WANIYETU WÓWAPI

Native American Records of Weather and Climate

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Pictographic calendars kept by the Lakotas and other Great Plains indigenous peoples provide important insight into the historical impact of weather and climate on society.

Since perhaps as early as the seventeenth century, many Plains Indian groups kept pictographic calendrical records called *waniyetu wówapi* or "winter counts" that record events that memorably affected individual bands of Plains Indians. In addition to important events—such as battles with other groups, the deaths of leaders, and famines—the winter counts frequently depict important natural phenomena, such as extreme climate conditions.

Several Plains Indian tribes—such as the Blackfeet, Kiowa, and Mandan—are known to have maintained winter counts; however, the various bands of Lakotas (or Sioux) probably produced the greatest number of these records (Burke 2000). The term *winter count* is derived from the Lakota terms *waniyetu*, referring to the season of winter, and *wówapi*, referring to anything noted, counted, or read (Mallery 1886; Burke 2007). Each "year" in the winter count calendar

Kills Two, a Sicangu Lakota painting a winter count on buffalo skin. Photograph by John Anderson. Image reproduced with permission from the National Anthropological Archives, Smithsonian Institution (NAA Inv. 03494000).

Fig. 1. Page 18 from the Battiste Good winter count (Corbusier 1886; Mallery 1886; NAA Ms. 2372, Inv. 08,746,802) showing the years 1821–50 [Western dates added by Corbusier (1886)]. Note the image of the meteor event in 1821/22, the mass drowning in 1825/26, and the Leonid meteor shower in 1833/34—all of which are frequently found in other counts. Image reproduced with permission from the NAA, Smithsonian Institution.

is individually named for the—usually one—notable event that is conveyed by the illustration (Mallery 1886). For example, the contemporary Gregorian winter season of 1821/22 is referred to as the "Star passed by with loud noise winter" in the Battiste Good count and refers to a meteoric fireball that was reported in several winter counts (Chamberlain 1984; Fig. 1). *Waniyetu* also refers to the year as a whole and thus in the context of the calendar, events could occur at any time of the year and still be referred to as occurring in a particular "winter" (Howard 1960b; Burke 2000).

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THE WINTER COUNT SYSTEM. Winter counts are generally based on a fairly fluid chronological year that begins with the first snowfall in autumn and continues until the first snow of the following autumn (Mallery 1886, 1893; Burke 2007). Kiowa records are unusual, in that they record an image for both the winter and summer seasons each year (Mooney 1898; Greene 2009). At the end of each winter (year), the individual keeping the winter count would consult with group elders to determine which remarkable event would represent that year and he would then illustrate the event in a succession of annual images, with the important feature being the preservation of the chronological order of events (Mallery 1886; Burke 2000; Fig. 1). The image itself acted as a mnemonic device to aid in the recall of a much more extensive narrative. Because of the temporally flexible methodology of defining the year in the winter counts, correlation of specific events with the Western calendar can be complex, though a great number of winter counts have been thoroughly studied, and the content and general temporal arrangement of many of the major counts are well understood through comparison of known historical events recorded in multiple winter counts (Howard 1960b). The temporal relationship of the winter counts with the Western calendar can also be calibrated through analysis of events recorded by both Native American and Euro-American historians. For example, almost every winter count known records the tremendous Leonid meteor shower that took place 12–13 November 1833 (Fig. 2; Chamberlain 1984).

Year names and the interpretation of the meaning of winter count images were, in many cases (e.g., American Horse, Battiste Good, Cloud Shield), provided by the count keepers when the records were originally collected (Corbusier 1886; Mallery 1886). In other cases (e.g., Rosebud), the origin of the winter count is unknown and images must be interpreted by

comparison with other counts and in the context of native histories.

Winter counts were first brought to the attention of the scientific community in the 1870s by Colonel Garrick Mallery (1877) while working for John Wesley Powell at the Bureau of American Ethnology. Mallery contributed additional important works in 1886 (with included works by Corbusier and others) and in 1893. Examples of key works that followed Mallery's include those by Mooney (1898), Howard (1960b), DeMallie (1982), McCoy (1983), Burke (2000), Greene and Thornton (2007), and Greene (2009).

Most winter count studies have principally focused on general overviews or the interpretation of individual calendars; however, several authors have also examined multiple calendars for information about a particular area of interest, for example, Plains Indian history (Howard 1960b), disease outbreaks (Thornton 1987; Sundstrom 1997), and archeoastronomy (Chamberlain 1984). Levy (1961) examined Kiowa winter count records and tree-ring reconstructed climate to study the impact of drought on Kiowa population variability and seasonal dispersal patterns. Sundstrom (1997) examined winter counts for evidence of famine and "hard winters" in relation to the study of epidemic disease, and Greene (2009) discussed several interesting weather-related images in Kiowa calendars. But we are unaware of any research that has examined multiple winter counts specifically for historical information about weather and climate events and their associated impacts on the native peoples of the Great Plains.

WINTER COUNT RECORDS. The original or facsimile calendars and their associated descriptions that we examined included major Lakota winter counts exhibited by the National Anthropological Archives (NAA; e.g., Burke 2000; Burke and Thornton 2007), such as the Lone Dog (Mallery 1877, 1893), American Horse, Battiste Good, Cloud Shield, Flame, Swan, White Cow Killer (Corbusier 1886; Mallery 1886, 1893), Long Soldier, No Ears, and Rosebud (DeMallie 1982; Thornton 2002; Greene and Thornton 2007).

Other less well-known Lakota counts studied included the Ben Kindle count (Beckwith 1930); the Hunkpapa count (Vestal 1934); the Big Missouri and Swift Bear counts (Cohen 1939, 1942; Wildhage 1991); the Wind-Roan Bear counts (Howard 1955; Higginbotham 1981); the Blue Thunder, High Dog–Swift Dog, and Jaw group (Howard 1960b); the Garnier count (Grange 1963); and the John K. Bear count (Howard 1976). We also studied several winter count records from other groups, including Mooney's (1898) description of the Set-tan or Little Bear count (Kiowa), a Mandan count by Butterfly (Howard 1960a), the Blackfoot count kept by Bad Head (Dempsey 1965), and Greene's (2009) description of the Silver Horn (Kiowa) counts.

We used the winter counts and related secondary sources to derive a chronological record of references to or descriptions of unusual weather and climate phenomena (Table 1). These records describe events in various locations of the Great Plains, including the modern states of Colorado, the Dakotas, Iowa, western Minnesota, Montana, Nebraska, Oklahoma, Wyoming, and the southern regions of the Canadian plains provinces.

Many of the events listed in Table 1 were recorded in only one winter count, especially the events in the early portion of the record, and although we have

Fig. 2. The image for 1833/34 "The stars moved around" winter from the American Horse winter count (Corbusier 1886, p. S33; NAA Ms. 2372, detail from Inv. 08,746,928). Described by Chamberlain (1984) as "the single most important event of known date for establishing the chronology of the winter counts," the image represents the Leonid meteor blizzard that was visible across North America in Nov 1833, and it is almost universally recorded in known winter counts. Image reproduced with permission of the NAA, Smithsonian Institution.

Table 1. A record of 42 events depicted in the winter counts that appear to indicate unusual weather or climate; the year of occurrence, including the winter count description; and the source for each event. When multiple winter counts record an event, one example name is provided. In most cases, modern year dates refer to the first winter season of the given year range. Events in bold are discussed further in the text.

Impact	Modern year event occurred	Winter count title or description	Winter count
Ice	1686	Ice all over the land	John K. Bear
Snow	1697	Made snowshoes	John K. Bear
Snow	1703	Deep snow	John K. Bear
Flood	1711/12	Four lodges drowned winter	Batiste Good
Snow	1719/20	Wore snowshoes winter	Batiste Good
Snow	1721/22	Wore snowshoes…	Batiste Good
Snow	1722/23	Deep snow…	Batiste Good
Snow	1748	Dry winter, snowy spring	John K. Bear
Ice	1750	Ice everywhere	John K. Bear
Snow	1773	Even the dogs got snow blindness	Ben Kindle
Snow	1774	No snow in winter	John K. Bear
Cold	1777/78	It was an intensely cold winter…	American Horse
Cold	**1788/89**	**Many crows died winter**	**Multiple**
Snow	1789–91	They could not hunt on account of the deep snow	American Horse
Cold	1798	Extremely cold	Big Missouri
Snow	1800	Much snow	John K. Bear
Cold	1811/12	Hard winter, deep snow	Big Missouri
Drought	1818/19	Sand-blowing year	Swift Dog, Long Soldier, Big Missouri
Cold	1820/21	Indicates cold, crows died	Blue Thunder group
Warm	1824/25	No snow	Long Soldier
Flood	**1825/26**	**Missouri floods, kills 30 lodges**	**Multiple**
Snow	**1827/28**	**The snow was very deep**	**Multiple**

made an attempt to ascertain as much as possible about each listed event, the frequent lack of specific information about the exact nature of the event as well as a general lack of comparative historical information makes definitive analysis of many of the events generally beyond the scope of this paper. In the following section, several selected episodes of extreme weather or climate are discussed in detail

Fig. 3. Image from the Flame's count (Mallery 1886; NAA Ms. 2372, detail from Inv. 08,633,800) for the year 1788/89 depicts a winter so severe that crows (*Corvus* sp.) froze to death. Battiste Good called it the "Many crows died winter" (Mallery 1886). This event must have been quite memorable because almost all the contemporary counts record it in a similar fashion. Image reproduced with permission of the NAA, Smithsonian Institution.

Table 1. Continued.			
Impact	**Modern year event occurred**	**Winter count title or description**	**Winter count**
Snow	1830/31	There was a great deal of snow on the ground	Cloud Shield, Bad Head, John K. Bear
Cold	1836/37	Battle on ice (North Platte River)	American Horse, Cloud Shield, Rosebud
Snow	1841/42	"Deep snow winter," snowshoes in several counts	Battiste Good, Blue Thunder group, Vestal's Hunkpapa
Snow	1844/45	Unusually heavy snow	Swan, Rosebud
Snow	1847/48	Depicts ice storm	American Horse
Drought	1848/49	No grass	Blue Thunder group, Vestal's Hunkpapa
Cold	1849/50	People froze to death	Wind-Roan Bear
Flood	1851	Heavy snows fell during the early winter but unseasonably warm weather caused winter thaws	Bad Head, John K. Bear
Snow	**1852/53**	**Snowshoes winter**	**Multiple**
Drought	**1855**	**Sitting year**	**Little Bear**
Ice	1856	When we were slipping	Bad Head
Flood	1857	Flood when ice broke	John K. Bear
Cold	1859	Severe winter—vultures even starved	John K. Bear
Snow	**1865/66**	**All the horses died**	**Multiple**
Cold	1867	Carry the wood winter	Blue Thunder
Cold	1870/71	Many horses drowned or froze	Blue Thunder
Bad spring	1877	Deep snow winter	Chandler-Pohrt, Bad Head
Mild winter	1878	Mild winter	Bad Head
Snow	1880	Hard winter deep snow	John K. Bear, Big Missouri
Cold	1900	Horses died of exposure	Red Horse Owner

using representative images and written descriptions of the events from various winter counts as well as Euro-American historical information from various sources.

DESCRIPTIONS OF SELECTED WINTER COUNT EVENTS. *Many crows died (1788/89).* This winter count image (Fig. 3) shows a dead crow, or perhaps a raven, and represents severe cold that resulted in the freezing deaths of large numbers of the birds. This episode was apparently recorded by all (six) of the NAA counts that cover this period, though it is recorded in the preceding year in the White Cow Killer record and for the following year in the American Horse and No Ears counts. It is also represented in the Ben Kindle count (Beckwith 1930) but not in other counts that cover this period (e.g., Howard 1960b, 1976).

Although we have found no other documentation of conditions in the Great Plains at this time, the winters of both 1787/88 and 1788/89 were reportedly quite severe in New England (Ludlum 1966) and apparently in portions of Ontario, Canada, where 1788/89 is remembered as "The hungry year" (Canniff 1872). Ironically, it has been suggested (Ball and Kingsley 1984) that a gap in Hudson Bay Company weather records around this time may have been the result of unusually severe climate. In Virginia George Washington noted the severity of the cold during February 1788 (Washington 1788), and Europe in 1788/89 was also bitterly cold (e.g., Lamb 1977, 1985; Lindgren et al. 1985). Thomas Jefferson, American minister to France at the time, described the conditions there as "a winter of such severe cold, as was without example in the memory of man, or in the written records of history" (Koch and Peden 1944, p. 91; Neumann and Dettwiller 1990).

They drowned (1825/26). One of the most frequently recorded events in the winter count records describes

Fig. 4. The image of the year called "A camp flooded" (1825/26) in the Rosebud winter count (NAA Ms. 2001–10, detail 3a) represents a flash flood caused by the breakup of an ice dam in spring 1826 that killed dozens to perhaps hundreds of people who were camped on the floodplain of the Missouri River. The blue coloring of the lower half of the tepee indicates the water submerging the lodges. Several counts suggest that 30 families—or about half the village—perished (Mallery 1886). The blue-painted buffalo horn in the upper left of the image indicates that a ceremony of calling the buffalo was carried out. This is apparently a separate glyph referring to events in 1824/25 as recorded in other counts, such as the High Dog, Swift Dog, and Jaw variants (e.g., Howard 1960b). Image reproduced with permission of the NAA, Smithsonian Institution.

the drowning of perhaps hundreds of people as a result of the breakup of an ice dam on the Missouri River in spring 1826 (Fig. 4). Almost every winter count known records this even, though a few erroneously record the event as early as 1824 and as late as 1828. All of the major Lakota counts in the NAA "correctly" record the event in 1825/26.

Apparently, as many as 30 lodges of Yanktonai Sioux were encamped in the "horse-head bottoms" of the Missouri River, below the Whetstone (near present-day Pickstown, South Dakota) "when the river, which was filled with broken ice, unexpectedly rose and flooded their village. Many were drowned or else killed by the floating ice. Many of those that escaped climbed on cakes of ice or into trees" (Corbusier 1886, p. 137). The Battiste Good count specifically suggests that many women and children drowned when the ice broke (Mallery 1893).

Presumably related flooding of the Red and Assiniboine Rivers in modern Winnipeg, Manitoba, Canada is well documented by the Upper Fort Garry post journal, which provides a vividly detailed daily account of the flooding that would later destroy the fort. In what must have been a similar situation to that experienced by the unfortunate Lakotas camped on the Missouri, the Fort Garry record described how the flash flood caused by the abrupt breakup of ice on the afternoon of 5 May 1826 "overflowed its banks everywhere" and carried off 47 dwellings in the space of the first half hour (Heron 1826, p. 1). The journal log of 20 May is of particular relevance to this study, as it records that the Missouri River was also flooding and that "a number of the natives of that quarter have been drowned in consequence" (Heron 1826, p. 5).

Wore snowshoes (1827/28). While most of the counts that record the apparently unusual amounts of snow do so by using the image of a snowshoe or a man wearing snowshoes (Fig. 5), others show a tipi with deep snow around it (American Horse) or in the single case of the Blue Thunder group, a tipi with two people sitting around a kettle (Howard 1960b), which is meant to convey an instance of cannibalism among the Santee as a result of the starvation experienced because of the severe conditions (Howard 1960b).

The unusual conditions recorded by the Lakotas in the winter of 1827/28 may have been part of a larger pattern of very extreme climate over much of the United States that year. For example, Mock et al. (2007) report that although much of the eastern United States experienced some of the warmest winter temperatures on record, historical climate records suggests that western North America was much cooler than normal and experienced heavy snowfall, with "a broad area of abnormally cold conditions extend[ing] from northwestern North America to the American Midwest" (Mock et al. 2007, p. 109). These conditions are substantiated in the Rocky Mountain region by Canadian fur trapper P. S. Ogden's detailed record of the severe winter conditions in Idaho (Mock et al. 2007). Ogden's *Journal* refers to 1827/28 "as the worst winter ever experienced in the fur-trapping era" (Williams et al. 1971, p. xlvi).

Plenty snow winter (1852). As suggested by both Higginbotham (1981) and Sundstrom (2010), this event (not shown) must have been quite severe, as the impacts of the harsh winter conditions are recorded by quite a few of the winter counts. Many of the counts refer to the unusually deep snow. The White Cow Killer count (Corbusier 1886) calls it the "Great snow winter" and the Wind count (Howard 1955) states that "The snow was very deep." Other counts

referring to the deep snow include the Battiste Good (Corbusier 1886; Mallery 1886) and John K. Bear counts (Howard 1976), both of which refer to the winter's impact on the Lakotas' horses and apparently people, referring to the year as the "Deep snow used up the horses" winter and "Ate the horses" winter, respectively.

Pioneer Americans also recorded the severe conditions of the winter of 1852/53 with reports of heavy snow from Minnesota to the West Coast. In the California Gold Country, many of the '49ers faced famine in the so-called critical winter when "tremendous snowstorms disrupted transportation in the Klamath, Cascades, and Sierra Nevada" from early November into January (McGowan 1953, p. 365), and in the Willamette Valley the deep snows of the winter of 1852/53 were categorized as "forever memorable in the annals of pioneer days in Oregon" (Thompson 1912, p. 11).

Sitting summer (1855). This event (not shown) warrants discussion because it is one of the few known instances when summer climate conditions were specifically referenced in the winter count records. In the Settan or Little Bear count (Mooney 1898), the image for this year is of a man sitting with legs extended and the literal translation of the Kiowa text is "summer of sitting with legs crossed and extended" (Mooney 1898). Mooney's description indicates that the conditions were very hot and dry, and that the grass dried up and as a result the horses were weakened with hunger and could not be ridden. Additionally, there was no medicine lodge ceremony in this year on account of the dry conditions. As Stahle et al. (2007) noted, these conditions were likely associated with the drought, apparent in tree-ring reconstructions that suggest that 1855 was one of the driest summers of the past 500 years in the southern Great Plains.

All the horses died (1865/66). The unusually deep snow and ensuing mortality of the Lakotas' horses are recorded by most of the NAA Lakotas' winter counts in one fashion or another (Fig. 6). Cloud Shield (Corbusier 1886; Mallery 1886) explicitly states that the cause of the great number of horse deaths was that the horses could not reach the grass under the unusually deep snow. This event is similar to some of the winter counts of 1852/53. Apparently, the conditions were so harsh that people also perished as a result of the extreme winter of 1865/66. For example, the Butterfly (Howard 1960a) and Foolish Woman (Beckwith 1934) counts record that the Mandans experienced famine as a result of the harsh conditions. Specifically, the Butterfly count states that this was the first time that the Mandans had ever experienced famine, and that they were not able to kill any buffaloes that winter. Settlers in Minnesota also suffered that winter. Ludlum (1968) noted that this was reported to be the coldest winter of the 1860s, and an extremely severe February blizzard resulted in "painfully large" numbers of people being caught in the open prairies and perishing from exposure (Fisk 2010).

Fig. 5. This image from the Battiste Good count (Mallery 1893; NAA Ms. 2372, detail from Inv. 08,746,802) represents the "Wore snowshoes winter" of 1827/28. Many of the Lakotas' counts refer to the harsh conditions of this year. The Big Missouri and Swift Bear counts (Cohen 1939, 1942) both describe how ice (snow?) covered the country, thus the Plains Indians were unable to use horses to hunt and had to drag game and other materials over the ice. Image reproduced with permission of the NAA, Smithsonian Institution.

CONCLUSIONS. Our analysis suggests that Native American winter counts contain a unique and valuable record of the occurrence, timing, and human impact of severe weather and climate in the Great Plains region from the late eighteenth through the nineteenth centuries. While it appears unlikely that the winter count records could provide a useful quantitative record of climate, an analysis of multiple records indicates that they do offer substantiation and insight into the impacts of events recorded in adjacent regions and may, in some cases, provide unique information about the spatial variability of climatic events.

The relative accuracy of the dates of the events portrayed in the winter counts (in relation to the Western calendar) is reasonably good; however, for some events, especially those only recorded by one or a few counts, the actual date of the event is not recorded consistently enough to determine its temporal accuracy. It is important to keep in mind, however, that the Western dates ascribed to the events were generally determined by the winter count collectors (e.g., Corbusier 1886) and not by the Native American calendar keepers.

It should also be noted that some events that might reasonably be expected to have been recorded in the winter counts were apparently not. For example, we found no apparent reference to cold conditions related to the Tambora eruption in 1815 that so strongly affected New England and much of Europe (e.g., Oppenheimer 2003). Work by Briffa et al. (1998), however, suggests that unusual cooling did not occur over the Great Plains at that time. Perhaps more surprising is that the "long cold winter" of 1855/56 (Ludlum 1968), which was well documented in Nebraska and which Burnette et al. (2010) found to be the coldest winter between 1828 and 2009 in eastern Kansas, does not seem to have been widely recorded in the winter counts for that year (though isolated records in 1856/57 may be related). As noted, however, the events chosen for inclusion in the winter counts were not necessarily the most important but rather the most memorable. And unless unusual weather or climate caused a particular hardship, it may not have been considered worth noting, especially as these characteristics were not the specific focus of the calendars.

As noted earlier, some events may have been recorded in terms of their societal impacts rather than specifically referencing climate. For example, several famine events recorded in winter counts are likely related to severe winter conditions; however, these were not included in our analyses. Sundstrom (1997) lists at least 11 different winter count records of famine events not included in our analyses (Table 1). Certainly at least some of those events were driven by climatic conditions.

Additional comparison of the winter count records with various proxy records—for example, tree-ring records of flooding (e.g., St. George and Nielsen 2003) and freezing (e.g., LaMarche and Hirschboeck 1984; Stahle 1990; Brunstein 1996)—would be especially useful in analyzing the events reported in the winter counts. Further analysis of winter count records in conjunction with both Euro-American historical records and proxy records should yield additional insight into severe weather and climate and associated human impacts in the Great Plains region. These types of analyses might also help scholars better understand events portrayed in the winter counts, both in terms of their spatial occurrence and in relation to the Western calendar.

To our knowledge this study represents the first systematic attempt to analyze multiple winter count records for information specifically about weather and climate, as well as one of the few such studies of Native American records of weather and climate (e.g., Therrell et al. 2004; Fuentes 2010). These records provide one of the very few sources of such information in the Great Plains and Interior West regions prior to Euro-American contact and even over much of the colonial period in most of the area. In addition to being historical documents of great importance, these Native American records provide unique and interesting insight into the human relationship with weather and climate, and they are important representations of the traditional knowledge systems of indigenous peoples and their experience that should be included in our collective understanding of climate and its impact.

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