

TREASURES OF THE SIERRA MADRE*

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June 1956. Where Barrancas Begin

When Colonel Davis made his offer I thought I'd simply turn it down. No more collecting trips south of the border. While I loved Mexico and Mexican fieldwork, it had come to its logical ending, including a dissertation on one hundred animals: the frogs, salamanders, snakes and lizards found at the edge of the tropics in eastern Mexico. Puzzles about distributions of such animals led to questions that could better be tackled by studying fossils. I had another life to live.

The search could best be conducted in the adjacent deserts of the western United States. Well preserved perishable remains of both animals and plants and occasionally even dung of unusual animals such as the extinct ground sloths were or would be discovered in dry caves of Arizona. Such deposits were ideal for radiocarbon dating and for the ecological study of diet. They would reveal a new aspect of primeval America, of native megafauna, and perhaps even help explain the extinction cascade that struck large animals at the end of the last ice age.

Nevertheless, the more I thought about the Colonel's proposal, the more tempting it became. At no charge he would fly anyone interested in the northern Sierra Madre Occidental to his mountain airstrip near his mining claim that lay over two hundred miles south of the border town of Douglas, Arizona. The alternative, to drive down there on rough mountain jeep roads, would take a week. It was a perfect opportunity to make some simple comparisons between the pine-oak forests at 31° North in Arizona's Chiricahua Mountains, where I was residing that summer, and those of 28° in Chihuahua, closer to the heart of pine-oak habitat in a part of the Sierra rarely visited by biologists. In addition, there might be caves in the canyons, caves with prehistoric fossils. Just possibly there could be dry cave deposits containing dung of extinct animals or ancient feathers of extinct condors like those found in a few famous caves of the Grand Canyon. There might even be fossil pollen in mountain cienegas (marshes) revealing climatic changes of the last ice age. How could I resist? If the Colonel and I both dreamed of treasures in the Sierra Madre, they were treasures of a different kind!

To my astonishment, other residents that summer at the American Museum field station outside Portal in the Chiricahua Mountains did not leap at the opportunity. While somewhat interested, they could not be diverted from their research. Some had to make periodic observations on the behavioral ecology of the local termites, moths, kangaroo rats, gray-breasted jays or long-nosed bats. Cave Creek in the Chiricahuas is beautiful; why leave it on a wild goose chase into Mexico? In addition, in the case of those who had never been into the interior, I began to suspect closet cases of borderphobia. To some, just the prospect of filling out papers across the desk from an unsmiling uniformed Mexican immigration official sporting a Pancho Villa mustache is spooky. Who wants to take chances in a remote part of a Third World country whose legal system, when it can be applied, stems from the Napoleonic Code. And finally what about the hazards of mountain bush piloting? Don't those guys have a death wish? For whatever reason, there were no other volunteers. It turned out the Colonel didn't bother with papers when he flew to La Pulvosa.

I packed my field kit, cotton, wire, and thread for stuffing mammals, and traps for catching them; formaldehyde and jars for preserving snakes, lizards, and frogs; and blotters for pressing plants. It would be one last, brief, blood-and-mouse-guts collecting trip, I promised myself, wife, and kids; one last good-by to the Sierra Madre before turning to more serious investigations like the search for dry cave fossils north of the border. I didn't reckon on the power of the land where the barrancas begin. Any Apache could have predicted the outcome.

We left Douglas International airport on a bumpy flight over broken country, the air and the ground below both growing considerably rougher as we flew on deeper into Sonora. Fighting nausea with limited success, I glimpsed out the cabin Plexiglas. Somewhere down below, the tropical trees of northern Mexico (including rock figs, Ures palms, mauto, pochote, palo santo, tepeguaje, and palo chino) battled to hold their northern limit, advancing or retreating through the centuries while dwarfed by drought, pruned by frost, and buffeted by temperate competitors. At our cruising elevation, ninety-one hundred feet, I could only imagine details of the timeless struggle. Down there, along the western margin of the Sierra Madre and east of the desert, a dozen

kinds of tropical trees maintained themselves hundreds of miles north of the Tropic of Cancer, and five degrees of latitude further north than their relatives in eastern Mexico.

The reason why tropical trees range farther north in western than in eastern Mexico is the milder winter climate of Sonora. El Norte, an outburst of frigid polar air that regularly pours down out of the Arctic into western Canada on beyond the foot of the Rockies, freezes the Gulf coastal plain of eastern Mexico, occasionally as far south as Veracruz, south of the Tropic of Cancer. El Norte bypasses the west coast. In the Sonoran lowlands winter nights may bring light frosts, on occasion heavy enough to damage the mangroves north of Kino Bay, or kill the tops of guasima near La Barranca, but the icy blasts of El Norte do not storm down Mexico's west coast with anything like the frequency or ferocity experienced in south Texas and Tamaulipas, well south of the latitude of Sonora.

Over Yecora, a large mountain town and lumber mill on Sonora's side of the Sierra, we began a gradual descent. The Colonel pointed ahead, to where the land sank down toward the Rio Mayo. While the drop, over four thousand feet of relative relief in four miles, is modest by the standards of west coast Mexican barrancas, it portends even more spectacular rims beyond. Perched on the edge of the barrancas at sixty-five hundred feet elevation, his airstrip on Mesa La Polvosa (dusty mesa) was surrounded by rich, uncut pine-oak forest.

By rights, since we had flown south on the Sonoran side, almost paralleling the Sonora-Chihuahua border, which runs north-south, we should still have been in Sonora. Nevertheless, for some mysterious reason a triangular jumble of basalt-capped mesas, six to seven thousand feet high and gouged by deep canyons draining southward into the Rio Mayo, was gerrymandered out of Sonora into the State of Chihuahua. As far as I can see, the boundary wanders aimlessly across mountains and barrancas, blithely disregarding rivers, peaks, drainage divides, latitudes, longitudes or any other natural or geometric logic. Even the new topographic maps carefully plotted from aerial photography don't attempt to show the state line; only local ranchers seem to know where it really is.

Vital to learning the botanical secrets of the Sierra was another invisible boundary line we had crossed. We were slightly south of the parallel of 28.5° North, at the latitude of Corpus Christi, Texas, and Tampa, Florida. We were just south of the Rio Yaqui drainage within the watershed of the Rio Mayo and near the northern limit of tropical dry forest. We had entered the botanical world of Howard Scott Gentry. His remarkable book, Rio Mayo Plants published in 1942, has provided naturalists with the best introduction to the region. Rio Mayo Plants was in my pack and would return on many more trips.

North of the border few people pay much attention to their native trees, shrubs and medicinal herbs. In contrast, the Sonorans and Chihuahuans living on the land are experts. Howard Gentry took advantage of this; in his fieldwork he learned a great deal about ethnobotany by talking to the natives, including the Warihio and other Indians. Increasingly, the lure of cities and towns, the need to educate children in school and, not least, the hazards of the drug wars are among a variety of forces working to depopulate the Sierra. Nevertheless, when you find them the country people remain the best interpreters of their plant and animal resources.

Gentry's collecting localities lie between 28.5° and 26.5° North and 110° and 108° West, a quadrangle of some sixteen thousand square miles, roughly twice the size of Massachusetts and only slightly smaller than Costa Rica. About half the land is low lying and tropical supporting thorn forest and tropical deciduous forest. The mountains above are semitropical or temperate with oaks (twenty species), pines (nine species) and madrone (two species). From his collections made in the 1930s, Gentry reported over twelve hundred species of vascular plants; subsequent work by Gentry and others suggests the region harbors at least two thousand. New species are being discovered in remote and unexplored canyons and on bare rock of cliffs. Even more accessible places along roads may harbor novelty.

We were landing, finally. The Piper Cherokee skimmed the trees next to a clearing, low enough to allow the pilot to eye the strip at close range. Satisfied that no cows or burros blocked our path and that no recent storms had gouged fresh runnels, he turned into a final approach, flaps fully extended, nose up and stall indicator screeching as the wheels bounced on the dirt.

Much relieved to be down on the ground and on good terms with my stomach again, I peered around to see what was outside. Flashing by beside the runway were round crowned trees, evenly spaced, with a dense foliage of big leaves suggesting mango trees. Surely, at this elevation we were not in a mango orchard!

Before I could solve the mystery, we had taxied to a rustic hangar of stacked pine logs. The Colonel introduced his manager, Juliano Rodriguez, and unloaded my sleeping bag and kit. It was late in the afternoon; thunderheads threatened. Leaving me to get my bearings, Colonel Davis departed immediately for business in Ciudad Obregon, promising to return in a few days.

I walked back along the runway to inspect the big-leaved trees. Indeed they were not mangos. They were vigorous young oak trees, released from competition after the clearing of the taller pines along the strip. *Encino gueja* Juliano called them after their large cupped leaves shaped like a small bowl. No oaks like these grew in the Chiricahuas. On subsequent days spent tramping the woods, Juliano showed me three other oaks that do not reach Arizona, plus two (blue oaks and Arizona oaks) that do.

Encino gueja is also applied to another oak tree with even larger dished leaves, some as big as a soup bowl. Recently I learned from Richard Spellenberg, a botanist at New Mexico State University, that the oak I'd collected, with somewhat smaller cupped leaves, has long been confused with its relatives and is actually still undescribed! I find it hard to believe that a common oak tree, widespread, it turns out, in the northern parts of the Sierra Madre at six to eight thousand feet in elevation, and the first tree I spotted the first time I came into the Chihuahuan Sierra, is just now being anointed with its own proper scientific name!

The woods yielded other delights — flocks of thick-billed parrots by day, wild turkeys gobbling around the Colonel's hangar at dawn and dusk, whippoorwills in the night and fresh scratch marks on the ground near the alders at a low pass a mile away. Juliano attributed the marks to *lobos* (wolves). "They are the size of a police dog; they hunt deer and heifers," he added. Most of all I was drawn to the smoky dry-season sunsets on the rim looking south over the mountains. The low country is tropical and was largely leafless at the end of the dry season; the high country is

temperate and, despite the drought, was stubbornly evergreen, all of it rolling on across the Rio Mayo and up again into more mountains in a vast topographic jumble of wildness toward and beyond Arechuibo, according to Juliano, the "capital" of the Warihio Indians.

Thirty years later I finally went back with some friends to revisit Mesa la Polvosa, guided by Jaime Sanchez from Talayotes. Virgin pines, wolves, and the Colonel are all long gone. The airstrip, a pawn in the drug wars, was ditched and rendered inoperable by the Mexican army and is overrun with bracken ferns. The Colonel's hangar and house slowly decay. Nevertheless, the view south from the rim down into the wild roadless maze of tropical dry forest beneath evergreen oaks and threaded by the Rio Mayo still beckons as powerfully as ever.

May 1960. To Moris for Fossil Sloth Dung

Although my flight with the Colonel had yielded no fossils, I learned that there were caves in the barranca country. Soon after moving to Tucson, I met a retired rancher, Ike Russell, who had taught himself to fly and was making trips to mining claims in the Sierra belonging to his friend from college days at the University of Arizona, Major William Swan (retired). A Mexican miner working gold claims outside Moris, Chihuahua told Ike about caves that he thought might yield fossil bones.

Besides, having gazed across it from Mesa la Polvosa, I knew I wanted to see the tropical part of the Rio Mayo country first hand, to see what grew down there, especially in a place that botanists apparently had seldom, if ever, visited. Howard Gentry's map indicated that although it was in his study area he had not been to Moris himself. The prospect was inviting.

To help share expenses, and adventures, Ike invited his friends, Art Almquist and Daphne Straub, to join us. With our sleeping bags, camping gear and a plant press we all squeezed into Ike's pot-bellied, tail-dragging Aeronca Sedan. Tail draggers, Ike said, are preferred to tricycle gear for rough field taxiing. The Aeronca, he added, was well thought of for its short-field performance. It could lift off easily with a full load despite its modest power plant, as he soon demonstrated.

Then we slowly floated upward, gradually gaining altitude, at a ground speed not much faster than one might expect from a loaded school bus. Once aloft, cruising speed was ninety miles an hour, a slim margin against the strong southwest winds to be expected many afternoons in the spring dry season in northern Mexico. From Tucson, it took us over four hours flying time to reach Yecora, where we would spend the night, not including time on the ground in Hermosillo clearing customs. I began to wonder what I had gotten into. How good a plane was the Aeronca Sedan and how good a pilot was this ex-rancher?

My apprehensions increased on the walk to town from the Yecora airstrip when my eye caught sunset reflections from broken pieces of metal. There were parts of an airplane (a

Taylorcraft it turned out) decorating various backyards. Here a strut or a wheel might be seen, there a tail section or an engine cowl.

"Ike," I asked, "whose airplane was that?"

"Mine," came the laconic reply.

Only years later did I get up the courage to ask about details of the crash. Ike had smashed his jaw and lost front teeth on a wobbly landing that Bill Swan blames on a loose raincoat fouling the control wires in the baggage compartment. Other details can be found in Desert Quest, a delightful new book about Yecora and the Yaqui River country by one of Ike's friends, the rancher-ornithologist-philanthropist, Randolph (Pat) Jenks. Pat happened to be in Yecora at the time and salvaged the engine of the Taylorcraft for Ike, returning to Tucson with it in the trailer of his jeep. Obviously the accident had not deterred Ike or his partner, Bill Swan, from further trips. News of the crash might well have deterred me. It was too late now.

The next day a cursory inspection of caves outside Yecora yielded nothing of interest and that afternoon we resumed our flight to Moris, our main destination. We decided that a seven thousand foot round peak, just behind Mesa la Polvosa, was the highest point on the western rim of the Rio Mayo country. Mountains loomed in all directions, except for one low valley to the east.

In it lay Moris, nestled five thousand feet below adjacent peaks and watered by tributaries of the Rio Mayo. Half the size of Yecora, Moris features well-built, thick-walled old adobe homes around a town square that is enhanced by a fine stone church. Warihio hats made of *sotol* (*Dasyliirion*) can be bought locally. In 1960, the nearest road ended thirty kilometers away at the mining town of Ocampo, four thousand feet higher up in the Sierra. We were told that from Ocampo the drive to Chihuahua City took two days. From Ocampo all goods to Moris had to come down the mountains by pack mule.

In 1927 J. Frank Dobie rode horseback this way with a treasure hunter, C.B. Ruggles, both in search of the lost mine of Tayopa in Sonora. According to Dobie (in Apache Gold and Yaqui Silver) the route from Chihuahua City through Ocampo to the Yaqui towns in Sonora was

the *camino real* — the "royal road" of the early Spanish and a route undoubtedly used by Indians before them. "From the mountains overtopping Ocampo snowclad in wintertime, it pitches down a mile in half a day's ride to the torrid level of oranges growing along the Mayo River and wild-cotton trees with thorn-studded trunks sticking out of its cliffs" (Apache Gold and Yaqui Silver, p. 187).

Built in 1934, the airstrip was reasonably well graded and fenced against livestock. There are a few corn fields around Moris irrigated by runoff from arroyos in flood season but most economic activity is focused on mining and ranching; the stores carried locally grown oranges.

In town, Ike located his friend, Gerardo Carmargo. For our explorations he would help find a guide and *bestias* (pronounced "véstias," literally meaning "beasts" — horses, mules, burros or even oxen, I suppose; Frank Dobie says early Spanish priests rode oxen); we needed four.

The tropical woods around Moris are low, thorny, and arid, almost too dry to be considered tropical deciduous forest. Except in the summer rainy season, grass is sparse, and we were near the end of a long droughty spring. The only uneaten grasses found sanctuary beneath piles of spiny acacia branches left by wood choppers or defied the reach of their herbivorous foes from pockets of soil on the top of boulders. Gerardo did his best but the four beasts he finally assembled for us were gaunt and weak, *muy flaco*, he admitted. If there were any fatter animals, they must have been pasturing in the grassy pine forests up in the cool mountains above Ocampo.

The trail north out of town led along a pretty arroyo into permanent water at Santa Maria, where there were many trees new to me. One I recognized from the *tierra caliente* in eastern Mexico is a low spreading tree with foliage like an elm. *Guasima* the natives call it. Its scientific name, *Guazuma*, is obviously derivative. How one wishes for more of this! Such a practice would make the matter of learning scientific names of plants so much easier.

There were thickets of tropical hackberries (*garabato*) along the stream. They made a tangle of branches wickedly armed with hooked thorns like cat claws. There were sycamores (*aliso*) in a more tropical setting than I had seen them in before. The handsome tree (*pochote*) whose fruits yield kapok (Dobie's wild cotton tree) and a low thorny tree common by the airstrip called *papache*

(*Randia*) were both covered with white flowers. Although there were no sahuaros to be found any closer than in the foothills outside Ciudad Obregon one hundred miles to the southwest, there was an even taller columnar cactus supporting many fluted pipes that rise out of a sturdy trunk, the *hecho* (*Pachycereus*) or aborigine's comb, named for its bristly fruit.

As we rode by them outside Santa Maria, I somehow overlooked the yellow and red bald patches on the hillside. Surrounded by dry tropical forest, the bare red soils support little beside oaks and *jarilla* (hop bush, *Dodonaea*), which I did see and collect. On the red soils, the oaks and, at slightly higher elevations, pines grow below their expected lower elevations. Much later I realized that in Sonora near Rancho El Tablon, outside Tesopaco Howard Gentry had discovered this phenomenon. In Rio Mayo Plants he briefly mentions red soils supporting oaks in tropical forests where oaks would not be expected.

By evening we arrived at Rancho Saucitos, named for its willow tree. A tiny irrigation ditch looked inviting and Daphne led the way to a rustic bath soon shared by her companions.

The next day saw us on the trail again, and the *bestias* were dragging their feet. We climbed out of the tropical lowlands into oak woodland. One oak is easily recognized by its distinctive, long, hair-like bristles extending beyond the margin of its large shiny, tapering leaves. This is the *kusi*, a relative of the Emory oak of Arizona and Chihuahua. The Wariho Indians consume the raw acorns in season, which is mid-summer. Effete Anglos find them somewhat bitter.

Besides the *kusi*, there were willow-leaved oaks and Arizona oaks. Small pines appeared; scattered with them were low palm trees. The tops of cliffs supported two-meter-tall candles, the golden yellow flowering stalks of octopus agave (amole). The stalks were in fruit at the base, full bloom in the middle, and budding at the top. A tropical touch was added by the sweet-scented white flowers that Daphne found on a leafless stubby low tree or shrub, the *suchil*, a close relative of the frangipani (*Plumeria*) of the tropics. Our *bestias* had some strong botanical inclinations of their own; they tugged against the reins to snatch mouthfuls of *cola de raton* (mountain muhley) and other perennial bunch grasses growing along the trail.

By mid afternoon we arrived at our destination, Cuevo de los Muertos, a big rock shelter with a flat floor overhung by yellow volcanic tuff. Cow manure strewn about the floor of the cave was pocketed with ant lion pits. Well, if the shelter was so clearly attractive to the hardy mountain cows, I reasoned, maybe in ancient times it was equally attractive to the ground sloths. I dug a test pit through the cow manure into sterile gravel and reached the floor of the cave without finding any ancient sloth dung or other fossils. Our guide had no information on *huesos fosiles* (fossil bones) from other caves. We started back, reaching Moris the next day, our skinny bestias somewhat energized now that they realized we were heading toward home.

Members of the party had business in Tucson, so we bid a fond good-by to Gerardo, settled accounts with our guide and went out to the *pista de aterrizaje* (landing strip) to see what the Aeronca would do. A take-off in the heat of the afternoon when the air is thin and aircraft performance is compromised can be risky. After lumbering down the full length of the field, the Aeronca reluctantly lifted off and Ike began a slow circle low over the town, then low over the adjoining hills, skimming the foot of the mountains, gaining some speed while looking for extra lift in thermals. For half an hour we circled around Moris from one landmark, a peak on the east called the Sebastopol, toward a sugar loaf on the west, El Pilar, and back again, the altimeter slowly rising along with the engine temperature. At last, spotting some vultures spiraling up in a thermal above cliffs, Ike flew to join them. There was enough of an updraft to get us out of the hole, up over El Pilar, into cooler air, and on our way to spend the night in Hermosillo. *Gracias a dios y los zopilotes* (thanks to god and the vultures).

Back in Tucson Ike presented me with an itemized receipt (which I recently discovered in my 1960 field notes). My share of the expenses, including truck rental at Yecora, taxi and hotel at Hermosillo, hotel room and meals in Moris, guide service and rent of beasts, customs fees and hours flying the Aeronca, came to just \$73.84! We all had a tremendous time. I had learned a few of the more common tropical trees and had begun to appreciate how good Gentry's plant information was, even in parts of the Rio Mayo that he had not seen himself.

Recently I learned that the yellow or red outcrops are acidic limonites well known to geologists as gossans. No prospector seeking gold ignores them. I certainly did. No one can see what is not in their "search image." According to Thoreau, "we cannot see anything [even a scarlet oak in its brilliant fall colors, he said] until we are possessed with the idea of it, and then we can see hardly anything else" (Journal, Nov. 4, 1858). A few years ago I drove back to Santa Maria (there are roads everywhere now, including to and beyond Moris) with a geologist, Kik Moore, to find my friend, Gerardo, and to return with him to inspect his property outside the old mining settlement of Santa Maria. Next to Gerardo's gold mine were gossans, plain as day, the hallmark of a promising mineralized district.

Eventually I forgot the wrecked Taylorcraft and my first dubious impression of Ike as a pilot. His knowledge of the Sierra was amazing, and the Sierra ranchers were devoted to him. We made many more trips together. So did many other border devotees from Tucson and elsewhere. We even flew the Aeronca across the Mexican Plateau (landing once by a Pemex station on the highway to refuel with car gas) and over cloud forest in the Sierra Madre Oriental to Xicotencatl in the cane fields carved out of the fast-vanishing tropical deciduous forest of Tamaulipas. Later, with his wife Jean, we flew in the Cessna through Egypt, the Sudan, East Africa, Mozambique and Madagascar. Another trip found us in South America east of the Andes in Tierra del Fuego before flying up the Amazon to Manaus, and north into Venezuela by Angel Falls, with many stops along the way. Wonderful as they are, none of those other places seemed to have the irresistible wild charms of the Rio Mayo country, with or without caves containing sloth dung!

January 1536. The Conquered Shamans

Over 450 years ago in the days of the conquistadores written history began in the Cajitan-speaking country these essays are about. The banks of the Yaqui River near modern Soyopa in Sonora was the scene of a strange tableau. Four travel-weary Spaniards (one of them actually an African slave), barefoot and threadbare, inspected a sign of deliverance. It was an amulet incorporating a horseshoe nail on the chest of an Indian. After spending eight years in a very foreign land, they were about to find their countrymen.

Followed by a large and faithful retinue of Indians, the four, led by Alvar Nuñez Cabeza de Vaca, were venerated as shaman (witch doctors). They had known terrible times. Their journey began when Cabeza de Vaca, Alonso Castillo Maldonado, Andres Dorantes, and Estevanico, a Moor from Morocco, alone survived the Narvaez expedition which failed to find gold or to subdue Indians in Florida, floated west past the Mississippi, and ended in shipwreck and a cruel captivity on the Texas Coast. The captives hauled water and wood and tended night-long smudgy fires to protect their Han and Copoque masters from the attack of clouds of mosquitoes. The Spaniards were beaten with no provocation. They starved. Some resorted to cannibalism, the very abomination that Cortez and his army denounced when they found the Aztecs ceremonially practicing it. Ignorant of how to forage on the local plants and animals, the survivors found themselves contemptibly inferior to the natives at finding food.

Their Indian captors expected more from these exotic strangers. Against their better judgment but with no other alternative, the surviving castaways were eventually induced to attempt faith healing. To their astonishment, the Spaniards discovered they had unexpected powers and were soon venerated as expert healers! Out of their unwilling "ordination" into shamanism they gained their freedom and began an incredible westward hegira of over one thousand miles to this spot on the Yaqui at 28.5° North, just upstream from the modern-day town of Onavas, on the threshold of the tropics. There they were detained by a winter flood.

Their unique odyssey through the interior of North America was no march of conquest, for they were thoroughly conquered and destitute. Along the way the Spaniards found themselves the

vortex of a rolling potlatch, a continual flow of goods from tribe to tribe as each new people they encountered in turn gifted them royally. They, the beneficiaries, passed on the harvest to their previous guides and followers. Cabeza de Vaca's is one of the best accounts we have of an unknown America before enslaving, relocating or missionizing of natives, before the spread of distilled spirits, of the horse, of guns, and countless other introductions that forever shattered native societies. These Spaniards preceded the worst impact of the contact, long discounted or unrecognized, the outbreak of Old World diseases, especially smallpox, a lethal fifth column in the European invasion of America.

When the Yaqui floods receded, the Spaniards crossed and sped south with their entourage, well inland from the Pacific Coast, on the back trail of their countrymen down through what is now Alamos and El Fuerte into what is now the State of Sinaloa. Geographer Carl Sauer called their route "the road to Cibola." It must have been in use prehistorically. Here the four found a land in smoking ruins, its native inhabitants terrorized. Finally the long-hoped-for reunion between the castaways and a band of Spanish cavalry took place. In shock, the Christian slavers viewed a sun-burned apparition speaking their tongue and surrounded by his native devotees. Troopers of the cruel captain, Nuño de Guzmán, learned that Cabeza de Vaca was second in command of the ill-fated Narvaez expedition to Florida. Three hundred were lost and all others were believed dead.

After they had recovered themselves, the soldiers proceeded to instruct the Pimas (through an interpreter) to obey them as lords of the land. The four survivors (failed conquerors) were inconsequential, the Pimas were told.

This in turn stunned the Indians. They had seen and heard enough of the treatment of native Americans by these Christians not to want any part of it. They caucused among themselves and their verdict rings through the ages. *"The Christians lied. We (referring to the four shaman) came from the sunrise, they from the sunset; we healed the sick, they killed the sound; we came naked and barefoot, they clothed, horsed and lanced; we coveted nothing but gave whatever we were given, while they robbed whoever they found and bestowed nothing on anyone."* The

Indians held firm in their view. "To the last," Cabeza de Vaca reported, "I could not convince the Indians *that we were of the same people* as the Christian slavers [italics added]." No wonder. This time in the history of America the tables were turned. The New World had conquered. In the wilderness between the Texas coast and the Sonoran foothills four would-be conquistadores had their eyes and hearts opened. I think it trivializes matters to say they were "born again." They had discovered more about America than any of the other captains from Spain or Europe.

After several years of trying to improve a small course I once taught at the University of Arizona under the bloodless title of "environmental education," I discovered Cyclone Covey's translation of Cabeza de Vaca's report, a slender paperback titled Adventures in the Unknown Interior of America. Adventures ... is the source of the quotes and other information used above. The book would, I felt, help us avoid the all too common problem of selling the borderlands short and of making too much of Coronado's contribution to the exploration of the southwest.

Better yet, it provided an extra excuse, if one were needed, to promote a field trip into the Sonoran foothills, down to parallel 28.5° North, southeast of Hermosillo, into the Yaqui River country on the old Indian trail followed by Cabeza de Vaca, and to see the land he saw. There, near the inactive mines of La Barranca, we could begin to learn the tropical forest trees: guasima, palo chino, chilicote, torote and amapa, among a dozen others. I'd challenge the better hikers to find and investigate the plants present below and above the "cowline." The roughest upper part of Cerro Los Amoles (so named for its agaves, *Agave vilmoreana*) features cliffs too steep to be ascended by mountain-bred *vacas* that are almost as sure-footed as goats.

On one trip Bill Gillespie and Diane Boyer censused the one hundred-foot tall sabinos (*Montezuma bald cypress*) along the Arroyo San Xavier. On another, Kik Moore and Elliott Lax explored the curious natural barrens below green cliffs washed with copper salts and being mined for silver at Cerro Verde. On another, my truck broke down outside Tecoripa and the driver of a passing pickup, Manuel Duarte, stopped to offer help, a common courtesy in these parts. I accepted and he towed me into his ranch for some shade-tree mechanical repairs. They worked wonders. Meanwhile, the students were enthusiastically exploring the Duarte ranch and had been

invited in for coffee by Manuel's parents. An animated conversation in "borderlingua" (parts of Spanish and English) was in full swing.

At some point in our explorations someone would be sure to turn up an indigo snake, a boa constrictor, or an iguana-sized ctenosaur or perhaps spot one of the resident bald eagles hunting fish along the river. In camp above the Yaqui at the end of the day under the brightest of stars we would cook a Dutch oven stew, keeping a sharp eye out for scorpions in the firewood. No trip ended without a baptismal dip in the river itself.

Here along the banks of the Yaqui there is much to ponder, like that business of rebirth. The year 2036 will soon arrive, five hundred years since a small group of Spaniards and their Indian followers passed this way on a magical journey. A suitable celebration would seem appropriate. It may not be too early to start preparing for it now. I envision a gathering of twenty-first century shamans of various nationalities and ethnicities. They will be purged of excess baggage, skilled at sharing and healing without enslaving, and also skilled, as Cabeza de Vaca was, at something Chuck Bowden believes none of the rest of us have accomplished since. Chuck calls it living in America.

March 1975. A Week Between the Rios Yaqui and Mayo

The word spread through select parts of the campus and back up to the Desert Laboratory on Tumamoc Hill. Spring semester break would feature a special event for the tropical "honkies," border devotees, some even registering for course credit at the University of Arizona. We would cross the Sierra from Ciudad Obregon to Ciudad Chihuahua, a distance of some four hundred miles, most unpaved and the stretch from Yecora to Yepachic rarely traveled. We would sample habitats south of 28.5° North and west of 108° West, ending our ecological survey at the spectacular waterfall at the head of the Rio Mayo, all of the trip in or near "Gentry Country." The recruits included ten University of Arizona students and five faculty members from three departments plus a geographer from the Boundary Commission at El Paso and a biology teacher from a California junior college. Finally, in Hermosillo, we were joined by Beatriz Braniff of the Instituto Nacional de Antropología e Historia (INAH). At the start of the trip she helped us find Rancho La Botana, an important Gentry locality outside Tesopaco, and she gave us a fine campfire talk on how the indigenous tribes, the Chichimecs of the border country, managed to elude foreign (European) conquest as long as they did.

Not everyone chose to go see La Botana, a Pleistocene deposit where Howard Gentry found bones of Pleistocene mammoths and other extinct animals. The more ecologically minded members of the party wanted to lay hands on the dry tropical forest trees without delay. Joining Professor Will Van Asdall, they set up line transects in attractive patches of woods within easy reach of the road. Construction of a new paved road into the Sierra had barely begun, and we soon had to revert to the old road to Yecora via Santa Ana and Santa Rosa. While narrow, slow, rough, and often treacherous, it was evidently an improvement over the first road into Yecora via Bermudez as described by Pat Jenks. I appreciated once again the advantages of Sierra travel in a light plane.

At Tesopaco, a town of several hundred families, Beatriz Braniff consulted her list of contacts. She unearthed the name of a nurse, Alicia Clark de Gonzalez. How could there be a Sonoran with the surmane of "Clark?" Almost surely Sra. Clark must be a descendant of the three

Civil War soldiers that various Sierra travelers, including Pat Jenks, have written about. Long ago three southerners left the States and ended up in the elbow of Chihuahua, leaving a large tribe of mostly blond-haired and blue-eyed mountaineers. In the cemetery at Bermudez their surnames, Clark, Moore and DeMoss, appear on most of the gravestones and families with these names radiate out from Bermudes over the Mesa El Campanero, La Mesa Colorada, into the Sierra Oscura and down to La Mesa Atravesada.

Sra. Clark hunted down Juan Mateos, who turned out to be one of Gentry's original guides to La Botana. With Juan we had no trouble crossing some fences beyond the Tesopaco road through leafless woods illuminated by the pink flowers of the wild *jicama* vine (*Exogonium*) to find the grassy valley of La Botana. Geologist Geof Spaulding soon discovered a few bones weathering out, including a real prize, the diagnostic scales or scutes from the armored shell of an extinct glyptodont. Gentry had reported them from La Botana.

Glyptodonts were edentates, fossil relatives of the living tree sloths and giant anteaters that looked more like giant armadillos. The largest full grown glyptodont was not much smaller than a Volkswagen Beetle, armed in the rear with a clublike tail. Some glyptodont tails even ended in spikes like a mace. They ranged South America, entering North America three million years ago when the Panamanian land bridge opened. Finding them at La Botana is of interest to paleontologists who thought glyptodonts might have been marsh or swamp dwellers. While open the La Botana locality certainly is not marshy, at least not now. It is surrounded by dry tropical forest.

Gentry also found fossils of *Taxodium*, the Montezuma bald cypress or sabino. The tree still grows along streams in the region; so perhaps the Sonora glyptodont lurked along the adjoining terrace. I envision them under attack by some large predator, for example, the large Pleistocene lion of the New World, akin to the African lion, which shared billing in America's extinct late Pleistocene game park. Too big to escape by digging holes like an armadillo, the glyptodont may have eluded its enemies by scuttling into dense thorny brush, a *garabato* thicket, the fore part of its scaly body protected on all sides by wickedly hooked thorns. Rushing up in hot

pursuit to tunnel in from behind, the would-be predator might suddenly find itself being clubbed over the head and ears by the glyptodont's heavy tail.

To be sure, my vision of how glyptodonts outwitted four-footed predators is fanciful. However, the likelihood that they and their edentate kin, the ground sloths, were totally vulnerable to the first human colonists of America requires no great imagination. Both would have been incredibly slow, easy to track, and easily stoned or speared to death from a safe distance, even if sheltered inside a tangle of garabato.

Furthermore, while we cannot be sure about the chronology, the time of glyptodont extinction being unknown in detail, the youngest radiocarbon dates on a relative, the extinct Shasta ground sloth, coincides remarkably with the first arrival of big-game hunters in the New World. Hence my interest in dry caves, where perishable remains of extinct animals may be found, including fossil remains ideal for the rigorous application of the radiocarbon dating method, which allows us to be considerably more precise about when large animals of the late Pleistocene disappeared than has been possible before.

What does any of this have to do with dry tropical forest and the cowboys who run their cattle in the Sierra? Under the moon around the camp fire that night, some tongues loosened by locally obtained distilled agave juice (*bacanora*), opinions clashed. Supporters argued that the cattle were reasonable proxies for the extinct Ice Age megafauna and that the mountains were too rough and too dry to support many cows anyway. It might even be better for the plants to coexist with livestock than without them, especially those plants like the aguarito which rely on large mammals for seed dispersal. The antibovine faction objected to stepping in cow pies, to local terracing and erosion on steep slopes caused by many hooves, and to the threat of buffel grass invasion or other touted range "improvements," another manifestation of "bovine imperialism." Easy for us to say, we tourists from the north, the land of many imperialisms. The debate, I noticed, seemed to separate the plant transect people from the fossil hunters. Drowsily we went off to sleep to the whinnying hoots of elf owls calling at the edge of the dry tropical forest, some to dream the wild fantastic dreams to be expected when sleeping on the hard ground out of doors in

an exotic land bathed in equinoctial moonlight. To be sure, few of our camps were so remote that we failed to detect a distant rooster crowing or ranch dog barking in the dawn.

The next day, a graduate student, Deborah Goldberg, unexpectedly came face to face with the subject of her dissertation, a geobotanical investigation she had not anticipated. We broke camp and drove deeper into the Sierra toward Santa Ana, totally unaware that we were coming up on the alleged locale of the famous lost treasure of Tayopa, much less that we were approaching what would become Deborah's study site, the place she would call "Vaca Valley." At the time none of us had read Frank Dobie's book, Apache Gold and Yaqui Silver, rich in stories of the route we were traveling, and of buried treasure, especially of stories of Tayopa. Dobie came into this country in the opposite direction, from Chihuahua, riding horseback on the *camino real* after leaving the railroad at Miñaca. He was looking for silver; we were looking for plants.

An enthusiastic ecologist, Deborah was not aware of lost mines of the Jesuits or tales of buried silver around Tayopa, "the richest mine of all." What caught her eye were the red barren hills, "red *topueste* dirt" Dobie called it from his treasure map, the type of habitat I overlooked outside Moris fifteen years earlier, the altered soil of a mining district.

All field ecologists familiar with the border region "know" that at their lower limits oaks and pines are restricted to cool, moist sites. Here at an elevation just over two thousand feet outside Santa Ana, we were enveloped by a dry tropical forest of *mauto*, *palo santo*, *pochote* and *tepeguaje*. At higher elevations we fully expected to (and would) see this habitat give way to oak woodland and eventually to pine-oak woodland and forest, the oaks and pines appearing first in cool, moist ravines and then on north slopes.

But right here, outside Santa Ana near Dobie's Guadalupe de Tayopa, that wasn't the way it was. When we *first saw* many oaks (and later the pines), they were *not* confined to north slopes or most ravines. We were driving east toward the settlement of Santa Ana on the side of a ridge which sloped south. The ridge included patches of Dobie's red *topueste* soils and that was where the oaks grew, no matter whether the slopes faced south, west, east, or north, in any direction as long as there were outcrops of red soils. Each patch of the altered red soils supported oaks or hop

bush, and apparently not much else. The gray soils surrounding the red patches were clothed with low, dense, dry tropical forest, making an impressive mosaic. By not being dependent on wet ravines or cool north slopes, the oaks were thumbing their noses, so to speak, at the ecological rules. That was enough to capture Deborah's interest and to bring her back on many more trips to Santa Ana

She stopped the vans and recruited volunteers to take line transects inside and outside the oak communities. She suspected, and later determined, that the red soils were highly acidic; they have a pH (the measure of acidity or alkalinity) of 4.5 or less. The acidity interferes with nutrient transport. Normal soils in the region are less acidic. We were in a region of rhyolites and welded tuff, capped by basalt mesas outside Yecora. The red spots apparently were formed by the extreme temperatures and pressures associated with past volcanic activity; the acidity, by sulfides released in the process. On the red soils the oaks (and at slightly higher elevation, egg cone pines) could escape competition with trees of the dry tropical forest. Later, Deborah's experiments showed that the oaks can tolerate the acidity better than other trees of the region. Beyond guiding the prospector in a search for precious metals, Deborah showed that the red *topueste* dirt can guide the philosophical investigator to discoveries about community composition and plant competition under extreme conditions.

Finishing a preliminary survey of the oak habitat, we proceeded on to Santa Ana where we saw our first *guerigo*, the handsome white cottonwood (*Populus monticola*) limited to the foothills and valleys of eastern Sonora. Frank Dobie mentions it as a botanical clue for treasure hunters in search of Tayopa. As Dobie discovered, the *guerigos* are local; they go no further south, not even entering the Sierra Oscura in the Rio Mayo country. The cottonwood for which Alamos is named and the tree along the lower Rio Mayo is a different species, *Populus mexicana*. Neither grow naturally in Arizona although both are planted on the University of Arizona campus.

The one acquisition we made in Santa Ana was not Jesuit silver but cuts of a freshly butchered beef, steaks and liver, the steaks much too fresh, it turned out, when we tried to cook

them in camp that night. Unhung mountain grown beef can be too tough even for mountain grown appetites!

Beyond Santa Ana the last of the *topuete* outcrops seen along the road to Yecora are associated with mines at Santa Rosa and La Trinidad. There, at 3000 to 4000 feet elevation, the "soup bowl oak" (*Quercus pennivenia*) whose leaf is the shape of a soup bowl also defies botanical life zone rules by reaching its lower limit with no regard for aspect, thanks to the acidic red soils.

We entered Yecora the next day. I noticed few changes from what I remembered of it from my flight with Ike. To be sure, instead of fifty-gallon drums one could now buy gasoline out of a pump. While filling up we were suddenly and unexpectedly assailed by young men in masks, gaudy costumes, and squeaky voices, the fariseos (pharisees) of Lent whose high jinks included brazen fund raising techniques that stripped us of pocket change! It was all for benefit of the church, said geography professor Dave Bradbury. At Yecora we also heard of the fate of Dave Cauginaugh, one of the best Sierra pilots. I had met him in Hermosillo through Ike Russell after our Moris trip. Ike claimed that he learned many tricks of mountain piloting from Dave. No trick in Dave's book could help him when the end came. Flying through the mountains, Dave had suffered a heart attack and had gone down with his three passengers; none survived. We would camp that night on his airstrip outside his ranch at El Trigo, near a mountain stream lined with alders and said to harbor otters.

By Easter Saturday we had been driving for days in our lowest gears over rough mountain roads that were steadily getting worse. The nights were getting colder as we climbed higher. In our valley camps, along sparkling streams lined with somber evergreen *tascate* (*Cupressus*) trees, we suffered the effects of cold air drainage. At dawn it was very hard to leave the sleeping bag to enter an icy world white with hoar frost. Finally we reached the Pima settlement of Maicoba, only to be "held up" by more wildly enthusiastic fariseos. At noon we were well into Chihuahua, up in the extreme northeastern corner of Gentry's Rio Mayo region, pressed for time and thinking of home.

Looking for gas, we left our route and entered the town of Yepachic pushing through packed throngs of Sierra people, far more than we had expected and, obviously, far more than the town itself would normally shelter. An Easter crowd, assembled from all over the Sierra, was streaming around the churchyard where we found an amazing scene.

Up on the roof of the church, above wreaths of desert spoon (*Dasylirion*), one man vigorously pounded a drum while another swung an ear-splitting wooden ratchet. A crush of people watched men run in and out of the church. The men began wrestling, each trying to throw over his opponent by pulling him up by the waist. Will Van Asdell and other sturdy types in our group declined kind invitations to join in. The local rites of spring were new to most of us. Finally some hardy native playing the part of Judas (so identified by Dave Bradbury) was pounced on by the churchyard mob who proceeded to raise him up and carry him bodily over their heads to throw him out, over the wall, where he was caught in mid air by the assembly outside the church yard and tossed back in.

Much relieved that none of us had been recruited to understudy Judas, we made a few purchases at the store, which lacked gasoline, and escaped, we thought, to resume our journey on the lumber truck road deeper into the Sierra toward fuel and pavement at the big lumber mill at Tomochic. The final goal, the ultimate highlight of the survey, was supposed to be a side trip to the waterfall at Basaseachic. We were already a day late.

Nevertheless, we did not escape so easily. A few miles out of Yepachic an obviously distressed and agitated native rushed out of his cabin to intercept us. Bravely he dragged a large pine log across the road in front of the first of five truck loads of heathen gringos. It seemed that on this holy day no one was supposed to travel. In retrospect, he was right. It was rash and thoughtless of us to leave Judas to his fate back there. Others in the party were having second thoughts about turning down invitations to the Saturday night dance. Should we stay for the rest of the Pascua festivities? On Bradbury's suggestion, a modest contribution, fifty pesos, was offered to the Indian enforcer of tradition. This seemed to soften his attitude toward us and kindly he removed the barrier. We were again on the road to the waterfall.

Outside Tomochic on Easter Sunday morning, at an elevation of sixty-six hundred feet, our camp by the side of the road was intensely cold, much too cold for those who were tentless in light sleeping bags intended for camping in the tropical lowlands. Going to Basaseachic would take all day. All the trucks were low on gas. A split developed. Some simply had to meet university classes to give or take quizzes in Tucson on Monday. Others felt they had equally demanding responsibilities at home. We had been warned that one week is too little for both crossing and investigating the Sierra. How we all yearned for a few extra "idle days." To the dismay of his students, professor Ron Pulliam left with grim determination. After driving a few miles with the "gotta-go-home" group he changed his mind and returned to rejoin the waterfall detachment, to cheers and whistles of the truants.

The extra effort was rewarded. Apart from its scenic splendor, the Basaseachic waterfall is a botanical oasis, very rich in endemic species, although most would not flower until late summer or fall. Much warmer than where we had camped, the base of the falls supported scarlet salvia, purple lupines, *Lobelia*, rare sedges and many other colorful early spring plants. A Tarahumara Indian, climbing the steep trail beside the waterfall, held a string of native trout, one of which was reluctantly sold to us for a scientific specimen after considerable bargaining. The species, *Salmo chrysogaster*, was first described only ten years earlier and had not been recorded before from the Rio Mayo drainage.

The height of the fall has been measured by geographer Bob Schmidt from the University of Texas at El Paso. He used a fishing pole and reel, with a sinker on his line. The drop, almost straight down, is eight hundred thirty feet. In the dry season, the time of our visit, a small stream cascades into a wispy spray. In the rainy season it is a thunderous torrent. At the bottom of the gorge, big-toothed maples and basswood were coming into new leaf, warblers were starting to migrate, and the moist woods with holly, hop hornbeam, silk tassel, *tascate* (Arizona cypress) and ten species of oaks felt lush and nurturing, like an Appalachian cove forest in spring. With mixed emotions we learned of plans for a new tourist hotel to be connected by a paved road from Ciudad Chihuahua and to Ciudad Obregon. The pavement is now complete and in a day tourists

comfortably drive across the Sierra over the route we had slowly bounced along for almost a week. When they get to Basaseachic, I hope some take the trouble to hike down below the falls to see the wonderful tascate woods, and ten species of oaks.

Make no mistake, I am told by some of the most venturesome University students that wild country is still left; it starts below the waterfall at Basaseachic and heads south and west for one hundred miles into Sonora, a roadless maze of mountain trails above a wild river known only to the *gente de la Sierra* (mountain folks). It is the country I once peered into from the Mesa La Polvosa.

We clambered back up to our trucks and had to resort to draining the white gas from our stoves to squeeze out enough fuel to reach Tomochic. It was well after midnight Tuesday morning when the last vehicles reached Tucson. In some cases, home would never again be quite the same and certain members of the spring of 1975 Sierra trip would discover reasons to return or to go on deeper into Mexico. The borderlands can do that.

March 1990. The Buffel Grass Bomb

Merv Larson knows all the roads around Alamos. He kept insisting there was a new one, a lumber road east out of Alamos up into the pines at Santa Barbara. Back in the 1950s a rough lumber truck road led up the Cuchujaqui valley into the Sierra at Milpillas. Then, many years ago, above Rancho Los Amoles the rains washed it out. To be sure, at Los Amoles the road ends in beautiful mountain country within the lower range of the *barba de chivato* (*Calliandra houstoniana*), a handsome shrub whose long rose-purple anthers dry into a brown "goat's beard." *Barba de chivato* promises to become an outstanding ornamental for the border region. Nevertheless, Rancho Los Amoles itself is just below the elevation of the lumber mill country. I wanted to explore the new road and see the effect of the fresh cutting, before more damage was done.

Merv guaranteed both cut and uncut pines. So a spring break trip with a group of students and friends that began on the Mesa El Campanero outside Yecora ended at Merv's in Alamos. He is restoring the old hospital on the southeast side of town.

Merv has transplanted many of the dry forest trees into a giant planter, like a mega window box, in front of his *portal*. He waters them, and his night watchman, Teodoro, a retired Alamos cop, poisons the *mochomos* (leaf cutter ants, *Atta*) before they can strip the foliage. There are *torotes* of various kinds (native *Bursera*, *Fouquieria* and *Jatropha*), *palo santo*, *guajilote* (*Bombax*), a giant *tempisque* (*Sideroxylon*) which fruits in June, and *ensangregado*, a much larger and more robust version of limber bush (*Jatropha platanifolia*) than the one that grows in the Sonoran Desert around Tucson.

Many tropical forest trees are shallowly rooted and can be transplanted with ease. One problem is that, even if one wages war on the ants and provides good soil and water, some of the dry forest trees are stubbornly deciduous. No matter how wet the winter or spring may be, they will not leaf out until shortly before the summer rains are due in late June (San Juan's Day according to tradition). And, despite ample moisture supplied by Merv's hose, some insist on defoliating as early as September. Phenologically the trees know what they are doing. Unless

adapted to moist soils in a floodplain habitat, they cannot rely on fall to be wet enough to sustain photosynthesis. Sonora is not Veracruz! Merv's plantation of natives is an excellent place to start learning the trees and the behavior of dry tropical forest. Even when leafless, the torotes, palo santo and other trees of the region are graceful and their trunks are quite distinct. One must admire the adaptation the trees have to the short summer rainy season, only ten to fifteen weeks, the one time in the year when all trees are in full leaf.

Friday morning we rounded up friends from various corners of Alamos, including Chuck Bowden and Stephanie Meyer, an Alamos ecologist, and started out for the pines. On the way, Merv promised, we would see *guajilote* (*Bombax palmeri*), a tropical tree in the baobab family, Bombacaceae. As we climbed out of the Cuchujaqui valley we came upon them, their large white blossoms wilting in the sun on the tips of naked, spreading, leafless branches. Their nocturnal flowering and wide-spaced, wide-open branches afford uncluttered access to sturdy white flowers with numerous long stamens (shaving brush tree), suggesting chiropterophily, the bat pollination syndrome. That does not mean that only bats can pollinate guajolote, but lots of their pollen has been found in guts of certain tropical bats such as the long-nosed bat, *Leptonycteris*. If bees visit the flowers they will not easily intercept the stamens which extend several inches above the nectar.

A good field trip discovers the unexpected. While George Ferguson climbed up into the *Bombax* to photograph flowers at close range, another student, Juan Rascon, struck up a conversation with a campesino working nearby. There was a fine tract of dry tropical forest above us. The man was clearing some of it. Juan asked why.

"To plant maize, señor."

"Is it your land?" Juan asked.

"No, señor, the owner lives in Navojoa. He pays me 300,000 pesos [about \$100.00] a hectare (three acres) to cut down the monte. Then I will plant maize."

"And what does he get out of it?" Juan persisted.

"After my corn crop, when the field will no longer produce, he will plant buffel [*Pennisetum ciliare*, the South African perennial grass widely introduced into Sonora starting in the

1970s]. He will fence it for his cattle." Juan also learned that the new owners from cities on Highway 15 may care little for the people of the Sierra, in some cases fencing the gente off the land, employing outsiders, and leaving the locals with no source of income or even subsistence.

All this was sobering news for us to mull over around the camp fire that night. Buffel is a favorite solution of range managers seeking to improve production in the dry tropical forest. Woods that yield sparse forage and make cattle roundups *muy trabajoso* (hard work) for cowboys, who must search hard in the dense monte for their elusive stock, are much easier to manage when converted (*desmontar*) into open buffel grass pastures. The wily Criollo cattle of the forest are replaced by lazy Charolais cattle of the pastures.

Most tourists driving from Navojoa to Alamos will not realize the damage already done over the last twenty years. West of the Cerro Prieto and along the road to Mocuzari Dam vast tracts of forest have been cut down by hand or, increasingly, smashed down by bulldozer, the trunks burned after they dry out and the ruins turned into buffel grass pastures. The place now looks like an African savanna with cattle standing belly high in buffel grass. Tourists and other visitors may prefer the openness to the claustrophobic feeling enveloping a narrow road enclosed by dense and mysterious woods, possibly the haunts of desperados. Indeed, if local people are dispossessed by new owners, there will be more landless peasants for the drug lords (*mafiosos*) to recruit as growers of marijuana and opium poppies. There will be more unrest in the *monte* which has already seen its murders.

Given half a chance, the dry forest trees recover if their stumps are not bulldozed. In mature dry tropical forest Howard Gentry reported thirty-three to forty-five species of trees and shrubs in half an acre. Four years after abandonment of a corn field in hand-cleared forest (Sonorans call these fields *rozas*), Gentry found twenty species of trees, one up to ten feet tall, some sprouting from stumps. Twelve to twenty years after clearing there were twenty-five woody species; the *pochote* were twenty-five feet tall. Recovery was well underway. The cycle is slow but renewable and eventually the forest can be cut again and in the ashes another maize crop can be harvested. With modifications, this is the classic land use pattern of subsistence adopted by

campesinos growing corn in milpas in much of rural Mexico. The system depends on forest recovery which in the Sonora-Chihuahua border country is slow but sure. Hand-clearing of *rozas* or milpas by subsistence farmers is not permanently damaging to the forest.

In contrast, the new buffel grass pastures don't give the trees a chance to recover. The dense grass prevents germination or seedling establishment. While ranchers often leave "keeper trees," large *palo santo*, *palo blanco*, *mauto*, thirty-foot tall mature columnar cacti called *hechos*, *palo cachora* and others to provide shade, edible fruit, or fence posts, these trees are doomed. If not cut down first, the "keeper trees" will die of old age or be blown down in storms, leaving the field exclusively to the buffel grass. For the buffel to remain thrifty, it must be grazed heavily or burned. Meanwhile more and more dry tropical forest and thorn forest is being destroyed for buffel grass. Based on what we saw, we guessed that already about half of the natural forest on rolling country along the upper Rio Cuchujaqui has been sacrificed. Steeper mountainsides further away from the river resist mechanical destruction by bulldozers and may be cleared by hand, as we witnessed on the road to Santa Barbara.

Fortunately, there still is much to save. Stephanie Meyer has supported the idea of preserving the Sierra de Alamos, a concept initiated by foresters of SARH (Secretaria de Agricultura y Recursos Hidraulicos) and endorsed by the municipality of Alamos. The Sierra de Alamos, looming over the town of Alamos, is thoroughly isolated from the rest of the Sierra Madre and is the home of many interesting tropical plants and animals at or near their northern limit. At the foot are excellent examples of uncut or selectively cut dry tropical forest. On top are pines, oaks and exposed cliffs supporting tank bromeliads and epiphytic orchids. Most of it is too steep for cultivation or grazing; it is the main watershed for Alamos, not to mention a magnificent scenic backdrop for the town. We could survey it from the road to Santa Barbara. Over 90 percent is uncleared.

A man coming down from Santa Barbara, Ruben Alvarez, assured us that the steep climb ahead was passable for four-wheel-drive vehicles. We drove past a small cave, the roost of fig-eating bats, admired great golden blossoms on a *palo barril* (*Cochleosperma*) and emerged on a

mesa of yellow volcanic tuff with stunted Chihuahua oaks and a very attractive sunflower bush, *Jaumea*, that looked like a great prospect for gardeners. Spring annuals including a pink-purple gentian, annual grasses and tiny sedges were scattered about.

Higher still we came to blue oaks festooned with epiphytes including the green cigar-shaped pseudobulbs of *Laelia*, a sturdy tree orchid, whose large lilac flowers appear in October. We found Santa Barbara in a beautiful valley at four thousand feet surrounded by forest and supporting well-made scattered ranch houses, all occupied by heirs or relatives of Don Chico, the senior member of the Alvarez clan. In July, we learned, oxen plow the new bean fields. Chuck and Merv returned to town; the rest of us found a camp site in the pines below a red peak with tank bromeliads, Cerro Agujudo.

The Alvarez boys came over to visit our camp, hospitably offering to share a bottle of *lechuguilla*, a local mescal distilled from the cow horn agave. After exchanging pleasantries, they eventually inquired what we were up to. "We are looking for unusual trees and shrubs native to the Sierra."

"Well, if that's what you want, you should have a look at Arroyo Verde. There are lots of strange plants there," they replied.

"Arroyo Verde? Where is that?"

"Just below your camp," said Beto Alvarez, "down in this canyon. Do you know about the stinging bush, the *ortiguilla*? In summer there is so much *ortiguilla* no one goes into the Arroyo Verde, not even the cattle."

We knew about *mala mujer* (bad woman), a stinging plant of summer time in southern Arizona, occasionally found in southern Sonora. We did not know *ortiguilla* (genus *Urera*), which, according to Gentry, was the name for a stinging shrub found along mountain streams.

The canyon dropped away precipitously below us. Down there was Arroyo Verde, too remote to explore in the half day we had left for fieldwork before leaving for a swim in the Gulf at Huatabampito. Arroyo Verde sounded very inviting and plans were soon hatched to return to explore it in May after the semester ended. The main discovery for us on this trip was not the

uncut pine woods of Santa Barbara. It was the conversation Juan Rascon had with the man cutting down the *monte* for buffel grass. We had discovered the buffel grass bomb.

May 1991. The Forest Nobody Knows

To make up for a lack of appreciation in New England at the time, Henry David Thoreau wrote an essay, "Autumnal Tints." It dwelt on the glorious fall colors of sugar maples, scarlet oaks and other trees of the eastern deciduous forest, a phenomenon unknown in Europe, unanticipated by European colonists, and invisible to many New England farmers in Thoreau's time.

The dry tropical forest along the foot of the Sierra is much less well known, even now, than the New England forests were in Thoreau's day. Dry tropical forest is wetter and taller than thorn forest of the southern Sonoran coastal plain and drier and shorter than New England woods. All are deciduous in their own way, losing leaves either to frost or to drought. Dry tropical forest extends to 29° North with occasional species even beyond, a narrow finger pointing up out of the tropics almost touching the Sonora-Arizona border. When Alberto Burquez, a young Sonoran ecologist raised in Hermosillo and familiar with the Sonoran Desert from his childhood, went as a teenager to Alamos, the trees looked so big and handsome he thought he was seeing a tropical jungle. He grew up in a place where no native upland trees exceeded twelve feet tall, so a canopy twenty to forty feet above the ground was indeed impressive.

From the main plaza in Alamos one can sip a cool drink and gaze into second growth dry tropical forest covering steep hills at the edge of town less than a mile away. Here, in Sonora, the trees may not be huge (although some figs are), but they still make up fine woods, as the young Alberto Burquez realized. Hot climates, typically innocent of frost or snow, appropriately dry most of the year and predictably wet at least two months in summer, are what this forest needs.

Alberto and his wife Angelina ("Gela" to her friends) Martinez recently earned doctorates in biology at Cambridge University in England. They are part of the new cadre of enthusiastic and highly skilled Mexican ecologists investigating their homeland. Mexico is extraordinarily rich in plants and animals, especially along the interface of the temperate and tropical forests that twist and turn endlessly through mountains and barrancas of the Sierra Madre, the sort of tropical maze I was looking into from Mesa La Polvosa in 1956.

We (Gela, Alberto, their two small boys, Berti and Emelio, botanist Phil Jenkins from Tucson and me) had gathered on Stephanie Meyer's cool portal outside Alamos next to the Alamos airport. With the cooperation of a neighbor, an Alaskan bush pilot in his other life, Stephanie had arranged a flight for us up the Cuchujaqui. Gela brought her video camera, and for almost an hour as we flew low above the river she taped the dry tropical forest and the encroaching new pastures, some scarred by piles of freshly burned trees left by ranchers preparing *lebensraum* for buffel grass. How I wished I had video tapes from my earlier flights! Gela and Alberto were well acquainted with the trees, the habitat, and the threats to it through their own research at Chamela, a field station operated in Jalisco by Mexico's Instituto de Biologia of the Universidad Nacional Autonoma de Mexico, better known as UNAM. Chamela is some 450 miles south of southern Sonora. Just as New Englanders can trace their forest trees — beech, sugar maple, red oak, hemlock, hickory — into rich, moist woods as far south as South Carolina or Georgia, so the trees of the dry forest around Alamos (locally called *monte mohino*) can be traced far to the south through seasonably dry parts of southern Mexico into dry interior valleys in Central America.

In Sonora, no less than in New England (although their leaves usually are smaller and the colors less brilliant), the trees display fall colors, such as the yellows of the torotes in September and October and russet reds of palo colorado and brasil in winter. Far more impressive are the flowers that completely outdo those of temperate forest trees. Tropical trees store energy in summer and budget appropriately for flowering in the dry season when bird, bat and insect pollinators can more easily penetrate the bare leafless branches. Unlike the conifer or hardwood forests of North America in which the majority of the trees are wind pollinated (to the distress of allergics), the forests of the tropics, those around Alamos included, are almost exclusively animal pollinated. That means the trees produce attractive flowers or copious nectar and pollen, a veritable feeding station, for suitable animal pollinators. Flowering can vary according to annual rainfall. Flowering in the spring of 1991 was especially intense after a very wet winter and preceding summer.

Back at her house that night Stephanie Meyer showed us slides taken in her two years at Alamos that captured the changing seasons. Starting in November, morning glory trees are tipped with white blossoms that look like ping pong balls. In January the amapas, valued as timber trees, are in full bloom, a haunting rose red color on otherwise naked branches of the dark-trunked trees on the hills, softly glowing in the mild winter sun. In the understory during early spring a shrubby cassia is covered with bright yellow flowers, its pollen released only by small native bees known as buzz pollinators. Their wings must vibrate at the proper frequency to shake out the pollen. The large purple flowers of a roadside nightshade, *sacamanteca*, also require buzz pollinators. In March abundant large blossoms, suggesting golden torches, mark the position of each *palo barril*, a stately tree of the upper slopes. Red accent appears in April thanks to blossoms covering the *torote verde* or tree ocotillo, a relative of the coachwhip of Arizona and the borderlands. May brings large creamy white flowers on *guajilote*; while in May and June the incessant blue of guayacan and nesco is punctuated by red trumpets of the chilicote, a tubular flower sought by hummingbirds. In late summer and fall there is a blanket of color from a sulfur orange cosmos (now popular as a garden flower) along with purple bells on morning glory vines and fox-glove-like flowers on the aguarcito whose flat-lying upper leaves close to clasp prayerfully at night. November comes and the tree morning glories begin again. Any one of these and other breathtaking botanical outbursts that I have not mentioned would be sufficient to justify a major pilgrimage like the gathering in May of hundreds of thousands of Philadelphia suburbanites driving through Valley Forge, Pennsylvania, to see dogwood in bloom. There is much celebrating to do if all the "botanical birthdays" of Alamos are to be acknowledged. Along with the saints' days on the calendar we need individually named weeks or months to commemorate the expected sequential flowering of the trees, shrubs and vines of this neglected tropical world.

Fruits and fruiting are also budgeted by each species. On the hillslopes some trees (*vara prieta* and *palo colorado*) throw their seeds through the air with a sudden twist of the drying pod. Others endow their seeds with a feathery parachute, especially noticeable in the big white powder puffs of kapok (*Ceiba*) fruits, which hang on the trees through the winter. In the lowlands

mesquite, *guamuchil*, *guinora* (boat spine acacia), strangling figs, tropical hackberry and other trees that grow along fence rows or near streams, the natural haunts of mammals and birds, have fruits designed to attract hungry mammals and birds. It would seem that the fruits expect to be taken to their favorite habitat by their animal vectors. The cascade of sugary pulp investing the pods of mesquite and guinolo, dropped in June at the end of a long dry season, is eagerly sought by large herbivores. After gorging, they defecate the undamaged seeds in a spot the animal picks, often shady, on soft ground and near water, at a point some distance away from the parent tree, in similar habitat, just what the mesquite or other tasty fruited tree had "intended" for its progeny in the first place.

Above the floodplains, the stony hills of southern Sonora are clothed in thorn forest or dry tropical forest. They rarely support mesquite or similar trees with sugary fruits. When they do, the exceptions usually grow along a trail crossing a low pass or saddle that is favored by livestock in hot weather, the kind of place animals will seek out for cool breezes and to escape bugs, along the easiest path. Manure accumulates including mesquite seeds from pods the animals ate down below. The result is to establish a few extralocal mesquite trees up on the airy *puertos* (passes across hills).

The sweet pods of mesquite have a long history. They did not evolve in response to cattle or horses or other domestic newcomers, ourselves included. Presumably, the extinct megafauna I have alluded to earlier, the native American elephants, extinct horses, ground sloths, and glyptodonts, were the intended dispersers for the fallen fruit. The tasty wild fruits designed to entice mammals and birds was part of the Garden of Eden gift to our species. After the megafaunal extinctions, beans of mesquite and other legumes, fruits of *guaiparin* (Sonoran persimmon) and other fruiting trees helped sustain native Americans in the Sonoran region. People and their livestock are now the proxies for the extinct beasts, helping to disperse the native trees.

The destiny of this land and its natives is being shaped by many forces and the outcome is unclear. There is a major opportunity now for those who love the Sierra, the montane oaks, pines and especially the many tropical species in the dry tropical forest of the foothills and barrancas to

join forces. Sonorans and Chihuahuans and their supporters outside the region have a chance to secure values that are easily crushed by narrow economic determinism. The problem of value, of wildness versus development, haunts our generation, this century, our world. If a modest economic return is possible when *vaqueros* (cowboys) run criollo cattle in the woods rather than charlois cattle in cleared pastures, is that enough to save both the *monte*, the criollo stock and the *vaqueros* themselves? Are there *gente de vision* to step forward and explore ways to help preserve the Sierra de Alamos and the "Forests of the Night," the wild country above a wild river, the Rio Mayo rushing down from its birthplace beyond Moris to San Bernardo, through the land of the Warahio, the deer, and the jaguar?

Chuck Bowden and Jack Dykinga, Alberto Borquez and Stephanie Meyer and others are optimistic. Mexican governmental agencies SARH and SEDUE are planning an ecological preserve for the Sierra de Alamos. The new Centro Ecologico de Sonora and the even newer branch of the Centro de Ecologia, UNAM, in Hermosillo, along with politicians and range managers are exploring conservation initiatives. The *monte* east of Highway 15 is no longer an unknown world. Of course, it never was unknown to its real denizens, the people of the Sierra who shared some of its secrets with Howard Gentry and are eager to share more with a new generation.

The country people have a word for a beloved place, derived from the Spanish verb *querer*, to love, to like. The Sierra is their *querencia*. One must admire their feelings and their insight. The *querencias* of this land cry for appreciation, protection and a new vision of stewardship.

References

- Bowden, Charles. In press. *The Secret Forest*. Illustrated by Jack Dykinga. University of New Mexico Press, Albuquerque.
- Covey, Cyclone, Translator. 1961. *Cabeza de Vaca's Adventures in the Unknown Interior of America*. University of New Mexico Press, Albuquerque, 160 pp.
- Dobie, J. Frank. 1947. *Apache Gold and Yaqui Silver*. Little, Brown and Company, Boston.
- Gentry, Howard Scott. 1942. *Rio Mayo Plants: A Study of the Flora and Vegetation of the Valley of the Rio Mayo, Sonora*. Carnegie Institution of Washington Publication 527, 328 pp. (out of print).
- Gentry, Howard Scott. 1963. *The Warihio Indians of Sonora-Chihuahua: An Ethnographic Survey*. Smithsonian Institution, Bureau of American Ethnology Bulletin 186: 61-144, Washington, D.C.
- Goldberg, Deborah E. 1982. *The Distribution of Evergreen and Deciduous Trees Relative to Soil Type: An Example from the Sierra Madre, Mexico, and a General Model*. *Ecology* 63: 942-951.
- Jenks, Randolph and Beverly Powell. 1991. *Desert Quest*. Zaudervan Publishing House, Grand Rapids, Michigan, 174 pp.
- Mason, Charles T. Jr. and Patricia B. Mason. 1987. *A Handbook of Mexican Roadside Flora*. The University of Arizona Press, Tucson, 380 pp.
- Sauer, Carl O. 1963. *Road to Cibola*, pp. 53-103 in *Land and Life: A Selection of Writings of Carl Ortwin Sauer*, edited by John Leighly. University of California Press, Berkeley.
- Thoreau, Henry David. 1984. *Autumnal Tints*, pp. 137-177 in *The Natural History Essays*. Peregrine Smith books, Salt Lake City, Utah.
- Torrey, Bradford and Francis H. Allen, eds. *The Journal of Henry David Thoreau, Volume 11*. Reprint by Peregrine Smith Books, Salt Lake City, Utah, 1984.

Appendix*

*Species marked with an asterisk are illustrated in A Handbook of Mexican Roadside Flora by Mason and Mason.

<u>English</u>	<u>Spanish</u>	<u>Family</u>	<u>Genus</u>	<u>Species</u>
aborigine's comb	hecho	Cactaceae	<i>Pachycereus</i>	<i>pectin-aboriginum</i>
aguarita	aguarita	Pedaliaceae	<i>Martynia</i>	<i>annua</i>
alder	alamillo	Betulaceae	<i>Alnus</i>	<i>oblongifolia</i>
amapa	amapa amarilla	Bignoniaceae	<i>Tabebuia</i>	<i>chrysantha</i>
amapa	amapa colorada	Bignoniaceae	<i>Tabebuia</i>	<i>palmeri</i>
Arizona cypress	tascate	Cupressaceae	<i>Cupressus</i>	<i>arizonica</i>
Arizona oak	encino blanco	Fagaceae	<i>Quercus</i>	<i>arizonica</i>
basswood	-----	Tiliaceae	<i>Tilia</i>	<i>mexicana</i>
big-toothed maple	palo de azucar	Aceraceae	<i>Acer</i>	<i>grandidentatum</i>
boat spine acacia	guinora, chirowi	Fabaceae	<i>Acacia</i>	<i>cochliacantha</i>
brasil wood	brasil	Fabaceae	<i>Haematoxylon</i>	<i>brasiletto</i>
buffel grass	buffel	Poaceae	<i>Pennisetum</i>	<i>ciliare</i>
bursera	torote	Burseraceae	<i>Bursera</i>	various species
cardinal flower	-----	Lobeliaceae	<i>Lobelia</i>	<i>laxiflora</i>
Chihuahua oak	encino roble	Fagaceae	<i>Quercus</i>	<i>chihuahuensis</i>
coral bean	chilicote	Fabaceae	<i>Erythrina</i>	<i>flabelliformis</i>
cow's horn agave	lechuguilla	Agavaceae	<i>Agave</i>	<i>bovicornuta</i>
cup leaf oak	encino gueja	Fagaceae	<i>Quercus</i>	<i>"mcvaughii"</i>
desert spoon	sotol	Agavaceae	<i>Dasyilirion</i>	(new species)
dragon blood, limberbush	ensangregrado	Euphorbiaceae	<i>Jatropha</i>	<i>platanifolia</i>
egg cone pine	pino blanco	Pinaceae	<i>Pinus</i>	<i>ocarpa</i>
epiphytic orchid	kiki	Orchidaceae	<i>Laelia</i>	<i>bancilarie</i>
feather tree	mauto, mauuto	Fabaceae	<i>Lysiloma</i>	<i>divaricata</i>

feather tree	tepeguaje	Fabaceae	<i>Lysiloma</i>	<i>microphylla</i>
fragipani	suchil, cacalosuchi	Apocynaceae	<i>Plumeria</i>	<i>acutifolia</i>
goat's beard	barba de chivato	Fabaceae	<i>Calliandra</i>	<i>houstoniana</i>
golden cosmos	-----	Asteraceae	<i>Cosmos</i>	<i>sulphureus</i>
guamuchil	guamuchil	Fabaceae	<i>Pithecellobium</i>	<i>dulce</i>
guasima	guásima	Sterculiaceae	<i>Guazuma</i>	<i>ulmifolia</i>
guayacan	guayacan	Zygophyllaceae	<i>Guaiacum</i>	<i>coulteri</i>
holly	-----	Aquifoliaceae	<i>Ilex</i>	<i>tolucana</i>
hop bush	jarilla	Sapindaceae	<i>Dodonaea</i>	<i>viscosa</i>
hop horn beam	huasimilla	Carpinaceae	<i>Ostrya</i>	<i>virginiana</i>
kapok	pochote	Bombacaceae	<i>Ceiba</i>	<i>acuminata</i>
kusi	kusi	Fagaceae	<i>Quercus</i>	<i>albocincta</i>
lupine	-----	Fabaceae	<i>Lupinus</i>	<i>huachucanus</i>
madrone	madrono	Ericaceae	<i>Arbutus</i>	<i>arizonica</i>
madrone	madrono	Ericaceae	<i>Arbutus</i>	<i>xalapensis</i>
mesquite	mesquite	Fabaceae	<i>Prosopis</i>	<i>juliflora</i>
Mexican cottonwood	alamo	Salicaceae	<i>Populus</i>	<i>mexicana</i>
Mexican jumping bean	brincado	Euphorbiaceae	<i>Sebastiana</i>	<i>pringlei</i>
Mexican sycamore	aliso	Platanaceae	<i>Platanus</i>	<i>racemosa</i>
Montezuma cypress	sabino	Taxodiaceae	<i>Taxodium</i>	<i>mucronatum</i>
morning glory	trompio, other names	Convolvulaceae	<i>Ipomoea</i>	numerous species
morning glory tree	palo santo	Convolvulaceae	<i>Ipomoea</i>	<i>arborescens</i>
mountain muhley	cola de raton	Poaceae	<i>Muhlenbergia</i>	<i>emersleyi</i>
nesco	nesco	Fabaceae	<i>Willardia</i>	<i>mexicana</i>
night shade	sacamontaca	Solanaceae	<i>Solanum</i>	<i>amazonium</i>

octopus agave	amole	Agavaceae	<i>Agave</i>	<i>vilmoreana</i>
palo barril	palo barril	Cochlospermaceae	<i>Cochlospermum</i>	<i>vitifolium</i>
palo blanco	palo blanco	Fabaceae	<i>Piscidia</i>	<i>mollis</i>
palo cachora	palo cachora	Olacaceae	<i>Schoepfia</i> sp.	
palo chino	palo chino	Fabaceae	<i>Pithecellobium</i>	<i>mexicanum</i>
palo colorado	palo colorado	Fabaceae	<i>Caesalpinia</i>	<i>platyloba</i>
papache	papache	Rubiaceae	<i>Randia</i>	<i>echinocarpa</i>
rock fig	tescalama	Moraceae	<i>Ficus</i>	<i>petiolaris</i>
sahuaro	sahuaro	Cactaceae	<i>Cereus</i>	<i>giganteus</i>
scarlet salvia	salvia roja	Lamiaceae	<i>Salvia</i>	<i>elegans</i>
shaving brush tree	guajilote	Bombacaceae	<i>Bombax</i>	<i>palmeri</i>
shrubby cassia	ejotillo del monte	Fabaceae	<i>Cassia</i>	<i>biflora</i>
silk tassle	-----	Garryaceae	<i>Garrya</i> <i>Garrya</i>	<i>ovata</i> <i>laurifolia</i>
silver leaf oak	encino	Fagaceae	<i>Quercus</i>	<i>hypoleucoides</i>
Sonoran persimmon	guaiparin	Ebenaceae	<i>Diospyros</i>	<i>sonorae</i>
soup bowl oak	encino gueja	Fagaceae	<i>Quercus</i>	<i>pennivenia</i>
stinging bush	ortuguilla	Urticaceae	<i>Urera</i>	<i>caracasana</i>
strangling fig	nacopuli	Moraceae	<i>Ficus</i>	<i>cotinifolia</i> , other species
sunflower bush	-----	Asteraceae	<i>Jaumea</i>	<i>peduncularis</i>
tank bromeliad	mescalito	Bromeliaceae	<i>Tillandsia</i>	<i>cretacea</i>
tree limberbush	torote	Euphorbiaceae	<i>Jatropha</i>	<i>cordata</i>
tree ocotillo	torote verde	Fouquieriaceae	<i>Fouquiera</i>	<i>macdougalii</i>
tempisque	tempisque	Sapotaceae	<i>Sideroxylon</i>	<i>angustifolium</i>
tropical hackberry	garabato	Ulmaceae	<i>Celtis</i>	<i>iguanea</i>
-----	garabato	Nyctaginaceae	<i>Pisonia</i>	<i>capitata</i>
Ures palm	palma	Arecaceae	<i>Sabal</i>	<i>uresana</i>

vara prieta	vara prieta	Fabaceae	<i>Brongniartia</i>	<i>alamosana</i>
white cottonwood	guerigo	Salicaceae	<i>Populus</i>	<i>monticola</i>
wild jicama	jicama	Polygonaceae	<i>Exogonium</i>	<i>bracteatum</i>
willow-leaved oak	saucillo	Fagaceae	<i>Quercus</i>	<i>viminea</i>