Weathering Montana : the social meanings of extreme environments in the Big Sky
by Kevin Conradt

A thesis submitted in partial fulfillment of the requirements for the degree of Master of Arts in History
Montana State University

Abstract:
Historians have largely ignored the influence of weather and climate on people. In Montana, this has certainly been the case. In a state where meteorological stability is ephemeral, society is consistently challenged by the extreme nature of Montana's environment. In my thesis I argue that the term weather, which is a social construction, is flawed for assessing Montana's meteorological instability because it relies on a methodology that sees temperature and precipitation in average or normal conditions. I also argue that the extreme nature of Montana's environment has helped to shape the societal infrastructure of the state, which has in turn strengthened the Treasure State's historical narrative. This nascent methodology requires a comprehensive understanding of meteorology from a state, regional, and global perspective. The combination of latitude, atmospheric circulation, land-water distribution, and topography act in concert to create the variability associated with Montana's natural environment. From a societal perspective I have relied on a combination of primary and secondary source information to interpret the perceptions of people and their relationship to Montana's natural environment. The human journey in Montana has historically been influenced by the severe nature of the state's weather and climate. From Native Americans to Euro-Americans, evidence of societal development in Montana, especially in agrarian enterprises, indicates that the construction of place has been largely influenced by the meteorological variability of Montana's natural environment. As long as Montana's natural environment continues to be influenced by meteorological instability, people will continue to challenge themselves against an environment of extremes. My hope is that future scholars interpreting the bond between people and weather will help to strengthen the methodology linking human beings with their nature environment.

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Kevin Conradt

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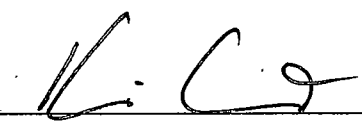
Signature 

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ABSTRACT

Historians have largely ignored the influence of weather and climate on people. In Montana, this has certainly been the case. In a state where meteorological stability is ephemeral, society is consistently challenged by the extreme nature of Montana's environment. In my thesis I argue that the term weather, which is a social construction, is flawed for assessing Montana's meteorological instability because it relies on a methodology that sees temperature and precipitation in average or normal conditions. I also argue that the extreme nature of Montana's environment has helped to shape the societal infrastructure of the state, which has in turn strengthened the Treasure State's historical narrative. This nascent methodology requires a comprehensive understanding of meteorology from a state, regional, and global perspective. The combination of latitude, atmospheric circulation, land-water distribution, and topography act in concert to create the variability associated with Montana's natural environment. From a societal perspective I have relied on a combination of primary and secondary source information to interpret the perceptions of people and their relationship to Montana's natural environment. The human journey in Montana has historically been influenced by the severe nature of the state's weather and climate. From Native Americans to Euro-Americans, evidence of societal development in Montana, especially in agrarian enterprises, indicates that the construction of place has been largely influenced by the meteorological variability of Montana's natural environment. As long as Montana's natural environment continues to be influenced by meteorological instability, people will continue to challenge themselves against an environment of extremes. My hope is that future scholars interpreting the bond between people and weather will help to strengthen the methodology linking human beings with their nature environment.

CHAPTER 1

INTRODUCTION

Here's the forecast for today: Probable northeast or southeast winds, varying to the south and west and east and points between . . . probable areas of rain, snow, hail and drought, succeeded or preceded . . . with thunder and lightning.

Mark Twain

Chances are, the person credited with coining the phrase, "If you don't like the weather, wait a minute, it'll change," may have been inspired by Montana's extreme weather and climate. In fact, had that person been Mark Twain, his whimsical weather forecast certainly would have seemed applicable considering Montana's place in national weather lore. Consider the following: coldest recorded temperature in the contiguous lower 48 states, -70.0 F at Rodgers Pass, Montana, on January 20, 1954; record for the most dramatic 24-hour temperature drop in United States, from 44.0 F to –56.0 F, for a total of 100.0 F, at Browning, Montana, in January, 1916; the national record for greatest differential between record low and high temperatures: -70.0 F to 117.0. F, for an astonishing difference of 187.0 F. The impact of extreme weather and climatic events on Montana's physical and societal landscape is profound, and it is that dynamic, I would argue, which has helped to create a distinct heritage in the Treasure State. To be sure, there is causation between the natural environment (weather and climate) and society that should be acknowledged. Just as human experience, in Montana, does not function

independently from the natural environment, neither does weather and climate behave apart from the global and regional meteorological paradigm. The general tenor of this thesis suggests that it is inappropriate for society to view weather and climate in terms of average or normal conditions, specifically temperature and precipitation. The classification of weather and climate are *social constructions*, not natural phenomenon. Weather and climate are the products of human ingenuity, descriptions and measurements, which are intended to comprehend, document, and predict the natural environment. Temperature and precipitation are the most important elements in this social construct because they have the most profound impact on human beings. And, although average and normal are important to weather and climate it is the variability and extreme conditions of meteorology that pose the greatest challenge on people and their activities. In Montana, this has certainly been the reality.

The crux of this study is concerned with the relationship between people and their natural environment (weather and climate) in Montana. I argue that the variability of weather and climate in Montana has helped to shape the societal landscape of the state. Moreover, the extreme nature of Montana's environment has influenced individual perceptions of place. And, finally, the association linking people to their environment in Montana has profoundly shaped the state's historical narrative. It is my belief that historians have largely neglected the role afforded to weather and climate and the impact on human beings, especially in an environment of extremes. My hope is that this scholarship will help inspire other historians to rectify this negligence.

I begin by directing my focus on a region that experiences its share of meteorological severity, the American West. In chapter two, I establish that there is a historical precedent for assessing the role of extreme weather in the Trans-Mississippi West. From the ill-fated Donner Party in the Sierra Nevada Mountains of California to the tornadoes, blizzards, floods, and wild fires that plague the region on a yearly basis, people are constantly challenged by severe meteorological conditions. I also examine the meteorological dynamics responsible for making the American West one of the world leaders in extreme weather. This section is significant because it recognizes that Montana is ultimately connected to a region that experiences similar climatic severity. Although Montana is certainly an environment of extremes, it would be inappropriate to place a label of "exceptional" on the state's meteorological variability.

The next section looks at some of the influences on people's perception of place and how weather and climate has shaped it. In chapter three, I suggest that the human relationship to the natural environment and societal constructions of place are largely influenced by the human ability to imagine their environments. Also, I examine how meteorologists construct weather in terms of average or normal conditions and how that methodology can be traced back almost two hundred years to an individual who had a profound impact on the American West and Montana. In addition, I also examine why Montana is home to such extreme meteorological conditions.

In chapter four, the focus of this study then shifts to Big Sky country and a socio/historical examination of how people have perceived their relationship to the

natural environment. From Blackfeet Indians, who have called Montana home for hundreds of years, to Lewis and Clark, the U.S. Army, and ranchers and homesteaders, the way in which people interpret their bond with physical environment is quite emotive. This section then explores how Montanans have developed a keen sense of place, and the influence that their perceptions and experiences have had on Montana literature.

In chapter five, my focus narrows to an assessment of a region of Montana that is famous for its extreme weather and climatic conditions: the Rocky Mountain Front. I examine the catastrophic flood of June 8, 1964 and assess the perceptions that people and communities exhibited towards this horrific event. In the end, people's perceptions in regards to their natural environment in Montana have evolved over generations of lived experiences, which have fostered a respect and an acceptance for the reality of their natural environment. First, however, it is imperative that I examine Montana's environmental relationship, from a meteorological and historical perspective, to a region that consistently produces some of the most severe weather in the world – the American West.

CHAPTER 2

EXTREME ENVIRONMENTS: THE AMERICAN WEST AND A METEOROLOGICAL EXPLANATION

To fully appreciate the complexities of weather and climate in the American West and the environmental challenges faced by peoples who chose to settle in a landscape of extremes, I must examine the meteorological history of the region as well as the physical dynamics responsible for producing severe weather and climate. Commenting on the challenges settlers would encounter in the West, Dr. Kenneth F. Dewey, climatology professor in the Department of Geosciences at the University of Nebraska in Lincoln states, "The European homesteaders who came to the American West to find their new homes during the 19th century were in for a rude awakening."[1] Unlike the relatively stable weather conditions experienced by Europeans in their native lands, the American West with its propensity for severe meteorological conditions presented a plethora of environmental challenges. Severe storms in the form of tornadoes, thunderstorms, flash floods, and blizzards, along with extreme temperature variations would often become the primary obstacle in newcomers' construction of place. Certainly, "the hardships placed on these early settlers by the weather and climate of the West," explains Dewey, " were of epic proportions."[2] Environmentally speaking, most settlers were unprepared and ill equipped for what lay ahead of them.

One of the most documented, as well as catastrophic meteorological events to impact the American West was the period referred to as the "Dust Bowl Years" of the mid 1930s. During the summer of 1936, the American West experienced some of the hottest conditions ever recorded for the region. Many of the record-breaking temperatures that were established that blistering summer still hold true today. "These include North Dakota, 121 F; South Dakota, 120 F; Nebraska, 118 F; Kansas, 121 F; Texas, 120 F; Idaho, 118 F; Oregon, 119 F; and Montana, 117 F," explains Dewey, while in stark contrast, "the previous winter had been the second coldest on record with temperatures at 50 days below zero in areas of North Dakota."[3] In addition to the incredible temperature extremes that gripped the West during the "dirty 30s," an unrelenting drought held the American West hostage. Thousands of destitute farmers were forced to flee the parched soils of the southern, central, and high plain states in search of a fresh start, providing the inspiration for John Steinbeck's classic novel, *The Grapes of Wrath.*

In addition to the extreme temperature variations and severe drought conditions experienced by people in the American West, the region is also capable of producing copious amounts of precipitation. The West has a long and storied history of prolific snowfalls, especially early in the autumn and late in spring when seasonal transitions are punctuated by unexpected severe storms. Take the example of the Donner party. In the early fall of 1846, already behind schedule and seriously unprepared for what lay ahead of them, the Donner party became casualties of unexpected winter-like conditions in the Sierra Nevada mountains. "The Donner Summit of the Sierra Nevada range in California," explains Kenneth F. Dewey, "is [aptly] named after the unlucky Donner

party, many of who perished in the winter of 1846-1847 when stranded by the deep snowfalls on the way to California."[4] Abundant and unpredictable snowfalls are not limited to the mountainous regions of the West, such as the Cascade ranges of Washington and Oregon, the Sierra Nevada of California, and the Rocky Mountains of the intermountain west. The Western High Plains are notorious for their severe blizzards. Illustrating the region's propensity for unpredictable snowfalls, Dewey remarks, "In January of 1949, an airlift of wood needed for heating was provided to stranded residents of western Nebraska, who became victims of the 'bookend-blizzards' that dumped almost 3 feet of snow across the High Plains of the west and left drifts up to 50 feet high in Nebraska."[5]

In addition to prolific snowfalls, flash floods are a major concern for people who decide to live in a landscape marked by the extreme weather and climate. Along the east facing slopes of the Rocky Mountains, stretching from Montana in the north to New Mexico in the south, residents are constantly reminded of nature's ferocity. From late spring, and on into the summer months, severe thunderstorms are capable of producing incredible amounts of rain in short periods of time. Because of the mountainous topography of the region, the results of such heavy rains can prove deadly. A tragic example of this was the Big Thompson Canyon Disaster that occurred in the Colorado Rockies on July 31, 1976, during the peak of the summer tourist season. Campers and recreationists were packed into Big Thompson Canyon when, as night fell, a severe thunderstorm became stationary over the steep and narrow canyon. With little or no

warning, the storm unleashed an astounding amount of rain in a short amount of time. Precipitation at the top of the Canyon was between 10 to 12 inches with 8 inches falling in only 2 hours, and with nowhere for the water to go, a 20-foot wall of water tore down through the Canyon killing 139 people and causing $35.5 million in damage to property.[6]

If the threat of extreme temperatures, blizzards, severe thunderstorms and flash flooding are not enough to contend with, people in the American West must also be wary of tornadoes. Every year the Western High Plains, especially in the spring, are transformed into a spawning ground for one of nature's most frightening meteorological forces – tornadoes. Colliding air masses, one being dry and cold, the other warm and tropical in nature, can combine with deadly results. One example of dangers of this volatile phenomenon occurred when, "without warning, a series of tornadoes moved across Nebraska in March of 1913, cutting a destructive path through the center of Omaha, killing 101 people."[7] People *usually* associate tornadoes with areas of the Great Plains, the South, and the Midwest. But mountain state dwellers also need to be alert. In the summer of 1999, residents of Salt Lake City, Utah, situated along the western slope of the Wasatch mountains at an elevation of over 4,000 ft. were shocked when a tornado ripped through the center of their urban landscape, injuring many and killing one person.[8] The diversity of severe weather events with which people in the American West must contend are caused by a number of meteorological forces, some of which must be understood from a global perspective.

Climate and weather in the American West, and especially in Montana, are connected, and thus affected, by a global meteorological system of controls. The four

primary factors called climate controls that influence weather and climate are: land and water distribution, latitude, topographical features, and atmospheric circulation. Earth is predominantly made up of water. In fact, the surface of the earth is made up of almost 70 percent water. The portion of earth's surface that is land, 30 percent, is distributed between the two hemispheres. "The southern hemisphere land masses, except for Antarctica," explains Dewey, "cluster in the lower, near equatorial, latitudes with only a small land area in the mid latitudes."[9] Most of earth's weather, specifically episodes of severe weather, occurs within the confines of each hemisphere's mid-latitudinal sections. Because only a small portion of the southern hemisphere's land mass resides within the mid-latitude section, episodes of extreme weather are not as prevalent.

In comparison to the southern hemisphere's land distribution, the northern hemisphere has a much larger area of land within its mid-latitude sections. Illustrating this important point, Kenneth F. Dewey states, "The comparable latitudinal transect in the northern hemisphere traverses the midsection of North America and the vast expanse of land stretching from central Europe across central Asia."[10] As a result of the distribution of land masses between the two hemispheres in relation to their respective mid-latitude sections, 45 degrees north or south, the northern hemisphere experiences far more variability and has greater contrast in seasonal climates and day-to-day changes in weather than has ever been observed, or recorded, in the southern hemisphere.[11]

Because the relationship of landmass in proximity to mid-latitude sections is so important to understanding the earth's weather, an explanation of *why* is in order. First, the earth derives most of its heat, or energy, from the sun in the form of solar radiation.

Energy is absorbed by the earth's surface, land and water, which is then transferred back into the atmosphere providing the atmospheric circulation necessary to create weather. In many ways, then, the sun can be viewed as the engine that drives earth's weather. Land is a very efficient absorber, as well as an emitter of heat, when compared to water. As a result, land tends to be much more efficient at absorbing energy, which is transferred from the incoming solar radiation of the sun, causing greater surface temperatures when compared to water. Conversely, when energy from the sun is at its weakest, during winter in the northern hemisphere, land surfaces are much colder than water. As a result, then, land surfaces, specifically in the North American West, experience a wide degree of temperature variations, which in concert with the mid-latitudinal transect, produce weather.

In addition to land/water distribution and latitude, topography as well as atmospheric circulation are also principal features responsible for the extreme weather conditions that exist in the American West. "The primary mountain range of North America, the Rockies," explains Dewey, "stretches from Alaska down through Western Canada and the Western United States and on into Mexico."[12] The topographical orientation of the Rockies is from a north to south direction. Also, the major mountain ranges of the West coast, the Cascades and the Sierra Nevada, are oriented in a north to south direction. Topographically, this point is noteworthy. In the American West, along the mid-latitude regions, contrasting air masses, which are responsible for influencing weather, move from north to south, or south to north. Because of the topographical orientation of the continent's mountain ranges, contrasting air masses are able to interact

largely unimpeded by topography, which can intensify storms as they move from west to east across the jet stream.

In contrast to the American West, the topographical orientation of mountain ranges in Europe and Asia, for example, are predominantly directed in a west to east track. As a result, Europe's mountain ranges act as barriers, keeping opposing air masses from colliding, providing for a much more stable environment. This is in stark contrast to North America, specifically the American West, where cold air masses from the north meeting tropical air masses from the south are unimpeded by mountainous terrain. "The ingredients for violent and rapidly changing weather conditions are brought into direct conflict throughout the year," remarks Dewey, commenting on the significance of the controls of climate, "making the Western United States the world leader in many types of severe weather."[13] Clearly, Europe and Asia receive their fair share of extreme weather, but nowhere on earth do the conditions necessary for the creation of dramatic weather come together with such severity as they do here, in the American West

[1] Kenneth F. Dewey, "Climate and the West," Journal of the West, (Summer 2001): 6.

[2] Ibid.

[3] Ibid.

[4] Ibid., 7.

[5] Ibid., 8.

6. Kenneth F. Dewey, "The Weather of the West," Journal of the West, (Summer 2001): 36.

[7] Dewey, "Climate and the West," 7.

[8] Ibid.

[9] Dewey, "The Weather of the West," 31.

[10] Ibid.

[11] Ibid.

[12] Ibid.

[13] Ibid., 32.

CHAPTER 3

THE PERCEPTION OF PLACE: MONTANA AS AN ENVIRONMENT OF EXTREMES AND THE CONSTRUCTION OF WEATHER

In her essay, "A Place of Extremes: Nature, History, and the American West," Susan Rhodes Neel eloquently argues, "What we need is a history that has at its heart this simple but enduring truth: nature has shaped us as surely as we have it."[1] In Montana, Susan Neel's assertion certainly rings true. As long as people have interacted with the natural environment of Montana, they have no doubt been influenced by its prevalence for extreme meteorological events. The very idea of place, and its stability, is largely predicated on people's ability to survive in an environment capable of rapid change. It is a landscape where average and environment rarely exist together.

The idea that weather and climate has been constructed in terms of average conditions, specifically concerning precipitation and temperatures, and applied to an environment like Montana seems flawed. Because one of the fundamental tenets of this thesis strongly argues that the construction of "average" is inappropriate for Montana, it necessary to explain how, and why, weather is so dominated by the term average or normal. When meteorologists say, for example, that the average temperature today is supposed to be 50 degrees, or that the average precipitation for a particular month is 2 inches, the question should be, "how is average constructed?" The answer is actually quite simple. Climatology is the study of weather on a macro scale, in other words, climate. Climatologists are meteorologists who study weather over an extended period of time, compiling numerical statistics into 30 day, month or year increments. Take

temperature, for example. A climatologist, at the National Weather Service in Great Falls will look-up the high temperature, using June 15 as an example, and compile the last thirty years' high temperature readings for our hypothetical date of June 15 and divide that number by thirty. Let us assume that the number divisible by thirty is 68 degrees. Sixty-eight degrees, then, is what weather forecasters will predict for the average high temperature for June 15. This formula holds true for calculating average low temperatures for a particular date and the same methodology applies to precipitation, too. Using the thirty-year formula for assessing average temperature and precipitation meteorologists compile this information, which can easily be accessed through internet web sites.

The answer to why is just as comprehensible. By assessing weather data and constructing it in terms of average meteorologists are afforded an idea of what weather may be like for a particular day, month, or even a year. This information is then disseminated to the general public. News organizations, weather service outlets, anyone, for that matter, can find out what the weather is supposed to be like for a given day or a month. As I have illustrated, and as I will continue to argue, this can prove to be quite problematic. Society has been conditioned to view, even expect, weather and climate to be average. This construction is incorrect. In Montana, society would be better served if weather and climate were, instead, seen in terms of extreme conditions. By choosing to view weather and climate in terms of *average* conditions our construction of weather relies upon a mathematical bias, which is blatantly inappropriate for the American West and Montana. The concept of constructing meteorology in average conditions is not only

biased, but it also falsely implies, for the region, an ecological coherence that does not in reality exist.[2] In Montana, the reality is that rapid change in weather and climate seems much more common, while average implies a false sense of environmental stability.

Thomas Jefferson speculated, upon the return of Lewis and Clark, that it would take a hundred years to settle the American West. Reality, however, was much more expedient. With the unearthing of gold in the Sierra Nevada of California in 1849 and the subsequent strikes along the Front Range of the Colorado Rockies ten years later, Americans began to see the West in a whole new light. In 1862, westering Americans set their sights upon the gold fields of Southwestern Montana as Euro-American settlement in Montana set into motion a relationship between human beings and their environment, which would time and again turn out to be problematic. As Elliott West notes, "People certainly remain ignorant about their full effect on their surroundings and about their environment's impact on them."[3] In Montana, human ignorance about environment has been replicated throughout the state's history.

As Euro-Americans began their human journey into Montana, their perceptions of the natural environment were altered, or re-imagined, as Elliott West would argue, in order to take full advantage of the opportunity for the extraction of wealth from the physical environment. "Through imagination," explains West, illustrating the power of perception, "humans thus gain enormous manipulative influence over their surroundings, they can perceive a new effective environment from the current one."[4] As people began the process of settlement into Montana, they did so mostly without an intimate knowledge of the environment, and of the severity of weather and climate.

By shifting their perceptions of the physical environment, Montanans could indeed manipulate their surroundings, or could they? "The problem is, just as we cannot truly perceive of all our effective environment at any moment, so we cannot imagine anything close to the full consequences of changing things," suggests West, "some repercussions are simply beyond our ability to understand."[5] In Montana, peoples' ability to fully perceive their environment could only go so far. Extreme temperature variability, severe wind events, horrific blizzards, and catastrophic floods, contrasted with prolonged droughts were not what people imagined for themselves, how could they be?

Habitation in Montana would, and always will be, fraught with environmental consequences created by extreme meteorological episodes. "It is the downside of the human advantage," argues West, " we are vastly superior to any other species in stretching our world into the shape we want; that also makes us infinitely more capable of creating unforeseen difficulties." [6] The human experience in Montana, cloaked by a perception of invincibility, has fostered a relationship between its people and a plethora of environmental challenges that has, and will always be, a problematic one.

Montana history is a narrative filled with heartache and stories accentuated by loss; it is an environmental trial-by-fire. In its most simple terms, weather and climate, especially its periodic extreme nature, have sculpted Montana's history with countless examples of tragedy, and sometimes triumph. "The relationship of human beings to their environment undergirds the 'Montana story'," writes historian Dave Walter, "as they suffer from it, battle it, struggle to understand it, adapt to it, and receive spiritual energy

from it."[7] It is, as Walter suggests, the connective thread, which enriches and strengthens our collective historical narrative.

In Montana the construction of place has consistently been a volatile undertaking, especially for those wishing to establish an agricultural enterprise. Moreover, in a state where agriculture is omnipresent, success is constantly in peril. Still, people continue to endure in the face of overwhelming odds. Perhaps no one has better understood these challenges and been able to articulate them than Ivan Doig. Passionately composed, reflective and inspiring, Doig's *This House of Sky: Landscapes of Western Mind* brilliantly captures a Montana family's enduring struggle against a hostile environment.

Doig's description of his father's struggle to manipulate an environment of extremes against what can only be described as *hopeless* odds, illustrates the desperation people competed with in their relentless construction of place. "Anyone of Dad's generation," remarked Doig, "always talked of a piece of land where some worn-out family eventually had lost to weather, not as a farm or a ranch or even a homestead, but as a *place*."[8] From its badland prairies on the eastern plains to the high mountain valleys of the west, Montana is littered with examples of failure, ghost towns where dreams lay frozen in time, "All of them," sadly laments Doig, "epitaphed with the barest of words, *place*."[9] Unquestionably, Montana's ability to produce extreme environmental conditions has left an indelible impression on its collective narrative and will always play a prominent role in the construction of both its physical and societal landscapes.

For people unfamiliar with Montana weather, the reality of its extreme nature can be an unforgettable experience. It was like that for Wilbur "Mac" McKinney. An

employee of the National Weather Bureau, McKinney was transferred to Great Falls, Montana, during the winter of 1940 to supervise the opening of the new Weather Bureau Office. His journey from Missoula, then to Helena, and on to Great Falls formed a first impression that would last a lifetime. "The ride from Helena along the old highway, straddling the Missouri River, was an adventure," recalled McKinney, "by the time we arrived in Great Falls the snow had been drifting and blowing – causing a delay so that a snow plow could clear the road – and the high temperature for Great Falls that day maxed out at a high of 0 degrees."[10] Although McKinney had experienced hard weather in his native Colorado, he was, nevertheless, impressed by Montana's harsh climate.

Montana is the fourth largest state in the nation, trailing only Alaska, Texas, and California in size. It is a place of broad dimensions and sharp contrast; the "Treasure State" contains 147,138 square miles, averaging 535 miles from east to west and 275 miles from north to south.[11] And yet, despite its size, Montana is one of the smallest states in the country in population, with less than one million people. Topographically, the state can be viewed in terms of two distinct landscapes. The eastern two-thirds of Montana are a combination of plains, prairies, and badlands environments. Occasionally, small island mountain ranges, such as the Sweet Grass Hills, break up the monotony of a relatively flat and unbroken landscape.

In sharp contrast to Montana's eastern topography, the western third of Big Sky country is comprised of mostly mountains. Western Montana is where the state derives it name, from the Spanish word for mountainous. Separating the two distinct sections of the state is the Continental Divide, the Backbone of the Continent, running along the eastern

flank of the Rocky Mountains from Glacier National Park in the north to Yellowstone National Park in the south. Its altitude, averaging 3,400 feet above sea level, ranges from a high of 12,850 feet at Granite Peak, in the Beartooth Mountains of southwest Montana, to a low of 1,800 feet where the Kootenai River flows into northern Idaho near Troy.[12] It is in part because of Montana's extreme variability in topography that the Treasure State is capable of bringing to fruition the conditions responsible for producing severe meteorological events. The Continental Divide separates Montana into two distinctly different climatic regions: west of the divide, Montana's climate is influenced by marine air from the Pacific; and to the east, Big Sky Country is shaped more by a continental pattern.[13] The diversity between the two distinct regions, meteorologically, can be profound.

Meteorologist Mike Heard, from KXLF television in Butte and a native Montanan, has an intimate understanding of why Montana is such a volatile breeding ground for extreme weather. "In terms of Montana's latitude," explains Heard, "we are positioned in close proximity to the Pacific Northwest, which places Montana relatively close to the procession of storms that roll out of the Pacific Ocean and the Gulf of Alaska."[14] In addition, Montana is influenced by Canadian and polar air masses which can move in from the north. The combination of moisture from the Pacific and cold air masses from the north often combine to create blizzards and heavy snow storms which can strike the Treasure State almost any month of the year. Making the volatile combination of Pacific moisture and cold air masses even more problematic is Montana's diverse topography. As storm systems move in off the Pacific Ocean and reach Montana,

the varied topography of the state's western portion can create a weather forecaster's nightmare. "The combination of mountains, valleys, canyons, and the Continental Divide," says Heard, "make forecasting accurate weather scenarios a real challenge."[15]

For example, as storms move across large bodies of water, the smooth surface conditions create little or no friction, which causes little or no disruption of the cyclone, or low-pressure system. Conversely, land surface conditions like the varied topography of western Montana, cause cyclonic storm systems to behave in drastically different ways. The friction associated with Montana's topography: mountains, canyons, and valleys causes storm systems to fracture and become micro-systems within a larger cyclonic complex. Two distinct different weather dynamics, which are associated with topography in Montana, orographic lifting and chinook winds, are distinctive features in the state's meteorological make-up.

Because Montana is mostly a region of semi-arid climatic conditions, the weather dynamic known as "orographic lifting" plays an important role in harnessing the state's water supplies. As storms move in from the Pacific Ocean they encounter the Northern Rocky Mountains of Montana, striking the north to south oriented ranges in a perpendicular fashion. Mountain ranges, acting as barriers to the incoming storms, compel the air to ascend, cooling it adiabatically as it rises, forcing moisture to condense and fall in the form of rain or snow.[16] Mountain snow packs in Montana are critical because they store water, acting as natural sponges, providing water for the state's rivers, reservoirs, farms, and ranches. Unfortunately, orographic lifting can prove disastrous

when too much water is made available, producing catastrophic flooding. A tragic example of this occurred in June of 1964 along the Rocky Mountain Front.

Topography, combined with atmospheric circulation, also produces severe wind events; the most famous of these are chinook winds. "Chinook," a term derived from Native American culture, means *snoweater.* The warm winds that occur usually in the winter are most prevalent along the east facing slopes of the Rocky Mountains. From Livingston in the southwest part of Montana northward along the Rocky Mountain Front, chinook winds are a prominent aspect of Montana's severe weather features. As the air descends the leeward slopes of the mountains, it is heated adiabatically, or compressed, and as it falls and picks up speed, the winds and temperatures in the affected areas can rise dramatically.[17] In areas like Great Falls, Augusta, Chouteau, and Cut Bank, people are consistently challenged by the dramatic chinook winds..

One of the most significant influences on Montana weather, in terms of atmospheric circulation, is the role of the jet stream. When asked why Montana is such a fertile environment for extreme weather, Rick Dittman, Warning Coordination Meteorologist for the National Weather Service in Great Falls, explained the importance of the jet stream. "Its like a river of air embedded high within the atmosphere," says Dittman, "separating contrasting air masses, one cold and dry, the other being warm and moist, which when combined can create severe weather events."[18] The "river of air" is the highway upon which storms are usually transported. Embedded within the westerly flow aloft in earth's atmosphere, these narrow ribbons of high-speed winds meander for thousands of miles at elevations of between 25,000 and 40,000 ft.[19] It is the mid-latitude

jet stream, which flows mostly in a west to east direction, that is largely responsible for the extreme weather in the American West, and especially in Montana. As the jet stream goes, so goes Montana's weather and climate, and the profound variability associated with meteorology in Big Sky Country.

Clearly, the diverse nature of Montana's geography, in concert with the combination of meteorological dynamics make the Treasure State an environment of extremes. How, then, should society perceive its natural environment in light of the overwhelming evidence which indicates that variability is more appropriately the norm, as opposed to average? Why is it that society is conditioned to see weather and climate in terms of average conditions? Ironically, that flawed construction can be traced back to an individual who, although he never personally developed an intimate understanding of the extreme nature of Montana's weather and climate, had a profound impact on the Big Sky. That person was Thomas Jefferson.

To say that Thomas Jefferson was a man of many talents would be a vast understatement. He is primarily recognized as one of our nation's great statesmen, but he was much more: architect, musician, agriculturist, lawyer, educator, inventor, philologist, and geographer.[20] In addition to Jefferson's many talents, it seems that he also recognized the significance of meteorology. What accounts for Jefferson's passion for understanding the relationship of atmosphere and environment? Of paramount importance in accounting for Jefferson's passion for weather and climate were the scientific rationalism of the Enlightenment and the influence of individuals like Frances Bacon, Sir Isaac Newton, and John Locke.[21] As early as 1778, just two years after Jefferson had drafted the

Declaration of Independence, his interest in meteorology was recorded in a letter to Giovanni Fabbroni.

Indicating his displeasure at having little time to devote to his philosophical studies, Jefferson nevertheless responded to Mr. Fabbroni's inquiry about the American climate. "I make my daily observations as early as possible in the morning," responded Jefferson in regards to assessing temperature, "and again about 4 o'clock in the afternoon, these generally showing the maxima of cold and heat in the course of 24 hours."[22] By taking twice-daily temperature readings, one the day's low, and most likely, the day's high, Jefferson could come up with a daily mean, or average temperature. In 1785, in response to another inquiry, Jefferson theorized that the difference between Americans, north and south, could be linked to climate. "In the North they are cool, sober, laborious, and persevering," mused Jefferson, while in "the South they are fiery, voluptuary, indolent, and unsteady."[23]

In 1803, with his mind's eye towards the American West, President Thomas Jefferson drafted a letter to Meriwether Lewis with explicit instructions for his impending journey into the Louisiana Territory. Within those instructions were directions to document meteorology: "climate, as characterized by the thermometer, by the proportion of rainy, cloudy, & clear days, by lightning, hail, snow, ice, by the access & recess of frost, by the winds prevailing at different seasons," Jefferson also instructed Lewis to account for "the dates at which particular plants put forth or lose their flower, or leaf, times of appearance of particular birds, reptiles or insects."[24] Obviously, Jefferson felt it

important that he, and eventually the nation, should have an understanding of the natural environment in regards to weather and climate in the new west.

After his retirement from political life, Thomas Jefferson was pleased to devote more time to his passion for philosophical studies and the study of weather and climate. It was during this period in Jefferson's life that he responded to a series of questions posed by the French legation in Philadelphia. A compilation of information and opinions on a multitude of subjects, Jefferson's *Notes on the State of Virginia* is an intriguing look into the man eager to know nature. Within his *Notes on Virginia*, the budding meteorologist devoted an entire section to weather and climate. Query VII, titled Climate, begins with the epigraph, "*A notice of all that can increase the progress of human knowledge?*"[25] The question may reveal Jefferson's ambivalence in regards to weather and climate. Certainly, it illustrates his passion for understanding, or at least trying to understand the natural environment.

Query VII, devoted entirely to the study of meteorology, is a compilation of weather data and climatic observations in his native Virginia. It reveals the man of science eager to plumb nature for the intellect, but it also shows a man of almost romantic sensibility, enraptured by the grandeur of the American environment.[26] Unquestionably, Thomas Jefferson's work in relation to his methodologies for collecting and compiling weather and climatic data were quit visionary for his time. A tireless pursuer of useful knowledge, Jefferson extolled Enlightenment ideology in hopes that his efforts might lead to a more cerebral understanding of the natural environment. By diligently collecting weather data, and compiling that information into a formula of mean or average

conditions, Jefferson utilized a methodology that would guide the United States military as Americans began to settle the vast and unknown regions of the American West.

In 1814 the first successful attempts at gathering long-term weather observations in the American West were attempted. Orchestrated by the United States Army under the direction of James Tilton, Chief Physician and Surgeon ordered hospital, post, and regimental surgeons to keep diaries of the weather.[27] In fact, the first weather observations in Montana were recorded in 1866 at Camp Cooke and Helena. As settlement increased across the west, military posts became increasingly important for the gathering of meteorological data. Over the years, as the American West was organized into territories and eventually into states, the responsibility of collecting weather data shifted from the Signal and Surgeon General's offices to state colleges and universities. As had Jefferson and Benjamin Franklin, the collection of weather data was compiled into means, or averages, as a way for assessing the climate of the American West. This methodology, as stated previously, would prove to be problematic as the region's variability proved to be far more severe than the eastern parts of the nation. Even now, with all of the technological advancements made through scientific inquiry, the ability to understand and accurately forecast and predict weather in the American West, and especially in Montana, remains extremely troublesome.

Currently, the responsibility for weather forecasts and warnings of extreme conditions are provided by the National Weather Service (NWS) under the auspices of the National Oceanic and Atmospheric Administration (NOAA).[28] In Montana, the duty for forecasting weather is divided between four NWS offices in Missoula, Great Falls,

Billings, and Glendive. When asked about the difficulties of weather prediction in Montana, Warning Coordination Meteorologist Rick Dittmann of the Great Falls National Weather Service says, "The ability to accurately forecasts weather is impacted by the sudden and rapid change in the atmosphere above Montana; how can you forecast and measure what you can't see?"[29] Dittmann's challenges, associated with accurately forecasting weather in Montana are in fact influenced by all the controls of climate. "Everything that impacts weather and climate affects Montana," explains Dittmann, "land/water distribution, atmospheric circulation, topography, and elevation, basically, the primary controls of climate, are at action here in Montana, only exponentially so."[30]

As an employee of the National Weather Bureau, and then the National Weather Service in Montana for almost four decades, Wilbur McKinney echoes Dittmann's frustrations for providing accurate weather forecasts in Montana, "Because of Montana's extreme topographical variability, creating a multitude of micro-climates, forecasting with any accuracy is very difficult."[31] Meteorologist Mike Heard of KXLF television in Butte agrees with both Rick Dittmann, and Wilbur McKinney. "The varied topography of Montana, in combination with the state's proximity to the Pacific Northwest Coast to the West and Canada to the North," explains Heard, "makes forecasting weather in Montana extremely challenging."[32]

Although technology continues to improve, providing meteorologists like Mike Heard and Rick Dittmann with more advanced forecasting tools, the ability to accurately forecast Montana weather, will continue to challenge and frustrate. As Rick Dittmann so accurately pointed out, "How can you forecast what you can't see?" The physical forces

governing the atmosphere are not, and may never be, fully understood. Because the flow aloft fluctuates in a somewhat unpredictable manner, weather prediction, especially long-range forecasting will continue to remain a challenge in Montana. For almost two hundred years, now, people have tried to understand the dynamics of meteorology. Yet to a large extent, weather forecasting still remains a mystery.

In Montana, the idea of weather and climate constructed in terms of average seems oxymoronic. The extreme variability of the landscape below combined with the complexities of the atmosphere above have made Montana's environment an inhospitable guest for human beings. Nevertheless, people for hundreds, perhaps thousands of years, from the earliest Native Americans who called Montana home, to the first Euro-Americans who dared to venture into the heart of the Big Sky have searched, and most likely always will be searching, for some way to reliably predict weather in order to make a place for themselves in Montana.

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[3] Elliot West, The Contested Plains: Indians, Goldseekers, and the Rush to Colorado, (Lawrence: University Press of Kansas, 1998), xix.

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[8] Ivan Doig, This House of Sky: Landscapes of a Western Mind, (San Diego: Harcourt, Inc., 1978), 22.

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[10] Wilbur Mac McKinney, Interview by Laurie Mercier, 25 February 1983, OH 654, Montana State Historical Society Archives, Helena, Mt.

[11] William L. Lang, Michael P. Malone, Richard B. Roeder, Montana: A History of Two Centuries, 2nd ed, (Seattle: University of Washington Press, 1976), 3.

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[14] Mike Heard, KXLF Television, Butte, Mt., Interview by Kevin Conradt, 28 September 2001, Tape Recording in Possession of Author.

[15] Ibib.

[16] Fredick K. Lutgens and Edward J. Tarbuck, The Atmosphere: An Introduction to Meteorology, (Upper Saddle River: Prentice Hall, 2001), 477.

[17] Ibid.

[18] Rick Dittmann, Warning Coordination Meteorologist, National Weather Service, Great Falls, Mt., Interview by Kevin Conradt, 10 October 2001, Tape Recording in Possession of Author.

[19] Lutgens and Tarbuck, The Atmosphere: An Introduction to Meteorology, 200.

[20] Merrill D. Peterson, ed., The Portable Thomas Jefferson, (New York: Penguin Books, 1975), xi.

[21] Ibid., xviii.

[22] Ibid., 359.

[23] Ibid., 387.

[24] Ibib.

[25] Ibid., 112.

[26] Ibid., xxiii.

[27] Kenneth G. Hubbard, "The History of Weather Observations in the Western United States," Journal of the West, (Summer 2001): 26.

[28] Lutgens and Tarbuck, The Atmosphere: An Introduction to Meteorology, 332.

[29] Dittmann, Interview by Kevin Conradt.

[30] Ibid.

[31] McKinney, Interview by Kevin Conradt.

[32] Heard, Interview by Kevin Conradt.

CHAPTER 4

WEATHERING MONTANA: A SOCIO-HISTORICAL LEGACY

"The Blackfeet evolved a very reasonable form of pagan religion in their Sun-worship . . . they determined the phenomena of nature, and connected causes and effects into a system of natural religion, which did credit to their reasoning powers, their piety and their imagination." *-The Old North Trail (1910)*

Well before Euro-Americans set foot into Montana, Blackfeet Indians trekked southward along the "Old North Trail" and settled along the leeward side of Montana's Rocky Mountain Front. Influenced by their natural surroundings, Blackfeet culture developed an intimate understanding of the natural environment and a deeply spiritual perception of the natural phenomena of environmental extremes. In Montana, Blackfeet culture represents, perhaps, the most powerful example of a people's ability to exist in an environment of profound meteorological severity. It was the western edge of Blackfeet geographical topography, Montana's Rocky Mountain Front, which provides most of the conditions responsible for the region's extreme weather and climatic variability. "For centuries the Blackfeet have regarded the Glacier area as part of the Mistakis, the Backbone of the World," commented historian Mark David Spence, who reported the Blackfeet belief, "within the mountains lived powerful spirits such as Wind Maker, Cold Maker, Thunder, and Snow Shrinker (Chinook winds)."[1]

Spence's comments are significant for two important reasons. First, topography in Montana plays an important role in the region's prevalence for extreme meteorological events. The Backbone of the World, or the Continental Divide, depending on which cultural construction you choose to invoke, significantly influences the variability of weather and climate in Montana. In a state where extreme weather abounds from east to west and all points between, it is the Rocky Mountain Front that lies at the epicenter. Second, Spence points out the spiritual connectedness Blackfeet felt towards the Backbone of the World in relation to their natural religion, and in turn, the forces responsible for swift environmental change. It is the ferocious wind events, propensity for severe cold, extreme temperature fluctuations, violent blizzards, flash floods, and the chinook winds that have played a significant role in shaping Blackfeet society along the Rocky Mountain Front.

The Blackfeet construction of weather and climate is markedly different from the Euro-American alternative, which would eventually come to influence societal perceptions and the way that people imagine their environment. "Native Americans view their association with the natural environment as a deeply personal relationship," says Walter Fleming, Professor of Native American Studies at Montana State University – Bozeman; "it can be seen as a mutual co-existence between one another."[2] Conversely, Euro-Americans have tended to see the natural environment not as a partner in a personal relationship, but rather, as an external force to be controlled and known through scientific inquiry. By acquiring daily temperature readings and precipitation amounts, weather and climate could be arranged and ordered into average conditions.

Blackfeet believed that powerful spiritual figures, which were responsible for the dramatic environmental conditions of the region, resided within the local mountains. Blackfeet religious ideology held that powerful spirits such as Wind Maker, Cold Maker, Thunder, and Snow Shrinker could be persuaded to act favorably towards the Blackfeet. Spiritually significant to the Blackfeet mythology is the trickster known as the Old Man or Napi. The spiritual figure's geographical affiliation with the Mistakis, and his spiritual connectedness with the mountains make the trickster known as "Old Man," an important figure for the Blackfeet. Considering that the Blackfeet spiritual figure resides within proximity of the entities associated with environmental change (Wind Maker, Cold Maker, Thunder, and Snow Shrinker), it seems appropriate that tribal leaders would see Napi as a intermediary, a liaison of sorts, between people and environment. "Many often-told stories detail Napi's adventures in Mistakis," Spence claims, "and he is attributed with the origination of many of the tribe's most important ceremonies, spiritual practices, and everyday customs."[3] Judeo-Christian belief systems, on the other hand, see the natural environment as a separate entity, which is in sharp contrast to the personal connectedness Blackfeet feel towards the natural environment.

Native Americans, and certainly Blackfeet Indians, viewed specific weather related events as a sign of changing seasons. For example, Blackfeet Indians would see the first thunderstorm as a sign of spring and the end of winter. In Montana, because of the long winters, this might not happen until May or June, especially on the Rocky Mountain Front. In addition, the first hard snow would indicate the beginning of winter, or the onset of Cold Maker. Again, in Montana, the first hard snow and arrival of cold

weather may happen in late September or October. With Montana's extreme meteorological variability, Native American constructions of seasonal change seem much more applicable given the state's environmental severity.

Euro-American constructions of seasonal changes are assigned fixed or static dates. For people living in the Northern hemisphere, June 21 or 22 is officially known as the summer solstice or the first day of summer and December 21 or 22 is known as the first day of winter or the winter solstice.[4] The equinoxes are midway between the solstices; the autumnal equinox in the Northern Hemisphere is September 22 or 23, while spring equinox is assigned to March 21 or 22. In Montana, assigned dates indicating seasonal change are clearly problematic. As indicated earlier, winter-like conditions may occur two or three months before December 21 or 22. And, conversely, heavy snowfall and bitterly cold temperatures may linger well into May and June. Certainly, it would seem apparent that Euro-American constructions of seasons, if they are supposed to indicate climatic change, are ill-suited for Montana's extreme meteorological variability.

For almost ten thousand years Native Americans were the sole inhabitants of Montana. Their intimate understanding of the natural environment fostered a deeply personal relationship between people and landscape. That construction inspired a spiritual connection, which enabled both people and environment to mutually co-exist in a region where meteorological conditions can coalesce into potentially extreme episodes. Conversely, Euro-American experiences with the natural environment, specifically east of the Mississippi River, were confined to a region with far less extremity of environment. In 1803, Thomas Jefferson, the Louisiana Purchase, and a band of

interlopers would forever change the perceptions a young nation harbored for a distant land.

Until the early part of the nineteenth century, the extreme variability of weather and climate in the west was a mystery to most, if not all Americans. In 1804, however, the ignorance Americans possessed towards their understanding of the natural environment of the American West began to erode. "In fact, the first written form of documentation," says Kenneth G. Hubbard, professor in the School of Natural Resource Sciences and director of the High Plains Climate Center at the University of Nebraska, Lincoln, "was not in the form of measurements but rather observations made in diaries and expedition records, the most likely the Lewis and Clark expedition (1804-1806)."[5] In terms of American history, and certainly western history, the Lewis and Clark expedition was a seminal event.

Throughout the journals of the Lewis and Clark expedition, examples of extreme weather paint a picture of an environment far different from the one they left behind. With the notable exception of Sacajawea, who was born into the Shoshone tribe and spent a considerable amount of her childhood in the area of southwest Montana, the majority of the Lewis and Clark expedition had never ventured west of the Mississippi. Lewis and Clark and the Corp of Discovery's exploration of the American West, and specifically Montana, were groundbreaking in many respects. Most importantly, perhaps, in respect towards this project, was the emphasis on detailed workings of the natural environment, through the methods of scientific inquiry. The journals of Lewis and Clark are richly inscribed with detailed accounts of flora and fauna, as well as descriptions of

weather and climate. Nowhere do the journals come to such vivid life, in regards to detailing the extreme nature of the natural environment, than during the expedition's trek through Montana. In terms of meteorology, the journal's rich narrative offers several accounts of the expedition's peril at the hands of extreme episodes of weather during their time in what would become the Treasure State.

In late March of 1805, the expedition left Fort Mandan where they had wintered-over and headed for Montana and an unknown environment. They entered Big Sky country on April 28, 1805 and soon discovered the volatility of their new surroundings. William Clark's journal entry on May 2, 1805 provides an apt description of Montana's volatile spring weather. "The wind blew very hard all the last night, this morning about sunrise began to snow, (The Thermomtr. at 28. above 0) . . . the Snow which fell to day was about 1 In. deep, a very extraordernarey climate, the evening verry cold, Ice fressing to the Ores."[6] This particular entry is quite evocative. Clark is clearly in awe of the environment; his assertion of a *"very extraordrnarey climate"* indicates his astonishment that such extreme conditions could exist in early May. All of these men were born and raised east of the Mississippi River, and although it is not unheard of to receive snow and cold temperatures in the mountainous regions of the eastern United States in May, it is not something that these men would have seen in their native environments with any regularity. Alternatively, the weather conditions, which Clark so vividly described, are actually quite common for Montana. Spring is usually the most volatile time of year for episodes of extreme weather: 60 to 70 degree days may be followed by blizzards in as

little as a few hours. Clearly, Clark's description of the environment turned out to be quite prophetic in regards to the expedition's continued travels through Montana.

As the expedition continued westward up the Missouri River, Lewis and Clark recorded many accounts of surprise at the volatility of weather and climate. As late as June 5, Clark took note of the rain and snow that fell the night before and the continued cold mornings, which both challenged and surprised the group. Perhaps the most challenging segment of the expedition's journey through Montana, in terms of extreme weather, was to unfold as the expedition approached the Great Falls of the Missouri. "From June 21 to July 15 the expedition remained at the Great Falls," notes Bernard DeVoto, "transporting the equipment across the portage and preparing for the next stage of the journey, it was a period of strenuous labor, the most strenuous so far, and of even more violent weather."[7]

The eighteen-mile portage around the Great Falls of the Missouri took almost a month to complete and proved extremely strenuous. Complicating matters were the violent thunderstorms, which severely impacted the expedition's already arduous task. Captain Lewis had this to say about the severe storms that rained down the group:

> One unpleasant feature was the sudden storms. They filled the runoff channels that gullied the portage route and made the clayey soil an impassable glue. Sometimes the rains were preceded by hail so fierce that everyone had to take shelter from it. Once "at Capt. Lewis camp" it was 7 inches in circumfrence & weighed 3 ounces, fortunantly for us it was not so large [along the portage rout], if it had [been] we should most certainly have fallen victims to its rage as the men were mostly naked, and but a few hats or any covering on their heads. And, the same cloud will discharge hail in one part hail and rain in another and rain only in a third within the space of a few miles. Or a gail would blow up up and chill everyone.[8]

Summertime in Montana is the most common period for thunderstorms and some of them may be severe in nature when accompanied by lightning, hail, and strong winds. Captain Lewis's description certainly qualifies as such. In the Northern Rockies of Montana, thunderstorms are a common occurrence when maritime tropical (mT) air moves northward from the Gulf of California. Meteorologists refer to this feature as monsoonal moisture thunderstorms. When moisture interacts with the intense heating from the land surface, air is forced to rise, forming large cumulus clouds. When cumulus clouds reach a mature stage, heavy rain can occur, accompanied at times with hail and lightning. Severe thunderstorms like the one described by Captain Lewis, are capable of producing heavy downpours and flash flooding as well as strong, gusty, straight-line winds, large hail, and frequent lightning.[9] Without knowing it, Meriwether Lewis had described with almost perfect precision one of the most common and destructive features of Montana's natural environment. Severe thunderstorms that occur over flat terrain can certainly be destructive. Over mountain and canyon topography, they can be deadly. Fortunately, the members of the Corps of Discovery survived their encounter with severe thunderstorms.

The expedition's trek through the Louisiana Territory proved invaluable for several reasons. They proved once and for all that an all-water route to the Pacific Ocean was simply pure fantasy. In addition, they encountered numerous indigenous cultures, and for the most part, these meetings proved to be benign in nature. Perhaps most importantly, Lewis and Clark described an environment vastly different from the one they had left behind. Certainly, their accounts of extreme meteorological events, especially in Montana, paint a picture far different from any they had experienced before.

Euro-American perceptions of weather and climate came face-to-face with an environment that would prove to be a formidable opponent for future peoples who wished to stake a place in Montana.

The exploration of the Louisiana Territory by Lewis and Clark and the Corps of Discovery helped to usher in future westward expansion by the United States of America. Eventually, as Americans started to settle in the vast expanses of the west, U.S. Army personnel began to establish military posts throughout the region. Montana was no exception. For United States Army troops stationed at Fort Shaw in north central Montana, the harshness and extremity of the environment would prove to be a deadly reminder of how different this environment was from the one they had left behind in the east.

The United States Army's indoctrination into the harsh landscapes of Montana proved how helpless humans could be when pitted against extreme weather. The 13th Infantry, for example, had an extremely problematical time with the environment while they were stationed at Fort Shaw,[10] which is situated west of Great Falls, along the Sun River at the eastern periphery of Montana's Rocky Mountain Front. A majority of the troops had been transferred from the east following the Civil War, and for the most part, Montana's sudden blizzards and severe wind events were alien to them.[11] The fact that these men were alien to Montana's environment is indeed relevant. Time and again, people unfamiliar with Montana's harsh environment seem to be the most susceptible to its ferocity. Clearly, army personal stationed at Fort Shaw were incapable of imagining what the environment could produce. Unfortunately, they would soon find out.

The winter of 1869 had been unusually mild for the region, according to U.S. Army records; temperatures were tolerant enough to allow for a steady flow of supplies between Fort Shaw and Fort Benton. On March 15 Colonel I.V.D. Reeves, who was Commander of the 13th U.S. Infantry, ordered three companies, B, D, and H, to Fort Benton under the watch of Major W.W. Prentiss.[12] Traditionally, March in Montana is often one of most volatile months of the year in terms of severe weather. As the days become longer, allowing for greater heating of the earth's surface, contrasting air masses are capable of producing severe storms at a moment's notice. Warm, mild sunny days can turn into sub-zero blizzards in the blink of an eye.

Nine days later, on March 24, as the command made their way back towards Fort Shaw, they continued to enjoy the mild spring-like conditions. With temperatures reportedly near 60 degrees under soft, sunny skies, Major Prentiss positioned 34 men from H Company as rear guards stationed about a mile behind the main supply train maintaining a visual contact at all times. Because of the mild conditions the men had taken their heavy winter clothing off and placed their gear on the supply train, keeping in mind, most of these men had been in Montana Territory, only a short while.[13] Unfamiliar and ill prepared for the rapid change associated with Montana weather, disaster fell upon the alien soldiers.

At 3:30 p.m. on the afternoon of March 24, a blizzard struck the unsuspecting men with vengeance. Several of the men said that in looking across the prairie to the north, they had seen a large cloud formation, but were unable to estimate its distance from them, and that the wind suddenly accelerated and engulfed them.[14] By all accounts

the storm that swept down upon the men would have been categorized as a severe blizzard, which is described as a storm with winds in of over 45 miles per hour, a large amount of falling or drifting snow, and temperatures approaching 10 degrees.[15] In a storm of this severity, visibility would have been reduced to almost zero, essentially cutting off the men stationed at the rear of the main supply train. Dressed in short sleeve shirts and unable to be assisted by their companions, the 34 men from H Company were extremely susceptible to hypothermia and frostbite brought on by what must have been incredibly severe wind chill readings.

Wind chill is a formula created by meteorologists to measure heat loss from exposed skin caused by combined effects of wind and cold. As the wind increases, heat is carried away from the body at an accelerated rate, driving down the core body temperature.[16] With a temperature of 10 degrees F, and winds approaching 50 miles per hour, the men would have experienced wind chill temperatures of 40-50 degrees below zero. Fighting to save their lives, they would have quickly succumbed to the effects of hypothermia, which include symptoms of uncontrollable shivering, loss of memory, confusion, incoherence, slurred speech, lethargy and apparent exhaustion.[17] Based on these types of conditions survival would have been extremely difficult.

As quickly as the storm had hit, it left. At around 5 p.m., the soldiers in the main supply train began forming a search party and within an hour, rescuers found 20 men and took them to shelters. The bodies of nine men were located and in some cases it was difficult to determine the cause of death. It was apparent that some had simply frozen to death, while other bodies were concealed in large drifts of snow, and may have even

suffocated in the blizzard conditions.[18] The search for survivors and bodies continued throughout the night and into the next day. In the bitter end, the death toll stood at seventeen soldiers. In the aftermath of the disaster an investigation was held and it was ruled that no one had been found guilty of negligence in any manner, and no charges were leveled; the deaths were deemed an act of God."[19]

What does the calamity that fell upon the unsuspecting soldiers at Fort Shaw tell us about Montana's environment? Several things. Meteorologically speaking, it indicates that change can come quickly, in fact, almost without warning, as it did for the men of H Company. In addition, as aliens in an unfamiliar environment, the United States Army shed responsibility for the disaster and put the onus in the hands of Providence. Unable to offer a suitable explanation for the loss of seventeen lives, God, it seemed, was the only viable answer. Inexperienced with Montana's severe environment, the men were simply guilty of ignorance. Alien soldiers, as it would turn out, were not be the only casualties of Montana's extreme environment.

Driving across Montana, from east to west, or north to south, and taking in a full visual perspective of the landscape reveals that the Big Sky is agriculture country. Like most of the American West, the discovery of gold and other precious metals in the early 1860s, enticed settlers to the Treasure State. Shortly thereafter, enterprising men with visions of endless open ranges saw another valuable resource prime for the taking, free range grasslands. In 1863, James Fergus, an early pioneer to the Big Sky state suggested, "Montana must eventually become the great grazing country of the United States."[20] Fergus's enthusiasm, it appeared, spread like wild fire across the region as cattleman

from the high mountain valleys of the southwestern part of the state, and stockmen from Texas looked to the eastern two thirds of Montana and saw unlimited potential in the open range. If, however, the enterprising stockmen had looked a little bit harder, through their rose colored glasses, they may have seen that reality was much more problematic. Although it is true that much of central and eastern Montana was suitable for livestock, the greater truth is that the large proliferation of cattle and sheep, which were funneled into these open ranges during the 1870s and 1880s, were tremendously susceptible to the harsh realities of Montana's weather and climate.

As far as winter weather goes, Montana's meteorological history is long and distinguished. If, however, a grand champion were to be crowned, it would probably go to the winter of 1886-87. It was during this horrific winter that an aspiring young artist, Charles M. Russell, working for the O-H Ranch near Utica, Montana, attempted to sketch a drawing of the calamity that had unfolded. Russell sketched his 2x4 inch masterpiece of a starving cow humped over in the snow, ready to keel over while hungry coyotes waited for their feast.[21] More familiarly known by the title "Last of the Five Thousand," or "Waiting for a Chinook," Russell's vivid depiction of the extreme conditions was chilling. The drawing shows in graphic detail the suffering inflicted upon livestock as a result of the incredibly severe winter of 1886-87.

The disaster, which unfolded that terrible winter, actually began the previous summer as soaring temperatures and exceedingly dry conditions combined to adversely task the already overcrowded livestock on the eastern high plains of Montana. From June through August, temperatures across the region were consistently over 90 degrees, with

many days over 100 degrees. Summer extremes in eastern Montana can be critical: the state record is 117 degrees F. In concert with the high temperatures, precipitation numbers reflected a severe drought across the region. Despite the extreme conditions, cattle continued to be brought into eastern Montana in record numbers. By the autumn of 1886 more than one million head of cattle were crowded on the open ranges of eastern Montana.[22]

As a hot and dry summer turned into autumn, with cattle prices dropping and livestock already weak, winter came in hard. "In November we had several snowstorms," Teddy Blue Abbott, a cowboy from Texas, recalled "and I saw the first white owls I have ever seen . . . The Indians said they were a bad sign, 'heap snow coming, very cold.'. . . It got colder and colder. . . . It was hell without the heat."[23] In late November, an arctic outbreak rolled into Montana, plunging temperatures. Then, a blizzard hit the region with full force. On November 27, 1886, the Great Falls Tribune reported that the blizzard had inflicted heavy losses of sheep and that a large herd had drifted into the Teton River and that the herder had frozen to death.[24] Conditions abated for a few weeks after the blizzard only to return with more ferocity by Christmas time. With the arrival of the New Year in Montana, another arctic outbreak struck the Treasure State: this one even worse. On January 8, 1887 a report from Fort Keough said, "The weather last night was the coldest of the season, the thermometer at the post hospital registered 50 below zero, which is their minimum, but it must have been much colder, six days later, on January 14, the post paper at Fort Keough reported a temperature of 60 below zero."[25] What seemed impossible was actually happening; the weather continued to worsen.

As the horrific winter of 1886-87 continued on, with conditions deteriorating, livestock across the region began to fall prey to the extreme weather. They were unable to cut through the heavy snow and ice to feed; their noses were cut and became raw, bloody and swollen, and they stood still like statues until their lower legs were frozen and then they fell down and died.[26] Huge losses of livestock were beginning to mount with no end in sight. It seemed like winter would never end. By February, some of the coldest temperatures ever recorded in the state of Montana, up to that point, continued: 40, 50, and 60, degrees below zero with estimated wind chills of around 95 degrees below zero continued to batter the eastern high plains.

It was during this period of astonishingly cold temperatures that the region was held hostage under a very strong dome of high pressure. Under the influence of high pressure, with mostly clear skies, heat is able to escape back into the atmosphere during the night, creating a condition called radiational cooling. With sinking air and no cloud cover to act as a blanket, whatever heat does exist is quickly lost into the nighttime sky. Making the conditions even worse would have been the heavy snow cover on the ground. Conditions similar to this would have occurred when Montana established the record for coldest temperature in the lower forty-eight states at 70 degrees below zero in January of 1954, at Rodgers Pass, northwest of Helena.

By the end of February, a chinook arrived on the high plains of eastern Montana, ushering the first sign of an end to the deadly winter. As the snow and ice began to melt, the catastrophe of the situation became bitterly clear. A rancher described the following carnage: