

Dendroecology & Dendrochronology

Autocorrelation in Nature, and why it's cool

Dendroecology & Dendrochronology

Ecology = Accounting of energy and matter in (natural) systems
= how organisms thrive and interact with each other and nature

Chronology = Time!

Dendro = Trees

Ecology



Figure 7. 1 A.E. Douglass (1867-1962) coring a ponderosa pine. Douglass' first major project was to date some 45 archaeological ruins in the southwestern United States. Here he is coring a ponderosa pine tree in the Forestdale Valley in Arizona in 1928 (Laboratory of Tree-Ring Research, University of Arizona, from Webb 1983 and Nash 1999).

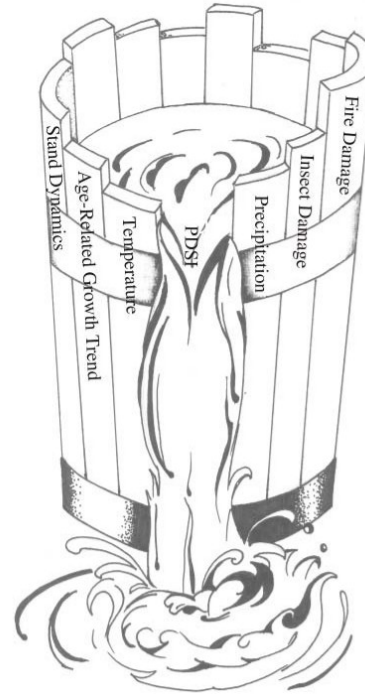
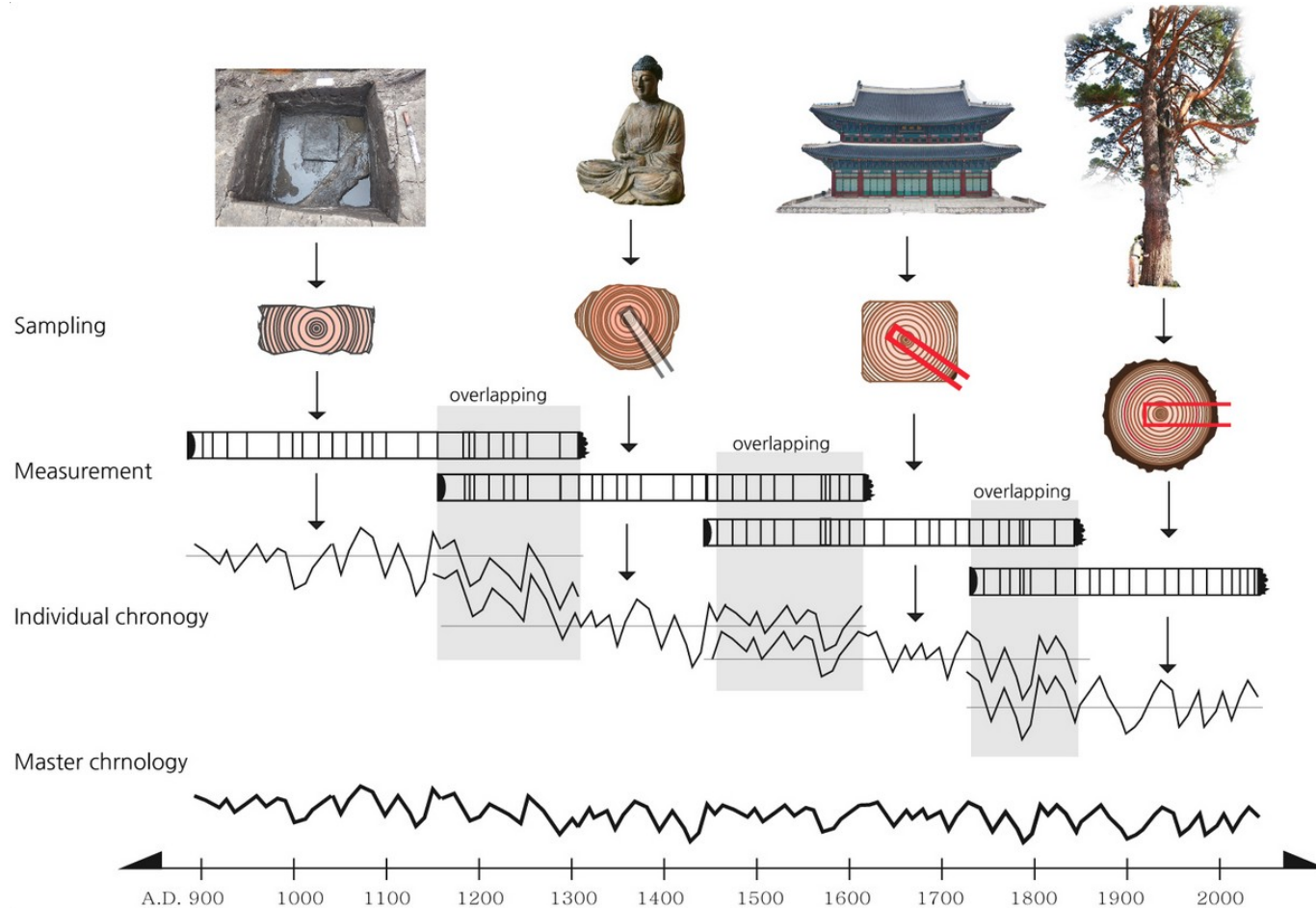


Figure 2. 4 Limiting Factors. Liebig's Law of the Minimum states that whatever factor is most limiting to growth will control the rate of growth for that organism. In this case, the slat labeled PDSI (Palmer Drought Severity Index) would be the most limiting factor for plant growth, therefore availability of moisture to the plant will control the ring width. It should be noted that this limiting factor may change through time.



Chronology



Growth: Autocorrelation!

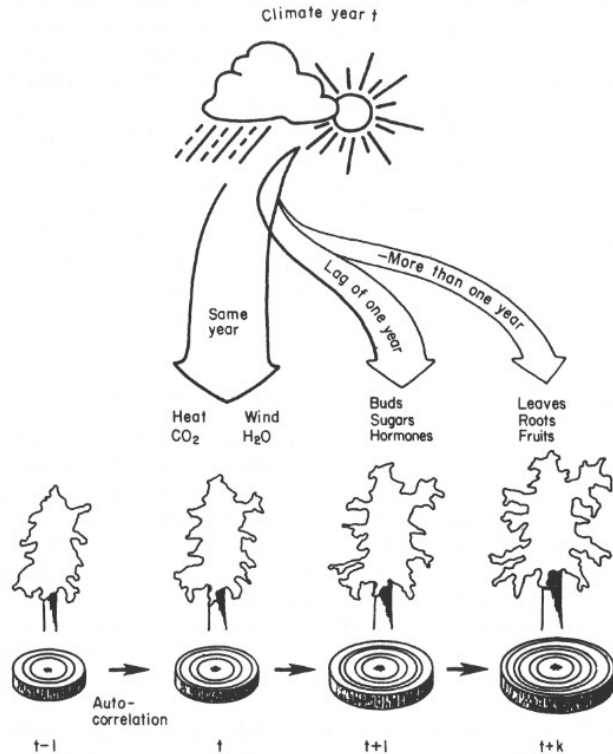


Figure 2.6 Autocorrelation. Tree growth often times includes autocorrelation which is the statistical characteristic that the current year's growth is affected by the previous year's growth. Autocorrelation can be driven by the biological activities of the tree in that the current year's climate will affect the heat, rainfall, and CO_2 levels for this year's growth but it also effects the following years growth through development of new buds, sugars, and hormones. Finally the climate from that same year will affect growth even further in the future by the development of leaves, roots, and fruits.

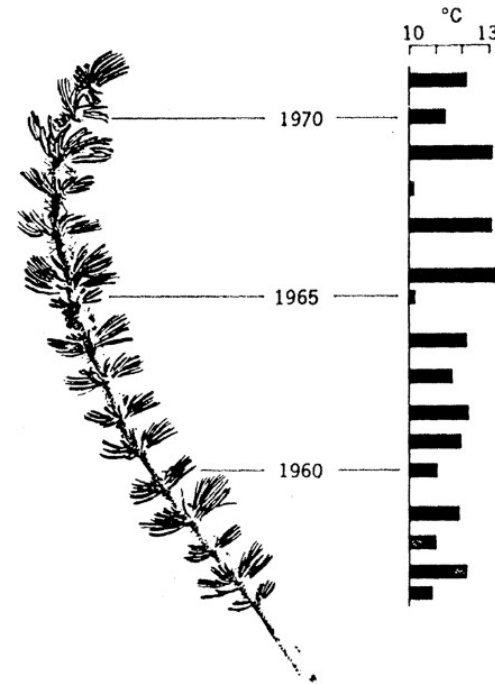
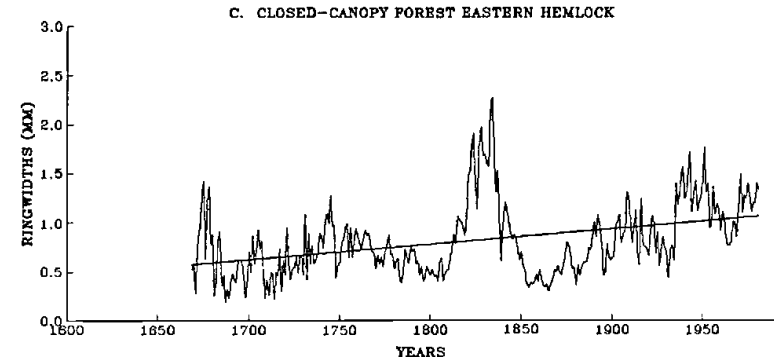
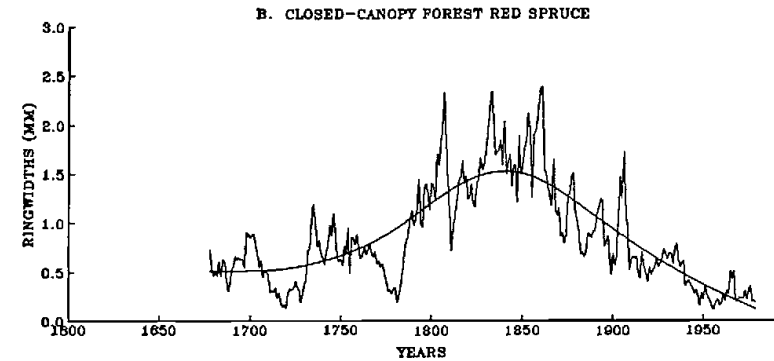
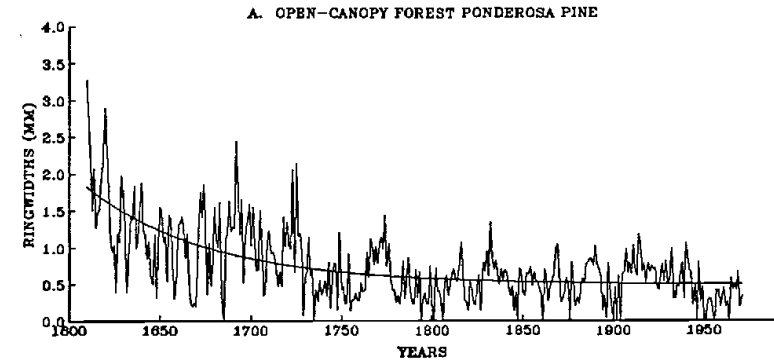


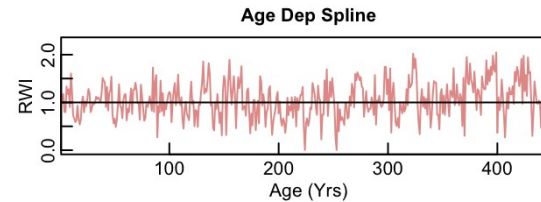
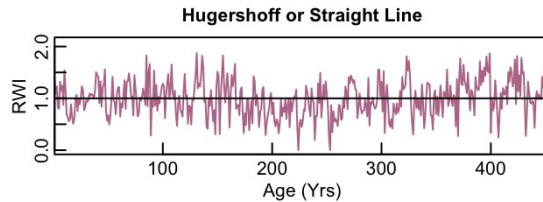
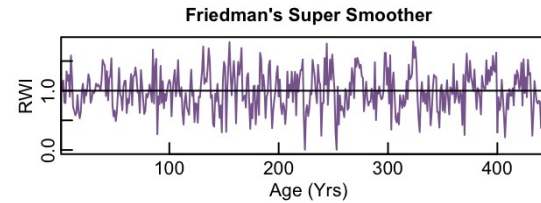
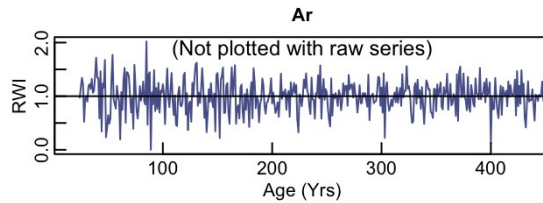
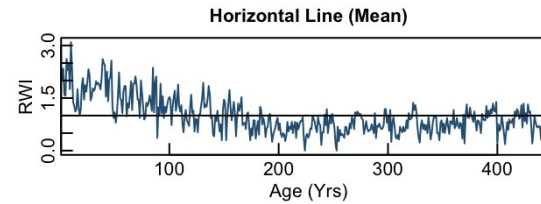
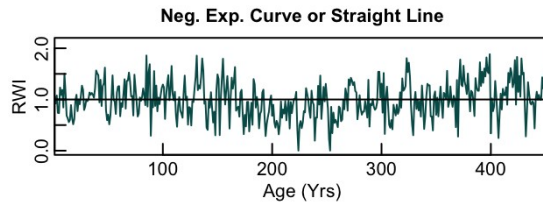
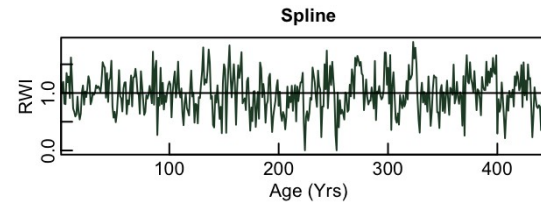
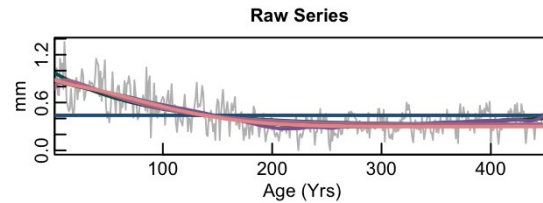
Figure 2. 7 Needle retention in bristlecone pine at upper treeline related to summer temperature (from LaMarche and Stockton 1974). Bristlecone pine trees retain their needles for many years, in this case 16 years, resulting in good growing conditions in the past affecting current year's photosynthetic potential.

Growth: continued

Competition, Disturbance, **Climate**



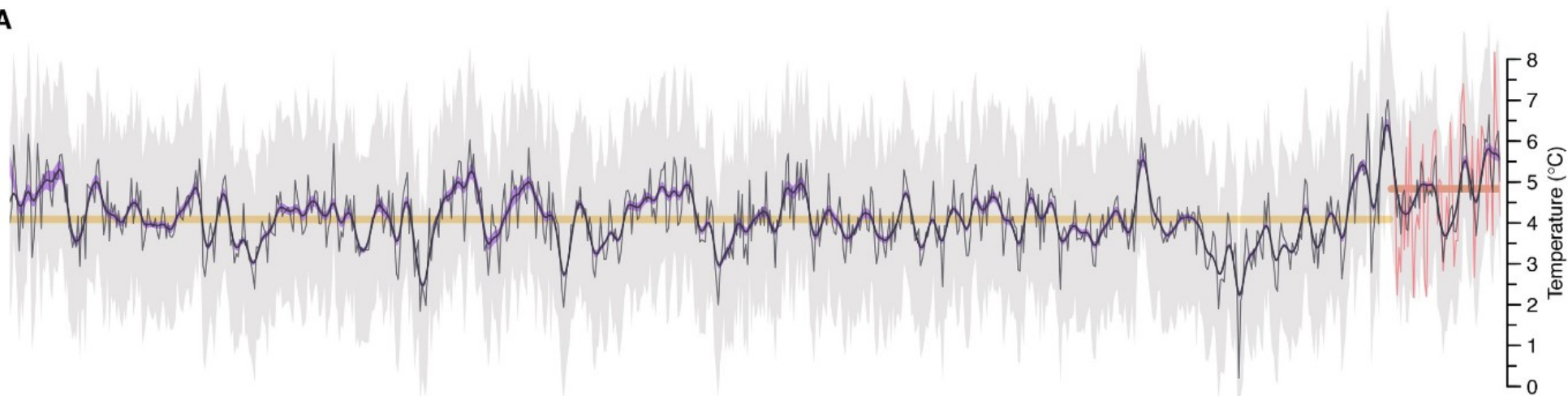
Growth to Time Series



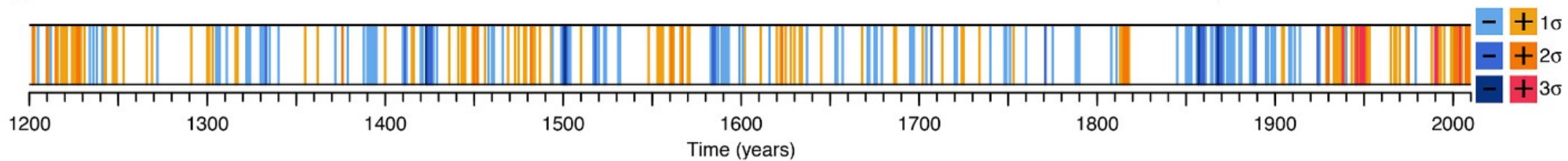
R package:
dplR

Applications

A



B



Applications

