

On the Holocene History of Elk (*Cervus elaphus*) in Eastern Washington

Abstract

Historically, North American elk (*Cervus elaphus*) were thought to have been absent from the arid steppe habitats of the Columbia Basin of eastern Washington. McCorquodale (1985, *Northwest Science*) used zooarchaeological data to show elk had been present there during the Holocene. Presently available zooarchaeological data indicate elk were present during each 1000 yr increment of the last 5000 years, but those data are not sufficiently robust to allow detection of changes in the range or abundance of elk. Limited data suggest that the introduction of Euroamerican technology and horses to Native American peoples may have initiated local extirpation of late prehistoric-early historic elk, and that some late-prehistoric elk in the Pacific Northwest were larger than modern elk.

Introduction

Since the middle of the nineteenth century when Suckley and Gibbs (1860:133) wrote that they "suppose[d] that the range of the [North American wapiti or elk (*Cervus elaphus*)] from the Rocky Mountains to the Pacific has been by the line of the heavily timbered Cascade Mountains," many researchers have believed that elk did not occur in the relatively arid steppe habitats of the Columbia Basin of eastern Washington state (Bailey 1936; Dalquest 1948; Murie 1951; Bryant and Maser 1982). Historic literature largely fails to provide evidence to the contrary (e.g., Schullery 1984), and suggests that elk were never very abundant east of the crest of the Cascades. Thus, McCorquodale (1985:192) cautioned that "an assessment of the original distribution of elk based upon these sources must be considered suspect."

McCorquodale (1985) turned to the zooarchaeological record to study the original occurrence of elk in the Columbia Basin. Citing data from just over a dozen archaeological sites, he found that the available evidence did "not support the hypothesis that elk were not present in the Columbia Basin" and concluded that they had been present during the Holocene or last 10,000 years (McCorquodale 1985:196). In this paper we expand on McCorquodale's (1985) analysis using his data as well as data gathered in the decade since his paper was published. In undertaking this analysis, we sought to refine McCorquodale's conclusions by searching for changes in the distribution of elk through time. We attained only limited success in

this endeavor due to limitations of the available sample, but found no evidence to contradict his findings.

The Columbia Basin

We define the Columbia Basin as that area of eastern Washington bordered on the west by the Columbia River, on the north by the Columbia and Spokane rivers, on the east by the edge of coniferous forests (just west of or approximating the Washington-Idaho border), and on the south by the Snake River (Figure 1). This area is relatively arid with warm to hot summers and cool winters. Vegetation is characterized as steppe and is dominated by big sagebrush (*Artemisia tridentata*) and bunchgrass (*Agropyron* sp., *Festuca* sp.) (Daubenmire 1970). The Columbia Basin is surrounded by coniferous forests consisting of various tree species (Franklin and Dyrness 1973). In order to gain as full an understanding as possible of the biogeographic history of elk, we defined our study area as that part of Washington east of the crest of the Cascade Mountains and within the northern, eastern, and southern boundaries of that state.

Fossil pollen and mammal remains suggest the post-glacial Holocene geological epoch was dominated by steppe vegetation and mammalian taxa (e.g., Lyman and Livingston 1983; Whitlock 1992). However, there were significant changes in climatic patterns during the Holocene that resulted in changes in habitat and in distributions of some mammalian taxa (e.g., Lyman 1991; Lyman and

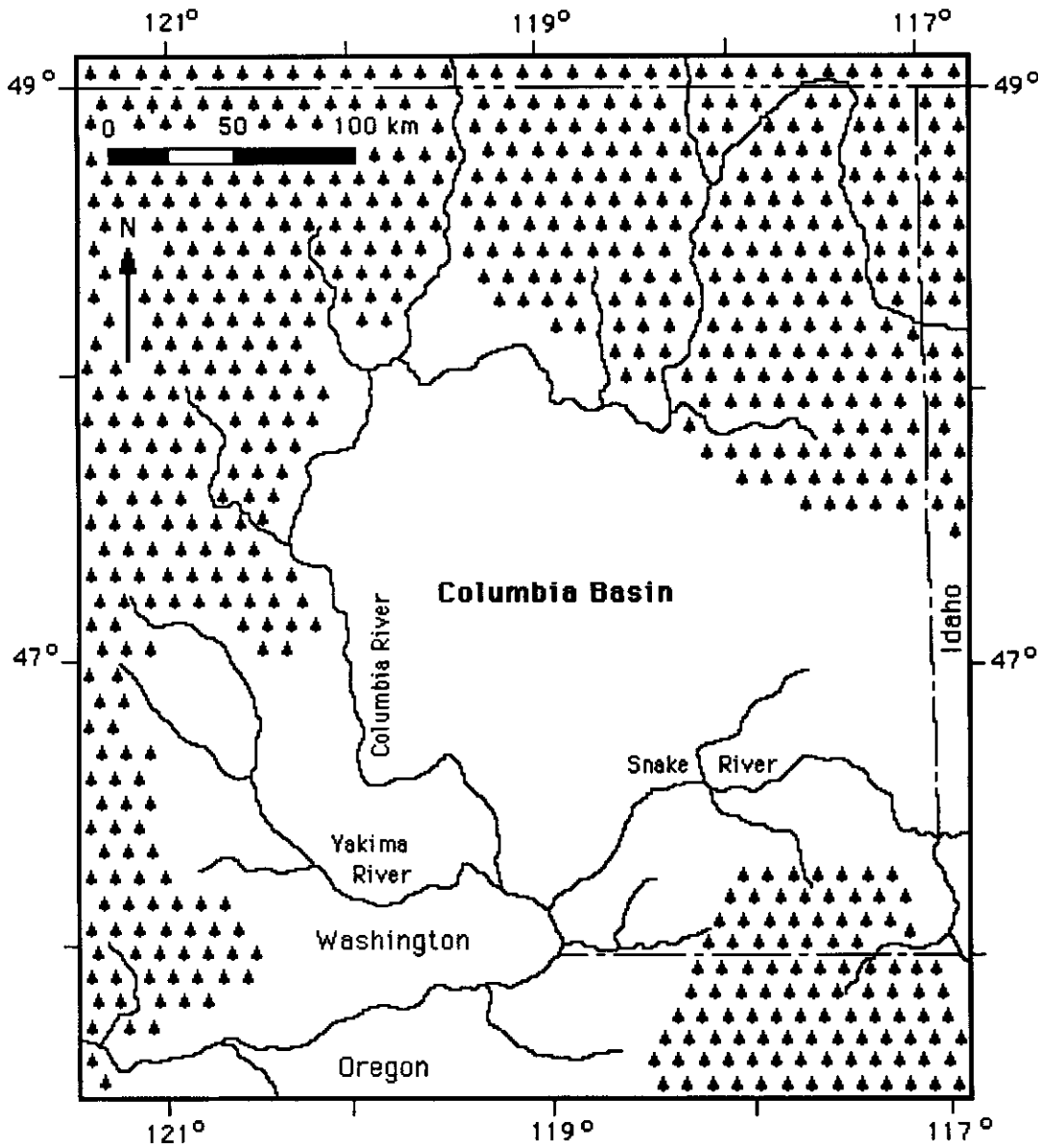


Figure 1. Distribution of forest habitats in eastern Washington (after Daubenmire 1970).

Livingston 1983). Thus, a single map showing archaeological sites that have produced remains of elk, but that disregarded the age of those remains, would not reveal potentially significant details of the biogeographic history of this species.

Historic data (e.g., Schullery 1984) indicate elk were seldom found in the central arid Columbia Basin after 1850. Elk tended to be restricted to timbered habitats surrounding the basin during the late

nineteenth and early twentieth century (Bryant and Maser 1982; Ingles 1965; Peek 1982; Figure 2). Only in the last twenty years or so have elk begun to move out of the forests into the steppe habitats of the western portion of the basin (e.g., Rickard et al. 1977) where a small population has become established (e.g., McCorquodale 1993 and references therein). This historic event underscores the possibility that elk may have at some time in the past

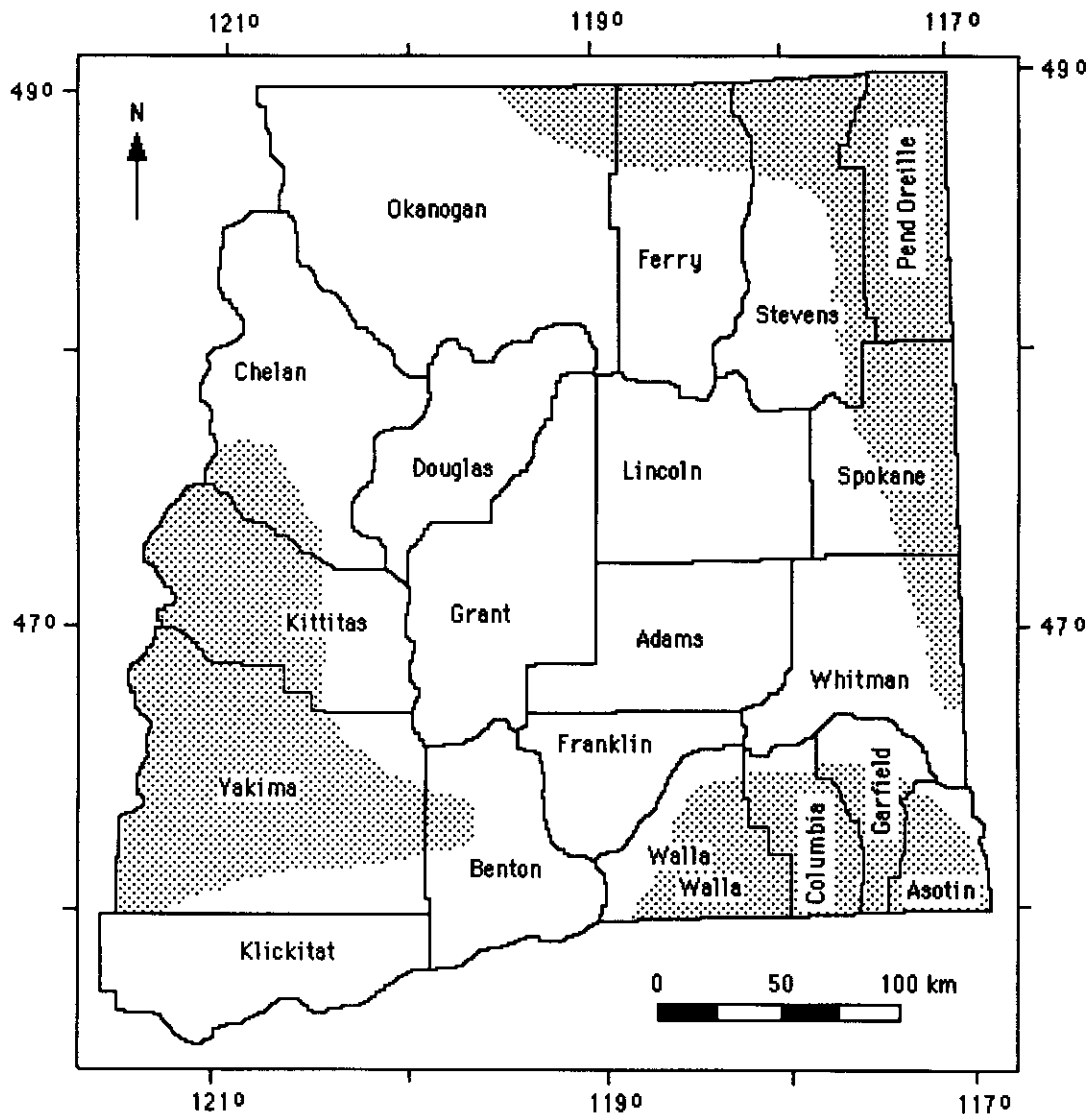


Figure 2. Approximate modern distribution of elk (stippled) in eastern Washington (after Booth 1947; Dalquest 1948; Ingles 1965; with modifications). County lines and names shown for reference.

been much more widespread in eastern Washington than during the previous 100–200 years.

Methods and Materials

We examined published and unpublished archaeological reports for evidence of elk. (Virtually no Holocene-aged paleontological mammalian remains have been reported in the area.) When an archaeological site had produced such remains, we recorded (a) the frequency and kinds of elk

skeletal parts recovered, (b) stratigraphically associated radiocarbon dates, (c) where the site was located, (d) when the site was excavated, and (e) when the faunal remains were reported. The first attribute helped us determine if the remains were of local derivation or if they might have been traded or transported into the site from elsewhere (see Lyman 1994 for a review). The last two variables allow us to assess sample adequacy and validity for determining changes in the prehistoric distribution of elk through time.

Stratigraphically associated sets of elk remains—assemblages—were assigned a chronometric age if they had one or more associated radiocarbon dates. In those cases when more than one radiocarbon date was available for an assemblage, we calculated the simple average of the multiple dates, and used that average to assign the assemblage a chronometric age. All assemblages with a chronometric age were assigned to one of six arbitrary time periods. Five of these span 1000 year periods, beginning with 0–1000 yr BP (radiocarbon years Before Present) and ending with 4000–5000 yr BP. The sixth time period spans the first half of the Holocene—5000–10,000 yr BP—because there were so few dated assemblages falling in this time span that to distinguish shorter time periods would have provided no useful information for our purposes.

We drafted a map for each of the six time periods, plotting the locations of sites that produced dated elk remains on the appropriate map. We also plotted all undated occurrences of elk on the 5000–10,000 yr BP map. Study of these maps (Figure 3) suggests where elk were at particular times in the past, but, as we will show, the maps tell us little about where elk were not present in the past.

Results

Seventy-seven archaeological sites in eastern Washington have produced over 1300 skeletal remains of elk. The latter value is a minimum because frequencies of elk remains were seldom reported prior to 1970; early reports rarely even note the presence of elk or other faunal remains. Fifty sites containing 74 assemblages of elk remains have been chronometrically dated; 35 additional assemblages have not been so dated or are dated to periods significantly exceeding a 1000-year time span and thus cannot be easily placed within one of our time periods.

A composite map of all dated and undated sites suggests that elk were present throughout eastern Washington, if at different times in different places, during the Holocene. Maps of the dated assemblages (Figure 3) indicate elk were rather consistently present throughout the Holocene in the upper-middle Columbia River area—between Okanogan and Douglas counties—and along the lower Snake River of southeastern Washington. Were elk in fact more regularly present in these

two areas relative to other areas? We believe this question cannot be answered with the available data for two reasons.

First, zooarchaeological research—which we define as the detailed description of animal taxa represented and their abundances in collections recovered from archaeological sites—only began to be systematically accomplished in eastern Washington in the 1970s (e.g., Gustafson 1972; Deaver 1973; Lyman 1976). Much of the archaeological research in the area, however, took place between 1950 and 1980 as a result of hydroelectric projects along the Columbia and Snake rivers. Thus, several rather large archaeological projects—such as those upstream of McNary Dam (Osborne 1957; Shiner 1961), Priest Rapids Dam (Greengo 1986), Wanapum Dam (Nelson 1969; Swanson 1956, 1962), Rock Island Dam (Hartman 1975), Rocky Reach Dam (Gunkel 1961), and Wells Dam (Grabert 1968) on the Columbia, and Ice Harbor Dam (Grater 1966; Rice 1965) on the Snake—resulted in the generation of much archaeological data but minimal, typically not detailed, and often undated zooarchaeological data. Later projects behind some of these and other dams—such as Wells Dam (Chatters 1986), Chief Joseph Dam (Campbell 1985), and Grand Coulee Dam (e.g., Chance and Chance 1985) on the upper-middle Columbia—have filled some of these gaps.

The second reason for the geographic gaps is that radiocarbon dating—the chronometric technique typically employed by archaeologists in eastern Washington—while first used in eastern Washington in the 1950s, was not consistently used until the 1970s, and even then not all assemblages of artifacts or faunal remains were dated. Thus, we not only have elk remains from sites excavated prior to 1950—such as those upstream of Grand Coulee Dam recovered in the 1930s (e.g., Collier et al. 1942)—that have no associated radiocarbon dates, we also have elk remains from sites excavated in the late 1950s with no associated radiocarbon dates—such as those in the Rocky Reach Dam reservoir area (Gunkel 1961).

To assess the influence of the history of archaeological research on the available zooarchaeological data, we compared two pairs of variables. In the first comparison, one variable is the date when a site producing elk remains was first reported; the second variable is the date when a site—whether or not it produced remains

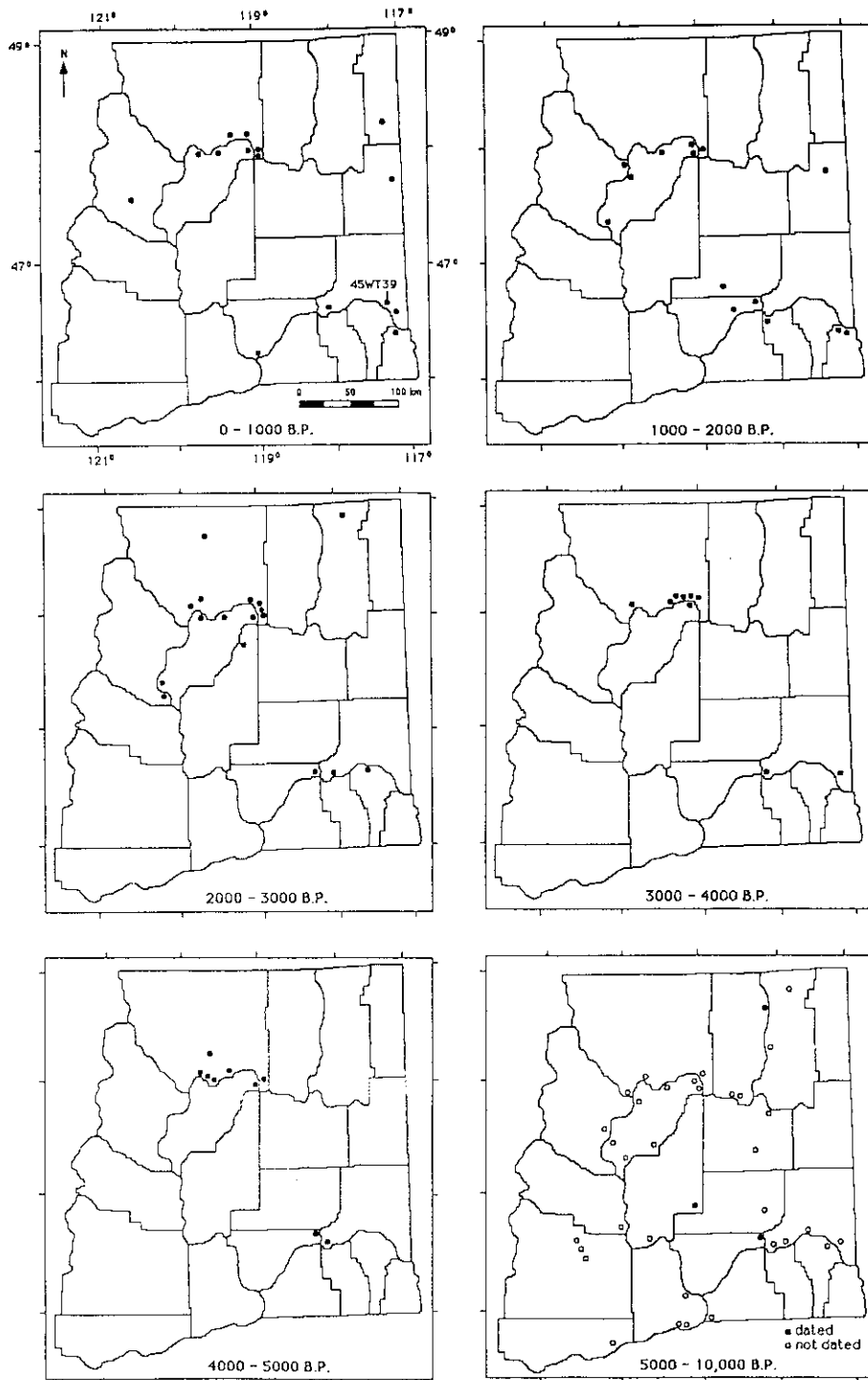


Figure 3. Distribution of sites producing elk remains per thousand year period; county lines shown for reference.

of elk—was first dated via radiocarbon analysis. We tallied the number of sites per five year increment, beginning with those reported prior to 1950. The two variables are correlated (Spearman's $\rho = .87$, $P = .002$), as implied in Figure 4. But note that between 1955—the beginning of the period when the first site was radiocarbon dated—and 1964, the number of sites reported to have produced elk remains exceeds the number of dated sites. After 1964, the number of dated sites—with one exception, 1970-74—exceeds the number of sites reported to have produced elk remains in all 5-year periods. This bivariate comparison, then, suggests that the history of reporting elk remains has been somewhat different than the history of dating archaeological sites and their included faunal remains.

In the second comparison, we tallied the number of dated assemblages per county irrespective of the age of the assemblage. Results (Figure 5) indicate that 44 of the 74 total dated assemblages are found in two counties—Douglas and Okanogan. Twenty dated assemblages are found in counties adjacent to the lower Snake River in southeastern Washington. Thus, 86% of the dated assemblages are found in these two areas; that is, well over three-fourths of the dated assemblages are from less than half—8 of 20—of the total counties. Clearly, the data available are not evenly

distributed geographically. The distribution maps (Figure 3) seem, then, to tell us more about when and where post-1970 zooarchaeological research has been done than where elk were not to be found during the Holocene.

The maps do, however, indicate to some degree where elk were during the Holocene. Artifacts of elk bone and antler have been found in many archaeological sites, but those sites have also produced non-artifactual bones and teeth of individual elk that were very probably taken within a few kilometers of where the remains were found. This seems likely because all portions of the skeleton—some that might have been transported long distances as well as many that probably were not transported long distances due to their low value as a source of food or tool material to prehistoric humans—are regularly represented when the sample exceeds a dozen or so specimens. Thus, we suspect the maps indicate well some of the places where elk were found during the last half of the Holocene.

Three sites have each produced over 90 bones and teeth of elk. Only one of these has been dated via radiocarbon analysis, but it is just across the Snake River from one of the other two. These two nearly contiguous sites—45WT39 (Yent 1976; see Figure 3a) and 45GA61 (Lyman, unpublished data)—seem to date to the same time period—the

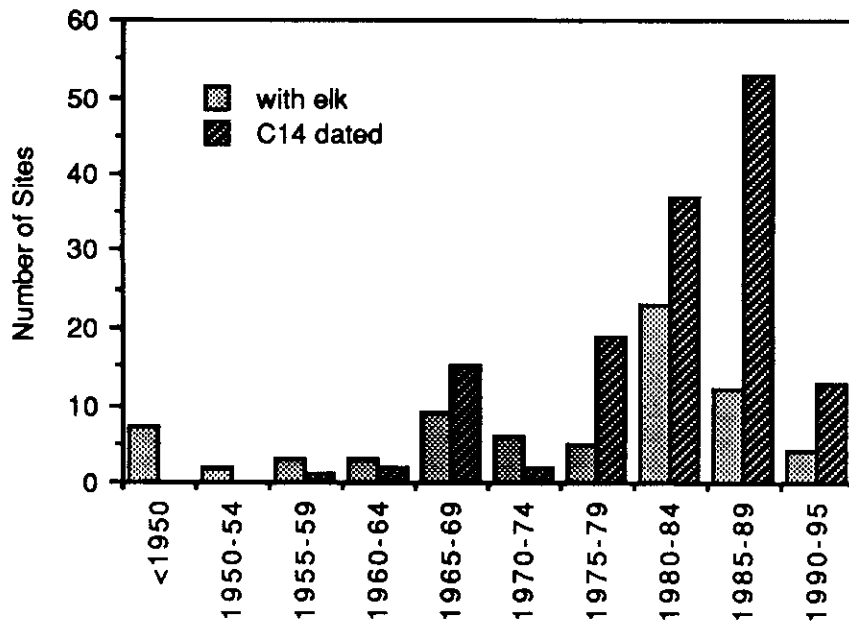


Figure 4. Frequency of sites producing elk remains and frequency of dated sites per five-year period.

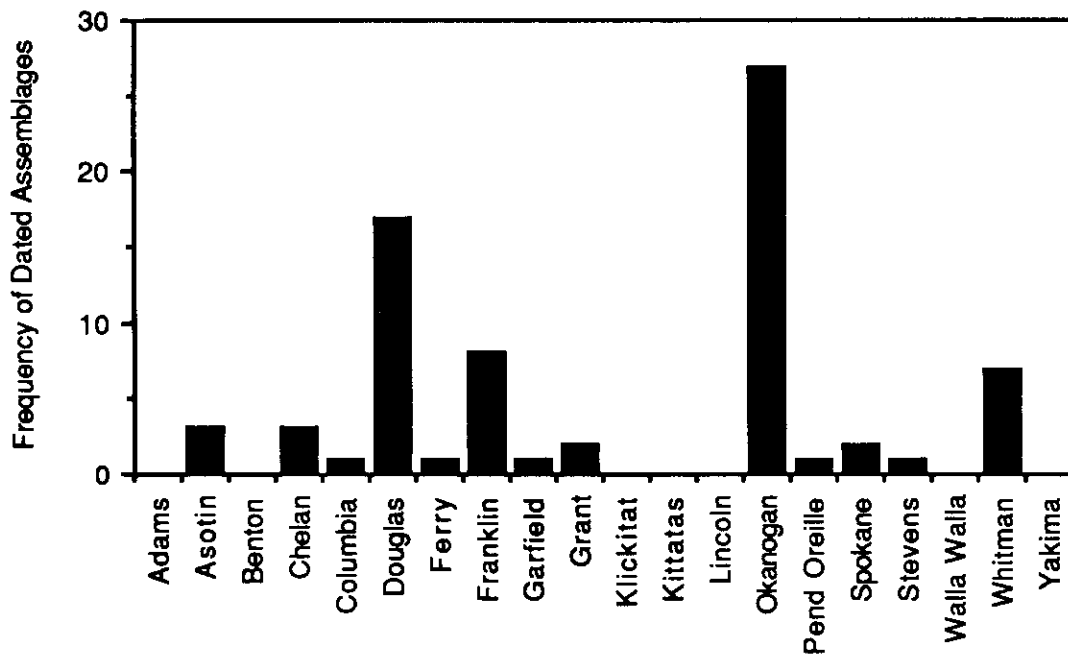


Figure 5. Frequency of dated assemblages producing elk remains per county.

last 1000 years—based on similarities of artifact styles. Together these two sites suggest that elk may have been abundant here relative to other areas of eastern Washington in the recent past—elk remains make up $\geq 28\%$ of the artiodactyl remains from these two sites, but tend to have lower relative abundances in most other assemblages we have examined. The other site with numerous elk remains is in Ferry County (Collier et al. 1942).

Discussion

Couch (1935:4) suggested that “it is not known if the Rocky Mountain wapiti (*C. e. nelsoni*) formerly inhabited any areas in eastern Oregon and Washington prior to [their] introduction [early in the twentieth century],” but he also went on to suggest “No doubt this species was originally in [eastern Washington but] with the arrival of man and subsequent settling of the country, the elk were practically exterminated in the Cascade region and the eastern portion of the two states.” We suspect Couch is referring to Euroamerican settlers of the nineteenth century rather than the late Pleistocene settlement of the area by Native Americans. Booth (1947:571) indicated that the Rocky Mountain elk “likely ranged formerly over most of the eastern part of [Washington] state,

but then was exterminated.” Murie (1951:20) stated that it “appears [that much of the arid portion of eastern Washington has] been unoccupied by elk.” Bryant and Maser (1982:57) noted that “controversy still exists as to [the elk’s] past occurrence on the east slope of the Cascade Mountains” of Washington.

While limited, the data we have compiled (Figure 3) indicate that it is probable that elk did occur on the eastern slope of the Cascades in the past. Further, these data suggest that elk were rather more widespread across eastern Washington prior to the nineteenth century than later. Did Euroamerican settlement result in the extirpation of eastern Washington elk populations? Perhaps (e.g., Edson 1930, 1931; Schullery 1984), but the introduction of horses and firearms to Native American groups in the eighteenth century may have initiated the extirpation process (Schalk 1980). In his review of historic data concerning the Mt. Rainier area just to the west of the southern half of our study area, Schullery (1984:23) found that early nineteenth century Euroamericans were surprised by the paucity of big game and “were inclined to attribute those low numbers to overhunting by tribes in the area.” A similar explanation for the rarity of big game in the Mt.

Baker area to the west of the northern half of our study area was offered by Brooks (1930) but was disputed by Edson (1930, 1931) who felt Euroamerican hunters were to blame. The potential impacts of Native American hunters on big game populations have become increasingly clear in the last decade, and their relevance to modern wildlife management issues are only now becoming understood (e.g., Kay 1994). The effect of such hunting on eastern Washington elk populations is presently unclear.

Taber et al. (1982:289) report that "transmission of disease from domestic livestock [applied] new pressures to elk populations." Kistner (1982) lists several bacterial diseases and some parasites have been transmitted from domestic livestock to elk. The impact of such exotic pressures on eastern Washington elk is probably irrelevant to determining late eighteenth century population sizes because it was not until the middle of the nineteenth century that the livestock industry began to flourish (Oliphant 1948). Exotic diseases introduced by Euroamericans may, however, have had an indirect impact on elk populations. As the Native American population became infected with European human diseases it decreased an estimated 30% by 1800, and 50% by 1830 (Boyd 1990). Resulting disruption to native cultures was significant; many traditional practices were discontinued (Dunnell 1991). One such discontinued practice was burning vegetation. "Broadcast burning by native peoples of the inland Pacific Northwest was widespread and persisted over an extended period primevally" (Shinn 1980:415). Given that elk seem to proliferate in recently burned areas (Peek 1982:859), discontinuation of Native burning in the earliest nineteenth century may have contributed to declines in elk populations. Thus, in order to identify the late prehistoric-early historic forces that controlled the size of the elk population, not only must zooarchaeological data become much more spatially representative of the area, it must become more tightly controlled chronologically as well if we are to begin to sort out the effects of Native American hunting from the impacts of Euroamerican settlement on resident populations of elk and other species.

Another factor that may eventually play a role in more effective management of elk in the area is the apparent differences in size of modern and prehistoric elk populations. Fryxell et al. (1968:514) noted nearly three decades ago that late-Pleistocene-aged elk remains recovered from

Marmes Rockshelter near the lower Snake River of southeastern Washington were "larger than those of living representatives in the area today," but no data have ever been presented to substantiate this observation despite more recent studies of the faunal remains from this site (e.g., Caulk 1988). Distal metapodial condyles of elk dating between 700 and 200 BP and recovered from the Meier site in the Portland Basin are (a) larger than most comparative specimens of Rocky Mountain elk (*C. e. nelsoni*); (b) overlap with but are generally larger than comparative specimens of elk killed by the 1980 eruption of Mount St. Helens (minimally, these elk are descendants of Rocky Mountain elk transplanted to the area early this century; they may be hybrid descendants of this transplanted gene pool and a native gene pool of unclear taxonomic affinity [Schullery 1984]); and (c) overlap in size with, but also have many individuals larger than, comparative specimens of Roosevelt elk (*C. e. roosevelti*; Figure 6). These and other data (Lyman, unpublished) from this and other sites in the Pacific Northwest suggest some late prehistoric elk populations in the area contained larger individuals than presently exist.

Late Pleistocene gigantism has been observed in other large mammals across the contiguous 48 states (e.g., Graham 1991; Harris and Mundel 1974; Hughes 1978; Wang and Neas 1987; Wilson 1978), but so far as we know has been reported for elk only in eastern Washington. Research on the closely related Norwegian red deer (there is some debate whether this cervid should be considered conspecific with North American elk; e.g., Schonewald 1994) indicates this animal tends to attain larger adult size in cool-dry climates than in warm-moist climates due to differences in the physiology of foraged plants (Langvatn and Albon 1986). Perhaps, then, habitat and climatic differences between the twentieth century, and times prior to the nineteenth century, produced larger elk prehistorically than historically. Such climatic differences may have placed elk resident to the Columbia Basin under selective pressure, contributing to their extirpation in some areas and their diminution in other areas. But this is conjectural because as yet we do not have sufficient, chronologically well-controlled morphometric data to map the history of late Quaternary elk diminution.

Prehistoric hunting pressure may have (a) resulted in prehistoric overkill, or (b) continually reduced intraspecific competition to the point that the elk found in the Columbia Basin and adjacent

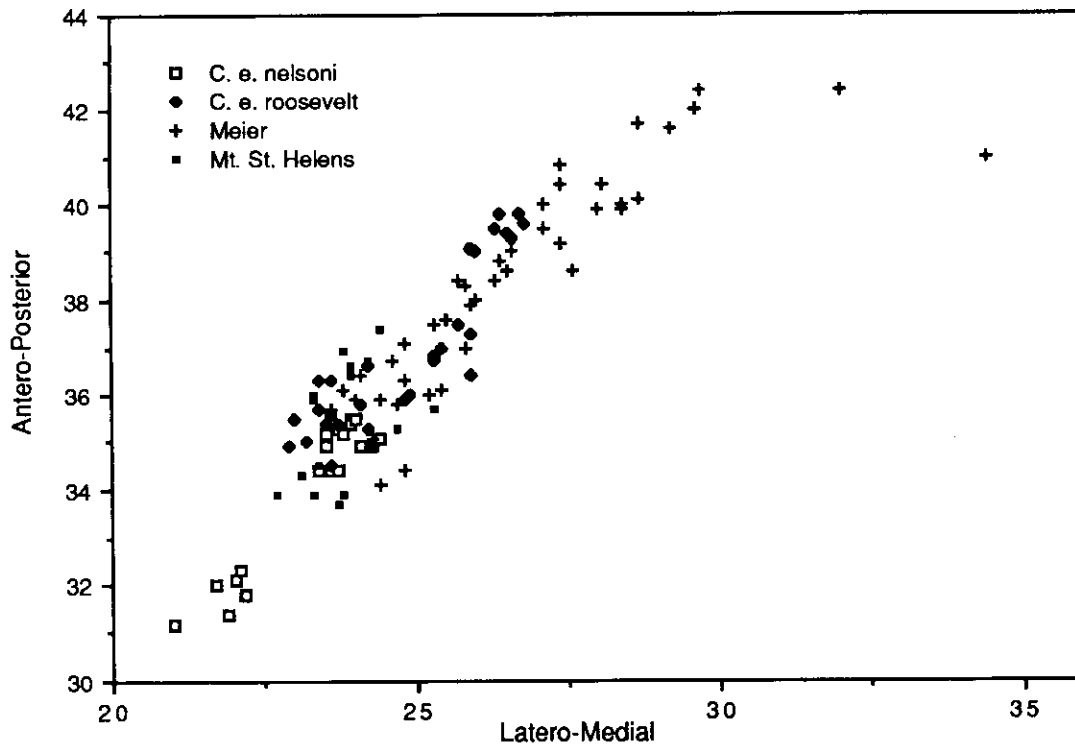


Figure 6. Latero-medial width (mm) plotted against antero-posterior breadth (mm) of elk distal metapodial condyles in three modern comparative samples and one archaeological (Meier) collection.

areas responded for extended periods of time much like a colonizing population. McCorquodale et al. (1989) found that elk historically colonizing the western portion of Benton County in Washington tend to have larger than average antlers and relatively high reproductive and survival rates. We suggest, therefore, that measures of prehistoric hunting pressure (e.g., Lyman 1987) in correspondence with morphometric analysis of tightly dated elk remains and modeling of past environmental systems (e.g., Whitlock 1992) may reveal much regarding not just the biogeographic history of elk in eastern Washington, but the ecological history of elk as well. Such analyses will allow evaluation of Couch's (1935) and Booth's (1947) hypothesis that Euroamerican settlement resulted in local extirpation, and may reveal why at least some prehistoric elk in the northwest were larger than their modern relatives.

Conclusions

A decade ago McCorquodale (1985) concluded that elk had been present prehistorically in the arid steppe habitats of the Columbia Basin of

eastern Washington. Subsequent research does not contradict this conclusion. Our data indicate that elk were rather consistently present there throughout the last half of the Holocene, and probably also during the first half of the Holocene. Available data do not, however, allow us to monitor changes in elk distribution because those data closely reflect the history of archaeological research in the area. Typical explanations for the absence of elk from the Columbia Basin suggest over-hunting by Euroamerican settlers resulted in local extirpation. A slowly growing body of data indicates, however, a combination of (a) technology introduced to Native Americans and (b) pre-nineteenth century climatic-induced stress may have initiated the extirpation process.

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