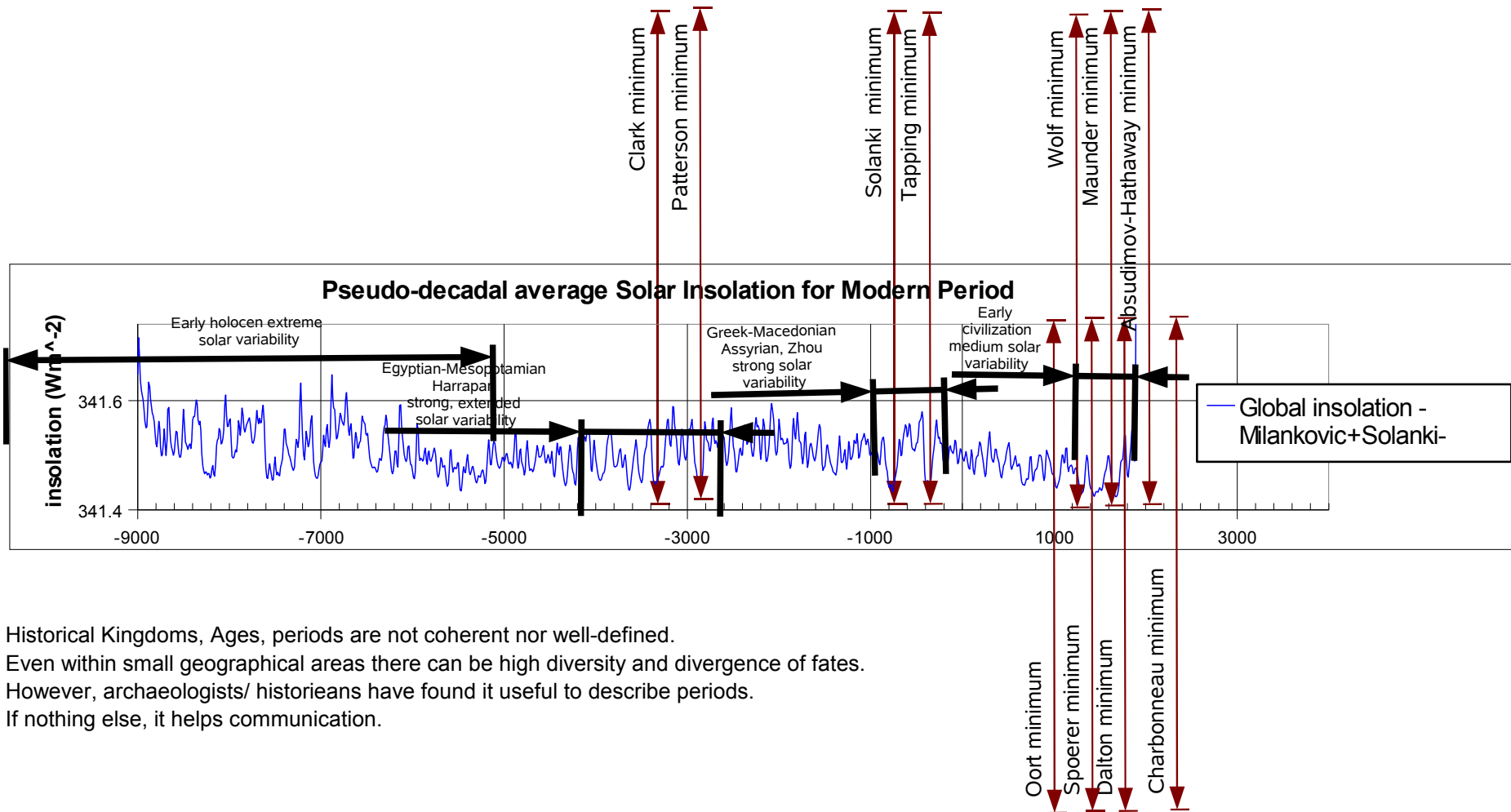
Perhaps the temperatures are mostly influenced by GLOBAL irradiance variations (and leveraging such as galactic rays-clouds, water vapour-cloud, ice albedo, ocean absorbance etc), whereas crops are also affected in a big way by the pattern of seasonal variations (irradiance, precipitation, cloud etc etc)





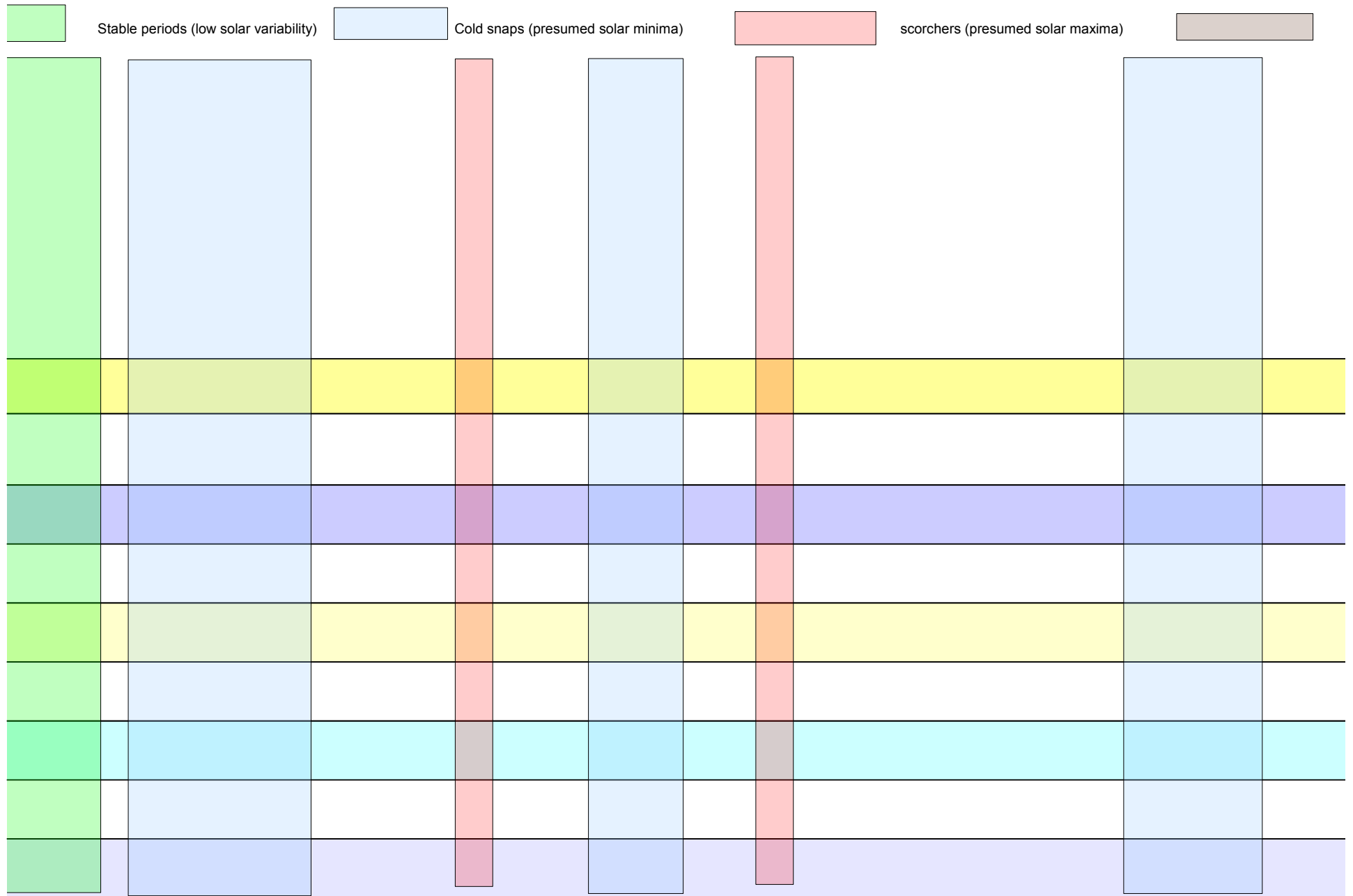
**How does one characterize "periods, phases or states" of a chaotic system (eg solar variability)?**

Valdes, Bonham-Carter - Time Dependent Neural Network Models For Detecting Changes Of State In Earth and Planetary Processes.pdf



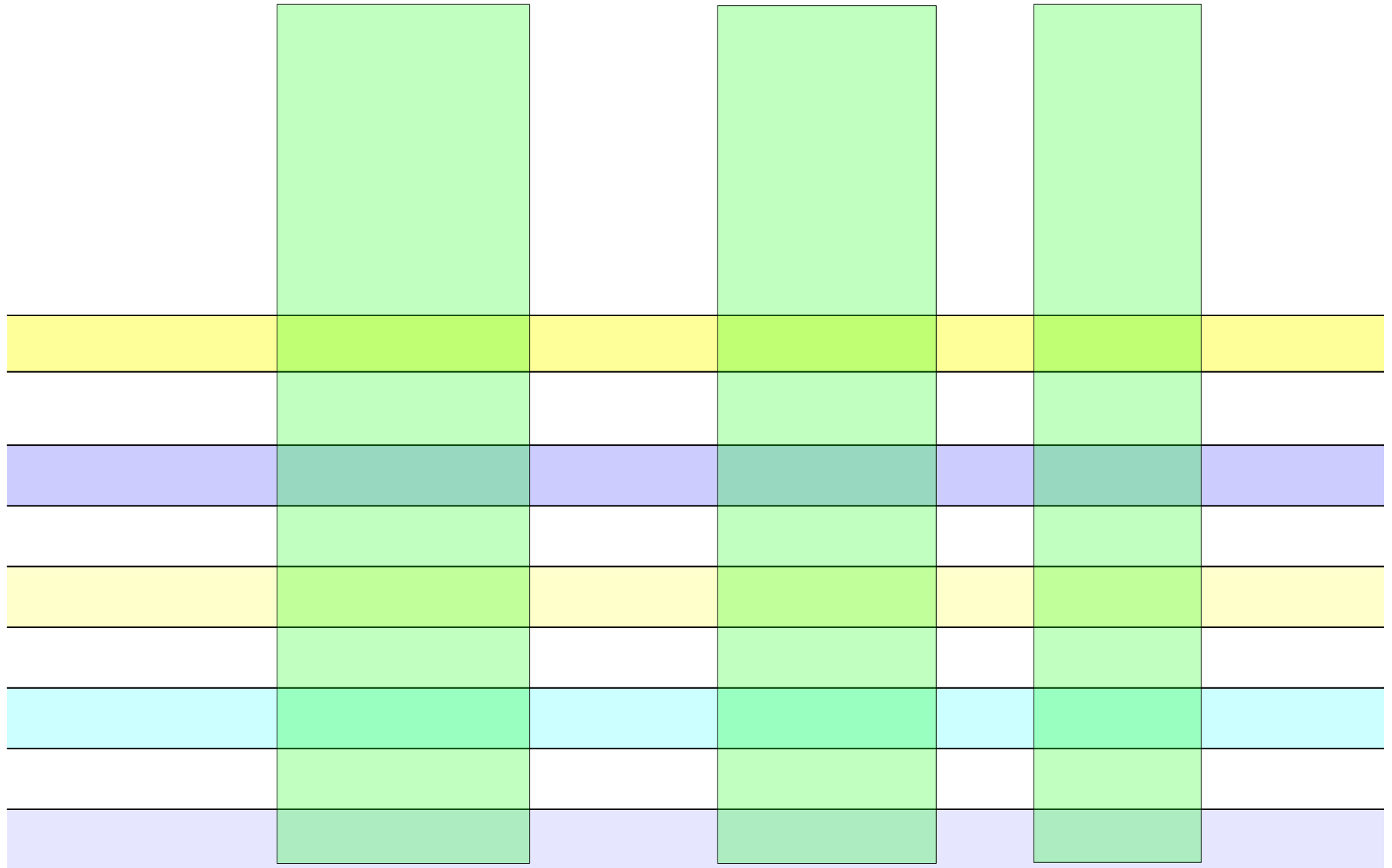
Historical Kingdoms, Ages, periods are not coherent nor well-defined.  
 Even within small geographical areas there can be high diversity and divergence of fates.  
 However, archaeologists/ historieans have found it useful to describe periods.  
 If nothing else, it helps communication.

Mesopotamia				
Egyptian - then Persian & Muslim				
India - Harappan, Gupta				
Mediterranean				
China				
MesoAmerica				
Anasazi, Missisppi, Hopewell Ohio				

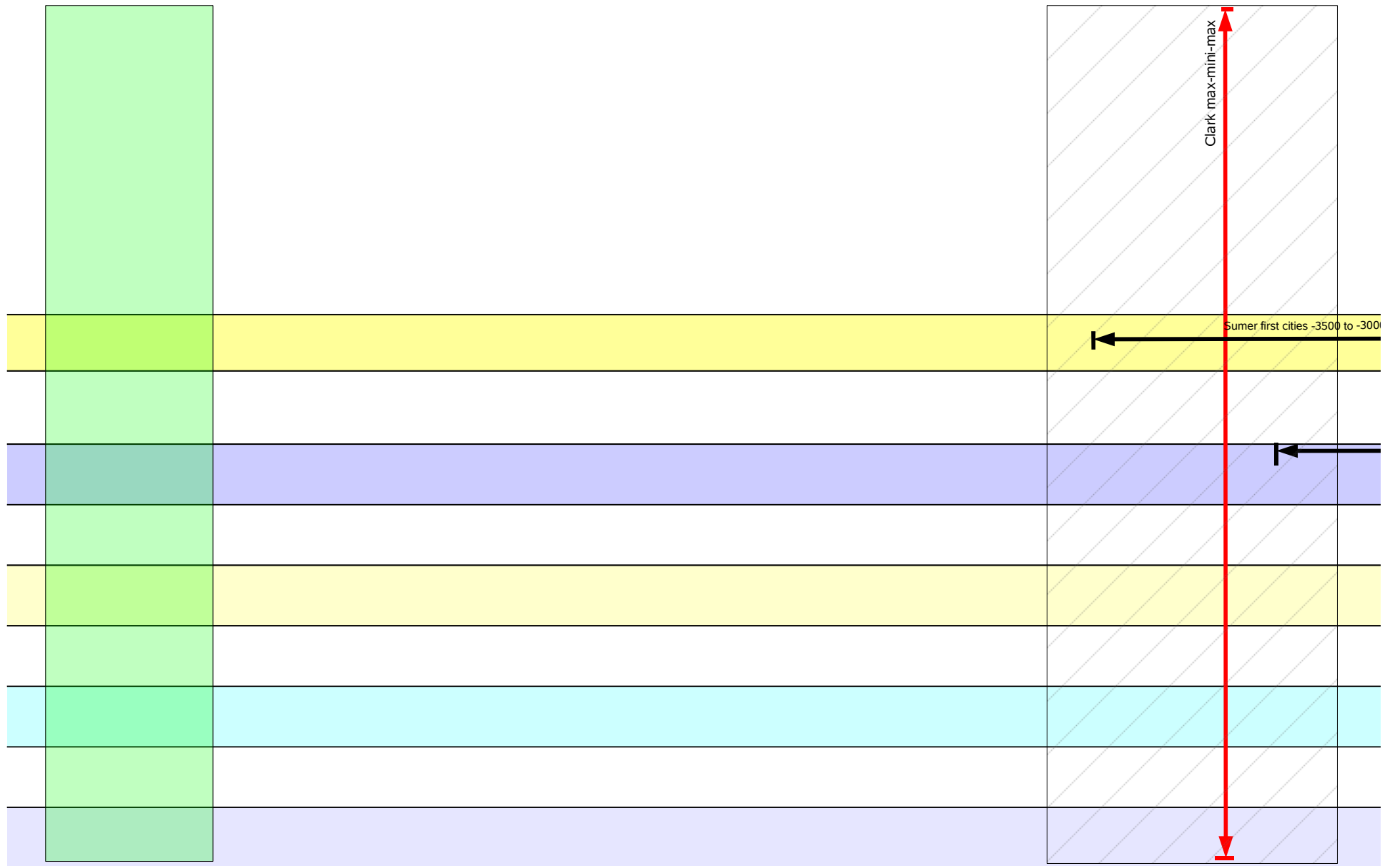


drought

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