DESPERADOS

Itinerary for Flocks and Rocks 2017, 938 miles

Day 1 (July 1, 2017): ABQ to Ponderosa Group Campground, Bandelier National Monument, 106 miles.

John B., Richard Stuhr, Arch, and Paul began the day at Base Camp. Richard left early to drop his rental car off. John headed for ABQ in our Commissary Truck, aka "Director's Truck," which he knows pretty well because he put some miles on it before donating it to the Gulch. Arch and Paul went in Paul's truck to Enterprise to pick up the SUV Kris had rented for our trip. Thank you, Kris! The Ford Expedition was big, clean, and most importantly, had a variety of USB and AC receptacles for charging our electronic gear. Paul drove on in his truck to shop and wait for us at his house in the North Valley. Arch swooped by the Ramada to pick up Ted, and met Richard at the airport, where we met John B. and the LAX guys, John Mayer and Richard Swabb. Then it was off to Paul's, where we had the first of many tasty road lunches. No PB&J here. Cheese, meat, bread both gluten free and normal, lettuce, fruit, etc. Outstanding.

John B. rode in the Expedition for the trip north so he could tell us about the geology we were seeing out the window.

We by-passed Sante Fe and turned off Highway 285 onto the road for Los Alamos and the secluded mesa selected for the secret government lab that built the world's first nuclear weapons. As we ascended NM Hwy 4, we saw evidence of nature's brand of conflagration, a very hot forest fire that swept through Bandelier National Monument in 2011.

The truck was packed to the brim with water cans, coolers, tents, stoves, and the like, but we made short order of moving all the kitchen gear into the covered cooking and eating facilities at the edge of the group campsite (Figure 1).

Figure 1. The Kitchen at Ponderosa Campground, El Morro National Monument.

We then got familiar with our tents, cots, etc. We had at least one tent for each person, and the area was big enough to space out in defense against snorers, which in the event didn't seem to present a problem. Richard Stuhr decided to try a cot, but that required sleeping under the stars. Ted showed us his legacy bedroll (Figure 2), which he used on his first trip to the Southwest in 1954.

Figure 2. Ted's vintage bedroll.

After sitting around and chatting for a while, the group got a little restless to learn something, and so an impromptu bird walk formed and moved off amoeba-like into the old burn that lay just beyond the kitchen. It was clearly a burn, even though it was covered with grass and clumps of Gambel's Oak, because there were no Ponderosa Pines. The campground retains a dusting of large Ponderosas, and that stand extended down into Frijoles Canyon in the past, but now it is gone. Inquiring minds want to know why.

The nearby La Mesa fire, which burned 15,000 acres in 1977, is said to have helped change the mind of land managers about fire in western pine forests. For decades they had been trying to completely eliminate fire from the landscape. It has been called the "Smokey the Bear" strategy. After all, fire destroys trees, which can be converted to money. Why let that happen? But wildfires kept starting and burning great swathes of forest. A seminal study looked at the Ponderosa forests on an Apache reservation in Arizona and found a landscape dotted with large, old trees shading expanses of luxuriant grass. Lightning fires there might burn a few acres of grass and then peter out for lack of fuel. The thick-barked old trees did not ignite and were not damaged by these "cool fires." In the millenia before Europeans and cattle, lightning-fires as well as human-set fires kept these forests open, making human enemies and game visible, and preventing the build-up of fuel -- brush and pine needles – that could lead a ground fire to jump to the canopy and ignite a disastrous conflagration, a so-called "crown fire." John Muir recognized the salutary effects of such fires in the pine forests of the Sierra Nevada, which like those of the Rocky Mountains, experience long, dry, fire seasons. He wrote memorably about it in the early twentieth century but it took the professionals a few decades to catch on.

When intentional fire management came to western North America, the landscape was not as Muir had described. The big trees had been taken out by private interests in the late 19th and early 20th century. Cattle and sheep ate all the grass. Dense stands of saplings called "doghair" sprang up where conditions were favorable, unpalatable brush grew elsewhere. The national forest system established by Gifford Pinchot and Teddy Roosevelt (in the Department of Agriculture, because they believed natural resources were crops) was built with the purchase of logged-over wastelands. Naturally, they wanted to protect their regrowing forests, but the destruction of the grass and the growth of woody vegetation made for the build-up of fuel loads that would stoke the ever-worsening conflagrations we have seen for going on 50 years, despite huge efforts to thin the forests and to conduct controlled burns. A warming climate makes this all the harder.

The principle of plant succession holds that a certain community of plants will occur in a certain range of growing conditions, and that, if disturbed, the same community will regrow as long as those conditions persist. The absence of Ponderosa Pines where they once grew in Bandelier suggests that something has changed. Perhaps the fire was so hot that the soil was changed.

Or perhaps the climate has changed and is not suitable for the growth of young pines, even if it's okay for ones that are already established. Perhaps there was no seed source for re-establishment of pine forest, although it might be noted that if animal-dispersed acorns made it, one would think that wind-dispersed pine seeds could. Or even maybe the grass was so successful at blanketing the ground that pine seeds couldn't germinate. (A grassfire would be needed to clear seedbeds before the pine seeds rained in.) These are the kinds of questions an ecologist might ask. They apparently were not asked by the Pygmy Nuthatches.

Pygmy Nuthatches are very small birds who live only in pine forests. Nuthatches are woodpecker "wannabes." They go up tree trunks looking for food in the spaces between and under bark scales. Unlike woodpeckers, which use their stiff tails as props and hitch up the tree like the Wichita Lineman on his power pole, nuthatches have short tails and use their ultra-strong feet to go both up and down. They do have long pointed bills like woodpeckers and may excavate their own cavities for nesting. Back to the pygmies not getting the memo, a noisy group of them seemed to be escorting us through the oaks. Presumably this flock was made up mostly, or entirely, of young of the year who were out exploring. This is not to say they were siblings. Most young birds drift away from their natal area as soon as their parents convince them they will not feed them anymore. This usually takes a few days of "negotiating." But Pygmy Nuthatches are very social. The dispersing young naturally associate with their peers and in fact live in flocks almost year round.

We saw similar numbers of Western Bluebirds as we ambled along, and a White-breasted Nuthatch occasionally darted onto a tree trunk in out path. This little jaunt put is into a good frame of mind for eating, which we did soon and well. The eating put us in a good frame of mind for sleeping. Enough said.

Day 2 (July 2, 2017): Camp remains at Ponderosa Campground, 40 miles in vehicles.

The Jemez Mountains were once a single peak, a huge strato-volcano. It repeatedly blew its top off, most recently only 40,000 years ago.

The Jemez volcano was steep and combed precipitation from the clouds. This led to formation of fast-moving streams on its slope, which cut canyons into the sides of the mountain. One of these is now called Frijoles Canyon, the canyon of beans. It falls 4618 feet from its source near the rim to the Rio Grande. It does this in 12 horizontal miles, although a few bends make that 14.5 river miles. Even so, the slope is 6%, i.e., steep. This produces a pretty significant carving force, as the water "tries" to get to the Rio as fast as possible. John tells us, however, that major episodes of down-cutting come from cataclysms, such as the breaching of a natural dam. (For a distant example, the ice dam holding up Pleistocene Lake Missoula melted and the ensuing floods not only cut the channeled scablands in eastern Washington but also deposited house-sized boulders in the Willamette Valley.)

The importance of cataclysmic change has waxed and wane in the minds of geologists. At the beginning of the 19th century, a mere two centuries ago, English-speaking earth scientists tended to assume, following the account in Genesis, that the earth was young and that the tortured features of its crust, such as mountains and canyons, were the products of planetary paroxysms, possibly with supernatural causes. (A more measured, atheological, approach was championed by Cuvier in France.) They were called catastrophists. Charles Lyell championed uniformitarianism and gradualism, the idea that frequent, low-amplitude disturbances, such as we see today, plus a lot of time, are all we need to explain the geological features we see around us. Lyell's explication had seminal influence on Darwin, who needed deep time for his gradualist theory of evolution to be tenable. Lyell's view won the day, and as scientific dogmas (known euphemistically as paradigms) often do, outlived its usefulness when it led to the suppression of new data suggesting that occasional extraordinary phenomena, such as an asteroid hitting the earth 66 mya, do occur. Today, happily, geology combines the best of gradualism and catastrophism.

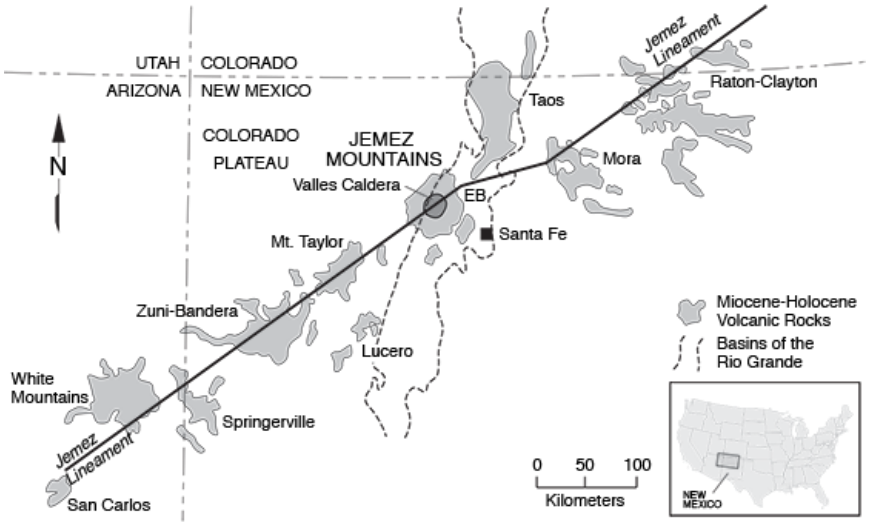

Figure 3. The Jemez Lineament is a string of volcanic hotspots.

Regardless of how it was formed, Frijoles Canyon is a little gem of a habitat. It collects enough water from the heights and is deep and shady enough to support Ponderosa Pines and a variety of moisture-loving plants along its banks. People also lived and farmed here.

A canyon is intimately connected to its uplands. The Las Conchas Fire burned 62% of Bandelier National Monument in 2011. The NPS was concerned for the buildings and the artifacts they protected, so they built special fire barriers and evacuated some of the artifacts. These measures succeeded, and the main visitation area was not burned. But then they had to deal with the increased potential for a destructive flood. Sure enough, it came on August 21, 2011 We hiked through the canyon six years later and saw the massive logs and boulders that had been moved by the waters. We stood at the overlook for Frijoles Falls, which produced only a trickle at the time, but which must have gushed during the flood. We were unable to walk the rest of the way to the Rio Grande because the trail no longer exists.

John explained the igneous geology we saw. Arch pointed out the difference between the yellow-green Oneseed Junipers on the slopes and the blue-green Rocky Mountain Junipers in the stream bed. The former are drought-tolerant, the latter must be superior competitors where soil moisture is abundant. We saw the first of many whiptail lizards among the junipers.

Whiptails as a clade (evolutionary lineage) have an unusual propensity to spawn all-female clones, which reproduce by virgin-birth, or *pathenogenesis* as the scientists cause it. Actually, those whiptail mothers are somewhat sullied virgins, for even though they don't experience coitus they do go in for foreplay with males of sexual species, as this seems to be required for their eggs to develop into offspring.

We heard numerous Spotted Towhees going "twee" in the brush, and saw numerous Western Wood Pewees, a kind of flycatcher, sallying from bare limbs to catch flying insects. One of these was followed to a nest saddled on top of a horizontal Ponderosa limb. About the same time a Peregrine Falcon passed overhead. The fastest animals alive and emblems of wildness despite their propensity for nesting on bridges and skyscrapers[1], Peregrines were nearly eliminated from the U.S. by DDT poisoning in the 1970s. Their decline, along with that of Brown Pelicans and especially Bald Eagles, all from egg-shell thinning resulting from accumulation of DDT derivatives in their food chains, was instrumental in the passage of the Endangered Species Act of 1973 (the world's most effective conservation law), as well as the banning of DDT use in the US. Seeing a pair flying over the canyon and perching on its cliffs reminds one that wildlife conservation's nadir has already been reached. Or has it? The Peregrine is back, but 3.5 billion people have been added since 1973.

John and Arch talked so much that the hike bled out of the cool morning hours into the less comfortable midday period. Plus, we had to walk back from the falls to the car, and we were hungry. It was a great opportunity for grumpiness, but no one succumbed. And so the pattern was set for the trip: lots of lectures and no grousing, a professor's dream come true.

Figure 4. A professor's dream come true.

Back at camp, Paul rewarded our good behavior with another great lunch, and then we were off again. It's all one mountain, so we capped the morning hike down the slope with an afternoon drive into the

[1] Our wild peregrines, it turns out, were occupying cliffs just below a sewage treatment plant on the mesatop. GoogleEarth tells all.

caldera. On the way up we passed through terrain that once supported the dark greens of lush mixed-conifer forest. Now it is sunny and the home of various high elevation shrubs, the trees yet to return after the very hot fire of 2011. We topped out and soon emerged at a vista that was already familiar to most of us: Valle Largo of the even larger Valles Caldera. The dead trees on some of the slopes had little impact on the splendor of the vista. Richard Stuhr initiated an ongoing conversation with himself about the relative size of the Valles and Ngongoro calderas. One always sees elk in this valley, but we had to search hard to find them this time. They were specks on the right flank, beyond a large herd of cows, but a look through a spotting scope confirmed their identities. Google Earth later revealed that they were 1.8 miles from out vantage point.

We had a nice look at the expansive view, and John told us how it had formed.

We thought we would have an early supper and then hike to Tsankawi ruin, down near White Rock, after supper. But for some reason we continued on NM 4 rather than turning around. Then we saw the entrance to the recently created Valles Caldera National Preserve. An NPS truck was parked inside, by the side of the gravel road. We'll just go a little way, we probably thought. At the bottom of the slope we came to a wooden bridge over a wine-dark trout stream, the East Fork of the Jemez River. Arch heard Savannah Sparrows out the window. They nest only in moist grasslands, including a little patch at the mouth of Sawyer Creek, north of Cottonwood Gulch. Arch had to pull his rig out and record them to prove they were in this location.

Everyone exulted in the waving green grass and the rushing water. The road pulled us inward, toward a cluster of buildings a mile or so away. Richard reflected again on the size of this place, this pit. From down here it looks every bit as big as Ngongoro. That crater has no outlet, the wildlife are trapped down there. The lions have become inbred, the males producing kinky-tailed sperm. Here, the little Jemez River has breached the wall, a bit to the west of here, and makes a very nice canyon running south through the pleasant village of Jemez Springs before sinking into the ground near San Ysidro. Spence Springs sits on the slope of Jemez Canyon. Some of us have soaked there in years long gone by. Maybe we should have tried it this time, but it might interfere with our afternoon routine.

It was still mid-afternoon, though, when we reached the NPS trailer with its seven Barn Swallow nests and two very nice portable toilets. We viewed the exhibits for a few minutes and were about to leave when one of the rangers said they had a tour leaving for the cabins momentarily. The attraction of those cabins, a mile or so away at the edge of the woods, was their use as the set for Longmire, a cable TV series some of us had never heard of. We demurred. He insisted. We submitted. Then the bus driver said he didn't have room for all of us. So, some went with him and the rest hopped into the Gray Ford.

Figure 5. The "Memory Forest" at Valles Caldera National Preserve. This is an old-growth stand of Ponderosa Pines showing the widely space trees and grass understory thought to have dominated the landscape before fire suppression by the U.S. government in the 20th century. Douglasfirs were also a component of this forest, but all have died in a recent drought.

It was a good decision. Not only did we get to see where this Montana iconoclast sheriff worked, we were taken to the Memory Forest. This was a small stand of old growth Ponderosa Pines which matched the ideal recognized at that protected forest in Arizona – a few large old trees with red bark and a lot of grass. None of us had ever seen anything like it. Just think, most of the mountain west looked like this 150 years ago. Until recently the Memory Forest was actually a mixed Ponderosa – Douglasfir forest, but the dougfirs are now dead or dying, the vicitms of a drought, or warming temperatures, or beetles that killed them because those environmental conditions had weakened them.

Toward the end of the day, as we sat serenely in conversation mode around Paul's work space, a fleet of white vehicles drove up, and quietly unloaded about 40 college students at the other group campsite, across the parking lot from ours. The burnt orange insignia on the vans told us that they were from UT-Austin. Someone found an informant who explained that they were a geology field school. It was impressive how quiet this very large group was, maybe because all they did was unload, set up camp, and go to bed. No clanging of pots and pans from them. And we probably did not disturb them either, stealing off to bed very shortly after clean-up.

But some time later some of us looked through the spotting scope's 60x setting at Jupiter. It seemed to have 7 visible moons, although one of them was way too far away and off the ecliptic to be a satellite of Jupiter. So, six moons. Our tides would be really confusing with six moons.

Day 3 (July 3, 2017): Ponderosa Campground to El Aguaje Campground, Rio Grande del Norte National Monument, 133 miles.

We wanted to get to a birding spot in Taos while it was still cool, so we packed up and moved out quickly. Nonetheless, the Texas group got out before we did. It should be mentioned that the heat, though frequently on the minds of the planners of our trip, was nothing compared to two weeks before, when record temperatures were recorded in New Mexico and Arizona.

We took the usual route from Ponderosa Campground through Los Alamos to Española. But something had changed for those of us who had been there before. State Hwy 501 goes right by parts of Los Alamos National Laboratory. For those who have experienced the security at the Savannah River Site in S.C., also part of the Department of Energy's nuclear weapons complex, this might seemed a little lax. But they have tightened up. Now they have a guard station, and to be granted passage, the driver has to show a driver's license AND vouch for the riders in the vehicle. Little did they know we harbored a former SDS operative in our midst.

Española was uneventful, except that Arch tried to go straight to Chama instead of Taos. With Siri's help, or was it John M's (he was packing a real map), we found a shortcut and got over to Hwy 68 quickly. Up the road a bit, we pulled off on a wide shoulder near the towns of Embudo and Dixon and took a look at the geology all around (Figure 4) and the riparian ecosystm below us (Figure 5).

Figure 6. John Bloch explains geology of the Rio Grande Rift on a bench above the river, near Embudo, NM.

The river splits here and makes a little island. (See the map associated with the ebird list for the exact location.) The slower flow 50 feet below us was home to some ducks, both Mallards and a hen Wood Duck and some ducklings. Both channels were lined with willows and other water-loving plants, while cottonwoods could be seen in the distance. The island between the channels was virtually desert. Numerous cholla cacti dotted a nearly continuous expanse of drought-resistant shrubs. This is the essential contrast of Southwestern plant communities, feast cheek by jowl with famine. That's a feast of

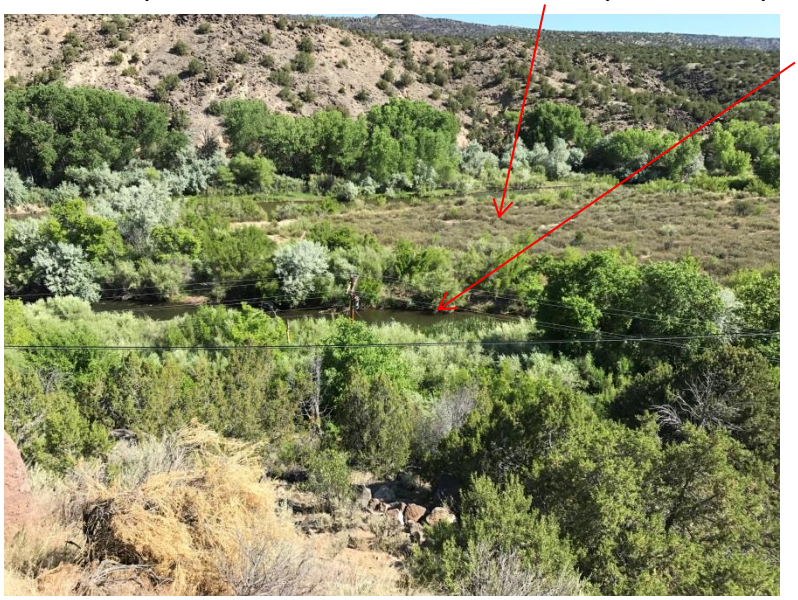

Figure 7. The Rio Grande flood plain near Embudo, NM, showing riparian vegetation flanking a dry upland.

water, of course. And the plant communities determine what animals are there. For example, we had a decent view of a Yellow-breasted Chat, a bird that is found all over the country in moist thickets. Here it was, right on cue. They're often heard, but seldom seen. We were lucky this one decided to sing from an exposed perch.

Fred Baca Park is a peaceful place on a secondary artery leading away from Taos's busy plaza. It has some swings, a dog walk, under-used asphalt tennis courts, and a nature walk alongside wetlands associated with the Rio de Taos. We ambled along the path, strangely surfaced with recurved synthetic planks. It would not seem to be a happy place for a wheelchair driver. The main attraction was a male Great-tailed Grackle, a large, long-tailed member of the Blackbird family, Icteridae. Icterids have a variety of mating systems. Orioles are typically monogamous and the colorful males help raise young with their somewhat less colorful mates. The same goes for Brewer's Blackbirds and Common Grackles. Meadowlarks are polygynous (more than one female per male), but males do help with the childcare. Red-winged Blackbirds, ubiquitous in marshes throughout the country, take it a step further. Males defend territories, and females choose the territory they like, not the bird defending it. This is not that different from the system practiced by Elephant Seals and other pinnipeds, the males of which defend prime birthing beaches from other males. The defending male gets to father the offspring, but does not assist his females in caring for them.

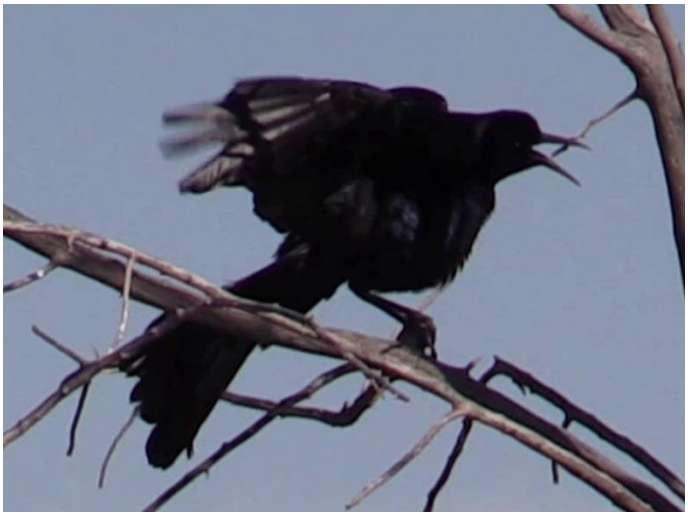

Figure 8. Great-tailed Grackle male "singing" and displaying, at Fred Baca Park, Taos, NM.

But Great-tailed Grackles, as well as the closely related Boat-tailed Grackles of the eastern seaboard, don't even bother to provide the material support of a safe nesting space. All they offer is their genes, which they advertise with literal puffery, first taking several seconds to pump air into their respiratory sacs, then exhaling it as though they were living bagpipes, while fluttering their wings and shaking their tail feathers. These tails, by the way, are too long to be of much use aerodynmically. Instead, they are thought, according to the Handicap Principle, to show the females that the male with the longest tails can haul the useless things around and still have the health to produce beautiful feathers and sing preposterous songs. The surreptitiously beautiful glossy blue-black feathers owe their allure to irridescence, which is optically similar to an oil slick on water. In bird feathers it's produced by structures in individual cells that are angled in such a way as to defract light in a particular direction relative to the incident rays of the sun. These structures have been identified in fossilized feathers from the Cretaceous, showing that one of the early flying dinosaurs, *Microraptor*, was the same color as the Great-tailed Grackle.

Great-tailed and Boat-tailed Grackle males may assemble in small groups and perform together, their bills pointing in parallel toward the sky, the better to attract females from afar. Such assemblies, called leks, are thus both cooperative and competitive, because each male hopes to be chosen by as many females as possible (and that number can be very high, as lekking species typically supply their males with very high sperm counts). The well-known dancing grouse are mostly lekkers, as are some hummingbirds and birds of paradise. Every mud puddle full of singing spadefoot toads is also a lek, and the list goes on.

The Smith's supermarket was our next stop, and a busy place it was on July 4. We thought we would stop for lunch at Taos's Kit Carson Park, but it was packed with people, so we decided to head up the road toward the Taos Ski Valley. We finally pulled over at a Forest Service campground that John knew and had a delicious assortment of lunchmeats and cheeses, chased with watermelon, by the roaring Rio Hondo. By this time, Hop was on the ground in Alamosa, having flown down from Denver after a visit with his son way up on the Wyoming border in remote North Park. His next task was to get a lift down to Questa, where we would pick him up.

We drove on up to the Ski Valley after lunch to do a little high-elevation birding while avoiding the afternoon heat along the Rio Grande Gorge. In 1889, C. Hart Merriam, head of the U.S. Bureau of Biological Survey (note the parallelism with the Geological Survey) published a formalization of the pattern that must have been obvious to every naturalist who looked at a mountainside in the semiarid American West. Parallel bands of different-colored vegetation can be seen from afar to march up the slopes. Up close, the plants are shaped differently. In the Taos area the bottom band is a cold desert with less than 12 inches of precipitation a year. Above that is pinyon-juniper woodland. Next is an open forest of Ponderosa Pine, with grass understory. (This fire-maintained configuration is analogous to the Longleaf Pine forest of the Southeast.) Then come White Fir, Douglasfir (more like a hemlock than a fir), then Limber Pine or, farther south, Southwestern White Pine. Finally, all these drop out and are replaced by Subalpine Fir and Engelmann Spruce. The treeline is above them, and above it is the mystical alpine tundra.

Along the rivers, the plants are different. In the lowlands Rio Grande Cottonwoods dominate. In the mountain canyons, as at our lunch stop, the cold-hardy Narrowleaf Cottonwood replaces the broad-leafed Rio Grande species. Also at our lunch stop were many Colorado Blue Spruce, another mountain riparian species, and some White Firs, a fire-intolerant species that grows at mid elevations.

The key to all this variety is . . . you guessed it, water. But it is soil water, not precipitation, that matters most. The riparian soils produce more luxuriant vegetation than the surrounding hillsides because the exogenous water in the streams seeps into the streambeds and percolates outward. Meanwhile, subsurface water is flowing downhill to become part of the underground part of the stream, just as surface runoff contributes to the visible stream. Soil moisture does increase with elevation because the clouds can hold less moisture at lower temperatures and therefore produce more precipitation at higher elevations, where the air is colder. Even here it is net soil moisture that determines the vegetation. In an east-west trending

valley, with the same amount of precipitation falling on both slopes, the south slope will lose more soil moisture to evaporation because of the longer and more direct exposure to the dessicating rays of the sun. And so, the bands are higher on the warmer, drier south-facing slopes (in the northern hemisphere). The ancient Chinese had a term for the “male principle” exemplified by these warm, dry slopes. The called it Yin. The cool, moist, female side of the valley they call Yang.

Merriam called the vegetation bands life zones, because they tended to harbor different vertebrate animals as well as different plants. The birds of the subalpine spruce-fir forests, which Merriam called the Hudsonian Zone, are the reason we ventured among the ski lifts at Taos Ski Valley. That development offers easy, paved, access to the high elevation forests. The first serious student of the birds of New Mexico was, by the way, Merriam’s sister, Frances Merriam Bailey. She published *Birds of New Mexico* in 1928. Her husband was a biologist with her brother’s agency. He, Vernon Bailey, may be seen in some of Hillis Howie’s early movies of the Prairie Trek, sharing trapping lore with the boys.

Where the pavement ends we were at 9350 feet, but that was not high enough. John B. was in the lead and he skis here. We passed through the huge but empty unpaved parking lot (why pave something that will be covered with snow when the customers arrive?) and took a steep gravel road to the left (how was Hop going to find this?) that ascended another 800 feet or so and topped out at a sizable parking lot surrounded by more rustic alpine buildings. One of them was the Bavarian Lodge (hold that thought). We ditched the vehicles and started walking. Why did the youngest person in the group have hiking poles? Turns out he skis here, too. We followed the path of the ski lift, which was ferrying empty chairs to 11,400 foot level, right up against the slope of New Mexico’s highest summit, Wheeler Peak (13,161 feet).

Figure 9

Soon we found a rivulet cascading out of the spruce-fir forest. On the mossy slope were dozens of azure Colorado Columbines, state flower of the state to the north. Numerous other wildflowers adorned the moist soil by the little waterfall. Underfoot was rock that was last hot over one billion years ago.

Up the slope past the rivulet, past a handsome male Audubon's Warbler and his agitated mate, we finally found the totem bird of the ski slopes, Clark's Nutcracker. Also known as Clark's Crow, these close relatives of the birds in black are noisy and visually conspicuous with gray bodies and white and black wings. We found three perched on a spruce snag. They are the champion freight haulers of the bird world. Many kinds of birds, especially, chickadees, nuthatches and corvids (jays, crows, nutcrackers) can remember hundreds of storage sites and so cache seeds for later retrieval when they need it most. In all these species the part of the brain associated with spatial memory is larger than non-caching relatives of the same size, and furthermore brain mass devoted to spatial memory

increases as an individual stores more and more seeds.

Figure 10. Colorado Columbine at Taos Ski Valley, Taos County, NM.

Pinyon Jays store pinyon seeds (more on them later) and chickadees store sunflower seeds from your feeder (just watch in early fall and you will see). Clark's Nutcrackers store the seeds of the "High Five" as forest conservationists call them. These are the five species of pines that grow at timberline in the North American West and produce large seeds that have co-evolved with the Clark's Nutcracker as their seed disperser. The deal is this. The high five (as well as the four species of pinyon, which might be called the "low four") produce seeds that are much less numerous, but much larger and more nutritious than the seeds of most other conifers, e.g., Ponderosa Pine and Engelmann Spruce. Evolutionists refer to this as investing in quality at the price of quantity. What the quality gets the pine is a bird partner willing to disperse and plant its seeds, sort of. Birds will eat any old pine seed, of any size. Same goes for spruce and Douglasfir. But these seeds are small, and they are only eaten in season. They're not the sort of thing you would specialize on. Not surprisingly, the little ones are produced in great numbers and are equipped with little paper wings to assist them in being blown a few hundred yards away from the mother tree, lest, ending up under mother (and father), they compete or interbreed with them. Dispersal of the young (see Nuthatch, Pygmy) is nearly universal in the living world, plant or animal.

The large seeds of Limber Pine (the local High Five species) and Colorado Pinyon (the local Low Four) also have a season, but the seeds are so large and nutritious that numerous animal species, including some human tribes, have evolved practices that enable them to depend on these seeds year round. You might think this is very bad for the pines, but, no, they encourage it. It is "intentional[2]." The plants that produce the largest seeds are more likely to have them dispersed and planted by the birds that are best at dispersing and planting them. In a wonderful case of positive feedback, natural selection simultaneously improves each species at the same time it makes each species more useful to the other. If only human nations could do the same.

[2] "Intentional" here refers to Daniel Dennett's concept of the "intentional stance." He explains it and everything else in *Darwin's Dangerous Idea*, the best book you will ever read about evolution, and the most enjoyable to read.

This is called co-evolution, and it does not violate the essential selfishness of Darwin's very dangerous idea. It's just win-win, a nonzero-sum[3] game in a sea of zero-sum ones.

But why do the Nutcrackers want to help the pines? They don't. They do it inadvertently. Several smart people, among them Yuval Harari, have pointed out the importance of error in systems of improving performance. Occasional errors are essential to the stability of the pine-nutcracker partnership. But there are several idiosyncrasies that are essential as well.

In order to specialize on a resource that is available for only a few weeks of the year, nutcrackers must store most of the seeds they harvest. This requires the pine to make lots of seeds, and to make them unperishable. The nutcracker must have a place to store the seeds. This is easy enough if you store the seeds where you harvest them, as does the Red Squirrel. They defend huge caches of small spruce and Douglasfir cones against all enemies. Birds, being more mobile, have hit on a different game. They fly them to perfect storage locations and store them there. This is where idiosyncrasy 1, championship hauling, comes in. The Clark's Nutcracker has a gap between its tongue and the skin of its throat, and under there is a pouch. A nutcracker can carry up to 80 large seeds in that pouch, for miles. If you had such a pouch it would give you a double chin, and that is what a nutcracker looks like when it flies by with 80 seeds in its pouch.

This is just the beginning, though. Nutcrackers live at timberline, where the High Five live, and that is pretty snowy. But there are places on the south-facing slopes of subalpine ridgelines where the wind and direct rays of the sun combine to keep snow cover low. Nutcrackers know these places. This is idiosyncrasy number 2. If nutcrackers glued their seeds to the bark of trees with spittle, as their cousins the Gray Jays do, the pines would not cooperate by making big seeds. Indeed, Gray Jays are seed predators, not seed dispersers, and store small seeds and other food on tree trunks because they live where snows are too deep for in-ground storage.

This system would not evolve if the nutcrackers were not able to find their caches, even months after they hid them, when other food is scarce. This they can do. Experiments done at Northern Arizona University in the 1980s showed that nutcrackers could remember hundreds of cache sites for months, and that they did it by memorizing the spatial configuration of extraneous objects, sticks and stones, on the ground. Similar experiments have shown that nutcrackers are best, Pinyon Jays are next, and Scrub-Jays and Steller's Jays are pretty good at remembering. A variety of chickadee and titmouse species also have passed experimental memory tests. The memory idiosyncrasy has therefore evolved several times. But here's where error comes in. Sometimes the nutcracker doesn't remember every cache, or dies before recovering its stores. It only takes a few bonanzas like this to make it worth it for the tree. Because the bird is planting the seed in a perfect place for it to become a tree. Whereas, those high quantity low quality ponderosa seeds are just lying on the ground, waiting to be eaten by a bird, or scrounged by a mouse, or to die of thirst when it germinates.

[3] This really should be "plus-sum" rather than "nonzero-sum," which could also include negative-sum games, but Robert Wright codified the term with his excellent book *Nonzero*.

By the way, Clark's Nutcrackers come down to the Pinyon-Juniper woodland in the fall and poach seeds from the Pinyon Jays. They load those pouches up and fly back to the highlands. They don't care that they are planting pinyon seeds in locations unfavorable for the growth of a pinyon tree. When it comes to the pinyon tree, they are not cooperators, they are just thieves. But then again, from time to time you see a pinyon in dry, sunny sites at high elevation. Keep an eye out for them.

We had an ear cocked for the arrival of Hop. He had been updating Arch with texts all afternoon, each with better news than the last, although phone reception was sporadic in this craggy environment. We knew already that Hop had made it down to Alamosa from Denver, but much advance work had not produced a sure-fire plan for getting from Alamosa to Questa. Renting a car was an option, but the owner of the only rental car franchise in Alamosa had told him he was taking four days off around July 4th. He found Uber willing to give him a lift the week before, but of course Uber is real-time only, and one never knows when the Uber drivers will be working. Eventually a delayed message got through that he was able to rent a car, and that he would drive himself down and return the car when we all passed through Alamosa. We later learned that a fellow passenger on his Cheapoair flight (that's really the name of the air line) expended considerable effort while on the ground in Denver demanding that the Alamosan rent her a car when she go there. It worked, and we all were beneficiaries. Despite all the ways the rendezvous plan could have misfired, it worked perfectly.

Figure 11. Happy hour at the Bavarian Lodge, Taos Country, NM.

While the Nutcrackers gargled on their spruce tree, Hop was sipping suds on the deck of the Bavarian. This was a mighty incentive for the rest of us to descend. We got there at last call, as for some reason the bar was closing at four. John Bloch and Arch eyed the chocolate-brown porter with avid anticipation, and then John volunteered to pass so Paul could have a beer. Well done, John. Arch also had the good sense to stay as alert as possible. We had another hour of driving ahead of us.

The Cottonwood Gulch office had reserved the group shelter at La Junta campground months ago, but our leader John examined the paperwork and discovered, a day before we hit the road, that the reservation was for June 3 not July 3. The BLM official he called admitted it was her mistake, but she couldn't evict the other group she had given the shelter to. La Junta means "the junction" in Spanish, and here refers to the junction of two very steep and deep canyons and their rivers, the Red River and the Rio Grande. We intended to hike the 800 feet (that's a lot of elevation) down to their meeting place to see the Servilleta Basalts, through which they have incised these narrow cracks, and

the La Junta campground occupies a great prow of basalt directly above it. The view is stupendous. We could have been outraged. But we were not. We accepted assignment to another campground, called El Aquaje, and when we got there we found a very helpful camp host named Holly, who directed the parking of all our vehicles. She had little nice to say about the Texas geologists, who must have partied themselves to exhaustion before crossing paths with us, perhaps at El Aquaje. More importantly, we made a rendezvous with Jack and Susan Oviatt, the last members of our group to show up, and they told us that El Aquaje was much nicer than La Junta, despite the evocative name of the place. La Junta, Colorado was, before any of our times, the place where Hillis Howie bivouacked his Trek vehicles during the winter. At any rate, we trudged out to the edge of the Red River gorge to have a look, perhaps saw some White-throated Swifts zoom by, and managed not to be so startled by them that we fell off the cliff. Having done that, we dutifully got down to the business of sitting in John's comfortable chairs sampling the hard cider that had been bought in abundance in Taos.

Day 4 (July 4, 2017): El Aguajue Campground to Pinyon Flats Campground, Great Sand Dunes National Monument, 95 miles.

Arch got up at dawn to scout the unique birds of the sagebrush desert. You might be surprised by their names, Sage Thrasher, Sagebrush Sparrow, Brewer's Sparrow, but then you might not be. At any rate, they were not home. Birds are supposed to sing in the minutes before dawn well into July, but not today. It's a pity, too, because these three species, drab though they be, illustrate how tightly aligned a species can be to a particular type of vegetation. The Sierra Nevada and Cascade range, which run from up in Canada almost to the Baja California border are high enough to pull almost all the moisture out of the wet westerly winds that roll in from the Pacific. The air descends on the east side of this north-south ridge and, while tightening its hold on the remaining moisture it brought with it, also "adiabatically" sucks up some of the local moisture in its path, making all of Nevada and more than half of Oregon and Washington deserts. But it still gets cold there in winter, so these are cold deserts. Such desert also occupies intermountain valleys in Colorado, and even down into northern New Mexico. Big Sagebrush (*Artemisia tridentata*) is superbly adapted to exactly this set of severe conditions. Let's review them. Very hot and dry during the summer. Very cold and merely arid during the winter. Inhospitable at all seasons. This is the domain of those three species of birds, and of the Pronghorn Antelope and, you guessed it, the Sage Grouse. Don't feel like they catch all the good luck. With global warming the range of Big Sagebrush is expected to shrink radically, and into the breach will move, from the hot deserts to the south, Creosote Bush. It's just too bad for those sagebrush animals.

The sagebrush grows in a veneer of soil on the flat upper surface of the Taos Vocanic Field, but the Rio Grande has made other habitat, and other animals occupy it. The gorge undoubtedly hosts nesting Golden Eagles and Prairie Falcons, neither of which we saw, but a smaller cliff-nesting bird, the White-throated Swift did zoom by as we embarked on the vertical descent of the gorge. It begins with a couple of nice paved switchbacks, then becomes gravel, then become a steel stairway. That's the steepest part, but there are other places one could fall off the trail and get hurt. We did fine going downhill and soon we were on a shoulder of alluvium below the basalt prow and between the two rivers.

Beside the trail, a Plumbeous Vireo was singing in a ponderosa. This was neither the first nor the last of these common birds. We found them every time we entered a lower-elevation dry woodland, the zone Merriam called Upper Sonoran. They sing slowly but insistently, rather like a robin, and even more like the common Red-eyed Vireo of the East, but with each brief phrase separated from the next by several seconds. This gives the singing a deliberate quality, as though the bird knows what he's talking about. A paragon of elocution, he also enunciates clearly and projects well. All his cousins sing similarly, with the result that one can hear something like this in every one of the lower 48 states. He and his cousins look alike as well. Vireos are small, but not as small as chickadees, warblers, or even titmice. They move slowly, so they should be easy to see, but this is often not the case. They are actually rather furtive in their movements among the leaves, and unlike almost all other birds, will sing from the nest while incubating.

The four kinds of vireos that sing alike all have "spectacles," eye-rings connected to the bill by a "nose piece" that is the same color as the eye-ring. They also have two well-marked wing-bars. This makes them pretty spiffy, for vireos. Within the group, the handsome Yellow-throated Vireo of the Southeast is easily distinguished from the others by its yellowness. It looks exactly like all the others, except that it seems to have been dunked in a vat of yellow dye. The other three were considered subspecies of the same species, the Solitary Vireo, until the advent of molecular genetics. Then a new fad in taxonomy led to promotion of subspecies to species rank if they were distinguishable genetically. So, the three slightly-different looking populations became the Cassin's, Plumbeous, and Blue-headed Vireos. The local one, which is found throughout the relatively arid Rocky Mountain Region, where drab coloration is the watchword, would be the economy model if you were shopping for cars. It features crisply demarked lead and white. The other two have admixtures of faint yellow and green. The songs of these forms are essentially identical, but the Plumbeous, like the Yellow-throated, adds a buzzy overlay to his notes, as though he were speaking the same language, but rolling his r's.

Subspecies were created to capture geographic variation within a single kind of animal, a species. By definition, two subspecies of a species do not occur together. But, for various technical reasons, they went out of favor. Now we are bringing them back, but calling them species. So, in a pattern that has been repeated dozens of times in birds alone, we now have three or more geographically isolated species where once there was one, with a much larger range. Regardless of the taxonomy, though, they are ecologically equivalent across the continent, the Plumbeous Vireo in New Mexico is doing the same thing in that canyon that a Cassin's is doing in Eugene, or a Yellow-throated is doing in Charleston, or a Blue-headed is doing in Montreal.

Figure 12. Jack measures the depth of one of the many basalt layers on the far cliff.

The walk back was easy enough until we hit the prow. We took our time, stopping to rest in the only shade, about half way up. A lizard was guarding a boulder there, reluctant to run off on account of us. The line inched onto the trail again and soon the word was passed to get out our cameras. Looking over the edge of a rock above us, in plain view, was a creature with horns. In fact there were five in all, with at least one juvenile. They were a family group of Bighorn Sheep. The horned animals were adult females, the others were probably their offspring, from at least two summers, and no ram was in attendance. The excitement of seeing the sheep probably gave some of us a rush of adrenaline that helped us climb those stairs to the top.

Figure 13. Lizard on rock.

Everybody was warm and tired and pretty full of lunch as the caravan pulled out of El Aquaje and headed north toward Blanca Peak, already visible on the skyline. John M. raised his head once and asked Arch if he was okay, but otherwise everyone in the Gray Ford except perhaps the driver slept for most of the trip. The road heads due north, then, once in Colorado, turns on a right angle and heads due east toward a long range of mountains that is clearly very high. This is the Culebra Range, and treeless tundra abounds along the entire ridge from well down in New Mexico to the vicinity of Fort Garland to the north. Then at San Luis, the road turns due north again. This little village is the oldest town in Colorado, founded in 1851. The San Luis Valley, which is high, dry, and vast, is just an extension of the Taos volcanic plateau into another political jurisdiction. It was natural for people to expand up there eventually, although the Spanish settlers had planted their flag next to the

Taos Pueblo in 1615. The present occupation of the Valley, with its irrigation canals and grid of roads reminiscent of the Texas Panhandle, stems not so much from the Taoseños who moved north as an influx of Anglo farmers who arrived in the 1880s with the railroads.

We had been in Colorado for maybe half an hour when we pulled into Fort Garland and someone noticed a store with a catchy name. Oh, of course. We are in Colorado and it's legal here. Discussion of the possibility of legal consumption, and the titillation of so doing, ensued. Some urged that we go back, while others favored continuing forward in search of a rest room. The loo won, and while at the Chevron, we consulted an adult. Paul reminded us that not all things that are legal are condoned by the Cottonwood Gulch Foundation. And so the question was settled, without any counsel from Board Members, past or present, of said Foundation.

Figure 14. The food was always plentiful and delicious.

It was still warm when we arrived at Pinyon Flats group camp site, a place designed for dozens of people if the two lines of three picnic tables was any indication. Luckily, the two neighboring group sites were not filled to capacity, one being empty, the other occupied by a small number of people with at least one small, yappy dog per person. Maddie, who didn't have much of a face, kept wandering into our campsite, and her grouchy owner kept following her. He warned us about the mosquitoes, which were already providing advance warnings themselves. But we foiled them.

We did pitch our tents, and cleaned off the dirty tables, and then we did sit around and have a few drinks, and then Paul prepared a great meal and we ate it, all without much interference from mosquitoes. But then we quit camp and headed for the dunes, returning after dark. That's how we defeated the mosquitoes.

The Great Sand Dunes, the veritable sands of time, have been assembled here not by waves of water but by the winds of time. They probably would have blown on to Kansas, but the Sangre de Cristo Mountains rose up in their way. Having nowhere to go, they piled up, up to a height of 660 feet. At their base, Medano Creek, a

Figure 15. Great Sand Dunes, seen from a slope just outside the park. Photographed on June 18, 2017.

perfectly normal creek, flows flatly over the outer edges of the dunes. According to the Park Service sign, the sand actually accumulates into little ridges, underwater dunes, under the force of the flowing water, then said dune collapses and the sand pulses down the creek, causing a slurping noise as it goes. The creek causing this slurping is a few inches deep. We took off our shoes and forded it.

And then, no one took charge. Some milled about. Some hiked up the nearest hill. Arch examined the green plants growing on the barren dune with the help of an abundance of snow the previous winter. Far above this scene geomorphologist Jack Oviatt walked a ridgeline toward the sky. If you followed him, as several did, you found that straddling a knife-edge with the left foot sliding downhill to the left, and the right sliding downhill to the right is neither easy nor much fun. But the view is unique, and going down is a blast.

Day 5 (July 5, 2017): Pinyon Flats Campground to Trujillo Meadows Campground, Rio Grande National Forest, 136 miles.

The sanitary facilities at Pinyon Flats were the best yet. Ponderosa Campground had two attractive brown, precast pit toilets with plenty of room inside. They didn't smell bad, although one of the Texas boys forgot to lift the lid. The pit toilets at El Aguaje were handmade, but also spacious and not too smelly. Pinyon, though, had flush toilets and lavatories with running water. These facilities seemed like the focus of our early morning activities. Paul gave us cereal with our coffee, we packed up quickly, and quit the place before the mosquitoes or the heat could kick in. Our first destination was Alamosa National Wildlife Refuge.

The Rio Grande, which we know to be capable of cutting a 1000-foot defile in basalt, has done nothing of the sort in the San Luis Valley. Instead, it meanders languidly through the flatness of the ancient lake bed, from its entry point up by Del Norte, past Monte Vista, and then Alamosa, before departing this large valley for New Mexico. Under normal conditions, meaning undisturbed by humanity, meandering rivers from time to time leave their banks, and so flatland rivers are likely to be flanked by swamps in humid areas, or in drier areas like this one, marshes.

Alamosa National Wildlife Refuge does what many, probably most, of the nation's 562 NWRs do. They use dikes, impoundments, and plantings of grain, to provide dependably, in a small area, a substitute for the wetland habitat that was once provided on a haphazard basis, now here, now there, by nature. It may not be perfect, but it's pretty good, and USA has long since foreclosed any chance of vast ephemeral wetlands like the Llanos of Venezuela or the Pantanal of Brazil. South of Alaska, that is.

We stopped by Alamosa NWR to drive the tour road along the dikes (de rigeur at NWRs) and look for waterbirds. The high point may have been the Cliff Swallows hovering and chirping madly as we came near their retort-shaped nests, made of dried mud balls, attached to the wall under the overhang of a display kiosk. Or it may have been the carefully-tended and lush wildflowers growing by the path to the Visitor Center, so colorful with red penstemons (purple

ones too), blue lupines, orange globe mallows, red and yellow blanket flowers, and much more. Or it may have been the Visitor Center itself, which a FWS employee on a tractor so kindly opened for us. The budgets for these facilities have been slashed and the Visitor Center is normally opened by volunteers. Inside, we saw taxidermic mounts of many species of birds, as well as dioramas explaining the hydrology of the valley and the refuge.

The high point probably was not the waterbirds along the tour route. The number of birds seen was considerably lower than two weeks before, when Arch scouted the area. Nonetheless, White-faced Ibises flew by in twos and threes the whole time, American Coots in all phases of maturation from flightless hatchling to adult plied the open water and surrounding tules, and Marsh Wrens chattered from the stems of those tall emergent plants. We had a glimpse of a Ruddy Duck and a Pied-billed Grebe, and luckily saw our only Avocet walk through the field of view as we studied a couple of ground-based ibises through the spotting scope.

We got a bit of a consolation prize after dropping Hop's car off at the airport, as we drove along South River Road, on the other side of the meandering Rio Grande from the NWR. Despite the graceful curves of the river, the paved country road proceed by the right angles and straight lines typical of western agricultural zones, but for miles it took us through wetlands that are clearly on private land but still home to a variety of waterbirds. At our main stop we saw a male Ruddy Duck, a male Redhead, possibly a pair of Gadwalls, some mallards, and two Black-crowned Night Herons. At another stop we saw a young Red-tailed Hawk sitting in a cottonwood with Western Kingbirds zooming past its head. It finally flew off, but the pests only followed.

With less than 8 inches of precipitation a year, the San Luis Valley would be naturally treeless except along the rivers. The towns now harbor, with the help of irrigation, respectable urban woodlands made up mostly of Chinese Elms, which attain small tree size with a minimum of water. Driving through Alamosa on the way to the airport, we had noticed a park with shade trees and deep green grass, so we returned there for lunch. It was a great spread of cheese and lunch meats topped off with watermelon. While there we got directions to a recylcing center, and Arch was able to drive off with our four-day accumulation of cardboard, plastic, and bottles and duly sort it into about a dozen different bins. Recycling collection centers are not numerous in the Southwest, so this was a great find.

Then it was time to shop. Alamosa has a big Safeway and a big Walmart. We visited both. We gassed up both vehicles. Then we visited the package store. It's not that we're into the hard stuff, it's just that Colorado does not allow the sale of wine or even beer in grocery stores. Seems a bit dated. But, while looking at the decorative bottles in the store, Hop found one he liked and wanted to show to the others, so we were introduced to the skeleton-bedecked label of Espolon tequila.

After this lengthy town stop we drove through the campus of Adams State University until we found Hwy 285, which returns to New Mexico, and took it south. We passed through La Jara, no relation to La Junta, which has a gas station. Then at Antonito, which has no gas station, as Jack and Susan discovered, we left 285 and headed west on Colorado 17. Soon we were in another valley county, Conejos, paralleling the river of the same name, which rises on the mountain of the same name, far above us to the west. As we followed the river up its flat valley

the vegetation, both riparian and on the slopes, changed steadily. Blue Spruce and Ponderosa Pines joined the cottonwoods along the riverside, while a variety of shrubs plus pinyons and junipers joined the Big Sagebrush away from the river. We stopped to look at the plants, and noticed an unusual geological feature towering over us on the right.

By now John had us all talking about “armored mesas.” A basalt flow clearly capped the steep slope on our right, but apparently the basalt had flowed many times. We saw six giant stair steps down from the top.

Figure 16. Six-layer basalt cap, beside Colorado Highway 17, between Antonito and Platoro Road, Conejos County, Colorado. John B. pointing.

A few miles farther up the road and the desert was gone. Now the slopes were covered with lush forests of pine, Douglasfir, fir, and spruce. At a large RV encampment the river swings to the right and into a dramatically alpine u-shaped valley. Here it meanders back and forth across the valley floor, which is maybe half a mile wide, leaving sufficient moisture for willows and valley-floor pastures, suitable for elk or cows. Both are present on a regular basis. We drove a few miles up the Platoro Road until we found a pull-off with a good view of the valley and room to park. After first spotting some Mallards, we thought we saw a duck diving in the river. Using binoculars we identified it as a female Common Merganser, a large fish-eating duck that nests in trees along cold, rushing rivers. We saw another up river around a bend. Some brown and

white birds were bathing in a pool on a gravel bar. Noting that a Spotted Sandpiper was nearby on the shore, Arch concluded that all belonged to this species, and probably were a family that had been raised somewhere nearby. Canada Geese cruised placidly in a natural pond near the river. We scanned the riverside for a Dipper, but saw none.

After returning to the paved road, we began the ascent toward La Manga Pass, but had to stop at an overlook for the expansive view of the Conejos River Valley.

We were a bit taken aback by Trujillo Meadows Campground, because most of the trees had been removed. The forest service sells a lot of timber, but they usually try to keep their campgrounds looking natural. (We later learned that they had been killed by a bark beetle outbreak.) We were looking around for a campsite, or two, none looking very inviting, when Jack and Susan zoomed up and said "we found a campsite right beside an Olive-sided Flycatcher nest." We followed them down the hill and settle on three campsites that had the added advantage of being at the edge of the campground. In no time were were unpacked and tents were going up, the flycatcher calling all the while.

Figure 17. A good supper deserves a good cleanup. Trujillo Meadows Campground, Conejos County, CO.

Day 6 (July 6, 2017): Trujillo Meadows to El Malpais National Monument, 290 miles.

Trujillo Meadows was the "birdiest" place we visited on the whole trek. White-crowned Sparrows were singing "Seee-tweedleledee-whaddaya-see" from nearby willows. On tops of the few remaining Englemann Spruce trees, rosy-naped Cassin's Finches were warbling like the sophisticated cousins of House Finches that they are. A Lincoln's Sparrow hid unseen in the

middle branches of a spruce skeleton that looked like a Lombardy Poplar, the better to belt our his gurgling-brook song. The frustrated Olive-sided Flycatcher continued to *kip-kip-kip* in plain view near the nest tree between the kitchen and the Oviatts' tent. The resident ornithologist didn't get around to showing any of these interesting birds to the group. Fortunately, John Mayer was along, and he found what he described as the best place for a Dipper he has ever seen. One of the random rivulets running through the upper part of the campground decided to throw itself over a ledge. Below the falls was a steep canyon. Beside the canyon was a very nice deck that would compliment any hillside house in the West, and the Forest Service built it just to encourage our appreciation of nature. It worked. John led us over there after we were packed and ready for the road. We immediately noticed a pair of Cordilleran Flycatchers ("Western Flycatchers" in Ted's slightly dated bird book) making repeated flights to the rock face of the canyon wall. That fits perfectly with their preference for building the nest of mosses and grass on a shady vertical surface. File that image away, because this was not the last time we saw a Cordilleran Flycatcher. In point of fact, we didn't find the nest, because, as John predicted, an American Dipper flew along the stream below us, then zoomed up to the vertical rock face by the falls to a crescendo of screechy nestling noise, right before our eyes. It immediately left and flew downstream. It did this again and again, every few minutes, until we finally found the nest with our binocs. One of the nestlings was leaning out over the abyss, spreading wide its yellow "lips" (*rictal flanges* to those In the know), the target mother evolution has given it for focusing the eyes of aquatic-insect-bearers. Video shows that the adult passed this youngster and darted out of for a few milliseconds, probably to feed younger nestlings in the nest, which typically would be a horizontal cylinder of moss and grass.

This was exciting viewing, but we knew we had a long way to go, all the way to El Malpais, via Albquequerque, where showers awaited us, so we pried ourselves away. We also said good-bye to Jack and Susan, who were heading back to Taos to see son Peter, after three short but lively days as members of our wagon train. Next time they should come for the whole trip.

Trujillo Meadows, at 10,152 feet, was the highest place we reached all week. It really had that Colorado Rocky Mountain High feeling, but now it was time for the downslope. Not before, however, climbing to another 10,000-foot pass, Cumbres, and accompanying the Cumbres and Toltec Railroad into Chama. We had just crossed the railroad, with oaks on our right and a grassy valley on our left when Arch slammed on the brakes and swerved onto the shoulder, gesticulating wildly at the perfectly ordinary crow that had just flown in front of the Ford and down into the valley. He knew better. It was not a crow at all, but the uniquely crow-like Lewis's Woodpecker, which by the way was named for the noted ancestor of our friend Henry Hooper. It was still quite early on a Thursday morning, but the Chama coffee shop was open, so we let Richard Swabb off to pick up second cups for Arch and himself. The train was steaming up in the railroad yard across the street. On the way out of town, another Lewis's Woodpecker flew by. A few miles down the flat road we came to Tierra Amarilla, site of an armed raid led by Reies Tijerina in the 1960s. No one was very clear on the details, so the iPhones came out and soon we had a complete biography of the man who started as a preacher, organized a commune in Arizona, and became an advocate for restoring Spanish royal land grants that dated back to the 1500s to the descendants of the grantees. He served time in prison, but was released, and died at home at the age of 88.

Just after we topped out south of T.A., we found ourselves looking at the Jemez massif and a broad expanse of subsidiary scenery. We stopped for John to explain it.

Figure 18. Echo Amphitheatre, Rio Arriba County, NM.

We were now in Geogia O'Keeffe country, so the phones came out again to fill in the details of her New Mexico career. Near Ghost Ranch we pulled off at Echo Amphitheatre, a place she must have visited many times.

John B and Arch had originally planned to take NM 112 from T.A. to El Vado Lake then "through the country" to Cuba, then down old NM 44 (now US 550) to Albuquerque. That would have taken us through some nice sedimentary deposits, and close to San Pedro Parks, a place John M remembers fondly from his Trek Cook days in the 1980s. We decided to stick to the pavement and tolerate a little civilization instead, in the interest of simplicity. For entertainment, the occupants of the Ford noticed that we were passing through the town of Hernandez, site of the celebrated photograph "Moonrise over Hernandez, N.M.," by Ansel Adams. We scanned both sides of the road so intensely that you would think we were playing cow poker, but we never saw the cemetery that would place us in the sight line of the photographer.

As we approached Albuquerque on I-25, we all notice a smoke on Sandia Peak. At first it was right of the towers. As we neared our exit, it had moved to the left of the towers, revealing that when driving down from Santa Fe one first sees the peak from the "rear" (technically the dip slope), and then later from the "front" (the steep strike slope). The top of this fault block mountain is reached not only by the famous tram, from the west, but also by a paved and windy

road from the east. A one-hour drive from the Rio Grande to the summit transects all the life zones in New Mexico, topping even Merriam's study area near Flagstaff for diversity.

The Cottonwood Gulch Foundation has a compound in the North Valley of Albuquerque. In addition to being their permanent office, it has a bunkhouse for the steady stream of staff flying into and out of ABQ. Of most interest to us, it has two showers. We partook, had a nice lunch, and could have been talked into a nap. But, 100 miles awaited us, and we had to get to Grants by 4 pm to get our caving lecture, or our plans for the morrow would be wrecked by the requirement to go back into Grants to learn the dangers of White Nose Syndrome in bats.

We made it to the El Malpais National Monument Visitor Center in time to get the briefing, which focused on safe practices that would prevent our introducing the fungus to any bat caves in the monument. This disease, which was first detected in New York in 2006, has spread to 33 states and has led to 6 million bat deaths. Some of the caves at El Malpais host bat roosts, so we were required to assure the NPS Ranger that we had no clothing that had been inside caves in the affected area. Hop volunteered that his boots had been in a cave in Borneo, but this didn't seem to be a problem.

The Visitor Center looks out onto the vast lava flow that stretches from I-40 southward and around the southeastern tip of the Zuni Mountains toward El Morro. It's basically flat, but one only has to walk a few feet into it to realize it is locally anything but flat. We postponed that exploration for the next day and headed south on NM Highway 53, the route several of us have taken over the years to reach the enchanted places on the south side of the Zunis -- El Malpais, Bandera Crater, El Morro, Los Gigantes, the calcite caves, Ramah, and most memorably, Zuni Pueblo, site of the annual dance of the Shalakos.

As we proceeded south a large and steep-sided mesa rose imposingly on our right. It dropped out of sight as we rounded a big curve and switched our heading to west, then reappeared as we looked north up the wide and flat valley known as Bonita Canyon. It's Gallo Peak, John explained, and he has actually camped on top of it. Arch was tantalized by a narrow canyon on its north side during bird surveys in 1981, but the strenuous hike didn't produce any ususual birds or plants.

Nicely layered sedimentary rocks made the east side of Bonito Canyon, but the west side was just rolling hills. Arch explained that these hills were the preCambrian granite that has been exposed when the Zuni Uplift pushed the overlying sediments up along a northwest-southeast axis in the early Tertiary (some 60 mya). Mirror-image cliffs of sandstone face each other on both sides of that axis, while matching valleys have been excavated in the softer shales. In the middle, along the axis, erosion has carried the sedimentary material away, leaving the uplifted granite exposed. Mt. Sedgwick, the highest point in the Zunis at 9,256 feet is granite. The low granitic hills before us, though, are the home of xeric woodland rather than mixed conifer forest. The signature plant of this granitic soil is the Gray Oak, a semi-evergreen species that is common to the south, but found nowhere else in the Zunis.

Leaving Bonita Canyon, we passed the granite hills for several miles, then transected a lava flow, and finally climbed a steep hill with a cutbank of pure cinders. Up ahead to the left was

Bandera Crater, a commercial attraction we would eschew, and beyond that was County Road 42, our route to the Big Tubes.

The gravel county road was in excellent condition, and the NPS road to the Big Tubes parking lot had been graded and was also easy work. We stopped at the parking lot and read the signs in preparation for our hike to the tubes tomorrow. But we were not allowed to camp on NPS land, we had to drive back out until we reached the Monument boundary, beyond which we could camp legally on BLM land. The road that continued past the parking lot was not maintained. It is one of those classic ranch roads that people make by following the ruts of those who came before. This is a workable and especially economical approach to road-building. Just look at the Oregon Trail. Actually, the ruts were not the problem, they could be straddled; it was the occasional rock outcroppings that slowed us down. But we made it, eventually. We knew we would be off the Monument when we hit a fork in the road, so as soon as we came to a fork, Arch called the wagon train to a halt on a soil-buried older flow a short distance from the tortured aspen-clad flow that produced the tubes. Amazingly, we all found relatively soft ground to pitch our tents on.

Figure 19. Campsite at El Malpais, Cibola County, NM.

After the tents were up and the kitchen was in full swing, Arch asked Paul for some sugar. The small hummingbird feeders he had bought in Alamosa came out, and after unceremoniously mixing a large quantity of sugar with unheated water, he hung one from a pine branch a few yards from our living room. Ted was loudly skeptical about any hummingbirds being in the area, much less finding this little feeder. It did take several minutes before the high-pitched wing sound of the male Broad-tailed Hummingbird appeared. He and a female were frequent visitors until we took the feeder down two days later.

A word about that wing noise. If you make a sonogram (a graph of pitch vs time, aka sound spectrogram) of the wing sound you will find that it has a frequency of over 6 kiloHertz, that's 6000 cycles per second, a very "high" sound, 7 keys past the last key on a grand piano. It's made by the wings, and the wings do move too fast for us to see individual beats, but 6000 beats per second? I don't think so. (The wings actually beat 38 times per second, and the sound that makes is very low, D#1, the 7^{th} key on a piano.) So, how do they do it? Strangely, like the Turkey Vulture, they do it with cut-outs. In this case, the narrowed tip of the leading primary feather oscillates around its shaft during each downward stroke. You know how a sheet of paper flutters if you hold it outside the window of a moving car. The feather flutters similarly, although in a very uniform manner, as the feather tip moves from the top of the stroke to the bottom. It

does this about 80 times each stroke, which lasts a little more than 1/100 of a second. Two biologists once captured some of these birds and applied enough glue to the wingtips to make them stiff. With no wing-whir, they lost their territories. Once they were recaptured and the glue was removed, they got their territories back. It's that simple.

Figure 20. Morning of July 7, before hiking into the Tubes, El Malpais National Monument, Cibola County, NM.

Day 7 (July 7, 2017): Camp remains at the same place. No driving.

The photo shows that we were up and at 'em as the sun rose. Several of us watched both the male and female Western Bluebird catch the early morning sun beautifully as they perched on a small dead ponderosa before slipping into their nest hole to feed their young. Inquisitive Pygmy Nuthatches, a least one shivering its wings to ask for food, crawled around the tree and even into the hole until they were chased away by the female bluebird, who seemed more serious about the feeding enterprise than the male.

We decided we could walk to the Tubes parking lot faster and more comfortably than we could drive, so we set off along the dirt track. As we approached the parking lot we began to hear and then see Pinyon Jays. These "blue crows" are shaped more like Clark's Nutcrackers than other jays, which have longer tails and less pointed bills. They harvest pinyon "nuts" by the thousands in the fall, storing them in the ground, just as nutcrackers do with the seeds of the high elevation pines. They recover them all winter long, and the energy boost enables them to nest as early as February. Unrecovered seeds may have a better chance of germinating than those falling on the ground, which is the co-evolutionary payback to the trees for producing such nutritious seeds. Still, the trees hedge their bets by producing bumper crops of seeds some years and none in others. This "boom-bust" strategy is thought to be an attempt by the trees to prevent seed predators from specializing on their seeds. Yet Pinyon Jays, Clark's Nutcrackers, and numerous species of boreal forest birds do specialize on conifer seeds. In "bust" years these normally sedentary species depart for the winter in mass migrations called "eruptions," only to return to their original ranges the following summer. Although they have similar environmental drivers, these eruptive migrations are not programmed into the genes the way annual migratory movements are.

We watched the flock of Pinyon Jays "roll" through the woodlands, half a dozen or more scurrying around on the ground under each tree, presumably looking for arthropods, each

squad flying to the front as it became the rear guard. Despite this movement, the flock was in the same place when we returned hours later.

While a lava flow may fairly be considered a geological entity, all rock is also of ecological interest. Black basalt has attracted the interest of mammalogists because of the tendency of local populations of rodents to evolve dark pelage, consistent with the advantage of blending in with their substrate. Recently, the genes responsible for these adaptations have been identified. The pattern long ago sparked a study of the mammals of the McCartys lava flow, now El Malpais NM, but melanistic mammals were not found. Perhaps at an age of 3000 years, the flow was too young for the necessary mutations to have occurred by chance. This didn't keep plant ecologists from also taking a look. In the 1940s, Alton A. Lindsey noted the occurrence of water-loving Douglasfirs and wondered how they survived. In the process, he determined that many of the trees were very old. Recent work by Henri Grissimo-Mayer extended the dendrochronological record of El Malpais back more than 2200 years, making it the longest continuous record for the Southwest. The trees are so contorted because during their lives they have been struck by lightning more than once, causing a different stem to take the lead each time. The oldest tree known for El Malpais is now 1,300 years old. A juniper that died there in 1859 had lived the previous 1888 years. Is the lava a great place to live a long time, or does survival there so disfigure a tree that no one wants to cut you down?

Figure 21. Cave in The Big Tubes area of El Malpais National Monument, Cibola County, NM.

Day 8 (July 8, 2017): El Malpais to Cottonwood Gulch Base Camp, 96 miles.

As usual, everyone woke up with the sun and hung around like hungry ravens waiting to be fed. Paul did his usual magic in the kitchen. We got the vehicles loaded quickly and set off for El Morro, wanting to arrive there before the doors opened at 9 a.m., so we could get to Base Camp for Rendezvous lunch at noon. Arch reckoned that taking the fork we did not come in on would get us back to the graded County Road 42 more quickly than retracing tracks via the Big Tubes parking lot. Comments made in the SUV implied that this was not the case, as we bounced over a rutted and rocky (yes, both) ranch road through the PJ, by a cattle tank, and over a cattle guard (or two). We did make it to 42, however, without getting stuck (impossible because the rains haven't started) or high-centered (possible, but avoided by the adroit rut-straddling of the driver) and examination of the official route map will reveal that this was the shorter way out, even if it wasn't the better way.

We pulled up to the El Morro National Monument Visitor Center just as they were opening the gate to the parking lot. El Morro ("the headland) is a massive piece of late Jurassic Zuni Sandstone that rises vertically from a sandy plain. The Jurassic was the time of the celebrated proto-bird *Archaeopteryx* and it is fun to realize that at the time El Morro was a sand dune bird-like dinosaurs were actually gliding from tree to tree (ginkgos, tree ferns, cycads) on wing feathers that would be sufficient for flight even today.

We saw some pretty decent flight when White-throated Swifts strafed us as we stood near El Morro's celebrated pool. Swifts nest in cracks in the rock, and their long, narrow, swept-back wings provide so much lift that they seldom need to flap. The formal scientific description of this distinctive species is based on visual observations made at El Morro in 1853. Swallows are swift "wannabes" (both take flying insects by opening their huge mouths while on the wing) from the large and very successful Passerine order, but they don't fly as swiftly as swifts. Their flight is rather batlike as they change directions to snag bugs, while the swift's more direct flight is often described as "twinkling" because they seem to be alternating the wing that is in its power stroke (not actually the case). We found inactive Cliff Swallow nest retorts on the cliff above the pool, reminding us of the very active ones at Alamosa NWR.

The pool is not a spring, just a basin in which run-off from the cliffs collects, but it has served as a dependable watering hole for centuries. A foot-path from Zuni to Acoma passed here long before Coronado was in the vicinity in 1540. Juan de Oñate is the first European explorer to incise his name in the soft rock (1605), and many others followed suit before the Park Service put a stop to the

Figure 22. The pool at El Morro National Monument, Cibola County, NM. With a concrete dam, it now retains more water than it did in pre-Park Service times

graffiti in the 20th century.

In addition to the swifts, we hoped to see Lewis' Woodpeckers at El Morro. The Superintendent told us that they are present in the pines north of the rock some years, as in the 1970s when Arch did some surveys there, but not this year. We did hear a Canyon Wren's peeling song from somewhere above the cliff, but we couldn't catch a glimpse of it. The monument also has a recent lava flow and a box canyon in the sandstone, both features that we had to pass on to make it to lunch at noon.

We did make it to Base Camp by noon and reluctantly released our chef to the more mundane task of feeding teenagers. He, and the many others in the kitchen, did a good job; the campfire after supper may have been the longest in Gulch history. Meanwhile, F&R was afforded privileged access to the showers, which were fun to use, especially if you were there 40 or 50 years ago. If you pull the cord for about 5 seconds, hot water pours forth as the on-demand heater hisses, then it relaxes. The idea is to release the cord for another 5 seconds during that recharge interval, then tug again. Very nice effect.

After another mass meal in the Cha-oh (I don't know how to spell this, it's a gigantic covered campfire circle, the young Trekkers had games. F&R hiked over to the Caretaker's House and worked on an ongoing project – emptying the beverage cooler, which Paul had conveniently left outside on the porch. Later, as the endless campfire got rolling, we had a final geology lesson, on the steep slopes, and top, of "The Mesa." Arch found a "pack rat's" nest and led the group down the dip slope to see it. Pack rats are actually woodrats of the genus *Neotoma*. In addition to building stick nests like the one we saw, packrats also nest in caves, where left-over plant material may be perfectly preserved in urine-drenched "middens" for tens of millenia. These plant materials are among the most imformative paleoecolgical indicators available.

We went to bed rather early, with the youngsters still whooping it up in the Cha-oh. There was, however, the matter of the Espolon. We dispatched it mercifully and quickly, so Hop could pack the artifact legally for the trip home.

Day 9 (July 9, 2017): Base Camp to ABQ, 118 miles.

Sunday is sleep-in day at Base Camp, so breakfast starts at 8:30. John Mayer and Richard Swabb had to leave before that, so, true to form, Paul pops out of the kitchen with two custom breakfasts just for them, around 8 a.m. The rest of us ate with the one Trek group remaining in camp. The Outfit had left around 7 for the airport (explaining the chorus of young voices we heard at Outfit camp around 5 a.m.). For the rest of the morning John Bloch, whose long resumé includes running a restaurant, huddled with Kris, Paul, Chet Kubit, and other kitchen honchos brainstorming the layout of a kitchen expansion, then he hopped into his pickup and took Ted and Hop to the airport on his way home to Mora, NM. Richard Stuhr and Arch stayed at Base Camp before meandering to ABQ by way of Socorro, where they spent the night with Jack and Susan. Hop was delayed for a day, so spent the night in Albuquerque's Old Town. We all eventually made it home, did our laundry, and slept under sheets again. And we declared it good.

Figure 23. Hop Igleheart, Richard Stuhr, John Mayer, John Bloch, Arch McCallum, Richard Swabb. Behind the camera: Ted Mann. Elsewhere, Paul Meeker, Jack Oviatt, Susan Oviatt.