The Holocene History of Pronghorn (Antilocapra americana) in Eastern Washington State

Abstract

Historical documents are ambiguous regarding the presence/absence and distribution of pronghorn (Antilocapra americana) in eastern Washington State. Paleozoological (archaeological and paleontological) data indicate pronghorn were present there during most of the last 10,000 years, and available samples imply the boundaries of pronghorn distribution coincided with the modern distribution of shrub-steppe habitats. There is no evidence of temporal fluctuation in the abundance of pronghorn that cannot be explained by sampling error. Pronghorn were abundant relative to wapiti (Cervus elaphus) at the mouth of the Snake River but rare near the Washington–Idaho border. Pronghorn were never abundant relative to other ungulates, but were occasionally sufficiently numerous to form herds that were taken communally by groups of prehistoric hunters. Pronghorn were present but rare in the nineteenth century and did not persist into the twentieth century.

Introduction

When Taylor and Shaw (1929:31) produced their provisional list of land mammals of Washington State, they noted that pronghorn (Antilocapra americana) were at that time “extirpated” within the state but “the former range included much of the plains country of eastern Washington.” Some years later Booth (1947:592) indicated that pronghorn “do not normally occur in Washington” but that this species’ range “probably extended into this state formerly, for a skull has been found in Okanogan County.” The skull was recovered from the extreme northeastern corner of Okanogan County, and Booth (1947:594) speculated that its find location may not indicate that pronghorn had actually ranged that far north in the past because the skull “may have been carried there by an Indian, a trapper, or a hunter.”

Dalquest (1948:415) reported that as far as he knew, “there is no record by any of the early explorers of antelope killed or seen in what is now Washington [State]. No bones of antelope have been discovered in caves in eastern Washington.” Among the records left by early explorers that Dalquest consulted, Suckley and Gibbs (1860:136) doubted the validity of Lewis and Clark’s report that pronghorn could be found in the Columbia Basin of eastern Washington because they (Suckley and Gibbs) failed to observe any. J. G. Cooper (1868:537), a naturalist who accompanied survey parties seeking a railroad route into the West, however, reported second-hand information that in the area “towards the most westerly bend of the Columbia [River], a region uninhabited, and almost unknown to the Indians, large herds of Antelopes [were seen].” Einarsen (1948:3) later indicated that the southern half of eastern Washington was occupied by pronghorn when its range was at its “greatest extent” but he does not identify any evidence for his comment.

More recently, Ingles (1965:437) implied that pronghorn are not native to Washington and stated that they were “introduced in central Washington in 1938,” referring to the release of pronghorn by the State Game Department in the “Squaw Creek Refuge in southern Kittitas and northern Yakima counties” (Booth 1947:594). O’Gara (1978:2) reported that pronghorn were transplanted from Oregon and the Charles Sheldom National Antelope Refuge in Nevada and illustrated two areas where pronghorn were found in Washington; his map is at a scale that does not allow determination of the exact location of those two areas. Kitchen and O’Gara (1982) reiterated the historic range shown by Ingles (1965). Yoakum and O’Gara (2000) illustrated the “original range” described by Nelson (1925); it included a small portion of south-central Washington along the Washington–Oregon border. They contradicted that map, however, when they stated that Washington was “outside of ancestral habitats” of the species (Yoakum and O’Gara 2000:562).
methods and materials

I consulted all reports known to me concerning the Holocene paleozoology of eastern Washington, a politically defined geographic area bounded on the north by British Columbia, the east by Idaho, and the south by Oregon. I chose the crest of the Cascade Range as the western boundary, and used county lines that follow or approximate the east–west drainage divide to define that boundary (Figure 1). I recorded the number of identified specimens (NISP) (Grayson 1984, Lyman 1994) of pronghorn at each archaeological site and paleontological location when such data were reported; sometimes only the presence of such remains was reported. A specimen is a bone or tooth or fragment thereof. Only those archaeological remains that were not modified into artifacts were recorded to avoid including bones and teeth that had been transported long distances from where animals were procured (Lyman 1994); all paleontological remains were recorded. Age of the remains was determined using stratigraphically associated radiocarbon ages, temporally diagnostic artifacts that were stratigraphically associated in the absence of the radiometric ages, or temporally distinct strata such as radiometrically dated volcanic tephra (e.g., Lyman 2000a). For analytical purposes, standard zooarchaeological procedure was followed and the mid-point of the age range of deposits was used (Lyman 2003). Geographic locations of deposits that produced remains of pronghorn were recorded by legal description (township, range) and also plotted on a map.

Because sampling of eastern-Washington deposits that contain mammalian remains has not been probabilistic across geographic space (Lyman 2002, 2004b), efforts to determine the prehistoric range of pronghorn or to monitor changes in the distribution of pronghorn must be tempered by knowledge that the samples may not be representative. The presence of remains of pronghorn, particularly those of low socioeconomic value (minimal food value or useless as tool material) such as phalanges that are unlikely to have been transported far by prehistoric hunters (Lyman 1994), may be viewed as evidence of relatively local origin (<10 km) while the absence of remains may reflect local absence of the species, lack of preservation of pronghorn remains, or lack of recovery of pronghorn remains as a result of minimal sampling (e.g., Grayson 1981; Lyman 1994, 2002, 2004b). Because pronghorn were likely acquired
Figure 1. Map of eastern Washington State showing townships sampled for paleozoological remains, and townships where pronghorn remains have been identified. Faunal remains have been recovered from but not studied in some sampled townships. County lines and county names are shown for reference.

by prehistoric hunters within several kilometers of the site of bone and tooth deposition, locations where pronghorn remains have been recovered were mapped by township. Each unique township that has produced remains of pronghorn is noted regardless of how many locations or sites within that township have produced remains. In the following, all ages are given in radiocarbon years which are only approximately the same as calendar years (Taylor 1996).

In eastern Washington, the older a deposit, the less intensively and extensively it has been sampled (Lyman 2000a, 2000b, 2004b). Thus I follow standard paleozoological procedure (Grayson 1984) and track abundances of pronghorn remains relative to abundances of remains of other taxa across time and space. This analytical protocol circumvents potential depositional and preservational biases that may skew results. Nevertheless, detection of the influence of sample size gives reason to be cautious.
Paleoecology and Ecology

The periphery of a taxon’s range is often the area where organisms are most sensitive to climatic change, competition, and the like (Brown and Lomolino 1998). A taxon is more likely to display responses to environmental change that are detectable in the prehistoric record at the edges of its range than in the center of that range where the response signature may be muted by high abundances of the taxon. Eastern Washington is one such peripheral area of the range of pronghorn. Eastern Washington witnessed changes in climate during the Holocene that might account for variation in pronghorn abundance during that time. As the Pleistocene ended and the Holocene began about 10,000 B.P., summers became warmer and drier (due to evaporation) and winters became extremely cold (climatic history from Chatters 1998). There was more grass and less shrub vegetation in the Columbia Basin than today. About 8500 B.P. winters became warmer and wetter, but there was greater aridity overall and grass decreased and sagebrush increased in abundance. Between 5500 and 3500 B.P., climates cooled and moisture increased after 4500 B.P. After 3500 B.P., climates remained cool and with abundant moisture, ground cover increased. After 2500 B.P. climates warmed and some shrub steppe in the southeastern portion of the basin became more grassy.

The productivity and quality of forage influence maternal condition, birth weight, growth rate, disease and predator resistance, survival, and recruitment of many ungulates (Yoakum and O’Gara 2000). Forage thus has a direct bearing on the size of local populations. Pronghorn consume mostly forbs, and ingest shrubs rather than grass when forbs are unavailable (Stephenson et al. 1985, Yoakum and O’Gara 2000). Grass is important during spring and fall when new growth is nutritious but only comprises about 10 percent of pronghorn annual diet. Mortality tends to be highest during periods of drought and exceptionally cold winters with deep, ice-crusted snow (Martinka 1967, Yoakum and O’Gara 2000).

Results

Osborne (1953) was the first to report the recovery of pronghorn remains from archaeological sites in eastern Washington. He listed five sites that had, at that time, produced remains of pronghorn. In the subsequent five decades more than 70 other archaeological sites and two paleontological sites produced remains of pronghorn. These sites tend to be concentrated along the Columbia and Snake Rivers where the majority of archaeological excavations have taken place (Lyman 2002). As of mid-2005, archaeological and paleontological deposits in 200 townships had been sampled (Figure 1). Not all sampled townships produced mammalian remains, and the remains collected from some townships have never been identified or described in the literature (Lyman 2004b). Nevertheless, 54 townships have produced remains of pronghorn (Figure 1). As implied by earlier researchers, pronghorn remains are distributed across the central Columbia Basin in areas that today support (or should support, in the absence of agriculture) shrub-steppe habitats (Daubenmire 1970).

No remains of pronghorn have been found in presently forested areas, and none clearly come from prairie–bunchgrass habitats. However, the presence of pronghorn remains about 10 km west of the Washington–Idaho border (Figure 1) and a few kilometers east of that border (Ames 1990) within the Snake and Clearwater River canyons suggests that pronghorn may have been present on the upland prairies both south and north of the lower Snake River. The skull from northeastern Okanogan County reported by Booth (1947) is the farthest north specimen in eastern Washington of which I am aware. There are no reports of pronghorn remains from areas of south-central British Columbia that might be thought to comprise suitable habitat for pronghorn (Grabert 1974, Richards and Rousseau 1987, Driver 1993).

Pronghorn remains occur during most 500-year intervals of the last 10,500 years (Table 1). Two lines of evidence suggest that the absence of pronghorn remains from several 500-year intervals is a reflection of sampling effort. First, pronghorn remains have not been reported for three 500-year intervals pre-dating 6500 B.P., the era least intensively sampled in terms of number of sites excavated and also in terms of number of radiocarbon assays, both of which correlate with sampling effort (Lyman 2000a, 2000b). Second, the abundance of pronghorn remains per 500-year interval correlates with the frequency of all identified mammal remains per 500-year interval (Pearson’s $r = 0.795, P < 0.0001$). This correlation suggests that the frequency of pronghorn remains per 500-year interval is a function of sampling.
and analytical effort per temporal interval, where sampling effort includes how many remains were recovered and analytical effort concerns whether or not recovered remains were identified. Thus it would be unwise to infer anything about the absolute abundance of pronghorn on the landscape (Grayson 1981, 1984; Lyman 1994).

Artiodactyl remains present in paleozoological collections under study here represent not only pronghorn but deer (*Odocoileus virginianus* and *O. hemionus*), bighorn sheep (*Ovis canadensis*), wapiti (*Cervus elaphus*), and bison (*Bison antiquus* and *B. bison*). All of these taxa of large mammal were frequent prey of prehistoric human hunters (Lyman 2003); some taxa represented in paleozoological collections were not exploited by prehistoric humans. The frequency of pronghorn remains per 500-year interval correlates with the frequency of artiodactyl remains per 500-year interval ($r = 0.665$, $P = 0.001$), suggesting that the frequency of pronghorn remains at any given time is a function of sampling and analytical effort.

Chatters (1998) suggested that pronghorn increased in abundance relative to wapiti between 8500 and 5500 B.P., a time that corresponds to increased abundance of sagebrush (*Artemisia* sp.). Deer are the most consistently and abundantly represented artiodactyls in eastern Washington (Lyman 2004b). The abundance of pronghorn remains relative to the abundance of deer remains plus pronghorn remains in 82 assemblages of known age displays no statistically significant trend in pronghorn relative abundance ($r^2 = 0.005$, $P > 0.5$); any apparent trend can be attributed to sampling effort (Figure 2). There are more collections containing pronghorn remains that date to the late Holocene than to the early Holocene because late Holocene sediments have been more regularly excavated than early Holocene sediments (Lyman 2000a, 2000b).

Gustafson (1972) suggested that along the lower Snake River in southeastern Washington, as one moved from the mouth of the Snake eastward, pronghorn remains decreased in abundance relative to the abundance of wapiti remains. The Snake River Canyon is an edaphic peninsula of relatively xeric vegetation, including sagebrush, that incises and extends eastward into upland grasslands (Daubenmire 1970). Twenty-two assemblages from the lower Snake River contain remains of both pronghorn and wapiti and date to the last 5500 years, when climates began to approximate modern conditions. Those assemblages display a trend in relative abundances of the two species (Figure 3). Wapiti are most abundant in

### Table 1. Abundance (number of identified specimens; NISP) of pronghorn remains and all artiodactyl remains per 500-year time interval in eastern Washington.

<table>
<thead>
<tr>
<th>Age (years B.P.)</th>
<th>Pronghorn NISP</th>
<th>Artiodactyl NISP</th>
</tr>
</thead>
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<tr>
<td>0–500</td>
<td>168</td>
<td>3391</td>
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<tr>
<td>501–1000</td>
<td>1235</td>
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<td>66</td>
<td>3802</td>
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<tr>
<td>3001–3500</td>
<td>20</td>
<td>1132</td>
</tr>
<tr>
<td>3501–4000</td>
<td>150</td>
<td>882</td>
</tr>
<tr>
<td>4001–4500</td>
<td>12</td>
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<td>8</td>
</tr>
<tr>
<td>6501–7000</td>
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<td>81</td>
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<tr>
<td>10,001–10,500</td>
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</tr>
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</table>

![Figure 2. Proportion of pronghorn remains among pronghorn plus deer remains in 82 collections. Some points do not show due to overlap. There is no statistically significant relationship between the two variables ($r^2 = 0.005$, $P > 0.5$).](image-url)
the eastern assemblages and pronghorn are most abundant in the western assemblages (Spearman’s rho = –0.543, \( P < 0.009 \)).

Relative abundances of pronghorn remains imply other aspects of the Holocene history of the species when those abundances are viewed in light of how pronghorn remains from the Great Plains have been interpreted. The low relative abundance of pronghorn remains suggests that pronghorn often occurred singly or in small groups from which only one or two individuals were taken during any given hunting episode. All archaeological collections in eastern Washington derive from habitation sites rather than procurement or kill sites. Communal kill sites are evident in the Great Plains archaeological record (e.g., Frison 2004). There, pronghorn were hunted throughout the past 10,000 years, and often only one or two individuals were taken at a time. On the Plains, evidence of taking pronghorn herds comprising multiple individuals consists of zooarchaeological collections in which pronghorn remains represent >50% of the remains of animals exploited by human hunters (Lubinski 2000); similar evidence is apparent in the Great Basin of western North America (Lubinski 1999). Of the 82 collections from eastern Washington plotted in Figure 2, pronghorn remains make up >50 percent of deer plus pronghorn remains in several. This suggests that during the past several thousand years, pronghorn were occasionally sufficiently abundant in eastern Washington that prehistoric hunters found it advantageous to pursue herds via communal hunts. Such communal hunts are reported in the ethnographic record (e.g., Roy and Walker 1961), most of which was generated in the late nineteenth and early twentieth centuries.

Conclusions

Many of the questions suggested by the ambiguity of available historical documents can be answered in light of the paleozoological record. Pronghorn were present in eastern Washington State during the last 400 years. Abundance data suggest pronghorn were never as abundant in eastern Washington as they were in prehistoric Wyoming (Lubinski 2000, Miller and Sanders 2000) and Montana (Davis and Fisher 1990), but occasionally they were sufficiently abundant that multiple individuals could be taken during one, likely communal, hunt. Pronghorn were present in pre-Columbian times and, allowing for sampling error, pronghorn were present in eastern Washington throughout the last 10,000 years.

There are insufficient data to determine if pronghorn abundances and distribution fluctuated in concert with climatic change over the past 10,000 years. There is no clear evidence for a suggested increase in pronghorn between 8500 and 5500 B.P. Pronghorn likely entered the state from Oregon, immigrating across the Ochoco Plateau of north-central Oregon at virtually any time during the past 15,000 years (until about 100–120 years ago). This is the likely the same route followed by bison (Lyman 2004a), but at present the paleozoological record of the Ochoco Plateau is too poorly known to provide a robust test of this hypothesis for either species.

Few archaeological materials dating to the nineteenth century have been collected and studied. Only two collections containing pronghorn remains, one from a site in eastern Kittitas County and one from southern Okanogan County (Figure 1), clearly date to the last 200 years. These collections hint at the cause of the ambiguity of the historical record. Pronghorn were rare in eastern Washington in the nineteenth century, and likely had become locally extirpated by the beginning
of the twentieth century. I hypothesize that local extirpation occurred because (1) the route followed by immigrants was closed or the source population in eastern Oregon was depleted to the extent that it could no longer serve as a source of immigrants, and (2) eastern Washington was marginal habitat for pronghorn over the past 10,000 years or more, so it didn’t take much human predation to deplete local herds.

Why previous efforts to transplant pronghorn to the state failed and how the probability of successful transplants in the future can be increased is unclear from the paleozoological record. I suspect the reasons include a naturally marginal habitat which agriculture-related land use practices have now rendered uninhabitable for pronghorn. Lack of habitatability results from habitat disturbance and competition with domestic ungulates. As paleozoological data accumulate, we can refine our understanding of the history of pronghorn in eastern Washington. For the present, there should no longer be any doubt among mammalogists that pronghorn are native to the Columbia Basin.

Acknowledgements

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Literature Cited


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