Below is a general key to their questions in Table 1.

***Comparison of the late Pleistocene and modern vegetation of the American Southwest***

[*https://www.ncdc.noaa.gov/paleo/slides/slideset/16/16\_322\_bslide.html*](https://www.ncdc.noaa.gov/paleo/slides/slideset/16/16_322_bslide.html)

* What patterns do you see?

Modern (top map) contains desert vegetation (yellow) at low elevations and wetter/cooler plants at high elevation. Pleistocene (bottom map) has some desert plants, but over a smaller area than modern map. Ecosystems with wetter conditions are located over wider areas in the Pleistocene than those in modern map. Boreal forests grew in parts of the American Southwest during the Pleistocene. Forests are restricted to high elevation mountainous areas today.

* Hypothesize why those patterns exist.

Modern climate in the Southwest is much warmer and drier than in the Pleistocene.

* What caused these climate changes?

This may take some further research on their part. Climate variability is caused by a variety of factors including: Milankovitch cycles, solar variation, volcanic eruptions, landcover changes, atmospheric gases, asteroid impacts, etc.

* Where did this data originate?

Pack rat midden data

***Macrofossil assemblages from pack rat middens found in Utah’s Allen Canyon Cave document 11,000 years of changing vegetation***

*http://www.ncdc.noaa.gov/paleo/slides/images/base/pack rat14.gif*

* What patterns do you see?

Middens that are 2000 years old show elevated levels of Douglas fir, Utah serviceberry, ponderosa pine, Gambel oak, little leaf mountain mahogany, Utah juniper, Colorado pinyon, and plains prickly pear. Middens between 11-10,000 years ago have high amounts of subalpine fur, Engelmann spruce, blue spruce, limber pine, russet buffaloberry, and Rocky Mountain maple. There appears to be a distinct change that occurs about 10,000 years ago.

* Hypothesize why those patterns exist.

A shift in climate about 10,000 years ago altered vegetation patterns. They shift is related to changes in temperature and precipitation associated with the ending of the Pleistocene.

# *Plant zonation with elevation on the Colorado Plateau from the last glacial to the present.*

*https://www.ncdc.noaa.gov/paleo/slides/slideset/16/16\_320\_bslide.html*

* How do the previous images involving the American Southwest maps and the Allen Canyon Cave in Utah data relate to this slide showing plant zonation on the Colorado Plateau?

The Southwest maps show the spatial distribution of vegetation in modern and Pleistocene times while the plant zonation diagram compares how vegetation changed with elevation. During the late glacial or late Pleistocene alpine tundra, spruce-fir, and mixed conifer forests cover a larger ecological range than modern times. This illustrates that climate was much cooler and wetter during the Pleistocene and allowed vegetation adapted to those conditions to flourish. The data associated with the Allen Canyon Cave provided plant information from 11-2,000 years ago showing a distinct change occurring about 10,000 years ago. Although from slightly differently geographic areas, combining this data allows scientists to investigative paleoclimate data spatially, temporally, and 3-dimensionally (elevation).