http://wwwpaztcn.wr.usgs.gov/home.html

The University of Arizona Desert Laboratory

USGS science for a changing world

FOR ALMOST ONE HUNDRED YEARS, the Desert Laboratory has been dedicated to studying plants, animals, and the environment of North American deserts. Since deserts are particularly sensitive to human disturbance, the need to understand desert life has become increasingly important as the population of arid regions has grown.

The Desert Laboratory is operated jointly by the University of Arizona's Department of Geosciences, Department of Ecology and Evolutionary Biology, and the U.S. Geological Survey. This interdisciplinary effort has enabled the Laboratory to expand its pivotal role in the understanding of structure, process, and change in desert areas.

NEW! Download an interview with Julio Betancourt and Travis Bean about buffelgrass (mp3 format, 5.5 MB) that appeared on Arizona Spotlight, courtesy Robert Rappaport and KUAZ.

Popular Links: Buffelgrass Eradication Go

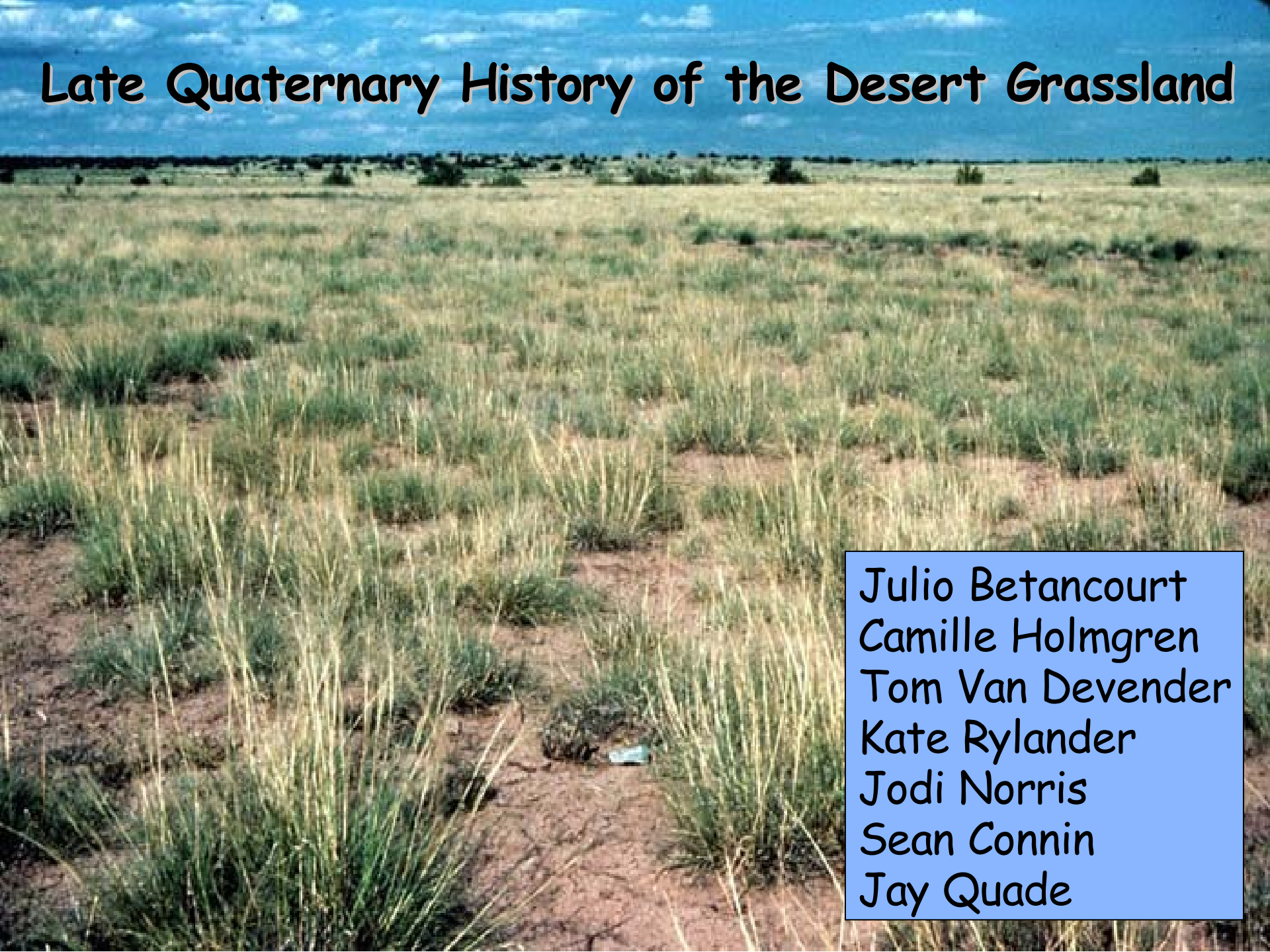
Jump to Contact Information

Research Highlight of the Month

October 2006

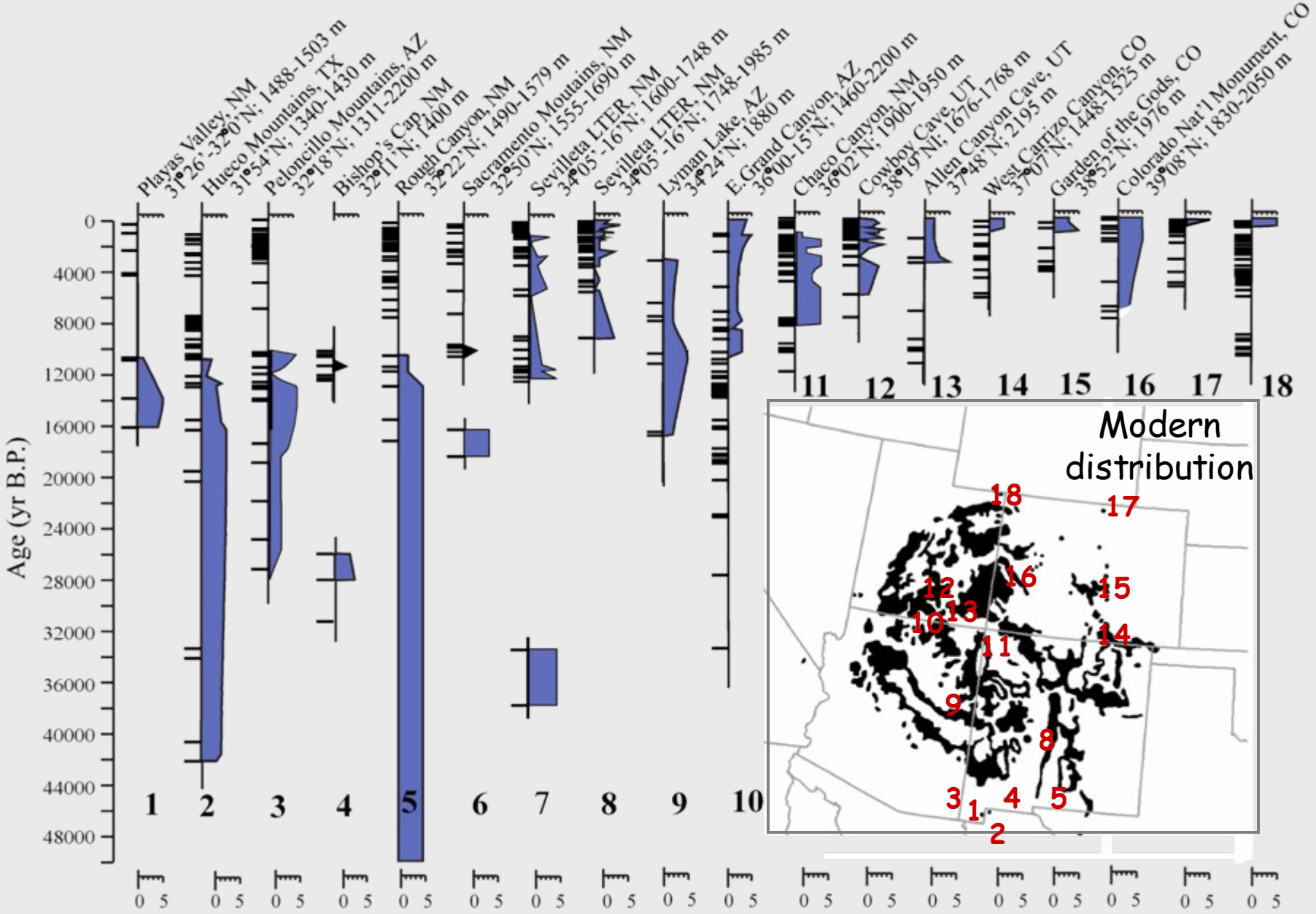
PROGRESS ON ESTABLISHING A USA-NATIONAL PHENOLOGY NETWORK (NPN)

Late Quaternary History of the Desert Grassland

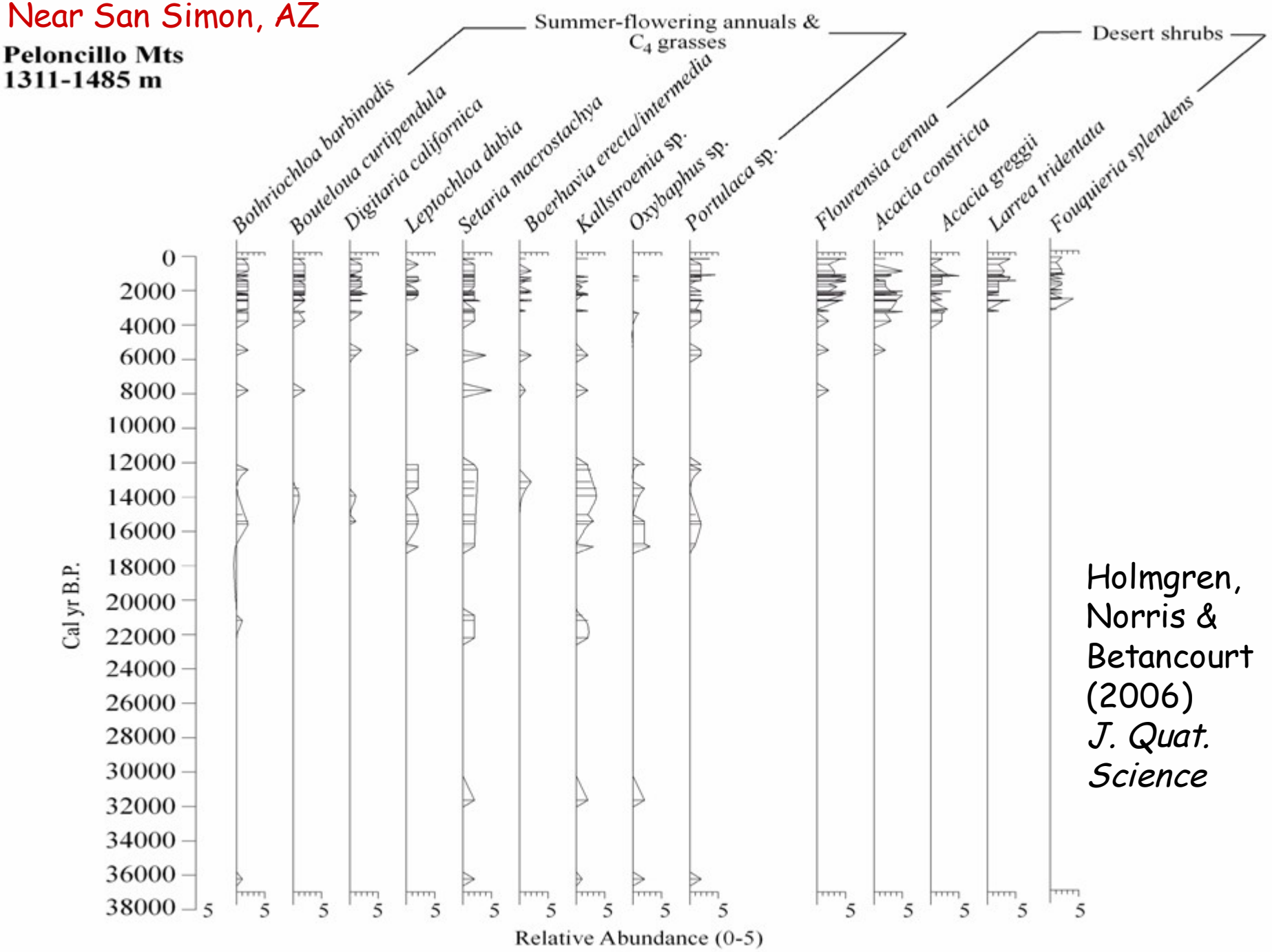


Julio Betancourt
Camille Holmgren
Tom Van Devender
Kate Rylander
Jodi Norris
Sean Connin
Jay Quade

Pinus edulis macrofossil chronologies arranged south to north

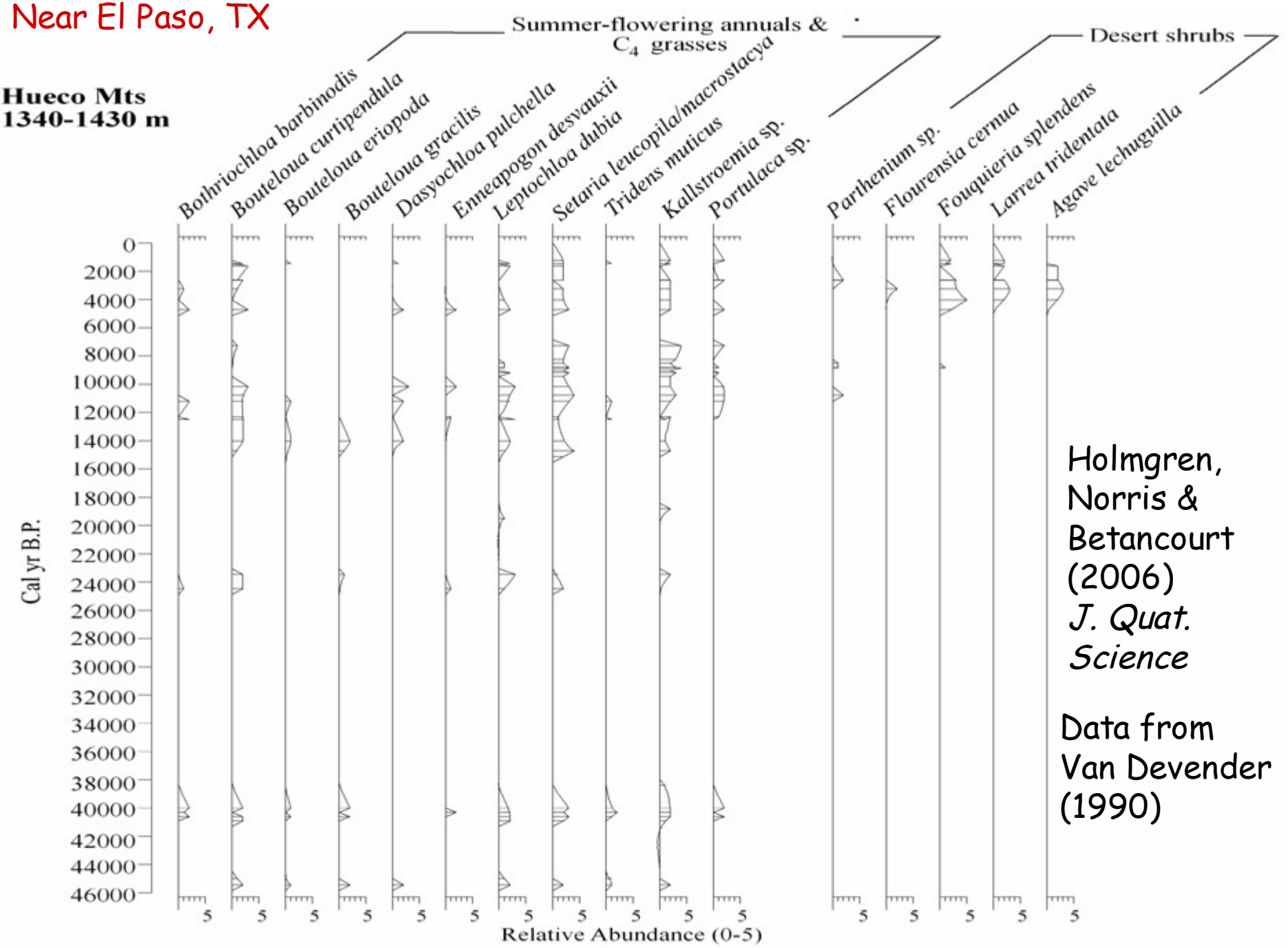


Near San Simon, AZ



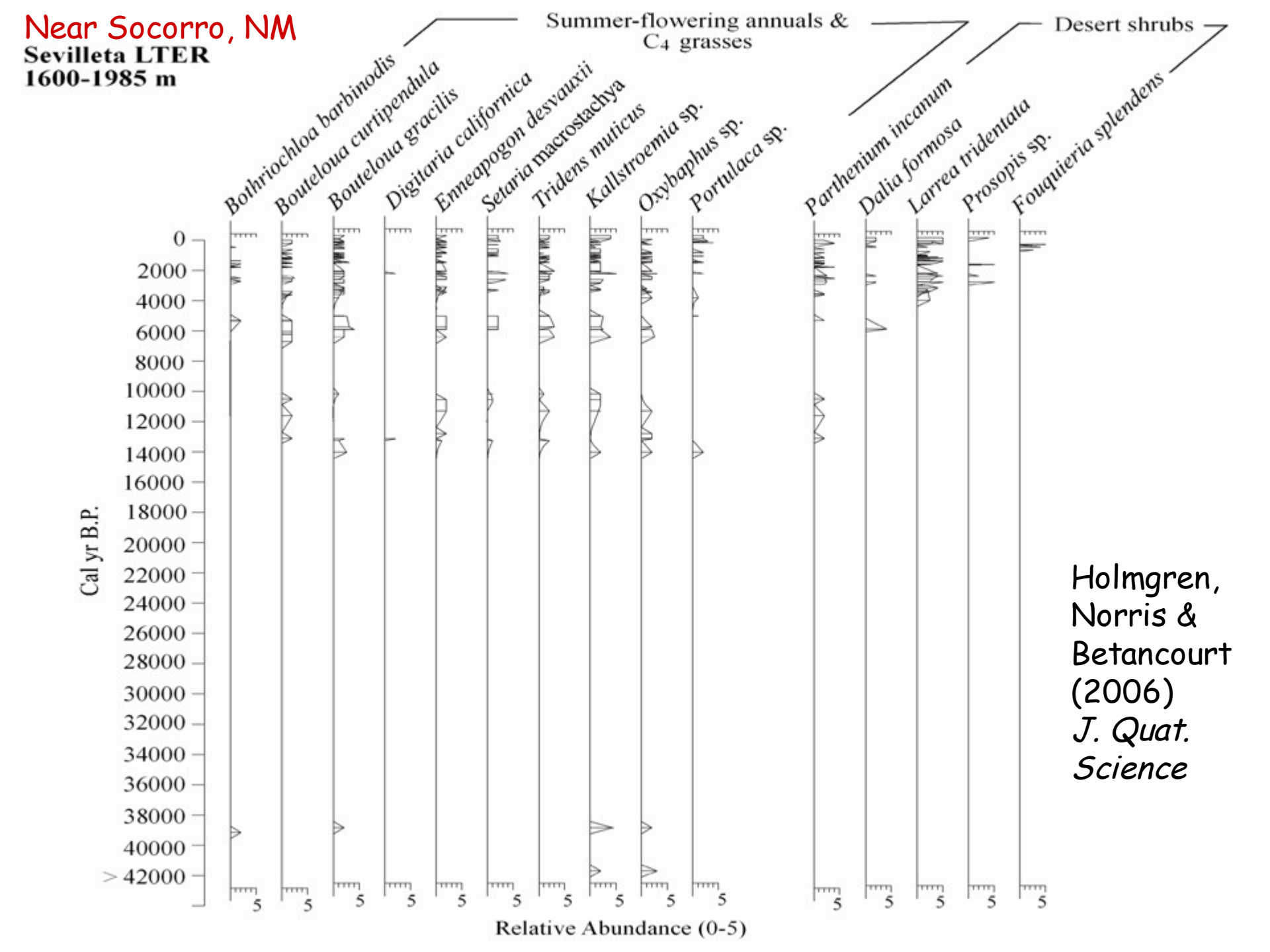
Holmgren, Norris & Betancourt (2006) *J. Quat. Science*

Near El Paso, TX



Holmgren, Norris & Betancourt (2006) *J. Quat. Science*

Data from Van Devender (1990)


Near Socorro, NM
Sevilleta LTER
1600-1985 m
Summer-flowering annuals & C4 grasses
Desert shrubs
Bothriochloa barbinodis
Bouteloua curtipendula
Bouteloua gracilis
Digitaria californica
Enneapogon desvauxii
Setaria macrostachya
Tridens muticus
Kallstroemia sp.
Oxybaphus sp.
Portulaca sp.
Parthenium incanum
Dalia formosa
Larrea tridentata
Prosopis sp.
Fouquieria splendens
Cal yr B.P.
0
2000
4000
6000
8000
10000
12000
14000
16000
18000
20000
22000
24000
26000
28000
30000
32000
34000
36000
38000
40000
> 42000
5
Relative Abundance (0-5)
Holmgren, Norris & Betancourt (2006) J. Quat. Science

Carbon & Oxygen Isotopic values of carbon apatite in late glacial tooth enamel from SW U.SA

Mammuthus, Bison, Equus, Camelops, Antilocapridae

NE Nevada (Great Basin): Rye Patch (Pyramid Lakes), Crypt Cave, Fishbone Cave,Wizard's Beach

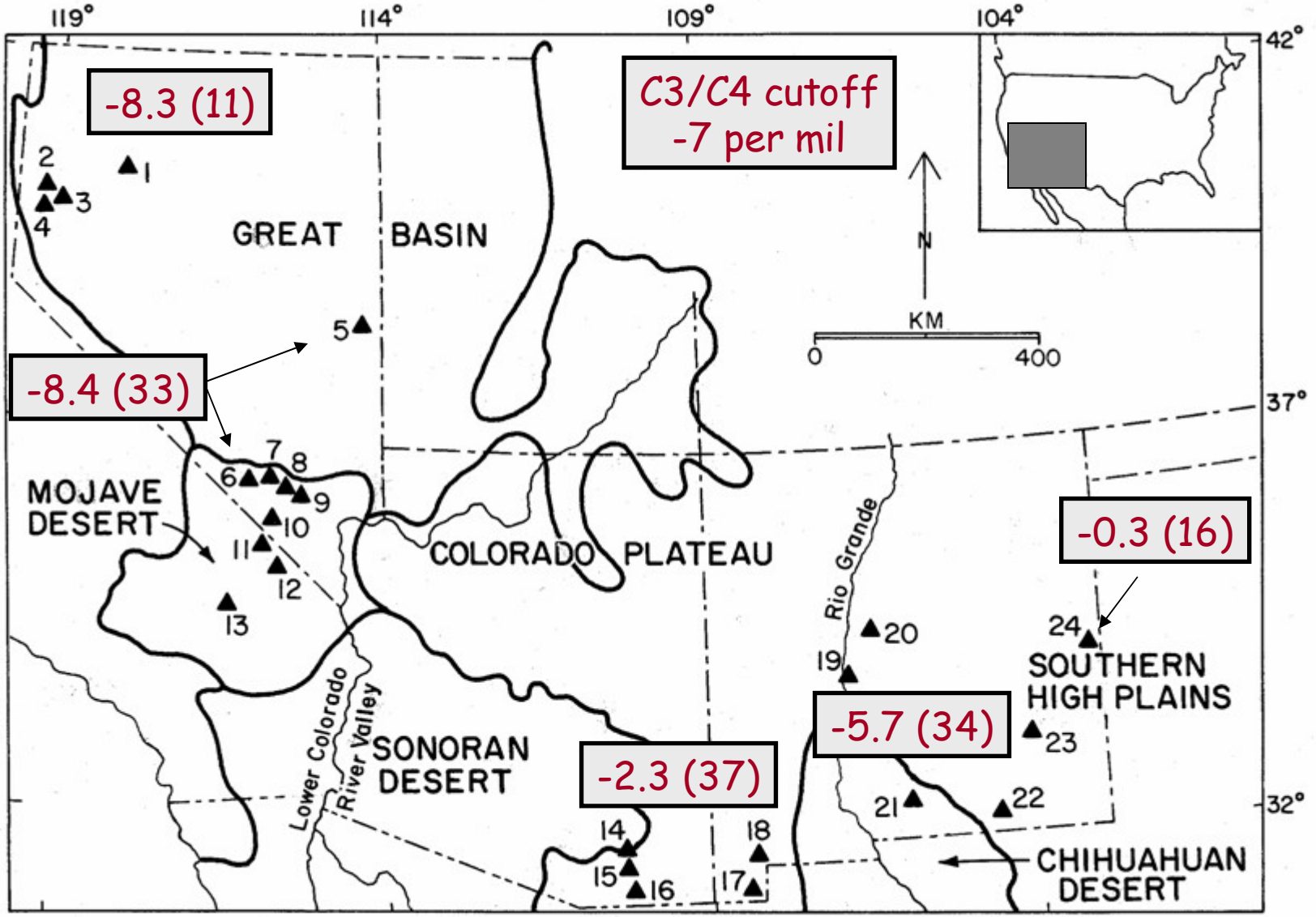
S Nevada/SE California (Mojave Desert): Sunshine Lake, Lathrop Wells, Cactus Springs, Corn Creek, Tule Springs, Pahrump Valley, Valley Wells, Kokoweef Cave, Calico Lakes, Solar 1

SE Arizona/SW New Mexico (Borderlands Desert Grassland): Self, Murray Springs, Naco, U-Bar Cave, Howell's Ridge Cave

South-central New Mexico East of Rio Grande (N. Chihuahuan Desert): Isleta Cave, Sandia Cave, Pendejo Cave, Dry Cave, Roswell

E. New Mexico (Southern High Plains): Blackwater Draw

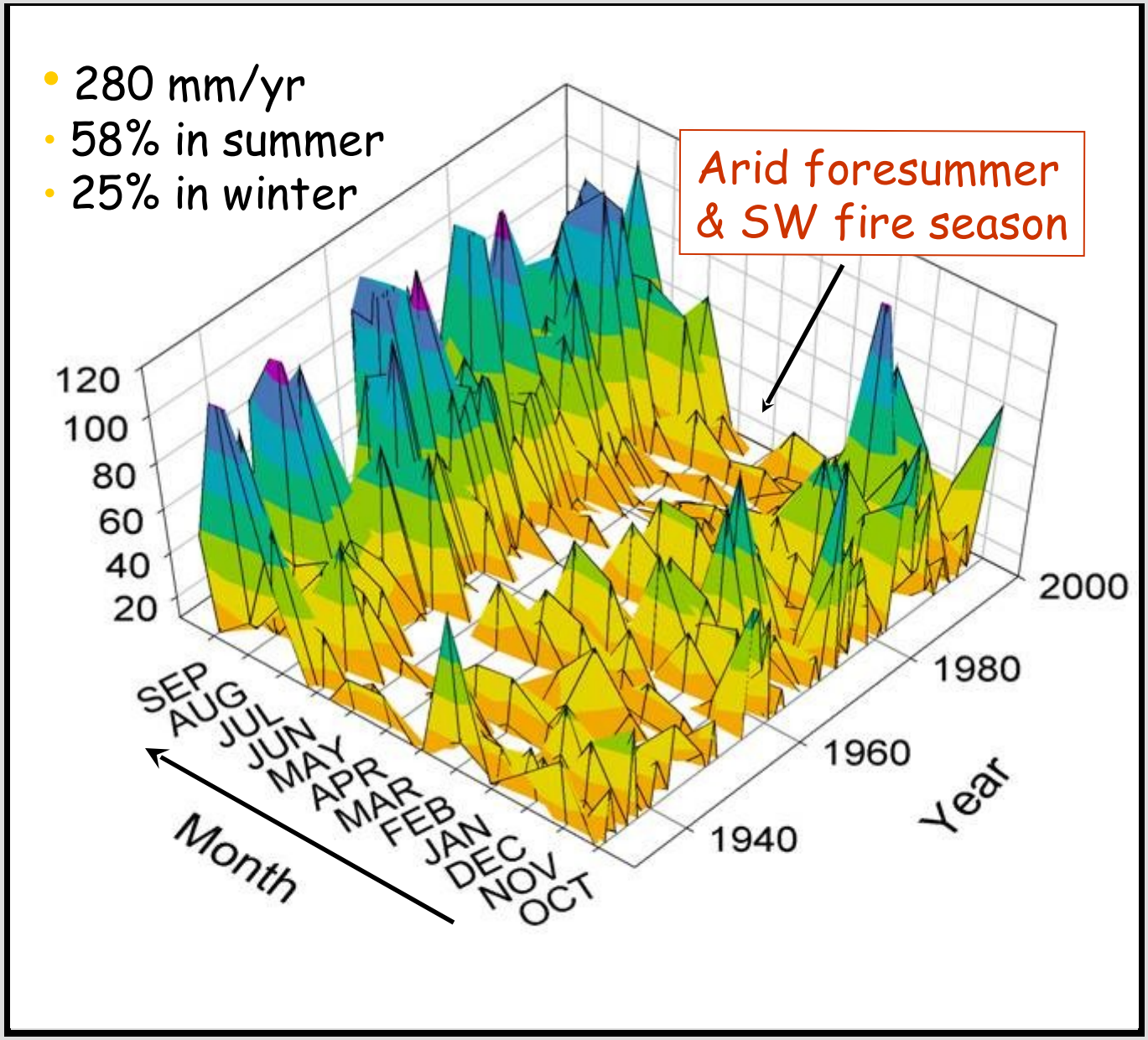
Carbon isotopes in megaherbivore tooth enamel



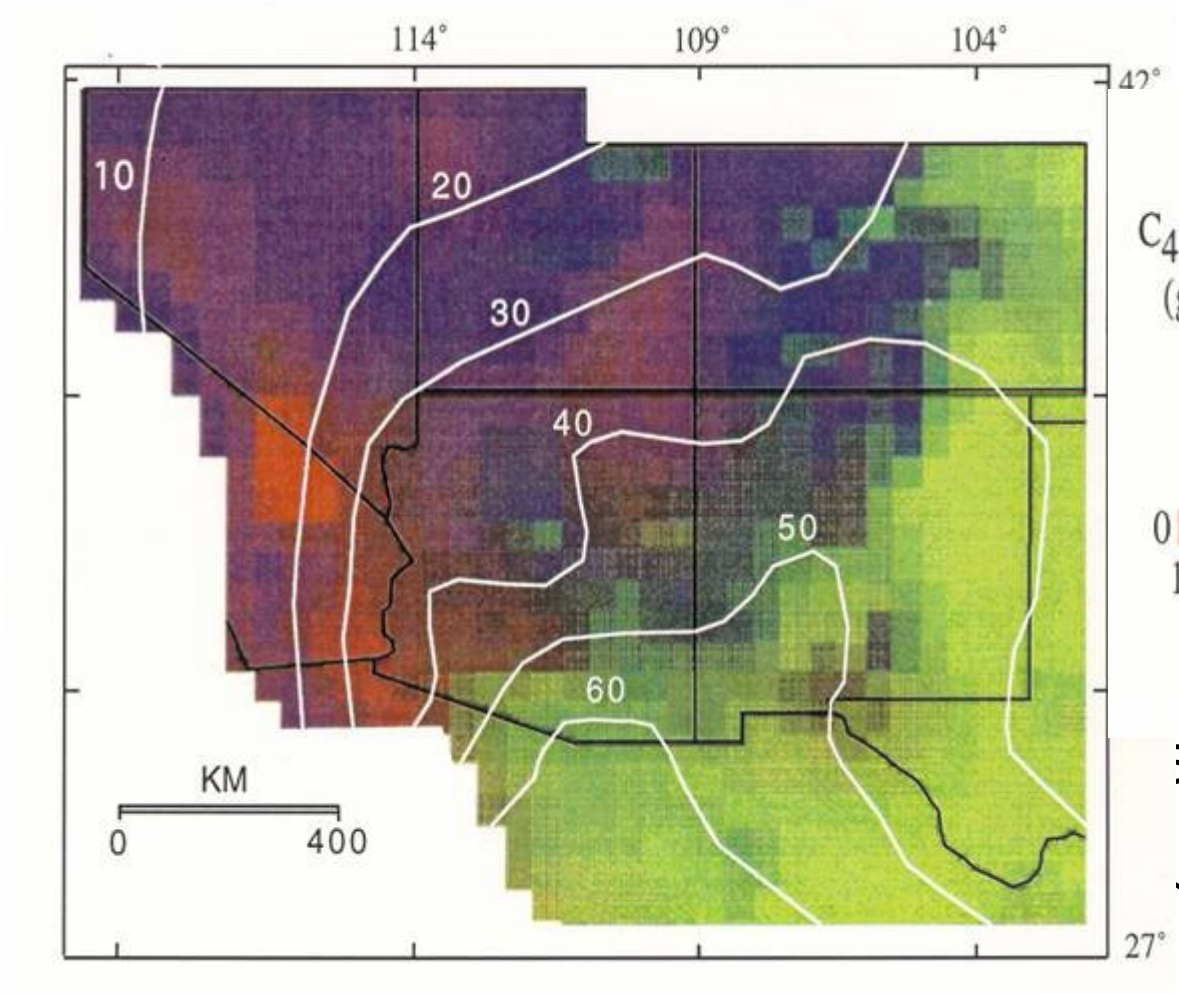
Connin, Betancourt & Quade (1998) Quaternary Research

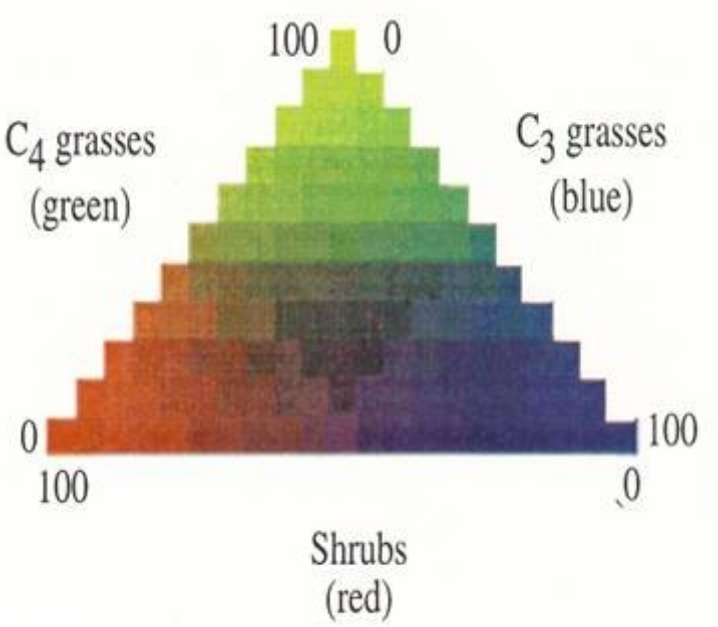

USA/Mexico Mid-to-late
Summer International Refuge
Karen Carr

Animas Valley, SW New Mexico



Influence of Summer Rains on Relative abundance patterns of C_4 grasses, C_3 grasses & C_3 shrubs





Sevilleta

Hueco Mts

Murray Springs

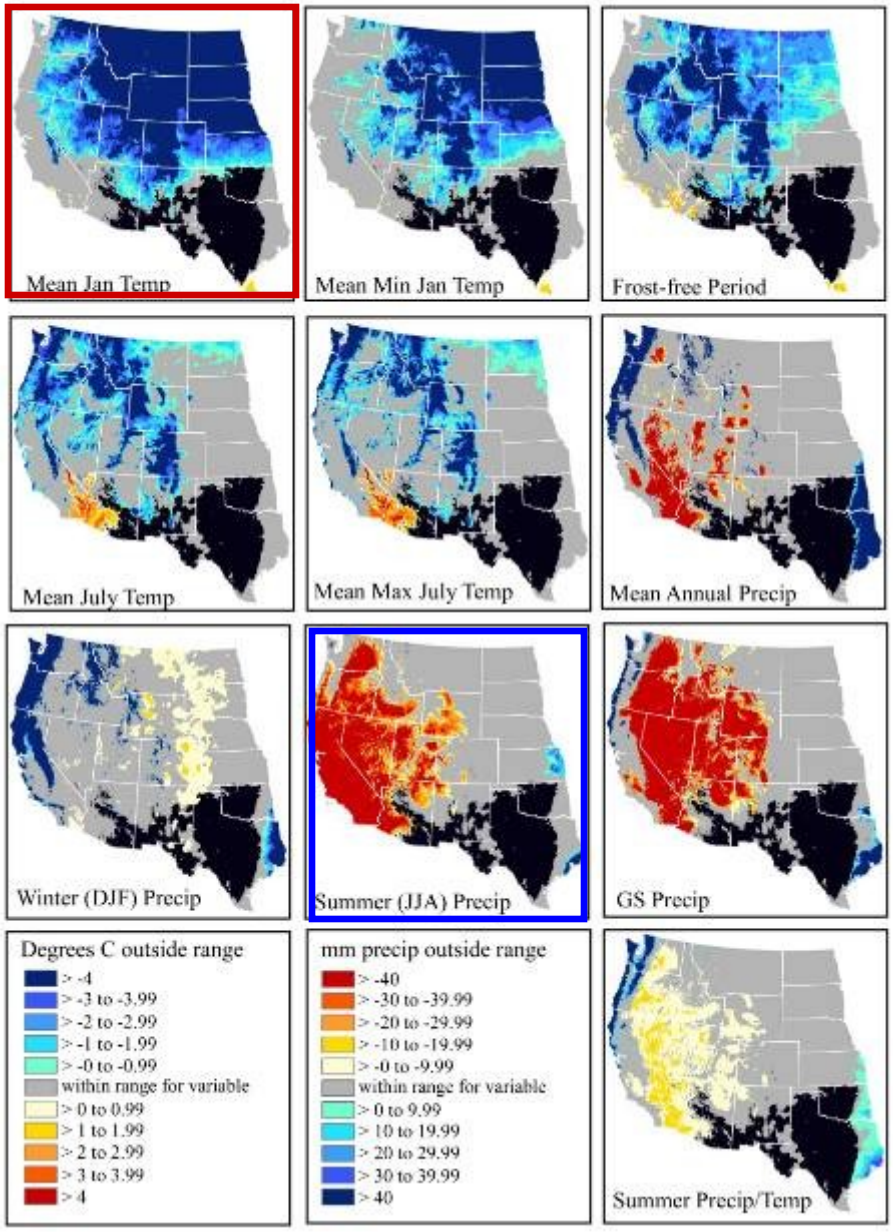
Peloncillo Mts

Animas Valley

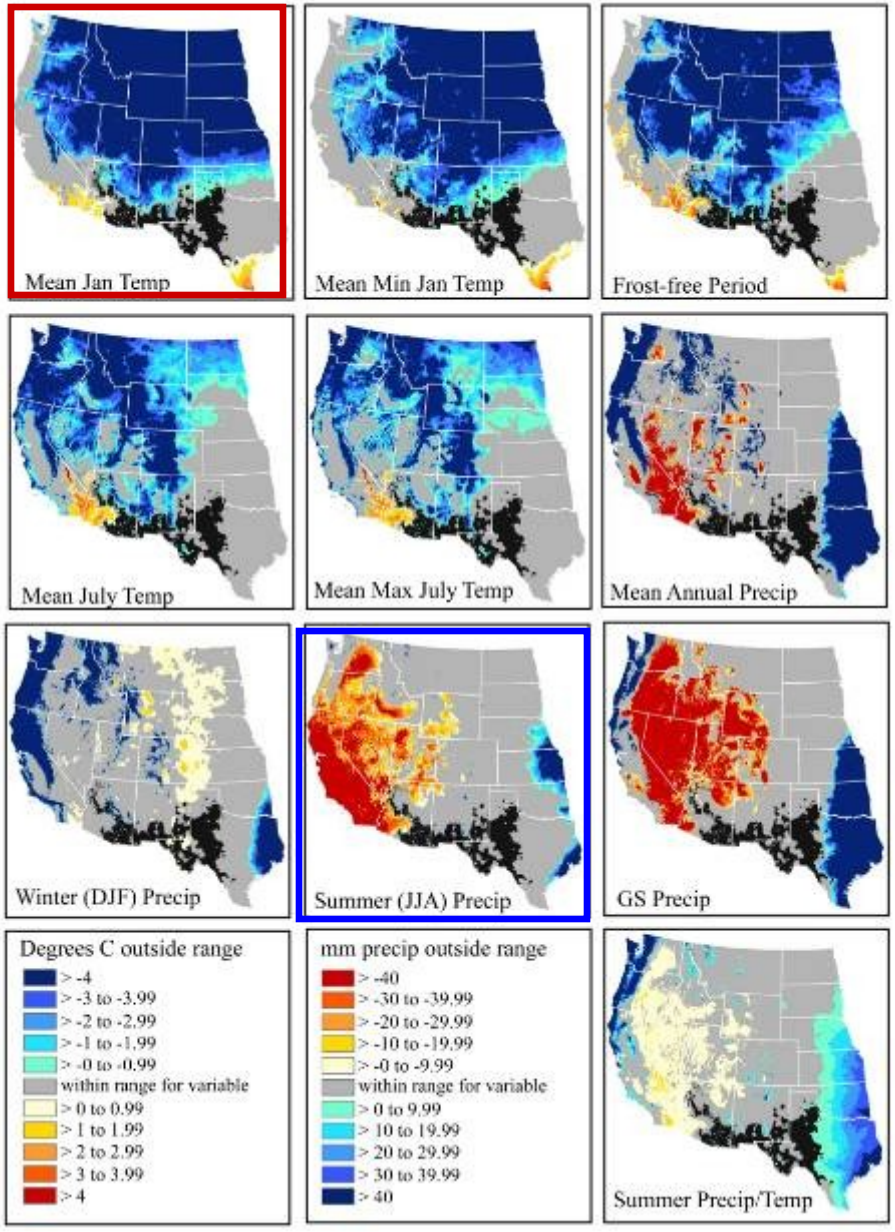
Percentage of summer (JJAS) rain

C_4 Grasses bioclimatic modeling

Leptochloa dubia



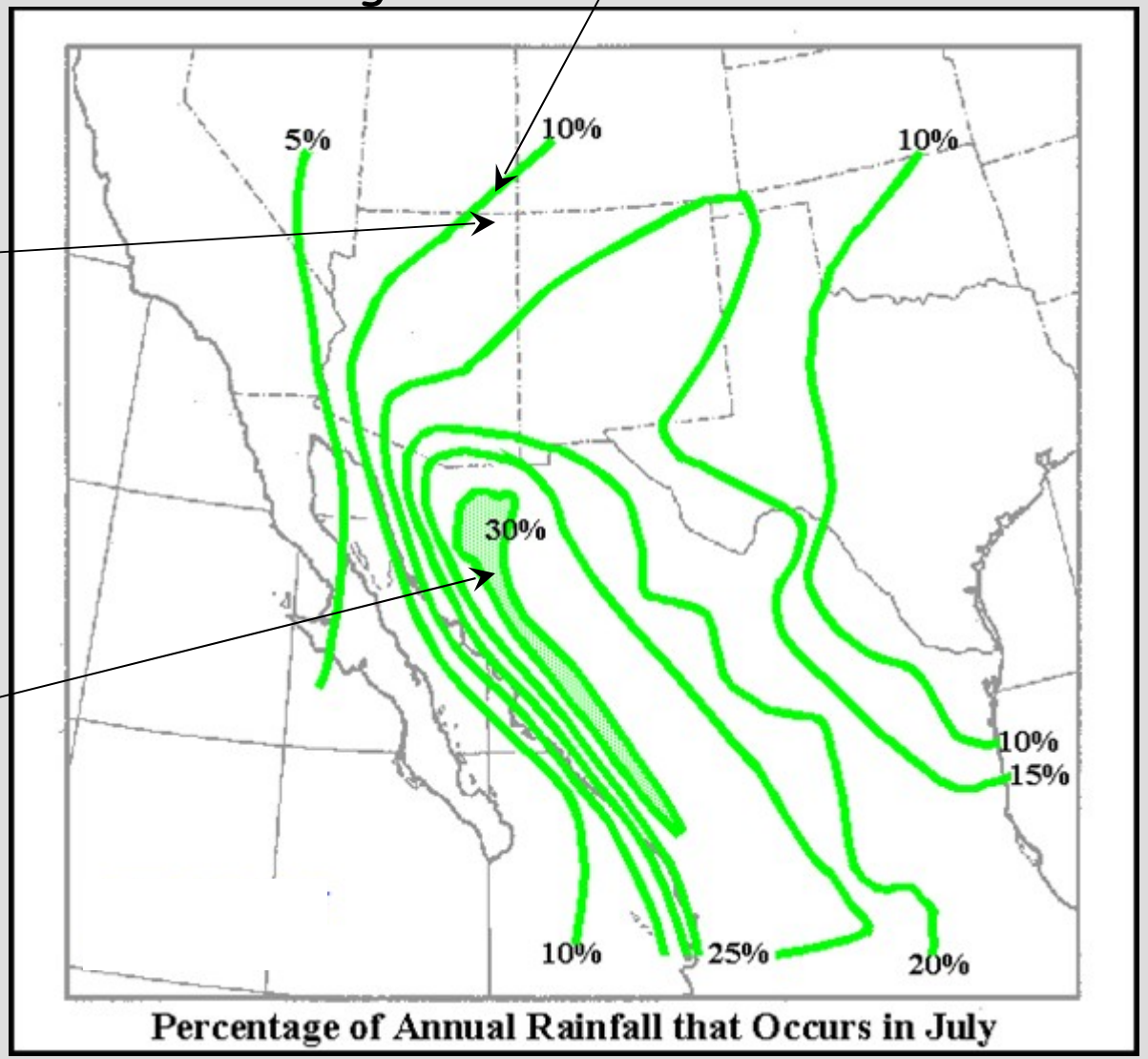
Setaria macrostachya



SE Utah glacial middens lack C4 grasses & annual herbs

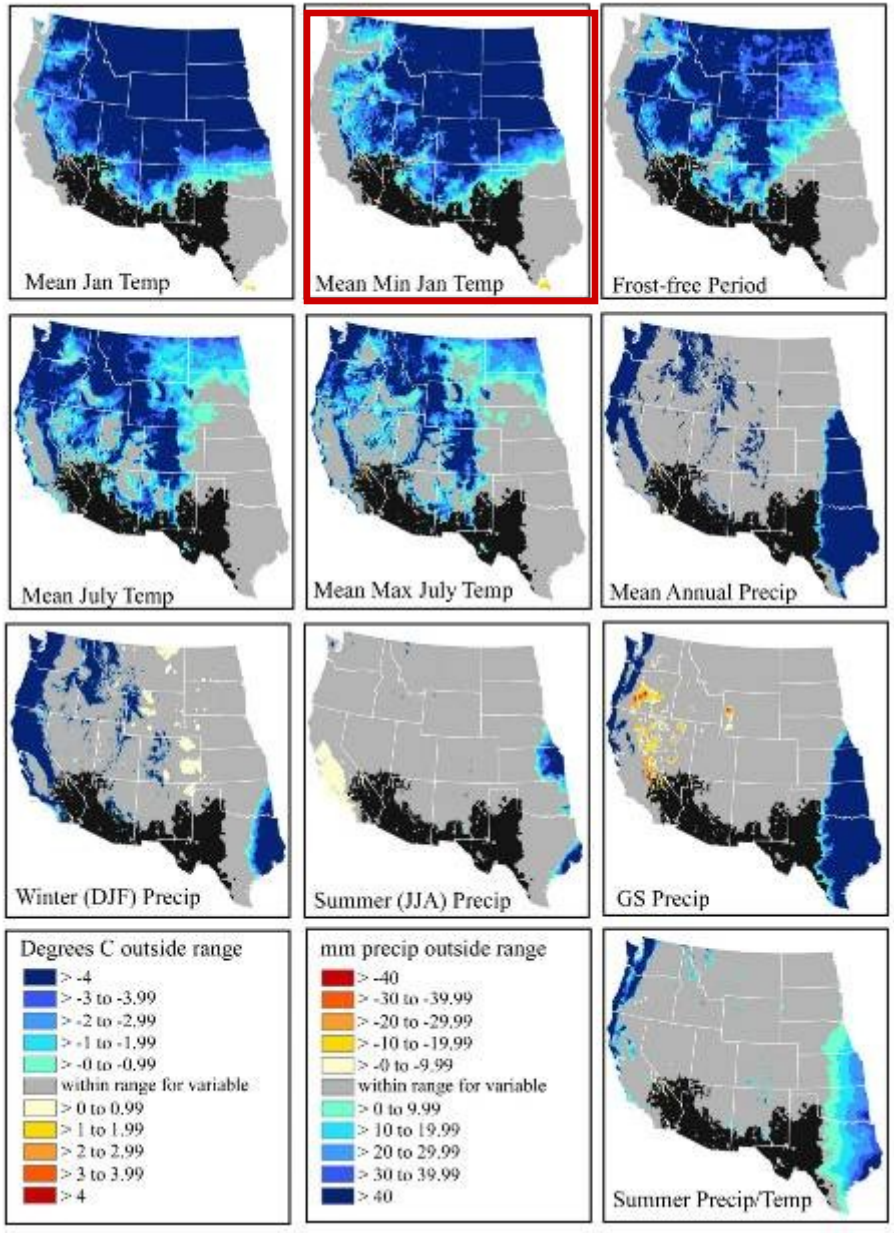
Persistent snowpack in Rockies/C. Plateau & 10° lat. displacement of westerlies year-round truncated monsoonal extension to the north

Core of Mexican Monsoon fixed by tectonic history; boundary conditions did not change enough during last glacial to eliminate monsoon

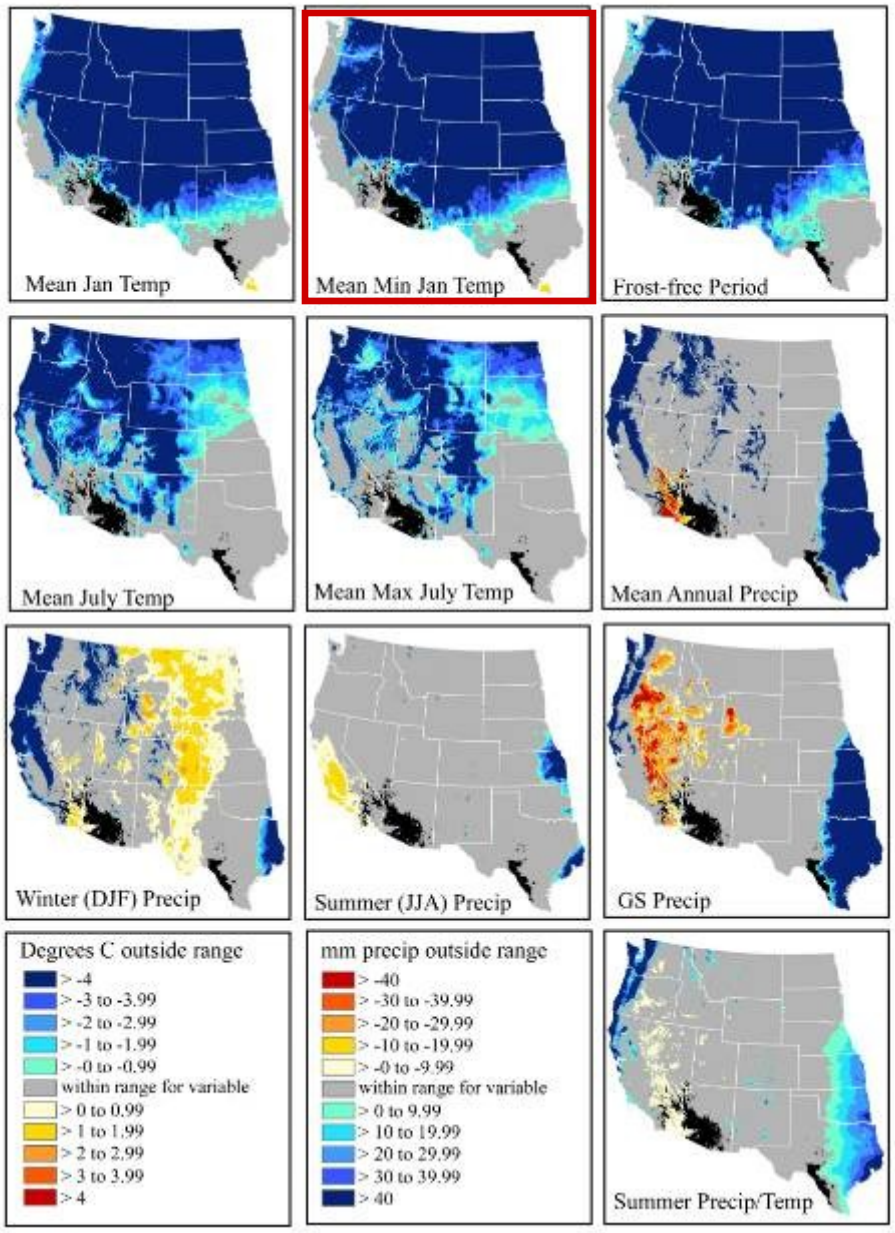


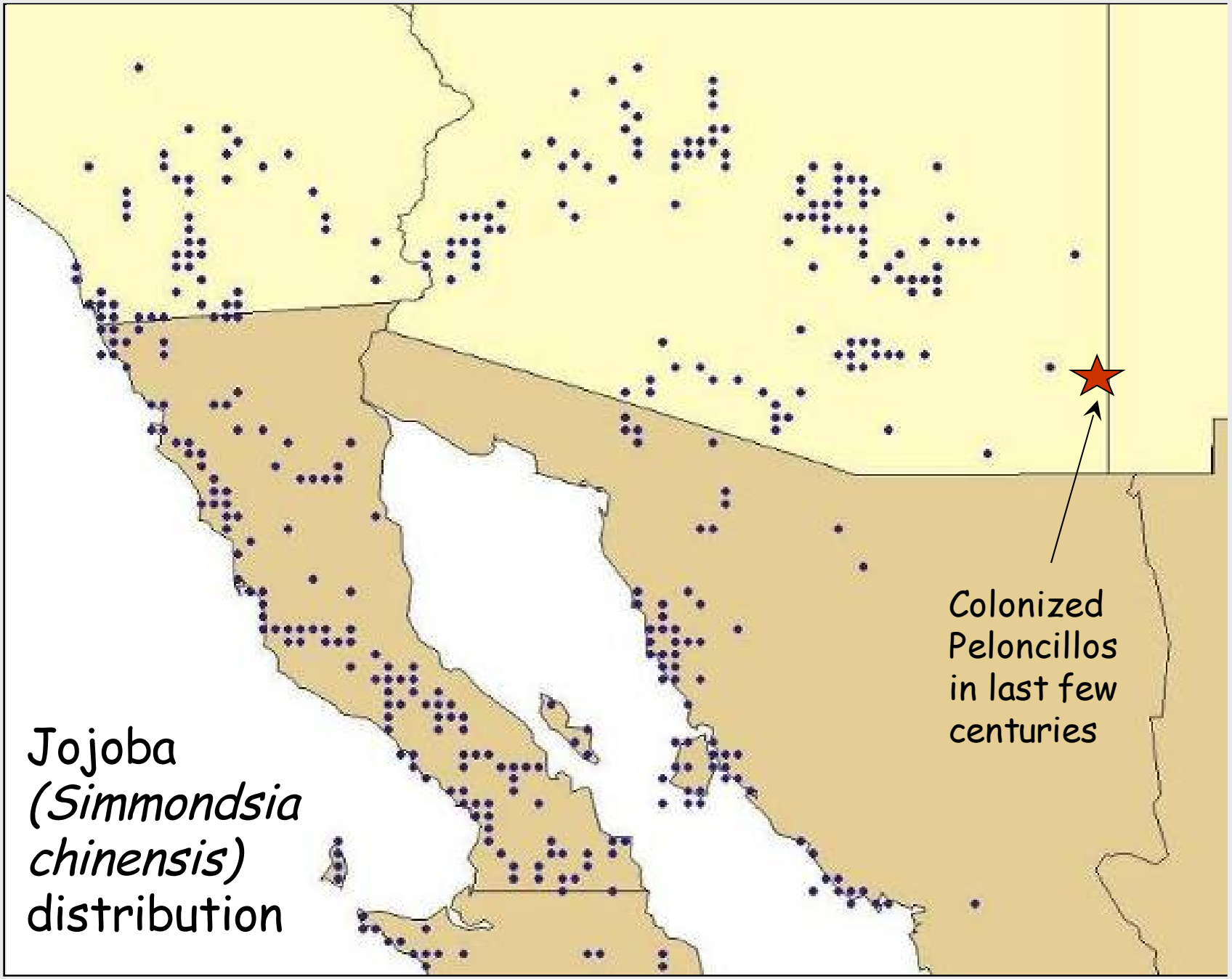
C_3 Desert Shrubs

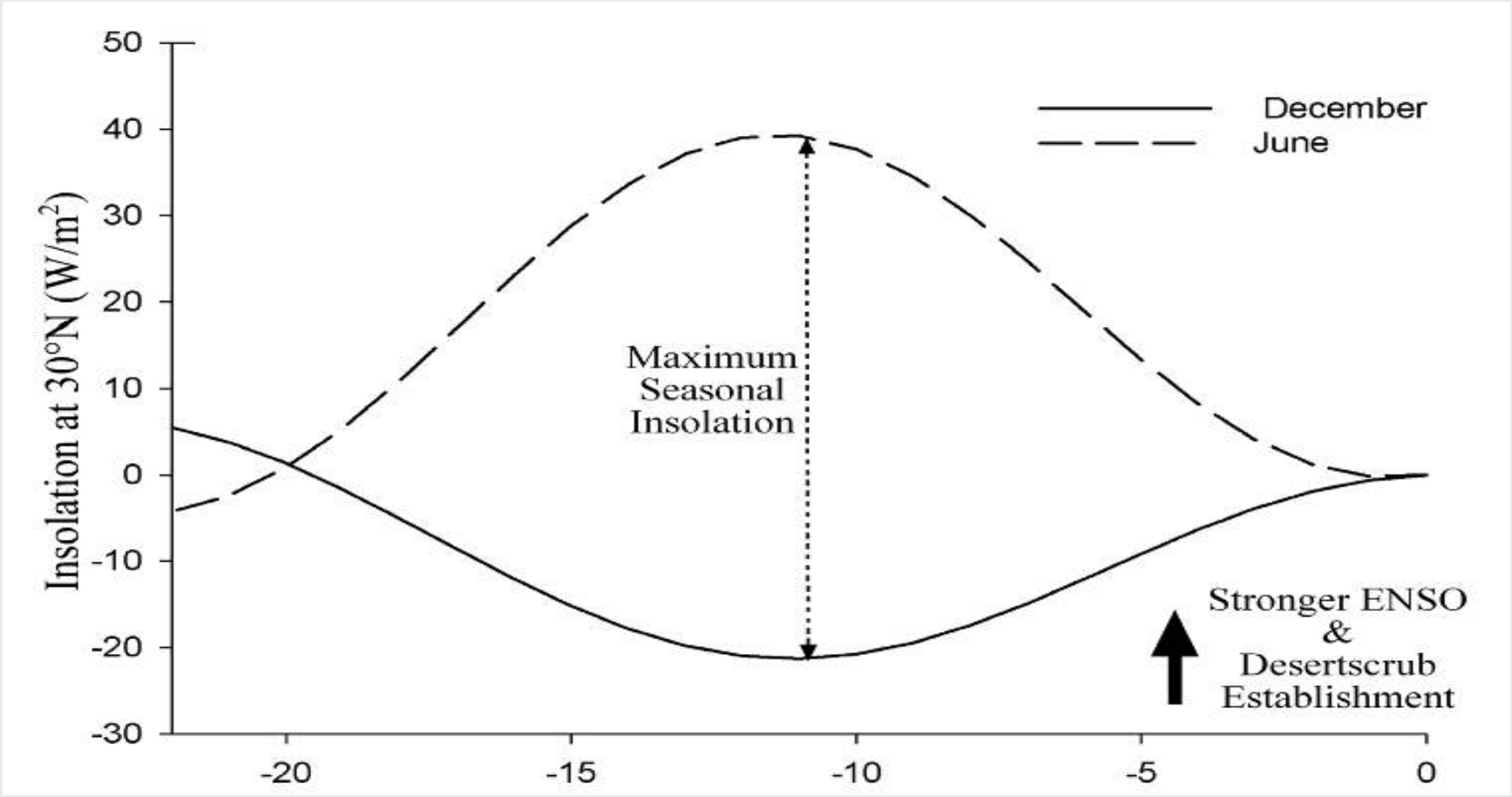
Larrea tridentata



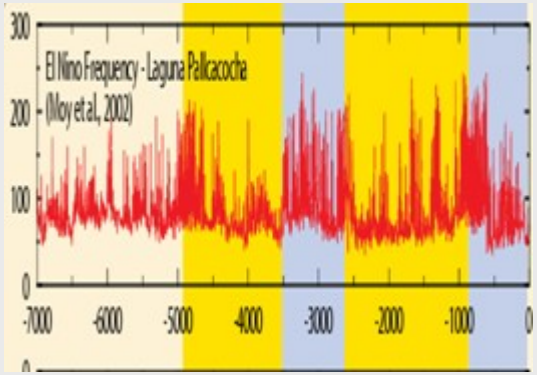
Simmondsia chinensis




Colonized
Peloncillos
in last few
centuries
Jojoba
(*Simmondsia chinensis*)
distribution



Winters have warmed and C_3 desert shrubs have expanded into desert grassland since 5 kcal yr B.P. w/ increasing winter insolation & ENSO frequency



C_4 desert grasslands represent one of the most stable biomes in North America

Persistence due to glacial-interglacial permanence of warm winters & summer rains

Contrary to conventional wisdom, core of Mexican Monsoon was stable through glacial-interglacial cycles (possibly throughout Neogene)

Location of Pleistocene refugia for C_3 desert shrubs remains elusive and warrants future study

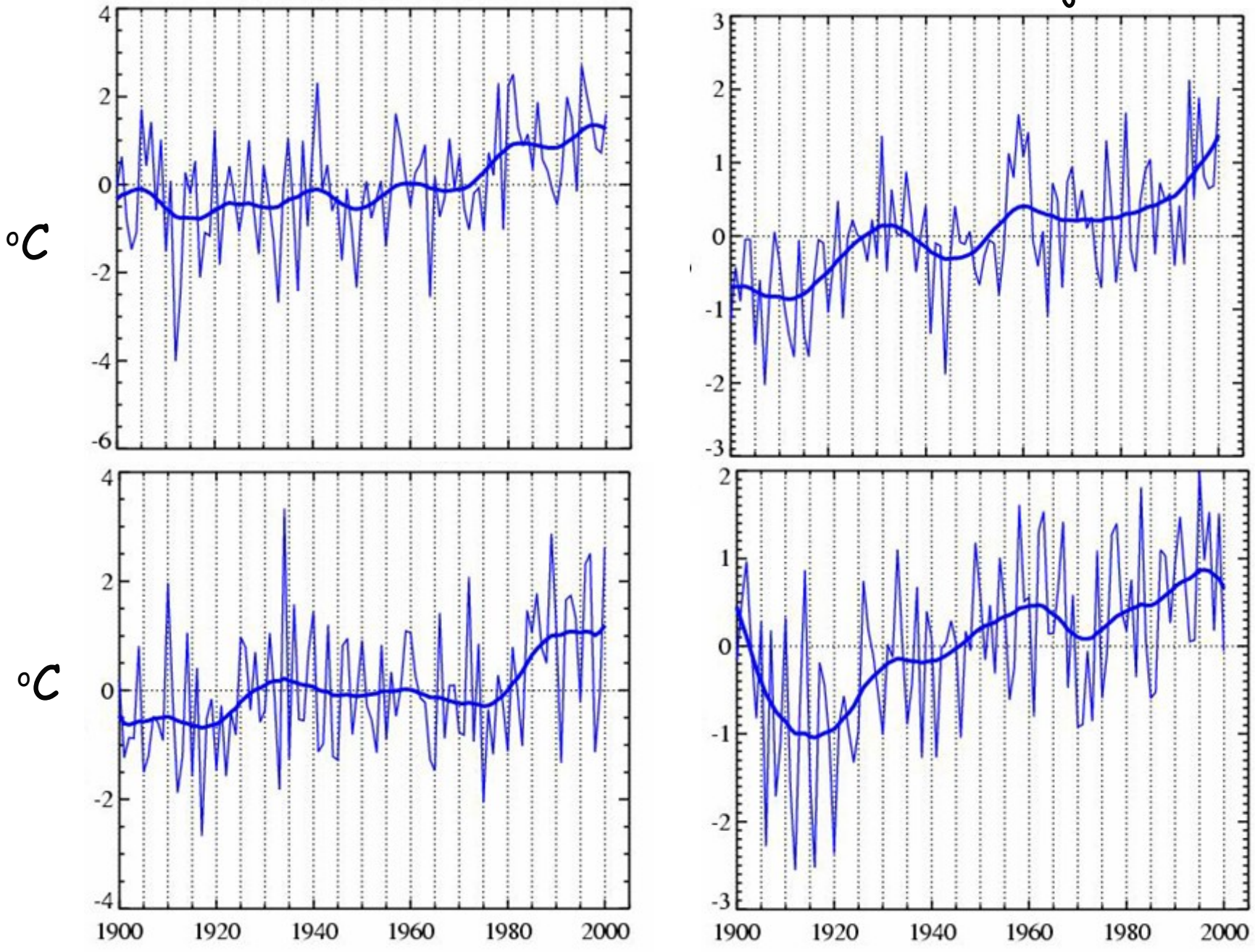
Abrupt C_3 desert shrubs expansion did not occur until ~5-4 kcal yr B.P.

Concurrent with increasing winter insolation and onset of modern ENSO variability since 5 kcal yr B.P.

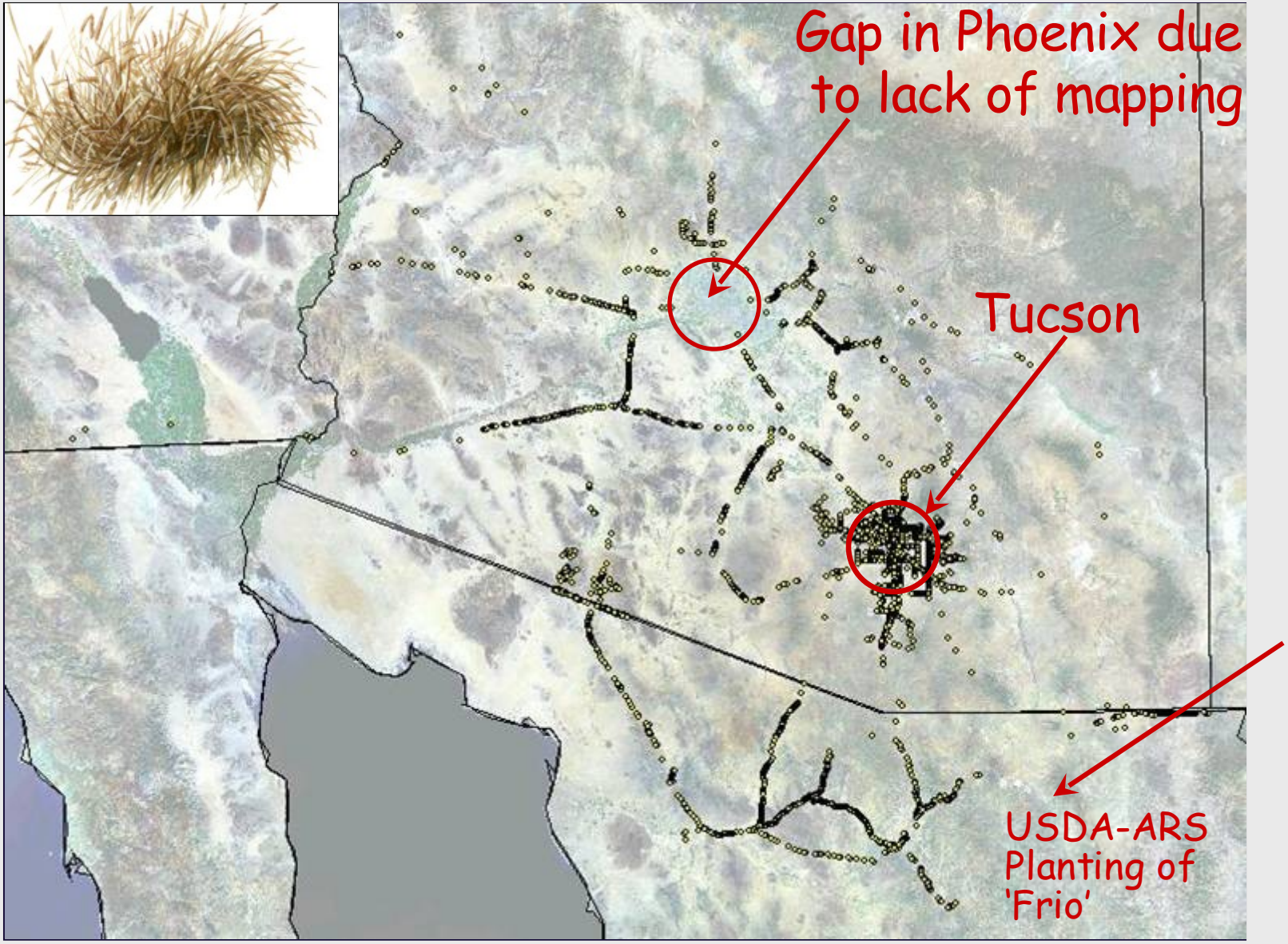
Permanence of summer rains and desert grassland, and inconstancy of adjacent desert and woodland biomes, must have left clear imprints on biogeographic & evolutionary history of regional biota

Invasion by cold-resistant and flammable C_4 African bunchgrasses + accelerated warming could result in dramatic changes in composition, fire frequency & regional extent of 'desert grassland.'

Mean minimum seasonal temp. anomalies in Sonoran & Mojave Deserts

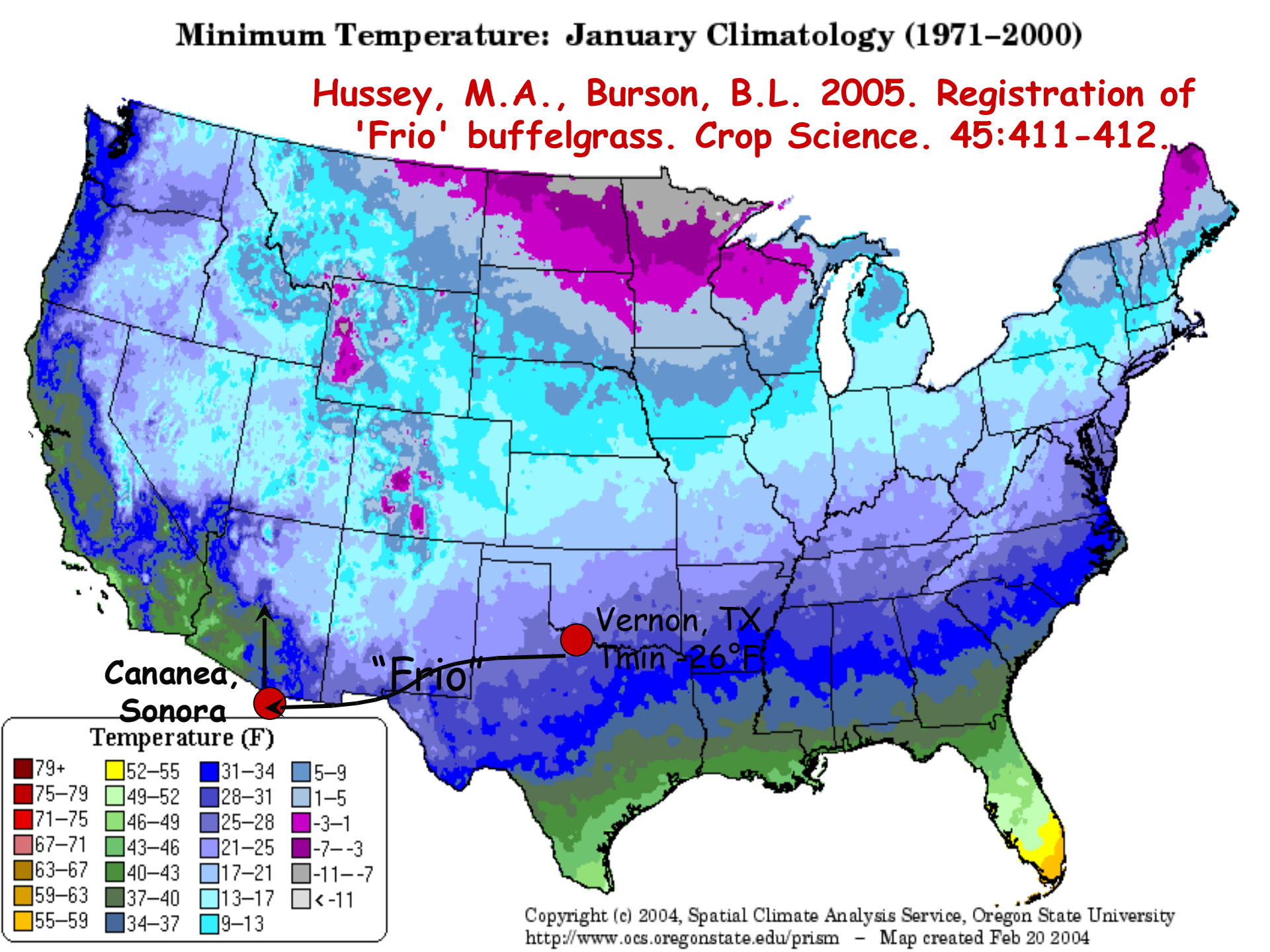


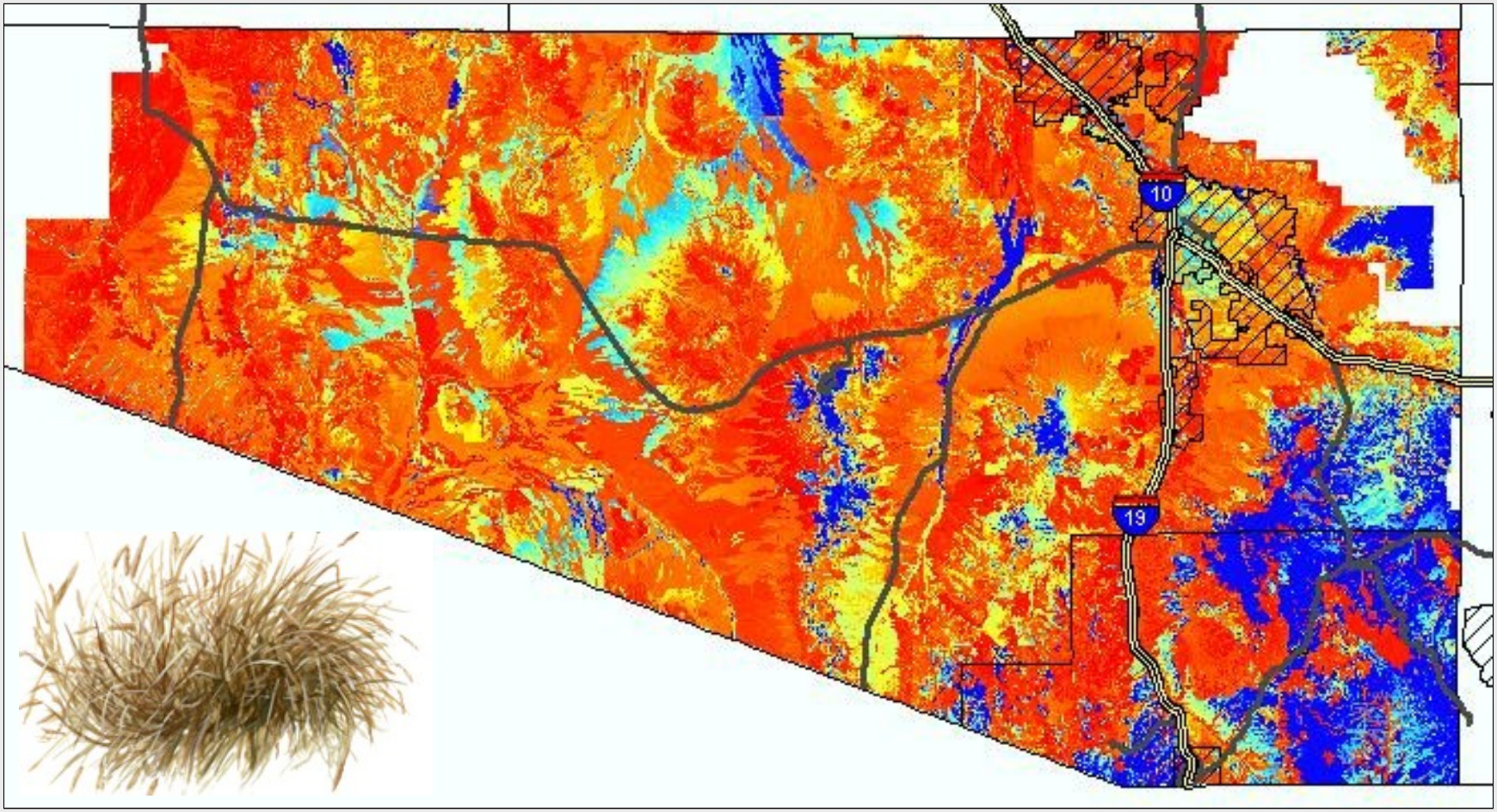
Mapped Buffelgrass Distribution Along Roadsides in Southern Arizona & Northern Sonora, Mexico (Courtesy of ASDM)



Minimum Temperature: January Climatology (1971–2000)

Hussey, M.A., Burson, B.L. 2005. Registration of 'Frio' buffelgrass. Crop Science. 45:411-412.





Potential distribution of buffelgrass in Pima and Santa Cruz Counties, Arizona, based on a neural net model that uses soil and topographic data from SSURGO and a USGS 10-m resolution DEM. Greatest suitability is depicted as red, least as blue (Olsson 2006).

Northern Sonora

Photo: Tom Van Devender

Research Needs for Buffelgrass Control

- Remote Sensing & Mapping
- Economic analysis (cost of control)
- Web-based Decision Support Systems
- Impacts on rare species & critical habitat
- Eradication treatment experiments
- Restoration after treatment or fire
- Unintended effects of glyphosate
- Phenological Models- prediction of greenup & brownup
- Seed Bank & Dispersal Ecology
- Soil Nutrient Dynamics
- Genetic studies
- Biocontrol