THE MISSING LINK: AN EXAMINATION OF SKIN CLOTHING PRODUCTION OF NORTH CENTRAL PLAINS NATIVE AMERICANS

by

Kassie Lynn Praska

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Deer hides are one of the most commonly used materials for clothing production among the prehistoric Northern Great Plains peoples. Richard Michael Gramly's 1977 article, *Deerskins and Hunting Territories: Competition for a Scarce Resource of the Northeastern Woodlands*, assumed an estimate of 3.5 hides per person per year. A figure widely cited in anthropological literature, yet provides no supporting data. This investigation seeks to find that data as applied to the Plains Indians. Measurements were taken of known clothing articles to determine surface area, and these were compared with the surface areas of average sizes of small, medium, and large hides. Comparing the surface areas allowed for an accurate estimation of the number of hides needed by both a man and woman for an appropriate climate wardrobe. Such information can be vital in interpreting prehistoric and historic hunting patterns, with significant social and ecological implications.

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INTRODUCTION

Today clothing reveals many different aspects of a person's life. Observing a person's attire may reveal their economic status, what they do for a living, their religion, where they come from, and their cultural heritage (Hanson 1982). Like today's society, the prehistoric people's wardrobes revealed much about them, but to acquire new clothes they did not go to a local clothing store, rather they made clothes by hand. Prehistoric peoples in the Northern Plains often clothed themselves by cleaning and processing animal hides into soft workable materials which were comfortable, protected them from harsh weather, and when processed properly were water proof (Theler and Boszhardt 2006; Belitz 1973). Men and women each wore different styles of clothing that required different amounts of materials to produce. Cave illustrations, figurines, and ethnographic photography and materials have allowed us to identify the various types of clothing, including animal hides and plant textiles, worn by prehistoric societies (Hoelscher 2008; Swartz 1990).

There is an abundance of information about deer used for food and tools, and much practical advice on how to process a hide (Gramly 1977; Haire 1934; Theler and Boszhardt 2006). Based on protein supply, we know how much a society would need to survive, and how many deer would need to be killed to maintain survival throughout the year (Theler and Boszhardt 2006). Calculations figuring the exact amount of deer meat needed to sustain enough nutrition within societies have been extensively researched. However, research has focused on

subsistence modeling of deer data, but not specifically on how many hides are needed for clothing or other material products.

In 1977, Richard Michael Gramly wrote an article estimating that a sustainable wardrobe for an individual, of the Late Woodland Huron tribes in Canada, would need approximately 3.5 deer hides for each person per year. His study, however, lacked evidence as to how he acquired this number, and it has been cited in further studies, including the Plains Indians. The purpose of the following research is to determine the best estimated number of deer hides needed for clothing in a typical northern North American Plains Indian society, using Gramly's number as a base estimate. This investigation is designed to collect primary and secondary data in order to calculate the number of hides needed to sustain a comfortable wardrobe for men and women.

This investigation provides estimates for the number of hides needed for clothing by a Native American man and a woman, given the selected hide sizes. To calculate these numbers, measurements of ethnographic examples of clothing pieces were taken to calculate how much hide was needed to produce these items, as seen among several tribes throughout the Great Plains region. This data was obtained through published photographs and text descriptions, and previously recorded measurements. Primary data was obtained as well by measuring local hides to calculate how much hide material is available, and how much of these particular hides are needed to produce a wardrobe. For example, how many hides does it take to make a shirt, skirt, pair of moccasins, breechclouts, et cetera? Does it take one, two, three, or more hides to fulfill the need of a wardrobe for a man or woman?

Outcomes for this investigation produced specific figures, with supporting data, for the number of hides needed for clothing. Identifying the base estimate of hides provides a more precise calculation of the number of deer needed to sustain their lifestyle. Future studies,

focused on how many deer are needed in society, will have accurate numbers, backed by sufficient data, to support their claim. It will also add much more detail to allow more sophisticated calculations and interpretations on the use of deer hides, and the social and ecological implications of such demands.

BACKGROUND OF PLAINS INDIANS CULTURE

To explain past human development and behaviors, we as archaeologists examine past human cultural and physical remains to provide us with an answer. When exploring this subject we examine every possible aspect of human life. This includes the substances they consumed, the places they lived, the tools they utilized, and the environmental conditions in which they lived. For tens of thousands of years humanity roamed the earth and survived by hunting and gathering all the supplies that they needed to eat, make shelters, and create clothing. These hunting and gathering peoples sought the best areas that provided water sources, abundant plant life, and populous herds. As their societies became larger, local resources became insufficient for increased populated areas; creating periodic shortages. A need for alternate methods of survival was crucial. Humans began to settle in semi-permanent or permanent homesteads where they took up first small, then large agricultural production. Changes occurred in their everyday lifestyles from the food they gathered to the clothes they wore.

Examining our homeland, the most common illustration that many people think about when picturing a Native American Indian costume is that worn by the Plains Indians, assuming that it is a universal costume. However, this design only dates back a few hundred years, and

this universal costume ideal is not accurate. The Plains Indians of North America, the focus of this study, have worn a variety of garments throughout the land and time.

To understand the types of clothing worn by the Plains Indians we must understand the climate in which they lived. The Great Plains in North America extends across the heartland of the continent, from the Mississippi Riverbanks to the base of the Rocky Mountains, stretching from Canada to Texas, and consists of many miles of prairie grasslands and short grass steppes (Figure 1). During the summer, massive rainstorms saturate the ground, but the moisture quickly evaporates due to the sun or sinks into the rocky and sandy soils (Spencer and Jennings 1965). The winter is characterized by icy and snowy blizzards, and freezing temperatures. Those who live in the southern plains live in a much warmer climate than those who live in the northern

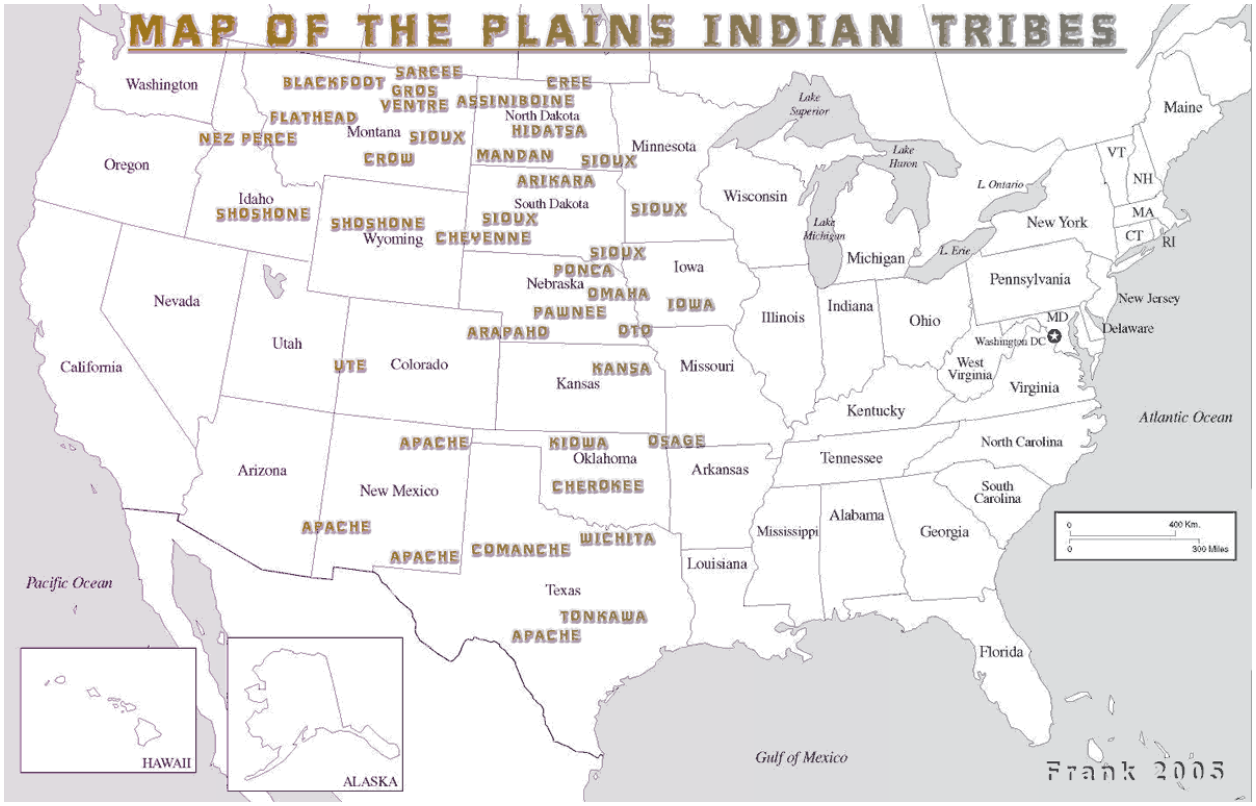


Figure 1. Tribes of the Great Plains (Frank 2005: Link: Map of Plains Indians).

regions of America. The same applies to those who live in desert areas, rather than forested areas (Haire 1934). The Indians who lived in warmer climates required a simple breechclout, or loincloth, during the warm days, made of plant textiles or thin hides, and a fur robe to keep them warm on cold days. Those who lived in colder climates required shirts, leggings, robes, and/or shawls (Paterek 1994). Each tribe has their own distinctive style, and that style varies from person to person. Those who made their own clothes had the chance to express their individuality and status (Ubelaker and Viola 1982).

The Plains Indians were great hunters of both large and small game, from 10,000 B.C and extending into the nineteenth century. Settling near water resources, the Plains peoples followed the herds, extracting as many resources as available to them. The Europeans began to settle in the east during the mid-sixteenth century forcing the Indians to move further and further out west toward the plains (Snow 1976; Fowler 2003). With the introduction of the horse in the late 1600s, buffalo and other animal herds began to greatly decline, forcing the Indians to find alternative resources, most of those they obtained through trade with the white man (Farber and Dorris 1975). Much of our knowledge about the Plains Indians is due to the archaeological record which is backed by extensive journal notes and records written by, for example, Lewis and Clark during their expedition in 1805 and 1806, and numerous other explorers, ethnographers, historians, and artists, as well as paintings of natives by George Catlin during the nineteenth century (Skinner 1926; Ubelaker and Viola 1982; Ewers 1997). However it may be because of paintings and photographs that we attain a misguided and stereotypical image of Native Americans (McCracken 1959; Hassrick 1977).

When looking into the different types of clothing worn by American Indian peoples, especially those of the Plains, several factors must be considered, according to Paterek (1994).

The first of these identifies that when we are examining a nomadic tribe we must understand that clothing should be easily transportable and not a burden for travel. The second consideration maintains that, given the climatic variations of the Plains, clothing must be versatile. Extreme warm and cold fronts mean that clothing is added or subtracted often, such as robes or sleeves, while other articles may be seasonal, such as skirts and shirts. Thirdly, clothing varied according to structure and design based on the culture of the time, individuality within the tribe, and consisted of features that created movement and sound. Lastly, similarity in clothing between Plains tribes is due to trading with the white man, or trading among tribes. To add to Paterek's consideration, we must also factor in how long the clothes last, a factor dependent upon how well the hide cloth is processed.

General Dress of Men and Women

The following descriptions were taken from early historic ethnographic records, early paintings, and photographs. Although we cannot account for the clothing worn thousands of years ago in this region, we are able to identify individual wardrobes from these ethnographic studies. The primary articles of clothing worn by the Plains men consisted of a breechclout, leggings, and moccasins. The breechclout, or loincloth, was a long strip of buckskin that wrapped around the navel of the man's body passing through the legs (Driver and Massey 1957). Its size was approximately 30-45 centimeters (12-18 inches) wide, and 152-244 centimeters (5-8 feet) long, and held together with a belt of leather (Paterek 1994). Men's leggings covered the legs from ankle to thigh. Leggings were thin rectangular strips of hide wrapped tightly around the leg, sewn at the sides, and tied to a belt with leather strips, or thongs (Driver and Massey 1957; Paterek 1994; Dubin 1999). Shirts were primarily worn during the winter season, with detachable sleeves added and subtracted as temperatures changed. The earliest shirts were either

poncho-style and tied at the sides, or composed of two hides. The two-hide shirt was made from two hides similar in size, cut below the forelegs, sewn at the shoulder, with an opening left for the head. The shirt was then decorated in paint, beads, quillwork, and hair (Skinner 1926; Driver and Massey 1957; Paterek 1994; Dubin 1999).

Generally women wore more clothing than the men, but the styles of the women's dress changed quite frequently (Skinner 1926; Dubin 1999). The earliest attire woman wore, for which we have direct descriptions, was that of a wraparound skirt, held by a belt, and a poncho or cape added in times of unpleasant weather. The wraparound skirt did not need to be sized for it was a single piece of buckskin wrapped around the waist. The next type of dress worn by Plains women was a strap-and-sleeve dress made of two skins. Two skins were sewn together at the sides with thick straps attached over the shoulders. As temperatures declined sleeves were wrapped around the arms and strapped together across the back and chest with a leather thong (Paterek 1994). Norman Feder, an art historian, was the first to name the "side-fold dress," describing it as a dress made of one large hide folded around the body and sewn with a single seam on the side (Feder 1984). A vertical cut was made for the right arm, and an over-the-shoulder strap was sewn to the dress on the right side to hold it to the body. The most common garment observed by ethnographers, as of the nineteenth century, was the two-skin dress. It consisted of two hides, equal in size, sewn together at the sides and shoulders (Paterek 1994; Dubin 1999). The latest dress style was a three-skin dress. As more hides became available, due to advancing technology and the introduction of the horse, women were able to create better structured dresses. The three-skin dress consisted of two skins sewn together at the sides forming a skirt, and a third hide draped over the head and shoulders attached to the two hide skirt

(Paterek 1994). Women's leggings were fashioned similarly to those of the men, however they only reached as far as the knees (Driver and Massey 1957; Paterek 1994; Dubin 1999).

Both men and women wore moccasins on their feet. Although moccasins varied in style among tribes, they generally occurred in two different types: The first a soft-soled one-piece moccasin, and the second a hard-soled two piece moccasin (Driver and Massey 1957; Paterek 1994). The soft-soled moccasin was made from a single piece of leather, with a single running seam on the outer side of the foot and up through the heel. The hard-soled moccasin was made of leather with multiple seams on each side of the shoe. Shoe cuffs, more common among women than men (Paterek 1994), may also be added as a modification for winter climates. The cuff could be turned upward and tied around the ankles. The space in between the leg and leather may be stuffed with grasses or animal hair for insulation.

The final articles of clothing found among the Plains Indians were robes. More common among men than women (Driver and Massey 1957), robes were made of buffalo hides and worn during cold weather or for ceremonial purposes (Skinner 1926). The everyday robe was made of deer, elk, or antelope hides. Depending on the hides, a robe could weigh as much as 90 pounds (Paterek 1994).

METHODOLOGY

The premise of this paper draws upon the findings of Richard Michael Gramly's 1977 article, *Deerskins and Hunting Territories: Competition for a Scarce Resource of the Northeastern Woodlands.* His article noted that it takes an average of 3.5 deer hides to sustain an individual's wardrobe for one year. Unfortunately, his article did not source much data to support this claim.

Finding the number of deer hides needed to sustain an individual's wardrobe for one year requires a specialized methodology and acquisition of primary data. This includes information regarding the items of clothing worn by different peoples, as well as, knowledge of past environmental conditions, necessary for determining which types of clothing articles are most appropriate for a particular area, in this case the Great Plains region. Information about differences in clothing types was recorded, considering men and women separately, among five Plains Indian tribes: The Blackfoot, Cheyenne, Dakota Sioux, Ioway, and Kiowa. Each tribe resided throughout the Great Plains of North America and was dependent on locally available resources until they made contact with the Europeans beginning in the seventeenth century. These natives used several materials, both animals and plants (Paterek 1994) to create their clothing, but this investigation will focus on clothing made from deer hides. Notes regarding specific measurements of clothing articles were taken, as available, and were compiled with measurements taken from first hand observation. As part of this study I went to the Milwaukee Public Museum to study an Ioway shirt, leggings, and moccasins to examine these items and calculate how much hide material was used or needed to make them. Other measurements of clothing articles were recorded from online databases of museum collections, as well as book references of museum clothing collections.

All information gathered was compiled into a Microsoft Excel spreadsheet for analysis. This spreadsheet shows the clothing items for each of the societies as mentioned above, as well as measurements taken of individual items cited in the literature or taken first hand from known collections of clothing. These measurements were used to calculate the surface area of each of the individual clothing items. The resulting areas were then compared to the area of average sized deer hides, to determine if one or more hides would be needed to create a particular

clothing item. First hand measurements of hides were taken to supply a comparative number. To serve as a control, another comparison was made with those of average sized deer hides, based on weight, for a small, medium, and large deer, as cited in Robert Wegner's *Deer and Deer Hunting* (1984). Calculations were made to determine the number of hides needed to create the clothing articles, and then further calculations were done to find the approximate number of deer hides needed to put an ensemble together for both a man and a woman. This calculation will either confirm or modify Gramly's claim of 3.5 hides per individual per year.

COLLECTIONS EXAMINED

The data used in this study was acquired from a review of the ethnographic and archaeological literature, and examination of museum and private collection specimens (references for each clothing article are found in Appendix C). The measurements for each garment are shown in Tables 1-5. The data analyzed in this study was entered into a Microsoft Excel spreadsheet which includes all measurements and calculations for surface area from the collected articles of clothing. The database is first divided by culture, followed by sex, and then separated into clothing articles. Each clothing article was found, with its individual measurements for length, width and, for the moccasins, the height. These measurements were then used to determine the approximate surface area of each individual item.

Measurements were taken for garments, breaking them down analytically into relatively rectangular blocks. To determine an approximate surface area the following equation was used: L x W = A, where 'L' represents the length, 'W' represents the width, and 'A' represents the surface area. Since there are two sides, a front and back, to a shirt and dress, each made of equal

sized hides, the surface areas of these items were multiplied by two. In the matter of sleeves and leggings we must not only take into account that they have a front and back, but also that there are two of them, left and right. Thus, the surface areas for sleeves and leggings were multiplied by four. According to Paterek (1994) a standard Breechclout, or loincloth, for a Plains Indian is estimated to be a length of five to eight feet by 12 to 18 inches. Due to lack of garments in present collections of native clothing, this standard measurement was used for this study. The middle of the range of each measurement of the breechclout was used to calculate a universal surface area to be used for breechclouts in every society. All surface area measurements were converted into squared centimeters for consistent comparison between clothing items.

Once the data was gathered, each clothing article, as well as the total surface area, was compared to five different hide sizes. The ratio of garment surface area to hide surface area, produced by this comparison, allows for the determination of the number of hides needed for

Table 1. Clothing Articles of the Blackfoot Society.

Sex	**Types of Clothes***	**Measurements**	**Surface Area in cm²**
Man	Breechclout	Length:16.5 cm Width:38.1 cm	658
	Shirt	L:119.38 cm W:45.7 cm	10,916
	Sleeves	L:53.34 cm W:15.24 cm	3251
	Leggings	L:101.6 cm W:48.26 cm	19,613
	Moccasins	L:29.21 cm W:10.16 cm H:7.62 cm	2258
		Total	**36,696**
Woman	Dress	L:145 cm W:50 cm	14,500
	Sleeves	L:15 cm W:50 cm	3000
	Leggings	L:42 cm W:19 cm	3192
	Moccasins	L:25.4 cm W:10.16 cm H:10.16 cm	2787
		Total	**23,479**

*Sources for clothing articles can be found in Appendix C.

Table 2. Clothing Articles of the Cheyenne.

Sex	Types of Clothes*	Measurements	Surface Area in cm²
Man	Breechclout	Length:16.5 cm Width:38.1 cm	658
	Shirt	L:116.84 cm W:50.8 cm	11,870
	Sleeves	L:58.42 cm W:12.7 cm	2967
	Leggings	L:95 cm W: 25 cm	9500
	Moccasins	L: 25.4 cm W:12.7 cm H:12.7 cm	3870
		Total	**28,865**
Woman	Two Skin Dress	L:136 cm W:55 cm	14,960
	Sleeves	L:25 W:35 cm	3500
	Leggings	L:50 cm W:28 cm	5600
	Moccasins	L:25 cm W:13 cm H:11 cm	3290
		Total	**27,350**

*Sources for clothing articles can be found in Appendix C.

Table 3. Clothing Articles of the Dakota Sioux.

Sex	Types of Clothes*	Measurements	Surface Area in cm²
Man	Breechclout	Length:16.5 cm Width:38.1 cm	658
	Poncho Shirt	L:101.6 cm W:50.8 cm	10,322
	Sleeves	L:63.5 cm W:20.32 cm	5161
	Leggings	L:120 cm W:14cm	6720
	Moccasins	L:27.94 cm W:12.7 cm H:10.16 cm	3187
		Total	**26,048**
Woman	Side Fold Dress	Dress-L:96 cm W:91 cm Folded Flap- L:32 cm W:114 cm	24,768
	Sleeves	L:45.72 cm W:17.78 cm	3251
	Leggings	L:43.18 cm W:16.51 cm	2851
	Moccasins	L:25.4 cm W:11.43 cm H:7.62 cm	2167
		Total	**33,037**

*Sources for clothing articles can be found in Appendix C.

Table 4. Clothing Articles of the Ioway.

Sex	Types of Clothes*	Measurements	Surface Area in cm²
Man	Breechclout	Length:16.5 cm Width:38.1 cm	658
	Poncho Shirt	L:63.5 cm W:78.74 cm	9999
	Sleeves	L:57.15 cm W:20.32 cm	4645
	Leggings	L:73.66 cm W:20.32 cm	5987
	Moccasins	L:25.4 cm W:12.7 cm H:12.7 cm	3870
		Total	**25,159**
Woman*	Wraparound skirt	n/a they would have used the whole hide no matter the size	1 hide
	Leggings	L:40.64 cm W:19.05 cm	3097
	Moccasins	L:25.4 cm H:12.7 cm W:7.62 cm	3354
		Total	**6451 plus one hide**

*Sources for clothing articles can be found in Appendix C.

Table 5. Clothing Articles of the Kiowa.

Sex	Types of Clothes*	Measurements	Surface Area in cm²
Man	Breechclout	Length:16.5 cm Width:38.1 cm	658
	Shirt	L:84 cm W:32 cm	5376
	Sleeves	L:42 cm W:10 cm	1680
	Leggings	L:88.9 cm W:33.02 cm	11,741
	Moccasins	L:25.4 cm W:12.7 cm H:5.08 cm	1625
		Total	**21,080**
Woman	Dress (Poncho with a Skirt)	L:124 cm W:111 cm	27,528
	Leggings	L:52.5 cm W:8.5 cm	1785
	Moccasins	L:26 cm W:6 cm H:4 cm	952
		Total	**30,265**

**Sources for clothing articles can be found in Appendix C.*

every article of clothing, as well as for the total number of hides needed for each man and woman per society.

There were two different hide comparisons made in this study. The first comparison was made between two hides collected for this study. Both hides were recently killed white-tailed deer; one hide was from a buck, while the other was from a doe. The second comparison was made from the surface areas of average approximate yields, based on weight, of buckskins as to

Figure 2. White-tailed Buck and Figure 3. White-tailed Doe.

serve as a control for the experiment. These averages are taken from Robert Wegner's 1984 article, *Deer and Deer Hunting: A Serious Hunter's Guide.* By comparison of the hides themselves, the experimental hides fell in the range of a medium to large sized hide. In Table 6, the sizes of the deer are first divided into weight categories; each category is separated into hide size, approximate rage of surface area, and then the measurements used for the calculations of this study.

All of the surface areas were found for both clothing articles and hide yields. Each article of clothing was compared to the average size of a small, medium, and large deer hide, as well as

Table 6. Buckskin Yields (Wegner 1984).

Dressed Deer Weights	Hide Size	Approx. Yield (ft^2)	Approx. Yield (cm^2)	Hide Yield Used for Calculations (cm^2)
90 – 130	Small	6.0 - 8.0	5,574 - 7,432	6503
130 – 175	Medium	9.0 - 11.0	8,361 - 10,219	9290
175 – 200	Large	12.0 - 15.0	11,148 - 13,935	12,542
200+	Extra-Large	16.0 - 18.0	14,864 - 16,723	n/a

Table 7. Experimental Hide Yields.

	Hide Size	Yield (ft^2)	Yield (cm^2)
Experimental Hides	Hide 1 (Doe)	9.0	8,361
	Hide 2 (Buck)	12.0	11,148

the experimental hides. It is highly unlikely that there would have been a large supply of Extra-Large deer hides available, therefore it has been excluded it from this study. The number of hides needed was found by comparing the total surface areas of all the garments, to the surface areas of the hides. This comparison provides values signifying the number of hides needed to make a wardrobe for the men and women of each society using hides from a particular sized deer. Summary tables and analysis for these measurements are shown in Figures 4-6, and Tables 8-10.

ANALYSIS OF PLAINS CLOTHING AND HIDE REQUIREMENTS

As seen in the summary tables and graphs below, each society is listed with their designated hide needs. Each number indicates how many of that particular hide it would take to make a man or woman's wardrobe for each society. The red line indicates Gramly's estimation of 3.5 hides per individual per year for comparison. As Gramly's article indicated, his study focused on the

Huron populations, therefore this study examined each Plains society on an individual basis. As these graphs show, the numbers between societies greatly varied indicating that hide needs vary from society to society. This inconsistency makes it hard to use a universal number to describe in what amount hides were needed. Variations occur due to several different factors, including hide size, climate, and the types and styles of clothing articles worn among each society.

The first variation results from the size of the hides themselves when the deer have been hunted. As one would expect, as the size of the hides increase the number of hides needed decreases. Understanding what size the deer were in a given area, allows us to more accurately estimate the number of hides they would have required fulfilling their wardrobe. For example: Those people who live in an area where the deer are all small in size will have higher numbers, versus a society who has an abundant amount of large deer available, and will therefore need fewer hides to make their clothing.

The second factor takes into account the climate in which people lived. According to the Environmental Protection Agency, over time there are constant changes in temperatures from the north to the south of the Great Plains region. This differentiation causes variation for the amount of clothing needed to keep warm during the winter, as well as the lack of clothing for those who live in warmer climates. The societies that reside in the northern areas, like the Huron in Canada or the Blackfoot in Montana, have a higher average than those that live in the lower region of the Plains, like the Ioway or Kiowa. This is evident as shown by the hide needs for men in Figure 4. The arrangement of the societies is ordered by geographical positioning from north to south, from the Blackfoot in Montana to the Kiowa in Oklahoma. In the case of the men the further south they live the less clothing they need.

In the case of the women, variation occurred not primarily because of climate, but in the styles of clothing they wore. When the Ioway designed their clothes they used deer hides to make skirts, and to make a shirt they patched together small animal hides. Since they did not use deer hides to complete their wardrobes their numbers are greatly lower than the other societies.

Table 8. Number of Hides Needed for each Man per Hide Size Category.

	Blackfoot	Cheyenne	Dakota Sioux	Ioway	Kiowa
Exp Hide 1	4.39	3.45	3.12	3.01	2.52
Exp Hide 2	3.29	2.59	2.34	2.26	1.89
Small	5.64	4.44	4.01	3.87	3.24
Medium	3.95	3.11	2.80	2.71	2.27
Large	2.93	2.30	2.08	2.01	1.68

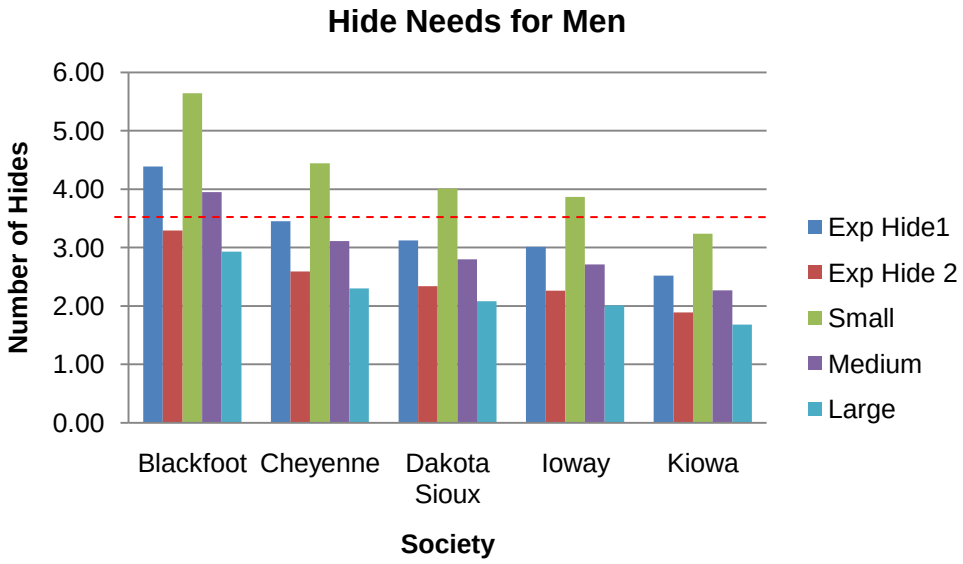


Figure 4. Number of Hides Needed for each Man per Animal Category.

Higher averages among the women of the Dakota Sioux and the Cheyenne are due to the advancement of their dress styles. If a society has a surplus of hides available they have the

ability to create more elaborate clothing. The women of these two societies made their dresses from two or three deer skins, creating a higher number for hide need (Table 9, Figure 5).

Table 9. Number of Hides Needed for each Woman per Animal Category.

	Blackfoot	Cheyenne	Dakota Sioux	Ioway	Kiowa
Exp Hide 1	2.81	3.27	3.95	1.77	3.62
Exp Hide 2	2.11	2.45	2.96	1.58	2.72
Small	3.61	4.21	5.08	1.99	4.65
Medium	2.53	2.94	3.56	1.69	3.26
Large	1.87	2.18	2.63	1.51	2.13

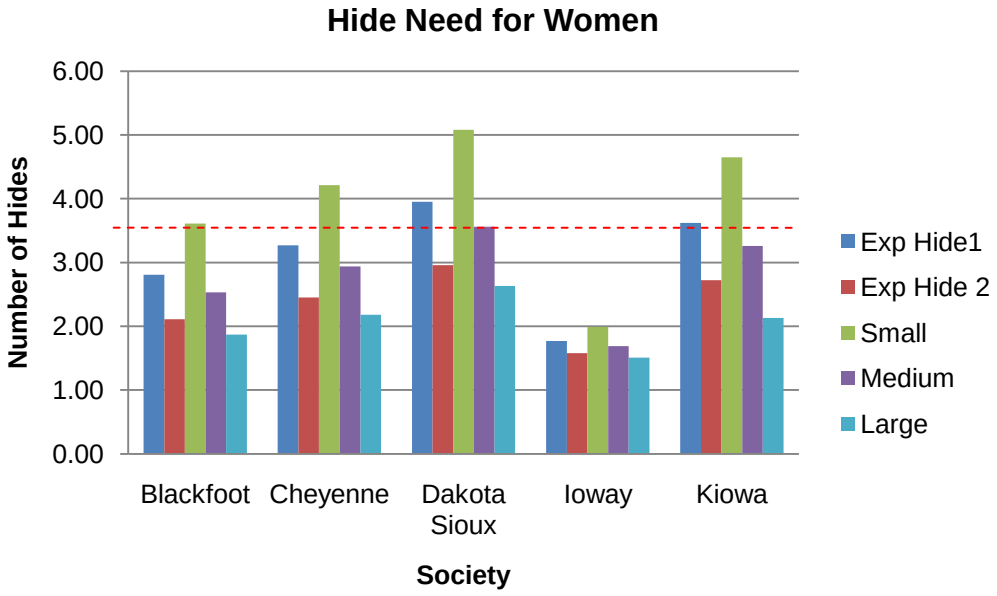


Figure 5. Number of Hides Needed for each Woman per Animal Category.

To simplify these numbers, the averages were found for each society, and can be seen in Table 10 and Figure 6 . When looking at the societies as a whole Gramly's suggestion of 3.5 hides per year appears to be a slight over-estimate. It may be appropriate for the Huron who live further north and would require a higher amount of hides. However, when applying his number to the Plains, as has been done in previous studies, his number is slightly high. Gramly's article also

Table 10. Summary Means for Men and Women.

	Blackfoot	Cheyenne	Dakota Sioux	Ioway	Kiowa
Overall Average	3.38	3.10	3.22	2.29	2.75

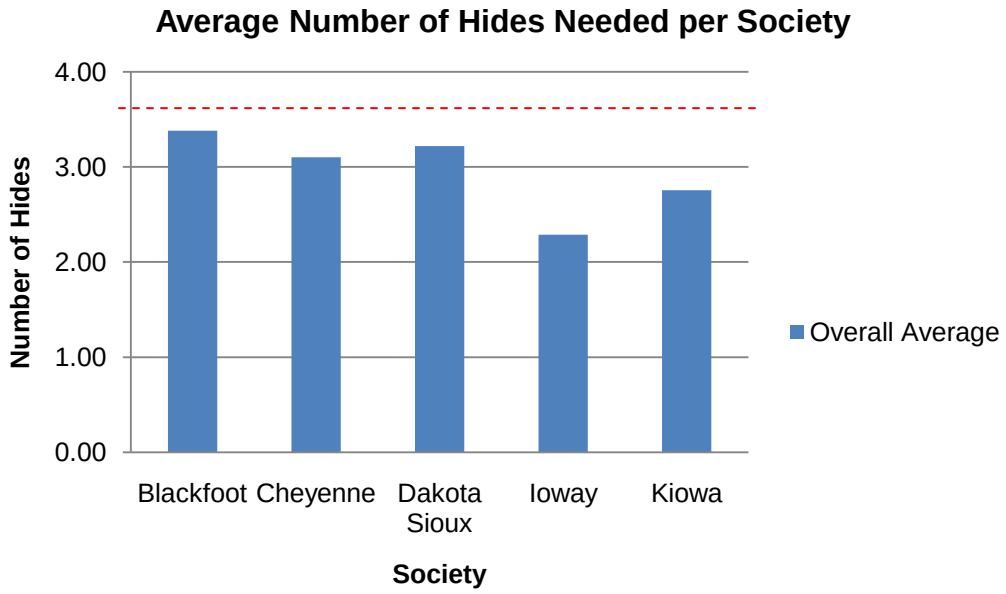


Figure 6. Summary Means for Men and Women.

noted that it would take a total of seven hides to create one outfit, and that it would last two years, creating a 3.5 average per year. However, this factors that a person does not need to replace their wardrobe in that time. Wearing the same outfit everyday creates a lot of ware after two years. If these clothes are not taken care of or processed properly they will need to be replaced. Based on the journal notes of Lewis and Clark, and my own experience with processing hides, if a hide is not properly processed it wears out quickly or goes rotten. Tanning a hide with brains, or even soap makes the hide waterproof. If the hide is not waterproofed, and exposed to wet conditions repeatedly, it will rot. The hides must then be replaced, and a new wardrobe constructed. If a new wardrobe is needed this causes the averages to increase, and thus

Gramly's prediction to become too low of an estimation. As we have seen, variations occur between tribes, according to their needs, the available deer, and the climate in which they live. To use a constant number would be quite difficult in determining the necessity of deer among individual societies because each society varies in their need for hides.

CONCLUSIONS

This study identified the base estimate of hides through a series of gathered articles and museum collections. Outcomes for this investigation produced specific figures, with supporting data, for the number of hides needed for clothing among Plains Indians. Although Gramly's estimate provides a standard approximation for the number of hides needed among a society, it is not accurate enough to be used as a universal estimation for any and all societies. Factors such as climate, deer size, and clothing styles create much variation, and using a universal number to describe them would not be accurate.

Future studies can be done to show possibilities that the need to hunt deer for hides could have been just as important as hunting the deer for food. This may allow us to clearly understand under what circumstances deer were desired among prehistoric peoples, and better yet the vitality of available resources among prehistoric societies. By exploring this topic we know that the average person would need approximately 50 grams of protein a day (Theler and Boszhardt 2006). Ground, raw venison contains 21.78 grams of protein per every 100 grams of meat (USDA Nutrient Database 2010; Watt and Merrill 1963:65 as cited in Theler and Boszhardt 2006). This means that for an individual to meet these requirements, they would have to take in 238 grams of venison each day. On average a white-tailed deer supplies 23 kilograms of meat;

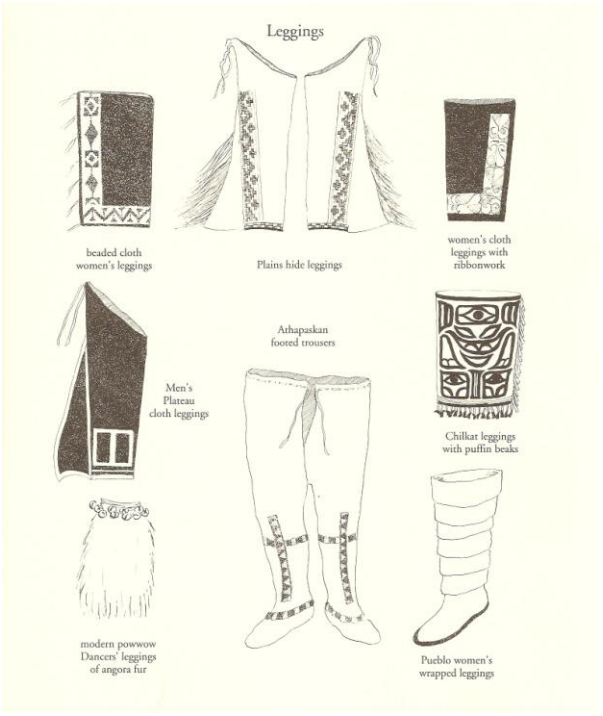
this supplies a person with enough protein for 100 days (Theler and Boszhardt 2006). With a similar formula as used in Theler and Boszhardt 2006, and applying it to the Blackfoot, a group of 20 people would need approximately 68 deer to provide enough hides (at 3.38 hides per person) to sustain their wardrobe. The 68 deer would provide enough protein for 20 people for 340 days. Similarly, a group of 20 Ioway members, at a rate of 2.29 hides per person, would need approximately 46 hides, which would provide them with enough protein for 230 days. Most studies focus on hunting deer for food first, but this scenario shows the effects of hunting the deer for hides first. Looking at these two scenarios the difference in hide rate was about one hide, but the number of days for protein supply, over this group of 20, was about 110 days. That small difference may be the defining line between surpluses and starvation.

APPENDIX A

TYPES OF CLOTHING WORN BY PLAINS INDIANS AS CITED BY PATEREK (1994)

Figure A1. Breechclouts and Figure A2. Shirts and Tunics.

Figure A3. Women's Dresses and Figure A4. Women's Skirts.



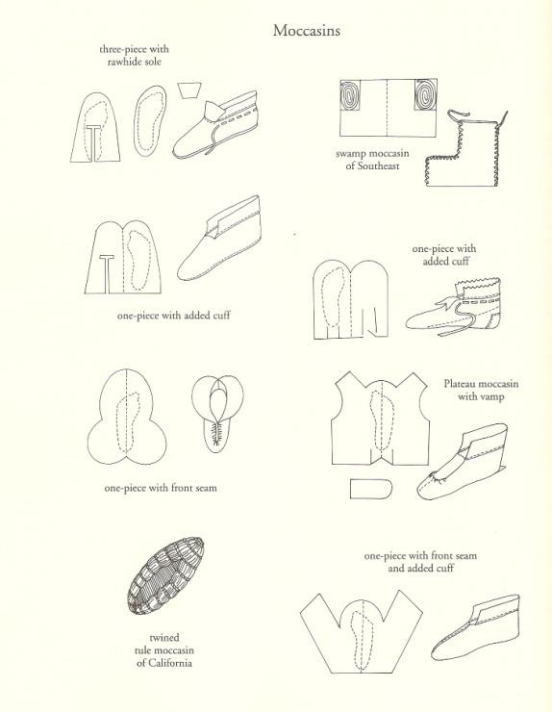


Figure A5. Leggings and Figure A6. Moccasins.

APPENDIX B

RAW DATA TABLES FOR ALL SURFACE AREAS OF CLOTHING AND HIDE COMPARISONS

Table B1. Surface Area Calculations.

Society	Gender	Clothes	Measure-ments	Surface Area in cm^2	Exp. Hide 1: 9ft^2 (8361 cm^2)	Exp. Hide 2: 12ft^2 (11,148 cm^2)	Typ. Small: 7ft^2 (6503 cm^2)	Typ. Medium: 10ft^2 (9290 cm^2)	Typ. Large: 13.5ft^2 (12542 cm^2)
Blackfoot									
	Man								
		Breechclout	L: 5-8" W: 12-18"	658	0.079	0.059	0.101	0.071	0.052
		Shirt	L: 47" W: 18"	10,916	1.305	0.979	1.679	1.175	0.870
		Sleeves	L 21" W: 6"	3251	0.389	0.292	0.500	0.350	0.259
		Leggings	L: 40" W: 19"	19,613	2.345	1.759	3.016	2.111	1.564
		Moccasins	L:11.5" W:4" H:3"	2258	0.270	0.203	0.347	0.243	0.180
				36,696	**4.917**	**3.292**	**5.643**	**3.950**	**2.926**
	Woman								
		Dress	L:145 cm W:50 cm	14,500	1.734	1.301	2.230	1.561	1.156
		Sleeves	L:15 cm W:50 cm	3000	0.359	0.269	0.461	0.323	0.239
		Leggings	L:42 cm W:19 cm	3192	0.382	0.286	0.491	0.344	0.255
		Moccasins	L:10" W:4" H:4"	2787	0.333	0.250	0.429	0.300	0.222
				23,479	**2.808**	**2.106**	**3.610**	**2.527**	**1.872**

Table B1 (continued).

Society	Gender	Clothes	Measure-ments	Surface Area in cm^2	Exp. Hide 1: 9ft^2 (8361 cm^2)	Exp. Hide 2: 12ft^2 (11,148 cm^2)	Typ. Small: 7ft^2 (6503 cm^2)	Typ. Medium: 10ft^2 (9290 cm^2)	Typ. Large: 13.5ft^2 (12542 cm^2)
Cheyenne									
	Man								
		Breechclout	L:5-8" W:12-18"	658	0.079	0.059	0.101	0.071	0.052
		Shirt	L:46" W:20"	11,870	1.420	1.065	1.825	1.278	0.946
		Sleeves	L:23" W:5"	2967	0.355	0.266	0.456	0.319	0.237
		Leggings	L:95 cm W: 25 cm	9500	1.136	0.852	1.461	1.023	0.757
		Moccasins	L:10" W:5" H:5"	3870	0.463	0.347	0.595	0.417	0.309
				28,865	**3.452**	**2.589**	**4.439**	**3.107**	**2.301**
	Woman								
		Two Skin Dress	L:136 cm W:55 cm	14,960	1.789	1.342	2.300	1.610	1.193
		Sleeves	L:25 cm W:35 cm	3500	0.419	0.314	0.538	0.377	0.279
		Leggings	L:50 cm W:28 cm	5600	0.670	0.502	0.861	0.603	0.446
		Moccasins	L:25 cm W:13 cm H:11 cm	3290	0.393	0.295	0.506	0.354	0.262
				27,350	**3.271**	**2.453**	**4.206**	**2.944**	**2.181**
Dakota Sioux									
	Man								
		Breechclout	L:5-8" W:12-18"	658	0.079	0.059	0.101	0.071	0.052
		Poncho Shirt	L:40" W:20"	10,322	1.234	0.926	1.587	1.111	0.823
		Sleeves	L:25" W:8"	5161	0.617	0.463	0.794	0.556	0.411
		Leggings	L:120 cm W:14cm	6720	0.804	0.603	1.033	0.723	0.536
		Moccasins	L:11" W: 5" H:4"	3187	0.381	0.286	0.490	0.343	0.254
				26,048	**3.115**	**2.337**	**4.006**	**2.804**	**2.077**

Table B1 (continued).

Society	Gender	Clothes	Measure-ments	Surface Area in cm^2	Exp Hide 1: 9ft^2 (8361 cm^2)	Exp Hide 2: 12ft^2 (11,148 cm^2)	Typ. Small: 7ft^2 (6503 cm^2)	Typ. Medium: 10ft^2 (9290 cm^2)	Typ. Large: 13.5ft^2 (12542 cm^2)
Dakota Sioux	Woman								
		Side Fold Dress	Dress- L:96 cm W:91 cm Folded Flap- L:32 cm W:114 cm	24,768	2.962	2.222	3.809	2.666	1.975
		Sleeves	L:18" W:7"	3251	0.389	0.292	0.500	0.350	0.259
		Leggings	L:17" W:6.5"	2851	0.341	0.256	0.438	0.307	0.227
		Moccasins	L:10" W:4.5" H:3"	2167	0.259	0.194	0.333	0.233	0.173
				33,037	**3.951**	**2.963**	**5.080**	**3.556**	**2.634**
Ioway									
	Man								
		Breechclout	W:12-18" L:5-8"	658	0.079	0.059	0.101	0.071	0.052
		Poncho Shirt	L:25" W:31"	9999	1.196	0.897	1.538	1.076	0.797
		Sleeves	L:22.5" W:8"	4645	0.555	0.417	0.714	0.500	0.370
		Leggings	L:29" W:8"	5987	0.716	0.537	0.921	0.644	0.477
		Moccasins	L:10" W:5" H:5"	3870	0.463	0.347	0.595	0.417	0.309
				25,159	**3.009**	**2.257**	**3.869**	**2.708**	**2.006**
	Woman								
		Wraparound skirt	n/a whole hide would be used	1	1	1	1	1	1

Table B1 (continued).

Society	Gender	Clothes	Measure-ments	Surface Area in cm^2	Exp Hide 1: 9ft^2 (8361 cm^2)	Exp Hide 2: 12ft^2 (11,148 cm^2)	Typ. Small: 7ft^2 (6503 cm^2)	Typ. Medium: 10ft^2 (9290 cm^2)	Typ. Large: 13.5ft^2 (12542 cm^2)
Ioway		Leggings	L:16" W:7.5"	3097	0.370	0.278	0.476	0.247	0.333
		Moccasins	L:10" H:5" W:3"	3354	0.401	0.301	0.516	0.361	0.267
				6451 plus one hide	**1.771**	**1.579**	**1.992**	**1.608**	**1.601**
Kiowa									
	Man								
		Breechclout	W: 12-18" L:5-8"	658	0.079	0.059	0.101	0.071	0.052
		Shirt	L:84 cm W:32 cm	5376	0.643	0.482	0.827	0.579	0.429
		Sleeves	L:42 cm W:10 cm	1680	0.201	0.151	0.258	0.181	0.134
		Leggings	L:35" W:13"	11,741	1.404	1.053	1.805	1.264	0.936
		Moccasins	L:10" W:5" H:2"	1625	0.194	0.146	0.250	0.175	0.130
				21,080	**2.521**	**1.891**	**3.242**	**2.269**	**1.681**
	Woman								
		Dress	L:124 cm W:111 cm	27,528	3.292	2.469	4.233	2.963	2.195
		Leggings	L:52.5 cm W:8.5 cm	1785	0.213	0.160	0.274	0.192	0.142
		Moccasins	L:26 cm W:6 cm H:4 cm	952	0.114	0.085	0.146	0.102	0.076
				30,265	**3.619**	**2.715**	**4.654**	**3.258**	**2.413**

APPENDIX C

REFERENCES FOR CLOTHING ARTICLES

Table C1. Clothing Articles with References.

Society	Gender	Clothes	References
Blackfoot			
	Man		
		Breechclout	Paterek 1994:84
		Shirt	Conn 1979:Figure 180
		Sleeves	Conn 1979:Figure 180
		Leggings	Yale Peabody Museum 2011: YPM ANT 029004
		Moccasins	Conn 1979:Figure 158
	Woman		
		Dress	Smithsonian 2011:NMAI 4/5110
		Sleeves	Smithsonian 2011:NMAI 4/5110
		Leggings	Smithsonian 2011:NMAI 6076
		Moccasins	Coe 1986:Figure 169
Cheyenne			
	Man		
		Breechclout	Paterek 1994:84
		Shirt	Penney 1995:Plate 11
		Sleeves	Penney 1995:Plate 11
		Leggings	Yale Peabody Museum:YPM ANT 009130
		Moccasins	Smithsonian 2011: NMAI 2/8390
	Woman		
		Two Skin Dress	Smithsonian 2011:NMAI 14/7094
		Sleeves	Smithsonian 2011:NMAI 14/7094
		Leggings	Smithsonian 2011:NMAI 25/1049
		Moccasins	Smithsonian 2011:NMAI 3/2631

Table C1 (continued).

Society	Gender	Clothes	References
Dakota Sioux			
	Man		
		Breechclout	Paterek 1994:84
		Poncho Shirt	Furst and Furst 1982:Plate 158
		Sleeves	Furst and Furst 1982:Plate 158
		Leggings	Yale Peabody Museum: YPM ANT 049195
		Moccasins	Coe 1986:Figure 129
	Woman		
		Side Fold Dress	Smithsonian 2011:NMAI 2/9801
		Sleeves	Smithsonian 2011:NMAI 2/9801
		Leggings	Dubin 1999:Figure 547
		Moccasins	Coe 1986:Figure 130
Ioway			
	Man		
		Breechclout	Paterek 1994:84
		Poncho Shirt	Skinner 1926:Plate XLV Figure 2
		Sleeves	Skinner 1926:Plate XLV Figure 2
		Leggings	Skinner 1926:Plate XLV Figure 2
		Moccasins	Skinner 1926:Plate XLVII Figure 4
	Woman		
		Wraparound skirt	N/A
		Leggings	Phoenix Auction 2009
		Moccasins	Skinner 1926:Plate XLVII Figure 5
	*Like the Sauk, they wore shirts made from raccoon when needed, not deer hide.		
Kiowa			
	Man		
		Breechclout	Paterek 1994:84
		Shirts	Smithsonian 2011:NMAI 2/1874
		Sleeves	Smithsonian 2011:NMAI 2/1874
		Leggings	Cowans Auction 2010
		Moccasins	Heritage Auction 1999
	Woman		
		Dress	Smithsonian 2011:NMAI 2/2172
		Leggings	Smithsonian 2011:NMAI 10/3060
		Moccasins	Smithsonian 2011:NMAI 10/3060

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