



A Review of the Pleistocene Record of *Cervus elaphus* in California

Comparing the Habitat of Tule Elk to the Paleohabitat of Pleistocene *Cervus*



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INTRODUCTION

- Tule Elk (*Cervus elaphus nannodes* Merriam, 1905) are a California endemic that inhabit arid open country such as the perennial grasslands, scrublands and oak scrublands of the Central Valley. Currently about 5,000 Tule Elk survive in 22 small protected herds (1).
- Fossils of *Cervus elaphus*, while rare in California, have been found from several sites attributed to the Late Pleistocene Rancholabrean NALMA (Figure 1).
- Examination of associated taxa from these sites can provide information on local paleohabitat structure.

MATERIALS & METHODS

Collections databases from University of California Museum of Paleontology (UCMP), and the Natural History Museum of Los Angeles County (NHMLAC) were queried to locate specimens attributed to *Cervus* from the California Pleistocene.



Fig. 2. Metatarsal (UCMP45286) and left M² (UCMP45009), *C. elaphus*, Montezuma Hills.

Table 1. Associated taxa by locality (2, 3).

	Montezuma Hills	Highway 40	McKittrick	Potter Creek Cave	Samwell Cave
<i>Perognathus</i>		●	●		
<i>Onychomys</i>			●		
<i>Ammospermophilus</i>			●		
<i>Taxidea</i>			●	●	●
<i>Antilocapra</i>			●		
<i>Camelops</i>	●	●	●		
<i>Mammut</i>			●	●	
<i>Gopherus</i>			●		
<i>Mammuthus</i>		●		●	

RESULTS

- Cervus* remains were found in association with seven grassland indicator taxa and four arid scrub indicators, compared to only three open woodland taxa (Table 2).
- Pleistocene *Cervus* remains were also found in association with four desert indicator taxa still found in California: *Ammospermophilus*, *Onychomys*, *Perognathus* and *Gopherus* (Figure 3).
- This indicates a wider habitat distribution for *Cervus* during the Pleistocene.

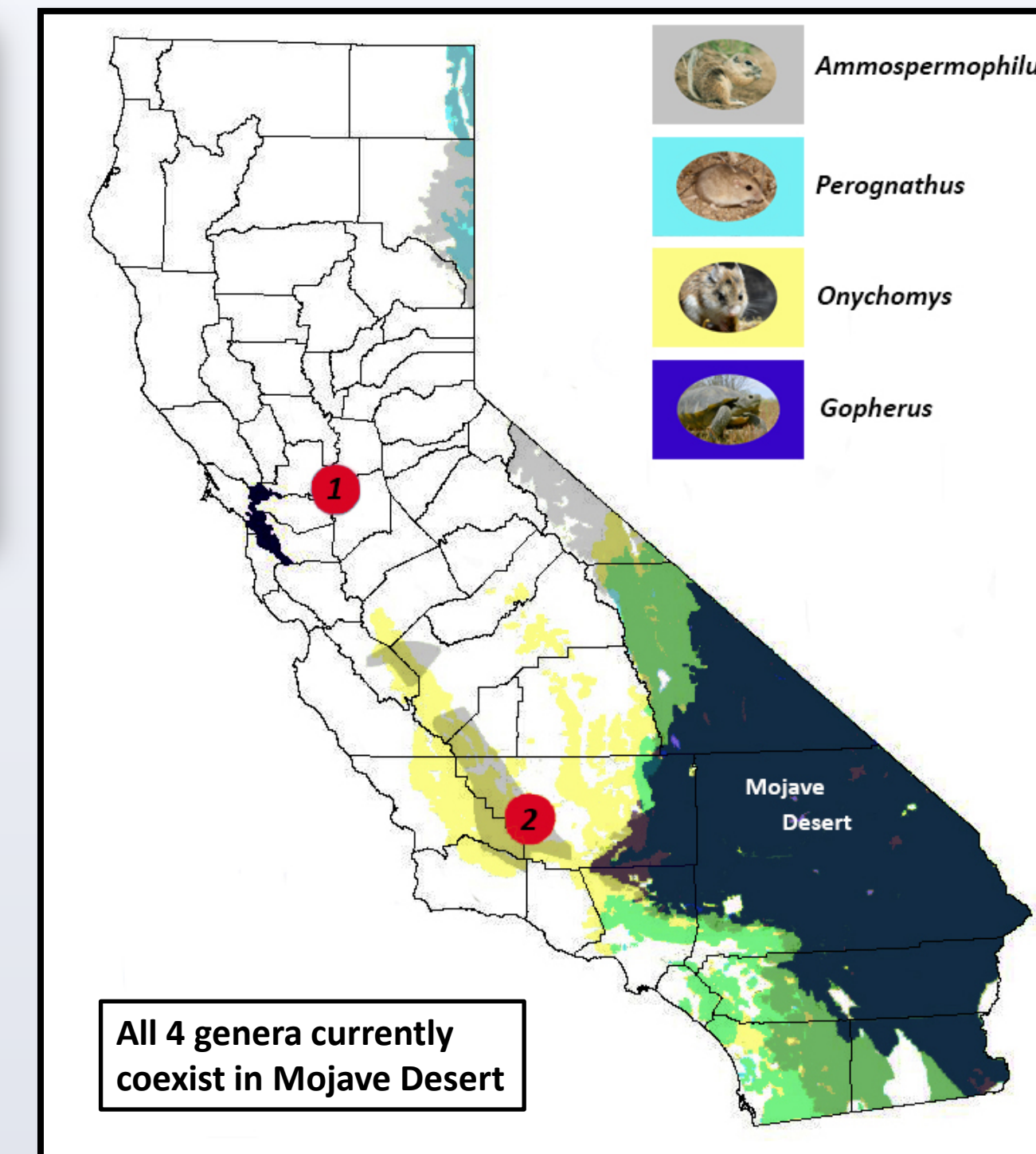


Fig. 3. Modern ranges of select taxa found in association with fossil *Cervus*. Red markers indicate: 1 – Highway 40 and Montezuma Hills; 2 – McKittrick.

For each *Cervus* locality, the faunal list was reviewed for associated taxa that could be used as environmental indicators. In all cases where a specimen was listed as *Cervus* but had not been published, I sought to verify the identification myself (Figure 2). I also examined unidentified material from several sites to check for the presence of *Cervus*. Identifications were made using the comparative collection at UCMP.

Table 2. Associated taxa by habitat (4, 5, 6).

	Desert	Arid Scrub	Grassland	Open Woodland	Closed Forest
<i>Perognathus</i>	●	●	●		
<i>Onychomys</i>	●	●	●		
<i>Ammospermophilus</i>	●		●		
<i>Taxidea</i>		●	●	●	
<i>Antilocapra</i>	●	●	●		
<i>Camelops</i>			●	●	
<i>Mammut</i>				●	●
<i>Gopherus</i>	●				
<i>Mammuthus</i>			●		

CONCLUSIONS

- Based on associated taxa, the habitat utilized by *Cervus elaphus* in the Pleistocene of California can be characterized as predominantly grassland with a mosaic of open woodlands, desert and arid scrublands with riparian corridors.
- This habitat preference is both identical to that of extant *C. elaphus nannodes*, and different from other North American elk populations. This may indicate that behaviorally elk in California had begun diverging down the path that led to modern Tule Elk. Indeed, the adaptation towards a more arid climate may have helped elk in California to survive the Pleistocene-Holocene Transition and the warmer, more xeric conditions suggested for this time (7).



DIRECTIONS FOR FUTURE RESEARCH

- Should additional cranial elements of *Cervus* from the Rancholabrean of California be found, they might allow comparison at the subspecific level.
- Palynological work on the sites examined herein could greatly enhance our understanding of both habitats and biodiversity of the Late Pleistocene Central Valley.
- Canis lupus* appears to have been absent from California. Canid forms intermediate in size between *C. latrans* and *C. dirus* have been found from McKittrick asphalt and their affinity is currently under investigation.

REFERENCES

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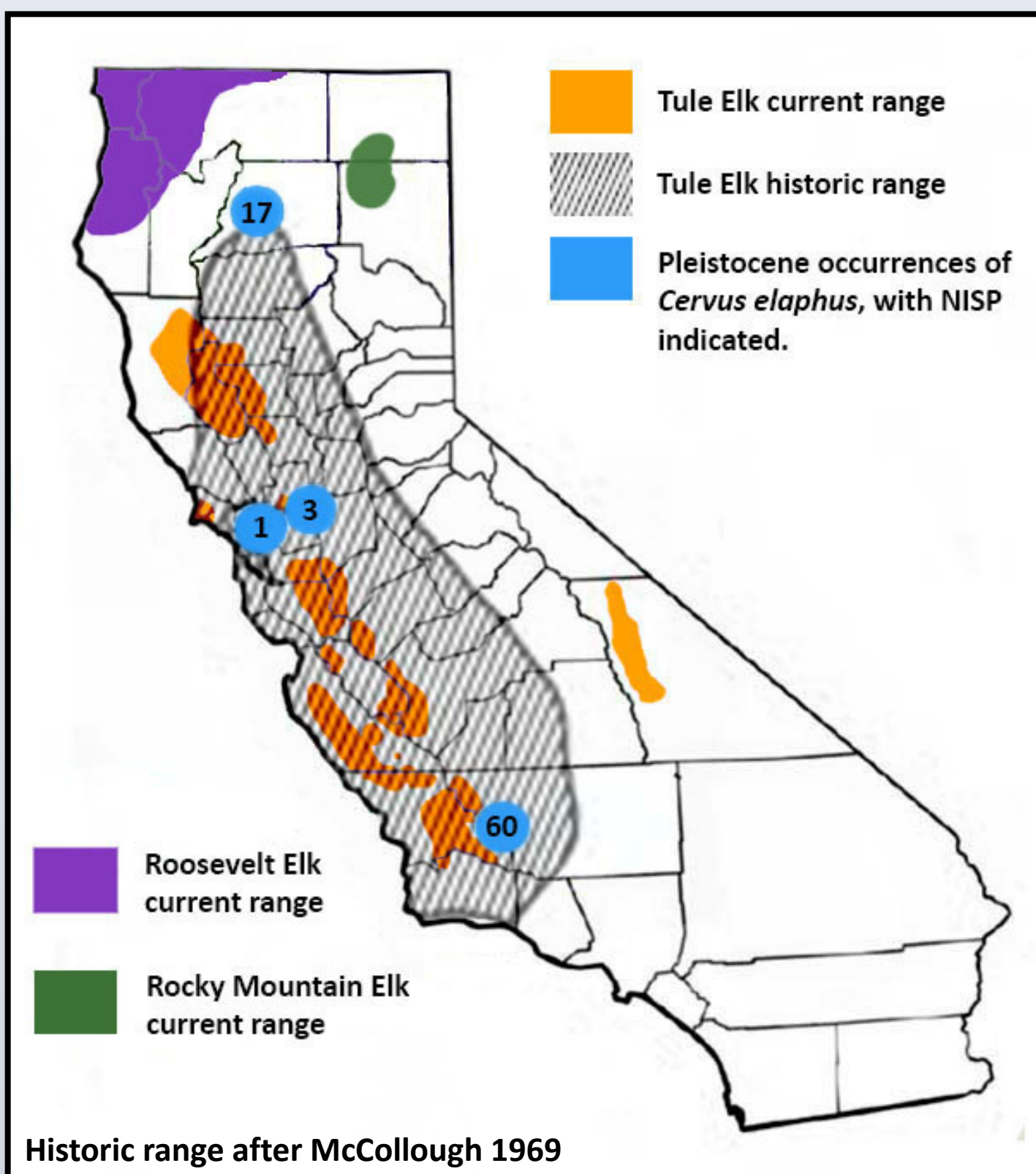


Fig. 1. Distribution of Pleistocene *Cervus* localities. NISP 17 indicates both Potter Creek and Samwell Caves. NISP 1 marks the Tule Canal site (no associated taxa). NISP 3 represents both Highway 40 and Montezuma Hills. NISP 60 marks the McKittrick asphalt seep locality.