

## ***Into the Lab but Born Out of the Frontier: A Scientist's Journey Growing Up in the American West***

I have lived in nine different states in my 30 years of living, which I have come to learn is no small feat. It actually ends up consisting of 13 official moves; plus, I lose track of the number of times where I just end up changing apartments. Many people through the years have remarked on my fun, trivia-like fact. Some feel sorry for me. When they ask me where home is, my response is usually unconventional to them: “Well, what do you mean?” Is it where I was born, or where I have lived the longest? Is it the place where I grew up or where I learned to grow up? What about one region encompassing everything? Is that really possible?

Of these nine states, five would classify as part of the “American West”: Utah, Nevada, New Mexico, Alaska, and Colorado. Despite my frequent moves, I always felt drawn to the West, especially the desert Southwest. All of these five states may be classified as the “American West,” in part by their geography or perhaps their climate. Having lived in these states I can say that, even with their similarities using these simple classification techniques, their understated differences can sometimes stand out in stark contrast with each other. Many authors have written about the allure of the “American West” and have described it as a “romantic” place. I feel as though I have seen first-hand and understand what many of these writers may have felt: the beauty of a New Mexico sunset, the magnificence and wonder of an icy Alaskan landscape, or the prominent and jagged Front Range mountains rising up along the Colorado horizon.

Living in nine different states in 30 years definitely requires the life of a nomad and a sense of adventure, albeit sometimes not by choice. I grew up a “military brat,” with not one, but two parents serving active duty in the military. I am extremely proud of them and their service, and I would not trade my childhood experiences for anything in the world. We did move around a lot though, and I would be honest in saying there were positives and challenges about these situations, as there is with any major change. I saw a lot of new places, met new faces along the

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way, and learned new things constantly. The experience reinforced the mindfulness of taking in your surroundings and treasuring the time you have spent with these locations. It is what gave me my love of science, learning to pay close attention to detail and how to ask questions about the data that is in front of you. I have had an interesting life as a result of these experiences, and it all began in the great “American West.”

I was born in Utah. I do not remember much of my time there as a baby. We only stayed for maybe two years before my parents were stationed somewhere else. It is almost weird to think about the place you were born and not have any recollection of it or feel any special attachment. We revisited the state in more recent years, when a parent was sent on temporary duty assignments or when I drove through on one of my other various moves. Most of the details I remember about Utah stem from my two “loves” of science – meteorology and geology. One turned into a passion with a subsequent career, and the other has remained a pleasurable hobby.

On one of my revisits to the state, we flew into the Salt Lake City airport just after an evening thunderstorm. I recall just making it on the tail-end of the weather, the after-rain smell still omnipresent, and I remember the color of the sky against the mountains to the east – an almost ominous hulking black mass of clouds, with just the tinge of reds and oranges from the setting sun brushing along their edge. Then, I looked upon the Great Salt Lake to the west, only learning later from one of my North American geology books that it formed when an even larger lake thousands of years ago diminished in size due to increasing temperatures and subsequent increasing evaporation rates. The high salt content is because it formed in a basin with no exit and relies on evaporational processes. It really is a state made for geological lovers, too, with its red rock through Moab or the first site of the unique and unusual Canyon Rock sandstone formation when first crossing the southern border near the Four Corners Region.

With our next move, we came to Alabama. We went from this desert land and mountainous region to what is essentially a very moist river basin, filled with green and trees as far as the eye can see. I also do not remember much of this move or this particular stay in Alabama. Much of what I can remember from here came from a later move. At this point though, my family and I were only here for about a year, but it is always interesting to think about the place. Mosquitoes were a new thing; we did not have a lot of those in the desert. Somehow, you never quite caught them in the act of violating your personal space, and you might think that you eluded them on one of your outings, until a mysterious bump on your leg became extremely itchy all of the sudden. In addition, there was always this ever-present sensation of feeling like I just stepped out of the shower and could not quite get dry enough to feel decent just by walking out of the front door. That was also an unusual feeling I never really got used to.

It was not until my next move that I really started to appreciate the widening chasm of differences exhibited between the eastern half of the country and the west. The next journey was going to be to Nevada. After the quick one-year stint in Alabama, we moved to Las Vegas, “the City of Lights.” It more than lived up to its namesake: glittering lights from the various casinos along the “strip,” more cars and people than I knew how to deal with, and oh dear, that desert heat! I was going on the age of four during this time, so I can recall a few more details from this move. I can remember that desert sun baking me and making me feel like that gooey tar they use for patch jobs on asphalt – poke me with a stick and I might melt or deform, depending on the heat, and ooze out along the sidewalk. The weather was generally decent most of the year, averaging over 300 days of sun, with only a few months where you remained indoors to seek solace with the engineering achievement that is AC. Nevada was also likely my first experience of the vivid colors of a desert sunset, the earliest I can remember. Those gorgeous reds and

oranges would be even more beautiful contrasting with the high cirrus clouds that would linger through the remaining light of the day, indicative of a strong high-pressure system in place. There are days I can remember playing in the backyard, my dad inevitably grilling something while my mom looked on, as the last rays of sun provided us with its own equivalent Vegas light show.

Nevada would have also been the first place I encountered desert thunderstorms and could remember the sensations that came with them. Some people may think that a lack of trees scattered along the skyline might signify a region “devoid of life” or describe it as a “wasteland.” There are two problems with this logic: 1) for as long as I have lived in the West (specifically the desert Southwest) “life” comes in other forms, like the humble cactus or blooming yucca plants and various desert flowers or even the important piñon pines native to much of the Southwest, and 2) the lack of typical deciduous trees allows for other picturesque and natural phenomena to show off, one of which is the desert thunderstorm. It may start as an initial puffy cumulus cloud that develops overtop of the higher terrain. Then, as the day progresses and the heat becomes more oppressive, these initial cumulus clouds almost appear as if they are bubbling up with the heat and begin to tower, giving us the namesake of towering cumulus or cumulus congestus. It is the same process – convection – where you would watch steam rise from your hot coffee cup. By the early afternoon, you may begin to hear distant rumbling as the storm matures into large cumulonimbus clouds. The clouds are given this designation once they begin precipitating.

Depending on how dry the atmosphere is in the lower levels, much of the precipitation would evaporate before ever reaching the surface, giving us virga – thin shafts of rain hanging just below the cloud that seem to disappear before reaching the ground. I would learn later in my meteorology undergraduate courses and escapades as a weather forecaster that this quick

evaporation process could lead to a gust of cooler air traveling down towards the ground.

Evaporation acts to cool the atmosphere, and the subsequent change in densities of the air would cause the cooler, more dense air to sink rapidly when compared to the much warmer, less dense air nearer the surface. Some people may be familiar with this phenomenon through other names, such as downdrafts, gust fronts as the air spreads in all directions at the surface, or even dry microbursts. The strong scent of rain would approach next as that gust of evaporatively cooled wind glides through. In the desert, that initial scent of rain is a prized commodity, since it is usually a good bet that you cannot even remember the last time rain fell. It makes the scent all the more pleasant and exhilarating. Finally, as the storm would begin to drift off the mountains and into the valley, where much of the town is situated, only then would you be lucky enough to actually touch the rain. When I think back on it, I really believe these desert thunderstorms were part of what inspired me to become a meteorologist, just so I could find out what mysterious processes dictated their initial development and formation.

After another stint in Alabama for about a year following our stay in Nevada, my parents received orders to head to New Mexico. This next move would be pivotal in my life, but I did not know it at the time; I was going on six years old, where my most pressing concerns were making new friends and trying not to embarrass myself heading into my first “big kid” grade school. New Mexico is a place I continue to find myself drawn to or returning to during turning points in my life, especially in recent years as I move on and see even more parts of this vast country.

If I could put it lightly, it really is an awesome place. The weather is even better here, almost like a goldilocks effect when compared to Nevada and Utah: it is usually not too hot in the summer and not too cold in the winter, and you still get that 300-day plus average of sunny

days. If you did get snow, typically it all melted by noon the next day. That is why two-hour delays are common here; I cannot remember how many times I have encountered someone who could not fathom the usefulness of a two-hour delay. It also had stunning mountain ranges, with the Sandias serving as the well-known strategic eastern border for Albuquerque (where my folks were stationed) across from the other famous western border – the Rio Grande. The “watermelon mountains,” as they were called, where the last light at the end of the day would give them the look of that particular melon fruit, rind and all. Those fascinating desert thunderstorms were a common sight here, too. As a kid, one evening with my dad remains clear in my memory – we watched the flashes of lightning dance across the Sandia Mountains from my bedroom window.

Most of what I remember from my first visit were from the eyes of a little kid, the fascination with experiences. We attended the International Balloon Fiesta a couple of times while we were there. Waking up at o’dark thirty to attend the mass ascension and watching all the many shapes and colors of the hot air balloons rise into the early light of dawn made the cold chill in the air all the more bearable. That, and the best hot chocolate I have ever tasted, or maybe it just felt that way. Then there were the special shape glow events in the evening, watching favorites like Scooby-Doo or Darth Vader light up against the dark, with just a hint of twilight barely hanging on in the autumn sky. I also loved my grade school and made a lot of new friends. The neighborhood we lived in was a great place to grow, as there was always someone up the street to rollerblade with or shoot hoops with. It was also my first experience with video games – playing with a brand-new Nintendo 64 at someone’s house, after finishing my homework of course, and getting my first Gameboy color for Christmas. It was also the longest we had stayed in one place at this point, which made it all the more difficult to accept that we were going to be moving again during the turn of the millennium.

I was about nine years old at this time, going on 10, and I do remember getting a little emotional as we loaded up our last suitcases in the car and headed east. I had built up this life in Albuquerque, and now, I was going to have to start over. Through no fault of their own, my parents seemed to get transferred between opposite ends of the climate spectrum with each succeeding move. The summer of 2000 would be our move to Georgia, to a much smaller town known as Warner Robins; we were likely expected to remain there for the next two years. It reminded me a lot of Alabama – those same walls of trees, same green everywhere you turned, and the same sauna-like air. Although, being a little older than I was in Alabama, I began to appreciate some aspects of the Southeastern states. They are rich in history, and I was always fascinated by that. I grew to like characteristics of the weather there, too. They had similar thunderstorms pop up in the summer heat, just like the desert. In my introduction to meteorology class, they called these air mass thunderstorms. I also experienced my first tornado watch (no actual tornado though) while there, and I did not feel scared, only curiosity. I started to ask more questions about aspects of severe weather: what made these storms different than the ones I grew up on in the desert?

Unfortunately, this time period also marked a tumultuous moment for the country as a whole. A year into our stay, 9/11 happened. I remember that day well – being told to stay inside while at school, the teachers with worried looks on their faces, and my brother and I wondering why we were the last kids to get picked up from daycare that day. I worried after that if my parents were going to have to be sent overseas. In the months following, most of the temporary duty trips my parents were sent on were not permanent, and my dad actually ended up retiring the following year. No one was more surprised than me to find out he had landed a new job in Albuquerque, NM.

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When we found ourselves moving back to New Mexico, I began to revisit things in a new light, so to speak. I was older – I thought maybe wiser, too – and had a new inquisitiveness and interest in learning novel things. I began to look at the state from the eyes of a budding scientist and also began to hope that we may actually stay longer than three years this time. School was initially tough because I came in as half the year was wrapping up, starting class in January. Making friends appeared tougher, but I grew to value the excitement some of my classes generated for me. I found out I really loved my earth science classes; not surprisingly, my English classes were a little harder to manage. I began to learn what made New Mexico fascinating from a science standpoint. The state itself covers territory driven by many geological processes, from the dormant volcanoes that laid new lava rock only just a few thousand years ago to the metamorphic rock formations of quartz and granite found in the San Juans or Sangre de Cristos to the north to the unique minerals – like gypsum – found in the White Sands National Park to the south. I also learned that the desert thunderstorms I loved in the summer were as prolific as they were in New Mexico because of the monsoonal pattern that sets up, typically at the end of July and continuing into August. Amazingly, New Mexico also has the distinction of being the first place I witnessed an actual tornado, and one winter during my high school years, I got to experience the record snowfall for a 24-hour period in Albuquerque. All of these events would further cement my desire in becoming a meteorologist.

My stay ended up being seven years, and I enjoyed every minute of it. My parents were officially retired and working civilian jobs, but I was up for my next adventure. I made the decision to attend the University of Oklahoma and major in meteorology. All the weather phenomena I had seen growing up, much of it in the desert Southwest, was something I wanted to study and learn more about. I stayed my four years for college, holding my first job as an



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intern, and graduating with my degree. I also witnessed many new weather phenomena while in Oklahoma: more tornadoes (sometimes too close for comfort) and strong thunderstorms, ice storms, and flash droughts just to name a few. Even if I was not located in the West, I began to realize through my studies the influence the West has on the severe weather in Oklahoma and other parts of the United States east of the Mississippi River. For severe thunderstorms in particular, they rely on wind shear differences through all levels of the atmosphere, and warm, dry air moving out of the Intermountain West interacts with the very moist air coming from the south out of the Gulf of Mexico. Many of these events were amazing to witness, and it always appeared as if Oklahoma played the role of “outdoor classroom” well. I almost made it the whole four years without receiving hail damage, but alas, March my senior year broke that track record. I had golf ball sized pock marks on my trusty Honda Civic after that, but I learned to flaunt it as a badge of honor later when the car reached 13 years of age.

Once I graduated, I moved back home to New Mexico for about a year until I got my first job offer. Again, I just could not stay away from the state; I always found my way back. I accepted the opportunity, and moved to Maryland the summer of the next year. I ended up in the Washington, D.C., metro area. It was, by far, the biggest metropolis I had ever lived in. I had visited bigger cities before, but it was a whole different animal living somewhere like this. My job kept me busy enough, but I usually spent weekends trying to think of something I might never have done previously. I loved taking the metro into the District and visiting any museum I could; any of the Smithsonian museums were especially enjoyable. I have always had an interest in the Civil War and the history associated with it, since my time in Georgia, and what better centrally located place is there than Washington, D.C, for battlefield sites. I had bought a camera for myself while in Oklahoma, thinking I would be more interested in weather photography. My

tastes with that activity evolved while being in Maryland. I really got into hiking here, and it presented the best chances for photographic opportunities. I gradually picked up landscape photography. I sometimes struggle in using the right words with writing to describe how unique or beautiful something is, and I usually do not do it justice. So, I make up for it with my camera, capturing a moment that I can later reflect on. One of my best hikes was through parts of the Shenandoah Valley as the autumn leaves were changing. I ended up driving there in the early morning hours to arrive before the sunrise. The view was breathtaking as the first light marked the terrain, and it probably goes down as one of the best trips I have ever taken. The Appalachians are a sight to see, but I caught myself missing those majestic Rockies, despite contemplating how the Appalachians were actually one of the tallest mountain ranges in the world when they formed hundreds of millions of years ago. I could sense that feeling of exploration stirring within me again.

Ever since I graduated with my degree in meteorology, I have always wanted to try weather forecasting. I observed many government forecasters through my time at college and always admired their breadth of knowledge on the subject. That's why – when the job offer came along to become a weather forecaster – I took it. Knowing that it would involve living in Alaska, I jumped at the chance. Alaska was nothing I was expecting at all; I knew a few tidbits about it, mostly through climate classes I took or things I had seen on television. I moved to Juneau, the state capital, and when I first got off the ferry early in the morning in June, I was not surprised I could see my breath. I knew it would be cold. What did surprise me was the rain; it was with me when I got off the boat, and it did not stop for three days straight after that.

Southeast Alaska is a very wet place, and it is actually climatologically considered a temperate rainforest, usually averaging well over 60 inches of precipitation a year. According to

my coworkers at the time, we were going to be heading into the wet season soon with late summer approaching. Additionally, the extreme fluctuations in daylight typical for the Arctic had a way of influencing the weather, too, making it all the more interesting for me in learning to forecast. Fog that formed overnight and ideally should burn off as the sun rises did not go quietly. In fact, some autumn days it would never dissipate at all, causing a lot of headaches for the airport. Another difficulty with forecasting here was the terrain. I have mentioned that I have a great appreciation for mountain ranges, but I always remember one of my coworkers joking about predicting the weather in Alaska: “Two of the biggest characteristics that influence the weather are oceans and mountains...In Alaska, we have oceans in mountains.” There was definitely a learning curve with the complex terrain of Alaska.

The weather never did stop me from exploring my environment though. I found an apartment with the best view I ever had with a home, looking at downtown Juneau across the Gastineau Channel from Douglas Island. I could witness all manner of weather phenomena here: the rain and snow and everything in between for precipitation, the sun when it shown through on one of those rare occasions, and the unbearably strong winds (called Taku winds) that whipped across the channel from one of our localized mountain wave events. Then there were the hiking opportunities, and there was no way I was going to let the weather be an excuse in discouraging me. I soon learned to embrace the enthusiasm of the Juneau local; just throw on the Gortex jacket, and you're ready to go. The only thing I did not yield to were those “bizarre” Xtratuf boots that everyone was wearing; I liked my usual hiking boots just fine. I hiked everything from a frozen lake to a glacier, up Mount Jumbo on Douglas Island, and along various rivers and valleys. I snowboarded at the local ski area, and took a boat and flew in a Cessna up the Tracy Arm Fjord, albeit not at the same time. I was also lucky enough to see the Northern Lights – the

Aurora Borealis – on more than one occasion; both times, I was grateful that I had practiced with my camera in Maryland beforehand.

My time in Alaska ended up being only a few short years before I took my next forecasting job. I happily accepted because it took me back home to Albuquerque, and I could do something entirely new from a forecasting perspective. The new job dealt in aviation forecasting, a new challenge for me, but I also learned to appreciate my newfound time with my adopted hometown when I think of all the time I had spent away. In the year and a half I was there again, I went to the Balloon Fiesta to see with new eyes, including new forecaster eyes. There were new shapes among the hot air balloons I remember from the early 2000s, but I also paid attention to the air currents, monitoring the winds through the lower levels of the atmosphere, and watching for any signs of fog (all which would hamper any launch). I cherished seeing thunderstorms again, even if the air traffic controllers did not; the part of Alaska I was in was not known for its convection. Once again, I began searching for a change, yearning for something different with my career, and I knew that my time was up again and I would be moving once more.

I finally find myself in the state of Colorado, embarking on another educational milestone in the form of graduate school. It is a little different this time around; I still have a love for meteorology but I want to share that enthusiasm with the field of climatology. After my time in Alaska, I have a growing interest in learning about changes in earth processes and extreme weather events in the context of a changing climate. Geology comes up every now and again, too. With my limited time in Colorado (eight months up until this point) it has proven to be an interesting place, which I would expect nothing less from a western state. The weather is slightly different here – cooler in the winters with more snow and increased severe weather possibilities in the late spring (similar to Oklahoma). Colorado possesses an atypical characteristic in that half

of the state belongs to the Rocky Mountains and half of the state falls within the Great Plains, enhancing the chance for severe weather with the right atmospheric ingredients. I have seen dramatic shifts in the weather in the span of a day, going from 90° on a Monday and waking up to snow on a Tuesday in the month of September. I am even writing this in the midst of an historic Colorado snow storm. You can still encounter those beautiful sunsets here but with a twist: when the sun lowers behind the Front Range, all the many contours and shapes and jagged edges appear along the mountains with the same touch of reds and oranges, like an Albert Bierstadt painting.

I believe that the “American West” and I are connected in so many ways. I would not be who I am today without my experiences from this region. Everything I learned through observing or the weather events I witnessed gave me the inspiration to ask questions and eventually become a scientist. The many moves of my childhood and decisions to move as an adult, despite being a difficult process, taught me to take in every detail, every feeling, and every sensation, as you never know when you may end up leaving or returning again. I’m reminded of a quote by Frederick Olmsted, the prolific landscape architect who designed Central Park in New York City: “The enjoyment of scenery employs the mind without fatigue and yet exercises it; tranquilizes it and yet enlivens it; and thus, through the influence of the mind over the body gives the effect of refreshing rest and reinvigoration to the whole system.” For me, the “American West” is home.