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The Communal Pronghorn Hunt: A Review of the Ethnographic and Archaeological Evidence

PATRICK M. LUBINSKI, Archaeological Services, Western Wyoming College, P.O. Box 428, Rock Springs, WY 82902-0428.

A review of the available archaeological, ethnographic, and historical data reveals that there is compelling evidence for communal pronghorn hunting across western North America in the protohistoric and early historic periods. The evidence is particularly compelling for the Great Basin, where corrals were in common use, as well as for the Great Plains, where drives into corrals or pits were common. Evidence for such activities in the remote past, including projectile point concentrations, hunting facilities, and bonebed sites, is considerably sparser and more ambiguous. Nonetheless, it appears that communal pronghorn hunting did not decrease through time, but rather was maintained or has increased within the last 1,500 years.

THE aboriginal communal pronghorn hunt of the last few centuries is well recorded in historical documents and ethnographies of the Great Basin and the Plains, but the nature of pronghorn hunting prior to contact is not well understood. Some have argued that the archaeological data indicate a decrease in communal hunting through time (Pendleton and Thomas 1983; Kelly 1997), while others see a maintenance or increase in communal hunting within the last 1,500 years (Arkush 1986, 1995; Frison 1991:241). Among the small-scale hunter-gatherers of the Basin and Plains, any significant change in the incidence of communal hunting might have "profoundly affected sharing and intragroup social relations" (Kelly 1997:29). Given the presence of contradictory assertions about the history, periodicity, seasonality, and other aspects of communal pronghorn hunting, a review of the documentary and archaeological evidence is in order.

THE PRONGHORN

Commonly called antelope in North America, biologists normally prefer to call this animal the pronghorn (*Antilocapra americana* Ord; Fig. 1). Today, pronghorn can be found over the western Great Plains and Intermountain West of North America. In the recent past, they probably were distributed into the central Plains and northern Mexico as well (Nelson 1925:Fig. 1). Like many species of large game, pronghorn numbers were drastically reduced with Euroamerican settlement of North America. Pronghorn populations began to recover with the onset of modern conservation and management, and by 1970 there were over 400,000 pronghorn in North America (Sundstrom et al. 1973).

Pronghorn are animals of the open plains, and have adapted to this condition with excellent eyesight, extraordinary speed, and a well-developed ability to broad jump. Pronghorn can see objects several kilometers away (Nowak and Paradiso 1983:1231). They can reach speeds of 60 or 70 miles per hour in short bursts, the fastest for a land animal in the western hemisphere (Whitaker 1980: 662; Wyoming Game and Fish Department 1992: 1). Fast runs of five to six km. (three to four mi.) are common, but exhaustion occurs rapidly (Nowak and Paradiso 1983:1231). They are accomplished broad jumpers, commonly completing leaps of 14 ft. (4.3 m.) at high speed, reaching up to 27 ft. (8.2 m.) or more (Wyoming Game and Fish Department 1966:30). However, they generally are poor at vertical jumping.

Fig. 1. Photograph of a pronghorn buck. (Photograph by Bart W. O'Gara.)

Pronghorn are social and form herds that vary in size throughout the year. Winter herds are the largest, containing all sex and age classes, and ranging from two animals to loosely associated herds of thousands of animals (Einarsen 1948; Mitchell 1980). As winter abates, pronghorn split into smaller, segregated herds; bachelor herds, female herds that regroup into nursery herds after birth, and solitary old males (Kitchen and O'Gara 1982). In Wyoming, the winter herd breakup may not take place until May in some years, and winter aggregation usually occurs after the rut at the first sign of winter (Creek 1967:5).

There may be a pronounced migration between

the summer and winter ranges, but some years there appears to be essentially no movement (Nelson 1925; Crump 1966; Kitchen and O'Gara 1982; Raper et al. 1989). There is historical evidence of large pronghorn migrations in the Dakotas in the early 1800s (Thwaites 1906b:215; Coues 1970: 171). In western Wyoming, radio-collared pronghorn have been recorded to move up to 150 air miles between summer and winter ranges, the farthest known seasonal pronghorn migration in North America (Christiansen 1993: 11). The migration routes in this area today appear to be highly regular and predictable (Raper et al. 1989).

Pronghorn Behavior and Hunting

Effective methods for hunting any game species are determined in large part by the habits of the prey (Frison 1987). For example, jackrabbits—which run when frightened—were hunted in communal drives in the Great Basin, but cottontail rabbits—which hide when frightened—were collected singly in snares or deadfalls (Thomas et al. 1986:268). Pronghorn have a number of characteristics that can be exploited by the hunter, particularly their reluctance to jump vertically, hazing characteristics, curiosity, predictable movements, and migration habits.

As pronghorn are poor vertical jumpers, in areas of the country where fences are relatively uncommon, they will rarely leap an encountered fence, preferring to search for an opening (Greenquist 1983:71; Frison 1991:240). Pronghorn also remember fences, and will not pass through a fence that they have learned about in the past, even if the fencing is removed and the posts remain (W. Hepworth, personal communication 1995). Although panicked pronghorn have cleared 8-ft. (2.4-m.) fences (Spillet et al. 1967) and will readily jump stock fences that have been in place for many years, all evidence suggests that pronghorn were extremely reluctant to jump vertically prior to the widespread introduction of modern fences. These characteristics suggest that it would have been relatively easy to keep pronghorn in an enclosure (unlike, for example, bighorn sheep). Modern pronghorn trapping operations (normally for transplantation) commonly involve a small fenced corral with long V-wing fences to funnel the animals into the corral (O'Gara and Yoakum 1992:Fig. 2). The modern corrals use high (8-ft.) fences, as pronghorn will begin to panic and jump once they pass from the open V-wings into the confined area of modern traps. Corrals that encompass large areas can avoid this problem by allowing animals to run in search of an escape rather than being forced to attempt jumping a fence.

Pronghorn have been hazed successfully by just a few people taking care not to approach too closely during Wyoming Game and Fish Department trapping operations (W. Hepworth, personal communication 1995). Once approached too closely, the animals bolt and the drive is a failure. Due to this behavior, a stampede-like drive for pronghorn is unlikely, at least until the animals are securely between trap walls.

Curiosity is another characteristic of pronghorn, and this is likely to have been exploited by hunters of the past. Pronghorn often come to investigate anything unusual in their territory that does not cause alarm by scent or sudden movement (Nowak and Paradiso 1983:1231). Although pronghorn can see great distances, they apparently lack visual acuity, and a motionless person only 10 to 15 meters away may be unnoticed (Kitchen 1974). Modern hunters have used small flags or ribbons to lure pronghorn within bow range (Schuh 1987). Pronghorn have also been observed to approach a human wearing a sheet, a person waving a colored cloth, a blanket draped over sagebrush, a tent, and even a crawling photographer (Thwaites 1906c:264; Nelson 1925:5; Greenquist 1983:21; Frison 1991). It would seem that such methods work only so long as a human is not recognized (Denig 1930:535).

The daily movements of pronghorn are also somewhat predictable. Many modern bowhunters have maintained that the most effective hunting method is to use a blind or stand by a water source (Cooney 1986; Schuh 1987) because pronghorn

will commonly come to drink several times daily when water is available (Cadieux 1986). A well-hidden ground blind also works well when placed at predictable travel locations, such as traditional fence crossings (Schuh 1987). One or two pronghorn can be stalked in broken country with good cover, but stalking generally is not effective for herds or on flat terrain (Schuh 1987). Decoy hunting also has some success when used during the rut. A buck decoy can draw a competing buck, and a doe decoy can draw a buck that is gathering a harem (Schuh 1987). Regular seasonal migrations of large numbers of pronghorn would present the opportunity for effective communal hunting, particularly if migration routes were predictable, as they appear to be in western Wyoming today (Raper et al. 1989).

ETHNOGRAPHY OF PRONGHORN HUNTING

Not surprisingly, there are ethnographic and ethnohistoric accounts of pronghorn hunting by aboriginal groups across most of the animal's range. Pronghorn were taken by a variety of methods, from single hunters using disguises to large-scale communal drives of many animals. Both encounter and intercept strategies (cf. Binford 1978) were used to hunt pronghorn. While encounter hunting might be productive, pronghorn behavior probably lends itself more profitably to a strategy of intercepting the animal in predictable locations, such as at watering holes or along migration routes. Most of the written records of pronghorn hunting describe intercept methods, often involving some constructed facilities, such as blinds, cairns, walls, and pits that sometimes leave archaeological traces.

Pronghorn may have been hunted for reasons other than food. Indeed, some records indicate that pronghorn meat was undesirable, at least compared to that of deer, bighorn sheep, and bison (Thwaites 1906a:298, 1906c:264; Fowler 1989:17). Turney-High (1937:119) noted that "the Flathead did not relish its musky meat. It was hunted only when hungry." However, pronghorn appear to have been desired for clothing (Irving 1837:214; Thwaites 1906a:298). Brumley (1984:109) noted that the "light hides of antelope were preferred by various tribes in the northern Plains for the manufacture of clothing items such as shirts, leggings and moccasins (cf. Masson 1889:279; Burpee 1910:67; Ewers 1955:170)."

Recorded methods of procuring pronghorn involve a variety of participants, from single hunters to large groups of cooperating men, women, and children. For the purpose of this discussion, a distinction is made between single hunter and small-scale cooperative hunting on the one hand, and larger scale communal hunting on the other (cf. Frison 1987). Although it is difficult to draw a clear distinction between these methods (as pronghorn hunting techniques form a continuum between these extremes), communal hunting implies a larger number of participants, greater degree of planning, and larger potential harvest than simple cooperative hunting.

Single Hunter and Small Group Methods

Pronghorn were hunted by a variety of single hunter and small group methods. In some cases these methods involved constructed facilities that could persist in the archaeological record. For example, pronghorn were driven past "ambushed" hunters hidden in brush or stone blinds (Drucker 1941:98; Stewart 1941:367; Steward 1943:294, 360; Smith 1974:55-56). Drive lines or V-wings might be constructed to help direct the game past the concealed hunter (Simpson 1869:52-53; Reagan 1934:54; Steward 1943: 360).

Communal Hunting Methods

Communal pronghorn hunting, as described in the ethnographic and historical literature, can be characterized by three major methods; drives, surrounds, and chases. For drives, the procedure generally was to drive the animals past waiting hunters or into a "catch" structure. Rarely, pronghorn might be driven into a river or over a cliff. In many cases, a series of "drive lines" was constructed to

guide the animals to the desired location. These might be composed of spaced people and/or cairns (piles of earth, buffalo chips, brush, or stones) or fences composed of stones, brush, logs, and/or living trees. Catch structures were highly variable, but usually consisted of V-shaped drive line wings leading into the entrance of a fenced enclosure or into a pit. The V-wings were often straight, but sometimes included a semicircular side (e.g., Hill 1938), perhaps for use as a "circling pen," or a bend near the trap (e.g., Wissler 1910:38) to help obscure it. In some cases, a shaman or antelope charmer would draw the animals into the trap (e.g., Fowler 1989:14-19).

A surround is a simpler method wherein the target animals were encircled at some distance and herded into a more concentrated group where they could be shot or clubbed. The surrounded animals were sometimes run in circles until they dropped from exhaustion (Egan 1917:240-241). The herding was accomplished by groups of noisy people with or without the aid of fire or horses (e.g., Grinnell 1962b:283-288). A third communal hunting method, the chase, consisted of running down and shooting pronghorn, often from horseback. While horseback chases were used extensively for bison on the Great Plains, they were rarely mentioned in the hunting of pronghorn.

Written records of communal pronghorn hunting are summarized in Appendix 1. Good summaries of written accounts for the Plains have been provided by Brumley (1984:111-120), and for the Great Basin by Arkush (1986) and Petersen and Stearns (1992:140-147; see also Anell's [1969] summary for all game in North America).

Although it is clear that communal pronghorn hunting did take place elsewhere, by far the most has been written about the Great Basin and Great Plains. In the Great Basin, pronghorn were hunted by a variety of methods, but drives into a corral are most commonly recorded. Perhaps the corral was indeed the preferred method, but it may have been widely reported simply because it was a late development that was still fresh in the minds of the Indian consultants (Arkush 1986: 243). In any event, it is discussed at some length here because it was so common and has the potential for leaving archaeological traces in the form of corral remnants.

Most corrals were constructed of juniper posts or logs and/or piled sagebrush, and measured from 18 in. to 10 ft. high, and 50 ft. to a mile or more in diameter (Fowler 1989:18; Steward 1941:219, 328, 1943:359). Sometimes, the corral was formed simply by placing a rope in a circle directly on the existing brush (Stewart 1941:422), or on widely spaced sagebrush piles (Steward 1943:359). In one account by Sarah Winnemucca Hopkins (1883:55-56), six widely spaced piles of sagebrush (with no rope) were used. Most corrals had one opening 15 ft. (Fowler 1989:16) to a half mile wide (Steward 1941:219). In many cases, the corral had V-shaped entrance wings and drive lines. One wing might be significantly longer than the other (Fowler 1989: 16), and the length of one or both wings might reach three miles (Steward 1941:328). Sometimes, the entrance wings might have one or several turns (Egan 1917:239). A "typical" Nevada Shoshone pronghorn corral with V-wings is shown in Figure 2.

The variety of methods used to drive or lure pronghorn into a corral might account for some of the variation in construction. For example, if pronghorn are to be trapped when they unwittingly wander into a corral, the corral needs to extend over a large area. One Shoshone corral used in this way enclosed 100 acres (Irving 1837: 51; see Appendix 1). A rather passive "drive," more akin to hazing, would require only widely spaced cairns or people in the V-wings, whereas a more aggressive drive would require more substantial facilities as pronghorn are likely to bolt or even jump when panicked. Thus the sturdier, taller corrals might well reflect a more aggressive style of pronghorn drive. Taller and more substantial corrals would also seem necessary for the small enclosures because the animals would easily be panicked, whereas a large enclosure would allow the animals to attempt escape by running within it (Greenquist 1983; W. Hepworth, personal communication 1995).

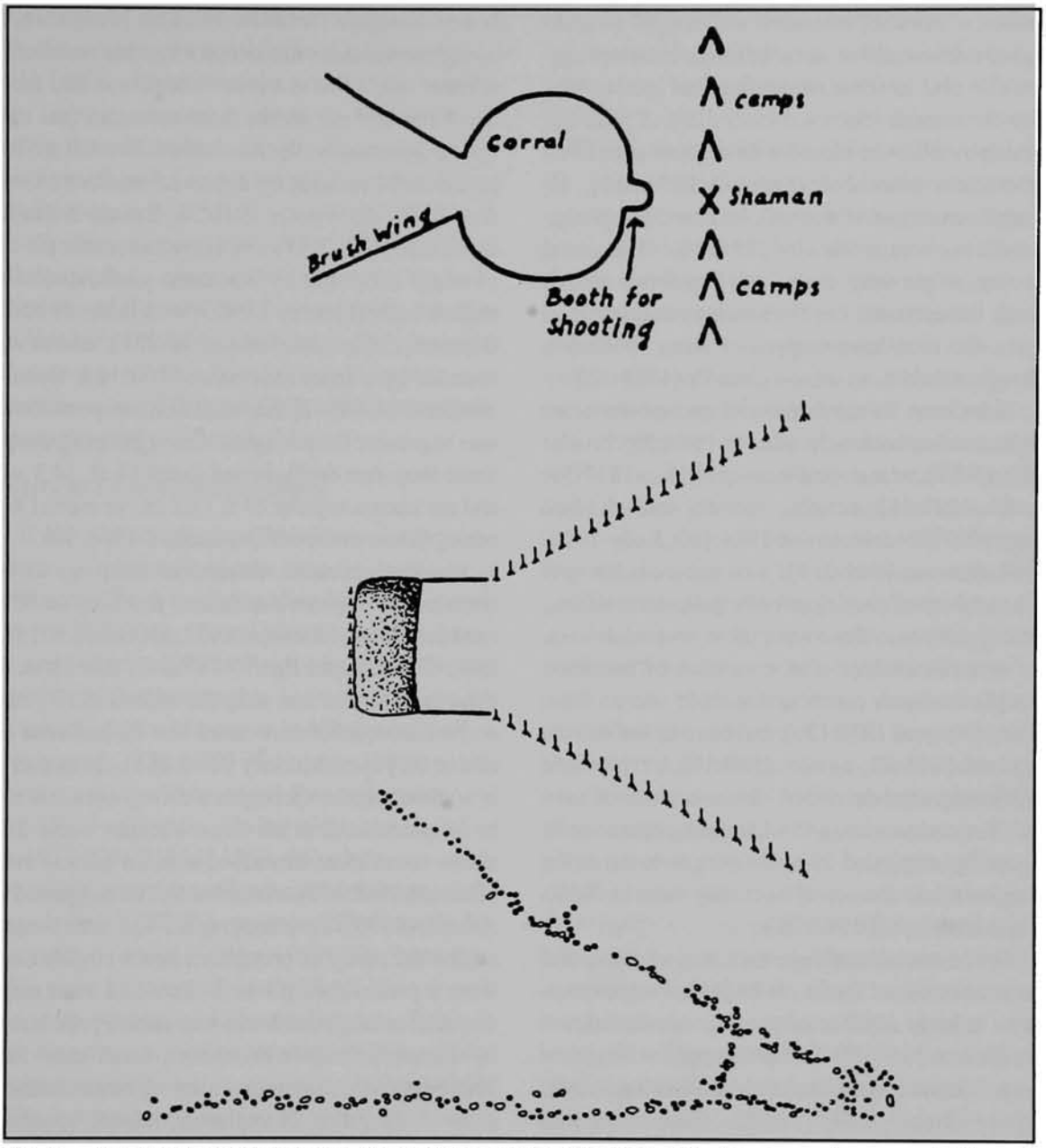

Fig. 2. Aboriginal pronghorn traps. Upper diagram is a Ruby Valley Shoshone pronghorn corral (Steward 1941:Fig. 1f). Middle diagram is a Cheyenne antelope pit with wings ca. A.D. 1855 (Grinnell 1962b:279). Lower diagram is the Laidlaw site trap ca. 3,280 B.P. (from Brumley 1984:Fig. 32).

The time needed to construct corrals is not described for the Great Basin, but one Hidatsa account noted that a corral was built in half a day (Thwaites 1906b:383), and a Navajo account reported that it took five days to build a stout corral (Hill 1938:149). Egan (1917:238) mentioned that it took the Deep Creek Gosiute "a few days" to refurbish an existing corral.

Differences in the style of pronghorn drive, as well as differences in the topography, the available

number of hunters, and other factors, all contributed to additional variation in Great Basin pronghorn corrals. In some cases, fire was used to help drive the animals (Steward 1941:220). The corral opening usually was closed with a brush gate when the animals entered it (Steward 1941:219), although sometimes it was left open and the pronghorn did not escape (Fowler 1989: 16). The corral opening might also have had flagstones placed across the entrance "so the antelope cannot smell where the men have stepped" (Henry Williams, Yerington Paiute, as cited in Fowler [1989:18]).

The Great Basin communal pronghorn drive might involve men only (Smith 1974:55; Fowler 1989:17-18), or men and women (Irving 1837:51; Fowler 1989:16), or men, women, and children (Egan 1917:239-240; Lowie 1924:305; Kelly 1932: 83-84; Steward 1941:219). Few accounts list specific numbers of participants for pedestrian drives, but it appears that there were often several drivers, one or more archers, and a number of butchers. Specific numbers mentioned include two to three drivers (Steward 1938:120), and eight to ten drivers (Steward 1938:82; Fowler 1989:18), but Steward (1938:163) also described "large crowds of people." For comparison, a 1981 trapping operation in Wyoming employed 20 to 30 people to drive the pronghorn into the corral once they were in the V-wings (Greenquist 1983:70).

The communal antelope hunt was an important event in the Great Basin. It might have drawn together a large number of people once or twice a year (Steward 1941:219). For example, a Northern Paiute informant stated that "15 or 20 camps came, maybe 100 men" (Kelly 1932:83). There often was a leader ("hunt boss") or a shaman.

On the Great Plains, there are accounts of horseback surrounds and chases, as well as pedestrian drives through V-wings into corrals, much like that in the Great Basin. However, some groups commonly drove pronghorn through V-wings into a pit, a method not recorded in the Great Basin. A sketch of an 1855 Cheyenne pit with V-wings is provided in Figure 2 (middle). These pits apparently were designed for taking multiple pronghorn, although no accounts mentioned a specific number, or whether only a few at a time were driven into the final wings and pit. In the three accounts that mentioned dimensions, the pits were 4.8 to 6.0 m. long by 2.0 to 2.4 m. wide by 2.4 to 4.0 m. deep (Snowden 1868:160; Wissler 1910:38; Stands in Timber and Liberty 1967:85). In many cases, the pit was partially disguised by branches, grass, and/or an earthen berm (Mooney 1898:309; Wissler 1910:38; Grinnell 1962a:236, 1962b:278-283), and/or surrounded by a fence (Snowden 1868:160; Grinnell 1962b:278-283). Either modification presumably was to prevent the pronghorn from jumping the pit, since they can easily broad jump 14 ft. (4.3 m.), and are known to jump 27 ft. (8.2 m.) or more (Wyoming Game and Fish Department 1966:30).

In some accounts, communal hunts so devastated local pronghorn populations that they could be used only rarely (Steward 1938:33; Shimkin 1947: 268). For example, Egan (1917:240) noted that the drive he observed was only the second in 12 years, and a Kiowa informant noted that he had seen but one in 60 years (Mooney 1898:288). However, it is unclear whether pronghorn drives were this rare in all places and at all times because some Shoshone consultants described it as an annual event (Steward 1938:175). Additionally, as suggested by Arkush (1995:12), ethnographic accounts that describe the rarity of pronghorn hunts largely come from a period during which there had been major impacts on ungulate herds and native populations by Euroamericans. Pronghorn herds may have been larger, and communal hunting more common, prior to the influx of explorers, miners, ranchers, and settlers in the nineteenth century.

ARCHAEOLOGY OF PRONGHORN HUNTING

There is no doubt that pronghorn were hunted in all areas of their modern range in prehistory, as amply demonstrated by the presence of pronghorn bones in archaeological sites. In the Wyoming Basin of southwest Wyoming, pronghorn remains oc-

cur in 67% of all radiocarbon dated assemblages with 10 or more genus level identified bones (Lubinski 1997). The method by which these animals were taken is, of course, unknown. While documentary records testify to the practice of mass procurement of pronghorn in many areas after Euroamerican contact, evidence prior to this time is more limited. In part, this is because it is difficult to demonstrate communal hunting in the archaeological record (Driver 1990; Hofman 1994; Shaffer and Gardner 1995). Archaeological evidence for communal pronghorn hunting might include concentrations of projectile points, extant hunting facilities, and pronghorn bonebed sites.

Projectile Point Concentrations

It has been suggested that particular concentrations of projectile points may be locations of communal kills, or point retooling locations associated with kills (e.g., Parr 1989; Hall 1990; Petersen and Stearns 1992). Point concentrations are consistent with ethnographic accounts that involve the use of bows and arrows to kill the animals in corrals (e.g., Egan 1917; Fowler 1989:16-18). However, it should be noted that pronghorn also were killed with clubs (Irving 1837:214-215; Lowie 1939:325; Riddell 1960: 56). In many cases, the animals were run until exhausted for easy clubbing (Irving 1837:51), or even killed simply by twisting their necks (Fowler 1989:17). Some projectile point concentrations that have been associated with communal kills are listed in Table 1. Such sites may, in fact, be communal kill locations, but the interpretation is hampered by inherent difficulties in establishing the target species or the contemporaneity of the points. There also is no obvious threshold point density above which a site might be considered a kill site.

Extant Hunting Facilities

Extant hunting facilities may provide less ambiguous evidence, although they clearly are limited by the preservation of organic construction materials, and may be difficult to link to a particular prey species. There is also the problem of distinguishing between aboriginal hunting facilities and other aboriginal or Euroamerican features (see Thomas 1988:336-339; Arkush 1995:13-14; Schwartz 1995). Documented archaeological features that may be associated with pronghorn hunting include fences/alignments, hunting blinds, pits, and enclosures. As described in the ethnographic review, enclosures and pit traps are most commonly associated with communal hunts, while isolated fences and blinds may better be associated with single hunters or small-scale cooperative hunts. For this reason, fences and blinds not part of a corral or pit-trap complex are not adequate evidence for communal hunting of pronghorn by themselves. Extant enclosures provide better evidence of communal hunting because they are well-documented during the historic period and their characteristics compare favorably with ethnographic descriptions.

Most of the extant enclosures (corrals) are in northeast Nevada or on the Nevada-California border (Fig. 3; Appendix 2). This distribution probably reflects more on the potential for preservation than original distribution, since the known corrals are all in remote areas not cleared for agriculture. Many are constructed with juniper, using vertical posts, end-to-end logs, and/or living trees (Murphy and Frampton 1986). Other enclosures, such as the Hendry's Creek or Mount Moriah trap (Rudy 1953), are composed primarily of stones, with remnants of juniper posts in protected locations (author's personal observation, 1994). Extant enclosures generally are from 150 to 600 m. in diameter. Most attempts to determine the age of these corrals by dendrochronology have failed (e.g., Polk 1987; Arkush 1995), but they clearly cannot be more than a few hundred years old. The stone enclosures could be considerably older, but, of course, it is difficult to date them.

A pronghorn corral might be associated with one or more butchery or short-term camps. Ethnographic accounts vary as to the location of such camps, with some sources placing them immediately adjacent to the corral (Steward 1941: Fig. 1f),

Table 1
SOME SURFACE SITES POSSIBLY REPRESENTING PRONGHORN KILLS[a]

Site	Location	Projectile Points		Area ($m.^2$)	Point Density (points/$m.^2$)	Reference
		N	Types			
Town Creek	NE NV	146	91 Gatecliff	1,134	1/8	Petersen and Stearns 1992
Clover Valley	NE NV	256	72 Humboldt 7 Elko 1 Gatecliff 5 Rosegate	14,137	1/55	Petersen and Stearns 1992
CR-11-8030	NE NV	149	55 Humboldt 45 Elko 1 Pinto 1 Rosegate	14,175	1/95	Hockett 1993
26MN705	SW NV	133	20 Humboldt 48 Humboldt/Elko 65 Elko	2,827	1/36	Hall 1990
26MN736	SW NV	179	2 Humboldt 6 Elko 1 Desert Side-notched	2,000	1/11	Parr 1989

[a] Points recovered below surface are excluded from table. Site area is calculated as an ellipse ($L*W*\pi/4$) if area is not provided in the original report.

and others placing them several miles away "so that the pronghorn would not smell the hunters" (Fowler 1989:17). In other words, a camp may not necessarily be found adjacent to a proposed pronghorn corral.

Extant pronghorn pits are rare and limited to the Great Plains. The only examples of which the author is aware are a pit in Belle Fourche, South Dakota, the Missouri Buttes trap in Wyoming, and the Laidlaw site in Alberta (see Appendix 2). The trap at Laidlaw consists of stone V-wings and a square enclosure about 7 m. long by 3 m. wide (Fig. 2, lower). Test excavations in 1983 revealed a silted-in pit with pronghorn and bison-sized bone (Brumley 1984), and produced a radiocarbon date of 3,280 RCYBP (Brumley 1986).

Of course, corrals and pit traps could be for other game besides pronghorn. Other possible big-game animals in pronghorn habitat might have included bighorn sheep, deer, bison, and elk. Bighorn sheep, deer, and bison are known to have been hunted communally, but there is some disagreement about elk (Grinnell 1962b:273, 276; Frison 1991: 261). However, pronghorn trap structures differ in several ways from the sort of trap needed for these other species, primarily because of differences in size and behavior between the species. As described above, the capture of pronghorn requires only a low fence or even a shaking rope or circle of people, as they are reluctant jumpers and climbers.

Capturing bighorn sheep, on the other hand, requires stout fences that cannot easily be jumped, because they are accomplished climbers and leapers. Although there are numerous ethnographic ref-

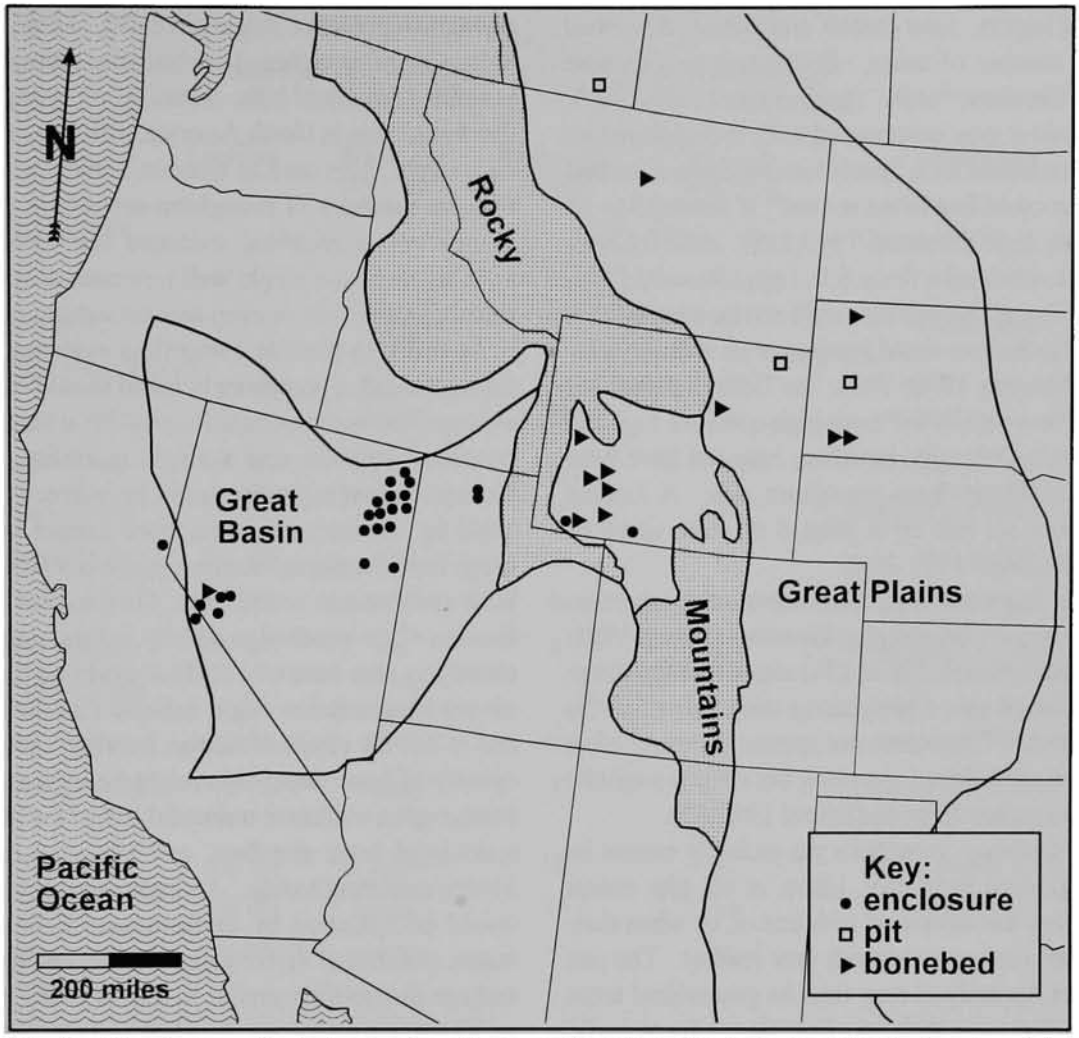

Fig. 3. Distribution of extant pronghorn traps and bonebed sites in western North America. The enclosures and pits are listed in Appendix 2 and the bonebed sites in Table 2.

erences to drives past hidden hunters, there are few descriptions of sheep traps, perhaps because they were considered ineffective (Steward 1941:220). A corral reported for the Egan Canyon Shoshone was a 100-ft. diameter enclosure of "mountain mahogany sticks sloping inward," with accompanying V-wings (Steward 1941:329).

Bison require fences that appear to be solid, although they may be made simply of willow or brush, as they may try to rush and break through any seemingly insubstantial wall that they can see through (Grinnell 1962a:231; Frison 1991). Blackfoot corrals were sometimes made with crisscrossed lodgepoles lashed together, filled with brush, and inclined slightly inward (Wissler 1910: 36), or with heavy logs about 8 ft. high (Grinnell 1962a:231). A corral might also be formed simply by "pitching the tipis closely in a circle and joining the covers" (Wissler 1910:38). Bison corrals often were built at the base of a small cliff, or on flat ground with V-wings leading to an earthen ramp before the pen (Wissler 1910:38; Grinnell 1962a:230-231).

The capture of deer requires tall fences that cannot easily be jumped, because they are accom-

plished leapers. Deer corrals and pits are described for a number of areas. For example, a Grouse Creek Shoshone "cedar" (juniper) post corral 30 ft. in diameter was constructed with V-wings and an entrance hurdle with "posts leaning inward, so that the deer could leap in but not out"; it yielded 5 to 15 deer per night (Steward 1943:359). An Elko Shoshone corral had a fence 8 ft. high (Steward 1941: 218). Pronghorn corrals might not be adequate for deer, "as the deer could jump over an ordinary corral" (Mooney 1898: 309). As Gifford (1940:85) noted, deer require an "extra high corral of logs and foliage." Deer pits, however, may not have been much different from pronghorn pits. A Eureka Shoshone pit was 20 ft. long, 5 ft. wide, and 8 ft. deep (Steward 1941:218).

Elk traps and communal hunts are rarely mentioned in the ethnographic literature (Frison 1991: 261), but Grinnell (1962b:276) stated that the Arapaho drove elk over a bank into an enclosure or pit "in old times." There does not appear to be any other mention of elk drives or corrals, but elk pits might be six to nine feet deep (cf. Gifford 1940:82).

In summary, pronghorn pits probably cannot be distinguished from deer, bison, or elk pits except when they are associated with fences, or when their location is inconsistent with prey habitat. The pits listed in Appendix 2 may thus be generalized traps not limited to pronghorn. Corrals are more easily distinguished as to target species, at least when they are well preserved. Deer and bighorn corrals should be taller, and bison corrals more solidly built than pronghorn corrals. Bison and elk are unlikely targets for most of the corrals in Appendix 2 because the habitat is inconsistent with the trap locations. Although one could argue that these corrals are too decayed to dismiss deer and bighorn as the target species, they are far more consistent with the habitat, behavior, and ethnographic records of pronghorn than of any other species.

Bonebed Sites

Pronghorn bonebed sites might provide good evidence for communal hunting if they can be shown to represent a single kill event. Table 2 provides a list of pronghorn bonebed sites representing possible communal kills, including all pronghorn-dominated sites in North America with five or more individuals. Sites such as those in Table 2 with significant numbers of pronghorn are not, in and of themselves, compelling evidence for communal kills, as such sites might well represent accumulations of smaller kills or even natural accumulations.

In order to provide compelling evidence for a communal kill, a pronghorn bonebed should ex hibit evidence for human-caused mortality, a single depositional episode, and a single mortality event. Human-caused mortality might be indirectly indicated by butchery evidence, bone impact marks, green bone fractures, burning, and associations of bone and features or artifacts. On the other hand, location of the bonebed in a likely natural death location (e.g., the base of a cliff) or evidence for carnivore accumulation might indicate that the bonebed is not the result of human hunting. A single episode of bone deposition might be indicated by stratigraphic evidence, unimodal bone weathering, articulated bone elements, and elevation-related bone weathering trends. A single mortality event would be indicated by uniform seasonality estimates, evidence of discrete age classes, and an animal age distribution similar to that of living herds.

There is no obvious threshold number of animals expected at a communal kill. Communal hunt yields from ethnographic accounts of drives into corrals range from 12 (Ray 1963:185-187) to 200 or more (Thwaites 1906c:264; Kelly 1932:85; Smith 1974:55-56), while yields from horseback communal hunts range from none (Thwaites 1904: 345-346) to three (Egan 1917: 241) to 500 or more (Bixby 1880:380; Grinnell 1962b:283-288; Kindig 1987). A communal hunt might result in any number of animals being taken, and a single pronghorn at an archaeological site could represent a communal kill. However, larger archaeofaunal assemblages provide better intuitive evidence for a communal kill and more adequate samples to evaluate the cause of mortality, weathering trends, seasonal-

Table 2
PRONGHORN BONEBED SITES IN NORTH AMERICA[a]

Site	Location	Mean Age (RCYBP)	Pronghorn MNI	% of site MNI total	Reference
GREAT BASIN					
Whisky Flat	W NV	none	8	Unk[b]	Yohe 1985
26MN715	W NV	1,750	21	62	Dansie 1990
ROCKY MOUNTAINS					
Trapper's Point	SW WY	5,587	27	54	Miller et al. 1999
Austin Wash	SW WY	1,187	15	60	Schroedl 1985
Firehole Basin	SW WY	628	26	84	Lubinski and Metcalf 1996
Eden Farson	SW WY	230	212	95	Frison 1971
Gailiun	SW WY	150	8	Unk	Current 1993; Lubinski 1997
Boar's Tusk	SW WY	100	6	Unk	Fisher 1981; Lubinski 1997
GREAT PLAINS					
Lost Terrace	N MT	1,061	41	92	Davis and Fisher 1988
Lightning Spring (Strata 8-14)	NW SD	4,038	8	57	Keyser and Davis 1984; Keyser and Wettstaed 1995
39FA23	SW SD	688	15[c]	52	Lippincott 1996
39FA83	SW SD	none	31	Unk	White 1952
48CA1391 (Component 2)	NE WY	2,760	5	50	McKibbin et al. 1988

[a] This table lists all known assemblages with pronghorn MNI ≥ 5, and pronghorn MNI ≥ 50% of total MNI. Fetal material has been excluded from pronghorn MNI as possible. Radiocarbon ages averaged with Long and Rippeteau's (1974) method.
[b] Unknown (could not be determined from reported data).
[c] Based on the 1985 excavations (Lippincott 1996); the 1948-1950 excavations produced 15 MNI mature and 6 MNI immature pronghorn (Wheeler 1996).

ity, and animal age distribution. Since large pronghorn bonebeds are rare (Table 2), five individuals might present a reasonable arbitrary value for initial consideration of an archaeological bonebed.

Few of the bonebeds listed in Table 2 have been examined in detail to determine if they represent communal kills. However, Lubinski (1997) evaluated five sites in southwest Wyoming. On the basis of evidence for human-caused mortality, single depositional episode, and single mortality event, Firehole Basin and Eden-Farson were accepted as mass kills while Austin Wash and Gailiun were rejected. The evidence at Boar's Tusk was considered equivocal (see Lubinski 1997).

OBSERVATIONS ON THE EVIDENCE

Across North America, there is abundant evidence for communal pronghorn hunting in the last

300 years or so from written accounts and standing juniper corrals, but what do the available data indicate about the prevalence of such activities in prehistory? At first glance, the various lines of evidence appear to offer contradictory conclusions. The projectile point concentrations, like rock wall sites in the Great Basin, tend to lack Late Prehistoric Period arrow points, suggesting a decrease in use of these facilities through time (Pendleton and Thomas 1983; Thomas 1988). On the other hand, the corral sites tend to include only late prehistoric/protohistoric features such as arrow points, steel axe cuts, or late radiocarbon ages, and three-quarters of the bonebed sites date within the last 1,200 years.

This dichotomy may not be as real as it appears, because the preponderance of Archaic projectile point types on the surface of some sites may simply reflect continuous hunting loss of projectile point styles utilized for different lengths of time. Using the Fort Sage Drift Fence (Pendleton and Thomas 1983) as an example, if a hunting facility came into use during Gatecliff times, then there may be 4,000 years (or more) for deposition of Gatecliff, Elko, and Rosegate series points but only 600 years for deposition of Desert series points (Table 3).

Even if use of a hunting facility was constant through time after 5,000 B.P., there would be far more of the earlier points simply because the earlier time span is more than six times longer. Even taking into account the age range for each point style, there is little evidence for a decrease in use with the introduction of Desert series points (Table 3). The lack of any Desert series points at other rock wall sites (e.g., Pendleton and Thomas 1983:Table 3) might present more compelling evidence for a shift in hunting strategies, but it might simply reflect the fact that points are lost or discarded somewhat rarely at such sites and the Desert series sampling period is so much shorter than the pre-Desert series sampling period. Naturally, a hunting facility might have been used over shorter intervals than implied by the maximum age range for point styles, but given the nature of projectile point cross-dating, it is difficult to support the argument for a decrease in use at about 1,500 B.P. at Fort Sage and many other similar sites.

Although the evidence for communal pronghorn hunting in the historic and protohistoric periods is abundant and convincing, the data indicating communal pronghorn hunting in the remote past is considerably sparser and more equivocal. None of the enclosure sites possess more than a handful of dart points. Many of the bonebed sites may as easily be palimpsests of small kills as single communal kills. The point concentrations may be hunting camps, retooling loci, or favorable ambush locales that were used repeatedly. Some rock wall and hunting blind sites undoubtedly date to the remote past, but probably represent single hunters or small cooperating groups rather than large cooperative ventures (see also Delacorte 1985).

Whether the preponderance of recent evidence reflects a change in the importance or frequency of communal hunts is, of course, questionable, since written accounts and standing juniper corrals cannot be very old. On the other hand, large pronghorn bonebed sites more than 10,000 years old could theoretically exist, yet to date there are few pronghorn-dominated faunal assemblages over 2,000 years old, only one of which (Trapper's Point) is thought to represent a communal kill (Miller and Francis 1993). In southwest Wyoming, none of 57 pronghorn-bearing faunal assemblages dating between 5,000 and 700 B.P. were found to be mass kills, while two of five such assemblages dating after 700 B.P. were found to be mass kills (Lubinski 1997). This seems to indicate a late increase in communal pronghorn hunting at the periphery of the Great Basin and Great Plains. In the Great Basin proper, a similar shift might have occurred as hunting from blinds and rock walls was replaced or supplemented with communal drives into enclosures.

It is reasonable to suggest that communal pronghorn hunting has a long history (Arkush 1986), but clearly it is more difficult to prove for the remote past than for the recent past due to inherent differ-

Table 3
POINT DEPOSITION AT TWO PRONGHORN-RELATED HUNTING COMPLEXES[a]

Point Style	Age Range	Span (in years)	Fort Sage		Box Spring	
			N	Deposition Rate	N	Deposition Rate
Desert series	A.D. 1300-1859	559	1	1/559	6	1/93
Rosegate series	A.D. 500-1300	800	2	1/400	4	1/200
Elko series	1,000 B.C.-A.D. 500	1,500	3	1/500	30	1/50
Gatecliff series	3,000-1,300 B.C.	1,700	3	1/567	6	1/283
Pre-Desert series	3,000 B.C.-A.D. 1300	4,300	8	1/538	40	1/108

[a] Age ranges are those given by Thomas (1983:Table 7; Pendleton and Thomas 1983). Fort Sage Drift Fence point distribution from Pendleton and Thomas (1983). Box Spring point distribution from Thomas (1988:Table 52). Deposition rate in points per year.

ences in the quality of the data available. It is possible that there was little or no change in pronghorn hunting tactics throughout prehistory. Many sites that appear superficially to be communal kill locations (particularly bonebed sites) have not been subjected to detailed investigations that might test this interpretation. Further faunal analyses of bonebed sites, the development of explicit criteria for distinguishing between fortuitous point concentrations and kill locations, and the dating of extant trap sites would provide us with more definitive information with which to address the antiquity of communal pronghorn hunting.

Traps and bonebed sites seem to have a nearly inverse distribution across western North America (Fig. 3). This may be because traps have remained only in areas with little land disturbance of the kind that has exposed bonebed sites. Presumably, there are as-yet undiscovered bonebed sites among the numerous standing corrals in northeast Nevada, for example. If this is not the case, one wonders why there is so much more faunal evidence in the Rockies and Plains than in the Great Basin.

CONCLUSION

There is compelling evidence for communal pronghorn hunting across western North America in the protohistoric and early historic periods, and intriguing if equivocal evidence for the prehistoric Basin and Plains. Although prehistoric pronghorn hunting facilities and bonebeds have been documented in increasing numbers in recent years, there are undoubtedly more of these facilities that have yet to be reported. Much more can be learned from extant hunting facilities like pronghorn corrals. In addition to the importance of discovering and documenting such perishable facilities before they are lost to fire, vandalism, or decay, excavations might allow us to determine if bonebeds are associated with them, and whether the present distribution of such traps accurately reflects a late phenomenon, or merely the surviving remnants of a long-term pattern.

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REFERENCES

Amme, Brian, and Patrick Lubinski
1994 IMACS site form for CRNV-04-7490 (Little Smoky Valley Antelope Wall) dated July 8, 1994. On file at the Bureau of Land Management, Ely, Nevada.

Anell, Bengt
1969 Running Down and Driving of Game in North America. Lund, Sweden: Studia Ethnographica Upsaliensia No. 30.

Arkush, Brooke S.
1986 Aboriginal Exploitation of Pronghorn in the Great Basin. Journal of Ethnobiology 6(2):239-255.

1995 The Archaeology of CA-MNO-2122: A Study of Pre-Contact and Post-Contact Lifeways Among the Mono Basin Paiute. University of California Anthropological Records 31.

Binford, Lewis R.
1978 Nunamiut Ethnoarchaeology. New York: Academic Press.

Bixby, A.
1880 History of Boulder County. In: History of Clear Creek and Boulder Valley, Colorado. Chicago: O. L. Baskin and Co.

Blissenbach, Tim
1977 BLM site form for CRNV-11-142 dated October 19, 1977. On file at the Bureau of Land Management, Elko, Nevada.

Brumley, John H.
1984 The Laidlaw Site: An Aboriginal Antelope Trap from Southeastern Alberta. In: Archaeology in Alberta 1983, David Burley, ed., pp. 96-127. Edmonton: Archaeological Survey of Alberta Occasional Papers No. 23.

1986 A Radiocarbon Date from the Laidlaw Site, D10u-7. In: Archaeology in Alberta 1985, John W. Ives, ed., pp. 205-206. Edmonton: Archaeological Survey of Alberta Occasional Papers No. 29.

Burpee, L. U. (ed.)
1910 Journal of Larocque from the Yellowstone to the Assiniboine 1805. Ottawa: Publication of the Canadian Archives No. 6.

Cadieux, Charles L.
1986 Pronghorn, North America's Unique Antelope: The Practical Guide for Hunters. Harrisburg, PA: Stackpole Books.

Christiansen, Tom
1993 Sublette Antelope Herd Unit Job Completion Report for 1992. In: Job Completion Report: District IV Annual Game Herd Unit Reports 1992. Cheyenne: Wyoming Game and Fish Department.

Cooney, Judd
1986 Bowhunting Pronghorns. In: Pronghorn, North America's Unique Antelope: The Practical Guide for Hunters, by Charles L. Cadieux, pp. 231-251. Harrisburg, PA: Stackpole Books.

Coues, Elliot (ed.)
1970 The History of the Lewis and Clark Expedition, Vol. I. New York: Dover. (Originally published in 1893 as "The History of the Expedition Under the Command of Lewis and Clark," by Frances P. Harper, New York.)

Creek, Darwin E.
1967 A Summary of Pronghorn Antelope Investigations. Cheyenne: Wyoming Game and Fish Commission.

Cremony, John C.
1868 Life Among the Apaches. San Francisco: A. Roman & Company. (Reprinted in 1983 by University of Nebraska Press, Lincoln.)

Crump, William
1966 Managing Wyoming's Pronghorns: Central Wyoming. Wyoming Wildlife 30(6): 20-23.

Current, William
1993 Archaeological Data Recovery Plan for the Gailiun Site (48SU1156), Sublette County, Wyoming. Report on file at the Bureau of Land Management, Rock Springs, Wyoming.

Curtis, Edward S.
1922 The North American Indian: Being a Series of Volumes Picturing and Describing the Indians of the United States, the Dominion of Canada, and Alaska (Vol. 12). New York: Johnson Reprint Company.

1924 The North American Indian: Being a Series of Volumes Picturing and De-

scribing the Indians of the United States, the Dominion of Canada, and Alaska (Vol. 13). New York: Johnson Reprint Company.

1926 The North American Indian: Being a Series of Volumes Picturing and Describing the Indians of the United States, the Dominion of Canada, and Alaska (Vol. 15). New York: Johnson Reprint Company.

Dansie, Amy
1990 Faunal Analysis. In: The OXBOW Archaeological Incident: Investigations at Twenty-three Locations Between Owens Valley, Eastern California, and Walker Basin, Southwestern Nevada, M. C. Hall, ed., Appendix C. Report on file at the Inyo National Forest, Bishop, California.

Davis, Leslie B., and John W. Fisher, Jr.
1988 Avonlea Predation on Wintering Plains Pronghorns. In: Avonlea Yesterday and Today: Archaeology and Prehistory, L. B. Davis, ed., pp. 101-118. Saskatoon: Saskatchewan Archaeological Survey.

Delacorte, Michael G.
1985 The George T. Hunting Complex, Deep Springs Valley, California. Journal of California and Great Basin Anthropology 7(2):225-239.

Denig, Edwin T.
1930 Indian Tribes of the Upper Missouri. In: Forty-Sixth Annual Report of the Bureau of American Ethnology, pp. 375-628. Washington: Government Printing Office.

1961 Five Indian Tribes of the Upper Missouri. Norman: University of Oklahoma Press.

Driver, Jonathan C.
1990 Meat in Due Season: The Timing of Communal Hunts. In: Hunters of the Recent Past, Leslie B. Davis and Brian O. K. Reeves, eds., pp. 11-33. London: Unwin Hyman.

Drucker, Philip
1941 Culture Element Distributions: XVII, Yuman-Piman. University of California Anthropological Records 6(3).

Egan, Howard R.
1917 Pioneering the West 1846 to 1878: Major Howard Egan's Diary. Salt Lake City: Skelton Publishing.

Einarsen, A. S.
1948 The Pronghorn Antelope and Its Management. Washington: Wildlife Management Institute.

Ewers, John C.
1955 The Horse in Blackfoot Indian Culture. Bureau of American Ethnology Bulletin 159.

Fisher, John W., Jr.
1981 Boar's Tusk: Pronghorn Utilization in Southwestern Wyoming. Paper presented at the Plains Anthropological Conference, Bismarck, North Dakota.

Fowler, Catherine S.
1989 Willard Z. Park's Ethnographic Notes on the Northern Paiute of Western Nevada, 1933-1944. University of Utah Anthropological Papers No. 114.

Frison, George C.
1971 Shoshonean Antelope Procurement in the Upper Green River Basin, Wyoming. Plains Anthropologist 16(54):258-284.

1987 Prehistoric, Plains-Mountain, Large-Mammal, Communal Hunting Strategies. In: The Evolution of Human Hunting, Matthew H. Nitecki and Doris V. Nitecki, eds., pp. 177-223. New York: Plenum Press.

1991 Prehistoric Hunters of the High Plains (2nd ed.). New York: Academic Press.

Gifford, Edward W.
1940 Culture Element Distributions: XII, Apache-Pueblo. University of California Anthropological Records 4(1).

Greenquist, Connie M.
1983 The American Pronghorn Antelope in Wyoming: A History of Human Influences and Management. Ph.D. dissertation, University of Oregon.

Grinnell, George Bird
1962a Blackfoot Lodge Tales: The Story of a Prairie People. Lincoln: University of Nebraska Press. (Originally published in 1893 by David Nutt, London.)

1962b The Cheyenne Indians: Their History and Way of Life (2 vols.). New York: Cooper Square. (Originally published in 1923 by Yale University Press, New Haven.)

Hall, M. C.
1990 The OXBOW Archaeological Incident:

Investigations at Twenty-three Locations Between Owens Valley, Eastern California, and Walker Basin, Southwestern Nevada. Report on file at the Inyo National Forest, Bishop, California.

Hill, W. W.
1938 The Agricultural and Hunting Methods of the Navajo Indians. Yale University Publications in Anthropology No. 18.

Hindley, Dixon
1985 IMACS site form for CRNV-11-3613 dated July 10, 1985. On file at the Bureau of Land Management, Elko, Nevada.

Hockett, Bryan S.
1993 IMACS site form for CRNV-11-8030 dated April 28, 1993. On file at the Bureau of Land Management, Elko, Nevada.

Hofman, Jack L.
1994 Paleoindian Aggregations on the Great Plains. Journal of Anthropological Archaeology 13(149):341-370.

Hopkins, Sara Winnemucca
1883 Life Among the Piutes: Their Wrongs and Claims. Boston: Cupples, Upham.

Hutchison, Daniel
1975 BLM site form for 48CK49/69 dated August 11, 1975. On file at the Wyoming State Historic Preservation Office, Cultural Records Office, Laramie.

Hyde, George E.
1974 Spotted Tail's Folk: A History of the Brulé Sioux. Norman: University of Oklahoma Press.

Irving, Washington
1837 The Rocky Mountains: Or, Scenes, Incidents, and Adventures in the Far West; Digested from the Journal of Captain B. L. E. Bonneville, of the Army of the United States, and Illustrated from Other Sources, Vol. II. Philadelphia: Carey, Lea & Blanchard.

Jaynes, S., and Tim Murphy
1980 BLM site form for CRNV-11-1561, dated August 27, 1980. On file at the Bureau of Land Management, Elko, Nevada.

Kelly, Isabel T.
1932 Ethnography of the Surprise Valley Paiute. University of California Publications in American Archaeology and Ethnology 31(3).
1964 Southern Paiute Ethnography. University of Utah Anthropological Papers No. 69.

Kelly, Robert L.
1997 Late Holocene Great Basin Prehistory. Journal of World Prehistory 11(1):1-49.

Keyser, James D., and Carl M. Davis
1984 Lightning Spring: 4,000 Years of Pine Parkland Prehistory. Archaeology in Montana 25(2 and 3):1-64.

Keyser, James D., and James R. Wettstaed
1995 Lightning Strikes Again: Excavation of Additional McKean Levels at the Lightning Spring Site, 39HN204. Archaeology in Montana 36(1):1-32.

Kindig, Jean M.
1987 An Evaluation of an Ethnohistoric Account of a Plains Indian Communal Hunt in the Boulder Valley, 1862. Southwest Lore 53(4):17-27.

Kitchen, David W.
1974 Social Behavior and Ecology of the Pronghorn. Ithaca: Wildlife Monographs No. 38.

Kitchen, David W., and Bart W. O'Gara
1982 Pronghorn. In: Wild Mammals of North America: Biology, Management, and Economics, J. A. Chapman, and G. A. Feldhamer, eds., pp. 960-971. Baltimore: Johns Hopkins University.

Kroeber, A.L.
1925 Handbook of the Indians of California. Bureau of American Ethnology Bulletin 78.

Lippincott, Kerry
1996 A Late Prehistoric Period Pronghorn Hunting Camp in the Southern Black Hills, South Dakota: Site 39FA23. Special Publication of the South Dakota Archaeological Society, No. 11.

Long, Austin, and Bruce Rippeteau
1974 Testing Contemporaneity and Averaging Radiocarbon Dates. American Antiquity 39(2):205-215.

Lowie, Robert H.
1924 Notes on Shoshonean Ethnography. American Museum of Natural History Anthropological Papers 20(3).

1939 Ethnographic Notes on the Washo. University of California Publications in American Archaeology and Ethnology 36(5).

Lubinski, Patrick M.
1997 Pronghorn Intensification in the Wyoming Basin: A Study of Mortality Patterns and Prehistoric Hunting Strategies. Ph.D. dissertation, University of Wisconsin, Madison.

Lubinski, Patrick M., and Michael D. Metcalf
1996 A New Look at the Firehole Basin Site in Southwestern Wyoming. Paper presented at the Plains Anthropological Conference, Iowa City.

Masson, Louis F. R.
1889 Les Bourgeois de la Compagnie du Nord-Ouest, Vol. 1. Quebec: De L'Imprimerie Generale A Cote et Cie.

McKibbin, Anne, Kevin D. Black, Ronald J. Rood, Margaret A. Van Ness, and Michael D. Metcalf
1988 Archaeological Excavations at 48CA-1391, Campbell County, Wyoming. Report on file at the Wyoming Cultural Records Office, Laramie.

Miller, Mark E., and Julie E. Francis
1993 They Aren't Just Foragers Anymore: New Perspectives on Early Archaic Adaptations in the Upper Green River Basin, Wyoming. Paper presented at the Rocky Mountain Anthropological Conference, Jackson, Wyoming.

Miller, Mark E., Paul H. Sanders, and Julie E. Francis (eds.)
1999 The Trapper's Point Site (48SU1006): Early Archaic Adaptations in the Upper Green River Basin, Wyoming. Laramie: Office of the Wyoming State Archaeologist, Cultural Resource Series No. 1.

Mitchell, George J.
1980 The Pronghorn Antelope in Alberta. Regina, Saskatchewan: George J. Mitchell.

Mooney, James
1898 Calendar History of the Kiowa Indians. In: Seventeenth Annual Report of the Bureau of American Ethnology, Part 1, pp. 131-445. Washington: Government Printing Office.

Murcray, Dirk
1993 An Assessment of the Newly Discovered Upper Powder Spring Sites: A Hunting Complex in Southwest Wyoming. The Wyoming Archaeologist 37(1-2):13-26.

Murphy, Robert F., and Yolanda Murphy
1960 Shoshone-Bannock Subsistence and Society. University of California Anthropological Records 16(7).

Murphy, Tim
1992 IMACS site form for CRNV-11-7914 (Thorpe Antelope Trap) dated October 13, 1992. On file at the Bureau of Land Management, Elko, Nevada.

Murphy, Timothy W., and Fred P. Frampton
1986 Aboriginal Antelope Traps on BLM Lands in the Elko Area, Northeastern Nevada. Paper presented at the Great Basin Anthropological Conference, Las Vegas.

Murphy, Tim, and Peggy Waski
1983 IMACS site form for CRNV-11-2773 dated August 4, 1983. On file at the Bureau of Land Management, Elko, Nevada.

Nelson, Edward W.
1925 Status of the Pronghorned Antelope, 1922-1924. United States Department of Agriculture Bulletin No. 1346. Washington: Government Printing Office.

Nowak, Ronald M., and John L. Paradiso
1983 Walker's Mammals of the World (4th ed.). Baltimore: Johns Hopkins University.

O'Gara, Bart W., and Jim D. Yoakum (eds.)
1992 Pronghorn Management. Rock Springs, WY: Pronghorn Antelope Workshop.

Parr, Robert E.
1989 Archaeological Investigation of the Huntoon Pronghorn Trap Complex, Mineral County, Nevada. Master's thesis, University of California, Riverside.

Parsons, Elsie C. (ed.)
1936 Hopi Journal of Alexander M. Stephen. Columbia University Contributions to Anthropology Vol. 23.

Pendleton, Lorann S. A., and David Hurst Thomas
1983 The Fort Sage Drift Fence, Washoe County, Nevada. American Museum of Natural History Anthropological Papers 58(2).

Petersen, Frederick F., and Steven M. Stearns
1992 Two Hunting-Related Archaic Sites in Elko County, Nevada. Sparks, NV: Falcon Hill Press.

Polk, Michael R.
1987 Mapping and Inventory of Seven Antelope Traps in Elko County, Nevada. Report on file at the Bureau of Land Management, Elko District Office, Elko, Nevada.

Raper, Elaine, Tom Christiansen, and Brad Petch
1989 Sublette Antelope Study: Final Report, November 1985-February 1989. Cheyenne: Wyoming Game and Fish Department.

Ray, Verne F.
1963 Primitive Pragmatists: The Modoc Indians of Northern California. Seattle: University of Washington Press.

Raymond, Anan
1982 Two Historic Aboriginal Game-Drive Enclosures in the Eastern Great Basin. Journal of California and Great Basin Anthropology 4(1):23-33.

Reagan, Albert B.
1934 The Gosiute (Goshute), or Shoshoni-Goship Indians of the Deep Creek Region in Western Utah. Proceedings of the Utah Academy of Sciences, Arts and Letters 11:43-54.

Riddell, Francis A.
1960 Honey Lake Paiute Ethnography. Nevada State Museum Anthropological Papers No. 4.

Rudy, Jack R.
1953 An Archaeological Survey of Western Utah. University of Utah Anthropological Papers No. 12.

Schroedl, Alan R. (comp.)
1985 Archaic and Late Prehistoric Adaptation in Southwest Wyoming: The Frontier Pipeline Excavations. Cheyenne: Wyoming Bureau of Land Management, Cultural Resource Series No. 3.

Schuh, Dwight
1987 Bowhunter's Encyclopedia. Harrisburg, PA: Stackpole Books.

Schwartz, Richard
1995 The Circle of Stones: An Investigation of the Circle of Stones in Stampede Valley, Sierra County, California. Salinas, CA: Coyote Press Technical Publications.

Schwartz, Warren E.
1988 The Last Contrary: The Story of Wesley Whiteman (Black Bear). Sioux Falls, SD: Augustana College.

Shaffer, Brian S., and Karen M. Gardner
1995 The Rabbit Drive Through Time: Analysis of the North American Ethnographic and Prehistoric Evidence. Utah Archaeology 8(1):13-25.

Shimkin, Demitri B.
1947 Wind River Shoshone Ethnogeography. University of California Anthropological Records 5(4).

Simpson, James H.
1869 The Shortest Route to California. Philadelphia: J. B. Lippincott.

Smith, Anne M.
1974 Ethnography of the Northern Utes. Museum of New Mexico, Santa Fe, Papers in Anthropology No. 17.

Snowden, J. Hudson
1868 Report of J. Hudson Snowden on Explorations from the Platte to the Head-Waters of the Shayenne, 1859. In: Report on the Exploration of the Yellowstone River, by William F. Raynolds, pp. 154-161. Washington: Government Printing Office.

Spillet, J. J., J. B. Low, and D. Sill
1967 Livestock Fences—How They Influence Pronghorn Antelope Movements. Logan, UT: Agricultural Research Station Bulletin No. 470.

Stands in Timber, John, and Margot Liberty
1967 Cheyenne Memories. New Haven: Yale University Press.

Steward, Julian H.
1938 Basin-Plateau Aboriginal Sociopolitical Groups. Bureau of American Ethnology Bulletin 120.
1941 Culture Element Distributions: XIII, Nevada Shoshoni. University of California Anthropological Records 4(2).
1943 Culture Element Distributions: XXIII, Northern and Gosiute Shoshoni. University of California Anthropological Records 8(3).

Stewart, Omer C.
1941 Culture Element Distributions: XIV, Northern Paiute. University of California Anthropological Records 4(3).
1942 Culture Element Distributions: XVIII, Ute-Southern Paiute. University of California Anthropological Records 6(4).

Sundstrom, Charles, William G. Hepworth, and Kenneth L. Diem
1973 Abundance, Distribution and Food Habits of the Pronghorn: A Partial Characterization of the Optimal Pronghorn Habitat. Cheyenne: Wyoming Game and Fish Commission Bulletin No. 12.

Thomas, David Hurst
1983 The Archaeology of Monitor Valley: 1, Epistemology. American Museum of Natural History Anthropological Papers 58(1).

1988 The Archaeology of Monitor Valley: 3, Survey and Additional Excavations. American Museum of Natural History Anthropological Papers 66(2).

Thomas, David Hurst, Lorann S. A. Pendleton, and Stephen C. Cappannari
1986 Western Shoshone. In: Handbook of North American Indians, Vol. 11, Great Basin, Warren L. d'Azevedo, ed., pp. 262-283. Washington: Smithsonian Institution.

Thwaites, Reuben G. (ed.)
1904 Original Journals of the Lewis and Clark Expedition, 1804-1806, Vol. 2. New York: Dodd, Mead & Co.

1906a Early Western Travels, 1748-1846, Volume 22: Part I of Maximilian, Prince of Wied's, Travels in the Interior of North America, 1832-1834. Cleveland: Arthur H. Clark.

1906b Early Western Travels, 1748-1846, Volume 23: Part II of Maximilian, Prince of Wied's, Travels in the Interior of North America, 1832-1834. Cleveland: Arthur H. Clark.

1906c Early Western Travels, 1748-1846, Volume 27: Part II of Flagg's The Far West, 1836-1837; and DeSmet's Letters and Sketches, 1841-1842. Cleveland: Arthur H. Clark.

Turney-High, Harry H.
1937 The Flathead Indians of Montana. Memoirs of the American Anthropological Association No. 48.

Voegelin, Erminie W.
1942 Culture Element Distributions: XX, Northeast California. University of California Anthropological Records 7(2).

Wheeler, Richard P.
1996 Archaeological Investigations in Three Reservoir Areas in South Dakota and Wyoming: Part 1, Angostura Reservoir. Lincoln, NE: J & L Reprints.

Whitaker, John O., Jr.
1980 The Audubon Society Field Guide to North American Mammals. New York: Alfred A. Knopf.

White, Theodore E.
1952 Observations on the Butchering Technique of Some Aboriginal Peoples: I. American Antiquity 17(4):337-338.

Wilke, Philip J.
1986 Aboriginal Game Drive Complexes At and Near Whisky Flat, Mineral County, Nevada. Paper presented at the Great Basin Anthropological Conference, Las Vegas.

Wissler, Clark
1910 Material Culture of the Blackfoot Indians. American Museum of Natural History Anthropological Papers 5(1).

Wyoming Game and Fish Department
1966 Naturalist's Nook. Wyoming Wildlife 30(6):30.

1992 Natural History and Management Information for Selected Wildlife Species in Wyoming. Cheyenne: Wyoming Game and Fish Department, Biological Services.

Yohe, Robert M., II
1985 An Analysis of the Vertebrate Remains from the Little Whisky Flat Antelope Drive Site, Western Nevada. Paper presented at the annual meetings of the Society for California Archaeology, San Diego.

APPENDIX 1
WRITTEN ACCOUNTS OF COMMUNAL PRONGHORN HUNTS

California Culture Area

Achomawi: Pronghorn sometimes surrounded or run down by men on snowshoes (Curtis 1924: 140).

Achomawi: Charmed, then driven into tule corral; women inside corral kill them, in spring near Alturas, California (Voegelin 1942:169).

Yokuts: Intertribal pedestrian surround, narrowing down from circle several miles in diameter, animals shot or exhausted (Kroeber 1925:528-529).

Plateau Culture Area

Klamath: Surrounds with a large net set on stakes in a wide, closed circle in the Klamath Marsh area, Oregon (Voegelin 1942:169).

Modoc: Pedestrian drive of up to 12 pronghorn through V-wings into corral (made of burning sage and women with circle of rope), near Tule Lake, California (Ray 1963:185-187).

Southwest Culture Area

Apache: Six to eight men drive into 300-ft. diameter juniper corral (one released for good luck); also horseback drive to waiting hunters (Gifford 1940:85).

Apache: Horseback surround involving 110 hunters (95 men and 15 women) yielded 87 pronghorn ca. 1863 near Ft. Sumner, New Mexico (Cremony 1868:203-204)

Hopi: Pedestrian relays exhausting animals inside surround (Curtis 1922:47).

Hopi: Story of former pedestrian drives into 600 x 300 ft. corral with 15 to 20 ft. opening and 800 to 1,000 yd. V-wings. (Although the enclosure is described as "a strong high stockade of tree boles and limbs, close, compact, and slightly overhanging inward, to prevent the antelope from jumping out" [Parsons 1936: 278], it also is called a "sheep house," which implies that the structure may be designed for sheep but used for pronghorn in this case.)

Navajo: Twelve men sufficed to drive pronghorn into brush corral, one released for good luck (Gifford 1940:85).

Navajo: Drive of 20 to 50 men on horse or foot into 300-ft. diameter corral of pinyon and cedar, with walls 10 to 12 ft. high, and V-wings (one possibly curved) 1,200 ft. to a mile long (Hill 1938:145-156).

Tiwa: Horseback chase involving 400 men from five pueblos, ca. 1896 in Estancia Valley, New Mexico (Curtis 1926:11).

Zuni: Up to 200 horsemen drive through two- to three-mile-long V-wings into corral and close rope/blanket gate (Gifford 1940:85).

Great Basin Culture Area

Gosiute: Pedestrian drive of 25 animals through winding V-wings into 250-ft. diameter corral; also horseback surround by 16 hunters, yielding three animals; both near Deep Creek, Utah (Egan 1917:238-241).

Northern Paiute: March drive into corral formed of brush and a shaking rope in Secret Valley, California (Riddell 1960:55-56).

Northern Paiute: Various pedestrian drives into corrals 150 ft. to one-quarter mile across, formed of sagebrush or brush and shaking rope, all directed by charmers; also run down on horseback; reported from Deep Creek, Honey Lake, Pyramid Lake, Walker River, and Yerington, Nevada (Fowler 1989:14-19).

Northern Paiute: Pyramid Lake, Nevada, informant describes pedestrian drive through sagebrush V-wings three to four feet high (set afire) into corral with sagebrush pile in center; animals run in circles until exhausted (Lowie 1924:304-305).

Northern Paiute: Horseback drive abandoned, then ambush of pronghorn by concealed hunters when the animals returned; also driven into corrals (Curtis 1926:73).

Northern Paiute: Winnemucca charmed antelope into a circle of six sagebrush piles; the pronghorn then ran about inside it as if there were a fence (Hopkins 1883:55-57).

Northern Paiute: Sagebrush or tule rope with suspended balls of sagebrush placed in circle on top of existing shrubs (Stewart 1941:422).

Northern Paiute: Accounts of driving pronghorn into a sagebrush pile corral or sagebrush rope circle by six Surprise Valley Paiutes (Kelly 1932:83-86).

Southern Paiute: Antelope surrounded, or driven past waiting hunters or into corral (Stewart 1942:241).

Southern Paiute: Pronghorn driven towards a straight 500-ft.-long sagebrush fence and shot as they passed through the single opening, or driven into a semicircular corral with V-wings,

or surrounded by 10 hunters under the direction of a chief (Kelly 1964:50).

Eastern Shoshone and Ute: Horseback drive and surround; pronghorn clubbed by men, women, and children, in Bear River Valley, winter 1834-1835 (Irving 1837:214-215).

Eastern Shoshone: Surround, then run down in relays on horseback during early Reservation Period; reported not to have built corrals (Murphy and Murphy 1960:308).

Northern Shoshone: Horseback chase of 10 antelope for two hours by 20 hunters (none killed), August 14, 1804, near present-day Bannock, Idaho (Thwaites 1904:345-346).

Northern Shoshone: Women constructed 100-acre sagebrush enclosure in spring, and await pronghorn. When pronghorn entered, men ran them in relays and exhausted them before clubbing, in southern Idaho (Irving 1837:51).

Northern Shoshone: Drive into corral of sage bark rope placed on sagebrush piles, reported from Mountain Home, Idaho (Steward 1943: 266-267).

Northern Shoshone: Drive into 18-in.-high sagebrush corral with additional poles supporting sage bark rope; also use of rattle to draw to waiting archers, reported from South Promontory, Utah (Steward 1943:359).

Western Shoshone: Various drives into corrals, usually directed by charmers. Informants from Battle Mountain, Eureka, Kawich, Reese River, and Ruby Valley, Nevada, describe 50 ft. to one-mile diameter corrals, with or without wings up to three miles long (Steward 1941: 219-221, 328-329).

Western Shoshone: Various drives into corrals, usually directed by charmers or shaman, and also horseback surrounds (Steward 1938).

Ute: Antelope surrounded, or driven past waiting hunters or into corral (Stewart 1942:241).

Ute: Men drove up to 200 animals through V-wings over low cliff into corral, or ran them down on horseback (Smith 1974:55-56).

Washoe: Antelope formerly driven through a chute into a sagebrush corral one acre in size and dispatched with arrows and clubs (Lowie 1939:325).

Plains Culture Area

Arapaho: Horseback surround of a variety of animals, ca. 1880 in present-day Boulder County, Colorado (Kindig 1987:23).

Arapaho: Abandoned pine log corral and attached pit, said to have been used ca. 1843 by the Arapaho, observed in 1851 in present-day Converse County, Wyoming (Snowden 1868:160).

Arapaho: Relays of ponies until over 500 exhausted pronghorn were taken in a hollow near Valmont in present-day Boulder County, Colorado, in the fall of 1860 (Bixby 1880:380, as cited in Kindig 1987).

Arikara: Prevented pronghorn from exiting river during fall migration across river, killing 58 with arrows and sticks, October 16, 1804, on Missouri River, south of Cannonball River in North Dakota (Coues 1893:170).

Assiniboin: Abandoned corral attributed to Assiniboin observed by Lewis and Clark, April 15, 1805, near present-day New Town, North Dakota (Coues 1893:274).

Brulé Sioux: Several hundred people drove several hundred antelope over cliffs into corrals in the White River Badlands (Denig 1961:18).

Brulé Sioux: Hinman party observed pronghorn bone in a brush corral at the base of a cliff, attributed to a Brulé Sioux horseback drive, near present-day Pine Ridge Reservation, South Dakota, in 1874 (Hyde 1974:21).

Blackfoot: Pedestrian drive through curved V-wings into partially covered pit 6 m. long by 2 m. wide by 3 to 4 m. deep on the Blackfoot Reservation, Montana (Wissler 1910:38).

Blackfoot: Pedestrian drive through V-wings into covered pits (Grinnell 1893:236).

Cheyenne: Pedestrian drive through V-wings into partially concealed pit, ca. 1855 (Grinnell 1923:278-283).

Cheyenne: Horseback drive of 600 or more pronghorn into human corral in 1858, with William Bent on Wild Horse Creek (Grinnell 1923:283-288).

Cheyenne: Pedestrian drive through human V-wings into 8 x 16 ft. pit, then killed with clubs, in present-day Belle Fourche, South Dakota, before 1850 (Stands in Timber and Liberty 1967:84-86; Schwartz 1988:67.)

Hidatsa and Mandan: Horse driven through one-to two-mile-long V-wings over a low cliff into small enclosure, then clubbed or taken alive (Thwaites 1906b:347).

Kiowa: Horseback and pedestrian surround, winter 1848-1849, near Bent's Fort on the Arkansas River, Colorado (Mooney 1898:287-289).

Kiowa: Drive through V-wings (built of posts set closely together and hung with blankets) into log post corral; also driven along game trail into a large pitfall covered with bushes and grass (Mooney 1898:309).

Mandan: Drive into corral with V-wings, yield of 100 pronghorn in two days, observed near present-day Washburn, North Dakota, on November 5, 1804 (Coues 1893:190).

APPENDIX 2
POSSIBLE PRONGHORN TRAPPING STRUCTURES

California

Stampede Valley: Lake Tahoe area, California; rock enclosure 65 ft. in diameter and 0.5 to 2.5 ft. high, with a 6 ft. entrance. Removed before reservoir flooded (Schwartz 1995).

Great Basin

42BO447: Utah; juniper enclosure about 300 m. in diameter, with V-wings (one 115 m. long), and no typeable points but steel axe cuts on wood (Raymond 1982).

42BO448: Utah; 170 x 140 m. juniper enclosure with 20-m.-long V-wings and steel axe cuts on wood, but no points (Raymond 1982).

Butte Valley: Northeast Nevada; U-shaped enclosure about 500 x 200 m. in size (Murphy and Frampton 1986).

Clover Valley: CRNV-11-3350 in northeast Nevada; U-shaped juniper enclosure about 380 x 320 m., some steel axe cuts (Murphy and Frampton 1986; Polk 1987).

Currie Hills: CRNV-11-3334 in northeast Nevada; 360 x 250 m. juniper enclosure with one 62 m. wing and one 785 m. circling wing, and some steel axe cuts (Murphy and Frampton 1986).

Cobre: CRNV-11-3335 in northeast Nevada; 330 x 300 m. juniper enclosure incorporating posts (some standing, some axe-cut) and living trees; 50 arrow points and four hearths on surface (Murphy and Frampton 1986; Polk 1987).

Dry Lake Flat North: CRNV-11-3337 in northeast Nevada; juniper enclosure about 400 x 300 m. in size (Murphy and Frampton 1986).

Dry Lake Flat South: CRNV-11-3338 in northeast Nevada; U-shaped juniper enclosure about 500 x 400 m. in size, incorporating a few living trees; some steel axe cuts (Murphy and Frampton 1986).

Five Mile Draw North: CRNV-11-3613 in northeast Nevada; juniper log and living tree enclosure about 400 x 300 m. in size (Hindley 1985; Murphy and Frampton 1986).

Five Mile Draw East: CRNV-11-3613 in northeast Nevada; juniper enclosure about 400 x 300 m. in size (Hindley 1985; Murphy and Frampton 1986).

Hendry's Creek: CRNV-04-04; 26WP13 in northeast Nevada; U-shaped enclosure about 180 x 160 m. in size formed largely of cobbles and boulders (Rudy 1953).

Little Smoky Valley: CRNV-04-7490 in northeast Nevada; U-shaped enclosure about 320 x 425 m. in size, constructed mostly of basalt cobbles and boulders (Amme and Lubinski 1994).

Maverick Range: CRNV-11-1561 in northeast Nevada; juniper enclosure about 500 x 500 m. in size with short V-wings (Jaynes and Murphy 1980; Murphy and Frampton 1986).

Mizpah: CRNV-11-8037 in northeast Nevada; juniper enclosure (B. Hockett, personal communication 1994).

Ruby Wash: CRNV-11-0142 in northeast Nevada; 400 x 200 m. enclosure formed by juniper logs (Blissenbach 1977; Murphy and Frampton 1986).

Thorpe: CRNV-11-7914 in northeast Nevada; U-shaped juniper enclosure about 620 x 280 m. in size (Murphy 1992).

Toano Draw: CRNV-11-3339 in northeast Nevada; enclosure about 350 x 300 m. in size (Murphy and Frampton 1986).

Tobar: CRNV-11-3336 in northeast Nevada; 430 x 360 m. juniper post enclosure with 100 m. V-wings, and some steel axe cuts (Murphy and Frampton 1986; Polk 1987).

Wendover: CRNV-11-2773 in northeast Nevada; stone and juniper enclosure about 275 x 275 m., with attached circling wall about 400 m. long and seven interior blinds; 52 points recovered on surface, mostly arrow point forms (Murphy and Waski 1983; Murphy and Frampton 1986).

Anchorite Pass: 26MN711 in Mono Lake area, Nevada; 300 x 300 m. enclosure of juniper, rocks, and living trees, with three Humboldt and one Rose Spring point recovered (Hall 1990:513-524).

Excelsior: Mono Lake Area, Nevada; 215 x 165 m. juniper, pinyon, and rock enclosure with ca. 400 m. long V-wings, flagstones across entrance; thought to be a deer trap (Wilke 1986).

Huntoon: 26MN589 in Mono Lake area, Nevada; 335 x 260 m. juniper and rock enclosure with 3,285 m. drift fence, and flagstones at the entrance (Parr 1989).

Whisky Flat: 26MN5 in Mono Lake area, Nevada; 345 x 260 m. juniper and rock enclosure with 1,046 m. drift fence, interior rock blinds, flagstones at the entrance; 79 Desert Side-notched and Cottonwood points recovered inside trap (Wilke 1986).

CA-MNO-2122, Trap 1: Mono Lake area, California; burnt juniper enclosure 230 x 200 m. in size, with parallel, sinuous entrance wings about one km. long; adjacent arrow points, historical debris, and feature dated 410 RCYBP (Arkush 1995).

CA-MNO-2122, Trap 2: Mono Lake area, California; burnt juniper enclosure 350 x 300 m. in size, with ca. 500 m. V-wings and 50 m. wide entrance associated with arrow points and dates from 560 to 490 RCYBP (Arkush 1995).

CA-MNO-2122, Trap 4: Mono Lake area, California; burnt juniper enclosure about 500 x 400 m. in size, with basalt flagstones across 60 m. entrance, and ca. 250 m. V-wings (Arkush 1995).

Rocky Mountains

Fort Bridger: 48UT1 in southwest Wyoming; juniper debris in 200 x 150 m. enclosure with 625 m. long "circling fence" (Frison 1991: 244).

Upper Powder Spring: 48SW9463 in southwest Wyoming; series of drift fence, wickiups, and rock art in a large (3,050 x 1,370 m.) juniper log and post enclosure with some steel axe cuts (Murcray 1993).

Great Plains

Laidlaw: D10u-9 in Alberta; 35-m .-long stone V-wings leading into 7 x 3 m. enclosure; test unit revealed pit with one pronghorn and probable bison (Brumley 1984); 3,280 RCYBP date on bone (Brumley 1986:205).

Belle Fourche: South Dakota; extant 16 x 8 ft. (4.9 x 2.4 m.) pit trap identified as a pronghorn trap by a Cheyenne shaman (Stands in Timber and Liberty 1967:84-86; Schwartz 1988:167).

Missouri Buttes: 48CK49/69 in Wyoming; a three-sided, log-lined 3 x 3 m. pit "appearing like an abandoned cellar" (Hutchison 1975) and attached juniper log V-wings (Frison 1991: 245).