Wolf Creek Pass

Snow continued to accumulate around me in the darkness as I collected another sample for my research. As I placed the Petri dish of fresh ice crystals under my microscope for more photographs I suddenly realized I hadn't seen another vehicle in over an hour. I looked across the road and saw that all the tracks made earlier in the evening were now covered with new snow. Even the evidence of the passage of the last snowplow had been buried. Snow was falling rapidly and building up on the ground at the rate of about four inches per hour. Over two feet of new snow had fallen since I had arrived on the mountain the previous evening.

I began to search through my microscope for various types of ice crystals to photograph which would characterize the snow conditions for this period of the storm. Most of the ice crystals appeared to be lightly-rimed, six-pointed dendrites which had tree-like branches radiating outward from each of the six arms. Frozen cloud droplets collected during their fall through the clouds above the mountain thinly covered them, more thickly near the edges. Scattered in among the dendrites were clusters of needles, long thin hexagonal columns of ice. Apparently, the cloud-seeding generators were active tonight.

I shivered in my heavy clothing, even though I was covered from head to toe in winter gear. Over my long underwear I wore jeans and a flannel shirt, over which I had pulled on heavy, insulated pants and a thick Alaskan parka with a fur-lined hood. On my hands I wore two pairs of gloves and on my feet a pair of rubber, insulated boots covered with mukluks. I realized that my shivering was not caused by the zero-degree temperature and wind, but from my sudden anxiety over working alone in the middle of the night on Wolf Creek Pass in a snow storm.

I had driven over three hundred miles the day before from Ft. Collins, Colorado in my four-wheel-drive truck to 10,000-foot high Wolf Creek Pass in the southwestern part of the state to collect snow samples for my graduate research at Colorado State University. I had arrived at the foot of the mountain about 8 p.m. just as the snow had begun to fall. After a quick dinner I had begun to drive back and forth across the pass stopping every two or three miles to photograph samples

of ice crystals under my microscope mounted in the camper shell in the back of the truck.

It was now two in the morning and I hadn't seen any traffic on the road for over an hour. Normally a snow plow would come by one way or the other every thirty minutes or so pushing snow off the road into the chasm below. On my passages over the mountain I would normally turn around before reaching the chain stations near the bottom of the mountain. So, I hadn't talked to anyone since dinner almost six hours before. I began to feel a prickly sensation running up and down my spine.

What if I became stranded in the storm? What if my truck slid off the road and I became isolated for several days? Earlier in the evening an 18-wheeler had had trouble negotiating the incline coming up the west side of the pass. He had come to a stop on the snow and ice heading up the mountain, his chains throwing sparks as his wheels spun and he slowly slid into the ditch on the upward side of the road. He was fortunate that the road had sloped away from the 200-foot drop off on the other side of the highway. What if I began sliding on a slick spot in the road and lost control of my truck?

I decided to head downhill to the chain station on the east side of the mountain and check out the conditions. Although the top of Wolf Creek Pass is flat and straight for about a mile, both sides of the pass are steep and curvy. In several places the road is built over steel beams which have been drilled into vertical cliffs. Empty space surrounds some segments of the road in all directions but the rock face. The road may be suspended 1,000 feet or more above the canyon at these places.

Treeless avalanche paths cross the road in other places. From time to time after heavy snowfall has occurred, large rivers of snow will flow from the tops of the mountains down these chutes and catch unwary travelers on the highway

below. If a car or truck is caught in an avalanche it will normally be carried off the road and into the canyon. If a traveler is caught between avalanches the roadway will be blocked and it may take hours for the path to be cleared by the highway department. Where avalanches have been the largest and most frequent, concrete snow sheds have been built so that the avalanches run over the top of a tunnel crossing the road.

Wolf Creek Pass is a challenge to truckers, particularly in winter. Truckers traveling west across the pass need to be careful not to overheat their brakes and lose traction on the way downhill. This steep, ten-mile section of highway has inspired at least one country-western song describing the experiences of a trucker losing his brakes and blowing into the feed store in downtown Pagosa Springs at the foot of the mountain. Unfortunately, the reality is that any trucker who lost his brakes on Wolf Creek Pass would probably not make it to Pagosa Springs. There is a sharp S-curve which a runaway truck would encounter about half way down the pass on the west side. If an 18-wheeler ever lost his brakes, an observer standing at this S-curve would be treated to a spectacular launch of the truck through the chain link fence at the overlook and a spectacular descent over a 1,000-foot cliff into the valley below.

All these concerns occupied my mind as I drove into the storm and headed downhill. I passed the buildings where the highway department stored and repaired its snowplows. A little farther down I drove through the snow sheds over which avalanches from above rumble down the mountain several times a year. To my right I could vaguely see the canyon below where the snow is pushed or blown over the edge. It was snowing so hard that my windshield wipers were iced up and I could only see through small openings here and there.

Where were the snowplows? They obviously weren’t out now. The road was covered with a smooth layer of snow from one side to the other, like icing on a cake. It’s amazing to watch the snowplows as they scrape snow off the highways in

the mountains. The drivers typically race along at between thirty and forty miles per hour with their right wheels inches from the edge. The blade on the front of the truck is angled so that the snow is scraped across the road toward the edge. This angle allows the drivers to speed along the road. If the blade hits a hard spot in the snow or an irregularity in the pavement, it will move the front of the snowplow away from the edge and farther on to the road. However, if the driver is not careful, he may overcorrect and allow the right wheel to slip over the edge and carry the truck into the canyon below. Vigilance is always necessary, especially in the dark of night after driving a snowplow for several days on end.

Later in the season when the snow has accumulated into large drifts along the road and the snowplows can no longer push the snow over the edge, the drivers will use snow blowers to clear the roads. Snow blowers are basically made from a large fan built on the front of a truck which eats into the snow and blows it in thirty-foot arches into the canyon. If the driver is not careful, he will occasionally suck objects like branches, rocks, or abandoned cars into the blower. Smaller objects clatter and bang as they are swept through the blower, but larger objects will sometimes bring the blower and its engine to a sudden stop with a terrible crunch when ingested. Although the snow blowers move more slowly down the road than the snowplows, because of their larger size, noise, and wind-blown snow obstructing the visibility, they are even more dangerous to drive. In high winds and icy snow conditions, it sometimes takes two men to drive and navigate them.

I saw no traffic as I drove slowly down the mountain toward the eastern chain station. It was now about three in the morning and I hadn’t seen any traffic, including the snowplows since I left Wolf Creek Pass. I now approached a narrow spot in the road where it crossed a bridge over the South Fork of the Rio Grande River. I fished this river for trout in the while in graduate school. What a beautiful place in the summer! It flows through stands of large pines, flower-covered meadows, and deep, rocky gorges. But, in the winter it is frozen over and reveals only occasional glimpses of flowing water under its burden of snow.

The Rio Grande flows from the northeast side of the San Juan Mountains eastward into the San Luis Valley where it turns south to New Mexico and then runs between Texas and Mexico on its way to the Atlantic Ocean through the Gulf of Mexico. The Delores, Animas, and San Juan Rivers flow from the southwest side of the San Juan Mountains to the Colorado River where the water flows into the Pacific Ocean through the Gulf of California. Because of this divergence in runoff from the mountains to separate oceans, it is evident that Wolf Creek Pass sits astride the Continental Divide.

Cloud seeding research was prompted in the seven western States by a shortage of water in the Colorado River Basin. In the early 1900s the water in the Colorado River was apportioned to each State based on a ten-year average flow measured between 1920 and 1930. Unfortunately, this ten-year average was about 15% higher than the long-term flow. Consequently, 15% more water was apportioned to each State than flowed down the river. This shortage wasn't a serious problem until the western States began to develop later in the century. For example, Arizona didn't use its full share of water until the 1980s. Until then, its unused portion of the water just flowed downstream for Californians to use. But, when Arizona started using its rightful share, California began to experience shortages.

Large dams built on the Colorado River helped smooth out the flow so that no water was wasted in the wet years and any excess was carried over to dry years. The total storage in the Bureau of Reclamation dams on the Colorado is equivalent to about ten years of annual flow. However, the total flow was still about 15% short of the apportionments.

About 1970 the U.S. Congress began to fund a pilot project to test the potential of cloud seeding to make up this deficit. Interestingly, the estimated increase in runoff from seeding the mountain clouds in and around the Colorado

River Basin was also 15%, enough to make up the deficit. While I was taking measurement on Wolf Creek Pass a set of some thirty silver iodide generators were seeding the clouds from positions south and west of the San Juan Mountains. The snow samples I was taking were designed to detect the effects of seeding on ice crystal number, type, size, and degree of riming. Seeding should theoretically increase the number of ice crystals, change the crystal type from dendritic to more plate-like or needle-like, reduce the average size, and reduce the riming. Riming is the collection of frozen cloud droplets by ice crystals as they fall through a cloud of supercooled droplets. Through a microscope round spheres of ice can be seen attached to the ice crystals, particularly near the edges, when riming is occurring. Only minor effects of seeding were observed from the many observations of ice crystals I analyzed over several years at Wolf Creek Pass. It turned out that much of the silver iodide released from the ground generators never made it up into the clouds where it could affect them. The seeding material often pooled in the stable conditions near the ground upwind of the mountain and tended to drift around the mountain rather than over it. My research on ice crystals was only a small part of the work that led to this conclusion.

After I crossed the Rio Grande River and followed the Canyon downstream, the terrain began to level out. As I approached the eastern chain station there was no sign of life on the road. The snow now was about six inches deep with no tire tracks. Obviously, no one had driven down from the Mountain in quite some time. I pulled up alongside the chain station to the side of the road and stopped. No one appeared to be inside. I knocked on the door and waited. After a few moments I heard a few bangs and clatters from inside and the door opened.

A bearded maintenance worker sleepily asked, “Where did you come from?” looking at my truck headed eastward.

“I’ve been driving back and forth up on Wolf Creek Pass taking snow samples,” I said.

“You’re nuts. The pass has been closed since midnight. The storm got so bad, we couldn’t even run the snowplows. Why didn’t you come down sooner?”

“I didn’t know the pass was closed,” I said.

“Well, next time,” he growled, “Pay more attention. When you don’t see any snowplows, you’d better get off the mountain. If you had slid off the road, we would’ve never known, and probably wouldn’t have found you until next Spring!”