Lower Colorado River Elevational Zonation

Radiocarbon age (yr B.P.)

Elevation (m)

Sea Level

0 5000 10000 15000 20000

Snowline

Treeline

Spruce Forest

Ponderosa Pine - Fir Forest

Pinyon-Juniper woodland

Blackbrush - Sagebrush Desert

Brittle Bush - Creosote Bush Desert

Juniper - Ash Woodland

Juniper - Blackbrush Woodland

Juniper - Sagebrush Woodland

Limber Pine, Fir Forest

Ponderosa Pine - Fir Forest

Blackbrush - Sagebrush Desert

Brittle Bush - Creosote Bush Desert

Joshua Tree - Brittle Bush - Creosote Bush Desert

K. Cole, 1995
Potato Lake, AZ, 2222 m
Pollen Percentage

Heinrich Event 0
= Younger Dryas

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= Younger Dryas

Allerod?
Terrestrial pollen and plant macrofossils from Bear Lake, AZ

Fig. 7. Terrestrial pollen and plant macrofossil diagram for Bear Lake. AMS radiocarbon dates, corresponding calendar-year ages, and lithology are on the left of the diagram. Shaded silhouettes represent pollen percentages. Dots in some plots indicate presence of needles. Histograms represent macrofossil concentrations (numbers per 70 cm$^3$ of sediment) or charcoal accumulation rate. Different zones are separated by horizontal lines.
Holocene

Oxygen Isotopes in *Neogloboquadrina pachyderma* foraminifera from Santa Barbara Basin (Hendy et al. 2002).
Conclusions

The southwest experienced sudden warming events of \( \approx 4 \, ^\circ C \) over less than 100 years around 11,700, 14,700, and possibly 16,800 years ago. These events were similar in pace and magnitude to temperature changes expected over the Twentyfirst Century.

Packrat midden macrofossils from after these events suggest that early successional/rapidly dispersing species, and species from directly downhill, dominate plant associations for several thousand years following the event.

Species co-occurrences (associations) are re-shuffled following such a warming event due to differential migration and differential shifts in climate variables. 5,000 years or more are usually required for them to re-associate in semi-arid habitats (if ever).

Monitoring vegetation on the association or community level will be a waste of time.

Widely distributed plant species have survived many prior warming events.

Plant associations are dramatically changing in character. Monitoring early successional species very important.