

EXPLORATION IN A CONTINENTAL CLIMATE: WEATHER IN THE CENTRAL PLAINS RECORDED IN THE JOURNAL OF WILLIAM CLARK

by

Karen Jean De Bres

...the weather disagreeably worm and if were not for the constant wind...we Should be almost sufficated coming out of a northern Country open and Cool between the Lat. of 46 and 49 (degrees) North in which we had been for nearly two years, rapidly descending into a woody country with a warmer climate....

William Clark's journal, September 15, 1806.

Weather usually matters to people in one of two ways: as a help or as a hindrance. For the Lewis and Clark expedition, it would act as both and it is the purpose of this paper to analyze the almost daily journal of William Clark to learn more about the weather conditions of the Central Plains in the summers of 1804 and 1806. While the expedition journals have often been studied with a view to understanding the local flora and fauna of the time, or studying the Native Americans who met with the expedition, there has been much less interest in the daily weather conditions recorded by the expedition.

It is the purpose of this paper to analyze the weather descriptions by William Clark in order to place the summer weather of 1804 and 1806, when the party passed through what we now define as the Central Plains (the states of Kansas and Nebraska) in several contexts. First, what was known about weather in this area around 1800 and what does modern research tell us about the general weather conditions of that time? This section will be followed by a brief explanation of the Central Plains

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climate today. The main body of the paper is, of course, focused on a discussion of William Clark's weather descriptions. Although four members of the party, two of the men as well as both of the officers, kept journals, those of William Clark are by far the most complete. How would men from the East react to the weather conditions they would find in the Central Plains? To what extent would the summers they encountered be similar to those experienced by Central Plains residents two hundred years later? What were the forms of weather data most commonly collected? William Clark's style of writing was very lively and descriptive and his original spelling will be used throughout.

I. Americans and Their Weather in 1800

The beginning of the nineteenth century was a watershed in the history of American meteorology. Before 1800, there were no government bodies or private institutions that collected daily weather observations with standardized instruments. During the colonial period isolated American diarists were the main contributors to meteorological science. Fifty years later, with increased government patronage and the emergence of trained scientists, a new stage in the history of meteorology would be reached. But in 1800, American meteorology was still in its infancy, and amateur observers were still the norm.

Thomas Jefferson, the creator of the Lewis and Clark expedition, was such an observer. Jefferson is credited, along with the Reverend James Madison, with making the first simultaneous meteorological measurements in the country in 1778. Although his main directive to the expedition was to "explore the Missouri river, and such principal stream of it, as, by its course and communication with the waters of the Pacific ocean, whether the Columbia, Oregon, Colorado, or any other river may offer the most direct and practicable water communication across this continent for the purposes of commerce"¹ Jefferson was also curious about local weather conditions. To that end he asked Lewis to note the "climate as characterized by the thermometer, by the proportion of rainy, cloudy, and clear days, by lightening[sic], hail, snow, ice, etc...by the winds prevailing at different seasons."² Jefferson also wanted Lewis

to note the types of vegetation, and when it appeared, since that could be taken as an indication of length of growing season and fertility.

Weather in the Central Plains around 1800

On reaching the Central Plains, the expedition would enter a new ecosystem, leaving the last of the well wooded areas in Missouri behind and entering the grassy Plains. What was the accepted interpretation of grasslands at the time, as an indicator of soil fertility? Zebulon Pike, who followed the Voyage of Discovery across the Louisiana Territory only two years later (1806-1807), proclaimed it an area too dry for settlement. Pike, however, was not the first explorer to consider the Plains to be barren ground. Two explorers in 1796 evidently felt the same. General Victor Collot included what would later be called western Nebraska in a lengthy tour and his map of 1796 listed the land between the Platte and the Missouri Rivers as "Barren Country covered with efflorescent Salt" and "Barren Ground." In the same year Jean Baptiste Trudeau, exploring the upper Missouri, said that beyond the river banks of the Plains "are vast mountains of rock (Rocky Mountains)...These large prairies, or great waste lands, are completely sterile; scarcely grass grows there."³

Aside from these reports, that part of the Louisiana Purchase beyond the mouth of the Kansas river was largely *terra incognita*. Most of the flora and fauna, as well as the weather conditions, were unknown to science. This was especially true when they reached the mouth of the Platte River. This, said the historian Stephen Ambrose, was a milestone, for "to go past the mouth of the Platte was the Missouri riverman's equivalent of crossing the equator."⁴

Weather observations on the Plains before forts were established were impressionistic. By 1825, hospital surgeons at twenty-seven army posts were collecting meteorological observations, under the direction of the surgeon general's office. Data was first collected in Kansas in 1827, at the newly established Fort Leavenworth. But until the 1850s, many conclusions about Plains weather and especially about precipitation was based largely on the appearance of vegetation and comments on vegetation will be noted in this paper. However, a more modern approach

to studying past climates is the use of dendrochronology. In 1974 Merlin Lawson reconstructed the climate of the interior west from 1800 to 1850. He concluded that the basins of the central Mississippi and the lower North Platte were quite moist (medium growth) at the beginning of the nineteenth century.⁵ Meko in 1992 used tree ring eigenvector scores to indicate wet and dry periods for the entire Great Plains region from 1790 to 1960 and also found the ten years around 1800 to be relatively wet, although declining from the overall moisture levels of ten years before.⁶

II Overview of Plains Weather

The Plains states are famous for extremes in temperature and for variability in precipitation. Kansas, for example, is located 37 to 40 degrees north of the equator and has temperatures that vary from a high of 121 degrees F. to a low of -40 degrees F. Precipitation varies from about forty inches a year in southeastern Kansas to about fifteen inches near the Colorado border.⁷ In Nebraska the amount of rainfall varies from about 28 inches in the east to about 18 inches in the west. As with Kansas, most of the rainfall comes between April and September.⁸ Air from three different sources—the Arctic, the Pacific Ocean, and the Gulf of Mexico—can meet on the Plains and create some of the nation's most severe weather. The air from the north is usually dry and cool, while the tropical air mass from the south is usually moist and warm. The air mass that comes from the Pacific has crossed the Rockies and may be either warm or cold, moist or dry. When any two of these air masses meet, storms may result. The most violent storms are created when the lighter, moist air from the Gulf rises up and over the heavier, dry polar air. Cooling, it releases moisture.⁹ As a rule, the farther an air mass travels from its moisture source, the more limited the rainfall.

Summer is the period of heaviest rainfall commonly in the United States, with average rainfall amounts of between 12 and 16 inches falling between May and August outside of the South.¹⁰ Summer droughts, which are common in the Plains, are the result of persistent subtropical upper-atmosphere high pressure cells over the southern United States that block penetration of moist air masses from the Gulf. Relatively warm air

from the southwestern deserts is drawn into the Great Plains by clockwise circulation from high-pressure cells. Reduced precipitation and higher temperatures are the result.¹¹

Plains weather can be very dramatic, with sudden, violent storms that sweep across large, open expanses, producing thunderstorms, blizzards, hailstorms, and even tornadoes. The encounter zone between air masses is controlled, in the eloquent words of geographer Donald Meinig, "by the shifting sinuosities of the stratospheric jet stream and experienced at the surface in the passage from west to east of front after front along the cyclonic storm tracks across the great lowlands."¹² In the summers of 1804 and 1806 Lewis and Clark would frequently find themselves under the track of just such storms.

III. Summer Weather on the Central Plains, 1804 and 1806

The expedition, as is well known, began on May 14, 1804, and followed the Missouri River north to its Great Bend, and then west and into the Rocky Mountains of Montana. The men reached what is now called northeast Kansas on June 26, 1804, at the confluence of the Kansas and Missouri Rivers and spent two days here, making observations, repairing the boats, and seeing their first bison. William Clark kept a daily journal, which frequently opens each day with a comment about the local weather and the wind direction. It was a hot early summer along the Missouri, particularly in the area that would later be called Kansas. The only reference to the use of a Fahrenheit thermometer was made on June 30:

The wind from the S.W, came to at 12 oClock & rested three hours, the (day) being hot the men becom verry feeble, Farn. Thermometer at 3 oClock stood at 96 above O.

The heat wave continued the next day, and the expedition paused opposite the site of Fort Leavenworth to give the men a rest from the heat. By the next week, "one man verry sick, Struck with the Sun, Cap. Lewis bled him and gave him Niter which has revived him much."¹³ The

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must have continued, for on July 22, Clark says that the company set out with a view that day of taking measurements (latitude and longitude) and "to make our party Comfortable in a Situation where they Could receive the benefit of a Shade."¹⁴

The first notation that Clark makes about the weather is ordinarily either about the temperature generally or about wind direction. Wind direction seems to be mentioned as a determinant of temperature, for Clark comments on heat and wind direction together on June 28, June 30, July 1, and July 2, saying for example on July 2: "a verry hot day, wind from the S.S."¹⁵ A change in wind direction often brings a change in local weather, as Clark notes on July 9, 1804: "at 8 oClock the wind Shifted from N.E. to S.W. and it commenced raining."¹⁶ Cool breezes were a welcome relief from the heat, as Clark said "the Breezes which are verry frequent in this part of the Missouri is cool and refreshing."¹⁷ At times the wind picked up, however, which caused problems when it blew up sand from the sandbars on the Platte. On July 26 Clark complained that "the wind Blustering and hard from the South all day which blowed the clouds of Sand in Such a manner that I could not complete my pan (plan) in the tent."¹⁸ He complained of the same problem on August 23, saying "the wind blew hard (west) and raised Sands off the bar in such Clouds that we could scarcely (see)...this Sand being fine and very light Stuck to everything it touched, and in the Plain for half a mile the distance I was out, every Spire of Grass was covered with Sand or Durt."¹⁹ Clark also mentioned the troublesome sandstorms on the return trip downriver on September 3, 1806: "wind continued to blow very hard this morning, it Shifted last night to the S.W. and blew the sand over us in Such a manner as to render the after part of the night very disagreeable."²⁰ This leaves the reader with an impression of hot, humid days with frequent gusts of wind that quickly dried up the pools of water on the sandbars.

The last week in August found the expedition suffering from another heat wave. Part of the party, including their dog, had gone on a walk, but "our Dog was so fatigued we was obliged (to) Send him back." Clark also notes that "Captain Lewis much taken with the heat, the day it being verry hot."²¹ By the beginning of September, as the party went further

north toward the present day border with South Dakota, the heat wave had broken. Clark now writes three times for the first week in September that it is a "verry Cold morning."²²

Two years later, as the Corps of Discovery traveled quickly downstream on their homeward journey, the weather grew hotter as they neared the Platte. Clark wrote on September 9, 1806 that:

the climate is every day preceptably warmer and air more Sultery than I have experienced for a long time. The nights are now so worm that I sleep comfortable under a thin blanket, a few days past was not more than sufficient.²³

A week later they reached the mouth of the Kansas River, the site of present day Kansas City. There Clark was less happy with the temperature and humidity, saying that " the weather disagreeably worm and if it were not for the constant winds which blow from the S. And S.E. we Should also be suficated comeing out of a northern Country open and Cool...is probably the cause of our experiencing the heat much more sesceable than those who have continued within the parallel of Latitude."²⁴

Degrees of latitude had been equated with temperature since classical times, and Clark appears to be also using that as an explanation for higher humidities. Clark also commented on increasing amounts of evaporation from his inkwell, saying on September 7 that " I am obliged to replenish my ink Stand every day with fresh ink at least 9/10 of which must evaporate."²⁵

Like much of the interior United States, rainfall peaks in the summer months on the Central Plains. Using dendrochronology, Lawson believed that this region was generally moist in the first decade of the nineteenth century. Rain was a common event the first summer of the expedition. Between June 26 and September 14, 1804 Clark mentions rainy days seventeen times in the Central Plains. There is no report of rain in late June. The first rain was reported on July 7, which came in a form familiar to modern residents of the region: "at 7 oClock a violent Ghust of Wind from the N.E. with Some rain, which lasted half an hour."²⁶

Clark reports rain eight days in July, eight days in August, and one day between September 1 and September 14 in 1804. Some of this rain came in the form of severe thunder storms. The first of these storms occurred on July 14. One of the boats could have been lost had it not been for the quick reaction on the part of the expedition. Here is Clark's description of the weather on that day:

Some hard Showers of rain this morning prevented our Setting out untill 7 oClock, at half past Seven, the atmosp became Sudenly darkened by a black and dismal looking Cloud...the Storm which passed over an open Plain from the N.E. Struck our boat on the Starb. quarter, and would have thrown her up on the Sand Island dashed to pieces in an Instant, had not the party leeped out on the Leward Side ands kept her off with the assistance of the anker and Cable untill the Storm was over... In this Situation we Continued about 40 minutes, when the Storm Sudenly Seased and the river become Instancetaneously as Smoth as Glass.²⁷

Other violent rainstorms were described by Clark as the expedition traveled northwestward in the Central Plains on July 28, and August 5, in 1804. Despite these experiences, Clark believed that "I have observed that Thunder and lightning is not as common in this Country as it is in the atlantic States."²⁸ Two years later, Clark may have changed his opinion, for on September 3, 1806 near Sergeant Floyd's grave, he says "...soon after we Landed a Violent Storm of Thunder Ligtning and rain from the N.W.. which was violent with hard claps of thunder and Sharp Lightening which continued untill 10PM after which time the wind blew hard."²⁹

The expedition spent far more time in what would be Nebraska than in Kansas, staying in the former from July 15 to September 7 in 1804, in effect spending most of their first summer in the Central Plains. This is not surprising, as the entire state of Nebraska lies within the drainage basin of the Missouri River and most of its secondary streams, such as the Platte, the Loup, and the Republican, form what Nebraska historian Frederick Luebke memorably calls a "ladder of rivers that flow eastward

toward the Missouri."³⁰ Olsen believes they first made camp in Nebraska on July 15, near the mouth of the Little Nemaha. On the Fourth of July, however, the party was still in what would later be the state of Kansas, encamped on the newly named Independence Creek. Clark's estimation of the landscape seems to have differed from those of Collot and Trudeau, mentioned earlier. Clark described the landscape as anything but barren, writing, "We Camped in the plain, in of the most butifull Plains I ever Saw, open and butifully diversified with hills and vallies all presenting themselves to the river covered in grass and a few scattering trees, a handsom Creek meandering thro."³¹

On July 15 a thick fog prevented their early departure, presumably to travel somewhat before the heat of the day. During the next week, on July 21, the rainy weather continued, as "we reached in the rain, at the distance of 14 miles, the great river Platte." On July 29 they noticed the remnants of a storm that was undoubtedly a tornado, which they called a hurricane: "above the highlands we observed the traces of a great hurricane, which passed the river obliquely from the NW to the Se and tore up large trees, some of which, perfectly sound and four feet in diameter, were snapped off near the ground."³² This was the most violent storm mentioned by Clark in the Central Plains.

The first week of September, 1804, as the weather grew cooler, the expedition entered the short grass country of the drier High Plains traveled beyond the parameters of this study. Clark's journal entries on the return trip were often shorter, and contained briefer descriptions of the now familiar Plains summer weather. On September 2, 1806, they camped opposite their September 1, 1804 campsite. The next day the party encountered another sandstorm, and later the thunderstorm already mentioned. A change in heat and humidity was noted on September 9, and again on the 15th. On September 15, 1806, Lewis and Clark came to the mouth of the Kansas River. They disembarked, climbed a hill and stood together overlooking the site of modern day Kansas City. When they rejoined their party and continued east on the Missouri, they left the Central Plains forever.

Conclusion

Two hundred years have passed since the Lewis and Clark expedition, and the English language has, of course, changed somewhat in that time. Clark often uses the term "storm" to describe a "storm of wind" and not as a rainstorm, as we use it today. The "harican" he remarked on was either a windstorm or most likely a tornado. Perhaps the most surprising reflection he makes on the weather was made on August 5, when he says that "I have observed that Thunder and lightening is not as common in this Countrey as it is in the atlantic States."³³ The Central Plains today is of course, famous for the violence of its thunderstorms. However, the contemporary reader must be careful not to contrast the experiences of one summer on Central Plains rivers with the large amount of data collected in the past century.

What were the major weather events encountered by the Lewis and Clark expedition in the summers of 1804 and 1806? Heat and humidity were the most common feature. Next were the "storms of wind" and the thunderstorms that often followed, and the difficulty of traveling in the sandstorms sometimes created by these conditions. Our most famous late spring/early summer "attraction," the tornado was not encountered, but the party did see the effect of either a tornado or at least a very strong wind. Morning fog was common, and winds often came from the south or southeast. If any of the thermometers Lewis had requested for the expedition were used daily, there is no record of it here. Weather was cooler and more pleasant to the north, above Kansas, and hotter and more "Sultry" to the south. There was no drought, for this was a moist period.

The very words that Clark used to describe the weather in his daily journal suit what we now commonly call a "continental climate" or "continental weather" very well. Continental weather is not characterized as moderate, it is instead well known for extremes. So it is fitting that Clark uses such words as "verry warm" (June 28, 1804), "verry hot" (July 2, 1804), "Violent" (referring to wind on July 7, 1804), "the wind Blustering" (July 26, 1804), "a violent storm" (August 6, 1804) to describe the weather he experienced first hand in the Central Plains in the summers of 1804 and 1806. If regional geography is a skillful description of areas and places, then William Clark has left us such a description of one part of that regional geography—the local weather

conditions—for the summers of 1804 and 1806.

NOTES

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28. Ibid., 100.
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31. Ambrose, *Undaunted Courage*, 149.
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