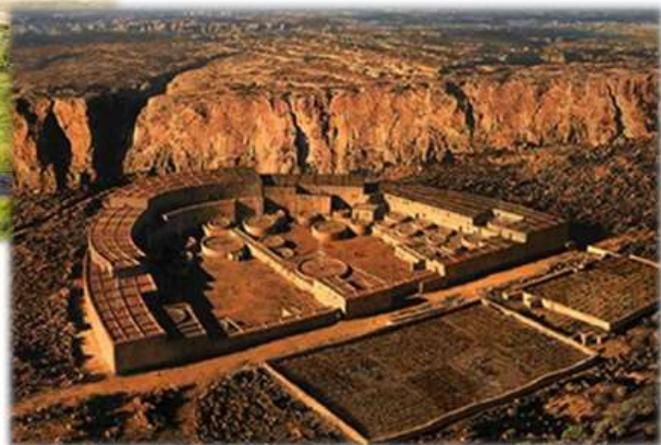


BISON, HIDES AND CHACO CANYON: A Southwest Trade Network?

*Historical Ecology of Bison and Human Movement Corridors, Western Cordillera, North America
Progress Report 2020-10-05*



Bison in San Luis Valley, Colorado (US NPS)



Chaco Canyon, New Mexico (US NPS)

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PREFACE

The builders of two of the most iconic cultural structures in North America placed these massive stone buildings in desolate lands at nearly opposite ends of the continent. Could these structures actually serve a common purpose related to complex societies and trade networks?



Pueblo Bonito, Chaco Canyon, New Mexico
(Bob Adams, New Mexico, Wikipedia)

Fort Prince of Wales, Churchill, Manitoba
(Parks Canada)

“No one really knows why this ancient site was built here or what the main purpose or function of the site was. The mystery and beauty of Chaco Canyon has enthralled visitors and researchers for many years. May it continue to do so.” An excerpt from a brief report of a field trip to Chaco by the School for Advanced Research in Santa Fe, and sent out to their constituency on “SAR November E-News” of November 1, 2016. From Footnote 59: Lekson, Stephen H. (2018). *A Study of Southwestern Archaeology* (p. 261). University of Utah Press. Kindle Edition.

“Built upon plans drawn by English military engineers to secure control of Hudson Bay for the Hudson's Bay Company and England. Construction commenced in 1733 and completed in 1771. Surrendered to and partially destroyed by a French naval force under La Pérouse in 1782. Its ruins are among the most interesting military remains on this continent.” Canada National Historic Sites Dedication Plaque on the stone wall outside main entrance to Fort Prince of Wales, Eskimo Point, Churchill, Manitoba.

ACKNOWLEDGEMENTS

To: Our Great Divide Trail Mountain Bike Crew for awesome companionship as we peddled our way from Banff to Mexico along the western edge of the buffalo's ancient range. There's no better way to see it.

To: Kelly Stoner, Cristina Mormorunni and other organizers of the 2019 American Bison Society (ABS) Meeting at Buffalo Thunder Casino and Hotel at Polanque Pueblo. What a wonderful event to share buffalo stories and bison research!

To: Karsten Heuer of Parks Canada, Bill Snow of the Stoney-Nakoda First Nation, and Marie-Eve Marchand of Bison Belong for inviting me to help them describe the Banff Bison Restoration Project to the great crowd of folks at the ABS conference. That invitation got me down to New Mexico, and stimulated the plan for the November road trip across Oklahoma, Texas, and the Southwest's four corner states.

Apologies To: The rental car folks at the Albuquerque Airport... next time be suspicious when someone shows up with a "Backroad Atlas" for each of 5 states, requests full insurance coverage and GPS, carefully checks out the condition of the tires, and measures how much sleeping and storage room is in the car. Anyways, the rental car, the car's computer (let's call her Edna), and I had an interesting 14 days and 8000 miles of dirt roads together. Unfortunately, Edna wasn't programmed for some of this—she was deeply concerned about anyone would keep wanting to spend nights in the car that was under her personal direction. Who could sleep though all the negative signals she was sending (flashing lights, periodic random use of the horn alarm)? Who would dare try to sleep in her car with the hatchback and all the windows open on a beautiful moonlit night overlooking a bison herd in Caprock State Park? Then there was the last straw. Who would want to take her car on a sketchy, snow-covered dirt track from the south-east into Chaco Canyon following the route of the 1849 US military expedition? Edna finally drew the line here. Well, actually she wouldn't draw the line here on her GPS map, so we didn't find the way along the maze of resource roads and truck trails on the Navajo lands.

Maybe I'll make it to Chaco Canyon some day, seems like an interesting place....

ABSTRACT

Human processing of animal hides is an ancient technology that provided a wide array of products useful for clothing, shelter, transportation, warfare, and ceremonies. In North America, numerous prehistoric and historic trade routes existed to move hides from areas of high supply (e.g., Great Plains bison herds) to areas of high human density and demand for hides, but with low supply (e.g., western salmon-bearing rivers, early agricultural zones in the southwest and along the Mississippi River). Many of these extant Native American hide trading routes were tapped by the Spanish, French, and British after ~AD 1500 to provide hides to the European market. In the southwest, for the prehistoric period ~AD 500 to ~1200, one of the strongest gradients between hide supply and demand lay between the southwestern edge of heavily used bison range, then on the central plains north of the Arkansas River near modern-day Denver, Colorado, and the Hohokam agricultural lands in the modern-day Phoenix basin of Arizona. It is likely that a hide trade route existed between these areas of supply and demand. If so, Chaco Canyon and its amazing array of engineered buildings and roads lay right along a “least cost route”, and are possibly linked with the movement and trade of hides. This paper uses comparative ethnology and historic literature on wildlife abundance, hide hunting, and trade networks to describe how Chaco Canyon could have functioned as an exchange center along the route until ~AD 1150. It describes some potential causes for the collapse of this potential network, and how southwest trade routes were then re-established further southwards after the expansion of bison herds onto the southern plains after ~AD 1350. These new trading routes and exchange systems were documented by the Spanish in the period after AD 1534.

FOREWORD

This is a working progress report that will hopefully go through periodic revisions. It is tied to a larger project looking at the ecological and cultural processes influencing the long-term western edge of bison range along the Western Cordillera from the boreal forest in the north to the Texas plains in the south. A progress report on this previous work is available here:

<https://lensoftimenorthwest.com/themes/lens-northwest-files/bison-movement-corridors-report/>

The next time I get back to this report on the “Chaco hide trade hypothesis” will likely be sometime in 2021, so if you are referencing it, just cite the version date, and periodically check the Lens of Time website for an update. Many thanks for comments, and hopefully testing of the “Chaco hide trade hypothesis” will move on to researchers more intimate with the Southwest’s fascinating ecology, history, archaeology, and traditional native knowledge.

Cliff

Contents

PREFACE	2
ACKNOWLEDGEMENTS	3
ABSTRACT	4
FOREWORD	4
1. INTRODUCTION	8
1.1 The Edge of the Buffalo’s “Home on the Range”	8
1.2 The Varying Range of the Southern Plains Bison: A Classic “Who Dunit”	9
1.3 The Enigma of Chaco Canyon.....	11
1.4 Chaco as a Potential Hide Trading Center.....	13
1.5 Hides, Women, and Captives	14
1.6 Bison, Hides and Chaco: Paper Purpose and Overview	15
2. ANIMAL HIDES TO FINE LEATHER: A PRIMER.....	16
2.1 Hunting, Hides and Human Global Dispersion.....	16
2.2 Hunting and Gathering Cultures	17
2.2.1 Hunting and Gathering Expertise.....	17
2.2.2 Mobility and Transport	19
2.2.3 Communal Organization	19
2.3 From Skins to High Art: Basic to Complex Hide Processing	19
2.3.1 Basic Hide Processing.....	20
2.3.2 Crafting Complex Hide Products	21
3. “ROADS TO THE BUFFALO”: HISTORICAL HIDE TRADING NETWORKS.....	26
3.1. The Pueblos and Southern Plains (AD 1300s to 1800s)	27
3.2 Southern Rockies, Abiquiu and the Old Spanish Trails (AD 1600s to 1800s).....	28
3.3. Arkansas and Platte Rivers to the Rockies (1100s to 1800s)	29
3.4 Heart and Knife Rivers’ Villages to the Rockies (prehistoric to 1800s).....	31
3.5 South Pass and the Shoshone Rendezvous (1600s to 1840s).....	34
3.6 Columbia River to the Rockies and Plains (Before 1600 to 1870)	35
3.7 The Northern Fur Trade: Atlantic to Arctic and Pacific Oceans (1500s to 1900s)	37
3.8 Carreteras and Red River Carts: The Last Biologically-Powered Trade Routes.....	39
3.9 Summary of North American Historical Hide Trade Networks.....	40
4. HIDE DEMAND: HUMAN DENSITY IN SOUTHWEST AND ADJACENT REGIONS	42
4.1 The Southwest	43

4.2 Southern Plains and Texas	44
4.3 Central Plains	45
4.4 Rocky Mountains and Interior Basin	46
5. HIDE SUPPLY: WILDLIFE ABUNDANCE IN SOUTHWEST AND ADJACENT REGIONS	47
5.1 Central Plains	49
5.2 Southern Plains and Texas	50
5.3 Southern Rocky Mountains.....	53
5.4 Southwest Valleys, Plateaus, Basins, and Hills.....	59
6. LINKING HIDE SUPPLY TO DEMAND: LEAST COST ROUTES.....	63
6.1 Pre-AD 1200 Routes	64
6.2 Post-AD 1350 Routes	66
7. THE CHACO HIDE-TRADE HYPOTHESIS.....	68
7.1 Overview: General Spatial-Temporal Pattern.....	68
7.2 The Southwest Hide-Trade “Business Model”	70
7.2.1 Southwest Trade at Historical Contact	70
7.2.2 Traded Goods and Services.....	71
7.2.3 Exchange Rates	77
7.2.4 Summary of the Business Model	78
7.3 Potential Trade Network Participants: Interactions and Governance.....	78
7.3.1 Mogollon-Colorado Plateau Hunter-Gatherers-Horticulturalists	78
7.3.2 Hohokam Traders.....	79
7.3.3. Mesoamerican Trained Technocrats	80
7.3.4 Porters.....	80
7.3.5 Upper Arkansas Bison Hunters and Horticulturalists.....	82
7.3.6 Caddoan Platte/Arkansas River Hide Traders.....	83
7.3.7 Hunter-Gatherers-Horticulturalists from the Rocky Mountains and Colorado Plateau	83
7.3.8 Captives, Wives and the Role of Women.....	85
7.3.9 Scenarios for Potential Interaction and Governance.....	86
7.4 Great Houses for Good Storage and Security	88
7.4.1 Location, Location	89
7.4.2 Protecting Trade Center Managers, Staff, and Trade Goods.....	90
7.4.3 Hide Storage.....	91
7.5 Great Roads: Maintaining Security and Independence	93

7.6 Value-Added: Leatherwork, Trade Fairs, Pilgrimages, and Express Freighting	94
7.6.1 Leatherwork	94
7.6.2 Trade Fairs and Pilgrimages	96
7.6.3 Steam-lining the Transport System.....	97
7.7 Collapse.....	98
7.7.1 Questioning the Human-Caused Environmental Degradation Theory	98
7.7.2 Precursors to Collapse: High Population and Increasing Societal Complexity.....	98
7.7.3 Potential Collapse Triggers.....	100
7.7.3 The Upshot for the Downfall.....	105
7.7.4 Post-Collapse Cultural Patterns	105
8. SECOND THOUGHTS AND CONCLUSION: BISON, HIDES AND CHACO CANYON	106
8.1 Main Lines of Evidence for Hide Trade Hypothesis	107
8.2 Considering the Edge of Bison Range on the Southern Plains.....	108
8.2.1 “Bottom-Up” Explanations: Climate and Grassland Productivity	108
8.2.2 “Top-down” Explanations: Human Predation.....	108
8.2.3 Bottom-up and Top-down Interaction.....	109
8.2.4. Bison Movements in the Rocky Mountains	111
8.2.5 Future Research on the Edge of Bison Range Edge	111
8.3 Considering Potential Chaco Canyon Socio-Economic Models.....	113
8.3.1 Semi-autonomous, Egalitarian Society	114
8.3.2 State-like Centralized Political System or Managed Cartel?.....	115
8.3.3 Pilgrimage Fair and Religious Center	116
8.3.4 Free-Market Trading Center	118
8.3.5 Future Research on Chaco Trade Socio-economic Models.....	119
8.4 Concluding Challenge: Chaco and the Southwest Edge of Bison Range.....	119
9. LITERATURE CITED	121

1. INTRODUCTION

1.1 The Edge of the Buffalo's "Home on the Range"

The buffalo, formally known as the American bison (*Bison bison*) is North America's largest terrestrial mammal. Prior to European settlement, bison had the largest extent of any indigenous large herbivore, ranging from the northern boreal forest to the Caribbean Sea, and across a wide breath of the continent (Gates et al. 2010). Through its interactions as a primary herbivore and important source of prey, the buffalo played an important role in both the biophysical and human cultural processes in many ecoregions (Roe 1972, Geist 1996). One of the most important eco-cultural properties of bison is its fluctuating range boundaries. From core, high abundance populations on the plains, the spread of bison to range edges result from biophysical processes such as climate, grassland production, and water availability (Lohse et al 2014a,b), all interacting with human predation and socio-economic processes that determined Native American population densities and tribal boundaries (Binnema 2001, 2016; Hämäläinen 2008).

Understanding the factors, past and present, that influenced the distribution and density of the buffalo has great relevance to conservationists, Native cultures, and ecologists engaged in restoring herds to various regions of the continent. As an eco-cultural process, it is an excellent topic for interdisciplinary focus by traditional knowledge specialists, anthropologists, historians and archaeologists. In 1932, historian Ceylon Kingston compiled observations on the western edge of bison range. He surmised:

The distribution of the buffalo over the continental area depended on a number of factors. Among these were the normal length of life of the species, and the rate of reproduction; the amount of available food as affected by soil, temperature and rainfall; such major obstacles as mountain chains, dense forests, deep canyons and areas of extreme desert type; predator animals and human enemies. In considering the range of the buffalo the Columbia Basin presents a curious and rather intricate problem and biological distribution in which the hunting by the Indians and physiographic difficulties explain in the most part the scarcity or absence of the buffalo. (Kingston 1932).

Some two decades later, in 1951 Frank Gilbert Roe furthered this historical work in his seminal book "The North American Buffalo." In nearly 1000 pages of small-font text, he condenses over 4 centuries of observations on bison. Similar to earlier research, he explained that:

*Even before the advance of the white men into the Rocky Mountain territory, the westward advance of the buffalo must have been much impeded by the 'economic pressure' of the Indian tribes beyond the actual buffalo range. For many Indians journeyed through the passes to procure bison meat and hides, either by hostile forays or by trade. This is attested by the earliest (European) observers and by many others, and was **clearly a long-established process**. (Roe 1972, p. 259, emphasis added).*

Since the latter 1980s, researchers from numerous disciplines have been integrating Kingston's and Roe's thinking into the distribution and abundance of bison and other large terrestrial mammals in the Pacific Northwest. Multi-disciplinary ecologists such as Dirk Van Vuren (1987), Charles Kay (1994) and others (Martin and Szuter 1999, Laliberte and Ripple 2003, Lyman 2004, Grayson 2006, Newton 2011) have more fully considered these eco-cultural processes. For the northwest edge of bison range, there are increasingly refined explanations for the spatial and temporal extent of bison dependent on the distance away from core "source" bison populations on the plains to "sink" populations in the mountains, and varying vegetation types, terrain conditions, winter snow depth, human population density, and communal hunting patterns (Kay 1994, 2007; White 2018).

Increasingly, multidisciplinary researches recognize the importance human predation as the key factor. After a detailed analysis of historical observations of bison in the American Rocky Mountains, and reviewing the evidence, wildlife biologist Jim Bailey (2016) concluded:

These observations provide compelling evidence that human predation was a major, perhaps preponderant, factor limiting bison distribution in the Rocky Mountains. While other factors varied geographically and temporally, Native American predation was more persistent, mobile and widespread.

1.2 The Varying Range of the Southern Plains Bison: A Classic "Who Dunit"

Evaluating the south western edge of bison range in the Southern Rockies is more problematic than to the north. For here, it is not just necessary to understand the process of bison movements into the mountains, but also the variation of the neighboring bison population on the adjacent Southern Plains. For much of the last few thousand years bison were relatively rare on the plains to the south of the Arkansas and Canadian rivers (Dillehay 1974). From archaeological bison bone samples, Lohse et al. (2014a) have dated several periods of relative periods of bison abundance on the Texas plains, with the first period of ~4455-4315 BC; the second and third periods coming in short succession with two discrete pulses between ~1795-1630 BC, then a 400-year hiatus with bison presence again from ~1200-650 BC. The last period begins in the Late Prehistoric period starting about AD ~1300, and extends to later historical accounts documenting that by AD 1400 the buffalo's range had clearly reached southwards into Texas (Creel 1991, Lohse et al. 2014a,b) and during the historical period bison were seen in abundance as far south as Caribbean Sea southeast of today's Houston (Roe 1972, WNA-JOBS Database 2020).

Why did bison populations ebb and flow across the Southern Plains? Lohse et al. (2014b) show some correlations with past periods of favorable climate for grassland production. However, for the decline in bison that began about 2500 years ago, it is useful to consider that climatic factors might be interacting with increasing human predation rates tied to improved technology (e.g., adoption of the bow and arrow), increasing numbers of people due to adoption of agriculture, and increased hunting pressure due to trade networks supplying bison products to complex societies that were expanding in the region such as Cahokia (Emerson and Lewis 1991) and the Hohokam and Anasazi (Cordell and McBrinn 2016). In

turn, after about AD 1200, the collapse of some of some human populations and societies might have been an important factor in reducing human predation rates on bison, and this could have interacted with productive climates to allow the expansion of bison population southwards by the AD 1300s. Historians have further elucidated the important role of humans in influencing the distribution and density of bison on the southern plains over the last 500 years tied cultures of Native Americans including the Apache, Comanche, Sioux, and Arapahoe (White 1978, Flores 1991, West 1995, Hämäläinen 2008).

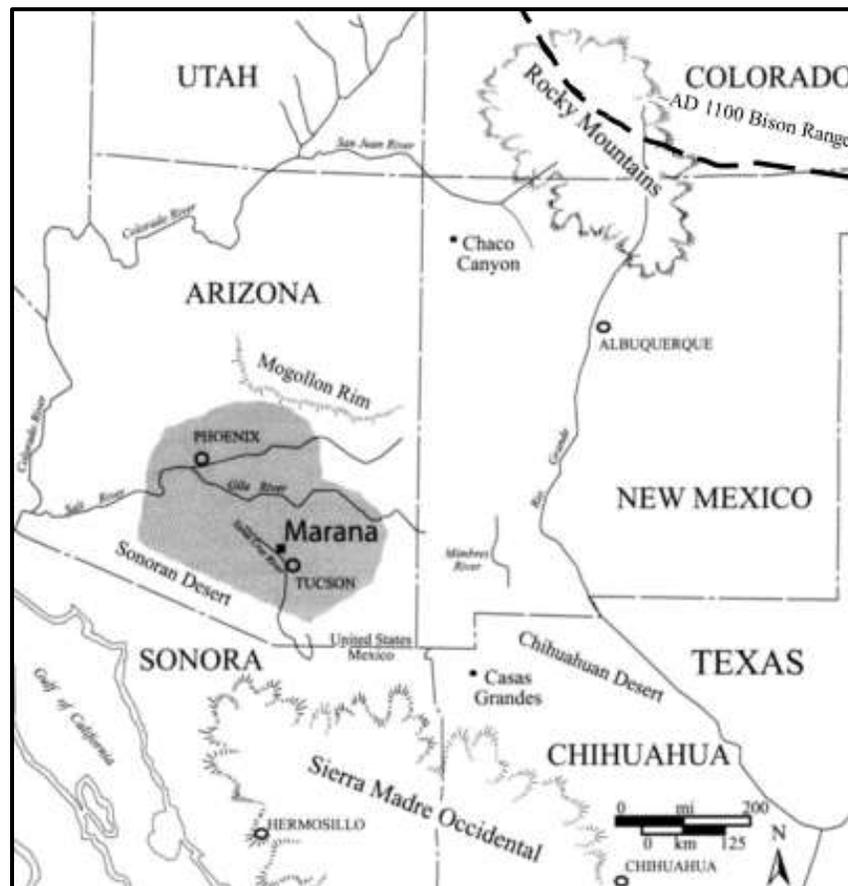


Figure 1.2-1: The potential southwest edge of heavily occupied bison range ~AD 1100 in today's southern Colorado prior to expansion of the range southwards into Texas ~AD 1300, and showing proximity to Chaco Canyon and Hohokam lands as the shaded area in the bottom right. (Base map source: Hunt et al. 2005).

One of the influences of humans on bison's southern movements was potentially intense hunting along the main west to east streams—the Canadian, Arkansas, and Platte-- carrying the run-off from the Rocky Mountains towards the Mississippi (Newton 2011). In drought years, these streams would be essential habitat for bison moving between the Central and Southern plain. However, these would also be major travel routes for Native Americans hunting westwards from the Mississippi lowlands, and possibly tribes coming over the Rockies from the west. During historic times there are accounts of Native American camps numbering in the hundreds of tipis bordering these rivers (Coues 1898, Hämäläinen 2008,

Newton 2011). In AD 1000, peoples associated with the Caddoans to the east were numerous along the Arkansas River (Gilmore 2008), and there were even had small permanent farms of hunter-gatherers on the river's headwaters in the Apishapa region (Zier 2018). This number of hunters would not only directly affect bison numbers through mortality, but more importantly, influence movement patterns as the buffalo avoided humans. Some scenarios of this human-bison interaction would clearly block movement routes between the southern and central plains, and potentially isolate then eliminate herds south of the Arkansas and Canadian rivers.

1.3 The Enigma of Chaco Canyon

As described above, historians have provided reasonable evidence from both sides of the Southern and Central plains to consider humans as an important factor influencing historical bison distributions during the period post AD 1500 (Newton 2011, Bailey 2016). Similarly, for the prehistoric period, archaeologists stress the role of widespread southeastern trading networks reaching westwards out onto the plains to bring bison products such as hides and robes back towards complex societies of abundant people along the Mississippi (Vehic 2002).

However, for the southwest, archaeologists generally describe bison prehistoric bison procurement by human hunters for the southern plains to Rio Grande area generally only after about AD 1000 (e.g., Creel 1991, Driver 1990b). For the core southwest region, archaeological research for the prehistoric period reviewed by Driver (2011) describes human use of local populations of smaller artiodactyls such as deer and sheep, but only provides limited reference to either hunting expeditions or trading networks to obtain bison products from the plains to the east. In contrast to several evaluations of prehistoric trade networks linking the plains to the Mississippian southeast, archaeological studies of the southwest are remarkably silent in describing any major trade networks that would move bison products towards the main southwest societies such as the Hohokam in the period prior to AD 1000.

This apparent lack of research on bison products moving into the prehistoric southwest is especially enigmatic for considering the economy of the Chaco Canyon region in northwest New Mexico. For a 600-year period from AD 600 to AD 1200, "Chaco" was one of the North America's significant centers of human population centers (Cordell and McBrinn 2016). It lay less than 300 km (200 miles) southwest of what was then occupied bison range in the southern Rocky Mountains and Central Plains (Figure 1.2-1), and midway between bison range and a high density of people on Hohokam farm lands (Figure 1.2-1). Chaco was a highly advanced civilization for its day (Lekson 2015, Heitman and Plog 2015), consisting of large massed structures (Great Houses) surrounded by numerous other buildings and road system (Figure 1.3-1). An early European traveller remarked:

"One of the most remarkable of all the pueblos is that of Bonito in the canyon of Chaco in New Mexico. This home of the Indian was built in the shape of a half circle and faced out on a yawning chasm. The high walls of the houses facing to the rear served the double purpose of a fortification against enemies and protection against the elements. The buildings were all of stone, and the masonry of the tribe, judged by the ruins of the towns that are left, was really marvelous. Their tools were much better than those of the other tribes of the time and the people more peaceful and industrious."

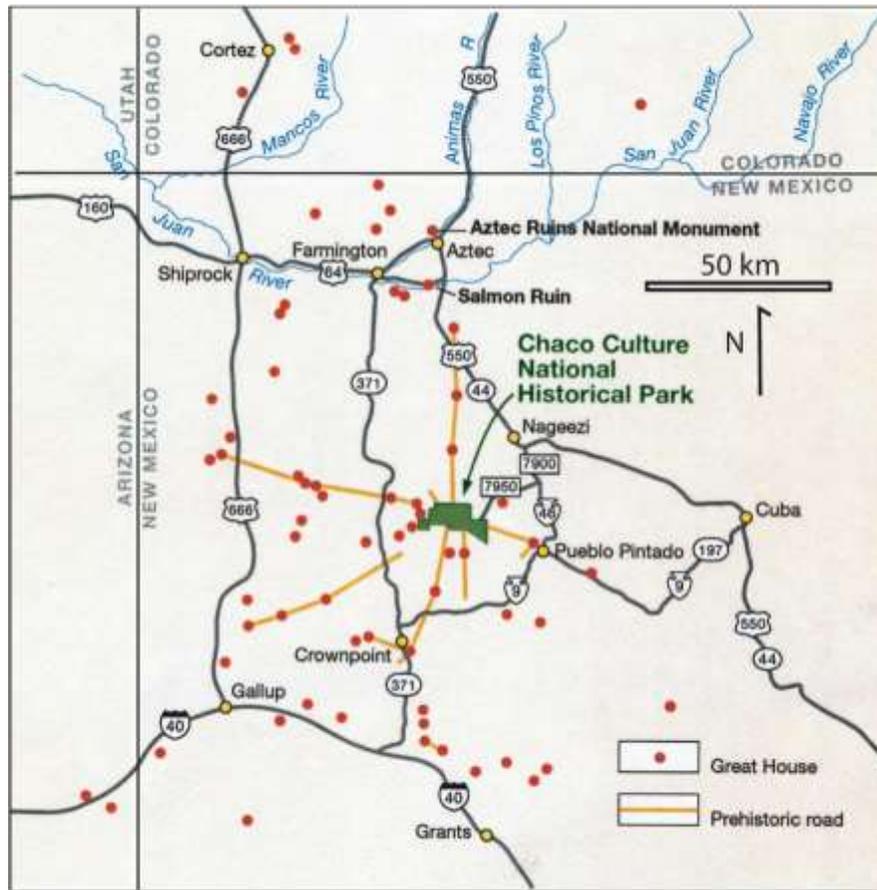


Figure 1.3-1: Chaco Canyon and vicinity showing Great Houses and prehistoric roads emanating from the central settlement zone (Map source: US NPS).

After over a century of research, archeologists have shown that Chaco societies traded extensively across a wide area of the southwest, including with the Anasazi to the north and west, the Mimbre to the south, the Hohokam in what is southern Arizona (Figure 1.2-1), and even afar afield as meso-America (Wilcox et al. 2008, Mills et al. 2013). Chacoans accumulated luxury products of the day including pet red macaws from the tropics, copper bells also from far to the south, beautiful shells from distant sea shores, and hundred of bits of turquoise from the mountains. But many researchers (e.g., Lekson 2015) ask the fundamental question: “What products of value did Chaco exchange for these?” Moreover, to build and provision the town, Chacoans required stone masons and porters to carry logs from distant mountains to build their buildings, and feeding residents and visitors likely required routine subsidies of maize, again carried by porters from distant locations. What economic and ecological processes energized this large supply of labor and materials? This mystical economy has been an ongoing dilemma to archeologists (Sebastian 1992, Mills 2002). As Benson et al. (2019) recently summarize: “The flux of material was mostly into Chaco, and a long-standing question has been what, if anything flowed out?”

1.4 Chaco as a Potential Hide Trading Center

One possibility for Chaco's economic role, given its general midway proximity between a source of hides from bison on the Great Plains and other species in the Rocky Mountains (Figure 1.2-1), and potential high demand from Hohokam farmers to the southwest is that the canyon area was an important node in an animal hide trading network, and particularly important in the movement of bison skins. But consider that if Chaco Canyon actually was a hide trading center, likely a few thousand hides of bison, deer, bighorn sheep and other species might have been transported and traded here each year. Over the period of 500 years or so that Chaco grew and thrived, this would mean more than a million hides would have passed through the community. The obvious evidence an archaeologist might present against the idea that Chaco Canyon was a center for trading hides is the rarity of hide or leather products. Judd (1954) describes the "material culture" of Pueblo Bonito:

Fragments of leather garments are even fewer at Pueblo Bonito than those of vegetal fibers. Indeed we found little more than tailor's waste—trimmings such as the edges of hides perforated for stretching pegs and one patched piece of fawn skin with the hair still adhering. A few scraps, exceedingly thin, appear to be tanned rodent hide, but they are too altered for positive identification; they may be parts of a shirt or a light blanket or even a small bag..

Bayman's (1999) review of archaeological evidence of southwest crafts makes no reference to hide or leather working. The current detailed database for results of archaeological investigations at the Pueblo Bonito site includes entries for 15,000 artifacts, and a search of this for "hide" or "leather" returns only 7 entries (in <http://www.chacoarchive.org/cra/>)

But in this case is "absence of evidence actually evidence of absence"? For as Judd (1954) also notes: "Like vegetal matter, leather soon decays unless protected from moisture, and there are few corners of Pueblo Bonito into which rainwater has not permeated." Moreover, even small scraps of hide and leather have high value both to humans and animal scavengers. Likely only meat products would disappear more quickly over time. Arguably, modern investigators should consider the absence of hide products in Chaco Canyon of little relevance to testing the "hide trading center" hypothesis. As with food preparation and storage where only the tools and implements remain (stone, bone and pottery), with hides it must be the tools of processing or where it was used that must be well-understood placed in context. This phase of detailed research is only beginning for Chaco, and researchers are focussing on potential uses of bone tools in the culture's evolution (e.g., Watson 2015, Anderson 2019).

As this new phase of research progresses, it is essential to place the testing of the "Chaco hide-trade hypothesis" in a larger, interdisciplinary context of ecological, archaeological, traditional knowledge, anthropological and historical understanding. The ability to hunt animals for food, and make their skins into clothing, shelter, and other goods is fundamental for human survival in many environments, and was critical for the expansion of our species into most areas of the world. Neandertal bone tools, dating to 40,000 years BP appear specialized for tanning hides, and in shape and wear patterns resemble tools used in historical times (Soressi et al. 2013). Although these hide processing tools are common the archaeological record, their products— robes, tanned hides, leather, cordage are nearly invisible due to reuse and rapid decomposition (Harris and Veldmeijer 2014). Thus, evidence of hide-working is common

where the hunting occurs through bone and stone tools, but hide products may be difficult to detect where they are ultimately used. In these areas, traditional knowledge of native peoples, historical observations, and comparisons to similar environments may be required to understand hide procurement, processing and trade.

The American Southwest during the period 3000 years BP to historical times is a classic case where large, hide-bearing animals were few in the agricultural zones where human densities were highest and the greatest demand for hide products could have occurred. In general, large wildlife was relatively rare near the intensively settled Hohokam and Pueblo farmers' fields (Grimstead 2010, Driver 2011). Both historically and prehistorically, the highest densities of bison were to the east and northeast on the plains (Roe 1972, Cooper 2008). Elk, deer, and bear were more common in rugged treed environments and higher elevations in local mountain ranges, or in the southern Rockies to the north. However, based upon historical and traditional knowledge, there was assuredly high demand for leather and hide products in the agricultural zone for host of uses including clothing, binding, tool construction, and armor for warfare. As one unique example of potential hide use, in ancient images, Meso-American ball court players appear to be wearing leather pads (Cahodas 1975). Spaces resembling ball courts are common in Hohokam archaeological sites (Wilcox 1991).

Thus, based upon this preliminary evidence, there was likely a major hide trade network in the Southwest during the prehistoric period reaching from the plains to Hohokam cultures that has remained largely undocumented. This possibility has, to date, certainly been given little attention by archaeologists. Depending on the timing and spatial pattern of this network, Chaco Canyon could be a potential trading hub in its development and movement routes.

1.5 Hides, Women, and Captives

Maintaining communal hunting camps, hide preparation, and transportation are labor intensive. Women did the majority of this work, and in many southwest and plains societies, many of the women were captives obtained during raids on enemy bands (Brooks 1996, 2002; Habicht-Mauche 2008). Sacajawea, the famous native woman who guided the Lewis and Clark expedition westward was herself a teenager on a Shoshone bison hunting expedition when captured by Hidatsa, and brought east to a village on the Missouri River where she was purchased by a Canadian trapper (Mann 2004). Because of the close association of the hide and captive trade, it is difficult to determine what was the primary economic motive. For the historic period, Baker (2015) argues that for this region of Spanish New Mexico, hide trading was in fact a front for the more lucrative, but Spanish-outlawed slave trade. In this paper I do not specifically focus on captives as a primary economic and social driver for trade, although at times it was clearly significant (Kohler and Turner 2006). However, I do integrate captives and their descendants into how the hide trade worked. Similar to later historic trading southwest trading communities such as Abiquiu (Blackhawk 2006), their important role in the social fabric may explain a great deal about how Chaco was built and functioned.

1.6 Bison, Hides and Chaco: Paper Purpose and Overview

In this paper I describe a scenario for how biophysical and human influences on regional wildlife hide availability was influenced human cultures, and in turn how this regional supply-demand differential may have created variable hide trading networks across the region for the period ~AD 500-1850. My particular interest here is bison abundance at its range edge on the southern plains and southern Rocky Mountains in the period ~AD 500-1500 and cultures that may have influenced the range edge. I focus on several social groups—the Anasazi, Caddo, Chaco Canyon people, Hohokam, Fremont and Ute-- but clearly this scenario influenced many cultural groups in the southwest and adjacent regions. To make this argument, I first provide a “primer” on the hunting and processing of hide products. Next, I describe selected North American hide trade networks to demonstrate the high economic and cultural value humans place on hide products (e.g., robes, hides and leather) and the effort people will expend to obtain these products through trade or travel networks. Thirdly, I describe wildlife abundance and the supply hides in the southwest region ~AD 1000, linking this to the distribution and density of humans and potential locations of highest demand for hide product. Then I use this information to propose the hypothesis that Chaco Canyon lay on a major supply route for hides into the southwest, and was possibly a key exchange and hide processing center. Finally, I integrate this information to describe a potential scenario for interactions between bison, other wildlife, and Caddoan, Chaco, Hohokam, and proto-Ute groups in the southwest and Texas region over the period ~AD 500 to 1500, and the expansion of bison herds onto the Southern Plains after ~AD 1300.

2. ANIMAL HIDES TO FINE LEATHER: A PRIMER

As we don our favorite shoes, fedora or cowboy hat, relax on our favorite old leather lounging chair, or admire a fine piece of Native American buckskin and beadwork clothing, we should appreciate that the hunting, processing, transport, and final finishing of these hide products is among the oldest and essential of human inventions. Hide technology is virtually as ancient as our species itself (Harris and Veldmeijer 2014). Next to hunting for food, hunting and processing hides for clothing and shelter was key to human survival. Even with the advent of modern synthetic clothing products, traditionally-processed hides and leather have few equals for ensuring human survival in some environmental conditions. In this section I briefly review the long history of hide processing, then summarize some products from leather-work in Chaco times that may have helped drive a southwestern trade network.

2.1 Hunting, Hides and Human Global Dispersion

Similar to the way the “fur trade” played an important role in the expansion of European cultures across North America, and founding of the modern nations Canada and United States (Innis 1962, Chittenden 1935), the procuring of animal skins was also a foundation for human evolution and dispersion around the world. The proliferation of scraping tools in archaeological sites dating to 250Ky BP indicates that Hominids in Eurasia were already using hides and furs for clothing and other purposes (Stiner 2002). The appearance of eyed needles of bone and ivory as early as 35,000 years ago in Eastern Europe and perhaps southern Siberia shows humans developing the sophisticated skills to survive in northern latitudes, and by 30,000 years BP there is evidence of rock rings and frames for hide tents across Eurasia (Hoffecker 2005). As humans reached eastwards towards the Beringia, they also mastered the use of hides for boat building (Jodry 2005). Kill sites in northern Europe show that humans likely hunted swimming caribou by 11,500 years ago. This had to be done from boats, and given the lack of trees in these areas, archaeologists suspect that people covered frames of caribou bones with hides to make watercraft (Fletcher 2015).

Clearly the first humans to reach North America were highly skilled in the procurement of wildlife, and processing food, clothing, shelter and tools from these animals. Clovis peoples, the first recognizable culture in the interior of the New World were big game specialists (Haynes 2002) -- using a unique tool kit of stone tools to kill and process large mammals such as mammoths and ancient bison (Frison 2004). As subsequent cultures adapted to the continent’s ecoregions, they developed regionally specialized annual rounds of hunting, gathering, horticulture and aquaculture (Kroeber 1947, Binford 2001). Studies from the disciplines of traditional knowledge, anthropology, history, and archaeology describe the hunting and hide processing practices by the Denedah and Sahtu of the northwest boreal forest (Helm et al. 2000, Polfus et al. 2016), northern woodland Cree (Feit 1973, Winterhalder 1981, Berkes 2012), the northern prairie’s Assiniboine (Denig 2000) and Cree (Mandelbaum 1969), the Blackfoot on the northwest plains (Wissler 1910, Reeves 2003), the Sioux on the central prairies (Hassrick 1964, White 1978, Hämäläinen 2017), the Comanche on the southern prairies (Hämäläinen 2008), and the Salishan peoples of the northwestern plateau (Teit 1900, Anatasio 1985, Prentiss et al. 2005). In combination, these studies show not just a general pattern in the importance of fur and hide use for clothing, shelter, tools, weapons, transportation, and cultural symbols across the continent, but also specialized cultural

adaptions to each ecological situation. Moreover, the innovative uses of the highly valued hide products continued to change over time. For example, Wilson (2011) describes that when Athapaskans expanded from northern Canada into the southwest during the last millennium that they may have brought their hard-soled, leather footwear with them, quoting Salwen (1960:222): “[t]he leather shoe did not come into general use in the Pueblos until after AD 1300. . . The Pueblo leather footwear trait might have been borrowed from the Athabaskan invaders.”

2.2 Hunting and Gathering Cultures

Many of the immediate pre-history cultures in southern areas of North America are best described as complex hunter-gatherer societies because for at least a portion of their annual cycle they may have had semi-permanent habitation near areas that they farmed, or where fish or plant resources (e.g., acorns on pine nuts) were abundant (Prentiss and Kuijt 2004, Anderson 2005, Cordell and McBrinn 2016). On the plains, the bison hunting cultures such as the Blackfoot, Sioux and Comanche were largely nomadic, but even these peoples could often be found in long-term camps in predictable locations during some seasons (Wissler 1910; Hassrick 1964; Hämäläinen 2008, 2017).

Hunting animals to obtain hides, food, and other products, even for part of the year, requires unique cultural adaptions (Driver 1990a, Frison 2004) including expertise in hunting and gathering native species, mobility and communal organization to conduct the hunts. Typically, hunters and gatherers have low densities of less than 10 people per 100 sq km (Binford 2001, Johnson 2014). These cultures are often relatively mobile to utilize a variety of species across a region during the period when they are optimal for use such as the phenology of plants, the amount of animal fat, or hide condition. Although large animals are favored prey, plants and other smaller animals may provide important subsistence during some parts of the year. However, by definition, this adaptability to adapt to local ecological conditions makes hunter gather societies highly variable (Bettinger 1991, Binford 2001, Kelly 1995, Berkes 2012).

2.2.1 Hunting and Gathering Expertise

Arguably, large mammal hunting was a driving force behind human evolution (Stiner 2002, Guthrie 2005: 228-236). Intelligence, skill, experience, intense family learning, and community cooperation are all required to hunt North American wildlife such as bison, elk, white-tailed and mule deer, bighorn sheep, and pronghorn antelope. All these species have evolved with predation by humans and four-legged predators, and have a wide range of physiological and behavioural responses to avoid mortality. To show the depth, diversity, and ingenuity of human expertise, below I summarise prehistoric hunting techniques described for each species by Frison (2004), Kornfeld et al. (2010) and other researchers:

Bison- Their large mass made bison highly preferred prey (Kay 2007, Newton 2011). The common occurrence of bison in herds in grassland terrain favored communal hunting (Reeves 1990, Brink 2008), but on the Great Plains, this also made herd movements unpredictable. Bison hunting techniques described by Kornfeld et al. (2010) included driving small herds towards wood fence corrals or pounds, arroyo traps, sand dune traps, bison jumps, human or fire surrounds, snow drifts or water crossings.

Bison could also be hunted by stalking using wolf or bison costumes to get close proximity (particularly after the advent of the bow). Within the mountains and foothills, bison were contained by terrain, and more easily hunted by communal groups (Arthur 1962, 1966; White 2018). For example, in 1860 the Raynold's expedition described a communal kill site upstream of Dubois Wyoming where the Crow contained and killed a herd of bison the previous winter (Merrill and Merrill, 2012: 40-41). Likely these bison had been driven up the narrow Wind River canyon from further downstream.

Elk- Given its large mass and hide quality, elk were likely second only to bison as a preferred prey, with the species historically occurring in low densities in rugged mountain terrain, and more commonly on the prairies near riparian zones or woodlands, or in west coast marshlands (Kay 2007). Hunting techniques included using human surrounds or drives to move elk into constrained areas with prepositioned hunters, driving elk into narrow pits excavated along game trails (Curtis 1970), or running and tiring small herds to the point where individuals could be killed (McCabe 1982).

Deer (white-tail and mule deer)- Mule deer were relatively easily hunted because they would flee into open terrain where they could be communally-herded or run down. In contrast, whitetails evade hunters by staying or fleeing into dense thickets such as riparian zones along streams (Kay 2007). Here, hunters would favor snares, deadfall traps, pits, or dogs to kill them. In the 1840s, Jesuit Father De Smet (Chittenden and Richardson 1905) describes how the Couer d'Alene, carrying burning rags "in a 100 little fires round about to prevent the deer from escaping from the circle" and "then pursued in every direction, the terrified animals flee from one clump of wood or brush to another until finally enveloped on all sides, and finding no issue, they fall into the hands of the hunters." He observed them "kill as many as 200-300... in a single surround."

Bighorn sheep- Bighorn sheep were commonly found in grasslands and alpine areas with nearby rock outcroppings for escape terrain. Prehistoric human hunting techniques of sheep are well-described by Kornfeld et al. (2010). Communal hunts, potentially using dogs (Frison 2004), were used to herd groups of sheep towards narrow terrain where hunters waited, or where netting or wooden corrals were placed. Benedict (1996, 1999, 2005) describes game drives defined by rock cairns, blinds, and other features across alpine meadows of the Colorado Rockies that helped hunters move sheep towards ambush areas.

Pronghorn Antelope- These grazers of open grasslands and sagebrush country frequently use their rapid speed to escape hunters (Frison 2004). However, they can be contained within relatively low brush fences, and there are numerous accounts summarized by Kornfeld et al. (2010) of groups people carefully herding pronghorn into corrals built in constrained terrain. Smith (1974:55-56) describes these hunts:

The Utes conducted communal antelope hunts, normally led by a special "antelope-hunt chief." The hunt-chief usually sent out scouts to locate the herds; once sighted, the band dispersed across the terrain in the direction of the antelope. Then, forming a loose circle, the band slowly enclosed their quarry in a "back and forth surround." The hunters then dispatched the animals with arrows. On a good day, the hunters would drive 200 antelope over a concealed cliff into a corral where those that had not broken their necks in the fall met their fate with clubs, spears, or arrows. At other times, the

hunters simply drove the antelope past an ambush near well-worn trails and springs, where a hunter or hunters disguised in antelope skins could shoot for the hunting party.

Beaver, Rabbits and other Fur Bearers- Native Americans possessed an array of trapping and hunting technologies customized to harvest each species. Several southwest groups used long nets to trap jackrabbits (Steward 1938).

2.2.2 Mobility and Transport

A fundamental characteristic of hunter-gatherer cultures is routine seasonal movements, or annual rounds, that take people to places in within their territories at a time where select plant and animal resources are optimally available. Kelly (1983, 1995) evaluates mobility characteristics of a range of hunter-gatherer cultures. In general, in locations with less primary productivity (deserts, dry plains, taiga) people move further and more often. In the North American pre-horse era, dogs with packs, or packs lashed to wooden poles (travaillles) in summer, or sleds in winter were often important for these moves (Reeves 1990). When visiting a native camp, Alexander Henry the Younger recorded that “I had the curiosity to count the Assiniboine dog travaillles, and found no fewer than 230” (Henry 1992). According to Ray (1998), this would indicate over 6 dogs per hunter, and that each family group could transport up to 2300 pounds of goods. In many cultures, women took care of the dogs and organized camp moves (Denig 2000, Hassrick 1964). Where rivers and lakes were available, native cultures built sophisticated hide boats, birch bark canoes and carved-log dugouts to hunt, move camps, and transport goods. In rugged terrain, or during winter, travel by foot might be necessary, but even in these cases detailed knowledge of travel routes and use of snow shoes allowed routine movement.

2.2.3 Communal Organization

The above description of the expertise and organization required for procuring hides though show that a high degree of communal organization is required to maintain this life-style. All members of a society-- men, women, and children-- have some role to play as hunters and gatherer groups move across a landscape. This organization becomes even more critical as cultures increase their level of hunting from local subsistence to procuring and moving hide products at numbers important for trade. One of the key issues at this scale of hunting is the processing of hides. Because of potential spoilage, at least basic processing must be integrated into the hunting and travel process.

2.3 From Skins to High Art: Basic to Complex Hide Processing

The ancient, long-learned technology of taking an animal skin and transforming it from a range of products ranging from simple clothing or binding cords critical for daily human survival to elaborate costumes demonstrating high societal rank is nothing short of amazing. In most societies, men did the wider ranging tasks of seeking out and hunting animals. But once an animal was killed, women lead in the more camp and family-centered tasks of hide preparation (Anderson 2019 and references within). Here I summarize the process, largely drawn from Ruth’s (2013) description for hide processing, and assorted other sources for the crafts of making selected final products.

2.3.1 Basic Hide Processing

Beginning at the time of the animal kill, and continuing for a few days after, hunting groups must process the skin into a relatively light weight and preserved hide. Processing varies by the animal species, sex, time of year, and desired ultimate products. Below are descriptions of general tasks for species (antelope, deer, mountain sheep, elk, bison) likely most important for long-distance southwest trade.

Skinning- Skinning is best done immediately after the hunt to minimize spoilage of the meat or hide, or damage from scavengers. During communal hunts of bison or other species where groups of animals are killed, this would require long hours of intensive work often done by women (Brink 2008). The animal's skin is often cut down the centerline of the belly, with incisions made along the center of each leg. Smaller animals may be hung for skinning. Adult bison hides might be removed in two halves with calves skinned as a whole (James 1823, Vol 1:312; Denig 2000:146). After the incisions, the skin is usually peeled back carefully by hand, with minimal use of knives that could piece the hide. The thicker skin on large bison may have to be pounded by cobbles to help it from the body before removal.

Fleshing- This is the process of removing all tissue, fat, and the hypodermis (most inner layer of skin) from the hide. Fleshing is usually done at the time of the kill or shortly thereafter while the hide is still moist. Immediate fleshing is also important if the hair on outside of the hide is to be retained (bison robes, clothing etc.). In areas with no trees, the hides are staked out on level ground. Where wood is available, larger hides are often stretched across an upright frame. A common tool to scrape the hide is a serrated bone flesher with a leather wrist strap. The user pulls the flesher downward or towards them to remove the fat and tissue. Again, fleshing is traditionally done by women, and tools may be used for years and individually decorated (Anderson 2019).

Drying, Stretching, Interim Storage- After fleshing, "green hides" can be dried for interim storage and transport. They are usually stretched on a frame, and dried from the center outwards to prevent the edges cracking or curling. When further processing is done, the hide must again be wetted and stretched to make it pliable.

Graining- If the hair or fur is to be removed from the skin, the next phase of hide processing is to remove the hair, epidermis and grain layers of skin, referred to as "graining" (Richards 2001:31). This process can be done by "wet scraping", where the hide is wetted, possibly with a weak alkaline or acidic solution made with fire ash, urine or fruit juice. Steaming, or carefully monitored decomposition will also loosen the hair for graining. Where a hairless hide was required from large animals such as a bison, the preferred process was "dry scraping" with the hide staked out or framed, and a relatively sharp tool used to remove the hair. For smaller sections of thick hide, such as those that might be used for a shield, the hair can also be pounded off with rounded stones (Wissler 1910:66).

Thinning- Continued scraping may be required to obtain the thickness of skin desired, and to ensure that when a tanning is applied, it fully enters the hide. Again, the process can be done by wet or dry

scraping, with dry scraping most common on large bison hides with thick skins, but smaller hides or pieces of hide would likely be carefully wet-scraped and thinned.

Tanning and Dyeing- This step produces leather that is more flexible and less prone to decay than less processed skins. Tanning methods can include vegetable, mineral (tawing), oil and smoke tannage (Farnham 1916:20). Western North American cultures usually oil-tanned using the fluids from the brain, liver and fat of the animals killed. The fats and oils oxidize with the hide and form insoluble bonds in the collagen structure. This process is useful for creating leather clothing worn next to the skin, because unlike other types of leather, it is resistant to alkaline fluids present in human perspiration (references in Ruth 2013). The tanning process required saturating the hides with these fats and oils, and mechanical softening to work the fluids into the skin. At this point various dye's, often obtained from plants, and some with waterproofing properties, can be also added into the tanning solution.

Continued Softening and Stretching- The continued working the tanning agents into the hide, and ongoing stretching and thinning is important for creating quality leathers. This is one of the most labor-intensive steps in hide-working, an ongoing cooperative task that is simply described as "work" by experienced tanners (Farnham 1916:121). Depending on the hide size, thickness, and purpose a range of techniques were used from stretching the hide across logs and ropes, to working it with stones, sticks, scapulae and shells. The more the hide was worked, the more the tanning agents permeate into it, and the finer the leather. Routine human use—as shawls, clothing and bedding- is one of best methods of softening and stretching hide. For example, traders paid the highest price for beaver skins called "castor gras" (greased beaver), or skins worn by native trappers and their family members for at least a year. These pelts had lost their long guard hairs due to constant wearing and friction and were permeated by human body oils. European hatters coveted the resulting soft, waterproof hides covered with fine felt hairs (McGill University 2001).

Smoking- After tanning, stretching and softening the hide is soft, but would still become stiff or decompose if exposed to water. Continued permeation with smoking coats the hide fibers so that they remain supple after wetting (Catlin 1844:52; Ewers 1968:11). Smoking was often done during times of the year when weather and daily routines allowed it to be carefully done. One or several hides might be suspended on a frame or tripod, then placed over a smudge fire. The hides could also be strung below the smoke aperture in lodges or pit houses (Binford 1967; Ewers 1968:11). Rotten vegetation was placed over hot coals in the fire pit to create the smudge.

2.3.2 Crafting Complex Hide Products

The basic hide processing steps described above produce a durable leather that can be crafted into numerous, more complex products. Due to the ultimate perishability of hide, the best evidence for more complex processing in the prehistoric period are bone, antler and stone tools such as scrapers and thinners, cutting tools, grinding stones, and awls, and a variety of other archaeological artifacts from the crafter's toolkits (Gilligan 2010, Kornfeld et al. 2010, Ruth 2013, Anderson 2019). For the historic period there are numerous traditional knowledge and anthropological accounts providing descriptions of the complex hide-working by Plains, Rockies and the Plateau cultures (e.g., Powell 1961, Smith 1974). Below, I summarize select archaeological and historical evidence of hide crafting for several broad

groups of products useful in the broader southwest and adjacent regions. Chaco hide-working is given further direct attention in Section 7. I emphasize a range of processing levels from hunter-gatherer cultures to those potentially found in complex, multi-class societies, and where possible provide information on which societal groups crafted these products based upon historical information.

Clothing- Hayden (1990) divided hide clothing into three levels: 1) A basic cape is made out of de-fleshed hide and that would require only the simplest of cutting and scraping tools; 2) An improved cape where the hides have additional processing (e.g. stretching and cleaning), and where a more specialized tool-kit is required including scrapers showing both wet and dry skin use, and perhaps camps or shelters with hide-smoking features; and 3) advanced clothing constructed of tanned hides, and that required a complete kit of scrapers, awls, ground stones for hide thinning, cutting and sewing. Advanced clothing is required for most high latitude and elevation areas. Humans clearly mastered this craft prior to their entry into North America through the Arctic, and maintained these skills in their advance southwards to Patagonia. Gilligan (2010) describes the importance of needles and awls to sew the tailored thermal clothing required in cooler climates.

In the southwest, archaeological descriptions of clothing materials for low elevation areas focus on textiles (e.g., Bayman 1999), but adjacent peoples living at higher elevations such as the Anasazi, Fremont and Ute, and on the Great Plains to the east used hide clothing (Kornfeld et al. 2010). Accounts from the Coronado expedition describe the clothing of the Teya people they encountered on the southern plains in 1543: “They cover their whole body. They wear shoes and buskins made of tanned skin. The women wear cloaks over the small under petticoats with sleeves gathered up at the shoulders, all of skin” (Winship 1904:71). In 1776, Escalante observed Ute men wearing buckskin jackets and leggings (Warner and Chavez 1976). Women wore a composite of various furs wrapped around plant fibers (Powell, 1961: 62-63; Smith 1974:72-76).

Footwear- Hides are universally used for footwear (Gilmore 2005). Possibly hard-soled leather footwear was unknown in the southwest until introduced by the Apaches in the 1300s (Salwen 1960, Wilson 2011). However, southwest peoples have likely long used hides to make moccasins and other footwear. Heap (1854:84) provides an example of how hide products are fully utilized. His 1853 railroad survey expedition used oxen hides stretched on wooden frame boats to ferry goods across the Colorado and tributary streams. For July 25 he notes: “At sunset, the crossing of Green River was effected, and we gladly gave the boat to the Indians, who ripped it to pieces to make moccasson soles of the hides.” Miller (1898) describes that at Taos Pueblo in the 1800s, it was the men made moccasins:

The moccasins of the women are made of buckskin, sometimes of goatskin, and are long enough to come up just below the knee, where they are tied about the leg. The sole is of rawhide like those of the men's moccasins. A wash of white earth, easily renewed when necessary, is rubbed over the buckskin. The making of the moccasins is apart of the work of the husbands and fathers, who take pride in having their wives and daughters provided with strong, well-made pairs.

Parfleches and Bags- Hide products make durable containers for transporting goods. Leather packs, purses and suitcases are modern versions carried by people. In the past, household tools, clothes and food were wrapped and bound in parfleches (meaning to “deflect arrows”) in loads of weights

appropriate for human, dog, or horse transport (Torrence 1994). The flexibility and toughness of well processed hides allowed loads to be repeatably shaped and wrapped for a range of transport means such as on person or animals back, or held in a travois. The bags provided protection from weather or pilfering, or could even be sewn to be nearly air-tight to protect food products such as pemmican (Colpitts 2015) and corn (Murray 1839, Baugh 1991). In the post-contact period, women decorated parfleches with distinctive bead and quillwork (Lycett 2017). Trader Anthony Glass (Flores 1985) described how parfleches of corn were cached near villages along the Red River in Texas:

During our stay at the Panies Villages we lived in plenty. fresh Buffalo meat was brought in every day---they dry their Corn on a scaffold erected for the purpose and each house has put up from an hundred to an hundred and fifty bushels. and when it is sufficiently dry they pick it up in bags made of the skins of Buffalo & if they leave the Village in winter as they generally do they bury these bags of Corn in the ground and so artfully cover up the place that if an Enemy should in their absence come and lay waste their towns they would not find their Corn.

Shelter Coverings- Prior to the development of canvas and nylon, tanned and treated hide provided the best material for portable shelter. The Coronado expedition describes hide use by the Querechos, the first people they met out on the southern plains: "These folks live in tents made from the tanned skins of the cows. They travel around near the cows, killing them for food." (Winship 1904:65). Further south, Coronado's army obtained from the Teya "a pile of tanned skins.... and a tent as big as a house." (Winship 1904:68). The knowledge and technology required to make a hide shelters are well-evidenced in the materials and design of the tipi. Traditionally, it was the women's role to make and erect the tipi, and transport them by dog and horse. A well-crafted tipi made of high-quality hides has long been recognized as the essential portable shelter for human travellers on the Great Plains and adjacent areas (Denig 2000, Hassrick 1964).

Boats- Water-craft made by wrapping, sewing, and sealing hides around frames of wood or bone is an ancient human innovation (Fletcher 2015). On the plains where wood was scarce, but bison abundant, Native Americans moved goods and people down or across rivers in "bull boats" of green bison hides stretched across a framework of driftwood or willow (Denig 2000:185, Jodry 2005). This means of transport was adopted by Euro-Americans. In 1810 Thomas James of the Missouri Fur Company descended the Yellowstone River in a hide boat after a season of trapping:

... we made three canoes of buffalo bull's skins, by sewing together two skins, for each canoe, and then stretching them over a frame similar in shape to a Mackinaw boat. Our canoe contained three men, about sixty steel traps, five hundred beaver skins, our guns and amunition, besides other commodities. Nine of us started down the river in these canoes and in two days reached Clark's river where the boats with the goods was awaiting us." (James 1846)

Magloire Mousseau, an employee of the American Fur Company in the 1800s, recounted how "packs" (bales containing ten buffalo robes) were freighted in boats made of hide (Hanson and Walters (1976):

The manner of constructing these which were called "bull skin canoes" was to make frames and cover them with green buffalo hides with the hair on the inside and then sew the several parts together, and then cover the seams with buffalo tallow. These "bull skin canoes" would hold 40 or 50 packs.

These little cargoes were brought down the tributary rivers like the White, the Cheyenne, and the Cannonball to Fort Pierre where they were unloaded and stored.

Shields, Body Armour, and Ceremonial Wear- In the pre-iron and pre-synthetic native world, thick leather combined with wood, shells, or other materials was a favored material for protecting the bodies of warriors or sports participants, and this wear had great ceremonial importance (Hough 1895, Jones 2004). Leather shields are the best-recognized form of this craft. Hundreds of ceremonial-tradition art pictographs from the Great Plains depict human beings holding large, decorated circular shields and, often, weapons (Keyser 2018). In some art the shield may portray symbolic weaponry, serve as a personal identifier, or have a spiritual connotation (Greer and Greer 2018). Plains tribes made the shields from the thick hide on the back of a bison, and images derived from visions and dreams were then painted on the shield increase their protective power (Huffman and Earley 2014). Shield use extended into the southwest. Obregon's *Historia* records that Pecos in 1584 was "enclosed and surrounded by a palisade, large houses, and by rows of walks which open out to the country. Here they keep their offensive and defensive arms, bows, arrows, shields, lances, and clubs" (Hammond and Rey 1928:18). Hernandez (2019) describes how both shields and body armour (Figure 2.3.2-1) became more common in the pueblos after approximately AD 1300, possibly in response to the introduction of the double re-curved bow.

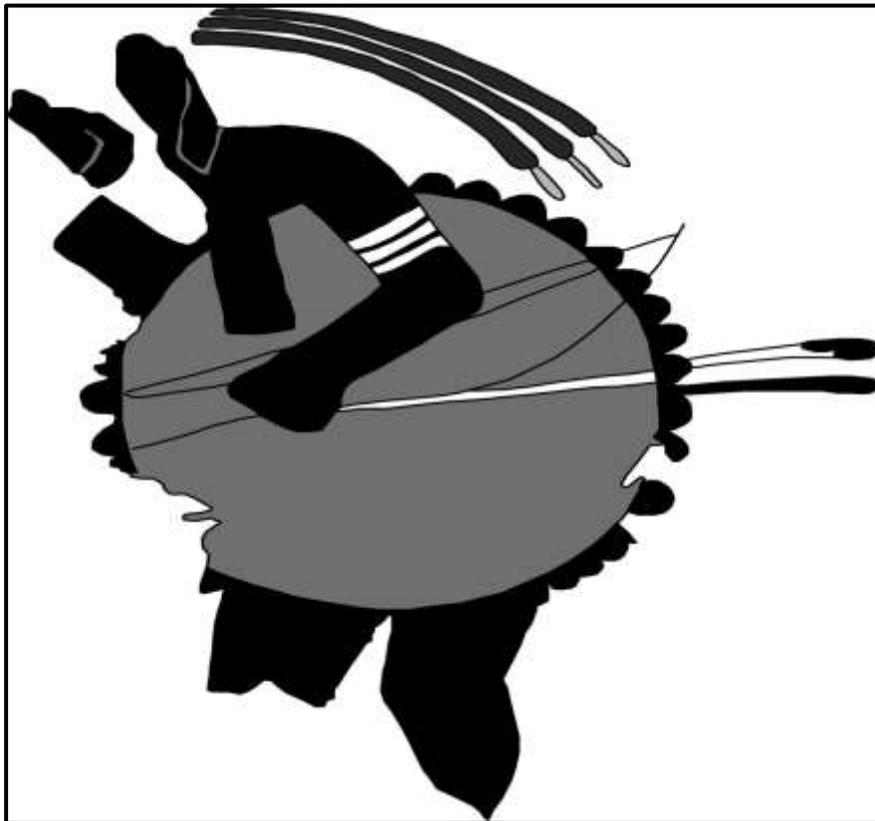


Figure 2.3.2-1: Pueblo warrior with shield, and bow and arrow from Pottery Mound, Kiva 7, Layer 8, South Wall (from Hernandez 2019).

Further south, leather was also important for defensive armour in Mesoamerica. Hassig (1988) notes that shields and leggings worn by Aztec warriors that were likely crafted with leather components. Wasserman (2017) proposes the use of leather for padding by Aztec ball court players (Figure 2.3.2-2). For a classic-era Mayan archaeological site, Emery (2009) describes crafting of bone needles, pins, awls, and other “perforator” implements that may have been used to sew hide or textile clothing. White-tail deer were the most commonly identified large artiodactyl in the region.

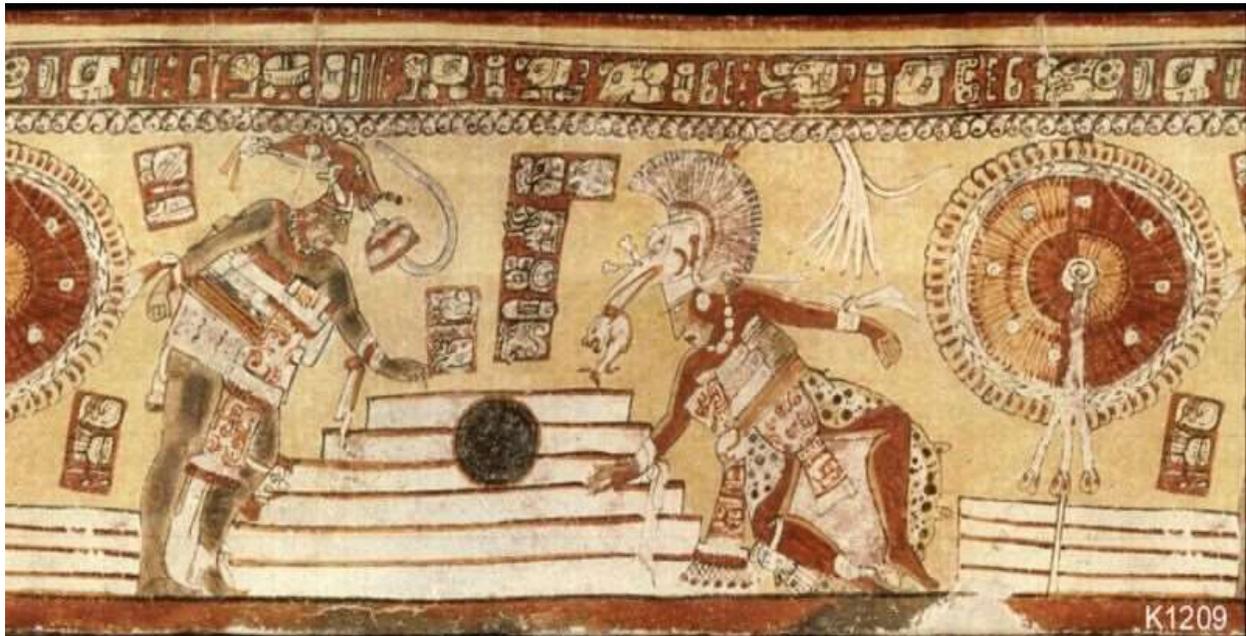


Figure 2.3.2-2. Game action in a Maya ball court as illustrated on a Mayan vase. The large, black rubber ball at the center. The kneeling figure wears a jaguar skin. Thick leather may have provided padding for players. Photograph, Justin Kerr, Mayavase Database, University of Oregon, <https://blogs.uoregon.edu/mesoinstitute/about/curriculum-unit-development/archaeology/ball-game/>

3. “ROADS TO THE BUFFALO”: HISTORICAL HIDE TRADING NETWORKS

Trade networks were an important component of prehistoric and historic cultures, and have been broadly reviewed for the Southwest and Mesoamerica by Ericson and Baugh (1993) and North America (Baugh and Ericson 1994). The history of western North America is replete with descriptions of hide and fur trading networks (e.g., Chittenden 1986, Ray 1998). From the sixteenth to the nineteenth centuries the trade of animal pelts such as beaver was certainly one of the continent’s greatest industries, but the traditional knowledge of Native Americans shows that this economic activity extended deep into the past (Van Sickle and Rodewald 2011). Figure 3-1 shows select trade networks for western North America.

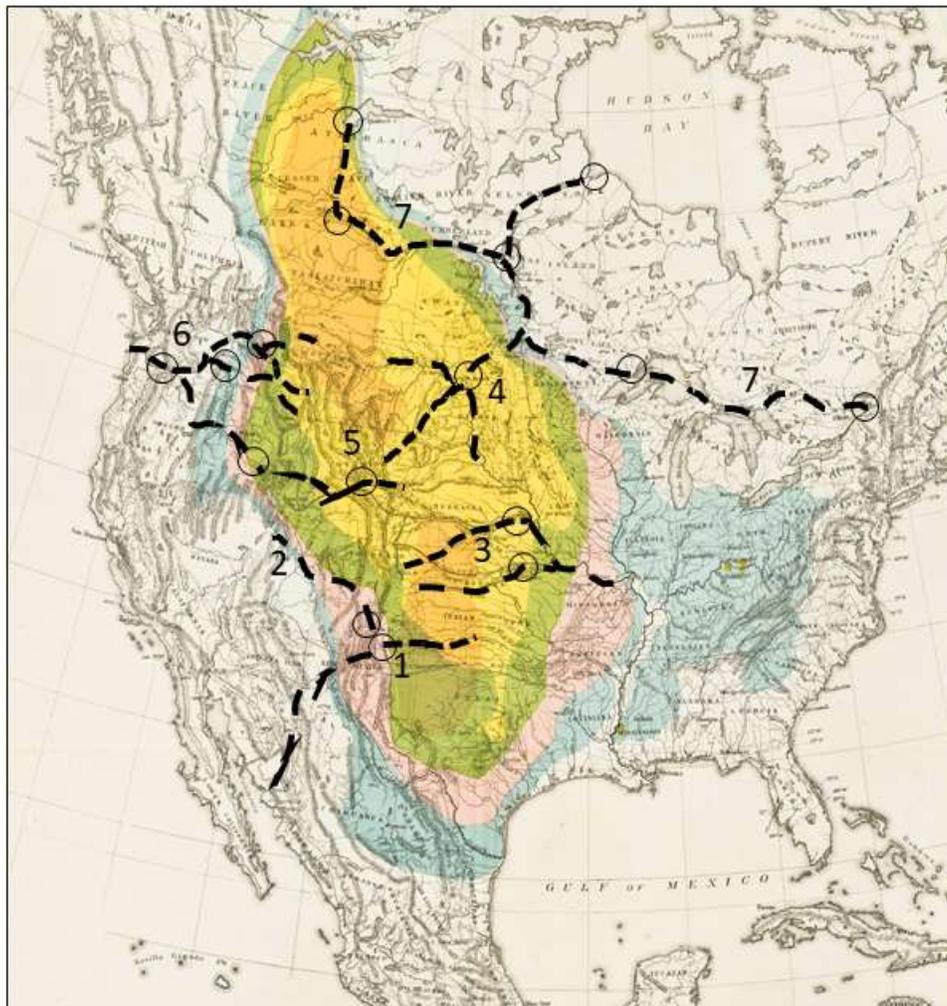


Figure 3-1: Select hide trading network routes (dashes) and trading centers (open circles): 1-Pueblos and southern plains, 2- Abiquiu and southern Rockies, 3- Lower Arkansas and Platte rivers to the Rockies, 4- Heart River Villages to the Rockies, 5- Shoshone Rendezvous, 6-Dalles to Northern Plains, and 7: Hudson’s Bay/Montreal to Northern Plains and Boreal Forest. Shades indicate bison presence from ~AD 1600 to 1880 grading from blue (maximum range) to orange (core remaining herds remaining after ~1850). Bison range map from Allen (1876).

Along the Rocky Mountains and Great Plains, the trade related to bison products was particularly important. The great beast provided large amounts of meat (often over 200 kg per kill) and wide variety of robe, hide, leather, and other products. The tendency for bison to form large herds in open plains where communal herding and hunting was possible encouraged human groups to move long distances for buffalo procurement. In this section I provide several examples of select trade networks for hides and other wildlife products (Figure 3-1), focussing on historical and immediate precontact period, and on bison as examples. I describe the regions and peoples that supplied the hide, the regions that had a demand for hides, the exchange goods involved, and the characteristics and protocols of the trading centers and fairs.

3.1. The Pueblos and Southern Plains (AD 1300s to 1800s)

Supply and Demand Regions, Routes and Goods- The chronicles of the 1540-42 Coronado expedition (Flint and Flint 2005) provide us with the some of earliest descriptions of a buffalo trade network, where semi-nomadic Teya and Tin-ne-ah (Apache) hunted bison herds on the southern Great Plains east of the Pecos River (Figure 3.1) and routinely transported hides and meat over 100 km westward to pueblo peoples living in the southern foothills of the Rocky Mountains (Spielmann 1983, 1991; Driver 1990b, Creel 1991, Habicht-Mauche 1992). This exchange network appears to have developed as, or just before Athabaskan peoples migrated onto the southern plains after about AD 1400 (Hill and Trabert 2018), exploiting bison herds that were increasing across the region during this period (Cooper 2008). These peoples were initially nomadic pedestrians following bison herds, and using dogs to move these products westward (Calloway 2003:159-160). Possibly due to their northern heritage, the Apache were highly proficient in creating fine bison skin products including tanned hides, saddlebags, parfleche storage bags, clothing, rawhide ropes, and footwear (Opler 1941, Salwen 1960, Haley 1997).

In the 1700s, the Comanche, with their mastery of the horse, assumed both military and economic supremacy in harvesting the supply of southern plains bison hides (Hämäläinen 2008). Later, in the 1800s, after treaties were made with the Comanches, buffalo hunters from the New Mexico villages, known as cibaleros, would take whole families eastward onto the southern plains, with supplies for six to eight weeks, horses and many carts to haul buffalo meat and hides back to their villages. In good years 10,000-12,000 buffalo were taken (Flint and Flint 2012b). In the period 1500 to 1850 the Rio Grande pueblos were the immediate main market for southern plains bison hide products. However, this region lay adjacent to a vast area with low hide availability in Mesoamerica, so hides could profitably be traded to the west or south. In 1539, Father Marcos de Niza describes bison hides being traded as far west as the San Pedro valley and further southwestwards towards the Gulf of California coast (Flint and Flint 2005). Records of the early Spanish period along the Rio Grande also show the importance of the export of hides to the south. In 1639 the mission supply train to the south carried “122 painted buffalo hides, 198 chamois skins (gamuzas), and an unknown number of finished leather jackets, shirts, and breeches” (Bloom 1935). In 1660, Governor Mendizabal exported 1,300 deerskins and some buffalo hides to Parral (Weber 1971: 20). Weber (1971: 20-21) also records that during the residencia of Mendizabal at Santa Fe in 1664, his inventory included 1,200 antelope skins and four bundles of elk hides (Weber 1971, 20-21). Products moving north and east from this region to trade for hide products include maize and labour in the pre-Hispanic era, and after the 1600s metal and manufactured goods. Captives were also important in exchanges both ways. Brooks (2002:48) remarks

that “in the vast region crisscrossed by trade in meat, hides, maize, jewelry. . . women might have been the most mobile and negotiable item of exchange.”

Trading Center Protocols -Trade fairs are well-described for Pecos Pueblo, New Mexico (Figure 3.2-1). Here, and at other eastern pueblos, bison products were in early times exchanged for maize, cotton, and other agricultural crops raised by the Puebloans (Spielmann 1983, 1991). Several authors describe the mutual benefits to Puebloans and the nomadic bison hunters of this trading arrangement. Spielmann (1982) and Habicht-Mauche (1992) review early Spanish accounts that the Teya and Apache nomadic hunters would go to the pueblos to spend the winter, thus avoiding the harsh winter climate and potential starvation. Apparently, the pueblo people let them shelter under the eaves of the buildings, and provided them with maize in return for hides and meat. The maize from the pueblos would be especially important to the hunters during the late winter and early spring when the bison were thin, and plants will still dormant (Spielmann 1983).



Figure 3.2-1: Pecos Puebloans and plains bison hunters at a trade fair.

3.2 Southern Rockies, Abiquiu and the Old Spanish Trails (AD 1600s to 1800s)

Supply and Demand Regions, Routes and Goods- The Southern Rocky Mountains, homeland of the Ute, was an important source of animal hides, dried meat, and slave goods to the southwest pueblos, Spanish and New Mexico settlers throughout the historical period (Simmons 2000, Blackhawk 2006). Trade routes ran from the Salt Lake area southeast across the southwestern slopes of the Rocky Mountains towards the Rio Grande River (Figure 3-1). The first historical accounts of actual travel along this heavily used southwest trade route comes from Rivera’s trip in 1765 which returned with mules loaded hides obtained through trade with Utes (Baker 2015). In 1776 Fathers Escalante and Dominguez again followed this path northwest reaching the Salt Lake basin, and returning by a more southwesterly

route (Warner and Chavez 1976). However, accounts of Utes bringing elk, deer, bison, and other skins down this route to trade fairs at the gateway community of Abiquiu on the Chama River begin in the early 1600s. Blackhawk (2006) also provides extensive documentation of Utes bringing Paiute captives (mostly young women or children) down this route for trade. An alternate route came from the San Luis valley to north and northeast, with the Utes, Apaches, and then the Comanches all providing bison and other species' hides to trade at both Abiquiu and Taos (Kayser 1965, Simmons 2000, Hämäläinen 2008). During the historic period, the pueblos and Spanish American settlers were the primary purchasers of these goods, providing in return food (maize, squash, beans), horses, knives, awls, and other European goods valued by the Native Americans. This trade with northern peoples was punctuated by periods of raids and warfare, but as Blackhawk (2006) describes:

Beginning in the 1750s, Utes brought trade goods and captives to northern trade fairs, and they did so peacefully. From 1752 until the end of the Spanish empire in North America, Utes and New Mexicans carved out a peaceful coexistence. "They bring captives to sell, pieces of chamois, many buffalo skins, and, out of the plunder they have obtained elsewhere, horses, muskets, shot-guns, munitions, knives, meat and other various things," noted Tamarón in 1760.

Trading Center Protocols- Abiquiu, along the Chama River was the main gateway between the northwest trails reaching into the hinterland, and the pueblos to the southeast along the Rio Grande. Maintaining a routine and peaceful trading cycle here was important to the pueblos, the early Spanish settlers, and the Utes and other northern Indian groups. Routine trade allowed the Utes to solidify their ties through friendship, exchange, and gift giving. Blackhawk (2006:133) describes that "the high volume of slaves brought into the community, particularly young women who began raising Spanish-Indian families, created a unique linguistic and intercultural class of 'genízaros', who guided, translated, and traded throughout the north, linking the Spanish, Puebloan, and Ute cultures." As with the eastern pueblos, the hides obtained by the early Spanish settlers gave them a highly valued good they could in turn exchange for implements available from settlements further to the south

3.3. Arkansas and Platte Rivers to the Rockies (1100s to 1800s)

Supply and Demand Regions, Routes and Goods- Early in the summer 1541 the Spanish Coronado expedition travelled hundreds of kilometers northwest from the pueblos to "Quivira", a region on the eastern Great Plains where villagers raised maize and other crops, and seasonally hunted bison further west (Hammond and Rey 1940; Flint and Flint 1997, 2005). In the late 1600s, early French traders along the Missouri River valley further described these bison hunting and trading networks along the Platte, Republican, Arkansas and Canadian rivers and extending to the eastern slopes of the Rocky Mountains. Some of these cultures were likely descendants of larger, corn-fed chiefdoms of three centuries earlier (Schambach 1993, Scheiber 2007).

Spiro, one of the largest pre-historic towns, was at the confluence of the Canadian and Arkansas rivers, and acted as a gateway for bison hide trade eastward towards the Mississippi from a vast trade network (Figure 3.3-1) that extended for many centuries across the central Great Plains to these rivers' headwaters in the Rockies (Kozuch 2002, Calloway 2003:110-111). Shambach (1993) provides a rationale for this long-term trade: "Hides and animal protein and fat were probably in short supply among the

Middle Mississippians of eastern Arkansas and beyond. Therefore, they would have been valuable, and the Spiroans, who could supply them, were in a position to profit from undertaking to do so. Thus, by A.D. 1200 or earlier the stage was probably set for the developments that created the hoards at Spiro.”

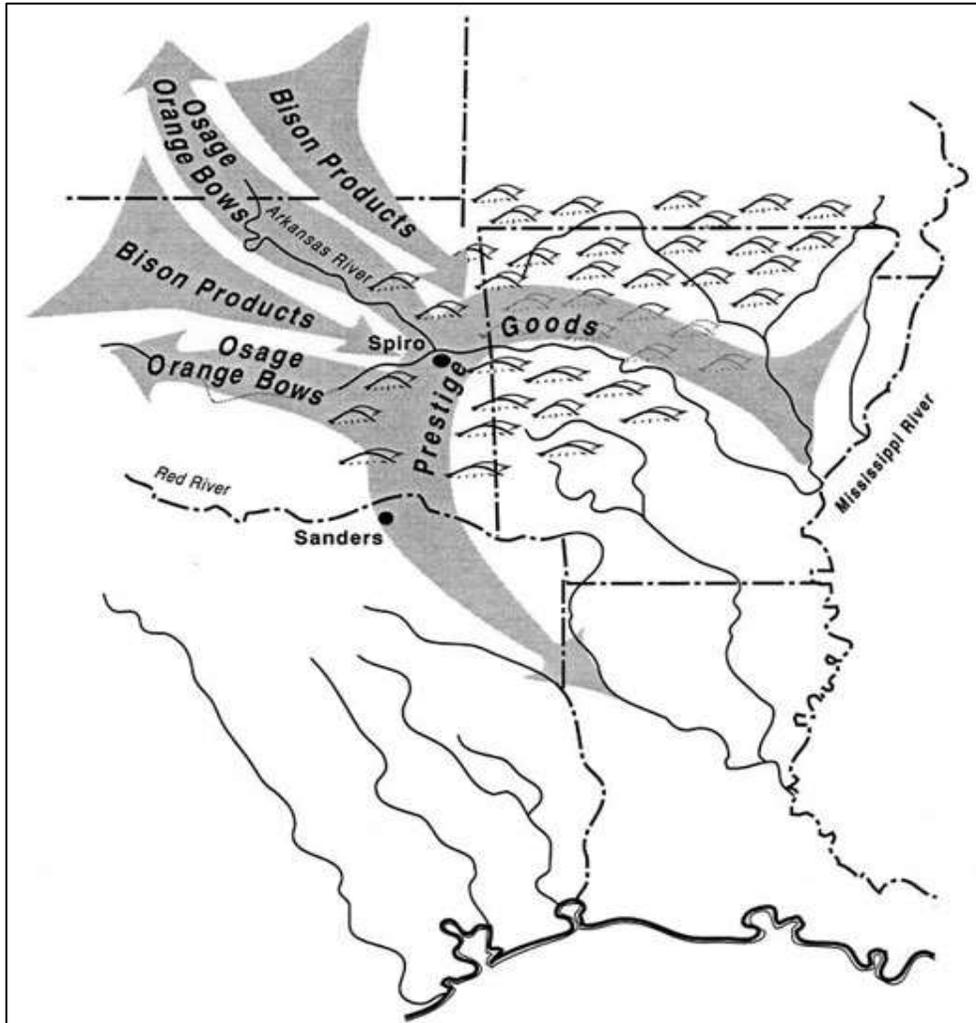


Figure 3.3-1: Spiroan trade network in Mississippian times (about A.D. 1250-1450) according to Schambach (1993). This interpretation shows bison products moving from the Plains east to the Mississippi valley, while prestige goods moved the opposite direction. Bows made of Bois d'arc (Osage orange) from the Red River valley near the Sanders site went both east and west. Map from Schambach (1993).

Trade Center Protocols- In the 1700s, Caddoan and Spiroan descendants, the Osage in the south and Pawnee in the north, were raising corn near villages along the Platte and Arkansas rivers' lower reaches. They often annually made trips westward to the edge of the core bison range on the central plains, but maintaining a buffer from their Arapaho and Cheyenne enemies (Wishart 1994). After planting, the Pawnee and foraging-farming cultures were often absent from their villages on bison hunts from late June to early September. They returned eastwards to harvest the corn, possibly caching it in parfleche

bags buried near their villages (Baugh 1991) then from November to March would again seek out the bison herds to the west (Wishart 1994, Scheiber 2007). Besides meat, the summer hunts were important for teshna'ha, the Omaha term for "hide without hairs" that was tanned for moccasins, leggings, and tipis. Women did the intensive work to scrape and stretch these skins. The winter hunt furnished meat and heavy robes for protection from the cold (Fletcher and Lafreshe 1972). By the mid-1700s, Pawnee were the main long-distance traders in their region. Both hides and robes were traded with tribes to the east for corn products. To the west, they traded guns with Utes for horses. This trading network extended over 500 km from the lower Missouri River towards the Rockies (Wishart 1994).

3.4 Heart and Knife Rivers' Villages to the Rockies (prehistoric to 1800s)

Supply and Demand Regions, Routes and Goods- The Mandan, Hidatsa, and Arikara villages, in the region of the south-turning bend of the Missouri River (Figure 3.4-1) were a key trading hub for the northern plains (Wood 1980; Mitchell 2007, 2018; Fenn 2014). This region was the most northerly location for raising maize along the river, supporting over 10,000 residents in the early 1500s (Mitchell 2013). Although a combination of raising corn and bison hunting was important to the villages' economy, Mitchell (2018) writes that for the prehistoric period:

As a share of the total economy, trade was even more important for the residents of the Heart River towns. The settlements at the Heart were the hub of a far-flung, multilateral trade network that incorporated downriver village communities occupied by Coalescent-tradition groups as well as mobile hunters living throughout the northern Plains, from the Red River valley westward to the Rocky Mountain Front and as far north as southwest Manitoba and southern Alberta (Mitchell 2013). Trade items included copper, marineshell, catlinite (red pipestone), Knife River flint, and pottery, almost certainly accompanied by maize and bison meat and hides.

The villages were well positioned to host native and European traders from all directions (Figure 3.4). Henry David Kelsey of the Hudson's Bay Company chronicled one of the first European visits here in 1691 (Epp 1993, updated route mapped in WNA-JOBS 2020). He was followed by Montreal's La Verendrye family traders in 1738, who returned in 1742-43 to travel with native bands hunting bison likely as far west as the Bighorn Range of the Rocky Mountains (Burpee 1927). The ability to produce and store corn provided the guaranteed source of nourishment that was one factor drawing nomadic plains peoples to the Missouri villages. These nomads brought bison hides, robes, and dried meat, beaver pelts, and eventually horses—all resources of value to the villagers, Europeans, and other peoples travelling to the trade center from the north and east. In return, traders brought valued European goods including pots, knives and guns (Wood 1980). Traders here also exchanged prestige goods such as marine shells and exotic stones as part of a pan-continental network (Wood 1972, Mitchell 2013, Figure 3.4-1).



Figure 3.4-2. Plains bullboats, in Mih-tutta-Hangkusch, a Mandan Village along the Missouri River. One of a series of aquatint engravings by Karl Bodmer from his 1843–44 trip (Source: Library of Congress). Prior to the equestrian period, bull boats may have been important for transporting hides downstream from bison range.

Trading Center Protocols- Missouri villages were often heavily fortified with wood bastions and trenches (Mitchell 2007) to protect residents, food, and other valuables. Important goods were cached in or under earthen lodges where they were difficult to find, and easier to secure. It was often the role of women to construct and maintain these sturdy dwellings (Roper 2005). The journals of Kelsey, La Verendrye, and Laroque all describe a complex ritual between visiting traders and the villages including advanced meetings at a distance from the villages, designation of actually who would be allowed to proceed into the villages, and schedules for the duration of visits (Epp 1993, Wood and Thiessen 1985). During his 1738 trip, Montreal trader La Verendrye even describes a ruse where the Mandan villagers warn their Assiniboine visitors that their enemies, the Sioux, were approaching to encourage an immediate departure (Burpee 1927). La Verendrye observes that the Assiniboine had been most interested in exchanging their iron and steel goods, obtained from the British and French, for the Mandan's hide and leather products. He notes that the Assiniboine

....had completed their purchases of all the things they were to buy, such as coloured buffalo robes, deer and buck skins, carefully dressed and ornamented with fur and feathers, painted feathers and furs, worked garters, head-bands, girdles. Of all the tribes they [the Mandan] are the most skilful in dressing leather, and they work very delicately in hair and feathers; the Assiniboin cannot do work of the same kind. They [the Mandan] are sharp traders, and clean the Assiniboin out of everything they have in the way of guns, powder, ball, kettles, axes, knives and awls. (Burpee 1927:332)

3.5 South Pass and the Shoshone Rendezvous (1600s to 1840s)

Supply and Demand Regions, Routes and Goods- A broad regional trade system appears to have become established by the early 1600s by the Shoshone after their expansion eastward onto the central plains (Wood 1972, 1980; Hodge 2013). An annual trading rendezvous, likely located most years on the upper North Platte River, was attended by natives from afar, bringing in goods from the Mandan and Arikara on the northeastern Missouri, from the Dalles in the Pacific Northwest, and from Santa Fe in the southwest (Figures 3-1; 3.4-1). By the early 1700s, horses, initially stolen from the Spanish, may have been a major item of exchange. These were brought north by the Shoshone's relatives, the Comanche, from their new homelands on the plains to the south, and the Utes from the headwaters of the Colorado (Hämäläinen 2008). In exchange, the Shoshone may have offered captives obtained from their raids on nations to the east. La Verendrye observed in his account of his 1742-43 trip the Shoshone "are not friendly with any tribe. It is said that in 1741 they had entirely ruined seventeen villages, killed all the men and the old women, made slaves of the young women and sold them on the coast for horses and merchandise" (Burpee 1927). The Comanche and Ute would take these captives south for exchange into the growing Spanish southwest slave trade (Blackhawk 2006). By the late 1700s, with their numbers decimated by smallpox, the Shoshone were pushed back westwards over South Pass by the advancing Cheyenne and Sioux (White 1978). However, the tradition of an annual mid-continental rendezvous continued, where Hodge (2013) surmises "natives exchanged horses, produce, and Spanish material goods from the Southwest, vegetables from the upper Missouri, meat and hides from the Great Plains, fish and shells from the Columbia Plateau, and nuts, obsidian, and roots from the Great Basin."

By 1820, traders from the Astor's Pacific Fur Company, followed shortly thereafter by Canadian North West Company, based in their new trade houses on the Columbia River, began to visit the Shoshone and other native groups in their quest for highly-valued skins of beaver. In the next two decades these companies were followed by the Hudson's Bay Company traders on the Columbia, several American fur trade companies freighting trade goods in from the east, and American free traders or "mountain men". All these traders adapted to the tradition of an annual Shoshone Rendezvous as a primary location to exchange of Euro-American goods for beaver and other furs (Wishart 1992, Mackie 1997).

Trade Center Protocols- During the period 1820-1840 the Rendezvous was most frequently held on the upper Green River, just to the northwest of South Pass. In these years, bison were abundant in this region during the summer and fall (WNA-JOBS 2020) possibly because the upper North Platte River region immediately to the east was in a lightly-hunted intertribal buffer zone between the Shoshone, Arapaho, Ute, Crow, Cheyenne and Sioux (White 1978). Hunting of these dependable buffalo herds on the Green River's headwaters provisioned the large encampments. An American visitor attending one of

the last rendezvous in 1839 along the Green River described “What first struck our eye was several long rows of Indian tents extending along . . . for at least a mile. Indians and whites were mingled here in varied groups” (Wislizenius 1912:90). The rendezvous of those years was a spectacular gathering of fur company men, independent trappers, sometimes embedded within bands of Shoshones or other Natives, all camping with Ute, Flathead, Crow, Shoshone, Bannock, Nez Perce, or other tribes. For several days, the participants drank, gambled, and exchanged their year’s take of furs for supplies of goods brought overland from St. Louis by wagon, or from the Columbia by pack train. Although conflict between individuals and groups did occur, the presence of many women and children clearly show that the annual rendezvous was mainly a time for trade and socializing (Hodge 2013).

3.6 Columbia River to the Rockies and Plains (Before 1600 to 1870)

Supply and Demand Regions, Routes and Goods- One of most complex, but well studied trade networks for centuries brought bison and other products from the northwestern plains and interior mountain valleys ultimately to the peoples on the northwest coast of Pacific Ocean (Galm 1994, Carlson 1994). On the network’s western periphery, the Dalles, with its annual Columbia River salmon fishery was a key location for regional trade at the time of Eurasian contact (Hunn 1990, Boyd et al. 2013). The archaeological antiquity of this trading center is obvious from “complexity, age range, and sheer number of sites” (Galm 1994). Based on ethnographic information, goods from the coast and interior plateau regions were exchanged with items from the plains. As described by Scott (2015) materials of trade from the east included bison robes, parfleches, pemmican, skins and furs, eagle feathers, bone beads, and finely tanned and ornamented clothing. From the west, trade goods included dried salmon, fish oil, feathers, roots and seeds, hemp and twine, shells (*Dentalium* and *Olivella*), mountain sheep horns, bowls, ladles and spoons, and woven baskets (Wood 1980, Josephy 1997, Scott 2015). From the Dalles, and from areas further east, native peoples including the Wasco, Yakima, Spokane, Nez Perce, Salish and Kalispel would band together into large, community multi-tribal groups for annual, or even multi-year trips out to the plains (Anastasio 1985). Main routes to the plains included Lolo Pass, a direct route over the Bitterroots later used by Lewis and Clark (Moulton 1986 to 1993), and northern, low elevation trails up the Clark Fork and Flathead rivers (Figure 3.6-1) that connected to the “Road to the Buffalo”, a corridor of trails over Lewis and Clark and nearby passes onto the northern plains in Montana near the Great Falls of the Missouri (Farr 2003, Scott 2015).

Early observers such as David Thompson describe use of dogs for packing and sledding (Belyea 1994). Once Native Americans obtained the horse, the frequency and distance of these trips likely increased (Scott 2015). Lewis and Clark bought horses from the Shoshone, and followed these trade routes on their 1805-06 trips across the continental divide (Moulton 1986 to 1993). Similar to La Roque’s trip with the Crow (see above), European traders might spend several months accompanying native groups such as the Flathead hunting on the buffalo plains (Lewis and Phillips 1923, Mackie 1997). These accounts show the importance of all family members in the hard work to contain, kill and process bison, and the many bison killed to sustain the large camps, often of multiple tribes (Farr 2003). The Nez Perce were likely the most significant traders, bringing hides and other bison products from the plains west to the Dalles (Anastasio 1985).



Figure 3.6-1. Native American camp along the Clark Fork River near Noxon, Montana c. 1885 (Wilsie, University of Washington Special Collections NA-1318). The tipi on the left appears to be made from canvas. The tipi on the right is likely made of in a traditional way with bison hide. The woman in center appears to be processing a hide, possibly from a deer. This campsite is along a traditional travel route to the plains, and is over 300 km west of the nearest edge of bison range on the northern plains near Lewis and Clark Pass. For a repeat photograph of this image see: <https://lensoftimenorthwest.com/galleries/montana-wyoming/clark-fork-bitterroot-flathead/noxon-montana/>

Trading Center Protocols- Native groups traditionally planned the main trading fair at the Dalles, and other large multi-tribal camps such as at Kettle Falls on the Columbia or Salmon Falls on the Snake River to occur during the peak of mid-summer salmon runs to provide food for the hundreds of locals and visitors gathered from afar (Hunn 1990, Galm 1994, Belyea 1994).

Astorian trader Alexander Ross was portaging through the Dalles in early August, 1811 during the annual trade fair:

The main camp of the Indians is situated at the head of the narrows, and may contain during the salmon season, 3,000 souls or more; but the constant inhabitants of the place do not exceed 100 persons, and are called Wy-am-pams; the rest are all foreigners from different tribes throughout the country, who resort hither, not for the purpose of catching salmon, but chiefly for gambling and speculation; for trade and traffic, not in fish, but in other articles; for the Indians of the plains seldom eat fish, and those of the sea-coast sell, but never buy fish. Fish is their own staple commodity. The

articles of trade brought to this place by the Indians of the interior are generally horses, buffalo-robbs, and native tobacco, which they exchange with the natives of the sea-coast and other tribes for hiqua beads and other trinkets... Now all these articles generally change hands through gambling, which alone draws so many vagabonds together at this place; because they are always well here, whereas no other place on the Columbia could support so many people together. The long narrows, therefore, is the great emporium or mart of the Columbia, and the general theatre of gambling and roguery.
(Ross 1849:118)

Cultural interaction at eastern trade centers was also complicated. For periods of time, each of Astor's Pacific Fur Company, the Northwest Company, and then the Hudson's Bay Company maintained small posts of about 5-10 traders along the Clark Fork River upstream of modern-day Thompson Falls, in northwestern Montana (Figure 3-1) where large native hunting groups rendezvoused just before and after their trips over the Rocky Mountains to hunt bison on the northern plains (Anatasio 1985). Again, trader Alexander Ross (1913), now working for the Hudson's Bay Company describes how he and a few assistants organized a one week trade fair at Flathead Post beginning in late November, 1825. It was attended by over 1000 native people from 5 different tribes, all coming back in from the plains after a summer and fall of bison hunts and trapping. The traders arranged that each group would come to the post's trade building on a specific day. At the end of the fair, he summarizes that: "in all we have traded 1183 beaver, 14 otter, 529 muskrat, 8 fishers, 3 minks, 1 martin, 2 foxes, 11,072 pounds dried meat, etc. (Buffalo meat)."

3.7 The Northern Fur Trade: Atlantic to Arctic and Pacific Oceans (1500s to 1900s)

Supply and Demand Regions, Trade Goods, and Travel Routes- Written descriptions of the northern fur trade began in the 1540s when French traders first obtained furs from the natives along the St. Lawrence River. For the next three centuries, Montreal and English based traders competed for hides trapped by native peoples, expanding a trade network along the northern river systems that eventually reached from the Atlantic to the Arctic, and Pacific oceans (Innis 1962). Although the sale of beaver pelt hats to the European gentry financed the fur-trade across this vast area, the fatty meat of bison fed the paddlers along most the distance of their epic trips, and it was the robes and hides of bison that often clothed and sheltered them (Ray 1998:126-127; Colpitts 2015). The main European goods traded for beaver pelts, and bison meat and hides were tobacco, kettles, guns, knives, adzes, ammunition, traps, blankets, etc. The fur trade stimulated, through provision of arms and iron goods, the northwest expansion of the Cree, a First Nation specialising in not just trapping, but long-distance canoe travel. The Cree were skilled in obtaining food and shelter resources from both the prairies and the boreal, and often aggressive against their neighbors (McMillan 1995).

Along the Cree's main travel corridor of the Saskatchewan River on the edge of the plains, the annual round of trapping and trade began with late summer and fall bison hunts to provide overwinter sustenance and shelter. First Nation's trapped beaver during the fall early winter and by early spring brought pelts in to the rivers for transport. In areas with bison nearby, another round of communal hunting provided dried meat to provision the upcoming trip east. Then, soon after the break-up of river ice, the Cree, Assiniboine, and later Northwest and Hudson's Bay company engagees would begin the long trip in canoes and later York boats, paddling over 1500 km to move the pelts to Montreal in the

south, or the main English forts on Hudson's Bay's coastline. In the north supply ships from England would arrive each summer, taking the beaver pelts back to market. And here, in the 1770s, at the mouth of the Churchill the British government built the massive Fort Prince of Wales, primarily to defend the interests of the English company against the French empire (see Preface). The paddlers would then load up with European manufactured trade goods, and make the almost all summer long trip over hundreds of kilometers back upstream. Local groups of native bison and moose hunters on the prairies and parklands would process meats, hides, and robes and store these at depots along the river to help sustain the travellers and provide for the next winter of trapping.



Figure 3.7-1: Hudson's Bay Company's Fort Edmonton on the North Saskatchewan River in 1871 (Horetsky, National Archives Canada). As early as the 1720s, the Cree began their 2000 km trips east from near here to bring furs to the British posts on Hudson's Bay. By the late 1700s both English and Montreal traders moved up the river to established trading posts in this area. Bison were abundant on the nearby plains, and by the early 1800s this fort maintained large gardens to minimize provisioning costs (Silversides 2005).

Trading Center Protocols- Over the centuries dozens of trading posts were established and abandoned, but the main long-term centers were usually located at the confluence of rivers (Figure 3-1), and often in the center of a First Nation's territory. The trading posts were usually sturdy log buildings, but often thinly staffed by Europeans during the summer hide-transport season. The First Nation's territory that the post was located in were often the "middlemen" that travelled and traded with peoples further

afield, and provided the posts with provisions including meat from bison, moose, or fish (Innis 1962). During several periods of time the two main competing companies often had forts in close proximity, each vying for trade from the region's residents. Family groups or larger bands would generally visit the post up to twice a year—once at the end of trapping season in the early spring, and again in the late fall before they returned to their wintering areas (Ray 1998). The European trade goods were held in a secure, dry central storage room, and small groups of sellers and buyers allowed into an adjoining room to exchange their furs, hides, or meat products for trade. Because of the beaver's value, a prime-quality skin called a "made-beaver", or its equivalent was the fixed unit of barter (Newman 1986). Skins were not necessarily exchanged in all transactions, but the "M-B" was the unit of account, and some trading posts could loan, or "up-front" their routine customers with provisions or traps if required in advance of the winter season. At Albany Fort in 1733 the value of one M-B could be exchanged for a range of products such as $\frac{3}{4}$ lb of colored beads, 1 brass kettle, 1 lb black lead, 1.5 lb of gun-powder, 2 lb of sugar, 2 lb of tobacco, 1 gallon of brandy, 8 knives, 2 hatchets, or 12 sewing needles. A gun was valued as 10-12 M-B. A moose hide or fur of a black bear could be exchanged for goods worth 2 M-B. Eventually the Hudson's Bay Company, Canada's largest fur traders, introduced "made-beaver tokens" minted of brass, that could be spent in any of the company's stores. Tokens were being used as late as 1946 as part of the white fox trade in the eastern Arctic (Newman 1986:62-64).

The long period of operation of the northern fur trade (over 3 centuries), and its extensive documentation, particularly through the Hudson's Bay Company archives, has allowed historians to explore the role of native women in the industry (e.g., Brown 1980, Van Kirk 1980, Mitchell 2017, Miller 2018.). The common "mariage a la facon du pays", the marriage between traders and native women, was often highly important for trade. As Miller (2018) comments: "What was involved was marriage and economic partnership, not casual sexual gratification and exploitation." The connection between the traders and their wives' families stabilized and enhanced the exchange of goods between cultures. The women knew the native languages, sources of nutrition, travel routes, and other traditional knowledge that made it possible for a small number of traders to survive and thrive in a vast rugged landscape where they were often outnumbered over 1000 to 1 by local inhabitants. Over the years as a woman's husband and offspring rose through the trading company's hierarchy, she might attain great prosperity and respect. It was often the marriage of her daughters to other traders that most greatly advanced her social standing (Brown 1980)

3.8 Carreteras and Red River Carts: The Last Biologically-Powered Trade Routes

Prior to the 1700s, dogs and humans were the primary transporters in hide and meat trading networks. However, as Native Americans and other people began to use domesticated animals such as the horse, burro, mules and oxen, trade routes for wildlife products became longer and more intensively used. Ultimately, when combined with wheeled carts, this trade began to drive species such as the bison towards extinction (Isenberg 2000). Three examples are 1) The development by the Sioux, starting by the 1820s, of a route used by travois, then wheeled-carts running from Fort Pierre on the Missouri River over 500 km westwards to the upper North Platte River (Hanson 1976). This route brought tens of thousands of bison hides and robes to the Missouri River steamboats and the St. Louis market (White 1978); 2) After treaties with the Comanche in the 1850s, increased use of two-wheeled carreteras to bring bison products from the southern plains to Santa Fe (Hämäläinen 2008); 3) In Canada, the Metis

gradually expanded use of carts to make two trips annually of over 500 km westward from their farms on the Red River in Manitoba to harvest bison on the northwestern plains. In 1876 the Metis and First Nations jointly conducted a great hunt on the last of Canada's bison herds near the Cypress Hills (Colpitts 2015).



Figure 3.8-1: A wheeled cart, and two Cree tipis, the one on the left likely made of canvas, the one on the right of hide, at the elbow of the North Saskatchewan River, Saskatchewan in 1871. Wheeled carts, drawn by horses or oxen greatly increased the number of hides that could be moved to trading posts. Source: Canadian National Archives, File Number NA-1408-15.

3.9 Summary of North American Historical Hide Trade Networks

Raymond Wood's (1980) seminal study of trade networks on the Great Plains observes that: 1) a pan-continental trade network existed for millennia; 2) through this trade, kinships, both real and symbolic, existed between peoples; 3) trade required common languages and translation; 4) ceremonial mechanisms and intermarriage facilitated exchange; 5) the volume of trade varied across space and time depending on resource availability and the relative isolation and hostility between peoples, and 6) trade was conducted largely for profit.

In the above examples, I focus on historic knowledge of hide and fur trade networks, and accentuate cases where the trade extends across different biomes (e.g., Great Plains to the Southwest, Great Plains to the Northwest, and Boreal to the East Coast). These examples show a long tradition Native Americans travelling long distances (>200 km) to hunt bison and other species, and to process then transport some lighter products (dried meat, pemmican, hides, and in some cases even robes) to home camps or trade fairs. The length of some of these trade networks likely increased with the advent of the horse, but the value of some products (e.g., well tanned hides) was such that even with human-only transport, these

would have been moved long distances. Further, on some trade routes, canoes and skin boats were used along rivers (e.g., Missouri, Arkansas, Platte, Saskatchewan, Columbia) facilitated transport of even relatively heavy materials such as robes. By the late 1700s, with the increased use Red River carts and carretas, natives, and metis began to move an increased volume of bison products towards trade centers. Eventually, in the mid-1800s, it was this inherent value of some of these bison products to the Euro-American industrial complex, combined with the advent of steam-driven mechanical travel (paddle wheelers and trains) that nearly caused the extinction of the buffalo (Isenberg 2000).

Some key points:

- Complex trade networks moved hides and other products from areas of surplus or supply to areas of often higher human densities and less wildlife abundance. In return, these traders received agricultural goods (e.g., maize, squash and beans), manufactured products (pottery, textiles), and later, European goods);
- Trade was often brokered by “middlemen” in areas with good security (pueblos, Mandan/Hisdatza villages);
- Trade fairs often occurred at times when food availability was at a maximum such as after fall maize harvest, during mid-summer when bison numbers were highest, or during the summer/fall salmon fishery;
- From all European accounts, Native American traders were highly skilled bargainers. They knew the value of their products, of the goods they were exchanging them for, the economic dynamics of supply/demand, competition/monopoly, and abundance/scarcity. These accounts do not give a strong perception of a “ritual economy” as proposed for various southwest, Mesoamerican and other trade networks (e.g., Mauss 1976, Mills 2002) but rather of a logical materialistic exchange of goods and services with well understood values. This doesn’t mean the routine ritual giving, receiving and redistribution didn’t occur within families, clans and cultures. However, between cultures and relatively independent groups, exchanging fur and hides for other goods was a serious business tied to improving the well-being of participants on each side of a trade;
- Native women were highly involved in the hide trade business in roles including captives, processors of hides and leather, wives of traders, and most importantly as social bridges between different cultures of hunters and gatherers, agriculturalists, and traders.

The well-documented historical information and traditional knowledge discussed above shows that hide trade networks were common across the Great Plains and adjacent areas at AD 1500 and certainly earlier. Moreover, these historical networks are clearly documented to exist in the southwest in the post-1500 AD period. Therefore, it is not a question of whether an extensive hide trade network likely existed in the southwest during prehistoric times between supply areas of abundant wildlife such as bison on the plains and mountains, and the high demand areas of dense human population such as the Hohokam. The main questions center on how, where, and when did these areas of hide supply and demand exist? Who were the main participants in the hide trade? What were the main items of exchange for hides? What travel routes were used by people involved in this exchange? Can we identify, similar to historical hide trade networks, central locations where this trade took place?

4. HIDE DEMAND: HUMAN DENSITY IN SOUTHWEST AND ADJACENT REGIONS

Hide and leather materials are rarely found in archaeological sites. Due to their high utility and nutritional value, they may be recycled by people until nearly gone, with remaining scraps eaten by animals or people, or rapidly decomposing under most conditions (Harris and Veldmeijer 2014). However, given that hide products were valued by many cultures for many purposes (Sections 2 and 3 above), one method to evaluate hide demand is to estimate past human densities. Moreover, human density and demand for hides, through hunting, is also an important factor determining the distribution and density of animals—the hide supply (Szuter and Bayman 1989, Driver 2011). Thus, a broad regional perspective of human density over time is useful to understand both supply and demand for hides, and particularly for a wide ranging, and highly valued species such as bison.

Thornton (2000) summarizes historical North American native population estimates. These vary greatly (e.g. 1 to 8 million), but most researchers agree on relative general spatial estimates of human density based upon the availability of plant, animal, and aquatic resources (e.g., Kroeber 1947, Bamforth 1988:151-152, Johnson 2014). Binford (2001) evaluated the potential density of over 200 historic pre-agricultural human cultures world-wide based upon modern climatic data. This “terrestrial model” assumes that: 1) the abundance and availability of food (plant productivity and animal biomass) are the primary factor determining human population density, 2) all food comes from terrestrial species, and 3) complex cultures or technology (e.g., irrigation) are not used to produce food or cultures (Binford 2001:187-188), and 4) the hunter-gatherer populations using the resources have reached an equilibrium intensification level. Johnson and Hard (2008) used Binford’s climatic prediction equations to map potential pre-agricultural human densities for the southwest and adjacent middle America (Figure 4-1). As would be expected, potential pre-agriculture human densities are highest in regions where climatic conditions favor high native plant and animal productivity such as the Yucatan, central Mexico, and up the Caribbean coast into Texas.

The expansion of agriculture from central America into the southwest and Mississippi valley greatly altered regional human distribution and densities (Calloway 2003: 72-75). By 500 AD, large sedentary agricultural cultures arose in southwest locations such as Hohokam along the Gila River (Fish and Fish 2007), Anasazi along the San Juan River (Cordell and McBrinn 2016), and further east along the Mississippi River at locations such as Cahokia (Emerson and Lewis 1991). Below I describe potential human densities for the southwest and adjacent regions.

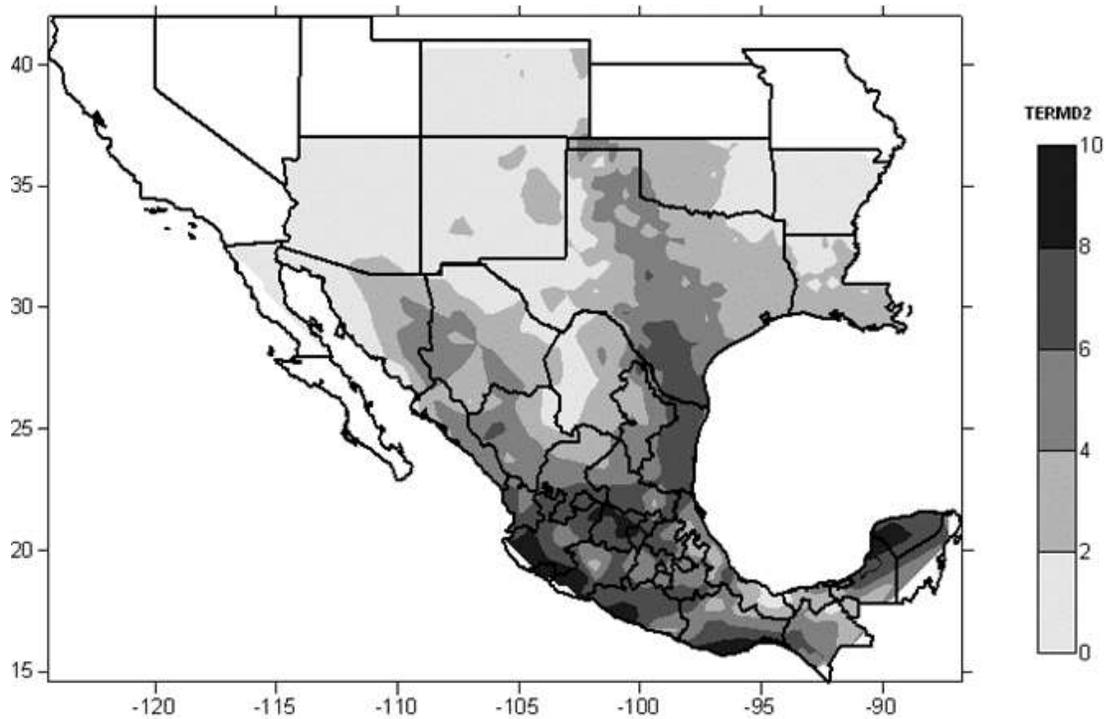


Figure 4-1. Terrestrial model of potential human population density prior to adoption of agriculture as expressed in the number of individuals per 100 sq km (TERMD2) from Johnson and Hard (2008).

4.1 The Southwest

Prior to the advent of irrigated agriculture, much of the southwest likely had low human densities (Figure 4-1). By 200 BC humans began planting maize, squash, and beans along southwest streams, and with more sedentary life styles, higher human densities and the use of pottery became common across the southwest before AD 300 (Plog 2008, Cordell and McBrinn 2016). By AD 1200 some areas had very high (>500/100 sq km) human densities (Hill et al. 2004, Wilcox et al. 2008; Figure 4.1-1). At ~ AD 1200 the highest densities of people were the Hohokam occupying the confluence of the Gila, Verde, and Salt rivers (near modern-day Phoenix, AZ), the Anasazi settlements in the San Juan watershed in the Four Corners region, and the growing settlements in the Rio Grande valley.

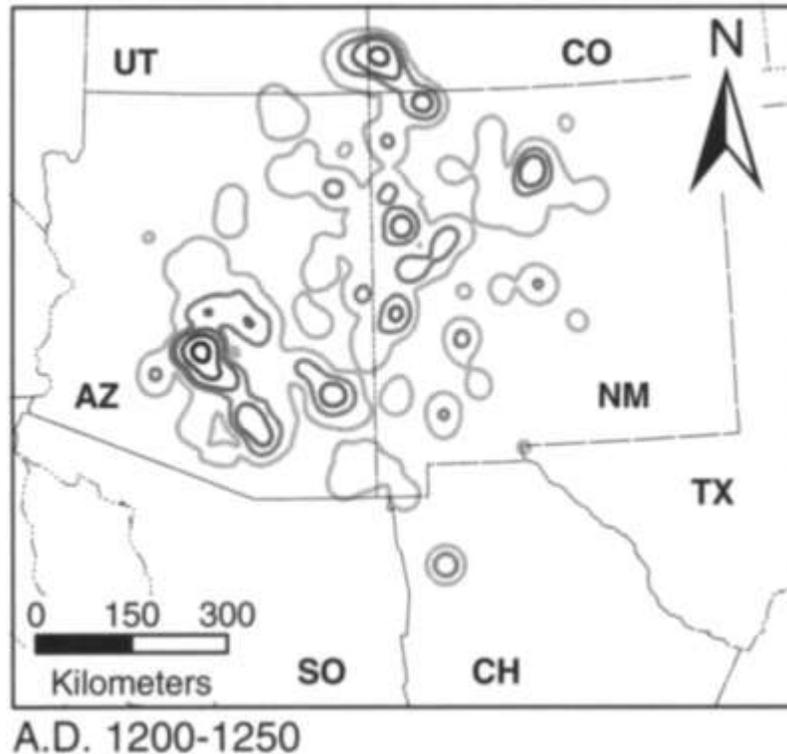


Figure 4.1-1 Southwest population density estimated for the period AD 1200-1250 from the density of structures as dated from tree-ring analysis. Contour lines from light dark represent 10, 50, 100, 250, and 500 people/100 km² (from Hill et al. 2004).

4.2 Southern Plains and Texas

Across much of Colorado, western Oklahoma and Texas, and eastern New Mexico, climatic conditions were unfavorable for agriculture until the advent of European crops and technology. Binford's (2001) model would predict low human densities (< 10 people per 100 sq km) across most of the southern plains (Figure 4-1). For Texas, Johnson and Hard (2008) observe that evidence of cultigens such as maize and squash is not common in archaeological sites. Early historical records, such as from de Vaca's 1532-1536 trip across Texas substantiate this (Geist 2018). As a potential explanation for low cultigen use, Johnson and Hard (2008) use a modified a human growth rate form of Binford's model, and include the availability of aquatic resources (Figure 4.2-1). They suggest that, counter-intuitively, this level of productivity actually discouraged the adoption of agriculture across much of the region because the existing high availability of terrestrial and aquatic food resources. However, even in the absence of agriculture, at high reproduction rates (>.012, or 1.2%) human densities will rapidly approach 6-10/100 km², and this is predicted to have prehistorically occurred across much of central Texas and along the Caribbean coast.

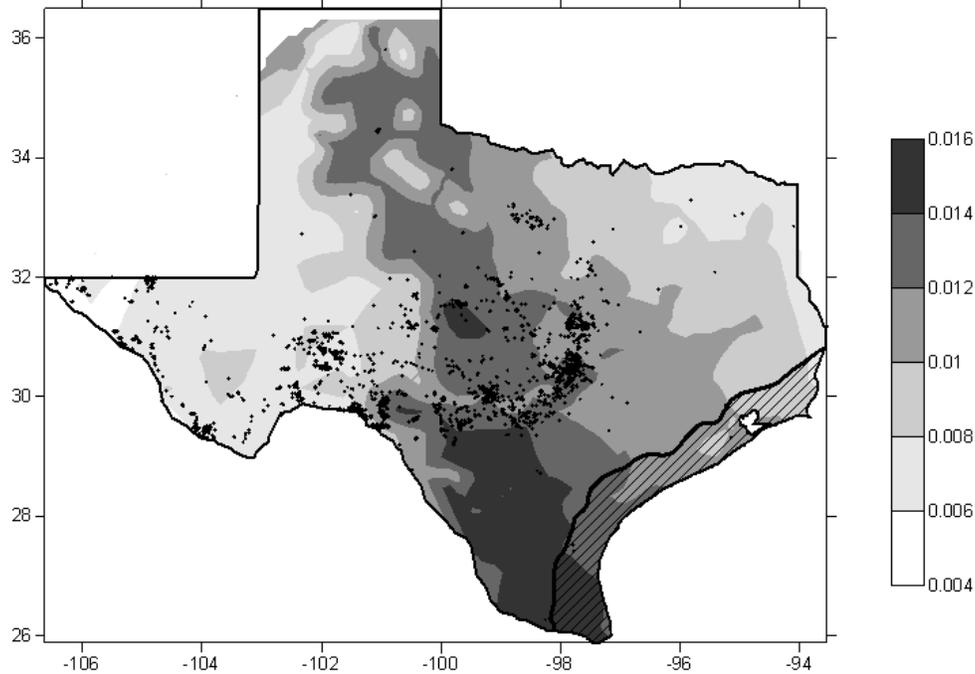


Figure 4.2-1. Predicted prehistoric human reproduction rate for Texas from a combination of terrestrial, aquatic and marine resources modified from Binford's (2001) model by Johnson and Hard (2008).

4.3 Central Plains

Cold and dry conditions limited resource productivity on the central plains in the pre-agriculture period. Human population densities (Figure 4-1) generally estimated at less than $2/100 \text{ km}^2$ (Kroeber 1947, Bamforth 1988:151-152, Johnson and Hard 2008). Then at about AD 500, possibly due to connectivity with southwest or Mississippian cultures, people in the Apishapa region on the headwaters of the Arkansas River (Figure 4.3-1) began to practice horticulture (Zier 2018). The greatest occurrence of maize, beans and possibly squash in archaeological sites occurred between AD 550 and 1350. In general, Zier (2018) observes that the timing of the adoption of agriculture in the Arkansas basin corresponds with human population growth curves for eastern Colorado developed by Gilmore (2008) based on summed probability distributions of calibrated radiocarbon ages for archaeological sites. For the Arkansas River basin, Gilmore's data shows a gradual increase in human populations until about AD 100, a decline until about A.D. 400, followed by a steady increase until around AD 1250-1300, far above any numbers estimated previously for the region. A major decline then followed and by AD 1500 the Apishapa region was lightly used by humans (Gilmore 2008: 87-122).

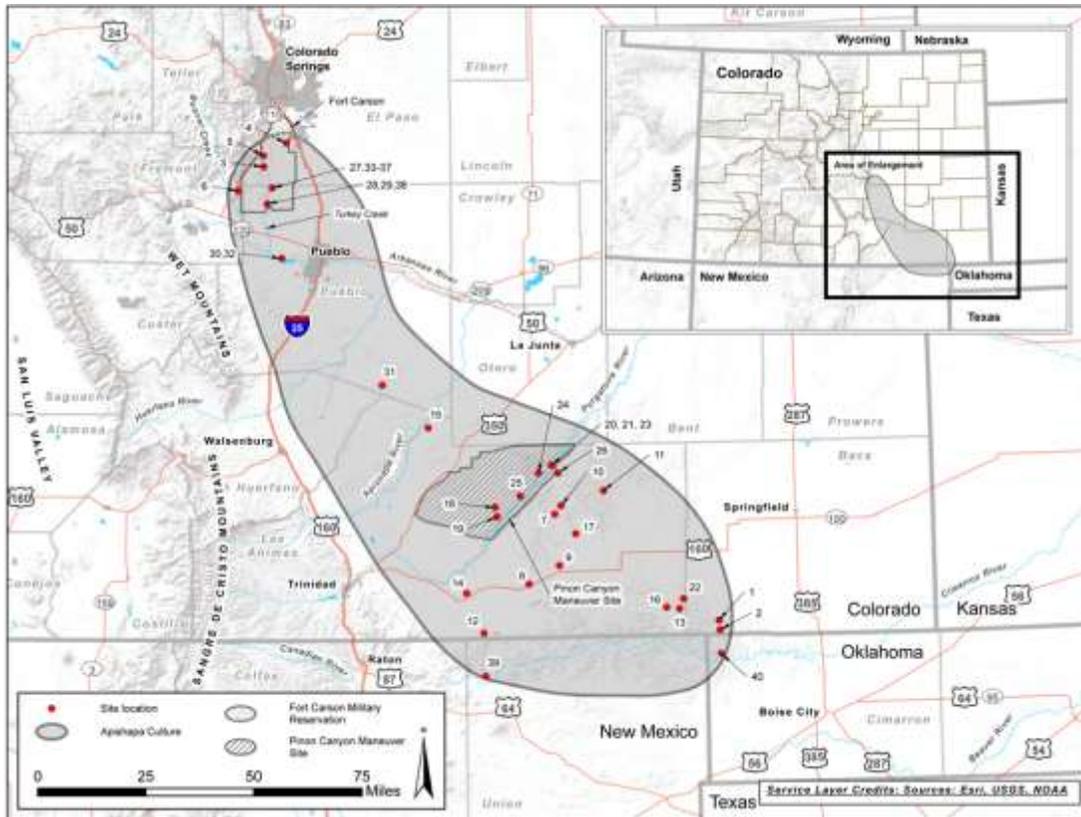


Figure 4.3-1. The Apishapa cultural region on the headwaters of the Arkansas River in Colorado, New Mexico and Oklahoma showing archaeological sites with evidence of maize horticulture during the period AD 500 to AD 1300. Reproduced from Zier (2018) by permission of Paleocultural Research Group.

4.4 Rocky Mountains and Interior Basin

Seasonally deep snows or drought conditions limited human use of both the Rocky Mountains and higher elevations of the Interior Basin to the west of the mountains. Native American populations are generally estimated at less than 2/100 km²m (Kroeber 1947) and there is little record of an early adoption of agriculture in these regions (Figures 4-1, 4.1-1).

5. HIDE SUPPLY: WILDLIFE ABUNDANCE IN SOUTHWEST AND ADJACENT REGIONS

Hides were largely supplied by three broad groups of species: 1) bison, 2) other artiodactyls (elk, deer, antelope, bighorn sheep), and 3) small mammals (hares, rabbits, ground squirrels etc.). Abundance of these species is dependent on two major groups of trophic interactions: 1) “bottom up” factors relating food, water, shelter and other characteristics of habitat quality; and 2) “top down” factors related to numeric and behavioral effects by humans, grizzly bears, wolves, and other predators. These broad groups of factors are highly interactive. For example, prey species may reduce their predation risk by utilizing areas of low predator density, dense cover or rugged terrain. In dry landscapes, predation risk may be highest near limited sources of water, and increase dramatically during times of drought.

Using data hunter-gatherer societies around the world, Binford (2001) describes that as human population density increases, dependence on terrestrial animals decreases such that there are no ethnographically documented hunter-gatherers primarily dependent on hunting terrestrial animals beyond the densities of about 10 persons/100 km² (Binford 2001:381). At this density humans are primarily utilizing other resources (terrestrial plants, aquatic and marine plants and small animals), but hunting can remain intense, and there are few vacant spaces or safe refuges for large terrestrial animals between human groups. For North America, the daily wildlife and human observations by the Lewis and Clark expedition (Moulton 1986 to 1993) allow detailed analysis of wildlife response to human densities across a range of habitats (Martin and Szuter 1999, Laliberte and Ripple 2003, Kay 2007). Again, these analyses show that the abundance of large animals declines as human densities increase. Kay (2007) specifically tested the predictions of optimal foraging theory as applied to humans (Winterhalder and Smith 2000, Broughton et al. 2004). Kay’s study quantified the abundance of wildlife species from Lewis and Clark’s daily journals as they entered areas of higher human density in the core of tribal territories (e.g. Mandan and Nez Percé villages). Animal abundance declined sequentially from largest to smallest species in the following order: bison, elk, mule deer, antelope, white-tail deer, small mammals and birds (Kay 2007). The largest mammals-- bison and elk-- were only abundant in buffer zones between human groups at war.

These observations generally follow a theoretical model for predicting foraging conditions for when humans will use low quality foods (Bettinger 1991, Winterhalder 1981, Smith 1983; Winterhalder and Smith 2000). For the southwest, using this perspective, Troyer (2012) viewed three groups of wildlife species in a generalized diet-breadth model (Figure 5-1). Bison, providing the highest post-encounter return rates in terms of kilocalories per hour of hunting time would have highest return rate and will be sought out by human hunters until they become rare. Next, other artiodactyls such as elk, deer, and antelope will be hunted. As these become less abundant, a broader range of resources such as hares, other smaller mammals, and plant should dominate diets. As noted above, the human population threshold for when the transition towards plant use and small mammals dominate diets appears to be about 10 persons/100 km² (Binford 2001, p. 381).

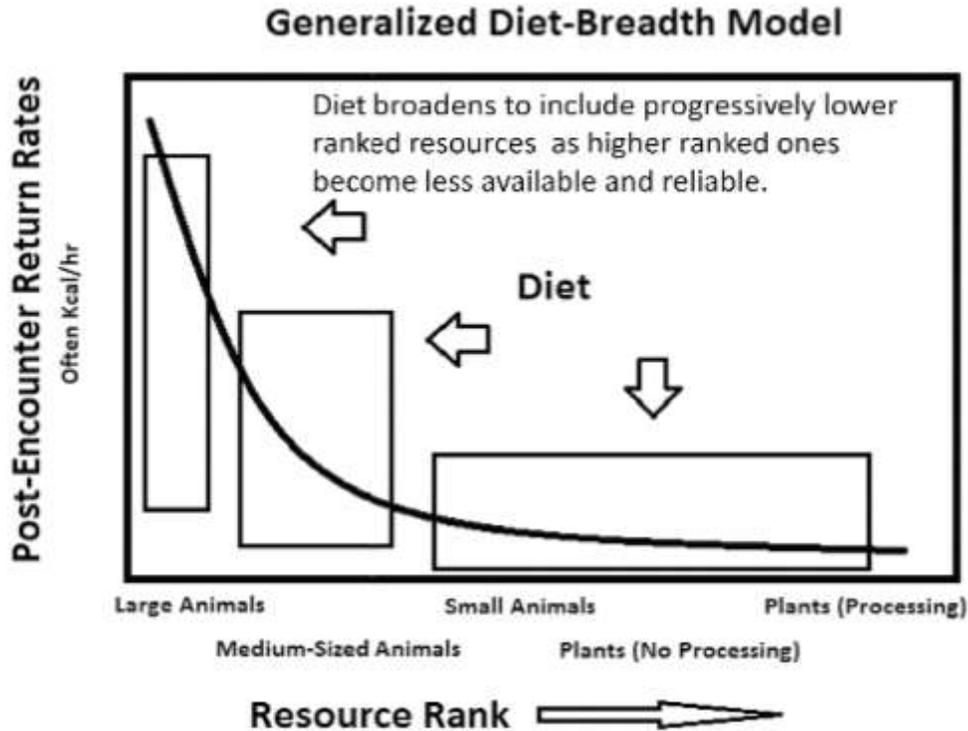


Figure 5-1: Generalized diet breadth model (from Troyer 2012). Hunters and foragers will utilize highest value resources until availability decreases, then broaden diet if these become rare.

Prehistoric wildlife abundance for the southwest region (generally west of the Pecos River) has been described by researchers including Szuter and Gillespie (1994), Driver (1990b, 2011), Cannon (2000), Nelson and Schollmeyer (2003), Broughton et al. (2010), and Schollmeyer and Driver (2012). For the Great Plains, Cooper (2008) evaluated relative abundance of bison for periods after 500 years BP. This information is relatively coarse over time and space. A higher resolution for wildlife density for the historic period (AD 1534-1852) is available from first person journal observations in the Western North America Journal Observations database (WNA-JOBS, 2020). The database and accompanying Google Earth map currently hold >10,000 journal-days of early traveller wildlife observations tallied following the methods of Kay (2007). Figure 5-2 provides an overview map of this data. For finer resolution, readers should download the most current Google Earth .kmz and Excel database files from: <https://lensoftimenorthwest.com/themes/lens-northwest-files/google-earth-map-journal-wildlife-observations/>

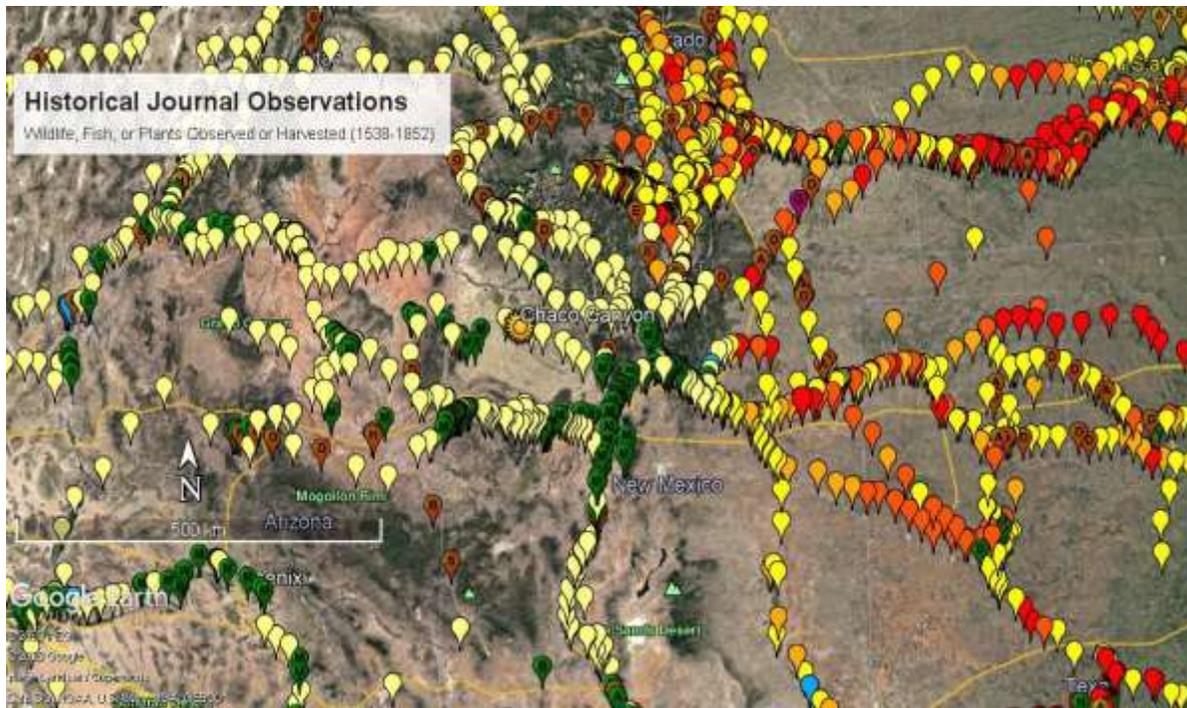


Figure 5-2: Historical journal observations of wildlife, fish, and plants observed or harvested for the period AD 1538 to 1852 for the Chaco Canyon area and adjacent regions (WNA-JOBS 2020). Daily journal observations are illustrated by yellow (Great Plains, no observations for day), pale yellow (interior southwest no observation), pale green (California or eastern woodlands no observation), red (bison numerous), orange (bison or bison sign observed), and brown indicates observations or signs of antelope (A), black bear (B), deer (D), elk (E), wildfowl (F), hares or rabbits (H), and bighorn sheep (S). Grizzly bears are a purple G. Green indicates use of maize (M), beans (B), squash (S), pine nuts (P), or undifferentiated (U). Use of fish is indicated by dark blue (heavy) and moderate (moderate shading). For detailed locations, dates, and wildlife/plant use observations download map and database from the Western North America- Journal Observations database (WNA-JOBS 2020):

<https://lensoftimenorthwest.com/themes/lens-northwest-files/google-earth-map-journal-wildlife-observations/>

Below, I describe wildlife densities (hide supply) for the southwest and adjacent regions using the above research, and emphasizing the potentially strong relationship between human density and wildlife abundance. I proceed from areas of potentially highest wildlife abundance (Central Great Plains) to lowest (agricultural zones in the southwest).

5.1 Central Plains

The Central Plains along Platte River, and its connections to the central and southern areas of the Rocky Mountains through South Pass, and directly to the Southern Plains, was a key and stable source of wildlife and hide abundance for the southwest.

Bison- During the historic period, first person journal observers (c.1742 to 1850) record abundant bison on the Central Plains, particularly along the upper Platte and Arkansas rivers (Figure 5-2) and on the eastern slopes of the Bighorn Range (White 2018). The North Platte and Sweetwater rivers and their tributaries provided water sources with adjacent broad flat rangelands that allowed bison to cross over South Pass onto the western slopes of the Rockies. Cooper (2008) analysed the study results from over 900 provincial and state archeological sites where bison hunting or processing was inferred from bone material. The abundance of bone matter was plotted by site for the Great Plains, and smoothed for three time periods after AD 500 to show general abundance patterns at the biome level (Figure 5.1-1). with relatively lower numbers of bison on the central and southern plains prior to AD 900, and a sharp increase in numbers and expansion of the range during the period AD 1250 to 1700.

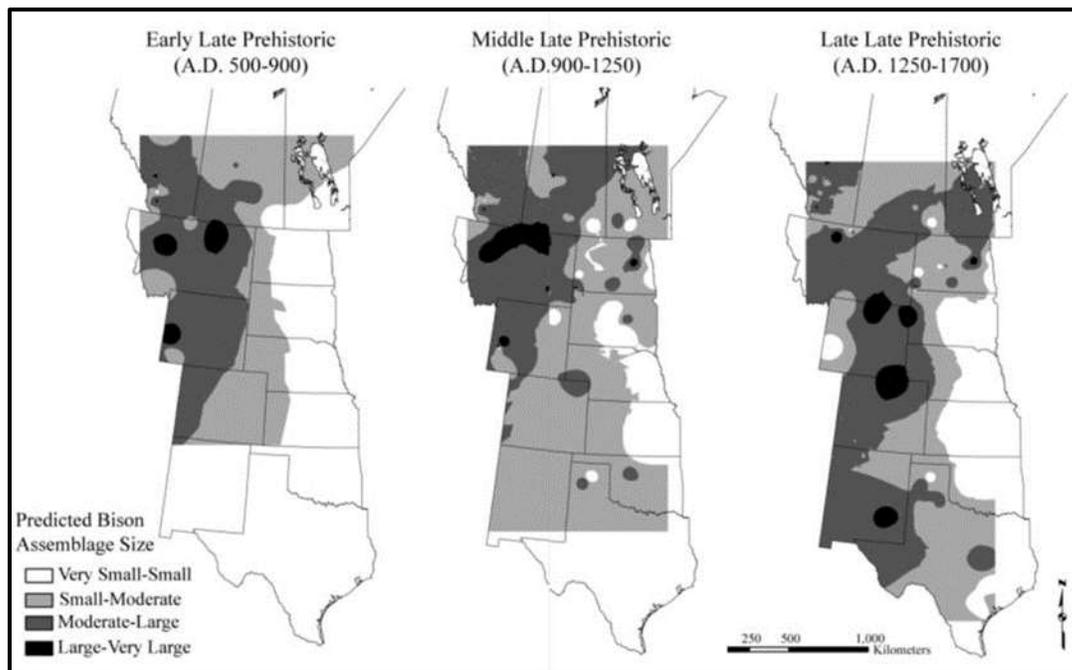


Figure 5.1-1. Patterns of bison populations inferred from predicted bone assemblage for archaeological sites for 3 time periods from A.D. 500 to A.D. 1700 (from Cooper 2008).

Other Artiodactyls- The historical journal dataset (Figure 5-2) indicates relatively common observations across the Central Plains of elk, antelope, and deer (mule-deer to west, white-tail to east). Kornfeld et al. (2010) extend this observation of abundance of these species back into prehistoric period.

5.2 Southern Plains and Texas

The Southern Plains and Texas appear to have had variable wildlife past wildlife abundance. Bison, deer and antelope are the most common hide-bearing animals on the southern plains during the historic period (Figure 5.2-1), but deer and antelope are not as common as on the central plains.

Bison- The numbers of bison on southern plains in the prehistorical period is highly variable. Dillehay (1972) evaluated faunal lists from 160 archaeological and paleontological sites in the Southern Plains, and described long-term periods of presence and absence of the genus *Bison* in the region. Two absence periods are from about 6000-5000 BC to 2500 BC and AD 500 to AD 1200-1300. He observed that these long-term changes seem to indicate a combination of fluctuating bison population densities and range shifts. Lohse et al. (2014a,b) used a XAD-purified AMS radiocarbon method to date 62 bison specimens from different contexts on the very southern extent of the Great Plains in the central Texas area, including the uplifted Edwards Plateau and extending to the Coastal Plain. Bison were present during the periods ~4455-4315 BC, ~1795-1630 BC, ~1200-650 BC, and the final period beginning in the Late Prehistoric period starting about AD ~1300. This last period of abundance extends to later historical accounts documenting that by AD 1540 the buffalo's range had clearly reached southwards into Texas, and in later years they were seen in abundance as far south as the Caribbean coast (Roe 1972, WNA-JOBS database 2020) near Houston (Figure 5.2-1).

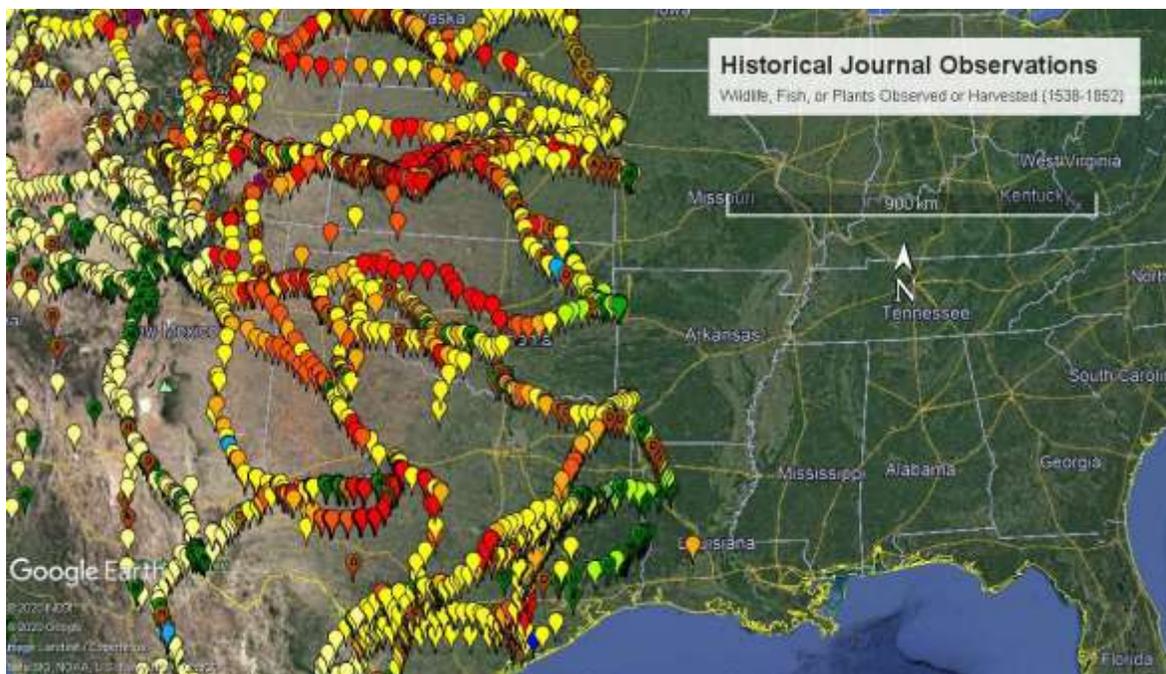


Figure 5.2-1: Historical journal observations of wildlife, fish, and plants observed or harvested for the period AD 1538 to 1852 for the Southern Plains and adjacent regions (WNA-JOBS 2020). Daily journal observations are illustrated by yellow (Great Plains, no observations for day), pale yellow (interior southwest no observation), pale green (California or eastern woodlands no observation), red (bison numerous), orange (bison or bison sign observed), and brown indicates observations or signs of antelope (A), black bear (B), deer (D), elk (E), wildfowl (F), hares or rabbits (H), and bighorn sheep (S). Grizzly bears are a purple G. Green indicates use of maize (M), beans (B), squash (S), pine nuts (P), or undifferentiated (U). Use of fish is indicated by dark blue (heavy) and moderate (moderate shading). For detailed locations, dates, and wildlife/plant use observations download map and database from the Western North America- Journal Observations database (WNA-JOBS 2020):

<https://lensoftimenorthwest.com/themes/lens-northwest-files/google-earth-map-journal-wildlife-observations/>

Determination of causal factors for variable bison abundance and range shifts on the southern plains remains inconclusive. Assuming that climate change was a primary driver, Lohse et al. (2014b) describe that central Texas proxy climate records are often contradictory and difficult or impossible to reconcile. They conclude that bison were consistently associated with cool climates, although each of these events differs in terms of effective moisture and degree of coldness. As described in Section 4.2 above, a contributing factor may be that humans, largely dependent on aquatic and plant resources, could over time have increased to high densities (e.g., >10 persons/100 km²) across much of Texas (Johnson and Hard 2008, Johnson 2014) and may have had localized high densities in agricultural areas such as the headwater's of the Arkansas River in southern Colorado (Gilmore 2008, Zier 2018). Humans at these densities would depress preferred prey such as bison, and possibly other ungulates to low numbers. If human predation was important, the general collapse of human cultures and trade networks ~AD 1200-1400 across North America's south central and western areas (Benson et al. 2007, Emerson and Hedman 2016; Hill et al. 2004, 2010) could have reduced human densities from the Arkansas River southwards, and thus allowed bison numbers to increase and allow large herds to eventually expand southwards across the plains and into central and southern Texas (Figures 5.1-1 and 5.2-1).

Other Artiodactyls- Early in the historical period, wildlife was uncommon in southern Texas. Geist (2018) summarizes observations of the de Vaca's 1534-36 observations as follows:

Nor did Cabeza de Vaca see pronghorns. The most common big game animal was the white-tailed deer, which was avidly hunted, and whose hides were widely used for cover and warmth. However, the availability of venison was not common, and such had to be consumed quickly lest a native took it away by force. Natives also pounded and ate bones.... Only in west Texas does Cabeza de Vaca encounter areas rich in wildlife, and this may be no-man's land between warring tribes. Deer were so uncommon, so efficiently hunted, that natives made "expeditions for such" into areas where the natives themselves had to carry wood and water. Upon arrival in these inhospitable places, they quickly killed deer, consumed such, and used them for provision on their home journey. In short, where there was wood and water, natives were occupying the land and there were no deer.

Wolverton et al (2008) evaluated white-tailed deer bones in Texas archaeological sites, and concluded that prehistorically, due to predation by humans and other species, the deer were less abundant than at present, and due to less competition for food, grew to a larger size.

5.3 Southern Rocky Mountains

First person journal observations (Figure 5.3-1) and archaeological site data shows that although wildlife was likely not as common as on the plains, a wider diversity of species occurred in the Southern Rockies, and localized areas periodically have high abundance (Benedict 1992, 1996; Anderson 2003, Pitblado and Brunswig 2007, Kornfeld et al. 2010, Brunswig 2015).

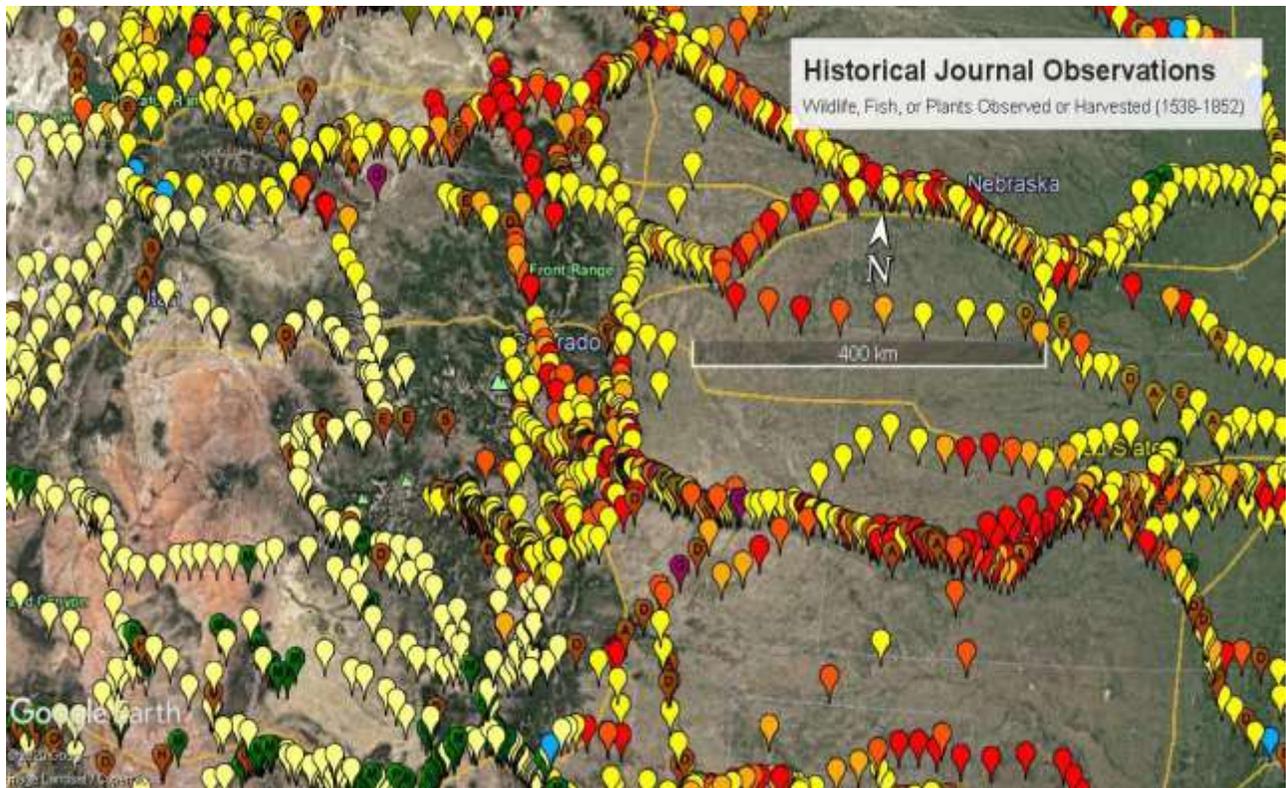


Figure 5.3-1: Historical journal observations of wildlife, fish, and plants observed or harvested for the period AD 1538 to 1852 for the Southern Rocky Mountains and adjacent regions (WNA-JOBS 2020). Daily journal observations are illustrated by yellow (Great Plains, no observations for day), pale yellow (interior southwest no observation), pale green (California or eastern woodlands no observation), red (bison numerous), orange (bison or bison sign observed), and brown indicates observations or signs of antelope (A), black bear (B), deer (D), elk (E), wildfowl (F), hares or rabbits (H), and bighorn sheep (S). Grizzly bears are a purple G. Green indicates use of maize (M), beans (B), squash (S), pine nuts (P), or undifferentiated (U). Use of fish is indicated by dark blue (heavy) and moderate (moderate shading). For detailed locations, dates, and wildlife/plant use observations download map and database from the Western North America- Journal Observations database (WNA-JOBS 2020): <https://lensoftimenorthwest.com/themes/lens-northwest-files/google-earth-map-journal-wildlife-observations/>

Bison- Historically bison were relatively common along the eastern slopes of the Southern Rocky Mountains (Figure 5.3-1) and are periodically recorded in along the western slopes in an expanding wedge north of the Rio Grande headwaters (Meaney and Van Vuren 1993). Prior to AD 1300 large herds may have not extended south of the Arkansas River along the eastern slopes and plains (Figure 5.1-1, see section 5.2 above). Both historically and during some pre-historic periods, bison were relatively abundant in the South Pass region of the continental divide (White 2018), and herds reached westwards through the pass as far as the Great Salt Lake, and southeast on the Rockies western slopes to the south slopes of the Uintah Range. However, as Fremont (Jackson and Spence 1970:491-492) observed for the historic period:

“In that region lying between the Green or Colorado river and the head-waters of the Rio del Norte, over the Yamjpah, Kooyah, White, and Grand rivers—all of which are the waters of the Colorado—the buffalo never extended so far to the westward as they did on the waters of the Columbia; and only in one or two instances have they been known to descend as far west as the mouth of White river.”

An important route for bison movement likely existed along a central corridor of connected inter-mountain valleys in the Colorado Rockies linking large grasslands on headwaters of the North Platte (the Bull Pen) southwards to North Park, Middle Park, South Park (known as Bayou Salade in the 1800s), and even as far south as the San Luis valley (Fryxell 1926, 1928; Meaney and Van Vuren 1993). Historical observers frequently observed bison along this corridor. For example, in 1839 Thomas Farnham was guided by “Kelly”, a veteran mountain man of region. Farnham (1843:231) recounts Kelly’s description of bison movements:

“The buffalo come into these valleys from the north through the Bull Pen, and go out there when the storms of the autumn warn them to fly to the south for warm winter quarters. But that valley off there, (pointing to a low smooth spot in the horizon), looks mighty like Boyou Salade, my old stamping ground. If it should be, we will have meat before the sun is behind the snow.” ...

A day later, Farnham (1843:241) recorded:

About ten o'clock we came upon a fresh trail, distinctly marked by hoofs and dragging lodge poles. Kelly judged these “signs” to be not more than twenty four hours old, and to have been made by a party of Eutaws which had passed into Boyou Salade to hunt the buffalo.....

And the next day, as they travelled north to ascend Boreas Pass, he described the view southwards across their route across South Park (Farnham 1843:246):

This is a bird's-eye view of Boyou Salade, so named from the circumstance that native rock salt is found in some parts of it..... A sweet spot this, for the romance of the future as well as the present and past. The buffalo have for ages resorted here about the last days of July, from the arid plains of the Arkansas and the Platte.

A partial explanation for the corridor's attraction to bison maybe the timing of grassland green-up (phenology) in the Platte watershed and the intermountain corridor valleys. Figure 5.3-2 shows the day of year that half of peak greenness occurs. This is considered an important metric of spring leaf-out. Greenness is calculated from satellite sensors that measure light reflectance from vegetation. Pixel values are the median day of year (2001-2017) the greenness of a pixel first reached 50% of the annual maximum (USA National Phenology Network 2019). Green up starts earliest (about the 120th day of the year, or early May) on the Central Plains bison winter range, then advances up in elevation, providing peak forage production in about mid-August in North, Middle, and South Parks. This phenomenon is called the "Green Wave" by wildlife ecologists. All other factors being equal, herds of bison and other ungulates tend to follow it upwards in elevation through the spring and summer season to obtain a maximum quantity of good quality forage (Merkle et al. 2016, Geremia 2018). Fryxell (1926) also recognized that this pattern of bison migration might have historically occurred in the upper Platte River watershed.

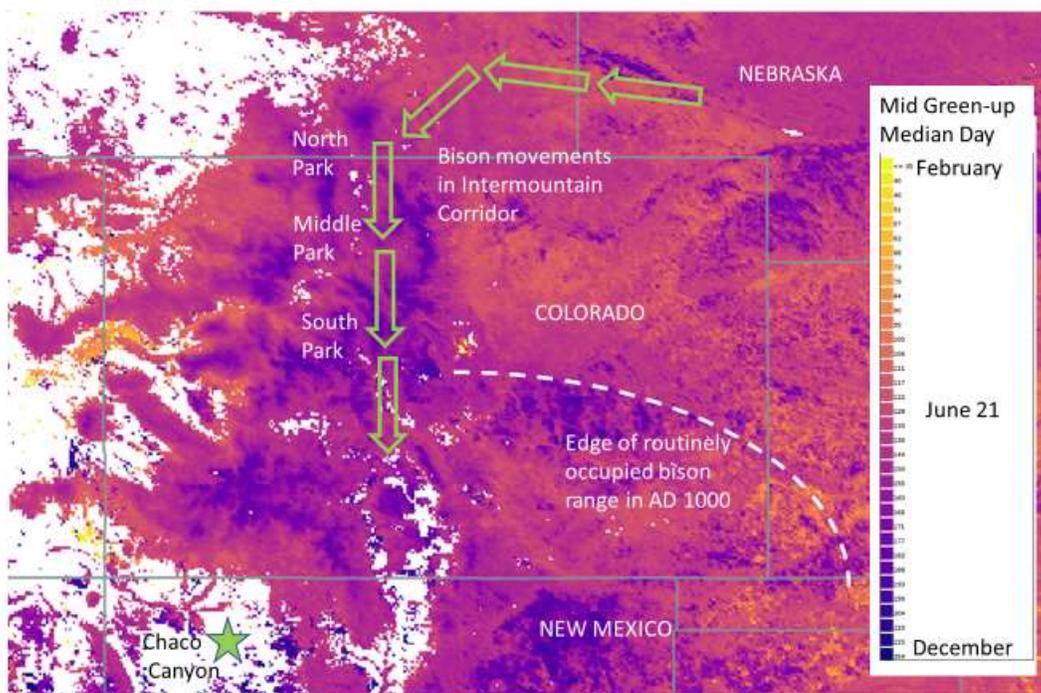


Figure 5.3-2. Median day of year (2001-2017) the greenness of a pixel first reached 50% of the annual maximum (from USA National Phenology Network 2019) and potential historical bison movements from winter range along the Platte River in Nebraska into an intermountain corridor connecting North, Middle, and South Parks in the Southern Rocky Mountains. In the mountains, dark purple indicates alpine meadows that have maximum herbage late in the season.

Once within the valleys of the Rockies, bison can be more easily contained or driven by Native Americans, either by purposeful hunting patterns or bison's response to humans (Arthur 1962, 1966; Frison 2004, see analysis in White 2018). For example, in late June 1844 Fremont was ascending the Blue River between Middle and South parks, and he described Native American (likely Utes) having driven bison out of the valley:

Here the river diminished to 35 yards, and, notwithstanding the number of affluents we had crossed, was still a large stream, dashing swiftly by, with a great continuous fall, and not yet fordable. We had a delightful ride along a good trail among the fragrant pines; and the appearance of buffalo in great numbers indicated that there were Indians in the Bayou Salade, (South Park,) by whom they were driven out. We halted to noon under the shade of the pines, and the weather was most delightful. The country was literally alive with buffalo; and the continued echo of the hunter's rifles on the other side of the river for a moment made me uneasy, thinking perhaps they were engaged with Indians; but in a short time they came into camp with the meat of seven fat cows.... (Jackson and Spence 1970:715-716)

The party continued over the pass into Bayou Salade (South Park) and Fremont recorded: *On the following day, we descended the stream by an excellent buffalo trail, along the open grassy bottom of the river.... (Jackson and Spence 1970:718)*

Heap (1854) describes that bison herds moved even further southwards down the corridor to the San Luis Valley at the headwaters of the Rio Grande (Figures 5.3-3, 5.3.4). In 1853, as his group left the valley and began to ascend Cochetopa (Buffalo) Pass he recorded:

The pass and creek are so called, from the large herds of these animals which entered Sahwatch and San Luis valleys through this pass, from the Three Parks and Upper Arkansas, before they were destroyed, or the direction of their migration changed, by the constant warfare carried on against them by Indians and New Mexicans. A few still remain in the mountains, and are described as very wild and savage. We saw a great number of elk-horns scattered through these valleys; and, from the comparatively fresh traces of buffaloes, it was evident that many had visited the pass quite recently.

Archaeological evidence for long-term intermountain corridor movement of bison and humans remains tentative, and largely focussed on the paleo-Indian period (before c. 7000 years BP). Benedict's (1996) "rotary or grand circuit seasonal transhumance system" is consistent in many respects with the intermountain corridor concept. Brunswig (2015) has given this model further consideration and describes that archaeological evidence suggests that long-term human use of the corridor may have originated from cultures with western slopes origin in contrast to the eastern slopes as proposed by Benedict. If so, this is consistent with the evidence that later prehistoric cultures such as the Fremont and proto-Ute that were also connected to the southwest trade networks could have been involved in bison movements in the North, Middle, South parks and upper San Luis valley corridor.

La Veta Pass, linking the upper Arkansas River to the San Luis Valley (Figure 5.3.3), likely also played an important role for bison movements into the southern end of the inter-mountain corridor that varied over time. The same "green-wave" plant phenological production that attracted bison to the headwaters of the Platte River also occurred along the eastern slopes of the Rocky Mountains on the upper Arkansas (Figure 5.3.2). During the historic period bison were likely fairly abundant in late summer and the fall near the present-day location of Pueblo (Figure 5.3.3). Indeed, both Zebullon Pike in 1806 (Pike 1895) and Jacob Fowler in 1825 (Coues 1898) report abundant bison here in the late fall. Fowler's journal recounts encountering a massive camp of over 700 tents from several tribes that had

appeared to have carefully contained a bison herd against the eastern slopes of the Rockies in November, 1825. The Native Americans insisted that the Americans camp further downstream from them on the Arkansas (east of Pueblo), but routinely supplied them with bison meat:

the Indians Still talk of moving but as yet Remain Heare—the furnish [us] With Plenty of the best of buffelow meet at a low Rate but do not Wish us to Hunt them our Selves—aledgeing We Wold drive the Buffelow all off.....(Coues 1898)

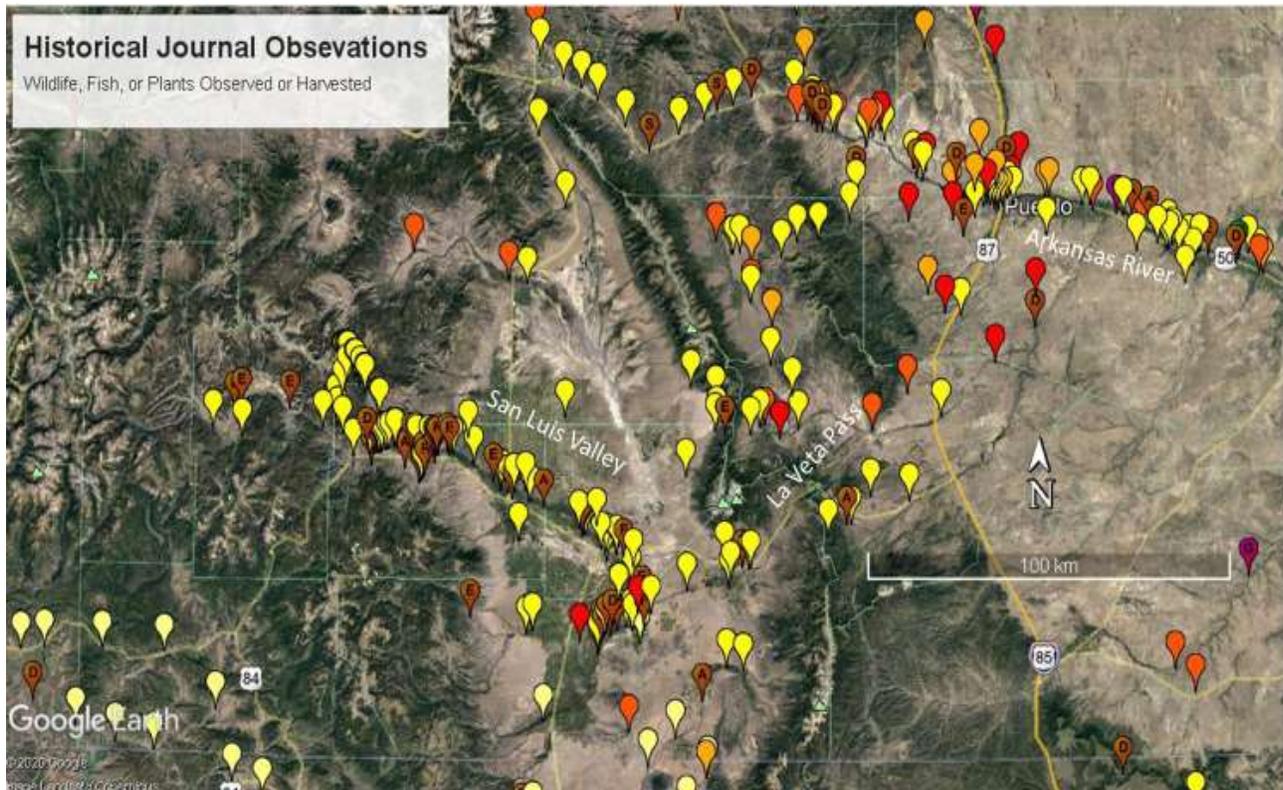


Figure 5.3-3: Historical journal observations of wildlife, fish, and plants observed or harvested for the period ~AD 1700 to 1852 for the upper Arkansas River and Rio Grande River (San Luis Valley) and adjacent regions (WNA-JOBS 2020). La Veta Pass likely was an important bison movement route during some time periods. Daily journal observations are illustrated by yellow (Great Plains, no observations for day), pale yellow (interior southwest no observation), pale green (California or eastern woodlands no observation), red (bison numerous), orange (bison or bison sign observed), and brown indicates observations or signs of antelope (A), black bear (B), deer (D), elk (E), wildfowl (F), hares or rabbits (H), and bighorn sheep (S). Grizzly bears are a purple G. Green indicates use of maize (M), beans (B), squash (S), pine nuts (P), or undifferentiated (U). Use of fish is indicated by dark blue (heavy) and moderate (moderate shading). For detailed locations, dates, and wildlife/plant use observations download map and database from the Western North America- Journal Observations database (WNA-JOBS 2020): <https://lensofthenorthwest.com/themes/lens-northwest-files/google-earth-map-journal-wildlife-observations/>

Given its low elevation and large areas of grass cover (Figure 5.3-3), its likely that La Veta Pass and nearby narrower passages through the Rockies were routinely crossed by bison during periods when bison frequented the upper Arkansas River such as in the 1700s and 1800s. This would maintain a relatively stable supply of bison “on the hoof” in the San Luis valley on the upper Rio Grande (Figure 5.3-4), and these bison would be contained in the valley by winter snows. During the period AD 550 to 1300 the region of the eastern slopes of the Rockies near the Arkansas valley was occupied by a relatively dense population of humans who both hunted and farmed (Zier 2018, Section 4.3). This would have restricted bison use of these routes. However, archaeological evidence (Cooper 2008) indicates bison may have remained moderately abundant just to the northeast on the plains between the Platte and the Arkansas rivers (Figure 5.1-1), and the “green wave” of plant production (Figure 5.3-2) and water sources on the Arkansas River would still periodically draw these bison to the La Veta Pass area where they could be contained by human hunters, or even driven over the pass into the San Luis valley and the southern end of the inter-mountain corridor.



Figure 5.3-4. Bison at The Nature Conservancy’s Zapata Ranch near Great Sand Dunes National Park & Preserve in the San Luis Valley, Colorado. These grasslands lie at the south end of the Intermountain Corridor and just west of La Veta Pass. This area was frequently used by bison during the historic period, and about 8-20 days travel by foot from Chaco Canyon depending on the route taken and speed (see Section 6. Source: National Parks Traveller Magazine, Jim Elder photo.)

Other Artiodactyls- The varied alpine, wooded mountain valley, and park habitats of the Southern Rockies were the source for the hides from a diversity species including bighorn sheep, mule deer, and

elk, and antelope. During the historic period, the journals of several expeditions record either directly hunting for these species, or trading for their hides (Figure 5.3-1). These data from these journals show that game was often dispersed and rarely sighted in summer, but due to deep snows at upper elevations, was concentrated in valley bottoms in late winter and early spring (WNA-JOBS. 2020).

There is also an impressive inventory archaeological sites (mapped in Pitblado and Grunswig 2007; LaBelle and Pelton 2013) that provide evidence of prehistoric Native American hunting of these species in the mountains and foothills. Archaeologists have focussed on prehistorical rock blinds and walls used for driving game (predominantly bighorn sheep) towards kill sites in alpine terrain (Benedict 1992, 1999, 2005). Lichenometry-dating of these sites range from AD 190 to AD 1645, with most dates between AD 420 and AD 1270 (Cassells 2012).

Summary- Terrain, vegetation, and climatic factors made the Southern Rockies, and particularly the South Park and San Luis valley unique areas for wildlife abundance. Human herding may have been important for bringing bison from the north along a wildlife movement corridor through the inter-mountain parks and valleys running north-south in the Rocky Mountains southwards (Figure 5.3-2), or westwards from the plains over La Veta and other passes (Figure 5.3-3) towards San Luis valley on the upper Rio Grande watershed in the historic period, and perhaps pre-historic times. Prior to ~AD 1300 bison were likely rare on the eastern slopes south of the Arkansas River, and on the southern plains (see Section 5.2 above), but these mountain valley and pass routes could have periodically brought bison to the San Luis valley within 100 km of Chaco Canyon, as occurred during the historic period (Figures 5.3-1 and 5.3-3), and where a “free-roaming” conservation herd bison occur present occurs (Figure 5.3-4) .

5.4 Southwest Valleys, Plateaus, Basins, and Hills

First person journal observations (WNA-JOBS 2020, Figure 5.4-1) and archaeological studies (Szuter and Gillespie 1994; Driver 1990b, 2011; Nelson and Schollmeyer 2003; Broughton et al. 2010; Schollmeyer and Driver 2012) generally show that the Southwest had relatively low large mammal abundance both in the historical and prehistoric period. Potential factors influencing abundance may include low habitat quality, limited water supplies, and high human population densities in areas in near water sources (Figure 4.1-1).

Bison- As described Section 5.2, bison were likely rare on the southern plains prior to AD 1350 and would likely not have approached the southwest area from the east. However, bison numbers increased rapidly after this time, and the species was relatively abundant across much of Texas and eastern New Mexico by the time of first European observations by de Vaca and Coronado (WNA-JOBS 2020) in the 1530s and 40s (Figure 5.2-1). Interestingly, for the next 300 years bison did not expand their range westward into the southwest region (Figure 5.4-1). The furthest west bison were generally observed was the Pecos River, and these animals were heavily hunted by both plains people and hunters travelling west from the Pueblos near the Rio Grande (see Section 3.1). To the northwest, the closest bison observed to Chaco during the historic period were in the Uintah Basin and near Great Salt Lake (WNA-JOBS, 2020).



Figure 5.4-1: Historical journal observations of wildlife, fish, and plants observed or harvested for the period AD 1538 to 1852 for the Southwest and adjacent regions (WNA-JOBS 2020). Daily journal observations are illustrated by yellow (Great Plains, no observations for day), pale yellow (interior southwest no observation), pale green (California or eastern woodlands no observation), red (bison numerous), orange (bison or bison sign observed), and brown indicates observations or signs of antelope (A), black bear (B), deer (D), elk (E), wildfowl (F), hares or rabbits (H), and bighorn sheep (S). Grizzly bears are a purple G. Green indicates use of maize (M), beans (B), squash (S), pine nuts (P), or undifferentiated (U). Use of fish is indicated by dark blue (heavy) and moderate (moderate shading). For detailed locations, dates, and wildlife/plant use observations download map and database from the Western North America- Journal Observations database (WNA-JOBS 2020):

<https://lensoftimenorthwest.com/themes/lens-northwest-files/google-earth-map-journal-wildlife-observations/>

Archaeological studies show a similar pattern. The Southwest and Colorado Plateau region has arguably received some of world's the most intense archaeological research. The dry climate and low vegetation cover are optimal for locating archaeological sites and preservation of organic materials such as wood and bone (Cordell and McBrinn 2016). These conditions have facilitated locating and dating numerous Folsom period sites of *Bison antiquus* across the southwest showing the range of this ancient species of bison extended into eastern Arizona (Meltzer 2006). However, for modern bison, Reed (1955), List et al. (2007), Huffer (2013), and Martin et al. (2017) report less than 60 records of individual bison bones from a multitude of archaeological sites with faunal analysis, and that bone beds or processing sites that would indicate the occurrence of intact individuals or human bison hunting are exceedingly sparse across most southwest and Colorado Plateau region. When evidence of communal hunting of bison

herds does occur in the archaeological record, such as about 1700 BC on the Plains of San Augustine, New Mexico it is a relatively unique event (Wills 1989), and this date corresponds to a short period when bison occurred to the east in Texas (see Section 5.2).

Thus, in the last few thousand years bison occurrence was rare in the southwest compared to areas further to the east in the Rocky Mountains or on the Great Plains where this archaeological evidence is common (Cooper 2008, Kornfeld et al. 2010). East of the Rio Grande, Driver (1990a) describes the presence of bison bone in Sierra Blanca, New Mexico pueblo archaeological sites. In concurrence with the historical record, he concludes that human hunters killed these bison further east near the Pecos River, then carried choice cuts of meat, some including bones, west to pueblos. Di Peso et al. (1974) similarly describe bison bones dating to the post-AD 1200 period at the Paquime archaeological site in northern Mexico.

These observations for bison abundance support the hypothesis that relatively high human densities in the southwest region, particularly near sources of water, and partially supported by agriculture after about 1000 BC could seriously deplete a highly valued resource such as bison (see above). It is also interesting to consider that after AD 1600 Mexican settlers and Native Americans began to raise cattle across much of the southwest. Cattle have similar habitat needs to bison and domestic cows became relatively common from the Rio Grande west to the Colorado River by the mid-1800s (WNA-JOBS 2020, Figure 5.4-2). This is further evidence that human predation, likely focussed on kill-sites at predictable sources of water, limited bison numbers across the southwest in the prehistorical and historical periods.

Other Artiodactyls, Lagomorphs, Other Small Mammals, and Plants- In contrast to the near total absence of bison, other larger mammals were observed and hunted, albeit rarely, in the Southwest Region (Figure 5.4-1). A few deer, black bear and sheep were recorded by travellers in forests along the Mogollon Rim, and in the mountains at the head of the Gila River. These species, plus elk, were recorded in the foothill areas of the Rocky Mountains to the north. Interestingly, early travellers provide very few observations of antelope across the area. However, early travellers do report that lagomorphs (jackrabbits, cottontails) were common, and routinely hunted to provide both food and clothing (WNA-JOBS 2020). In addition, it was often recorded that maize, squash, pinyon nuts and other plants were the primary sources of food used by native peoples (Figure 5.4-1).

For the prehistoric period, archaeologists also describe the rarity of elk, deer and other mid-size mammals in most southwest areas, and particularly near areas with dense human populations (Szuter and Bayham 1989, Szuter and Gillespie 1994, Nelson and Schollmeyer 2003, Broughton et al. 2010, Driver 2011, Schollmeyer and Driver 2013). The relative abundance of artiodactyls in faunal bone assemblages is typically described by the “artiodactyl index”, or the ratio of artiodactyls to artiodactyls plus lagomorphs (Szuter and Bayham 1989). In general, southwest areas with high prehistoric human densities have low values of the index (.4-.7), whereas more remote areas, and particularly those next to mountains or forested habitats have higher indices (.5-.6) generally indicating that a higher abundance of deer, sheep and other larger species were hunted, and less use of small mammals (Driver 2011).



Figure 5.4-2. Cattle on the Navajo lands near St. Michaels, Arizona in 2017. (Source: Ravonelle Yazzie, Navajo Times). The modern-day abundance of cattle across the southwest is evidence that the historic and prehistoric rarity of bison was likely due to human predation, not habitat limitations.

6. LINKING HIDE SUPPLY TO DEMAND: LEAST COST ROUTES

Chaco's location has always been troublesome.... Chaco was a tough place for farming. Little rain, short growing season, long nasty winter, no water—there's little to recommend Chaco Canyon but sandstone, and sandstone is pretty much everywhere around the San Juan Basin. Chaco was not there because of any overwhelming local advantages of its canyon. There is no "there" there—but there once was, a history that overrode the lack of amenities.... Once begun, Chaco flourished in part because it was a strategic, central location.... I favor out-of-favor explanations that link Chaco's rise to the rich margins of the Chaco Basin, the 150 km inner circle—location! location! location! Chaco took off because it was literally a central place—not perfectly geometrically central, but close enough.
(Lekson 2015: Kindle Edition, Location 2879-2885)

The analysis of human and wildlife densities across the southwest and adjacent regions (Sections 4 and 5) shows an important spatial-temporal pattern for hide demand and supply. The dry southwest region, particularly along streams that provided opportunities for irrigation (Rio Grande, Salt, Verde, San Juan etc.) has consistently, throughout the last two millennia, had nodes of high human density that would have a high demand for hides, and relatively low abundance of large artiodactyls (bison, elk, deer sheep etc.) that could supply this demand. In contrast, the Rocky Mountains and Central Plains to the north and northeast have had relatively consistent supply of hide-bearing animals over this period. For bison, prior to AD 1300, the best source of large hides would be the Central Plains north of the Arkansas River, and possibly along a corridor in the southern Rocky Mountains. After AD 1300 bison herds expanded southwards into central and southern Texas, the Hohokam culture declined, and this would have changed the spatial supply-demand pattern.

As Lekson (2015) describes above, understanding Chaco's location is critical. After reviewing historical hide trading networks (Section 3), to support the hypothesis of a Chaco as an exchange center along a hide trading network before AD 1300, the location should be logically supportable from two scales: (above):

- Broad Region (>300 km)- The trading center should be on energetically efficient route from the main source of hides to the main source of demand. For the southwest and surrounding regions for the period c. AD 400 to AD 1350, the supply was bison on the Central Plains to the northwest and bison and other artiodactyls in mountains to the north, and the main area of demand on the irrigated plains of the Hohokam lands. After AD 1350 the source of bison changed from the Central to the Southern plains, and Hohokam demand sharply declined;
- Local to Regional (<100 km)- Secondly, but highly interlinked to the broad scale, the location of a trade center had to be defensible from potential raiders and enemies, but also within range of dependable provisions and construction materials.

Figure 6-1 shows preliminary broad regional “least-cost” routes the “pre-AD 1300” and the “post- AD 1300” southwest hide supply to demand situations (also see Wilcox et al. 2008). This is a simplified perspective, following the routes of historic travellers (e.g., Escalante, Espejo etc.) that describe trails and nightly campsites at sources of water (NA-JOBS 2020), and combining this with the routes of modern highways that generally use least-cost routing based upon construction costs.



Figure 6-1: Hypothetical selected pre- AD 1200 (yellow dashes) and post AD 1350 hide trade routes (orange dashes) and trade centers (circles) illustrating key trading centers of: 1) Chaco Canyon, 2) Hohokam lands, 3) Apishapa lands, 4) Spiro, 5) Cibola, 6) Pecos, 7) “Quivera”, 8) Paquime, and 9) Toyah feasting area. The broad green arrow indicates the advancing edge of heavily used bison range southeastwards after AD 1200.

6.1 Pre-AD 1200 Routes

Figure 6.1-1 shows potential campsites at approximately 15 km spacing along the potential main route for moving hides from Apishapa lands on the edge of the Central Plains to the Hohokam lands. Most the northeastern and southwest segments of the route between the plains to the Hohokam farm lands are relatively obvious and are similar to routes followed by historic travellers (WNA-JOBS 2020), modern roads, or both. However, given change from the pre-AD 1200 situation for hide supply and demand, there are few historical journal observations (e.g., post-AD 1540) and no modern highway analogs for the route passing through central Chaco Canyon area. However, the obvious link for pedestrian traffic between historically used trails 50 km to the northeast and southwest, and also modern highway routes would pass right through the Chaco Canyon region.



Figure 6.1-1: Potential overnight campsites (at ~15 km spacing) shown in yellow along potential pre-AD 1200 hide trading route from Apishapa lands (A) on Central Plains (near modern-day Walsenberg, Colorado), to the southern end of intermountain wildlife corridor (B) in the San Luis valley (near modern-day Alamosa, Colorado). The route then moves southwest to Chaco Canyon, New Mexico, and ultimately further southwest to Hohokam lands (C) near Phoenix, Arizona. North-south running “Great Road” routes that would also provide goods to Chaco Canyon are shown in green.

It is interesting to consider that the pre-AD 1200 route would likely have evolved over several centuries before the major construction began in Chaco Canyon at about AD 800. Hide traders and other travellers likely experimented with other routes both south (along the northern slopes of the San Mateo Range), and to the north (nearer to the San Juan River). Here are some considerations for why a route through Chaco Canyon was chosen between the modern-day localities of Cuba and Gallop New Mexico:

- At a broad regional scale Chaco Canyon is an obvious direct broad corridor between the potential bison hide supply area on the Central Plains to the northeast, and the main demand area of the Hohokam lands to the southwest.
- On a finer scale, Chaco Canyon lies on a direct line from the modern-day Cuba to Gallop NM (Figure 6.1-1), and this route is likely a least cost route that crosses terrain with least elevation loss/gain across the area (Borck 2012);
- Other routes both to the north and the south are longer and risk sustained risk from hunter-gatherer groups from adjacent mountainous areas. These people could raid trading expeditions, then escape into adjacent mountains;

- Although the pre-development Chaco area would generally have relatively low water, food, and wood (heat/cooking) resources (Lekson 2015, Benson and Grimstead 2019, Benson et al. 2019), these resources could be cached or moved in on an “if and when” basis for traders moving through, using routes similar to the Great Road system (Figure 6.1-1).

In ~AD 800 when the potential key trading partners (see Section 7.3 below) were beginning to consider building large infrastructure in Chaco Canyon, all this experience was possibly brought to bear in the context of the political situation of the times, and construction of Great Houses here was perceived as the optimal solution. If one of Chaco’s advantages was that it was relatively barren area away from “unplanned visitation”, the builders clearly then clearly had to have a plan for how to build it, heat it, and obtain provisions. This eventually led to construction of the Great Roads to provide a predictable flow of goods and services from areas within about 100 km of Chaco Canyon. Unlike the discussion in Lekson (2015), I believe the initial decision of where to place Chaco may have had little to do with what meridian of longitude it lay on. However, as the hide trade evolved with supporting infrastructure and roads, a rigid “north-south” engineering perspective developed. This was likely informed with some rituals of the cultures of the day, and the skills of “straight-line surveying” along a meridian clearly guided the builders in their road construction decisions.

Why were no “Great Roads” built eastward from Chaco? One explanation might be that hide freighting porter groups might be relatively infrequent (e.g. 5-10 groups per year). These groups might vary routes and schedules to avoid potential raiders because much of the route lay greater than >100 km from Chaco, and the potential for rapid military assistance. In addition, one of the most dangerous areas may have been through the rugged territory of the Gallinas, potential enemies to the east (Borck 2012, 2018, Borck and Erikson 2017), where it was unlikely that a fixed route could be protected. Large fast-moving groups and variation in the timing and route of travel may have been better option to travel here.

6.2 Post-AD 1350 Routes

The best place to start in mapping post-1350 hide trade routes is to follow the historic journals of Spanish and other travellers that began to frequent southwest area after AD 1540 (Figure 6-1). The objectives of these early travellers were often similar to native peoples of the day: travel on relatively direct routes to their destinations, camp at locations with water and plant foods, visit native villages or camps to trade for goods and services, and locate and hunt wildlife (WNA-JOBS 2020 database). In many instances these early journalists had native guides, and although there were occasions where they were deliberately led astray, in most cases these guides took the early European travellers along established routes.

The main difference in the post-1350 plains hide trading routes is that they are further south (Figure 6-1) reflecting the advance of heavily used bison range to the Canadian River and southwards after about AD 1200 (Lintz 1991, Baugh 1991, Lohse 2014a,b). With bison now relatively abundant on the Southern Plains, the most efficient routes to obtain bison hides and meat was now directly eastward from the recently-occupied bison range on the Canadian and Pecos rivers and the Llano Estacado (Staked Plains), and these connected to trade centers at pueblos at Pecos and in the Sierra Blanca region. For the movement of hide products to the southwest, the former Hohokam lands were likely not a strong

source of demand due to population collapse. Likely the best route towards 1500's centers of hide demand near the Gulf of Mexico were the trails followed by de Niza in 1539 (Hartman 2014), and Coronado in 1540-42 (Flint and Flint 1997) through the Zuni (Cibalo) Pueblos (Figure 6.2-1), and from their to the southwest. A further important trade route for hides also existed after ~AD 1300 from Toyah hunters in bison habitat north east of the Pecos River (Dozier 2018), southeastwards initially towards Paquime (Di Peso et al. 1974, Wilcox et al. 2008), and in later times to Spanish trading centers in today's Mexico (Figure 6-1).

The travel pattern to north and west towards the Rocky Mountains would be similar to the pre-AD 1350 situation except that instead of Chaco Canyon, the main trade centers were further east at Abiquiu and Taos (Figure 6-1) and these centers then connected the dense agricultural populations along the Rio Grande.



Figure 6.2-1: A Zuni (Cibalo) Pueblo in c. 1875 (John K. Hillers photograph). After AD 1300 the Zuni villages likely assumed Chaco Canyon's previous role as one of the northernmost native centers for exchanging bison hides traders from the lower Colorado River and Sea of Cortez areas. Following this trade route from the south, Father de Niza arrived here in AD 1539 followed by Coronado in AD 1540.

7. THE CHACO HIDE-TRADE HYPOTHESIS

In the above sections I have attempted to make the case that from an ecological and cultural perspective, the Chaco Canyon florescence was in a location during a unique period of time when the hide trade might have been highly advantageous to its participants. In this chapter, I will totally enter “the gin-palaces and brothels of unbridled hypothecation” and suggest potential ways the trade network may have worked. My frame of reference is the workings of other hide trading networks on the continent for which we have some knowledge, and particularly considering the buffalo hide trade (Section 3 above). All this discussion is tentative, and needs to be evaluated by southwest experts with individual specialities. I expect most of what follows below will be extensively revised by subsequent researchers with a firmer grip on Chaco Canyon’s prehistory than I have attained in my brief attempt to digest the massive literature of research for the area.

7.1 Overview: General Spatial-Temporal Pattern

Figure 7.1-1 is a conceptual spatial model of the “greater Chaco trade network,” linking both hide supply (largely ecological states and processes) to demand (largely cultural states and processes). The vast spatial and temporal scale of this greater network may be conceptually important to understand many regional ecological and cultural phenomena (Benson et al. 2007, Chase-Dunn 2011). For example it is possible that high demand for bison products from the east (Caddoan towns, Cahokia etc.) were factors that began to negatively effect the southern plains bison herds and early as 1000 BC, and it was the lack of bison on the southern plains that helped position Chaco Canyon, as early as about AD 500 on an optimal route between the then-abundant central plains bison, and the growing Hohokam agricultural zone to the southwest (see Section 6 above).

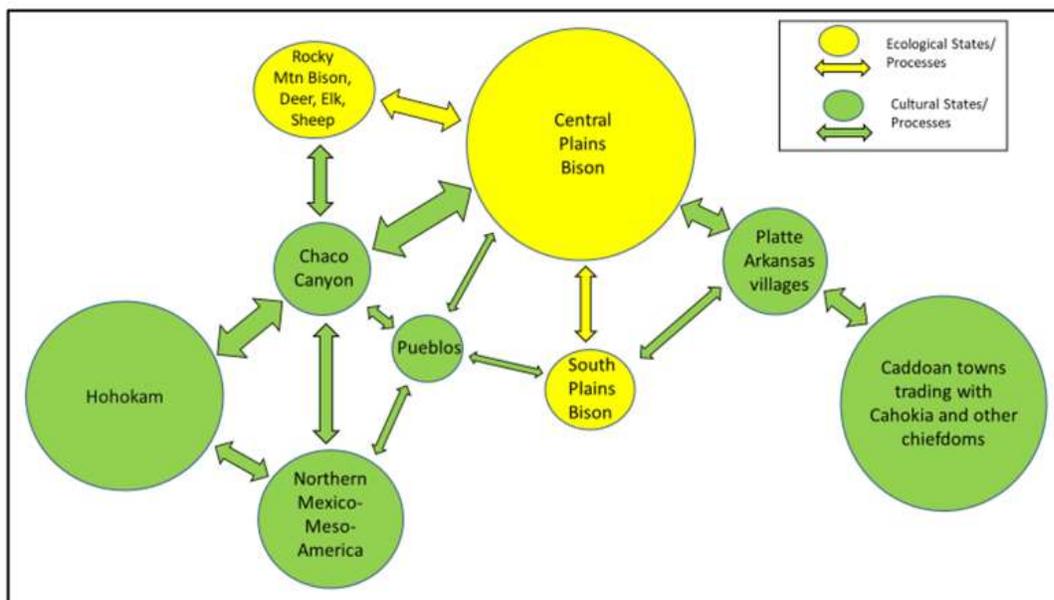
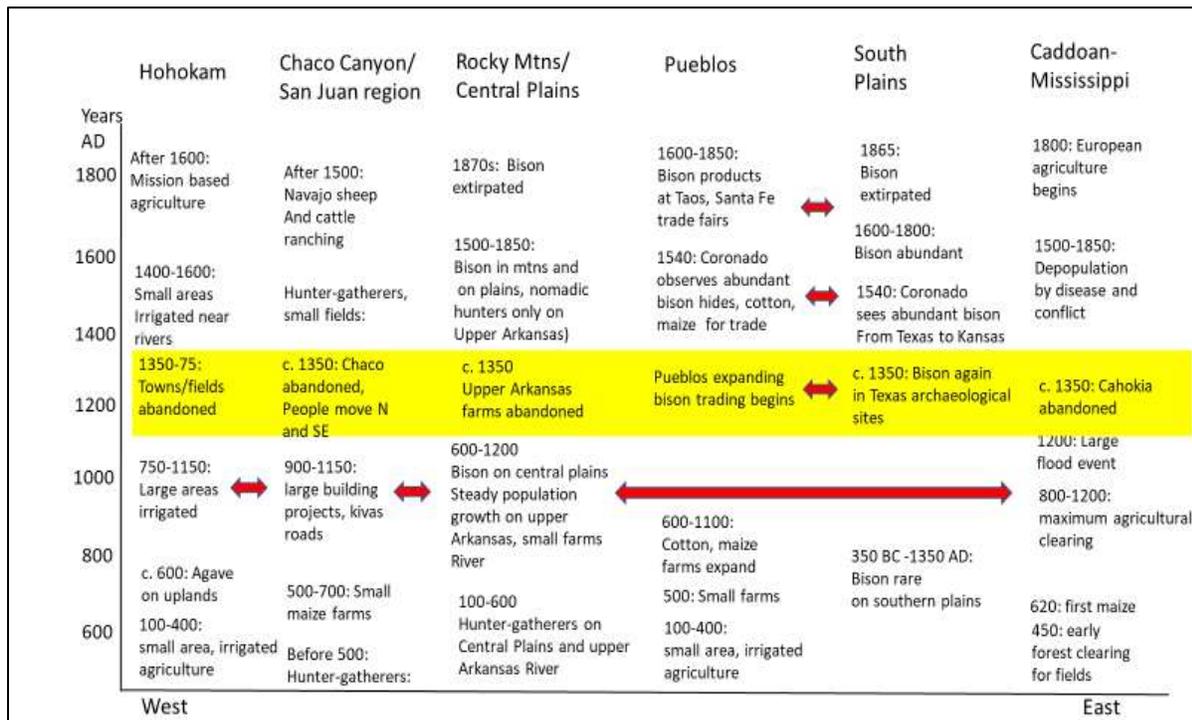


Figure 7.1-1: A conceptual model of the proposed pre-AD 1300 greater southwest hide trade network showing ecological and cultural linkages.

The argument for the hypothetical southwest hide-trade network is largely suggested by a temporal pattern of states and processes across the broader region (Table 7.1-1).

Table 7.1-1: Chronology of major events for the Southwest and adjacent regions. Red arrows indicate trading connections, with the c. AD 1000 indicate the period of maximum extent of the hide-trading network with bison not available on the Southern Plains. The red arrows indicate trade interactions at during the period of the proposed Chaco hide trade network. Yellow shading indicates the period of collapse of the Hohokam-Chaco-Apishapa- Central Plains-Caddoan trade networks.



Key points of the temporal pattern are:

- Before 1000 BC to AD 500- Increases in human population in the southeast along tributaries to the Mississippi River (Red, Canadian, Arkansas, and Platte rivers) begin to over-utilize bison on the southern plains on these river's headwaters. After AD 500 Cahokia and other south Mississippi procurement and trading empires begin to expand to the headwaters of the Arkansas and Platte rivers to hunt the southern edge of the Central Plains bison. This intensive use of bison may largely block any connections between south and central herds along the Arkansas River. Isolated remnant herds along the Canadian and Red Rivers begin to disappear, possibly accelerated by periodic drought events.
- By AD 500 the quantity of bison trade materials (robes, hides, meat) typically moving south and west from Texas into the middle Rio Grande area declines;

- From AD 300 to 800 trading entrepreneurs open up a new trading corridor to the northwest to access hides from the Fremont on the San Juan and upper Rio Grande watersheds, and the Apishapa on the upper Arkansas.
- From AD 800-1150 the Chaco Canyon hide trading network is at its apogee. The regional agricultural system provides enough basic staples to feed locals and visiting participants at Chaco trade fairs. Great houses and a regional road and defense system provide security for traders and their products;
- From AD 1150 to 1300 cultures and trade networks across the south from the Hohokam east to Cahokia collapse. Intense human hunting pressure on bison on Arkansas-Canadian headwaters ends, and large bison herds begin to move southwards, possibly driven by more intense hunting to north along Platte from advancing cultures such as the Shoshone and Apache;
- After AD 1300 bison herds were rapidly increasing in numbers on the southern plains. By 1534 De Vaca reported that bison were found 200 km north of him on the southern plains. By the 1680s bison herds were near the Caribbean coast and the lower Rio Grande (WNA-JOBS 2020). After AD 1300 Chaco Canyon was no longer on the least cost route for moving bison southwards or westwards. The main Southwest bison trading routes were now further to the south than the pre-1300 AD routes.

7.2 The Southwest Hide-Trade “Business Model”

7.2.1 Southwest Trade at Historical Contact

Our best historical analogy for the workings of a potential Chaco hide exchange comes from the early Spanish descriptions of the southwest trade routes at the time of European contact. There are many accounts (see Sections 3.1 and 3.2). Here I will describe one of the earliest observations. On about April 9, 1539 Fray Marcos de Niza was likely on the Rio Sonora on his epic trip from Mexico City to find Cibola, the famed kingdom to the north. Here, he interviewed villagers:

They told me that from that place they were accustomed to travel to the city of Cibola in 30 days. . . . Not just one told me about this, but many. And they told me in great detail about the grandness of the houses and their form, just as the first [messengers] told it to me. They told me that besides the seven cities there are three other reinos [kingdoms], called Maratta, Acus, and Totontec. I tried to learn why they traveled so far from their homes. They told me that they went for turquoises, [bison] hides, and other things. . . . [I asked what they traded for those things.] They told me [it was] their sweat and their personal service (adapted by Hartmann (2014:172) from the translation in Flint and Flint 2005:70)

Marcos de Niza continued his questioning about Cibola (now known as the Zuni pueblos), recording that:

The people in the town where I was all wear fine turquoises hanging from their ears and noses. They say that decorations on the main doorways of the buildings in Cibola are made from these stones. They said the men of Cibola wear a cotton shirt, reaching to the instep of the foot, with a button at

the throat with a tassel hanging from it. . . . It seemed to me like a Bohemian outfit. They go around with belts of turquoise. On top of the shirts some wear very good mantles or blankets. Others wear buffalo hides, which are considered to be the best clothing. They say there is a great quantity of these in that land. The women also go about clothed similarly, covered to the feet in the same manner. (adapted by Hartmann (2014:173) from Flint and Flint 2005:70)

Moving further towards Cibola, by early May, de Niza was likely in the San Pedro valley near today's Sierra Vista, Arizona, and described that:

"I traveled through this valley for three days. . . . Here . . . I saw more than two thousand buffalo hides. I saw a much greater quantity of turquoises and necklaces in this valley than in any of the earlier ones. (adapted by Hartmann 2014:173 from Flint and Flint 2005:70)

These writings in Fray Marcos de Niza's "Relationes" are some of the first descriptions of the hide-trade anywhere in North America. Cibola was not the Zuni's name for their pueblo, but as anthropologist and Zuni tribal member Edmund Ladd described to Flint and Flint (2012a), possibly Marcos de Niza's earliest informants "had robes, probably buffalo robes, with them...Probably the bearers were pointing to the robes and saying, 'Cíbolo, cíbolo,' because the word for buffalo in the Zuni language is ciwolo."

By the 1500s, the southern plains had become well-populated with bison (Section 4), and "Cibola" (Zuni), Pecos, Taos, and other pueblos had replaced Chaco as trading centers, but this earliest description gives us the fundamentals of how the hide trade then functioned in the southwest, and could have worked a few hundred years earlier at Chaco.

7.2.2 Traded Goods and Services

Fray Marcos' 1539 observations and those of the Coronado expedition the following year (Flint and Flint 2005, Hartmann 2014) provide us with a general list of some valued goods and services in the southwest trade network at historical contact, and it is highly probable these had value in previous times. Figure 7.2.2-1 is a conceptual model of the origin and flow of products that flowed in and out of the pueblos in the early 1500s, and were likely also important at Chaco Canyon prior to AD 1200. This model of exchange combines historical observations with archaeological perspectives that focus on durable materials (e.g., Mathien 1992).

Goods and services potentially exchanged (Figure 7.2.2-1) included:

- **Hides-** As per de Niza's comments, similar to turquoise, hides were one of the highest valued trading products in the southwest, and their abundance and source was clearly important to regional residents and Spanish travellers. It is likely that a well-processed skin from each of the region's large mammals (bison, bighorn sheep, antelope, deer, elk) had a well-established value similar to the fur and hide trade networks described in Section 3. From de Niza's comments, bison hides may have been a standard measure of wealth.

- **Hide Products-** Over time, intact hides are generally cut-up and processed into a host of high value items including clothing, foot-ware, bags, binding, shields, and ceremonial ware (Section 2.3.2 above). Given Chaco's proximity to the bison range of the pre-AD 1300s, it could produce a unique set of hide products that could have great value.
- **Turquoise-** Snow (1973) describes: "The importance of turquoise in later prehistoric southwestern culture is spectacularly illustrated by the accumulation of more than 65,000 turquoise artifacts, fragments and unworked pieces at Pueblo Bonito in Chaco Canyon." Clearly turquoise must have been a highly valued commodity, and important to the economy (Figure 7.2.2-1) through its mining, manufacturing and exchange, with sources in mines both in North and Central America (Hull et al. 2014, Thibodeau et al. 2015). Due to its value and portability, perhaps turquoise eventually became a currency in the Chaco hide trade similar to the "made-beaver tokens" used in the northern exchange network (Section 3.7). Wilcox et al. (2008) provide a broader perspective for southwest trade, including potential trade routes in the time period where turquoise could have been an important unit of exchange.

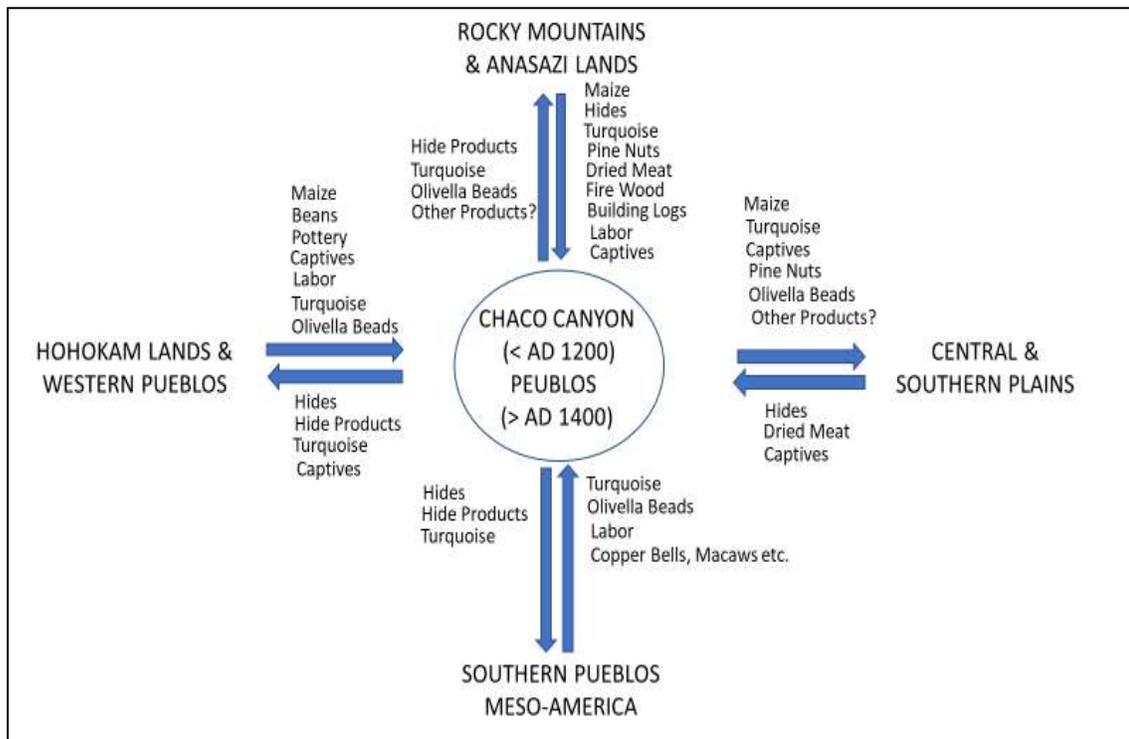


Figure 7.2.2-1: Areas of origin for participants in a hypothetical prehistoric southwest hide trading networks, and some goods and services possibly exchanged. For a trade center to persist, the value of goods and services coming in had to exceed the value of those going out.

- **Captives-** Humans were clearly an important commodity in many past cultures (Brooks 1996, 2002; Cameron 2008, 2013). During inter-tribal conflicts and raids, young women were frequently captured, and later brought to trade fairs (Blackhawk 2006). Bison hunters from the plains likely also

exchanged hides for captives. Brooks (1996) described the use of slaves by southern plains cultures in the 1700s and 1800s:

With the horse and gun, one Indian man could procure fifty to sixty buffalo hides per season, twice as many as one Indian woman could tan for use or exchange. An increase in polygamy, and raiding for captive women, served to counteract this labor shortage. The captivity narratives quoted earlier make it clear that captive women were "set to work to tan hides" almost immediately. The appearance of polygamous households probably made this work more efficient, for "cowives" might process hides while the "first-wife" performed higher-status production and distribution like cooking, clothing manufacture, and ceremonial activities.

Plains bison hunters may also have first increased their demand for women captives to process more hides as the southwest trade developed in the period ~AD 800-1150. For the overall southwest, Brooks (2002:48) observes that "in the vast region crisscrossed by trade in meat, hides, maize, jewelry women might have been the most mobile and negotiable item of exchange." This is further discussed below in Section 7.3.8.

- **Labor-** In the Southwest's pre-domestic horse and oxen era, human labor was high important to dig irrigation ditches, till fields, plant and harvest crops, and to move products from place to place. As de Niza's informants told him, they would travel northwards to Cibola to obtain hides and turquoise in exchange for "their sweat and their personal service." (Flint and Flint 2005). Due to its remote and barren location, Chaco Canyon clearly required a major porter service to provide food, firewood, building logs, hides and other goods (Malville 2001, Malville et al. 2001, Benson et al. 2019). The "hide trade hypothesis" would predict that major porter convoys were sent north and north-eastwards from here to procure hides from the mountains or plains hunters, or southwest to deliver them to the Hohokam. Some of this massive need for labor may have been provided by captives, but likely, similar to de Niza's observation, the paid workers from outside Chaco were paid with hides, hide products and turquoise. In current-day societies in rugged landscapes such as Nepal or Peru, terrain, members of small farm families may work as porters to subsidize or diversify their income (Malville 2005). Did Anasazi farmers provide this labor, similar to the Nepalese in more recent times?
- **Food (Maize, Beans, Dried Meat, Pine Nuts)-** Obtaining adequate and consistent supply of food would be one of the greater challenges in maintaining a trading center distant from the buffalo ranges or the large irrigated fields of the Hohokam lands or along the San Juan River (Benson and Grimstead 2019). Farmers on the limited lands of Chaco Canyon could produce crops in years with favorable weather (Vivian and Watson 2015), but from the perspective of the "hide trade hypothesis" the Great Houses were not located here because of agricultural potential, and possibly to partially even to avoid the security issues of a large local population of resident farmers (Section 6 and 7.4.1). Possibly farmers within the local region (<100 km) from Chaco provided an annual tribute of maize to the canyon's Great Houses in return for military protection, but supplying the food needs of Chaco residents, visitors to trade fairs, seasonal laborers, or porter groups transporting hides and other goods would require a substantial food exchange system. For example, Benson et al. (2019) calculate that under a scenario of 2300 full-time residents, provisioning Chaco would annually require about 18,000 trips to Canyon by porters each carrying 45 kg of provisions from areas >40 km

distant. Table 7.1.2-1 compares the nutritional value of potential Chaco foods (maize, beans, pine nuts, meat) to 3 recipes for pemmican, the favored “high energy” preserved food for northern communal hunters (Reeves 1990) and boatmen moving hides and other goods along northern hide trade routes (Section 3.7). Colepitts (2015) describes that pemmican was difficult to make and preserve in warmer climates, but possibly the cooler and drier climate of upper elevations in the Southern Rockies favored its production here from bison for use by porters or as a “luxury good” in the trade network. However, regular dried (jerkered) meat and pine nuts would have likely been the most valued foods regularly available at Chaco. Betancourt et al. (1993) discuss that the regional distribution of pinyon pine (*Pinus edulis*) may be partially due to human movement of seeds along trade routes. Grimstead et al. (2016) provide isotopic evidence that most meat eaten at Chaco was hunted at distances >40 km from the canyon. Due to the high cost of food, human occupancy of Chaco Canyon was possibly relatively low most of the year (Benson et al. 2019). Under a hide trade scenario, similar to some other hide and fur trading centers (Section 3), perhaps Chaco was only densely occupied during scheduled trading periods when provisions could be most easily provided such as after the fall maize harvest.

Table 7.2.2-1: Nutritional information for southwest foods, fresh meat, and three recipes for pemmican.

Food Type	Serving (gm)	Calories (gm)	Fat (gm)	Carbs (gm)	Protein (gm)	Remarks
Corn	100	96	1.5	21	3.4	Canada Food Guide
Beans	100	127	0.5	22.8	8.7	Canada Food Guide
Pine Nuts	100	673	68.0	13.0	14.0	Canada Food Guide
Fresh Meat	100	217	11.8	0	26.1	Regular ground beef, 10% fat
Pemmican	100	211	7.4	23.4	12.7	Stluka and Gengler 2004, South Dakota
Pemmican	100	380	38.0	5.0	19.0	Cherokee recipe
Pemmican	100	575	52.0	1.0	26.0	Carnivorearelius.com website

- Pottery-** The abundance of dated shards from different types decorated ceramic wares can be used to evaluate the strength of trade networks between various prehistoric sites (Mills et al. 2013, 2018). This analysis shows that Chaco’s earliest ninth-century trade in pottery (or the contents within) was strongest to the Mogollon Rim area to the west and south in comparison to northern areas. Most pottery originated in these locations west of Chaco, possibly due to fuelwood shortages at Chaco itself (Wills et al. 2014, see below). Only by the late eleventh century was trade at Chaco Canyon for pottery, or the contents within, more strongly connected to sites in the Middle and Northern San Juan (Figure 7.2.2-2). These observations are consistent with predictions of the “hide trade hypothesis” in that for most of Chaco’s history, it exchanged hides primarily towards the southwest and the Hohokam. The pottery linkage towards the southwest lies in the corridor of the proposed least cost route for the hide trade network the Mogollon Rim (Figure 6.1-1), and this research reveals potential trade linkages to the Hohokam lands further southwest (Mills et al. 2013). If pottery was a primary exchange good for hides, pottery origins could help predict some of the variable routes that moved hides further to the southwest.

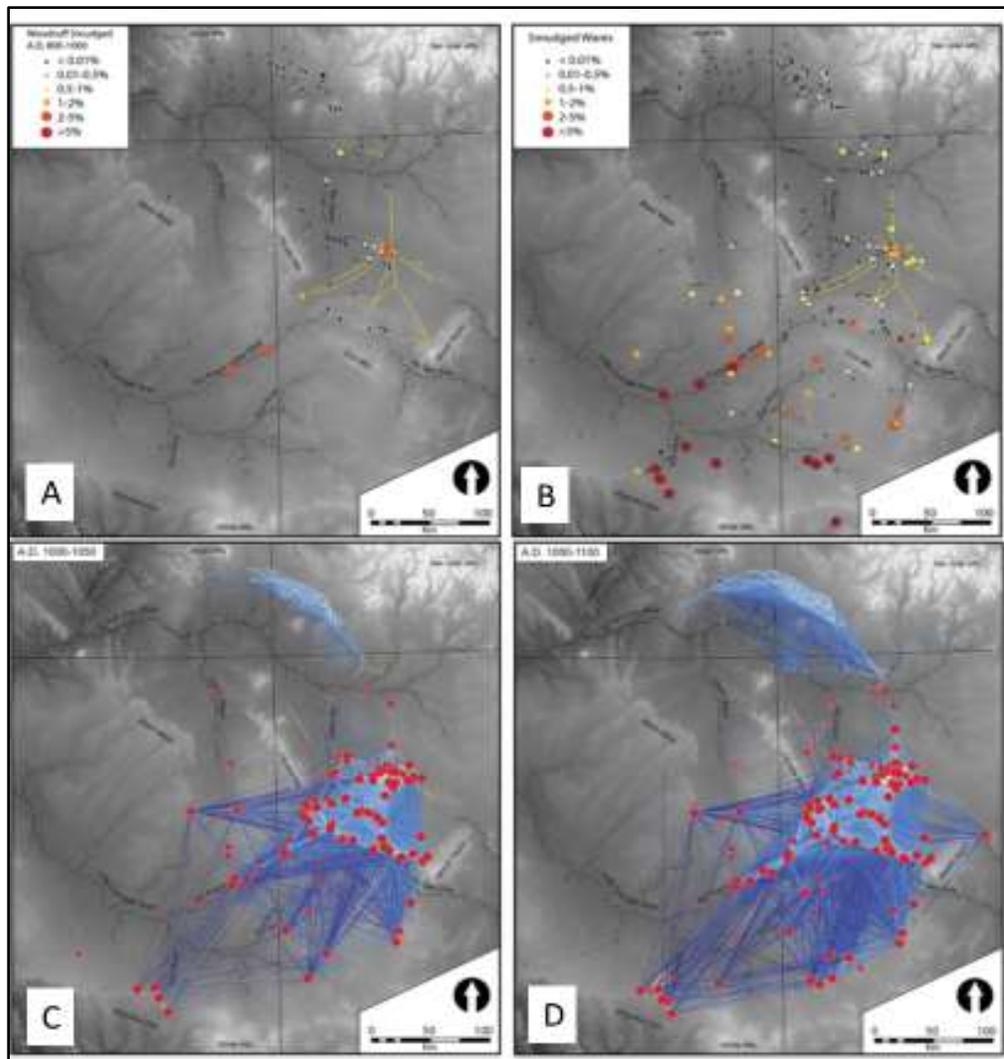


Figure 7.2.2-2: A) Percentages of Woodruff Smudged in Chaco great house and other great kiva assemblages between AD 800–1000; B) percentages of all smudged brown and red ware at Chaco great houses and great kivas (all time periods); C) shared pottery linkages between Chaco great house and great kiva networks for the period AD 1000–1050; and D) for the period AD 1050–1100. Figures by Matthew Peebles from Mills et al. (2018).

Was pottery from Chaco exchanged to the east along the proposed main route for the hide trading network? In the Apishapa region on the Central Great Plains, Zier (2018) reports that pottery is rare during the period c. AD 1000, but trade links are evident to the Southwest, Pacific Coast, and other Plains areas by the occasional presence of exotic lithic materials, shell, and ceramics. Likely on the plains where human movements and bison were more common, people used lightweight vessels such as hide parfleches (Torrence 1994). Closer to Chaco Canyon, the proposed hide trade route crossed the Gallina cultural region on headwaters of the Chama River. Here, pottery shards are not closely related to Chaco ceramics, possibly indicating a somewhat antagonistic relationship to Chaco and associated cultures (Bork 2012, 2018; Bork and Simpson 2017). This could indicate that the

Gallina might have even been a threat to any hide trading groups passing through their territory (see Section 7.7), and were thus avoided.

- **Olivella Beads and Other Marine Shells-** Similar to ceramics, the evidence of different types and sources of marine shell artifacts moving over long distances also reveal the remnants of trade networks, potential currencies and rates of exchange. Beads from *Olivella* sp. are relatively common across the southwest and adjacent plains (Kozuch 2002). The detailed database for results of archaeological investigations at Chaco Canyon returns hundreds of entries for a search of for “fossil shell” or “Olivella” (<http://www.chacoarchive.org/cra/>) Grimstead et al.’s (2013) research on the origin of marine shells for a site on the Mogollon Rim determined that shells here originated from the east shore of the Gulf of California, and the “hide trade hypothesis” would predict that this is likely the source of Chaco’s’ materials. Kozuch (2002) describes that Olivella beads were commonly traded as far as Spiro on the eastern edge of the plains during the period AD 1000 to 1400, and possibly Chaco was part of this exchange network.
- **Wood for Building and Fuel-** Procuring wood for building, and fuel for cooking, pottery curing, heat, and other uses was clearly a major expense for Chaco Canyon’s construction and ongoing operations. To construct the buildings of the 10 largest ruins in Chaco Canyon may have required about 45,000 large trees from high elevation areas trees from mountain ranges as far as 75 km away (Betancourt et al. 1986). Fuelwood was an ongoing “utility” expense, with charcoal studies showing this was dominated by shrubby plant species such as *Atriplex* and *Artemisia*, and dried maize cobs (Wills et al. 2014 and references within). Likely the cost obtaining fuelwood increased over time as these sources declined near residences, and needed to be brought from further distances. Given fuelwood costs, trade fairs were possibly scheduled to be for short time periods when heating requirements were low, and in winter many Chaco residents probably moved closer to wood, or to warmer climes. Some Great Houses would need fuelwood for small contingents of soldiers and traders providing security for the buildings and stored goods.
- **Mesoamerican Prestige Goods-** Although these may have not been routinely exchanged, Chacoans obtained luxury items from regions far to the south (Cordell and McBrinn 2016:327) including copper bells from the area of central Mexico and scarlet macaws (a tropical parrot whose skeletons are found in Great House sites). Residues from cacao, grown in the lowland tropics, is detected in unique Chacoan cylinder vessels. These cups are similar to those used in the Mayan areas to serve a chocolate beverage in political rituals. Crown and Hurst (2009) suggest that the Chaco vessels were used in a similar way. The presence of these goods in the Great Houses show that Chacoans were aware of Mesoamerican luxuries and that Mesoamericans would also know about Chaco’s goods. Perhaps Chaco’s hides and leather goods were valued thousands of kilometers to the south.
- **Liquor-** I haven’t included exchange of liquor in Figure 7.2.2-1, but liquor was highly sought after by Native Americans in their later hide trade with European-based societies, and became important both as an exchange good and for ritual consumption during trade fairs, often with ruinous consequences (Chittenden 1986). More research is needed here to evaluate the southwest situation both in the prehistoric and historic periods.

7.2.3 Exchange Rates

As with all human cultures, the various participants in the hypothetical Chaco hide trade likely had numerous goods and service redistribution mechanisms within their individual families, clans, and broader social groups. However, the proposed exchange of hide and hide products was fundamentally between groups, or even competitors, and was likely “business” similar to the more complex trade networks described in Section 3. Some of these groups may have travelled a great distance and at great risk to Chaco or associated trading rendezvous sites to deliver or purchase or offer goods and services, so rates of exchange had to be relatively predictable. In addition, the wide range of products being traded over such a vast area (Figure 7.2.2-1) possibly required that rates be tied to some relatively transportable or hide-able (“cache-able”) unit of currency or accounting (e.g. prime pieces of turquoise) to facilitate commerce. Table 7.2.3-1 is an ongoing list of historic exchange rates I have encountered in the southwest literature to-date, and needs much further research.

Table 7.2.3-1. Preliminary historical exchange rates for hunter-gatherer source products (green columns) and products from horticulturally based communities (orange columns). Turquoise, horses and mules were available from both sources (yellow columns).

Location, Date Reference	Bison robe	Tanned buckskin: elk, deer, etc.	Captive	Good mare/ average horse	Turquoise	Knife	Maize, plant product	Navajo Blanket	Other	\$US
Sante Fe, NM, 1754, Hämäläinen p. 122-123	1					1				
Sante Fe, NM, 1786, Hämäläinen p. 122-123	1					2				
Sante Fe, NM, 1786, Hämäläinen p. 122-123				1		13				
Abiquiu, NM, 1805, Blackhawk 2006:76			1	7						
Ute trade...find ref	1	5		1				1		
Abiquiu, NM, 1820, Blackhawk 2006 p.			1	1						
Bear River, WY, 1839 Wislizenus 1847:125			1 female							250
Fort Uinta, UT, 1842, Simmons 2000:54		1							10 charges of ammunition or 3 awls	
Santa Fe, NM, 1842, Simmons 2000:54		1								2
Sevier Valley, UT, 1850s, McNitt 1962:18			1 female							200
Sevier Valley, UT, 1850s, McNitt 1962:18			1 male							100

7.2.4 Summary of the Business Model

Chaco Canyon researchers naturally tend to focus on the amazing structures and roads. However, from the “hide trade hypothesis” perspective, it is necessary to consider the economic function of the buildings and roads, what peoples in this relatively unproductive region could have provisioned the traders and trade fair participants, who had the need for hides, and most importantly, what cultures also had experience in hide procuring, treating and creating value added leather products, and then trading these? This is a complex combination. In considering hides as a primary trade product we have a tentative framework to evaluate Chaco’s role in comparison to the pueblos that followed in the hide trade system some three centuries later. The trade goods and potential exchange rates described in Figure 7.2.1-1 and Table 7.2.3-1 are a start at understanding this economic system. There still remains very poor understanding of what was potentially traded between Chaco, and later the pueblos, with people from the plains. Were plant products such as maize and perhaps pine nuts of enough value to encourage a great supply of hides from plains people? Similar to “made-beaver” in the northwest fur trade (Section 3.7) was turquoise been the “made-beaver” chits of this economy? What other goods in the pre-European period would have incentivized the plains people to trade hides? How did travel and transport function? Did plains people come to Chaco as they later did to the pueblos?

7.3 Potential Trade Network Participants: Interactions and Governance

Who lived in Chaco Canyon? This question is not easy to answer, and in fact, it is not easy to even define. But it should not be ignored. We need to use all the lines of evidence we can to decipher what the Chaco phenomenon was all about. (Snow and Leblanc 2015)

The hypothetical Chaco hide trade network was complex. It would have spanned several hundred kilometers, three biomes—the southwest, the Southern Rockies, and the Central Plains, and many cultures and lifeways (Figure 7.1-1). Below I will summarize who were potential the key participants in developing and maintaining the network, and some possibilities on how they may have interacted with other groups. Recognizing the complexity of managing the Chaco hide network, I will also describe their potential governance experience. Papers in Heitman and Plog (2015) and references therein provides a useful starting point in characterizing this diversity.

7.3.1 Mogollon-Colorado Plateau Hunter-Gatherers-Horticulturalists

During the period AD 200 to 700 small groups of hunter-gatherer-horticulturalists began build small villages in the Mogollon Rim and San Juan River region. These early Mogollon and Anasazi practiced small scale horticulture, raising maize and other crops, but also hunted elk, deer, sheep and other animals. They likely also likely traded corn for hides with people further north in the Rocky Mountains, and in turn traded hides with the growing number of people beginning to farm along the Verde, Salt, and Gila rivers to the south (Plog 2008, Cordell and McBrinn 2016). This was possibly the beginning of the regional hide trade, and established the critical link between local farming and hide trading in the north and east that could have eventually led to the establishment of Chaco. However, given their

partial dependence on raising maize and other crops, it is unlikely that these cultures could, on their own, fully developed the trade network extending northeast towards the Central Plains.

7.3.2 Hohokam Traders

The rapid expansion of agriculture and complex societies in the Hohokam area after about AD 500 (Fish and Fish 2007) would have created a great demand for hides required for a wide range of purposes including clothing, binding material for tools, harnesses and packs for dogs and human carriers, shields for warfare, and padding for sports games (Section 2). Likely, as noted above, this demand was initially supplied by trade with Anasazi hunters-gatherer-agriculturalists expanding in numbers into the Mogollon Rim, then Rocky Mountain foothills where deer, elk and sheep were found. However, eventually demand would require, as it did in the Puebloan period a millennia later, that traders obtain bison hides from the Southern Rockies Intermountain Corridor (San Luis Valley and Colorado parks), and from the Great Plains. But because of the scarcity of bison to the south, traders had to access a supply of bison hides from the Central Great Plains—and to southwest traders this was conveniently accessible through the Intermountain Corridor at La Veta Pass on the headwaters of the Arkansas.

Compared to hide trading networks in the historical period (Section 3), the evolving “Hohokam to the Rockies-Central Plains” trade route was long, but not exceptional being <500 km, but the ratio of demand to supply, and complexity of the Hohokam society would have made it unusually lucrative. A complete expedition from today’s Phoenix, AZ to the vicinity of Walsenburg, CO and return could up to 4 months (see Section 6). Hypothetically, given their experience in managing large-scale irrigation projects (Fish and Fish 2007), Hohokam’s rulers had the capability to conceptualize these expeditions, provide nobility to lead them, maintain provision caches along the route, provide military support (a small brigade of troops/hunters), fund large numbers of porters (see Section 7.3.4), and provide the goods desired by the Central Plains or San Luis valley in exchange for the hides (Figure 7.2.2-1). The knowledge and nobility heritage of the Hohokam traders would likely be important for the future development of Chaco Canyon. These traders came from a classed society, were aware of a range of governance methods, and were seeking the most efficient way to transport trade materials between the southwest and northeast regions. Their understanding of functioning meso-American altepetls, or small kingdoms, and societal hereditary connections could possibly have laid the socio-economic foundation for the eventual establishment of Chaco (Lekson 2015). Alternately, the expanding number of Great Houses over time could indicate that multiple entities got into the business over time, possibly rooted in the each of the several entities managing the Hohokam canals (Fish and Fish 2007) with each Great House governed under the “house society” model described by Heitman (2007), that ultimately led to locally-born leaders (Price et al. 2016). Whatever the societal organization, it is possible the trading business may have moved through phases of from being a monopoly to a cartel, to eventually becoming seriously competitive as many trading groups vied for hides and other goods.

7.3.3. Mesoamerican Trained Technocrats (**Engineers, Soldiers etc.**)

I think that Windes's (2014) conclusion is largely correct—that these structures were built by a group of builders who shared the knowledge of how to construct them within a relatively restricted network. This network was heavily involved in the construction of ritual architecture in “downtown” Chaco... (Mills 2015)

In the AD 600 and 700s as the Hohokam-Anasazi traders experience firmed-up their decision to build an exchange center in Chaco Canyon (Section 6), they would have had enough experience passing through here to understand the both benefits and the costs of locating in this environment. In some ways this could be viewed as a type of early “Biosphere” design problem where there would clearly be architectural, engineering, security and supply issues to surmount as the Chaco center expanded in this relatively remote and resource-poor location. As Lekson (2015) describes, this type of expertise was available from Mesoamerican societies and some of these people might already be involved in the network moving hides south.

7.3.4 Porters

Southwest region hunter-gatherer-horticultural societies would have long hunted hide-bearing animals, and brought the processed skins to potential local camps and collection areas (Section 6). These groups would include the Mogollon-Colorado Plateau Anasazi (Section 7.3.1), the Apishapa people on the upper Arkansas River (Section 7.3.5), the Fremont and pre-Ute cultures from the Rocky Mountains and other regions to the north (Section 7.3.7). A mass transportation system was then required to carry the hides from these local centers to Chaco Canyon, and then onwards to areas of high demand such as the Hohokam agricultural zone.

Research on prehistoric mass transportation systems for utility goods such as food, hides and pottery are an ongoing focus of southwest research. For example, Malville (2001) evaluated the network of domestic and commercial portage operating today in eastern Nepal, and showed that foot transport of food staples and durable goods would have been feasible in the pre-Hispanic American Southwest on a regular basis over distances of at least 100 to 150 km and on an occasional basis over much longer distances. Mills et al. (2013) use pottery types to model connectivity of prehistoric communities. The potential requirements for mass transport of maize into Chaco by porters has recently been considered (Benson and Grimstead 2019, Benson et al. 2019). Based upon current day porter operations in Nepal (Bastien 2005) and South America (Figure 7.3.4-1), both men and women would work as porters.



Figure 7.3.4-1: Modern day women porters on the Inca Trail in Peru (Image: Flor Ruiz Source: <https://outsider.ie/travel/first-female-porters-on-the-inca-trail/>)

In the pre-horse era, porters would have also been critical for moving hides, and possibly a similar class to “Canadien couer de bois” and Orkneymen who powered the watercraft of the northern fur trade a millennium later (Innis 1962, see Section 3 above). Similar to the couer de bois, the porters may have “corn-powered” through large portions of their trip, but would switch to animal meats and fats when near sources of meat in the foothills and plains (Colepitts 2015). The trading expeditions could likely partially guided, fed, and otherwise supported with the Mogollon and Anasazi whose lands they moved through, and with whom they already had a trading network. Once near the plains or mountains, the traders and their porters would “rendezvous” with plains and foothills hunter-gatherers, trading maize, captives, turquoise for goods such as hides, meat and again, likely captives. They might also buy dogs that could carry hides, and eventually be eaten on the return trip. Perhaps contract “mushers” would accompany them partway on their journey back to the southwest. Some expeditions might also require soldiers for the security of porters and goods.

Over the centuries the Chaco hide exchange, the senior traders likely experimented with various combinations of transport requiring paid porters, captives and soldiers. Further research on Chaco and regional societal structures will likely reveal how the southwest goods transportation system functioned.

7.3.5 Upper Arkansas Bison Hunters and Horticulturalists

An increase in human population and societal complexity in the Apishapa region of the Rocky Mountain foothills and Central plains at the headwaters of the upper Arkansas River after about AD 500 (Gilmore 2008, Zier 2018) is coincidental with increased potential demand for hides from increasing populations in the Cahokia region downstream on the Arkansas (Emerson and Lewis 1991) and the Hohokam and Anasazi region to the southwest (Cordell and McBrinn 2016). During this period, the Great Plains immediately to the north of the Arkansas was likely the closest region densely occupied with bison (Cooper 2008). It is likely that the Apishapa peoples had long occupied the region (Zier 2018), and had Caddoan affiliations (Huffman and Earley 2014). Therefore, although they might have initially prioritized trade with their associated cultures in the Spiro area downstream (Schambach 1993) in a similar pattern to the Arkansas-Platte Rivers trade network of the historical period dominated by the Pawnee (Calloway 2003, see Section 3.3). However, as Zier (2018:26-28) describes, the adoption of maize by these people after 100 BC was likely from the southwest, and the rapid increase in its cultivation after AD 500 may result from population increases. Could this tie to an economic boom coinciding with a developing trade network with the southwest? Would the Apishapa people's close proximity to bison immediately to the north made bison products a primary resource in this trade? The position of the Apishapa region (Figure 4.3-1) was ideal for both bison harvesting, and to control the hide trade between the Central Plains bison and the southwest.

Moreover, Apishapa people were relatively unique in that they would have likely had the communal capacity to do mass hunts and process a high volumes of bison products for trade. This work required all members of the family to work together, to hunt, move the meat and hides to camps, jerk the meat, and start the process of treating the hides (see Section 2 above). With the exception of the Fremont and Proto-Ute (see Section 7.3.5 below), few other peoples in the Southwest trade network likely had this capacity during this period. Possibly the Apishapa people pursued a similar lifeway to the Pawnee and Apache of later times, and conducted two bison hunts a year onto the plains, an early summer hunt to harvest spring hides most useful for thin hides, and late fall and winter hunts for robes and thicker leather (James 1823). The completion of the summer hunt, and harvesting of corn would have provided food stocks and resource availability for a rendezvous with traders, both from the east and the southwest.

Similar to the semi-nomadic peoples of later times, its likely that the Apishapa also took captives from adjacent peoples hunting the bison resource on the plains, and integrated them in the communal production of hides and meat for trade.

7.3.6 Caddoan Platte/Arkansas River Hide Traders

The large Caddoan cultures to the east would also have high demands for hides and other buffalo products. Schambach (1993) describes the Spiroans, who had large villages along the middle Arkansas River during the period before AD 500 to the AD 1300s:

...the Spiroans had found a way to do the impossible so far as prestige goods systems are concerned: to convert prestige goods or "primitive valuables" into commercial valuables or capital. This might have happened in the following way. In a situation such as I have hypothesized, where there was, on the one hand, a society facing shortages of protein, fat, and fiber, and on the other, a small group of people capable of supplying modest quantities of buffalo products, the value of such products could have risen to the point where members of the social elite would have been willing to exchange prestige goods for them. They would not have done so out of any intent to help feed or clothe the population at large, almost certainly an impossibility in any case. Their purpose would have been to convert buffalo products into prestige goods by circulating them (to their own social and political advantage) in the general Southeastern prestige goods economy.

Is it possible the Spiro traders that likely trafficked the bison and exchanged goods with peoples such as the Apishapa described above could have considered expanding their network over the Rockies into the southwest? Similar to the Hohokam, through their Spiroan and other Cahokian connections, these traders from the southeast might have had the political support and resources to consider exploiting the Central Plains to Hohokam bison hide market.

7.3.7 Hunter-Gatherers-Horticulturalists from the Rocky Mountains and Colorado Plateau

Not unlike the Utes that later provided the hides for the historical southwest trade fairs at Abiquiu and Taos (see Section 3.2 above), its likely that people occupying the Rocky Mountains to the north during the prehistoric period also provided hides, meat and captives to the southwest. Archaeologists describe two likely candidate cultures. To the northwest the Fremont peoples were the earliest and largest culture, occupying a large area of the Colorado Plateau and western Rocky Mountains at about AD 1100 (Figure 7.3.7-1). Similar to the Anasazi, this culture practiced as range of subsistence activities, ranging from raising maize to hunting, and likely were semi-nomadic for a portion of the year (Madsen and Simms 1998). Fremont hunters would have provided hides for trade to the early Anasazi who in turn connected to the Hohokam, and possibly to the early occupants of Chaco Canyon.

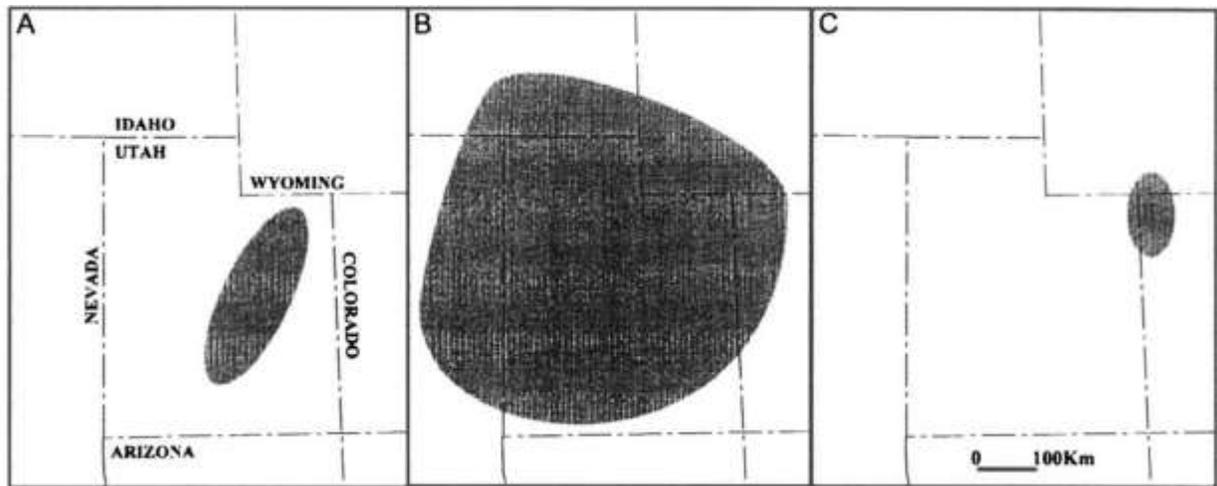


Figure 7.3.7-1: Evidence of the Fremont culture in AD 200, AD 1100, and AD 1500 (from Madsen and Simms 1998).

The expansion of the Fremont to the east between AD 200 and AD 1100 suggests that their culture was in some ways positively associated with Anasazi and Chacoan whose numbers were also growing during this period. Janetski (1997, 2002) describes Fremont hunting and trading patterns, and that prestige trade goods such as turquoise and shells that would have likely been obtained from the southeast, and were perhaps obtained by trading hide and meat products with Chaco Canyon peoples. Moreover, during their expansion, the Fremont may have taken captives from the peoples whose territory they took, and these could have also been traded into the growing Anasazi-Chaco economy. It is interesting that the last archaeological vestiges of the Fremont culture (Figure 7.3.5-1) are found within 100 km of the “bull pound”, or prime bison habitat at the north end of the southern Rockies movement corridor (Figure 5.3-2).

By about AD 1100 the area of Fremont’s cultural influence began to decrease, and by the latter period of Chaco’s importance, it is possible that Chacoans began to trade with proto-Ute people, a Numic culture expanding in from the California southwest, and who eventually controlled the Rocky Mountains and foothills to the north and west of Chaco (Simmons 2000). The Numic expansion is significant. The culture was aggressive to neighboring peoples (e.g. the Fremont), and compared to the Fremont, less dependent on agriculture, more dependent on nomadic hunting and gathering (Sutton 1986). They were clearly hunters of bison, and willing to be much more mobile to conduct trade. Recorded traditional knowledge from their successors, the Ute (Smith 1974:55-56), shows that they conducted an annual bison hunt during the fall by crossing the low-elevation passes in the Park and Rabbit Ears ranges on the northeast border of their territory. This would have put the Utes in the “bull pound” or entry way for bison movements southwards through the intermountain parks and valleys corridor (see Section 5.3, Figure 5.3-2), and from here its possible that are relatively large group of Utes could have hunted bison while driving them southwards down through North, Middle, and South Parks towards the Rio Grande basin. Blackhawk (2006:30) recounts an early Spanish description of the Ute hunting bands:

In his Apuntamientos que a las Memorias del P. Fr. Gerónimo de Zárate Salmerón, Father Juan Amando Niel analyzed Salmerón's 1626 Relaciones and determined that many of Salmerón's "Vaqueros" were Utes rather than Apaches. Additionally, Niel noted that these "Yuttas" traveled in large bands of up to a thousand, divided into squadrons for protection, with the elderly and young in the center, and used dog travois and horses to help carry their many supplies.

As described below, Blackhawk (2006) also describes the Utes significant role in bringing captives to southwest trade fairs during the historical period, and this may have also occurred during the prehistorical period as they usurped the territory of the Fremont and other earlier cultures. An interesting question is whether the Fremont or pre-Utes actually visited Chaco, or were they met by porters at more remote rendezvous sites? Perhaps Chaco was deliberately located to minimize the probability that large groups of hunter-gatherers would travel here (and require food, fuelwood, and special security).

7.3.8 Captives, Wives and the Role of Women

As with the hide trading centers such as Abiquiu during the historical period (Section 3 above), a further group of people that were likely highly important to Chaco's development were women. These could be captives obtained by regional peoples during their hunting or raiding trips, and then brought to the trading fairs. This practice was common across the historic southwest (e.g., Brooks 2002, Kohler and Turner 2006, Blackhawk 2006, Cameron 2013). The captives were generally young females who could be traded to be laborers or wives. Alternately, the young women may have even been the daughters of native leaders that were gifted to be wives of traders to solidify long-term relationships, as in the northern fur trade (see Section 3.7). Many of these women likely had experience in food preparation and preservation (corn, jerked meat etc.), could serve as porters (Figure 7.3.4-1), and if they came from hunter-gatherers groups, they might also be skilled in hide working (see Section 2). With Chaco's consistent store of hides, they make "value-added" products such as clothing, bags, shields, armour, or nobility prestige wear. Interestingly, the flow of captives exchanged by trade could have also been eastward toward nomadic hunters. For the early historic period, Habiche-Mauche (2008) presents evidence that male bison hunters would obtain captive Pueblo women to increase their production of bison hides once back on the plains. These women also had the skill to make pottery, possibly helping transfer this technology north-eastward.

As described for historical southwest trading villages (Blackhawk 2006), and the northern fur trade example (Section 3.7), the descendants of captives or other women arriving in Chaco Canyon could become important parts of the culture. Many of the young women would be the mates and servants of soldiers, builders, traders, farmers, porters or other male settlers in the area. The offspring of the relationships might have a unique advantage in the hide trading business. Through their mothers, sons and daughters might speak the language of other trading bands (Brooks 2002) and be well-suited for some trade expeditions. While their husbands and sons were away on trading, supply or security missions, the women and locally born offspring remaining in Chaco would manage and provided stability to the Great Houses, dealing with the numerous complex issues tied socio-economics here (Price et al. 2016). They could refine leather-working techniques, and manage others doing this important value-added task. Given the value of these tasks, resident Chaco women of various backgrounds could possibly

achieve high societal standing. As an early historical example of this type of societal evolution, Brooks (2002:100-105) describes how a young woman of part Spanish and part Pueblo Indian descent was captured by the Navajo, was later returned to Abiquiu after being ransomed, but continued to communicate with her captors. She eventually became a wealthy trader and interpreter who facilitated economic exchanges among the three groups with whom she had ties.

7.3.9 Scenarios for Potential Interaction and Governance

The above cast of characters, all possibly associated to the hypothetical Chaco Canyon hide trading business, could have a wide diversity of optional working relationships and leadership scenarios. Over the centuries that the trade center developed, thrived, and at times was in recession, it is likely that these participants experimented with many permutations of working and societal relationships. Here's a few scenarios that generate some interesting questions for archaeological, historical, anthropological, and traditional knowledge research:

- The obvious scenario is that Chaco might have started off as a hide-trade monopoly when some entity, likely from the Hohokam area, or even further south, established a trading "Great House" ideally positioned to purchase most the hides moving from the Central Plains and Rockies towards the southwest. This would be the equivalent of the initial business models of the Montreal traders of the early 1600s along St. Lawrence, the Hudson's Bay Company at the mouth of the Nelson River in 1670, or Jacob Astor's trading house at the mouth of the Columbia River in 1807 (Innis 1962, Chittenden 1986). Under this scenario, Chaco rapidly became an oligopoly where several other groups (Hohokam leadership sects?) built individual Great Houses. Heitman (2007) proposes that these were "house societies" with long-term hereditary leadership. Likely these entities acted as a cartel and colluded to restrict output and/or fix prices in order to obtain high financial returns. Goods and service manipulated by the cartel would include all those shown in Figure 7.2.2-1, with the main focus being controlling the market of hides, hide products, turquoise, food, and labor. The cartel cooperated to use some of the revenue generated to build the Great Roads. Possibly the cartel also funded a mercenary army to exact tributes from peoples that could be directly controlled from Chaco in about a 100 km radius. This guaranteed some stability in provisions and provided security for the transport and storage of the hides.
- One interesting idea is that during some periods the cartel might include a mix of both Caddoan and Hohokam nobility, all based out of Chaco to co-manage the hide-trade network. Their respective connections both northeast across the Rockies to the bison and hide hunters, and southwest to the multitude of Hohokam farms would be optimal for maintaining both supply and demand for the hide-product. Does the archaeology research for Chaco Canyon provide any evidence for this type of working relationship? Recent research summarized by Snow and Leblanc (2015) uses a range of zooarchaeology and genetic techniques to elucidate the societal and genetic make-up of Chaco and other southwest prehistoric communities including sex-age composition at death (Kohler and Turner 2006) and ancient native mitochondrial DNA haploid groups (Kemp et al. 2010). The "Chaco as hide-trade center" hypothesis can generate numerous propositions that can be further tested with these techniques.

- Did the Anasazi provide much of Chaco's porter system, especially moving goods from the north and the west? Perhaps the Hohokam or Mogollon people moved goods between Chaco and southwest areas. Benson et al. (2019) describe the logistics and energetics of supplying maize and meat to Chaco over distances up to 100 km. However, if Chaco was a hide trade center the skins from the plains had to be moved over 200 km. These distances are fairly short compared to hide transport in some of the networks described in Section 3, but its interesting to surmise how was this transport could have been done. Did the Fremont, Pre-Ute and Apishapa actually travel to Chaco similar to native peoples visiting Pecos or Abiquiu in the historic period's hide trade? Or did the Anasazi porters and their Chaco managers arrange rendezvous at a central location such as in the San Luis valley near today's Alamosa, or even further north east in the eastern foothill in the Apishapa lands? Over time, did the Anasazi establish farms or pre-position supply caches or feeding stations along the way to feed porters? If so, where were these? Is the development of the Gallina culture (Borck and Simpson 2017) in some way associated with the demise of the trade route?
- How strong was the proposed hide trade cartel? During some periods it is possible the individual Chaco Great Houses did not collude, but competed on the pricing of goods and services (Figure 7.2.2-1). For example, during the historic period, in both the Canadian and American hide trading systems, governments and companies from the high demand areas (Europe, eastern American seaboard) established or authorized multiple competing groups to purchase hides from native peoples in the hinterlands (Section 3). In British North America there were at times three or more companies vying for the local hunter's products. Perhaps at Chaco, each of several Hohokam nobility groups had set up independent networks of porters and hide traders each working bring a supply of hides from the Central Plains to a Great House and then sell these to groups of buyers arriving from around the southwest at Chaco trade fairs. If there actually were long periods of strongly competing hide trading groups at Chaco, how were joint projects like construction of the Great Roads financed and planned? Was there a senior governing entity?

In the following sections, I will link Chaco's business model (Section 7.2) to the various players in the regional hide trade (described above). I will argue for the case that Chaco's location, marvellous infrastructure, roads, and connections to adjacent farms and villages was related to the actions of the entrepreneurs of the day to work with some, and against other network participants to get maximum value out of the hide trade. The basic premise is that to negotiate high prices for hides, the enterprise had to have security for their supply (hides), and maximum agricultural independence to negotiate highest rate from their buyers arriving from areas of hide demand (e.g. Hohokam lands).

7.4 Great Houses for Good Storage and Security

Until we are able to identify the nature of the occupation of the great houses, if any, it will be impossible to generate any defensible population estimates for Chacoan structures
(Sebastian 1992:53)

Chaco's peoples began to construct large, rock-faced buildings ~ AD 800 and by the AD 1000, eleven "Great Houses" lay along 32 km a prehistoric road through Chaco Canyon (Figure 1.3-1). Eight of these are the largest prehistoric structures in the San Juan basin, and all are surrounded by smaller residential sites. As Wills et al. (2014) elaborate, this amazing agglomeration of ancient buildings "contain more than 99% of all great house architecture within a 40-km radius of Pueblo Bonito." Figure 7.4-1 shows Pueblo Bonito's planimetric design. On the basis of spatial extent, no pre-AD 1750 rock structures in North America west of the Mississippi, with the exception of Fort Prince of Wales on Hudson's Bay (see figure in Preface) compares to Pueblo Bonito and other Great Houses. The obvious question is who could have conceptualized and financed this scale of construction in the remoteness of Chaco Canyon? Citing the research of Wills (2005) and Craig (2007) for the Hohokam, Mills (2015) proposes Great Houses were "house societies", or entities that maintained inheritable estates and goods, had associations with similar other houses, but embodied each their houses with unique societal values visible in architectural style and objects. In the southwest during the period of Chaco's growth the Hohokam were the only nearby people with this type of complex society. It was apparently needed to develop and maintain the Hohokam's large irrigation systems (Wills 2005, Craig 2007).

There seems little doubt that at some level animal hides must have occurred in Great Houses. Humeri spatulate tools (HSTs), often associated with hide-work (Section 2) have been found in many rooms (Figure 7.4-1). However, as Anderson (2019) describes, HSTs were also necessary for processing plant materials (See Section 7.7).

If Chaco Canyon followed a similar model to other Native American trading centers (Section 3), it likely was a largely a seasonal operation, and likely busiest in late summer or early fall when food resources could support an influx of traders, porters, and other visitors. The main issue would be to provide security for the local senior brokers (nobility?) and their inventory of trade goods, and to feed the potential large pulse of visitors from arriving from afar. Social protocols must have been established for how long visiting trading groups could remain at Chaco, where they would camp, and where goods inspection and trading would occur. A security force must have been available to enforce these rules. However, perhaps the best method to managing visitors may have been to simply schedule the trading rendezvous to occur late in fall season when it was obvious that Chaco Canyon could not sustain large visiting delegations for long, and that upcoming winter storms would close routes back to the homelands of various traders.

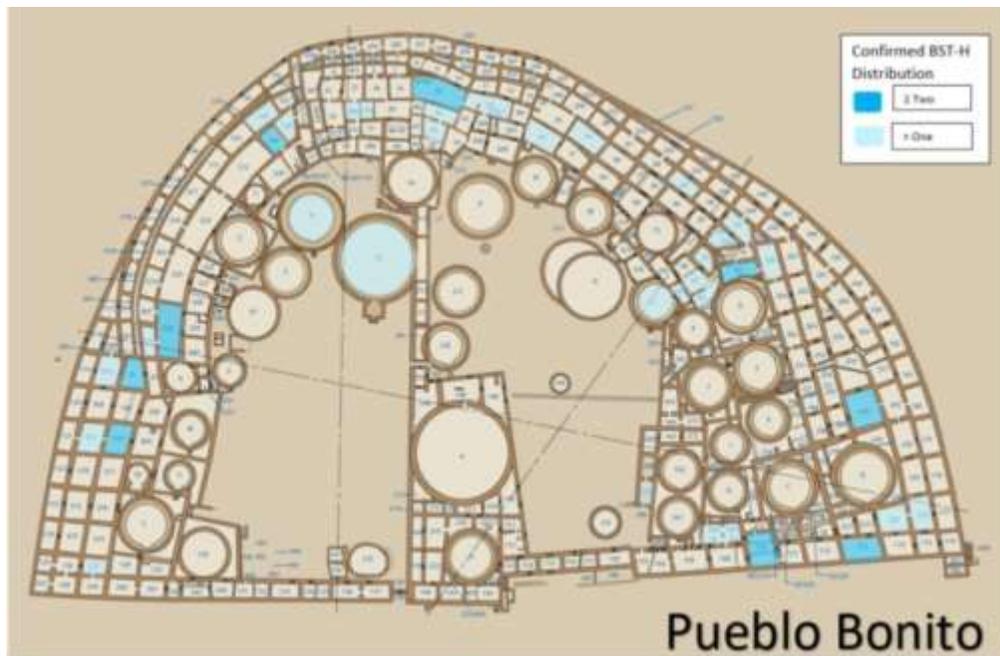


Figure 7.4-1: Map of Pueblo Bonito. Anderson (2019) indicates in blue shading rooms where humeri spatulate tools have been located. (Source: Anderson 2019, base map from chacoarchive.org).

7.4.1 Location, Location

Current-day trade networks have a combination of strong property rights and treaties, pre-negotiated economic transactions, rapid and cheap transportation, and police and military to enforce the rules. But even today, warehouses and banks have security systems, and are located in safe cities and countries. In the past, the security issues of maintaining a successful trade network were no less complex. Over the initial centuries of the expansion of the hide trade between areas of hide demand near the Hohokam, and supply in the mountains and central plains, it likely became apparent that to traders that they could not obtain the best price for their hides if they transported them directly to Hohokam lands. Here, their hides were at great risk. The traders would have to physically defend, protect, or otherwise make the hides unavailable until transferred in exchange, and all this would be under the control of local nobility who would expect a strong commission at best, or at worst, just expropriate the hides. And worse yet, once the traders had received corn, prestige goods etc. they still had to initially move and protect these products through densely populated Hohokam lands back towards their hide hunters.

One solution to this security problem is fairly obvious, and was used in several of the historic hide trade networks described in Section 3 above. Where possible, the traders, or “middlemen” established a trading center under their direct control where both the buyers and sellers of hides had to leave their homelands, come to the center or rendezvous, and do their transactions under conditions most favorable to the traders. Examples from historic hide networks include the Mandan-Arikara villages, Pecos, Abiquiu, “Cibola” and others. Here’s a list of potential factors that could have made Chaco an optimal location for this center from this security and socio-economic perspective:

- As described in Section 6 above, Chaco was directly on the “least cost” transportation route between hide supply and demand—in was unlikely that a competitor could place an alternative trading center in a better location that minimized both hide seller and buyer transport distances;
- The location was remote, and not near food and wood resources that could support concentrations of local farmers or frequent nomad visits that could threaten hide trade and storage (Benson and Grimstead 2019, Benson et al. 2019). Here the traders could maintain a military or police force for security, but it would not have to be as large as would be required in a more densely populated area;
- In this remote location, the traders could control the availability of food (Benson et al. 2019), and even water that would in turn allow them to dictate terms to visiting sellers or buyers. These terms would include who was invited, when they could visit, for how long, and what products were expected for trade;
- The traders, either individually, or more likely as a consortium, clearly had the economic, military, and political resources to establish a regional socio-economic system that would routinely supply Chaco with provisions including maize, beans, meat, fuelwood and other resources (Heitman and Plog 2015, Lekson 2015, Benson et al. 2019). This was necessary to sustain enough residents to maintain and secure the center, and feed trading groups from afar during their visits. Moreover, this supply system was critical to maintain Chaco trader’s food-independence from Hohokam or other food suppliers during trade negotiations;
- Sequenced scheduling of trade parties might leave Chaco with a minimal hide inventory over the winter. Given the remoteness, this low inventory might require only a minimal security force be based at Chaco during winter, and many traders and porters could go to winter residences in peripheral areas with a better wood and food supply (Benson et al. 2019). Possibly the wealthiest established what would become a long-term migration pattern continuing into the 21st century, and went to the warmer climes of today’s Phoenix or Sedona areas for the winter;
- With careful management of the hide trade industry, Chaco’s rulers and many of their workers and associates could become relatively affluent—possibly more affluent than any other political entity in the region. This level of profit likely allowed Chaco to diversify over time into other economic and cultural ventures. These might include elaborate trade fairs featuring luxury leather products, turquoise, and macaws, copper bells, and other exotic products. Moreover, Chaco likely built structures that invited religious pilgrimages. With careful planning and control, and sale of products to visitors, these ventures would further support Chaco in its remote location (see Section 7.6).

7.4.2 Protecting Trade Center Managers, Staff, and Trade Goods

One of the greatest risks of the hide trade would have been the large number of porters, guards, hunters, gatherers, warriors and other people composing a trading party. Often these might have even long-term enemies of other trading groups, or the traders themselves. A consistent pattern is that hide suppliers tend to be nomadic hunters and gatherers that are may periodically raid either trading centers or the settlements of the horticulturalists that are in need of hides (Hämäläinen 2008). As described in Section 2 above, often the protocols from historical hide centers trade might stipulate when various

groups could attend the center, and require that most of these people stay outside, or even a day's distance from the main center.

The trading center's buildings themselves would also be designed for defense, such as described by the Coronado expedition for the Zuni villages (Cibola) and Pecos (Flint and Flint 2005), or the Mandan-Arikara villages (Mitchell 2007, 2018). Therefore, archaeologists evaluating the "Chaco as hide trading center" hypothesis would need to confirm that at least key structures in the area were secure to protect hides, turquoise, food and other trade goods. If we recognize that a trade of bulky but valuable item, not agriculture or pilgrimages etc. was the main business of the town, and that the expertise to manage this system at least partially came from Mesoamerica, can we find other historical centers where the architecture or other functional elements of design can be evaluated in comparison to Chaco? Or were the principle trade goods, the cast of characters, and timing of visits so unique that there are few trading centers to the south that are comparable, and we must continue to look to the north for analogous economies?

7.4.3 Hide Storage

Likely there would be periods of time between the visits of suppliers and buyers when hides would be stored. Also, if at times Chacoans did more advanced hide preparation and leather work (see Section 7.6.1 below), they would need an inventory of materials. Hides need to be properly treated and stored to retain value. A "wet salt" treatment is a traditional means of achieving this, and is described for modern practitioners as follows:

Wet-salt- Lay hide out flat with the flesh side facing up. Spread fine salt over the entire surface, all the way out to the edges. Don't skimp, salt is cheap. To salt the next hide, lay it directly on top of the first, and so on. Allow the salt to soak in overnight. Store in cool place with no air flow, so they won't dry out. Use air-tight plastic and wooden containers.....One or two hides will fit in a five gallon plastic bucket, while a big pile can be put into a garbage can. After one week drain any water that has accumulated at the bottom of the container. Will store at least one year. This is the most practical method for people who tan a lot of hides.... The only way to really screw this up is by storing salted hides directly on the ground. Some-how the ground causes the hides to rot over time.

From <https://braintan.com/articles/storing.html> Accessed: 2020-05-01

Is there any archaeological evidence of storage rooms where large numbers of hides were salted and/or be stored off the ground? The following passage from Lekson (2015) describes rooms with log platforms (Figure 7.4.3-1) commonly found in the Great Houses of Chaco Canyon and similar structures in the southwest for which archaeologists have yet to firmly assign to a purpose:

Room-wide platforms... are well attested in quantity at Chaco, Aztec, and Paquimé... and nowhere else in the Southwest. They were very deep shelves—across almost half the width of the room, set midway between floor and ceiling in both ends of rectangular rooms or in room-sized alcoves. They appear to be original equipment (not later additions), and they would have defined completely the uses to which a room could or could not be put. In effect, a large rectangular room at Chaco became a narrow walkway from door to door between

room-wide platforms filling both sides of the room. So too at Aztec. At Paquimé, they most often appear in alcoves off larger rooms. At Chaco and Aztec, they typically appear in rooms one room removed from the plaza; at Paquimé they are everywhere. Lekson, 2015, Kindle Edition Location 1588-1591)



Figure 7.4.3-1: A room in Chaco with built-in log rails spanning from side to side. The logs were inserted in the stone walls at the time of original building construction indicating that whatever was to be placed on them was of very high priority (photograph from Lekson 2015).

7.5 Great Roads: Maintaining Security and Independence

Chaco's remote location provided unique opportunities to make it secure, independent, and profitable as a trade center, but all of this hinged on obtaining and transporting a dependable flow of subsistence goods and services into the valley. This included food, building materials, labor and firewood. Gieb and Heitman (2015) describe this challenge:

Chacoans had to import not only beams for building, pottery for cooking and storage, and stone for flaked tools but also even the staff of life—corn. And when you add in such exotics as turquoise, parrots, copper bells, and cacao, the potential “trade” deficit looms large. If Chaco Canyon did not provide even enough food for basic sustenance, what was it that made the place so special in the first place? More importantly, what literally fueled the obvious cultural fluorescence of Chaco Canyon and its massive labor-intensive construction projects? (Gieb and Heitman 2015: Kindle Edition Location 1212).

The “Chaco hide trade” hypothesis provides a potential explanation for the highly lucrative exchange product that could have fueled the valley's economy. Hides brought here, as elsewhere across North America in past times, had great value and could be traded for a host of products and services necessary for Chaco's prosperity. The “Great Roads” were the amazing transportation system that linked Chaco's needs for food, building materials, and security within its “inner core” radius of about 150 km (Nials 1983, Lekson 2015). These were partially important because at least along portions of their routing they potentially provided a “least cost” routes for hauling food, wood, hides or other materials in or out of Chaco's inner core (Friedman et al. 2017, Field et al. 2019). However, Kanter (1997, 2003) concluded that in general the Great Roads are not the most efficient route for moving heavy goods

From the hide trade hypothesis perspective, the importance of roads might be best linked to security. As described above, the Chaco hide trade hypothesis argues that it's originating entrepreneurs located the center in a near optimal position given the hide supply and demand regions of the AD 600-1200 period (Section 6.1), and designed and built its Great Houses and other structures to facilitate trade exchange with a wide range of participants (Section 7.3). Clearly Chaco's managers would also have realized that in locating the town on a least cost, central location for the hide trade, but still remote enough to minimize problems with unwanted visitors, they also risked problems of food and wood supply, and periodic raiders. Therefore, the construction of the roads may have been critical for Chaco's economy because the roads served as a demonstration of power and societal/religious cohesion, and when necessary as a high-speed system for communication and movement of military forces (Lekson 2015). Ultimately their purpose in the hide trade (that funded their construction) was as a deterrence to any would be raiders, enemies, buyers, sellers or competitors that might attempt to steal goods, or squeeze profits through some threat to trade routes and goods, or the supply of food and wood necessary for the exchange center's survival.

7.6 Value-Added: Leatherwork, Trade Fairs, Pilgrimages, and Express Freighting

As the hypothetical hide-trade at Chaco Canyon evolved, it's likely that a range of profitable activities became associated with the exchange of goods and services related to the core business.

7.6.1 Leatherwork

Father Marcos de Niza recorded that in 1539 journey northwards into today's American southwest that the native people gave him bison hides from Cibola that were "so well dressed [that] they seemed to have been made by highly civilized men." (Hartmann 2014:176). Except for failing to recognize that it was women that dressed the hides, de Niza was correct in appreciating that the craft of hide processing and leather making was as highly developed in North America as it was in Europe. Moreover, the Native Americans of the southwest could probably obtain hides from a wider range of species than de Niza would have seen in Europe or Mesoamerica (see Sections 2 and 3).

The "Chaco hide trade hypothesis" is consistent with a proposal that in addition to being a center for trading basic dressed hides, the valley could have also, during some periods, become a prime location to do further hide work to both create and market highly processed hide products. As described in Section 2, the craft to making high quality leather products at Chaco might have started with the careful storage of recently delivered "green hides" that had been fleshed and given a preliminary stretching, then dried for transport. At this point, the real work of preparing the hide would begin: graining, thinning, tanning, dyeing, more stretching, more thinning, then smoking. Then, even more highly skilled crafting would be needed to make the ultimate products such as clothing, foot-ware, parfleches, and luxury goods. The knowledge, skills, and work for producing the dressed hides and leather products at Chaco would likely have been women from the plains or northern mountains and foothills that had been captured by hunting and raiding groups, then eventually brought to Chaco for trade (Section 7.3.8). Many of these women were from hunting cultures where they would have honed their hide making skills from a young age. At Chaco, they might be purchased to serve as servants in Great Houses, or if Chaco was a male dominated outpost, as mates for traders, porters, or soldiers. This work force of skilled women could then be matched with flow of hides coming into the Great Houses to select those from suitable species, and that had basic processing of high quality (Section 2.3.1) and to craft these into fine leather products. Possibly during periods when the hide cartel's collusion in fixing prices and outputs was at a peak, only processed leather could be bought, and only from Chaco- a classic case of vertical product marketing where the cartel attempted to control the cost and availability of hides from source to ultimate use.

Given that the skins themselves rarely survive time, is there other evidence that Chaco was a center for processing high quality hides and leatherwork? Well, first there are the storage rooms and racks in the Great Houses that seem ideal for hides (Section 7.4.3 above). But equally significant are the remains of bone tools such as awls, punches and scrapers useful for working hides, textiles and other products. Watson (2015) analysed the variability in bone artifacts dating from AD 600 to 1200 from several Chaco Canyon sites. Bones from deer, pronghorn, and bighorn sheep constituted the raw material for bone tools at all sites. Watson (2015) hypothesized that if hide and other material processing increased over time, these tools should show greater quality and standardization over time, and this indeed the trend until the final period of Chaco's occupation when Watson surmises labor shortages may have limited

production of craft goods. Further bone evidence of hide-work's potential value comes from women's burial crypts (Anderson 2019) including humeri spatulate tools (HSTs) embellished with turquoise and elaborate carving (Figure 7.6-1), along with an abundance of valuable turquoise, jet, and shell beads. Anderson (2019) describes that this is "evidence that Ancestral Puebloan women made ritual and economical contributions to the Chacoan society.... These artifacts were likely utilitarian tools as there is clear evidence they were heavily used."

Where was this proposed production of elaborate leathers actually done at Chaco? As described in Section 7.4.3 above, the valuable hides could be carefully stored in specially constructed rooms within the Great Houses. Subsequent steps in hide and leather work also require a controlled environment for repeated wetting and slow drying, smoking, and ultimately careful sewing. Large rooms, cool in summer, heated in winter, would be needed to stretch and dry larger hides, or to do work on multiple skins at a time. The obvious location is thus the large, circular roomed kivas associated with the Great Houses. Windes (2014) describes their relatively standard, but thoughtful construction of the large "court kivas":

A Chacoan court kiva is a large, circular structure containing a firepit, a subfloor ventilator with a break in the bench directly above (but without a southern recess), low radial-log pilasters, perhaps a bench niche or two, and a large subfloor vault or foot drum placed west of the firepit. Aside from its size, the most distinctive features of a court kiva are its low, radial-log pilasters, a subfloor ventilator, and its western vault....

And as Mills (2015) describes, the groups of people that used them could have been in competition with each other:

Along with the more limited number of great kivas in any single settlement, I suggest that the network that built and maintained great kivas was coeval with individual houses within the Chaco house society at Pueblo Bonito. The great kivas at Pueblo Bonito were not built or even used at the same time—the four that have been identified were constructed between A.D. 900 to after A.D. 1100.... Their sequence and locations on either side of the central wall suggest an alternation and even competition between the groups who built them.

If the Great Houses were used for hide processing, Mill's scenario of some competition between individual hide manufacturing groups would be one obvious prediction. Further, if the kivas are associated with hide and leather processing, there should be some positive correlation at individual Great Houses between the number of stone and bone tools and the floor space allocated to kivas and possibly storage rooms. Anderson's (2019) evaluated Chaco's HST's "use-wear" pattern on the assumption that fleshing was their primary use (see Section 2). However, as described above, most hides arriving at Chaco were already de-fleshed, and the work here was in making more sophisticated leather products. Her conclusion that HST's "use-wear" patterns best fit plant processing may need reconsideration. For example, what use-wear pattern would occur on HSTs used for working an already partially processed hide into a fine pair of ballcourt shoes?



Figure 7.6-1: Humeri spatulate tool found in Pueblo Bonito room 244 crypt. The tool is highly embellished with turquoise, jet, and shell inlay, and has significant use-wear. National Anthropological Archives, Smithsonian Institution [335158]. From Anderson (2019).

7.6.2 Trade Fairs and Pilgrimages

Beyond manufacturing of quality leather products, in what other ways could the Chacoans monetize hides? One of the simplest ways, especially if a consortium of the Great Houses had a strong control of the hide market, would be to only offer quality leatherwork for sale in limited lots, only at Chaco, and only to the ultimate users or their agents. In other words, the retail buyers of luxury leather (likely nobility or their agents) would have to come directly to a Chaco trade fair to procure leather goods. Here, they would require accommodation, food, likely buy other products, and generally be at the mercy of the Chaco's merchants. Possibly similar to other native (and current) American gatherings and tradeshows, gambling may have also been an important mechanism for exchange (Galm 1994). In this context, perhaps the Great Houses, Great Roads, and marvellous array of leather products, gems etc. could be all trappings of Chaco being the "Las Vegas" of its day— with the relatively cool New Mexico highlands being a marvellous place for a shopping and gambling pilgrimage during the baking heat of a Phoenix summer.

At this point, researchers will recognize that the conceptual "hide-trade" socio-economic model presented here for Chaco and its region converges on "trade fair" or "seasonal pilgrimage" models proposed in various forms by numerous researchers including Judge (1983), Toll (1985), Sebastian (1992), Benson et al. (2020) and others. A pilgrimage model based upon seasonal human use appears to provide a realistic analysis of the supply of food and wood resources available in the Chaco Canyon area (Benson et al. 2019), potential purposes of visiting, and resource demands by visitors and residents. The

hide trade hypothesis could provide the core explanation for Chaco's location, economic viability, and timing of its development and demise. In other respects, and for the trade of most goods and services, variations between some conceptual models could be semantics. Any arguments may simply depend on how researchers categorize human behaviors ranging from "practical" and "economic" to "ritual" and "ceremonial". Returning to the modern-day Las Vegas analogy from above, is the modern city's downtown grid-like road system and array of spectacular hotels, casinos and other attractions related to economic or ritualistic human behavior? Doesn't much of Las Vegas' infrastructure serve multiple purposes? Don't the array of Las Vegas' visitors, merchants, architects, builders, pastors, priests, and gamblers all follow many of standard practices and rituals in their chosen interests? It may not be useful or possible to categorize the primary purpose of a building or a street. Possibly all we can conclude is that for the varied range of human needs Las Vegas' infrastructure serves, its construction and long-term maintenance depends on an economy that routinely provides benefits to its owners, workers, residents and visitors. The socio-economic viability of Chaco Canyon's infrastructure may have had similar complexities.

7.6.3 Steam-lining the Transport System

The main yearly cost in operating Chaco, as in many trade networks, was transportation and freighting. Also, as hides, hide products, food, or fuelwood goods were handled, exposed to weather, or used along the trading route quality and the quantity of the product could decline. In the following passage, Cordell and McBrinn (2016:345-346) describe evolution of the trading system north of the Hohokam region that likely influenced the potential hide trade at Chaco:

More often, the distributions of Hohokam traits north of Phoenix are interpreted as representing changing patterns of interregional trade. Before 1000 CE, trade was conducted from village to village ("down-the line" trade), which could explain the presence of early Hohokam pottery at Flagstaff-area sites. The Hohokam might also have provided people in the Flagstaff area with a few items of Mexican origin, such as copper bells, macaws, and onyx ornaments. Later, trade may have shifted to a form in which one party traveled to the source of the desired goods and carried the goods directly to the ultimate buyers. In this case, traders might have developed relationships with local people who supplied the goods, or they might have mined or otherwise extracted the desired resources themselves. With more intensive trade relations, formalized trade routes would have developed. It is also possible that communities held trade fairs or periodic markets, perhaps associated with ceremonial activities and formalized trading centers. With regular, predictable trade, professional full-time or part-time traders might have been present in the resource areas (Doyel 2008; Gumerman 2008).

In a sense, when Chaco Canyon was at its peak, this is what it was all about. It was a core exchange center on an efficient (for its time) system for moving valued goods, services, information and belief systems across the southwest.

7.7 Collapse

7.7.1 Questioning the Human-Caused Environmental Degradation Theory

The last major building activity in Chaco Canyon occurred ~ AD 1130. Most researchers describe that soon thereafter many of the Great Houses were abandoned (Mills 2002, Lekson 2015). Theories on the decline of Chaco often suggest a human-caused degradation through interactions between local deforestation and erosion of crop fields that in turn required a complex and costly system to import fuelwood and food from distant locations. Ultimately a widespread drought in the 12th century led to a general depopulation of the area (Betancourt and Van Devender 1981, Betancourt et al. 1993, Diamond 2005). However, from prehistoric vegetation cover trends described by Wills et al. (2014) there is little support for this hypothesis. Trees were rare in Chaco Canyon as early as before AD 400, the predominant fuelwood for most of Chaco's history was from shrubs. The conditions for maize cultivation in Chaco Canyon were similarly never exceptionally good, and varied over the years with varying weather conditions (Sebastian 1992, Benson and Grimstead 2019, Benson et al. 2019).

From a "hide-trade hypothesis" perspective, the local area, human-caused degradations theory for Chaco's demise is also questionable. The business is predicted to have generated wealth that funded the labor and technical skills to build large buildings and wide roads, and funded the required annual procurement of distant food and fuelwood to support trade fairs and some year-round residency (Section 7.2.2). Moreover, given that the proposed hide trade system was in place for several centuries, it was clearly flexible and financially viable enough to be both resistant to collapse, and resilient to be able to recover after a few bad years. For example, during a few years of "average" drought, the trade fair system was resistant because although food supplies would have to be brought from further afield at higher elevations, the basic porter system was already in place. Moreover, the system could technically recover rapidly after a few years of low activity. Word of a strong harvest of bison hides out on the plains or on the south end of the intermountain corridor could be passed within a few days by runners to potential Hohokam hide buyers. A Chaco trade rendezvous could then be planned to occur within a few weeks or months, and the process of financial and social recovery could begin.

7.7.2 Precursors to Collapse: High Population and Increasing Societal Complexity

The hypothesis that Chaco's location, wealth, and ongoing "reason for being" came from a hide trade exchange system that ranged from the Rockies and Central Great Plains southwestwards to the Hohokam along the Salt, Verde, and Gila rivers opens whole range of possibilities for "what could go wrong?" Clearly, for a collapse to happen there has to be a society of sufficient size and complexity to collapse. Probably in the early days when the hypothetical hide trade only involved one or two traders moving convoys of hides southwest towards the Hohokam, sometimes passing through Chaco Valley, sometimes not, a decline in trade and its infrastructure would be undetectable by archaeologists. But by AD 800 the human activity in and around Chaco Canyon was high. Two trends during the period ~AD 800 to 1150 both locally to Chaco, and in its surrounding region were increasingly "setting up the pins" to make the trading network less resistant to environmental stress, and eventually ensure that resilience, or recovery from stress was impossible.

- **Increase in Regional Population-** Not only were the numbers of Great Houses at Chaco Canyon increasing during the post 900 AD period, but the overall southwest population reached a 1000-year apogee in ~AD 1200 before beginning to decline (Figure 7.7.2-3). Segments of this population were likely part of Chaco's exchange network for goods and services, and benefitted from the economic diversity. For example, as described in Section 7.3.4, possibly many Anasazi farmers had diversified their income by both selling maize and working as porters carrying hides or food. To a point this economic diversity allowed population growth with resource availability during the vagaries of "average year" droughts, economic downturns, political instability or raids. However, high numbers people dependent on a complex economic system could be very unstable during extreme climatic events or other sustained crises (Emerson and Middleton 2017).

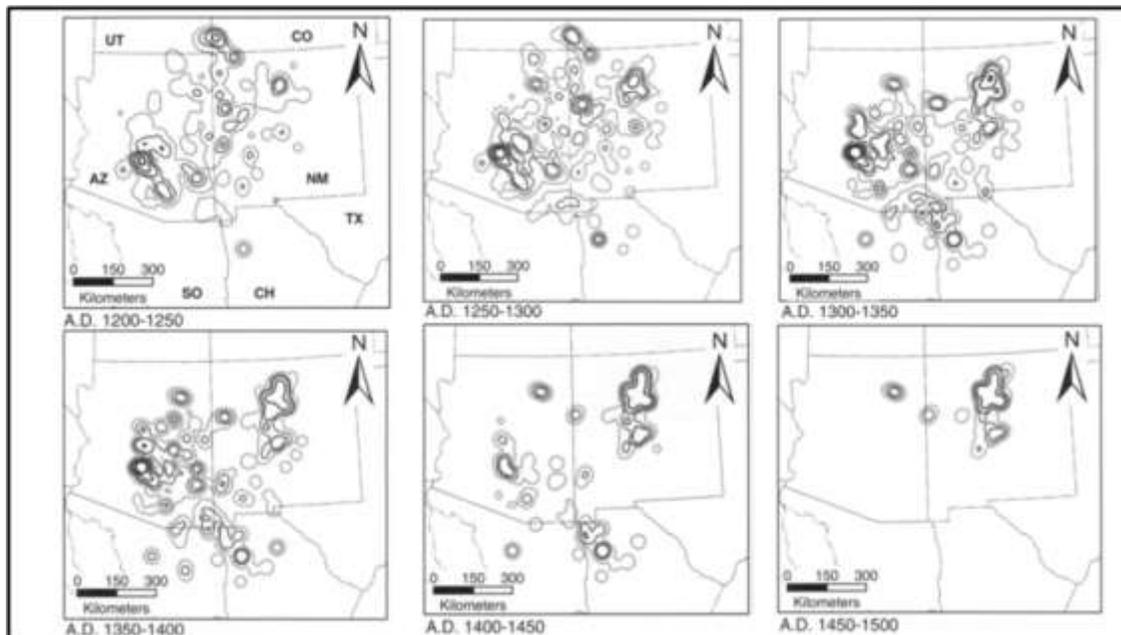


Figure 7.7.2-3: Southwest population density estimated for the period AD 1200-1500 from the density of structures as dated from tree-ring analysis. Contour lines from light dark represent 10, 50, 100, 250, and 500 people/100 km² (from Hill et al 2004).

- **Increasing Hide Trade Participants and the "Prisoners Dilemma"**- The prisoner's dilemma presents a situation where two or more parties, separated and unable to communicate, must each choose between co-operating with the other or not. The highest reward for each party occurs when all parties choose to co-operate, but if someone does not, they may benefit marginally but at overall greater cost to the group. The development of Chaco's hide trade may demonstrate an example of this situation. Initially a few Great House partners cooperated as a cartel to control prices and the flow of goods and services, and to use some of the profits to build Great Roads, and possibly fund mercenary and porter groups that were of benefit to all members (see above). However, as the number of hide-trading entities grew, as evidenced by increasing numbers of Great Houses over time (Lekson 2015), it is possible that communication and cooperation declined. Eventually some members "broke ranks," and deviated from cartel

policies. They may have paid higher prices for incoming hides from the north and northeast, and sold hide products for less to customers from the southwest. Due to thinner profit margins, the rebel traders may not have contributed to the cartel's joint road building, defense or provisioning requirements. Similar to later trade networks, new competitors may have exchanged products such as weapons or liquor that could destabilize societal relationships. In the scenario of no central government to tax and regulate all participants, and given the triggers described below, the potential for Chaco's collapse would increase over time.

7.7.3 Potential Collapse Triggers

With hundreds, and potentially thousands of people directly and indirectly dependent on the hide trade through complex relationships (Section 7.2), and with increasing competition, the stage was set for any of a range of events to trigger off serious societal repercussions. Some or a series of the events described below could have ended the hypothetical Chaco Canyon hide industry.

- **Megadrought-** Two large area, multi-decadal droughts described by Stine (1994) and Cook et al. (2016) occurred during the Medieval Climatic Anomaly (Figure 7.7.3-1). These papers and references therein describe a wide range vegetation and soil responses to these droughts including increased wildfire frequency, dune mobilization and increased aeolian sediment deposition, elevated lake salinity, and episodes of river incision on the Great Plains. Chaco Canyon's buildings and other infrastructure actually slowly expanded during the first drought period then rapidly expanded during the inter-drought period of AD 1074-1122. The canyon was abandoned early in the subsequent period of drought during the period AD 1122-1290 (Benson and Berry 2009). This aridity was intense, and is temporally synchronous with collapse of the Fremont (Benson et al. 2007), the Apishapa (Zier 2018), and the initial periods of fortification and other indications of political stress at Cohakia and other Mississippian complex cultures (Benson et al. 2007, Cook et al. 2016). For the Southwest, Benson and Berry (2009) attribute human population declines and movement as a response to drought effects on maize agriculture.

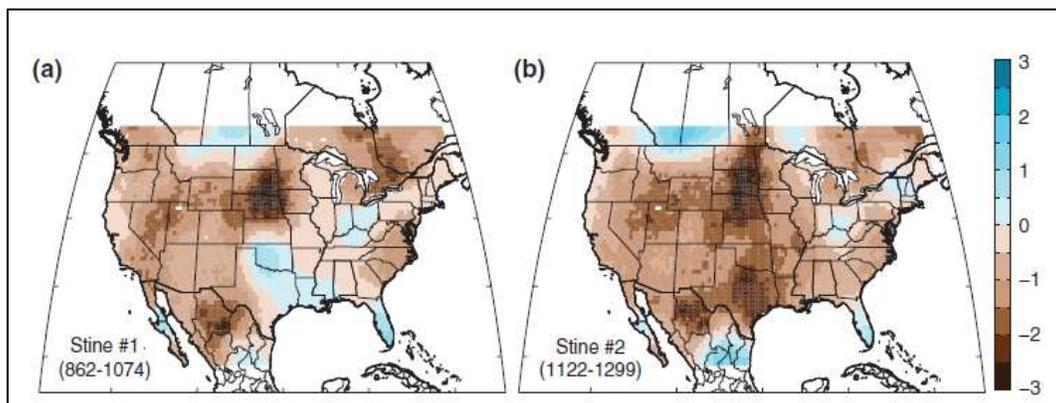


Figure 7.7.3-1. Multiyear spatial plotting of average Palmer Drought Severity Index (PDSI) from the updated drought atlas for the first (a) and second (b) of the centennial scale Stine megadroughts (from Cook et al. 2016).

- **Expansion of pre-Ute and collapse of the Fremont-** There was possibly a long-standing trading synergy between the Fremont and the Chaco Anasazi. The Fremont culture seems to have expanded in concert with Chacoan success, and failed at about the same time (Madsen and Simms 1998; see Figure 7.3.7-1). The hides brought in by the Fremont from the Rockies, and particularly from bison-kills in the intermountain corridor (Figure 5.3-2) would be an important part of Chaco's trade during the period up to ~ AD 1100. The Numic expansion and the arrival of the proto-Utes clearly coincided with the demise of the Fremont archaeological signal. But Madsen and Simms (1998) caution that "whether or not Fremont peoples were killed off, forced to move, or integrated into historically known Numic-speaking groups is unclear." Regardless, it is important to recognize that the Numic speakers are often considered as relatively aggressive cultures (Sutton 1986), and it's useful to consider that the transition from Fremont to pre-Ute could have reduced the number of hides traded to the Anasazi, and even blocked the trade route to the Central Plains (Figure 6.1-1). During the period of the pre-Ute expansion into Colorado, the Apishapa peoples occupied the headwaters of the Arkansas River (Zier 2018), and herein are proposed to be a major supplier of hides to the Chaco trade (Section 7.3.5). If the proto-Utes were antagonistic to the Apishapa, as the Utes were to subsequent plains cultures (Simmons 2000) this would further disrupt the supply of hides to Chaco.
- **Rise of the Gallina-** After ~AD 1000 the number of archaeological sites of the Gallina culture appears to have expanded virtually on top of the northeastwards link from Chaco towards the San Luis Valley where it passes through the pass between the Valle de Caldera and the highlands at the head of the Chama River (Figure 7.7.2-1). Least cost movement routes modelled by Borck (2012) for the Gallina have several intersects with the proposed route of the hide trade. Borck (2012) further describes that a cultural buffer zone of archaeological sites northeast of Chaco Canyon may be the result of conflicts between the Chacoans and those living in the Gallina region during the period ~ AD 1000 to the mid-1100s. If an antagonistic relationship actually did exist, the Gallina were in an excellent position to seriously disrupt the proposed Central Plains to Chaco hide movement route through raiding or ransoming hide-bearing porter groups. It is interesting to consider whether the rise of the Gallina is related to a phenomena identified by Mitchell (2019:292-293) as a threat to trade networks on the Great Plains where "*frequent, intense fighting on the one hand and economic intensification and large-scale, multilateral trade on the other suggests that warfare did not erupt over competition for scarce resources, but rather over control of the trade system. What was at stake was not the possession of specific resources but rather power over the principal engine of wealth, status, and political influence during periods of expansion and abundance.*" Was the rise of the Gallina tied to raiding, or perhaps even trying to control the Chaco trade network?

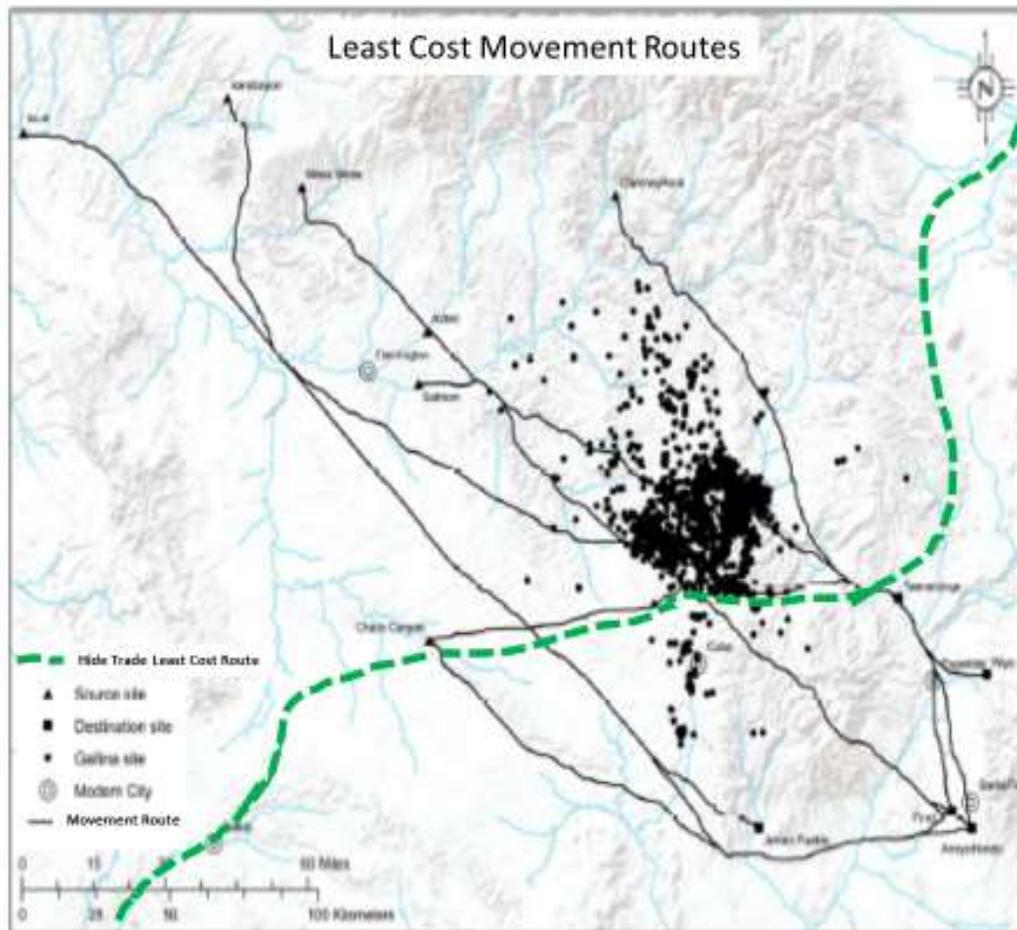


Figure 7.7.2-1: Galina archaeological sites, modeled least cost movement routes for Gallina peoples (solid black lines), and the proposed movement route for the hypothetical Chaco hide trade (green dashes) from the Central Plains southwestward through Chaco Canyon, and from there onwards towards the Hohokam lands near the Gila River (Source: Borke 2012, hide trade route from Figure 7.7.2-1 this paper).

- **Collapse of the Apishapa and Lower Arkansas/Mississippian Cultures-** As described above (Section 7.3.5) the Apishapa are proposed as the major source from the Central Plains that provided hides to the Chaco trade. Zier (2018) describes that the Apishapa culture begins to increase numbers in about ~ AD 600, and “*from that time until around A.D. 1250/1300, population increased steadily, far surpassing levels seen previously in the region. Then, beginning in the thirteenth century, human numbers dropped precipitously until about A.D. 1500 by which time the region appears to have been virtually abandoned.*” Its possible that about AD 1100 the Apishapa bison hunters were thriving, selling hides to both Chaco on the west, and to downstream on the Arkansas to traders linking to pre-Spiro communities, and who ultimately moved hide on to Cahokia. Much of this trade connectivity was broken during the

period AD 1100 to 1350 (Table 7.1-1), likely first on the west by collapse of Chaco and possibly caused by proto-Utes antagonism to the Apishapa. Very soon thereafter, cultural turmoil begins to the east with a series of multi-decadal droughts in the period ~AD 1125 to 1250 (Benson et al. 2009) that may have contributed to the collapse of Cahokia (Emerson and Hedman 2016, White et al. 2019). Benson et al. (2007) describe that: "*Indications of political unrest in Cahokia appeared in the AD 1100s when walls were first constructed. In AD 1150, a 3-km-long 20,000-log palisade was placed around downtown Cahokia.... This wall was built and rebuilt at least four times during the following 50 yr...*" By whatever means these changes in trade relationships and other factors played out, the Apishapa culture was apparently doomed, and this group of mixed agriculturalists and bison hunters, once potentially so critical to Chaco's hide trade, virtually disappeared (Zier 2018).

- **Expansion of bison populations onto Southern Great Plains-** Although bison were likely present south of the Arkansas River in western Oklahoma before about ~AD 1300 (Baugh 1986), their numbers were likely low (Cooper 2008). However, after this time bison abundance increases in archaeological sites on the upper Canadian River (Lintz 1991, Baugh 1991), and soon thereafter, for the first time in nearly in over 1000 years, large herds of bison again occupied the Southern Plains in Texas (Figure 7.2.2-2, Dillehay 1974, Cooper 2008, Lohse et al. 2014a,b). Given the strong relationship of bison abundance related to human density and hunting patterns (e.g., West 1995, Binnema 2001, 2016; Kay 1994, Bailey 2016), its likely that this return of bison abundance to Texas is in some ways linked to both to climate change and also the demise of the Apishapa and other hunting cultures that could have previously blocked their movements from the north. Whatever the cause, the return of bison to Texas was a mixed blessing to cultures such as the Toyabe and the growing eastern Pueblos. These peoples feasted on the great beasts (Driver 1990b, Dozier 2018), but also had to develop social relationships with the Dene Apache hunters who arrived soon after the bison (Gunnerson and Gunnerson 1971, Spielmann 1991 and papers within). The arrival of bison in Texas would also discourage any initiatives to revitalize Chaco Canyon as a hide trade center. For at this time, not only there was no longer an Apishapa culture to hunt the bison on the headwaters of the Arkansas, but there was also another source of bison for the southwest through exchange with the eastern pueblos (Creel 1991). The availability of this valuable resource may have been one of the incentives for opening of new trade routes from the Rio Grande towards the Zuni pueblos (Cibolo) and southwards towards Paquimé (Wilcox et al. 2008, see Figure 6-1 above).

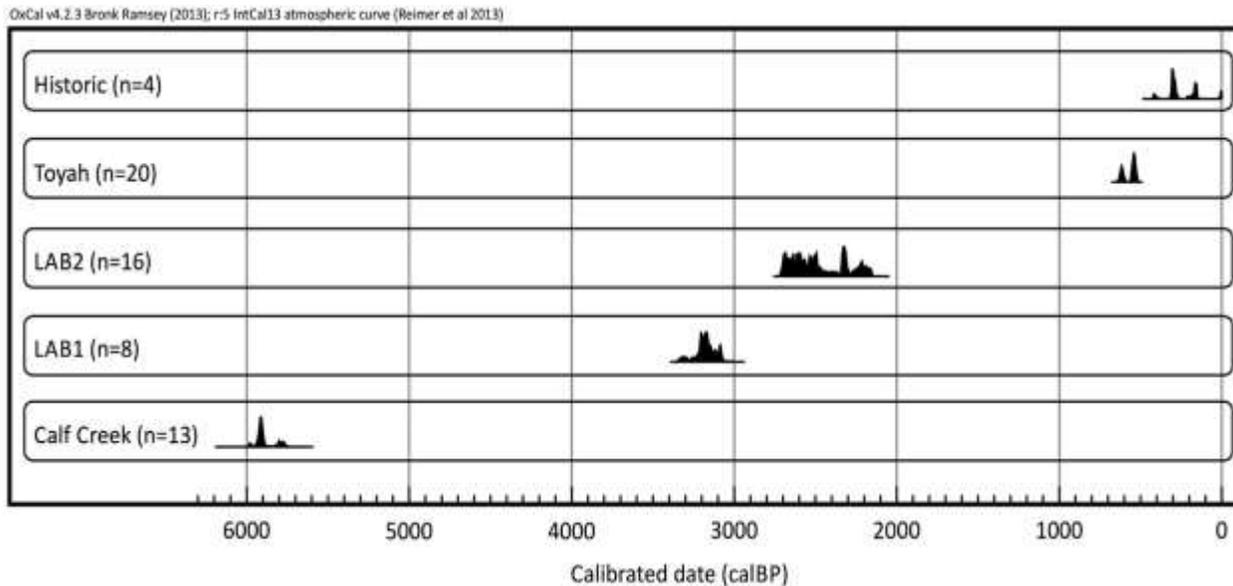


Figure 7.7.2-2. Summed probabilities for 61 XAD-purified AMS dates on bison from archaeological contexts in central and southern Texas (from Lohse et al. 2014a). The ~1000-year period when bison were not detected in Texas archaeological sites was when Chaco could have been on least cost route to supply hides to the Hohokam, or areas further south in Mesoamerica.

- **Collapse of the Hohokam**- The ultimate factor that constrained any recovery of Chaco to its potential prominence as a hide trading center was the massive shrinkage in human numbers across much of the southwest (Figure 7.7.2-3), and most importantly in the populations that were the principle market for Chaco's hides—the Hohokam along the Verde, Salt and Gila rivers. The process of population decline in this region appears to have begun in the ~ AD 1350 (Bayman 2001), and by ~AD 1450 this massive area of irrigated farmlands appears to have nearly abandoned. Unlike the situation near Chaco Canyon, the Hohokam collapse may actually be a case of human-caused environmental degradation where soil salinization caused by irrigation interacted with climate change (Fish and Fish 2007, Short 2019). Given that Chaco appears to have declined in importance by AD 1200, likely the ongoing hide and leather demand for Hohokam for the period ~AD 1150 to AD ~1350 was partially met by the expanding cultures of Anasazi along the San Juan River. Some of these traders were possibly from veterans of Chaco that re-established here after potential bison hide supply issues arose along the northeast plains route (Lekson 2015). Possibly the Hohokam were also an initial market for a developing hide trade network from the expanding pueblos in the Rio Grande region westwards towards the Zuni. This may have been the deep roots of the network later sought out by de Niza and Coronado (Flint and Flint 2005, Hartmann 2014).

7.7.3 The Upshot for the Downfall

Chaco's decline has generally been explained as a relatively simple case of local, human-caused environmental degradation to forests and cropland (e.g., Diamond 2005). As Wills et al. (2014) describe, this explanation appears difficult to support with deforestation or crop production data. The main conceptual issue here is that with no logical explanation for why Chaco existed, or how its economics functioned (Lekson 2015), it is equally difficult to understand why it failed.

The "hide trade hypothesis" provides a conceptual model to consider a broader range of potential options and scenarios for Chaco's decline. These can be directly tied to the economic functioning of the proposed trading center, and possibly to its ultimate downfall. Evaluating these options will require ongoing refining of archaeological site dates, analysis of evidence for goods and services that may have been exchanged across the broad regional system, and increased understanding of the number of participants over time in the proposed trading cartel. At this point in time, given the archaeological dating of various sequence events in the area, one theory is that the main initial trigger to Chaco's serious economic problems was the role of the proto-Utes and possibly the Gallinas in interrupting the hide supply trade route from the northeast. Possibly due to expansion in the number of traders, and weakening of the cartel, Chaco traders simply could not cooperate to overcome threats from these cultures to their supply of hides from the plains and Rockies. It will be interesting to see what comes of this potential explanation as further evidence is amassed and evaluated.

7.7.4 Post-Collapse Cultural Patterns

The Chaco hide trade hypothesis can provide an explanation for some of the dispersal patterns for the valley residents in the latter ~AD 1100s. The hide traders simply tried to stay in the business. First, once the flow of hides from the plains and east slope of the Rocky Mountains ceased, they moved north to the San Juan to broker skins coming in from the south and west slopes. Then, as bison moved southwards onto the Oklahoma and Texas plains a few decades later, likely descendants of these traders moved east to the Rio Grande and Pecos rivers area to establish trading posts here. Ultimately, it is possible that as the Hohokam market began to collapse in the ~AD 1300s, another generation of these traders looked south toward the Mesoamerican market, and built the large center of Paquimé (Di Peso et al. 1974) in a centralized location that could obtain bison skins from hunters exploiting the newly established bison herds on the southern plains, then move these hides southwards towards Mesoamerica (see Figure 6.1). The Paquimé builders located the town on nearly the same meridian of longitude as the center of Chaco Canyon and its north-south Great Roads (Lekson 2015). Possibly by locating on the "Chaco meridian" Paquimé's founders were simply trying to invoke ancient spiritual traditions that brought them so much wealth to the north in previous centuries.

8. SECOND THOUGHTS AND CONCLUSION: BISON, HIDES AND CHACO CANYON

*There is more turquoise at Pueblo Bonito than all the other hundreds of excavated eleventh-century sites in the Southwest combined. Stephen Lekson (2015) in *The Chaco Meridian*.*

*The Indians say that it is the animal most liked by the French, the English and the Basques, in sum, by all Europeans. One day, I heard an Indian say that beaver makes all things perfectly well, that it makes kettles, axes, swords, knives, bread, in brief, everything. He mocks Europeans who are passionate for the skin of this animal. My Indian host told me one day, showing me a very handy knife: the English do not think right; they give us 20 knives like this one for one beaver skin. (Jesuit Paul Le Jeune, in *Jesuit Relations*, Thwaites 1896-1901. Vol 6: 296-98)*

Chaco Canyon is generally considered an enigma in the archaeology of the Greater Southwest. It contains large structures or great houses that are bigger than any other structures in the contemporaneous Ancestral Pueblo world. The large size, degree of planning, expertise, and complexity shown in great house construction is very different from that found among the ethnographic Pueblos. Except for a few unusual burials, however, the construction of great houses was not accompanied by obvious signs of status and hierarchy, such as social ranking, palaces, limited access to long-distance goods, or a means of controlling the staple economy. A high proportion of materials consumed at Chaco were transported over long distances, but there is little evidence for what went out in exchange. (Mills 2002:65-66)

*How can we explain not only the extraordinary quantities of turquoise and shell at Pueblo Bonito but also the often-ignored abundance of ground stone and bone tools? Was the canyon a productive agricultural locale or an area whose inhabitants were forced to rely on corn and meat imported from other regions? What was the relation among the inhabitants of the numerous small house settlements and the great houses? I suggest that if we fail to understand the nature and dynamics of Pueblo society in the canyon itself, we have little chance of understanding the broader Chacoan world. (Stephen Plog 2015 in *Chaco Revisited*)*

This paper describes an hypothesis of proposing that during the period of ~AD 600 to 1150, a movement strategy that led the bison during the summer to head for greener pastures in the narrowing valleys at the headwaters of the North Platte River or the eastern slopes of the Rocky Mountains in modern day Wyoming and Colorado might, through the communal efforts of human hunters and porters result, within a few months, in their hides being traded at a Chaco Canyon, then eventually being worn as decorative padding by players on a ball court in the area of today's Phoenix, or maybe even Mexico City. This may sound far-fetched but it is no more improbable than the eco-cultural process by which a beaver is attracted by the smell of castoreum into a trap in a pond along the Mackenzie River in north western Canada during the latter 1600s, then after some preliminary processing, a Dene hunter wears

its hide for the winter and spring before trading it to a Cree paddler who, the following summer, takes the hide by canoe all across Canada to the waters of Hudson's Bay, then trades it with an Englishman for an iron axe, and where the hide is next shipped across the Atlantic Ocean. Then, within a few months, the pelt is being turned into a hat proudly worn by a London banker. And in this context, does the construction and operation of the Great Houses on the desolate plateaus of New Mexico, in and near Chaco Canyon seem any stranger than the stone walls Fort Prince of Wales overlooking the icy waters of Hudson' Bay?

8.1 Main Lines of Evidence for Hide Trade Hypothesis

The "Chaco hide trade hypothesis" rests mainly on four interconnected lines of evidence:

- Prior to the invention of synthetic materials, the skins of animals were one of human's most valued commodities, and had a host of uses from clothing, footwear, shelter, warfare, sports, and ceremony;
- As a result of this value, hide processing and trade networks developed in virtually any region where an area of hide supply could be connected to an area of hide demand. Hide trade networks occurred across North America in both prehistory and history. Thus, for the southwest and adjacent regions, it is not a question of whether hide trade networks existed, but where were the routes of movement, who was involved, what products were exchanged for hides, and how did the networks change over time.;
- During the pre-AD 1200 period, bison were uncommon on the Southern Plains, but more abundant north on the Central Plains north of the Arkansas River, and possibly in an inter-mountain corridor in the Southern Rocky Mountains. Chaco Canyon lay on a relatively direct route between this supply of hides, and an area of high demand around the Hohokam agricultural communities in southwest Arizona. Intense bison hunting along the Arkansas and adjacent rivers to supply hides to densely populated cultures both to the southwest and to the east may have maintained the long-term southern edge of bison range;
- After AD 1350, possibly due to climatic events and cultural collapses, bison numbers expanded on the Southern Plains, and the Hohokam culture with high demand disappeared. As a result, the Rio Grande pueblos were better positioned between areas of hide supply and demand. The hide trading network for bison shifted southwards and eastwards, centering on the locations such Pecos and the Rio Grande pueblos. In the mid-1500s, the first Spanish chroniclers describe these hide trade network's routes.

This line of reasoning for the "Chaco hide trade hypothesis" provides a relatively simple basis to solve two of the Southwest's greatest prehistoric enigmas: 1) What ecological and cultural factors caused the southern edge of bison range on the Great Plains prior to AD 1300? 2) What was the ecological, economic and cultural function of Chaco Canyon's amazing human-built infrastructure?

If an explanation seems too simple, it likely is. In this concluding section, I will give further consideration to other explanations for these eco-cultural phenomena, and some ideas for additional research to resolve incongruencies in evidence and explanations.

8.2 Considering the Edge of Bison Range on the Southern Plains

The Chaco hide trade hypothesis largely rests on the evidence that the canyon lay on *the* least cost route for moving hides from the plains and southern Rockies towards the Hohokam lands prior to ~AD 1200. Moreover, due to intense hunting on the Central Plains, the bison could not, until after Chaco and other cultures collapsed after about ~AD 1300 extend their range southwards. This varying edge of bison range is critical in evaluating the Chaco hide trade hypothesis. It determined where, when, and why Chaco was built. The change in the bison's range also explains why the trading center was abandoned and never resettled. However, the potential ecological and cultural interactions determining the southern edge of bison range is controversial. In fact, the general consensus of most researchers is that climatic variation determined the southern edge of bison range (Lohse et al. 2014a,b), and until recently, there has been little evaluation of potential human influences on this range edge. This development of interdisciplinary research on the range edge topic can be broken into three general explanations based upon habitat productivity ("bottom-up"), human predation ("top-down"), or a complex interaction between these two general groups of factors.

8.2.1 "Bottom-Up" Explanations: Climate and Grassland Productivity

The obvious hypothesis evaluated by many researchers is that unlike core bison range on the northern and central plains (Cooper 2008, see Figure 5.1-1 above), the southern plains are marginal bison habitat, therefore bison could only expand into this region during periods of higher grassland productivity (Dillehay 1974, Bamforth 1988; Huebner 1991, Lohse 2014a,b), or inversely "the suggested primary cause of an absence of bison is climatic change, which reduced the population density and/or caused significant range shifts" (Dillehay 1974:187). For example, Bamforth (1988: 99-101) describes predicted differences between relatively high and low productivity grasslands in terms of bison herd size, regularity and frequency of movement, and distance of movement. On this basis, Lohse et al. (2014b) remark that: "Understanding when and under what climatic conditions bison moved into regions where they were not continuously present is important not only for our general knowledge regarding cultural and environmental records in North America, but also for providing insights into bison ecology and related human responses throughout the Holocene." However, defining the climatic conditions favorable for bison presence on the Southern Plains has proved allusive. Huebner (1991) ironically found that bison expanded into the area during arid periods. Lohse et al. (2014b) used isotopic analysis of plants eaten by bison and conclude that periods of bison abundance on the southern plains may be correlated with cooler conditions, but with variable moisture levels.

8.2.2 "Top-down" Explanations: Human Predation

Given the importance of bison as a resource for humans and that humans are one bison's primary predators (Kornfeld et al. 2010, Gates et al. 2010), an alternate explanation for bison abundance on the southern plains and elsewhere near the edge of its range might be the differential densities and hunting

patterns of humans over time (Roe 1972, Bailey 2016). I have used this general explanation—with human densities as quantified by Binford (2001) and mapped by Johnson and Hard (2008)— to give an overview of ~AD 1000 wildlife abundance on the southern and central plains (see Sections 4 and 5 above). Kay's (1994) controversial "aboriginal overkill hypothesis" for large artiodactyls provides the preliminary archaeological and historical evidence to broadly apply these potential human effects on depressing wildlife populations to much of the western North American continent, with further supporting research provided from analyses of the Lewis and Clark's journal observations (Martin and Szuter 1999, Laliberte and Ripple 2003, Kay 2007). However, this explanation for areas of low wildlife abundance requires further consideration. For example, Lyman (2003) critiqued Kay's conclusion for the rarity of elk because archaeological data on taxonomic abundances are averaged over time and space, therefore obscuring that elk could have been periodically numerous, even as highly abundant as they are in some parks and reserves today. Yochim (2001) argued that aboriginal overkill might be overstated because of recent high numbers of elk and bison are found in Yellowstone National Park, an area he argued is a representative pristine baseline for long-term ecological conditions. Moreover, aboriginal overkill in itself does not provide an immediate explanation for why bison expanded across the Southern Plains ~AD 1200.

8.2.3 Bottom-up and Top-down Interaction

Historical analysis provides some key information to understand variation in large artiodactyl, and bison abundance in general, and why areas of abundance might occur. The journals of many early explorers describe high densities of bison, elk, and other species in buffer zones between tribes at war. Reynolds (in Merrill and Merrill 2012) and White (1978) describe that bison were abundant in the relatively barren Powder River valley in the 1860s because this was in a war-zone between the Sioux and the Crow. For the Southern Plains, historian Dan Flores (1991) and Newton (2011) describe the inter-tribal buffer zone in the 1840s along the Arkansas and Platte rivers between the Comanche on the south, Kiowa and Arapaho on the north, and the Pawnee to the east. This area was rarely visited by large communal hunting groups from any tribe, and thus had high densities of bison. Hämäläinen (2008) shows how Comanche control of the central zone, and intense warfare zones around periphery their southern plains empire of the 1700s was important for sustaining the massive herd of bison. He then shows how treaties allowing multi-tribal and New Mexican hunting access into the area in 1800s started the bison's decline to eventual disappearance. As historian Richard White (1978) concluded for intertribal buffer zones: "Two things stand out in travelers' accounts of these areas: they were disputed by two or more tribes and they were rich in game."

Kay (2007) conducted the most detailed effect of inter-tribal buffer zones to-date by plotting wildlife numbers observed and killed by the Lewis and Clark expedition as a function of the number of Native Americans seen each day as recorded in their journals (Moulton 1986 to 1993). This analysis, and similar work (Martin and Szuter 1999, Laliberte and Ripple 2003, Newton 2011) on the Great Plains clearly shows that human density clearly influences artiodactyl abundance at a relatively fine scale, with larger species such as bison becoming rare first as high human use areas are approached.

The next link in this chain-of-analysis is to evaluate what habitats tend to be occupied by seasonally (or permanently) by humans, where would intertribal buffer zones then occur, and how this might in turn

effect large mammal abundance. For bison on the northern plains, Binnema (2001, 2016) conceptualized a general pattern of Native American seasonal round and bison movements, modified by White (2018) as the “buffalo-heartbeat model” to integrate the location of inter-tribal buffer zones and potential bison dispersal patterns to the west (Figure 8.2.3-1). This annual pattern of bison movement can be conceptualized as have several components: First, the aggregation of large herds in spring and early summer where green up occurs earliest in the center of the plains (Phase 1). These areas are often inter-tribal buffer areas. Then by fall, as the core central plains become arid, the bison will begin moving towards peripheral areas of the plains where conditions are moister, and later in the year, winter snow storms may even force them into dense forest (Phase 2). During the periods when bison are on this periphery, dispersal events into or across the mountains may occur (Phase 3), followed by persistence or demise of these small herds depending on Native American hunting pressure.

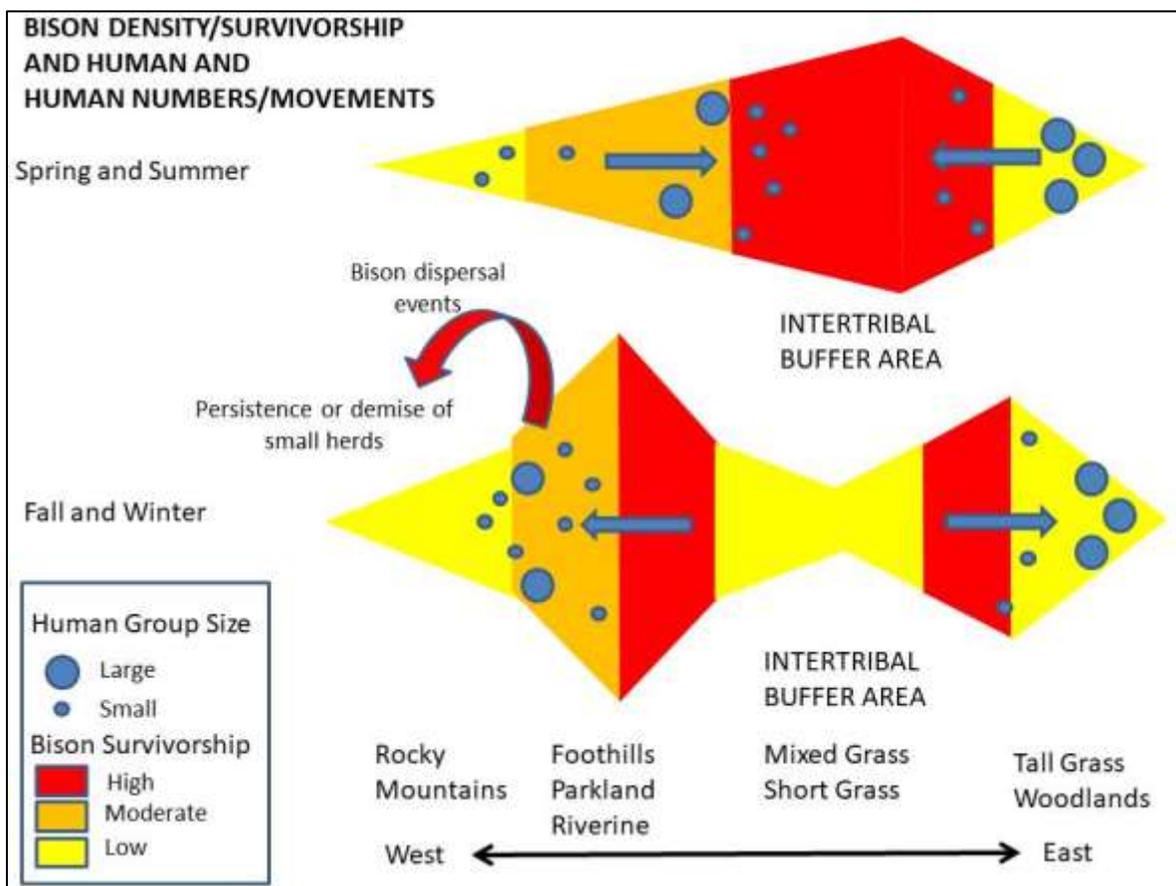


Figure 8.2.3-1: The “buffalo heart-beat model”, a three-phase pattern of regional bison habitat use on the northern plains with regular movements between plains and immediately peripheral areas (modified from Binnema 2001, 2016).

8.2.4. Bison Movements in the Rocky Mountains

A potential intermountain bison movement corridor is described in Section 5.3 that could have been used by the Fremont culture, then the proto and historic Utes, to move bison southwards from the North Platte headwaters through North Park, Middle Park, South Park (Bayou Salad), and ultimately into the San Luis valley on the headwaters of the Rio Grande within a few days travel of Chaco Canyon. This corridor is longer (>300 km) and it is relatively narrow in many places compared to those historically used by bison and mapped for the northern Rocky Mountains by White (2018). If indeed native peoples were actually herding bison this far south through the corridor, the socio-economic motivations and implications are relatively complex.

8.2.5 Future Research on the Edge of Bison Range Edge

Considering the importance of the edge of bison's southern range to Chaco, here are some potential research topics for bison-human ecology at the interface between the central and southern plains:

- **Update “Bison Heartbeat Model” to Reflect Southern Plains Conditions-** Research to-date on the processes influencing the edge of bison range have generally focussed on the northern and central Rocky Mountains and plains (Bailey 2016, White 2018). The “buffalo heart-beat model” needs modification to reflect southern plains conditions. On the northern plains, winter human habitat use is determined by the need for wood and shelter, and bison movements towards foothills and woodlands in the winter are also driven by the need for shelter (Binnema 2001, White 2018). In contrast, on the southern plains, bison movements from winter and spring range on the Llano Estadio towards the western mountains or eastern woodlands are likely driven more by drought, and by bison “following the green wave” of plant green-up (Merkle et al. 2016, Geremia et al. 2019) as the core winter range areas on the plains dry out.
- **Rivers, Human Use, and Barriers to Bison Movement-** There is a major gap in our understanding of how rivers influenced bison movements and abundance on the plains. Clearly for bison rivers are a source of water, and may be especially important during droughts. However, they are also important for humans as a source of water, wood, shelter, transportation, and perhaps agricultural lands. For the southern plains, where bison presence is episodic (Cooper 2008, Lohse et al 2014a,b) it appears than on balance, rivers may constrain bison habitat use, especially during periods of high human populations. The best historic analog may be the apparent effect of human hunters and trade networks along Rio Grande and Pecos River in limiting bison expansion into New Mexico after ~AD 1500 (see Section 5.4). Moreover, research on whether Native Americans used prairie rivers to move goods such as bison hides is needed. Clearly the technology to build hide boats was known to native people (see Sections 2.3.2 and 3.4 above), but early historic observations of native use of hide boats on the central and southern plains boat use are sparse. If pre-historic peoples were using “bull boats” to

freight hides, robes, and meat down the Platte, Arkansas and Canadian rivers to serve the demands of Mississippian cultures in the period ~AD 500 to 1200, intense hunting along these rivers could have limited bison movements southwards.

- **Effect of Drought on Humans and Bison-** In the south, humans may also be anchored to agricultural areas near rivers. Both species focus on sources of water during drought periods. Ironically, Dillehay (1974), one of the earliest researchers to describe the expansion of bison range onto the southern plains at ~AD 1200, also recognized that the preponderance of bison bones in archaeological sites might reflect changing hunting and foraging patterns by humans as a result of drought. This might occur if bison were forced to sources of water where human hunters awaited. However, there is the alternate scenario where drought may have dramatically lowered human densities (e.g., Benson et al. 2007), and that decreasing predation from humans might then actually increase bison abundance.
- **Mountain Bison Movement Corridors-** In general, mountain valleys restrict bison movement and range expansion, and especially narrow mountain valleys with low forest cover that allows human hunters to use terrain-traps to help kill bison (e.g., Arthur 1962, 1966; Reeves 1990, 2003; White 2018). However, there is also evidence that humans can use terrain to move bison long distances (e.g., Haig 1991, Brink 2008, Zedeño et al. 2014). On the northern plains, the opportunity for humans to use foothill and mountainous terrain may be limited by bison behavior of remaining in large herds out on the plains most of the year, and only moving into peripheral areas during late winter (Binnema 2001, 2016) when mountain valleys are blocked with snow. However, on the central and southern plains, herbage green up patterns appear to almost annually attract bison and other wildlife to higher elevations on the plains, and from there into the foothills during the summer (Flores 1991, Merkle et al. 2016). This pattern would be accentuated, and occur earlier during drought years. The pattern would routinely place bison where humans might have many opportunities to travel and hunt them within the Southern Rockies (as described for paleo-Indians by Benedict 1996, Brunswig 2015), and perhaps even drive bison further south down the corridor. This could be an eco-cultural process that resulted in high numbers of bison being observed in the southern Rocky Mountains during the historic period in areas such as the Laramie valley (Leonard 1839) and North, Middle, and South parks, and as far south as the San Luis Valley on the upper Rio Grande River (e.g., Farnham 1843). It is possible that the Fremont, followed by the Ute had long utilized this combination of terrain and vegetation phenology to herd bison southwards through corridors connecting these intermountain grasslands of the Southern Rockies, and towards areas of high demand for hides and meat in the southwest (see Section 5.3 above). The potential long-term eco-cultural process may account for the increasing recognition of the archaeological richness in this area (Pitblado and Brunswig 2007). This possibility needs more archaeological, historical, and traditional knowledge research.

In summary of these bison-related research needs, the “Chaco hide hypothesis” proposes that the canyon was on the trade route from the Hohokam to the southern edge of bison range, or perhaps even somewhat north of the Arkansas River on the Central Plains, and possibly at the southern end of an intermountain corridor on the upper Rio Grande River. Further, it is likely this range edge may have

been relatively stable for hundreds of years, and only moved south a whole series of cultures collapsed in a massive region from the Colorado to the Mississippi rivers in the period ~AD 1150-1400. Although this broad cultural collapse may be tied to drought (Benson et al. 2007), it appears that bison actually thrived during this period, and expanded their range over 500 km southwards (Dillehay 1974, Lohse et al 2014a,b). Moreover, these new southern plains herds appeared amazingly resilient, resistant right into the 1850s through an amazing range of cultural impacts related to the Apache, the Comanche, and European intrusions across today's Oklahoma, New Mexico, and Texas (Flores 1991, Hämäläinen 2008). All this begs the question, if cultural effects on bison prior to AD 1200 actually limited bison's expansion southwards, just how could this process have been so strong?

8.3 Considering Potential Chaco Canyon Socio-Economic Models

The “Chaco hide trade hypothesis” is biased towards the “supply side” of the exchange, describing much of the economic pattern based upon the regions where hides were procured and the various uses for which they were processed. However, it's possible that although hides may have initially created the network, over time the Southwest population's demand for a range of goods and services began to greatly transcend that of just hides, and Chaco Canyon evolved towards being a major trade fair and pilgrimage center (Toll 1985, Benson et al. 2020 and others) with numerous products exchanged (Figure 7.2.2-1). Thus, although the initial location of Chaco Canyon's infrastructure was because it lay on a least cost route for moving hides from areas of high supply (central plains, southern Rockies) to high demand (irrigated farmlands in the Phoenix basin), once established as a trade center, Chaco's pattern of development may have reflected a range of societal demands and conditions not directly tied to this location or exchange of hides.

To understand how the “demand side” of the exchange may have influenced Chaco, as for any trade network, the logical place is to “follow the money” and look down the trading chain to the cultures with the “where-with-all” to buy commodities, be they hides or other products. For the many historic trading networks in North America (Section 3), this requires understanding the economic and social conditions and travel routes used by primary traders and buyers—the Pueblos, Cahokians, Mandans, Nez Perce, Cree, and later the Spanish, French, English and Americans, and the various traditions and charters these social entities used to guide their trading systems. For Chaco, “following the money”, or perhaps more accurately “following the pottery” (Section 7.2.2 above, Mills et al. 2013, 2018), will likely mean understanding the Hohokam, the most populous culture with the strongest economy of the in the region. A host of researchers (e.g., papers in Fish and Fish 2007, Hunt et al. 2005) puzzle how the Hohokam culture organized to build hundreds of kilometers of canals in 9 major systems, irrigating over 8000 ha of farmland. After describing both the Hohokam's archaeological record and comparative ethnographic evidence from similar irrigation systems elsewhere, Hunt et al. (2005:452) conclude that elite leadership from a private or state basis is unlikely for ongoing operation of the Hohokam's irrigated lands and that after evaluating several models of communal governance:

We are left, then, with the various communal forms of charter of authority as the more plausible alternatives. Ethnographically each seems viable. The major question is whether that organization is single purpose (irrigation alone, as in the irrigation communities), or multiple purpose.

If we consider that Hohokam's canal governance was actually multiple purpose, perhaps each of the 9 entities that managed the individual canal systems also created a trade network to satisfy the demands of members within each of their respective irrigation systems. Each of these individual trade networks may have reached to Chaco Canyon or beyond, but taken different routes, linked different villages and regions, and demanded somewhat different goods and services. This may be evidenced in pottery exchange networks (Mills et al. 2013, 2018). Based upon variations in this demand and individual governance over hundreds of years, a range of socio-economic models may have occurred at Chaco over time. In general, the pattern seems to have evolved from a relatively simple culture to one that required the most complex building and transportation system in the prehistoric southwest (Mills 2002, 2015; Lekson 2015; Cordell and McBrinn 2015; Plog and Heitman 2015). So rather than evaluating a single socio-economic pattern to Chaco, I will describe a range of general models summarized by researchers (Sebastian 1992; Mills 2002, 2015). I will attempt to downplay my bias towards the importance of hides, and recognize that a broad range of goods and services possibly demanded by the Hohokam (Figure 7.2.2-1) and variations in this general socio-economic demand for many products might better explain "how Chaco worked" over time. I will make some tentative recommendations for further research to evaluate the importance of hides versus other goods and services in the area's economy.

8.3.1 Semi-autonomous, Egalitarian Society

Egalitarianism is a belief in human equality, especially with respect to social, political, and economic rights and privileges. One means of becoming a successful trader was an egalitarian perspective, where the trader would often marry into the families of native hunters and gatherers, learn their language, understand their seasonal rounds, hunting, and hide processing capabilities, and where eventually they, their wives, and offspring would act as a societal bridge between the more nomadic hunter-gatherers that supplied the hides, meat, and wild vegetation products to the more sedentary and population-dense agriculturally based societies that had the greatest demand for them. In the Canadian fur trade, the success of these egalitarian-oriented traders such as David Thompson, David Harmon and others (and their native or part-native wives) is significant both in terms of maintaining peace and cooperation in the exchange system around their trading posts, and more importantly in generating profits for their owners in the Northwest Company, and Hudson's Bay Company.

Possibly, in Chaco Canyon's early development ~600 to 800 AD a single entrepreneur owning or managing a relatively small trading center may have operated in a relatively egalitarian way. The valley may have locally produced enough food to feed the local trader, a group of local porters, and one or two visits a year from hunter gatherers bringing hides, pine nuts, or corn from the region. Bulk-grown food may have also been provided by a few groups of traders coming from further the Hohokam or other societies in the region. With a small population, in a good crop year, with a good trader-manager that was well integrated into the local cultures, we could visualize Chaco as been similar to some of the smaller historical trading posts and rendezvous locations that operated relatively independently, using their local area for much of their subsistence, and operated for many decades to the mutual benefit of both the local peoples (hunter, gatherers, workers at the posts), and the trading company itself. For the southwest, Spielmann (1983, 1991) also describes a mutualistic benefit to farmers, traders, and hunters from the adjacent plains through late prehistoric and historic hide trading.

However, even with a relatively small trading post, similar to some of the Hudson's Bay Company examples of later centuries, many of the societal benefits came from the income that was generated by the trade of the hides or other products such as dried meat or fish (Mackie 1997). So, although the early Chaco community could have possibly been relatively egalitarian and semi-autonomous, and many of its members may have worked cooperatively for pay, ultimately the basic economy of this group of people living in remote Chaco Canyon was tied to its location along an important trade route, be it for hides or other goods (Figure 7.2.2-1). Moreover, as the Hudson's Bay Company's post journals describe (Cole 1979, Harmon 2006), operating a remote trading post in a desolate environment, especially one dependent on its local farm, required much hard manual labor, and there were many complex tasks that involved specialized expertise, direct supervision of workers, and discipline. In truth, "egalitarian" doesn't describe this social complexity very well.

8.3.2 State-like Centralized Political System or Managed Cartel?

The growth of the Hohokam farming system during the period ~AD 600-1300 would have created demand for a wide range of goods and services, and by ~AD 800 could have a need for greatly expanded hides and other products through Chaco Canyon. The building of several Great Houses during this early period suggests that each of several individual entities (Mills et al. 2015) got into the trade business to satisfy the demand, and as described above, these likely originated in the Hohokam area. Lekson (2015) argues that the development of Great Roads and other joint infrastructure could mean that these houses were under the direction of an overarching, centralized political system similar to a Mesoamerican kingdom or altepetl. But there are other options, in the Canadian fur trade history (Section 3.7), at times several different companies would build trade houses at the same location for geographic, security, and socio-economic reasons. Although these companies were in competition, at times they did cooperate, but certainly not at the scale of jointly building Great Roads.

One way to help answer the question of multiple versus single governing entities is what were the basis of this organization: Was it economic, political, religious, or something else? Again, returning to the Hohokam, procuring many necessary goods and services from distant sources, not just hide and leather products, could have been one of the communal tasks under Hunt et al.'s (2005) multi-purpose organizational option. Perhaps several groups of the Hohokam's communal canal managers each chartered a "Great House" to be established at Chaco. If the Hohokam's communal management system led to hereditary leaders, members of these lineages might then be assigned to manage one Chaco's Canyon's Great Houses, they would form "house societies" (Heitman 2007) and their history of cooperation in irrigating the Hohokam lands might then also be applied to Chaco's joint projects and management. In essence, in the form of a business cartel, we are now close to the Chaco organizational model proposed by other researchers (e.g., Sebastian 1992).

Importantly, through some cooperative mechanism already established, and essential for managing the Hohokam canal system, this limited "cartel" of houses would cooperate to build the "Great Roads", and jointly operate a security force or whatever to make it possible for the Chaco houses to obtain from the Anasazi, through purchase or possibly tribute, the necessary supplies of food, building logs, and fuelwood to build and operate the Great Houses. So, for at least some time periods, there was "centralized management" at Chaco, but not from a single state (as proposed by Lekson 2015), but

rather through the pre-existing cooperative management system for the Hohokam canals. This level of cooperation was never attained in the multiple entities competing for skins in other North American examples described in Section 3, but they did not share a common societal territory like the Hohokam. Ultimately, many of these historic trading systems and companies failed due to “ruinous competition” that destroyed the resource base, or debauched the cultures of the native hunting trading and transport systems (Innis 1962, Wishart 1992). In the Canadian boreal system, it was finally under a unified British governmental system that the Hudson’s Bay Company, in 1821, formed the monopoly that brought stability to the fur trade for the next century, even through the collapse of the European hat market (Newman 1988).

8.3.3 Pilgrimage Fair and Religious Center

Both the above phases of Chaco’s socio-economic system could be visualized as beginning to provide the basic economic system to provide food, shelter, and security for groups of people gathering each year in the canyon to exchange a range of goods and services. Researchers have long recognized that given Chaco’s desolate environment, it may have only been fully occupied during limited time periods. For example, Toll (1985) concluded that most Chacoan sites did not have full-time residence and that the great houses built for elites, but rather that they were for gatherings of people from outlying communities. Similarly, Judge and Cordell (2006) describe that people living outside Chaco may have constructed, maintained, and owned some of the structures in Chaco, including great houses and communal great kivas. Benson et al. (2019, 2020) more fully evaluate the limited resources available to feed and heat Chaco residents and visitors, and likewise conclude that its use was seasonal and limited.

Hides, turquoise and captives may have provided the main source of wealth in this system (Figure 7.2.2-1), but as in any gathering of peoples and cultures, there will also be information and ideologies exchanged. Again, from comparative ethnology of other North American trade networks, it is likely that the trading rendezvous and locations frequently become foci for sharing and expanding religion, or as a destination from visitors afar. In the Canadian fur trade, long-term trading houses were frequently associated with a “home-guard” village of local hunters, gathers, fishermen, or laborers. Often one or more missionary-based churches associated with the English or French traders established themselves in the villages (Figure 8.3.3-1).

One of the more interesting historic examples of both religious and political indoctrination facilitated by the economics of the hide trade are the travels of missionaries during the 1830s and 40s, in the closing period of the Rocky Mountain fur trade. A host of religious notables proceeded west to “Oregon Country” including Methodists Jason and Daniel Lee, and American Board Missionaries Dr. Whitman and Reverend Mr. Parker. These religious instructors sometimes travelled with fur trade brigades, and preached at trading posts or rendezvous sites. One of the best travelled missionaries was the Catholic Jesuit priest Father Pierre Jean De Smet (Chittenden and Richardson 1905). He first travelled west in 1840 with the American fur brigade, accompanied by guide Ignace la Mousse, a Catholic Iroquois then living among the Flathead people who desired a “Black Robe,” to come west to instruct them. On Sunday July 5, at the Green River trade rendezvous near today’s Pinedale Wyoming, De Smet gave mass to hundreds of assembled traders, mountain men, Flatheads and Shoshone. In several later trips, again travelling with guides between various trading posts, De Smet toured the length of the Rockies

preaching from Ft. Hall on the Snake River to camps of Kootenai and Secwepemc on the headwaters of the Columbia, to assembled Hudson's Bay staff and Cree at Fort Edmonton on the North Saskatchewan. De Smet not only preached Catholicism, but was he was also a fervent American, and played a role in the eventual expulsion of the Hudson's Bay Company from the lower Columbia, and establishment of the American border on the 49th parallel (Chittenden and Richardson 1905).

The important point here is that in several North American historic examples, the exchange of some select goods or services provided the basic economic and social requirements to peacefully assemble various cultures at fairs and trading posts. This could have also occurred at Chaco Canyon, and perhaps each Great House of the trading cartel may have supported their preferred religion or attractions for a pilgrimage. During the hey-day of Chaco, as outlined in Section 7.6.2, the importance of these "value-added" components may have expanded to actually provide the majority of wealth exchanged at the trade center. There is thus strong convergence between an initially specialized trade, such as for hides, and the proposal that Chaco Canyon ultimately expanded into a major center for trade fairs and pilgrimages (Benson et al. 2020).



Figure 8.3.3-1: The Dakelh First Nation's village of Nak'azdli on Stuart Lake, British Columbia in foreground, with the white-painted Hudson's Bay Company's "Fort St. James" trading post in center background, with its adjacent gardens beyond. The white-painted steeple of the Roman Catholic Church, built by Oblate missionaries, is visible in center right. Long-term operations of the Hudson's Bay Company fur trade posts may provide some historical and cultural analogs for the functioning of Chaco Canyon's great houses. (Image date c. 1915, source British Columbia Archives D-06388).

8.3.4 Free-Market Trading Center

Another option, or perhaps phase, for Chaco Canyon's socio-economic functioning, and one that may have occurred during Chaco Canyon's last building boom, is the free-trade model of exchange. As described in Section 7.7.2, abandonment of the limited-member cartel, and an influx of new traders all competing with each other could have been a precursor to collapse. Free competition would maximize prices paid for goods and services to Chaco as buyers outbid each other, and minimize the price for goods and services going out as competitors undercut each other to make sales. With minimum profits, and little cooperation, community infrastructure and maintenance projects such as building Great Roads or joint-funding of a security force would be difficult.

Can we find analogies to this competitive situation in historically-documented other trade networks? In the Canadian boreal fur trade during the period 1780s to 1821 there were, at times, up to four trading companies at some northern exchange centers (Figure 3-1). For Native American hunters and trappers this intense competition initially meant high prices for their skins. The companies then turned to liquor (Innes 1962:268-269). Newman (1988:146) describes the result:

Liquor became the currency of the fur trade. The initial utility of rum and brandy was based mainly on the fact it was the most cost-effective item to carry inland, much less bulky in its concentrated form than such standard goods as blankets axes, guns, and bolts of cloth. Also, once addicted, the Indians could not get enough of the white man's deadly nectar, and lost their ability or willingness to bargain patiently or shrewdly for their booty of furs.

Moreover, the alcohol precipitated cultural chaos at trade fairs, and ultimately began to influence the pattern of hunting and gathering annual travel rounds, and the supply of skins. In some areas, intense competition for food and furs greatly depleted wildlife numbers. Finally, in 1821, through an amalgamation with the North West Company, the Hudson's Bay Company obtained a monopoly on the Canadian northern trade network. The company banned the sale of alcohol, regularized prices for skins, and set about rebuilding wildlife stocks in some areas (Innis 1962:283-286). Similarly, in the 1820s and 30s the Hudson's Bay Company intense competition with American traders on the western slopes of the Rocky Mountains led to a company policy of over-trapping beaver to create a "fur desert" to discourage American adventurers and the liquor trade, and create a more stable exchange with the Native Americans in the regions around exchange centers such as Fort Hall and Flathead Post (Mackie 1997:102-113).

In summary, given the unique mix of cultures, goods, and services, free trade in the fur and hide trade, and perhaps other natural resource systems can be unstable. This can be especially so in the absence of central governance rules for trade practices and natural resource management. If free trade did develop in the Chaco Canyon situation, it may have helped lead to the collapse of the exchange system.

8.3.5 Future Research on Chaco Trade Socio-economic Models

The “hide trade hypothesis” provides one perspective to evaluate Chaco Canyon’s social and economic processes, but it can be modified to emphasize an increased exchange of other goods and services, and the emergence of Chaco as a general trade fair and pilgrimage trade center. There is such a well-documented ethnological and historical literature on the trade in hides and associated goods from North America and elsewhere in the world. This literature can be synthesized to develop a range of models and evaluate their predictions against the archaeology of the area. Given that hides, skins, and other goods and services generally do not persist in the archaeological record, the Southwest’s incredible data on the of other goods such as pottery potentially exchanged for these perishable products will have to be brought to bear on evaluating various ideas on how the trade may have worked over time (Mills et al. 2013, 2018). The hide trade hypothesis provides one reasonable proposal on what the primary goods were being exchanged, and in what direction they were moving. Various socio-economic models based upon hide processing and trading can also be tested through archaeological research.

8.4 Concluding Challenge: Chaco and the Southwest Edge of Bison Range

The impetus for this analysis of trade networks in the Southwest region around Chaco Canyon was to gain further understanding of the factors determining the edge of bison range along North America’s western cordillera (White 2018). For millennia, along these mountains, ecological processes driving bison westward, such as the large herbivore seeking out fresh forage and distributing its vast numbers was matched by the socio-economic pressure of humans coming to the mountains, particularly from the west to obtain hides and meat (Kingston 1932, Roe 1972, Brunswig 2025, Bailey 2016). For analysis, this southwest area is ideal because of exceptional historical records of bison hunting during the early Spanish era (e.g., Flint and Flint 2005), and excellent late prehistoric archaeological evidence of hunting and trading bison products the pueblos east of the Rio Grande (e.g., Spielmann 1981, 1993; Driver 1990b). However, going back in time another few hundred years to before AD 1200, the archaeological analysis for bison presence in the southwest becomes strangely vague. Researchers concede that bison and other large mammals were rare across the area due to high human densities and perhaps intense hunting (e.g., Szuter 1991, Driver 2011), but consideration of whether and where a trading network could have existed towards the north and east to obtain important products such as hides and dried meat from the plains or Rocky Mountains is only giving passing consideration. This is indeed unusual, for these hide trading networks are clearly recognized to have existed historically in the southwest and other areas, and prehistorically also across much of North America.

This knowledge gap in socio-economic and ecological continuity is most pronounced for the Chaco Canyon area. Until ~AD 1300, “Chaco” was ideally placed to be an important center along the most direct route from the edge of bison’s then southern edge-of-range on the Arkansas River to the Hohokam lands on the Gila River, yet almost all researchers conclude their analyses with some variation

on the enigmatic theme of *“many goods of value moved into Chaco, but little of any came out.”* Hopefully the above analysis of the “hide trade hypothesis” will encourage researchers to consider that, like other communities that lay along hide trade networks, a great deal of value could have actually come out of Chaco Canyon through its moving, processing, and exchanging hides.

If some version of the “Chaco hide trade hypothesis” does eventually gain some credibility, southwest region eco-cultural research may be able to make some strong contributions to understanding what socio-economic processes influenced the edge of bison range. In all regions along the Western Cordillera, as with elsewhere in the world, the primary evidence of the hide trade, the hides themselves, have long-since cycled back to carbon and other basic elements. But in the southwest there is an incredible archaeological body of evidence, well referenced in time and space, of goods such as pottery and turquoise that may have been exchanged for the skins. The ongoing network analysis on how these goods moved across the southwest (Mills et al. 2013, 2018, Section 7.2.2. above) could be used to backtrack along pathways of the now-invisible hides for which they were possibly traded, and build fine scale models of the trade network.

There is little new ecological and cultural evidence to be considered to at least begin to integrate hide trading hypothesis into our knowledge of Chaco Canyon, and the southwest and adjacent region’s prehistory. Many researchers describe prehistoric trade networks reaching from the Southwest to the Mississippi (e.g., Ericson and Baugh 1993, Chase-Dunn 2011) and climatologists such as Benson et al. (2007) describe how the mega-droughts of the period ~AD 1150 to ~1500 could have destroyed many agriculture-based cultures across this whole region, and their associated trading networks. What is new here is the recognition that hides, invisible in the archaeological record except for their association with bones, weapons, and processing toolkits, may have actually been the driving economic forces underlying much of this trade. Moreover, there is the counter-intuitive evidence that drought, through its role in reducing human numbers and hunting pressure, actually resulted in bison populations increasing on the Central Plains after about ~AD 1250, and for herds of buffalo then to expand to again make the Southern Plains “their home on the range” for the first time in over 1000 years. This potential process of human population collapses, then of bison moving southwards restructured the spatial pattern of regional supply-demand for hides, and new trading networks developed by the ~AD 1500s that the Spanish then documented.

At this point it is time for me to pass these ideas on to regional researchers more fully informed about the people and places in this proposed hide trading system— knowledge experts on the bison hunters on the southern and central great plains, the traders at Chaco Canyon, and the main groups of hide consumers on the lower Salt and Gila rivers. For these skilled skeptics, probably the place to start in evaluating the “Chaco hide trade hypothesis” is to consider the fundamental question:

“If there wasn’t a major southwest trading route for bison hides going through Chaco Canyon for the period ~AD 800 to ~AD 1200, just where then was it?”

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