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BISON PRESENCE AND ABSENCE IN COLORADO

by
WILLIAM B. BUTLER
National Park Service

Archeological data from some 150 sites led Tom Dillehay (1974) to propose that there were three periods when bison (*Bison bison*) were present on the Southern Plains, and two periods in which they were absent. Dillehay suggested that the reason for the presence or absence was related to climatic change that affected the bison's grassland food source. Thus, the presence or absence of bison at certain periods could be used, either directly or indirectly, to help with paleoenvironmental reconstruction and, concomitantly, with understanding human settlement and subsistence practices and cultural dynamics.

Since the publication of Dillehay's work (1974), the model has been criticized by Lynott (1979) with data from north-central Texas, Baugh (1986) from central and western Oklahoma, Creel et al. (1990) from central Texas, and Huebner (1992) from central and southern Texas. The ca. 150 sites used by Dillehay were primarily from the Southern Plains including Texas, eastern New Mexico, southern Oklahoma, and Louisiana.

The purpose of this paper is to provide information on bison presence or absence from archeological sites in eastern Colorado and western Nebraska—areas north and west of the Southern and Central Plains in what is generally recognized as the Western Plains Subarea as originally proposed by Wedel (1963:2) for western Kansas, eastern Colorado, and southeastern Wyoming and later expanded by J. Wood (1967:13-15) to include the foothills and mountains of central Colorado.

Tables 1, 2, and 3 summarize information on bison presence or absence from the present to 6000 years B.P.; only sites with associated radiocarbon or dendrochronological dates are included. These dates are uncorrected B.P. Only the earliest and latest date for each site are presented; i.e., not all available dates from a site are included. The reports on the sites listed also must have reported that a faunal analysis was undertaken. More information on the radiocarbon dates with laboratory numbers, etc., can be found in the associated references or Butler (1981, 1986).

Although the data presented on Tables 1-3 only include sites with radiocarbon or dendrochronological dates, there are many sites without such objective dates,

TABLE 1. Bison Presence or Absence in Dated Eastern Colorado Sites From 4500 to 1450/1500 B.P.: Dillehay's Bison Presence Period II.

| Site Name & Number | Date(s) Range B.P. | Cultural Affiliation | P/A | Reference |
|-------------------------|-------------------------|-----------------------------|-----|-----------------------------------|
| Cherry Gulch (5JF63) | 5730 ± 220 | Early Archaic ? | A | Nelson 1981 |
| Willow Creek (5DA259) | 4580 ± 65 4710 ± 70 | Non cultural assoc. | P | Gooding 1982 in Butler 1986:53 |
| Recon John 3 (5PE648) | 4400 ± 80 3680 ± 100 | Middle Archaic | A | Zier and Kalasz 1991 |
| Spring Gulch 4 (5LR252) | 2415 ± 85 3700 ± 105 | Middle Archaic | P | Kainer 1976 |
| Dipper Gap (5LO101) | 3180 ± 90 3520 ± 70 | Middle Archaic | P | Metcalf 1974 |
| Campion Hotel* (5LK221) | 2480 ± 130 | Late Archaic Butler 1986 | P | Buckles 1979 |
| Uhl Site Comp 5 (5WL32) | 1955 ± 95 2170 ± 160 | Late Archaic | P | J. Wood 1967 |
| Recon John 2 (5PE648) | 1870 ± 50 1910 ± 90 | Late Archaic | A | Zier and Kalasz 1991 |
| Michaud A (5AH2) | 1800 ± 110 | Woodland | P | J. Wood 1971 |
| Uhl Site Comp 4 (5WL32) | 1755 ± 95 | Woodland | P | J. Wood 1967 |
| Metate Cave (5LA211) | 1680 ± 95 | Woodland | P | Campbell 1969 |
| Belwood Site (5PE278) | 1500 ± 55 | Woodland | A | Hunt 1975 |
| Recon John 1 (5PE648) | 1500 ± 70 1150 ± 60 | Woodland | P | Zier and Kalasz 1991 |

*Campion Hotel is a high-altitude site ca. 9200 feet

but where bison are reported as being present. Table 4 includes many (but not all) of these cross-dated sites arranged by the major climatic episodes of Wendland (1978). Excluded on Table 4 are sites in the mountains. Caution should be used with the Table 4 data as it is selective and data from several cultural affiliations are vastly underrepresented, e.g., Sopris phase. Most of these data were derived from the site reports wherein a good deal of confidence could be placed on provenience information (see Butler 1986). Caution is also warranted in that it is difficult to determine in which climatic episode a site is to be assigned given the mean and standard deviation of a radiocarbon date or the approximating nature of cross dates.

DILLEHAY'S BISON PRESENCE PERIOD I

Presence Period I for the Southern Plains extends from ca. 12,000 to 7500-6500 B.P. (10,000 to 6000-5000 B.C.) and includes all Paleo-Indian and Late Paleo-Indian groups. Examples of Colorado sites falling into this time period where bison are present include Lindenmeier at ca. 11,000 B.P. (Wilmsen and

TABLE 2. Bison Presence or Absence in Dated Eastern Colorado Sites From 1450 to 750/650 B.P.: Dillehay's Bison Absence Period II.

| Site Name & Number | Date(s) Range B.P. | Cultural Affiliation | P/A | Reference |
|-------------------------|--------------------------|--------------------------|-----|--------------------|
| Biggs Comp 7 (5WL27) | 1400 ± 90 | Woodland | P | J. Wood 1967 |
| Owl Canyon (5LR104) | 1280 ± 80 930 ± 60 | Woodland | P | Burgess 1981 |
| Happy Hollow | 1270 ± 80 780 ± 90 | Up Repub & Woodland | P | Steege 1967 |
| Uhl Site Comp 2 (5WL32) | 1210 ± 220 | Woodland | P | J. Wood 1967 |
| Peavy Shelter (5LO1) | 1145 ± 155 810 ± 125 | Up Repub | P | J. Wood 1967 |
| TC:9:20 (5LA1416/B) | 1075 ± 15 1085 ± 31 | Initial Sopris | P | Wood and Bair 1980 |
| Spring Gulch 2 (5LR252) | 1075 ± 135 935 ± 140 | Woodland | P | Kainer 1976 |
| Senac Dam (5AH380) | 1070 ± 100 1620 ± 60 | Woodland 1988 | P | O'Neil et al. |
| Bayou Gulch (5DA265) | 950 ± 60 850 ± 50 | Woodland | P | see Butler 1986 |
| Ocean Vista (5PE868) | 940 ± 70 | Apishapa | P | Kalasz et al. 1992 |
| Avery Ranch (5PE56) | 940 ± 80 640 ± 100 | Apishapa | P | Zier et al. 1988 |
| Cramer (5PE484) | 830 ± 60 1100 ± 70 | Apishapa Hamblin 1989 | P | Gunnerson 1989, |
| Biggs Comp 5 (5WL27) | 735 ± 105 695 ± 110 | Late pre-historic | P | J. Wood 1967 |
| Kasper (5LO4) | 655 ± 250 or Woodland | Up Repub | A | J. Wood 1967 |

TABLE 3. Bison Presence or Absence in Dated Eastern Colorado Sites From 750/650 to 400 B.P.: Dillehay's Bison Presence Period III.

| Site Name & Number | Date(s) Range B.P. | Cultural Affiliation | P/A | Reference |
|----------------------|----------------------|--|-----|---------------------------|
| Site 5LO6 | 545 ± 60 | Late prehist | A | J. Wood 1967 |
| Ash Hollow Cave | 275-740 Dendro | Dismal River Upper Republican Woodland | P | Champe 1946 |
| Lovitt (25CH1) | 244 Dendro | Dismal River | P | Hill and Metcalf 1941 |
| White Cat (25HN37) | 227 Dendro | Dismal River | P | J. Gunnerson 1960 |
| Lykins Valley (5LV1) | 210 ± 95 250 ± 85 | Late prehist historic | P | Ohr, Kvamme & Morris 1979 |

TABLE 4. Bison Presence or Absence from Selected Dated and Undated Eastern Colorado Sites.

| Site & Comp No. | Cult Afil | Date B.P. | Bison P/A | Reference |
|--|-----------|---------------|-----------|-----------------------------|
| <i>Neo-Boreal Episode Sites: 100–400 B.P.</i> | | | | |
| LE 1 | DR | 210–275 de | P | J. Gunnerson 1960 |
| HY 1 | DR | 210–275? | P | J. Gunnerson 1960 |
| LY 1-3 | LP | 227–750 cx | A | Olson 1953 |
| LV 1-2 | LP | 230 ± 90 lr | P | Ohr, Kvamme & Morris 1979 |
| WC 1 | DR | 241 de | P | J. Gunnerson 1960 |
| LO 1 | DR | 244 de | P | Hill & Metcalf 1942 |
| <i>Pacific Episode Sites: 400–850 B.P.</i> | | | | |
| CT | AP | 550–700 cx | P | Hamblin 1989 |
| MN | AP | 550–700 cx | P | Hamblin 1989 |
| SB | AP | 550–750 cx | P | Hamblin 1989 |
| JB | AP | 550–750 rcs | P | Hamblin 1989 |
| TC 1 | AP | 550–650 cx | P | Simpson 1976 |
| UC | AP | 590 ± 110 r | A | Campbell 1969 |
| CR | AP | 600–700 rcs | P | Hamblin 1989 |
| AV 1 | AP | 640–940 rcs | P | Zier et al. 1988 |
| SM 1 | UR | 650–715 cx | P | W. Wood 1971 |
| BC 1 | UR | 650–850 cx | P | W. Wood 1971 |
| TC 2 | AP | 650–850 cx | P | Simpson 1976 |
| AG 1-4 | UR/W | 650–1200? cx | P | Irwin & Irwin 1957 |
| KA 1 | W | 655 ± 250 r | A | J. Wood 1967 |
| GC 1 | IM | 675 ± 75 r | A | Nelson & Graeber 1966, 1984 |
| BI 5 | UNK | 715 ± 76 r | P | J. Wood 1967 |
| SM 2 | UR | 715–790 cx | P | W. Wood 1971 |
| HP 1 | UR/W | 780–1270 r | P | Steege 1967 |
| SM 3 | UR | 790–815 cx | P | W. Wood 1971 |
| SG 1 | W | 800–908 cx | P | Kainer 1976 |
| UL 1 | W | 800–990 cx | P | J. Wood 1967 |
| HW 1 | W | 800–1250 cx | P | Nelson 1967 |
| HC 1 | W | 800–1500 cx | A | J. Wood 1967 |
| MB 1 | W | 800–1500 cx | A | J. Wood 1971 |
| CG 1 | W | 800–1850 cx | A | Nelson 1981 |
| PS | AP | 815 ± 25 | A | Campbell 1969 |
| MS 1 | AP | 819 ± 85 r | A | Campbell 1969 |
| BI 6 | W | 840–1310 cx | P | J. Wood 1967 |
| <i>Neo-Atlantic Episode Sites: 850–1260 B.P.</i> | | | | |
| TC 3-4 | W | 850–1850 cx | P | Simpson 1976 |
| BG 2-3 | W | 900 ± 55 r | P | Butler 1986 |
| CS 2 | W | 935–1075 cx | P | Morton 1954 |
| PV 1 | UR | 944 ± 97 lr | P | J. Wood 1967 |
| SG 2 | W | 1005 ± 97 lr | P | Kainer 1976 |
| HA 2 | W | 1010–1220 cx | P | J. Wood 1967 |
| OC 1 | W | 1037 ± 37 lr | P | Burgess 1981 |
| SE | W | 1070–1620 rcs | P | O'Neil et al 1988 |
| CS 3 | W | 1075–1210 cx | P | Morton 1954 |
| TR | SO | 1076 ± 12 lr | P | Wood and Bair 1980 |
| BG 5 | W | 1107–1285 cx | A | Butler 1986 |
| RJ 1 | W | 1150–1500 rcs | P | Zier and Kalasz 1991 |
| UL 2 | W | 1210 ± 220 r | P | J. Wood 1967 |
| HA 3 | W | 1220–1440 cx | A | J. Wood 1967 |
| <i>Scandic Episode Sites: 1260–1680 B.P.</i> | | | | |
| ME 1 | UR/W | ca. 1300? | P | J. Wood 1967 |
| BI 7 | W | 1400 ± 90 r | P | J. Wood 1967 |

TABLE 4. Bison Presence or Absence from Selected Dated and Undated Eastern Colorado Sites (Continued).

| Site & Comp No. | Cult Afil | Date B.P. | Bison P/A | Reference |
|---|-----------|----------------|-----------|--------------------------|
| <i>Scandic Episode Sites: 1260-1680 B.P. (Continued)</i> | | | | |
| HA 4 | W | 1440-1650 cx | P | J. Wood 1967 |
| UL 3 | W | 1440-1660 cx | P | J. Wood 1967 |
| TM 4 | W | 1450-1600 cx | P | Campbell 1969 |
| BE 1 | AP/W | 1500 ± 55 r | A | Hunt 1975 |
| MB 2 | W | 1500-1850 cx | A | J. Wood 1971 |
| SG 3 | W | 1563 ± 46 lr | P | Kainer 1976 |
| <i>Sub-Atlantic Episode Sites: 1680-2760 B.P.</i> | | | | |
| MC | W | 1680 ± 95 r | P | Campbell 1969 |
| UL 4 | W | 1775 ± 95 r | P | J. Wood 1967 |
| MA 1 | W | 1800 ± 110 r | P | J. Wood 1971 |
| CG 2 | A | 1850-3385 cx | A | Nelson 1981 |
| 40 1 | A | 1850-2170 cx | A | J. Wood 1967 |
| RJ 2 | LA | 1870-1910 rcs | A | Zier and Kalasz 1991 |
| MS 2 | LA | 1970 ± 100 | A | Campbell 1969 |
| OC 2 | A | 2200-5800 cx | A | Burgess 1981 |
| UL 5 | LA | 2010 ± 50 lr | P | J. Wood 1967 |
| 40 3 | A | 2215-5800 cx | P | J. Wood 1967 |
| <i>Sub-Boreal Episode Sites: 2760-5060 B.P.</i> | | | | |
| SG 4 | MA | 2788 ± 49 lr | P | Kainer 1976 |
| DG 4 | MA | 3391 ± 47 lr | P | Metcalf 1974 |
| CG 3 | A | 3460 ± 75 r | A | Nelson 1981 |
| RJ 3 | MA | 3680-4400 rcs | A | Zier and Kalasz 1991 |
| SG 5 | MA | 3700 ± 105 r | P | Kainer 1976 |
| BG 8 | A | 3940-5800 cx | P | Butler 1986 |
| <i>Atlantic Episode Sites: 5060-18490 B.P.; Boreal Episode Sites: 8490-9300 B.P.; Pre-Boreal Episode Sites: 9300-10,030 B.P.; Late-Glacial Episode Sites: 10,030 to 11,500 B.P.</i> | | | | |
| BG 9 | A | 5800-? cx | A | Butler 1986 |
| JS 1-3 | PI | 6450-9180 rcx | P | Wheat 1979 |
| CL 1 | PI | 8000-9000 cx | P | Stanford & Albanese 1975 |
| JM 1 | PI | 9000-10100 cx | P | Stanford 1974, 1975 |
| OH 1 | PI | 10150 ± 150 r | P | Wheat 1972 |
| LM 1 | PI | 10818 ± 127 lr | P | Wilmsen & Roberts 1978 |

*Bison from Paleo-Indian sites are *Bison antiquus* or *Bison occidentalis*.

TABLE 4 NOTES:

Site Codes: AV = Avery Ranch (5PE56); AG = Agate Bluff Sites 1-4 (5WL?); BC = Buick Campsite (5EL1); BE = Belwood (5PE278); BG = Bayou Gulch (5DA265); BI = Biggs (5WL27); CG = Cherry Gulch (5JF63); CH = Champion Hotel (5LK221); CL = Claypool (5WN?); CP = Cedar Point Village (5EL8); CR = Cramer (5PE484); CS = Cliff Swallow Cave (5EL?); CT = Canterbury (5PE387); DG = Dipper Gap (5LR101); GC = Graeber Cave (5JF8); HA = Hatch (5WL38); HC = Hackberry Canyon (5WL33); HP = Happy Hollow Rockshelter (5WL107); HW = Hall-Woodland Cave (5JF9); HY = Humphrey (5HO21); JB = Juan Baca (5LA1085); JM = Jones-Miller (5YMP?); KA = Kasper (5LO4); LE = Lowe (25LO7); LO = Lovitt (25CH1); LV = Lykins Valley (5LR263);

LY = Lyons Rockshelter (5BL?); L6 = Site 5LO6; MA = Michaud A (5AH2); MB = Michaud B (5AH3); MC = Metate Cave (5LA211); ME = McEndaffer Rockshelter (5WL31); MN = Munsell (5PE797); MS = Medina Rockshelter (5LA22); OC = Owl Canyon Rockshelter (5LR104); OH = Olsen-Chubbuck (5CH3); PS = Pyeatt Rockshelter (5LA550); PV = Peavy Rockshelter (5LO1); RJ = Recon John Rockshelter (5PE648); SB = Snake Blakeslee (5LA1247); SE = Senac Dam (5AH380); SG = Spring Gulch (5LR252); SM = Smiley Rockshelter (5EL9); TC = Trinchera Cave (5LA?); TM = Tecla Mogilewicz Cave (5LA815); TR = Trinidad Reservoir TC:9:20 (5LA1416/B); UC = Umbart Cave (5LA125); UL = Uhl (5WL32); WC = White Cat Village

Roberts 1978), Olsen-Chubbuck at $10,150 \pm 150$ B.P. (Wheat 1972), Jurgens at 9070 ± 90 B.P. (Wheat 1979), Lamb Springs at 8870 ± 350 and 7870 ± 240 B.P. (Stanford, Wedel, and Scott 1981), Jones-Miller ca. 9000-10,000 B.P. (Stanford 1974, 1975), Claypool ca. 8000-9000 B.P. (Stanford and Albanese 1975), and Jurgens at 6450-9180 B.P. (Wheat 1979).

DILLEHAY'S BISON ABSENCE PERIOD I

Absence Period I, ca. 7500-6500 to 4550 B.P., began in the Atlantic II episode and continued through Atlantic III and IV and some 500 years into the Sub-Boreal episode (Wendland 1978). Benedict (1979) proposed two Altithermal drought periods for the mountains and piedmont of Colorado at 7000-6500 and 6000-5500 B.P. during Atlantic III and IV times.

Atlantic I (ca. 8500-7700 B.P.) and II (ca. 7700-7100 B.P.) episodes were periods of warming and drying, with a maximum expansion of grasslands occurring by about 7000 B.P. (Hoffmann and Jones 1970:361; Wendland 1978:278-279). A peak in effective moisture (late winter/early spring precipitation) that would have had a favorable effect on vegetation occurred in the mountains at about 7250 B.P. (Benedict 1979:4-5).

Decreased winter/spring precipitation with a generally warm and dry climate marks the Atlantic III episode (ca. 7100-6000 B.P.). The earlier of Benedict's "two drought altithermals" occurring in the region began about 7000 B.P. and lasted until about 6500 B.P. His second and most severe drought occurred in early Atlantic IV times at about 6000-5500 B.P. (Benedict and Olson 1978; Benedict 1979).

A period of increased winter/spring precipitation occurred at about 6300 B.P., between the Early and Late Altithermal droughts (Benedict 1979:4-5). Benedict has proposed that the piedmont and plains effectively were abandoned by human groups during each of the two droughts and that populations shifted to more moist areas, i.e., the Colorado Front Range and higher mountains. The piedmont and plains were occupied in the periods before the onset of the Early Altithermal and again between the Early and Late Altithermals (Benedict 1979).

TABLE 4 NOTES (Continued)

(25HN37); 40 = Site 5WL40. A ? = site number not assigned. Not included are mixed sites with questionable cultural affiliations.

Cult Afil = Cultural Affiliation: AP = Apishapa; DR = Dismal River; LP = Late Prehistoric; W = Colorado Plains Woodland; A = Archaic General; MA = Middle Archaic; LA = Late Archaic; PI = Paleo-Indian; UR = Upper Republican; IM = Intermountain; UNK = Unknown Affiliation.

Dates: Dates are given as uncorrected B.P. Radiocarbon dates are cited in the relevant report—see also Butler (1981, 1986) for a list of dates. Single radiocarbon dates are indicated

with the lower case "r"; two or more radiocarbon dates from a component are indicated with a "rcs" and note the range; dates averaged by the technique of Long and Rippeateau (1974) are followed by an "lr"; "de" for dendrochronology; and cross-dates by "cx." The cross dates provided are derived from a compilation of: (1) cross-dating temporally sensitive artifacts (projectile points and ceramics dated elsewhere), (2) stratigraphic relationship to other components in the same site where radiocarbon dates are present, (3) geomorphological information—see Butler (1986) for complete information the dates presented.

A peak in increased effective moisture is recognized by Benedict (1979) to have occurred after the Late Altithermal drought at about 5200 B.P., accompanied by reoccupation of the previously droughted and abandoned areas. Benedict's argument for a more moist environment in the mountains is supported by his identification of the Ptarmigan Glacial Advance during the Early Altithermal. He notes, however, that there is very little evidence to support glacial activity elsewhere in North America at this time (Benedict 1981:116).

The Sub-Boreal episode is dated to between ca. 5060-2760 B.P. (Wendland 1978). The climate of the region during the early Sub-Boreal is poorly known. Markgraf and Scott (1981) suggest that the montane pine forests in Colorado began their upslope retreat shortly before 4000 B.P. The upward movement of the montane pine forest was associated with the establishment of sagebrush/pinon pine communities which indicate warmer temperatures and less moisture at high altitudes at this time.

Most dated sites in Colorado in the Absence Period I, ca. 7500-6500 to 4550 B.P., are in the high mountains where bone preservation is very poor. Although other animal remains were identified, no bison were recorded in any of the four cultural levels including the lowermost component of Cherry Gulch (5JF63) with a radiocarbon date of 5730 ± 220 B.P. (Nelson 1981). The dates of 4580 ± 65 and 4710 ± 70 B.P., although not in direct association with cultural remains, do date bison remains at the Middle Archaic Willow Creek site (5DA259) just south of Denver (Gooding 1982).

It is possible that sites will be found—especially along the mountain-plains juncture—to indicate occupation during the Altithermal. However, the data presented for the plains before, during, and after the Altithermal (Benedict and Olson 1973, 1978; Benedict 1979) are strongly suggestive of plains abandonment during the Altithermal. Given Benedict's data and analysis, and the present data (or lack thereof) we must conclude at this time that Dillehay's Bison Absence Period I is applicable for eastern Colorado.

DILLEHAY'S BISON PRESENCE PERIOD II

Presence Period II for the Southern Plains was proposed by Dillehay as occurring between 4500 to 1450 B.P. This period begins in the Sub-Boreal episode (ca. 5000-2760 B.P.) and extends into the Sub-Atlantic episode (ca. 2760 to 1680 B.P.).

As discussed above, the climate of the Sub-Boreal is poorly known. The upward movement of the montane pine forest was associated with the establishment of sagebrush/pinon pine communities, which indicate warmer temperatures and less moisture at high altitudes at about 4000 B.P. (Markgraf and Scott 1981) However, Hoffmann and Jones (1970), Markgraf and Scott (1981), Wendland (1978), and various authors in Caldwell et al. (1983), caution that whereas it might have been warmer and drier in certain areas of the Plains, other areas were apparently becoming wetter. The Late Triple Lakes glacial advance is suggested to have occurred near the end of the Sub-Boreal, between about 3300 and 3000 B.P. (Benedict 1981). It has also been suggested that cooler climate prevailed in the latter third of the Sub-Boreal (ca. 4500/3500 to 2760 B.P.) and the steppe retreated eastward across the Plains to its present position (Hoffmann and Jones 1970).

The climate of the plains during the Sub-Atlantic episode (ca. 2760 to 1680 B.P.) is thought to have been somewhat more moist than the preceding later third of the Sub-Boreal (Hoffmann and Jones 1970:361; Wendland 1978:281).

Bison Presence Period II for the Southern Plains was proposed by Dillehay as occurring between (4500 to 1450 B.P.). Table 1 notes that bison are present in nine objectively dated Plains sites: four Colorado Plains Woodland components at 1500 to 1800 B.P., two Late Archaic components dating 1955 and 2480 B.P., and two Middle Archaic at 3180/3520 and 2415/3700 years B.P. Of these nine sites/components, only three did not report bison in the faunal analysis. These data suggest that, like the Southern Plains, bison were present in the Western Plains at the same time.

DILLEHAY'S BISON ABSENCE PERIOD II

Table 2 presents dated Colorado sites occupied during Dillehay's Absence Period II—ca. 1450 to 750–650 B.P. This period begins in the Scandic episode (ca. 1680 to 1260 B.P.), extends through the Neo-Atlantic (ca. 1260 to 850 B.P.), to the end of the Pacific I episode (ca. 850 to 700 B.P.).

The Scandic episode has been characterized as a climatically transitional period, with a return to the warmer and drier conditions of the Neo-Atlantic (Hoffmann and Jones 1970:361; Wendland 1978).

The Pacific I episode is seen as a period of increasing dryness beginning about 850 B.P. and continuing through to the end of Pacific II times at about 400 B.P. (Hoffmann and Jones 1970; Wendland 1978:281). Baerreis and Bryson (1965) note that the Central Plains are dry during Pacific times whereas the Southern Plains experienced a period of increased moisture. A relatively high frequency of pine pollen from a site in northeastern Colorado suggests a period of decreased effective moisture at about 700 B.P. (J. Wood 1967:565)—i.e., near the end of Bison Absence Period II.

Although bison are reported as being absent (or at least present in very low numbers—see Creel et al. 1990; Huebner 1991) in the Southern Plains, bison are noted as being present in 12 of 13 components from eastern Colorado. Only the Kasper site, with a date of 655 ± 55 B.P., contained no bison. However, the Biggs site, in the same area as Kasper, does have bison present at a slightly earlier point in time, ca. 715 B.P.

Table 4 includes some 26 sites/components with bison present and nine absent during the Scandic, Neo-Atlantic, and Pacific I episodes, i.e., bison were present the Colorado Piedmont and High Plains during the Southern Plains Absence Period II.

Because bison were present on the High Plains and Colorado Piedmont during Dillehay's Southern Plains Absence Period II, this would seem to indicate that more moisture was available in the Colorado area to support the bison's grassland food resource. This agrees with Hoffmann and Jones (1970:361) and Wendland's (1978) warm and moist conditions of the Neo-Atlantic episode, ca. 1260 to 850 B.P.

DILLEHAY'S BISON PRESENCE PERIOD III

Dillehay's Bison Presence Period III covers the period from 750–650 to 400 B.P. This period is included in the later half of the increasingly dry Pacific episode, i.e., Pacific II at ca. 700 to 400 B.P. (Hoffmann and Jones 1970;

Wendland 1978:281). As noted above, a decrease in effective moisture was noted from pollen samples from a site in northeastern Colorado at about 700 B.P. (J. Wood 1967:565).

Tables 3 and 4 list 11 sites/components where faunal analyses were conducted for this period in eastern Colorado and western Nebraska and bison were present, and one where they were absent. Bison were present in north-central Texas (Lynott 1979), central and western Oklahoma (Baugh 1986), and in the Antelope Creek phase sites (Lintz 1986) in the Texas Panhandle at this time. However, Huebner (1991) notes that bison are not found in Austin phase sites (1250–750 B.P.) in central Texas—see below.

BISON FROM 400 B.P. TO THE PRESENT

The Neo-Boreal episode, ca. 400 to 100 B.P., exhibited a return to more moist and colder conditions (Hoffmann and Jones 1970:361; Wendland 1978:281), with the Arapahoe Peak glacial advance occurring in the Rockies (Benedict 1981:118). However, tree-ring evidence suggests that there were several periods of alternating decreasing/increasing moisture during this time on the Plains (Weakly 1943). From about 100 B.P. to the present, the Recent episode has also exhibited several periods of alternating wet and dry climates (Barry 1983; Hoffmann and Jones 1970; Wendland 1978).

From ethnohistorical sources, D. Gunnerson (1972) suggests that large herds of bison were present on the Plains from at least A.D. 1500 to late in the nineteenth century. She also notes that these large herds may have been responsible for the appearance of the Apacheans and some new traits in the protohistoric large village cultures in the Central Plains. New items added to the post-Upper Republican large village components include “elk antler tine scraper handles and bison metapodial fleshers (often serrated) [that] may well represent the adoption of heavier tools to do a heavier job” (D. Gunnerson 1972:1), i.e., more bison procurement and processing. Huebner (1991:350–351) also notes that Plains-like lithic tool assemblages appear after ca. 750 B.P. in the Toyah and Rockport sites suggesting a change in subsistence—i.e., a focus on bison such as noted by D. Gunnerson (1972) for the Central Plains. Although these data on Tables 3 and 4 are meager, the information presented supports D. Gunnerson’s conclusion that bison are present in the Plains from at least A.D. 1500 to the nineteenth century.

DISCUSSION OF BISON PRESENCE/ABSENCE

The information presented above suggests that Dillehay’s Bison Absence Period I appears to be valid for the Western Plains Subarea; this period is coincident with the Altithermal. This information also suggests that bison are present in archeological sites in Absence Period II (ca. 1450–750/650 B.P.) in Colorado.

In using data from north central Texas, Lynott (1979) “argued that bison were present during Absence Period II in thin scattered herds, with population density increasing during Presence Period III” (Huebner 1991:346). Likewise, data from central and western Oklahoma led Baugh (1986) to conclude that bison were also present in those areas during Absence Period II.

Huebner (1991:346–348) notes that in central and southern Texas, bison are not found in Austin phase sites (1250–750 B.P.—Prewitt 1981), but are

present in the Toyah phase horizons (ca. 750–350 B.P.—Black 1986), Dimmit-Zavala pattern sites (550–400 B.P.), and in the Rockport complex (950 B.P. to historic) on the Texas coast.

In discussion bison presence/absence in the Southern Plains, Huebner (1991:350) identifies a cultural bias that may directly influence studying bison distribution from the archeological record in Colorado or elsewhere:

The absence of bison during the Austin phase may not reflect their total absence on the landscape, but rather, their absence from the subsistence regime of these people. Interpretations of Austin phase subsistence indicate an emphasis on gathering and deer hunting (Prewitt 1981). Bison may not have been hunted during this time due to their low numbers, and the superabundance of deer in the region.

Lintz (1986:245) points out that bison availability is subject to their seasonal breeding pattern and long-term climatic patterns. Whereas very large herds numbering in the thousands may occur during the summer rut, small groups of about 20 or so animals may be dispersed over the landscape at other times (see also McHugh 1972 cited in Lintz 1986). We might expect that hunting strategies would vary according the bison's seasonal habits. Periods of rut would support larger human population aggregates, whereas small bands might be more appropriate for following bison at other times.

In sum, the work of Benedict and Olson (1973, 1978) and Benedict (1979) along with the little information on faunal remains summarized here from archeological sites in the study area, supports Dillehay's Bison Absence Period I (ca. 7500–6500 to 4550 B.P.) in Colorado. The studies of Baugh (1986), Lynott (1979), Huebner (1991), and this paper, all indicate that Dillehay's Bison Absence Period II (1450–750/650 B.P.) may only be valid for central Texas.

With the exception of Altithermal times (Bison Absence Period I), the information on Tables 1–4 indicates that bison were present in the Western Plains from Late Glacial times to the present. Although we may note that bison were present, the sample size, and the level of analytical detail reported, provides us with little or no information on the size of the bison herds available during seasons or at different periods in time. Huebner's (1991:351) terms of "High Visibility" and "Low Visibility" for bison in the archeological record may be more appropriate than presence or absence until better data are available.

Table 5 presents bison presence and absence summary information as organized by the major cultural affiliations currently recognized in eastern Colorado without regard to climatic episode. Whereas the sample size for most cultural units is not as large as we may have wanted, these data do provide some preliminary information on bison by cultural taxa. The percentages of bison presence or absence in Middle Archaic and Apishapa phase assemblages are similar: ca. 60% with bison and 40% without. Note that the percentages of bison in Middle Archaic assemblages are just the opposite of Late Archaic and Archaic sites of unknown affiliation: more bison use during the Middle Archaic. Some 75% of the Woodland sites/components contained bison, and all the known Upper Republican sites contained bison. As noted throughout this paper, the data used are biased toward the best documented sites where a faunal analysis was conducted, and not all known sites are included; more

TABLE 5. Bison Presence and Absence by Major Cultural Affiliation.

| Cultural Affiliation | Freq Present | Pct Present | Freq Absent | Pct Absent | Total Sites |
|----------------------|--------------|-------------|-------------|------------|-------------|
| Dismal River | 4 | 100 | | | 4 |
| Intermountain | | | 1 | 100 | 1 |
| Late Prehistoric | 1 | 50 | 1 | 50 | 2 |
| Apishapa | 7 | 64 | 4 | 36 | 11 |
| Upper Republican | 5 | 100 | | | 5 |
| Sopris | 1 | 100 | | | 1 |
| Woodland | 22 | 76 | 7 | 25 | 29 |
| Archaic General | 2 | 29 | 5 | 71 | 7 |
| Late Archaic | 1 | 33 | 2 | 66 | 3 |
| Middle Archaic | 3 | 60 | 2 | 40 | 5 |
| Paleo-Indian | 5 | 100 | | | 5 |

*Excluded are sites/components of unknown cultural affiliation and sites of equivocal affiliation.

and better data are needed. Given these cautions, these summary observations may be indicating important changes in subsistence emphasis (at least as far as bison are concerned) that merits further investigation.

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