

## DRAGONS OF A DESERT FOREST



**Desert Spiny Lizard**  
(*Sceloporus magister*)

### *APRIL*

Some days I feel insignificant. Crowded freeways, swarming shopping malls, college classrooms make me feel puny and inconsequential. On my good days I try to fight such feelings because they can be used to justify doing almost anything or more often, they can be used to justify doing nothing. Sometimes a place can help to deal with such feelings. For me one such spot is a mesquite woodland, a desert forest. It is a place where I feel comfortable, a place that almost always lets me leave feeling better than when I came.

It is mid-morning on a day in early April and I am paying a return visit to a mesquite forest located on a flood plain of the Salt River near Phoenix, Arizona. The rays of the Sonoran Desert's sun are already mildly uncomfortable. I recognize individual trees and am glad to see them again. The mesquites in this particular forest include some large individuals, between 35 and 40 feet tall with their basal trunks perhaps as thick as three feet in diameter. Their bark is rough and dark, contrasting sharply with new bright green lacy leaves, which each tree has produced, signaling the beginning of a new growing season. Soon many trees will be covered with small pale yellow flowers hanging down together in long woolly-worm masses. A mature mesquite tree produces over a million blossoms in a

single season, attracting more kinds of animals than any other plant found in the Sonoran Desert, according to Gary Nabhan in his excellent book, Gathering the Desert.

Mesquite formerly grew along many of the larger desert drainage ways in Arizona in dense forest-like stands called *bosques*. As human undertakings began to alter these desert rivers the fate of many a magnificent mesquite bosque was sealed as well. Today in Arizona only remnants of these once grand mesquite bosques remain, but these are still very important sites for birds and a large variety of other wildlife. Despite my admiration for mesquite trees, I have not come to this place on this day to honor them; instead I have come to search their branches for lizards, tiny dragons who hunt, fight, breed, and die among the boughs of the mesquite.

I am a self-trained lizard watcher. As I amble around amongst the mesquites I stare at their trunks, limbs, and smaller branches for signs of motion or for a certain pattern or shape that identifies one of the resident lizards for which I search. It is an odd form of hunting, but not without considerable satisfaction in the searching. Today I concentrate mainly on the main trunks and lower limbs of the mesquites, for the lizards seem to be more common here than in other parts of the trees. The targets of my hunt are small, only a few inches in length. They possess definite sets of colors and patterns that blend in well with the natural background upon which they live. Perhaps it is concentration on a single "search image" that causes me to fail to see a much larger reptile until I am only a few feet away from her. A coachwhip or red racer is circling around the base of a moderate sized mesquite about ten feet from me. This snake, like others of its kind, is long and slender, perhaps five feet in length, and extremely agile. It moves first from one side of the tree and then rapidly around to the other, stopping briefly to raise at least one-third of its body off the ground to stare at the tree with alert round pupils. Next she drops her body to the ground and proceeds to the opposite side of the tree where this pattern is repeated. The snake's behavior seems peculiar, but as I watch I see the objective of her actions. When she goes to one side of the mesquite, a tree lizard appears on the other. The lizard does not seem particularly impressed with the predatory skills of his pursuer. He does not flee rapidly up the tree but seems to be most concerned about preventing the snake from viewing him directly. This time this strategy is flawed - in an instant the head of the serpent appears only a few inches away from the lizard who narrowly avoids the hooklike teeth of his pursuer. The tree lizard climbs rapidly upward into the tree to a height of perhaps fifteen feet, but the coachwhip has no difficulty swiftly following the fleeing lizard. Now up in the tree, the coachwhip repeats its "peek-a-boo" pattern circling the entire tree with its head and fore-coils, rapidly flicking its dark tongue in and out repeatedly. The tree lizard remains stone still, his chances appearing slim.

I have no intention of interrupting this natural drama unfolding before me. Yet despite my lack of intention to interfere, the coachwhip suddenly seems aware of my presence. In an instant her hunt is over. Swiftly she climbs higher into the tree and then almost effortlessly she glides from branch to branch and then from one branch to a branch in an adjacent tree. Her method of locomotion is a graceful mixture of climbing, gliding, and falling. She moves through the trees with the same smooth and elegant undulations that seem to work so well on the ground as well.

I give half-hearted pursuit, mostly to get a better view. My efforts are futile, for the coachwhip rapidly descends to the ground and then quickly disappears in a direction I am unable to determine. I am left standing, impressed with the speed and the agility of a creature without limbs. Without legs they crawl, climb, chase, feed, flee, frighten, and fascinate.

Not long ago, I was asked to talk about snakes to a group of visitors to the Phoenix Zoo. The zoo had provided me with several serpentine "volunteers" to show these folks and I was busy trying to teach my audience something about these animals. It is my hope that at least one person leaves such a

talk with increased tolerance of and appreciation for these legless reptiles. As I continued talking, my eyes kept returning to a lady in the audience whose own eyes were fixed on a snake in one of the cages. The snake at which she stared was an average sized gopher snake, an attractive but not particularly unusual fellow. He was being held in a plastic cage that was labeled "Handicapped Program." The snake was among those used by a group of Phoenix Zoo volunteers to help demonstrate animals to handicapped children. Each time I would glance at the lady she seemed almost entranced by the gopher snake. I soon found myself more interested in this woman's behavior than in what I was saying, to the point where I forgot what I had just said and what I should say next. But somehow I finished my talk and asked for questions. I answered one or two before the lady who had stared at the gopher snake cautiously raised her hand.

Simultaneously she pointed to the gopher snake and to the label on its plastic cage and asked, "Is that snake really handicapped?"

I looked at the gopher snake for a moment or two and then turned back toward the lady and solemnly answered, "Yes ma'am, can't you see he doesn't have any arms or legs?"

Well, some of the members of my audience saw some humor in my answer, but the lady who asked the question was not amused. To this day I am glad that she was unable to find anything resembling a weapon nearby. If I learned anything from this experience it was that while being limbless is no handicap for a snake, bad taste is probably a handicap for a human being.

Such experiences among my own species have made me even more thankful for the opportunity to escape to a place like a mesquite bosque. Almost every trip allows a new discovery or a chance to see already discovered things in a new way. Today I have stopped my search for lizards to watch larval ant lions build their perfectly symmetrical funnel-shaped traps in the sandy soil beneath the mesquite trees. Later these tiny, curious, large-jawed predators will change into lacy winged, slender-bodied adults who seem too fragile for such a developmental history.

Near some of the ant lion funnels are tiny footprints in the sand accompanied by a larger streak formed in the sand by the tail of another lizard resident of the mesquite bosque. This particular patch of mesquite trees is home to six lizard species. Three of the mesquite bosque lizards are arboreal or tree dwelling while the other three makes their living mainly on the ground, opting for a terrestrial life style. The tree lizard mentioned earlier shares the arboreal habitat with its close cousin, the long-tailed brush lizard, and with the much larger desert spiny lizard. The ground-dwelling species include the side-blotched lizard, the zebra-tailed lizard, and the tiger whiptail lizard.

All of these lizard species, with the exception of the tiger whiptail lizard, belong to the same family of lizards, the family Iguanidae. This is a relatively large family of lizards (approximately 650 species) which is restricted mainly to the continents of North and South America. Most members of the family Iguanidae are active in the daytime, are good climbers, and are highly dependent upon vision as their primary sensory modality. They see colors and have often evolved structures and behavioral devices that have visual significance, such as extensible throat pouches and throat fans, and brilliant colors upon the throat, shoulders, sides, and belly.

The tiger whiptail belongs to a quite different group, the family Teiidae. Whiptails rely more on their sense of smell to find food and as a result dine for the most part on quite different fare from the mesquite dwelling iguanids. The foot and tail prints in the sand belong to a tiger whiptail (The subspecies found in this locale is called the Arizona Desert Whiptail). I follow them for a few feet but they disappear as the ground becomes more compacted with no surface area of loose sand. However, it takes only a few seconds more to spot a large tiger whiptail moving along the ground near the bases of a pair of small mesquite trees. The tiger whiptail is a long streamline lizard with a

pointed nose that it is constantly sticking into the sand or soil apparently in search of prey. Occasionally the lizard stops and digs rapidly with powerful forelimbs. The forearms of these lizards seem much larger than their upper arms, causing them to somewhat resemble the upper appendages of Popeye the Sailor Man. In the case of the whiptail lizards, however, these powerful forearms have nothing to do with nautical travel but are apparently an adaptation allowing these reptiles to rapidly dig up beetle larvae and other prey located by the lizard's nose and tongue.

Whiptail lizards do not depend exclusively on buried prey and are also capable of capturing grasshoppers and other insects on the surface. In addition to insects, whiptails are known to eat spiders, scorpions, centipedes, and other small animals, including other lizards. To this list my wife might suggest that I also add two more foods: fried chicken and hard-boiled eggs. To those who might be skeptical as to the authenticity of this report let me admit that I am also an eye witness that at least one tiger whiptail lizard has fed upon such rations. On a picnic trip to the banks of the Verde River (a tributary of Arizona's Salt River earlier alluded to), I had left my wife and a companion while I briefly hiked along the river to work up an appetite and to avoid any chores associated with setting up the picnic lunch. When I returned to join my wife and her friend I asked for a piece of chicken but she replied that she was sorry but she had just shared the last piece with a passing lizard. My wife was never a particularly good liar but this seemed to be hitting a low point even for her.

As I began to express my doubts on the validity of her story she interrupted me and simply told me to wait and the lizard would return shortly. As I sat contemplating what sentence would be appropriate for a skilled chicken thief, my wife said in a hushed whisper, "Quiet! Here he comes!" Sure enough an adult tiger whiptail lizard was approaching the edge of a blanket that my wife had spread on the ground to contain the contents of our picnic. When the lizard reached the boundary between blanket and desert soil, it stopped and paused, seemingly cautious about stepping upon the blanket. At this moment my wife tossed a small piece of chicken in his direction and the lizard moved toward the chicken with a rather strange jerky gait, turning his head from side to side. When he reached the piece of chicken he touched it once with his slender forked tongue before quickly seizing it with his jaws and then rapidly bolting away carrying his prize over a small hill and out of sight. He returned a total of three more times, first for an additional rather large tidbit of chicken, then a piece of hard-boiled egg, and finally for a piece of eggshell. He did not return again, perhaps dissatisfied with the quality of my wife's last offering. In her defense I must admit that I had eaten up all of the other edibles by this time. In any case, the pieces of chicken that this whiptail had absconded with seemed too large for him to have eaten all at one time. Perhaps he was hoarding these pieces of "carrion," but I know of no descriptions of this type of behavior in whiptail lizards.

Whiptail lizards belong to the genus *Cnemidophorus* (the letter C is silent when the name is pronounced). Their reproduction, behavior, and genetics have been the focus of considerable scientific study. While some species like the tiger whiptail lizard are essentially "normal" when it comes to reproduction, other whiptail lizard species are unusual in that no male individuals have ever been found. These all-female species reproduce through a process called parthenogenesis ("virgin-birth"). Females lay viable but unfertilized eggs that hatch into female lizards only.

Tiger whiptails share the mesquite forest floor with two other lizard species: zebra-tailed lizards which are more common in sandy desert washes, and smaller side-blotched lizards which occupy a variety of habitats in the southwestern United States. One might ask how these three lizards can "peacefully coexist." That is, why doesn't one of the three species out compete the other two in the struggle for food and other resources? The answer to this question seems to be that they really are not complete competitors. Each lizard species fills a different niche in the mesquite forest community. By

feeding on different foods, at different times, in somewhat different places, or in different ways, the members of one lizard species avoid competing with members of other species. The avoidance of competition under some conditions, rather than direct skill at competition, may be essential for evolutionary survival.

I have come to the mesquite forest to look for the lizards that dwell in the trees but I have spent my time watching almost everything else. I have observed coachwhips and whiptail lizards, ant lions and a great horned owl, woodpeckers and jumping spiders, but not the creatures that have brought me to this spot in the first place. I do not feel much guilt in allowing myself time to observe the birds of the mesquite bosque. To me the birds are the "feathered lizards" of the trees. Their colors and their behaviors are much like those of arboreal lizards. There is much the same satisfaction in lizard watching as in bird watching. I have included this statement at this point only because I am confident that few readers will believe me. Many people seem to enjoy bird watching but lizard watchers are as rare as some endangered species. Perhaps it is pretension on my part but I am glad that there are many bird watchers and only a few lizard watchers. There are also more sparrows than eagles.

Employing two different strategies of predatory animals there are "active" and "ambush" lizard watchers. I tend to favor the former strategy of continually moving and searching, but with increasing age I find the ambush strategy of waiting and watching from one place becoming more attractive. The problem is that often times (today is no exception) lizards spend much time basking, hiding, and just generally conserving energy. All of these saurian behaviors make good sense but they do not result in particularly stimulating observation. Therefore I keep moving, noting where and when I spot resident male tree lizards and long-tailed brush lizards. I watch female tree lizards patrolling about, but I observe only one female long-tail brush lizard, despite seeing at least twelve males of this species today.

Usually tree lizards or long-tailed brush lizards are most often found at the base of a mesquite tree just a few feet above the ground. The usual response of these lizards when one approaches is to flee upward into the mesquite and out of sight. Yet sometimes it is the exceptional lizard response that is more interesting than the typical. I approach one rather large male tree lizard feasting on small black ants at the base of a rather strangely branched mesquite. I try to get close enough to this fellow to see exactly what he is eating but my presence is not appreciated. The lizard climbs up to a height of about six feet in the same tree and stops, staring directly at me. He pauses for several seconds, sitting motionless on a horizontal limb before darting still higher into the tree, finally stopping at a new height about twelve feet above the ground. At this second height he stops, turns his body sideways towards me and tilts his body so that it is oriented directly toward me several feet below him on the ground. In this position he does a series of seven push-ups performed on all four legs. His throat is extended, revealing brilliant orange and green coloration, and his body is compressed laterally during these push-ups revealing luminous turquoise blue belly patches.

This male lizard has performed a visual display and sent me a message. Lacking the brain of a tree lizard I am not capable of completely comprehending this message. What did this display mean? What did this lizard say to me? Perhaps his message is, "Predator, you have been seen. You will not catch anything to eat now so go away and hunt elsewhere!" A similar explanation has been suggested for the "tail-flagging" wave of an escaping white-tailed deer to a near-by mountain lion or other predator.

I am now participating in a way of examining our world called science. To do science one first tries to make objective observations of the real world. Next one asks a question. In this case the question is: "Why does a tree lizard do push-ups?" Once we have a question we can formulate hypotheses (possible answers) to our question. In our case one hypothesis is: "This display serves to

inform predators that they have been spotted so that they will leave the vicinity of the lizard." This is a valid hypothesis. A valid hypothesis may not necessarily be true, or if true it may not be the whole truth. A hypothesis is valid if it attempts to explain observed phenomena and if it is testable. Attempted explanations, which do not meet these two criteria, are invalid.

The testing of our hypothesis explaining lizard push-ups now requires that additional observations be made. I continue to walk amongst the mesquites but I see nothing that sheds any new light on the correctness of my hypothesis. The sun is now very low on the horizon and additional observations and answers will have to wait for future walks through the mesquite forest.

## *MAY*

One month ago grasses, dense stands of London Rocket, and other annual plants covered the mesquite forest floor. Now it is mid-May and what was a green lush ground cover in many places is now brown, dead, or gone. It is now mid-afternoon and the temperature is close to, if not in excess of one hundred degrees. The lizards of the mesquite bosque do not mind. They are active and abundant. This year's winter rains have been greater than normal. Increased plant growth has helped populations of insects and spiders and ultimately their saurian predators as well. Tree lizards of both sexes can be found easily, but they are not quite as common near the ground as they were one month ago. The long-tailed brush lizard seems to be the most abundant lizard of the three arboreal species. Both males and females can be detected with a minimal amount of searching. Often a pair of long-tailed brush lizards will be found with the male and female only a few inches apart on the main trunk of a small to average size mesquite tree. Larger desert spiny lizards can be seen, but despite their size they are the most difficult of the three species to spot. Often they are heard first, and then seen only as they scurry into a tree cavity or scoot to the ground to take refuge in a rodent burrow.

I watch one large male long-tailed brush lizard as he forages about in the branches near the top of a mesquite tree. He comes to the end of a branch and then jumps across a ten inch span landing on a similar branch in an adjacent tree. He does not seem to be foraging now but instead he seems to be heading downward toward the mesquite's main trunk, perhaps to reach the ground. He comes to a point about six feet above the ground where he stops, opens his mouth slightly and turns his body exactly ninety degrees from his previous direction of travel. Next, he proceeds to perform a series of several push-ups done on all four legs. His body is compressed laterally; revealing an iridescent speckled blue-green belly. His throat is extended, dull orange in color and adorned by a large, centrally located crescent shaped scar.

His push-up display is similar to that of the tree lizard described earlier but the timing of the bobs is somewhat different. The first push-up in particular is notably more complex, including some partial bobs that were not observed in the display of the tree lizard.

It is also quite clear that I am not the target of his display. Four feet below the displaying long-tailed brush lizard is another male of his own species. This second male is slightly smaller than the first. By the time I notice him he has apparently turned himself so that his body is now sideways and parallel to the first male up above him in the tree. Like the descending male, he too performs a series of push-ups. The two males do not perform push-ups simultaneously but alternately. The timing of the bobs of the two male lizards seems identical or nearly so. The display of the lizard at the base of the tree reveals the same bluish-green belly patches as the other lizard above him, but the former's throat is a bright yellow compared to the dull orange throat of the latter.

Both lizards repeat a series of push-ups twice more before the larger lizard stops and begins moving down the tree. His mouth is slightly open as he progresses down the tree in a slow and jerky

manner. In an instant he is attacked by the male from below. The open jaws of his opponent meet the attacker's bite. The battle is now joined and so are the lizards; their jaws are locked together. Their bodies become almost perfectly still except for the simultaneously twitching tails of the two combatants. Suddenly with a violent jerk, the smaller yellow-throated male twists his entire body and both he and his jaw-locked opponent fall to the ground below.

They land on their feet, still connected by interlocked jaws. The yellow-throated male has the upper jaw of the orange-throated male between his own. The upper and lower jaw of the orange-throated male are firmly clamped onto the lower jaw of his smaller opponent. Again the yellow-throated male twists his body and this time the pair rolls over and over in the dead grass. Finally the pair breaks apart and the orange throated male runs away along the ground, headed apparently for a different mesquite tree. The yellow-throated male simply returns to the mesquite tree and reassumes a position very near the one where I first saw him only minutes ago. He settles down and remains motionless. It is as if nothing has happened at all.

These most recent observations do not support our original hypothesis (predator notification) as to the function of iguanid push-up displays. In this case the male long-tailed brush lizards "aimed" these displays at another member of his own species and his own sex. This suggests perhaps that these displays function in inter-lizard communication and perhaps that they are related to territorial defense.

Biologists have defined a territory as a "defended area." Usually this "defended area" is guarded against other members of an individual's own species and own sex, but this is not always the case. This simple definition does not limit the methodology of defense. In addition, it states that what is defended is a particular two-dimensional area, thus fixing this defense to a geographic locality. There are many reasons why lizards and other animals should not defend areas against others of their own species and sex. Such behavior can result in potential injuries or even death from fighting or more likely from the increased exposure to predators that may be necessary to successfully defend a territory. Energy and time devoted to defending a territory is not available for other pursuits including, perhaps, looking for food and other resources. Unless resources are clumped and concentrated, territorial defense may be inappropriate, although animals sometimes defend sites completely lacking in any observable resources.

With all of these risks and costs, territorial behavior would have been unlikely to evolve unless the benefits of this behavior are greater than the sum of these risks and costs. For some, but not all species of lizards and for some other animals this seems to be the case. An individual lizard that successfully defends a territory may be insuring himself of a share of available food resources and a share of available mates. His offspring may also have an increased chance of survival by virtue of having been born in or near quality habitat.

Conceivably we may now know why a lizard might defend a mesquite tree. The next question is how a lizard might do so. Our own species' propensity for the use of weapons might lead a human to predict that a desert spiny lizard will use whatever weapons such an animal has available to defeat a territorial intruder. Such weapons might include strong jaws, sharp teeth and claws, and perhaps a muscular tail. The problem here is that the intruder also has strong jaws, sharp teeth and claws, and a muscular tail. We might ask our typical human what do you do when your "enemy" also has weapons. His answer might be that you threaten to use your weapons, hoping all the time that you never have to do so. Threat behavior is one type of display behavior, and threats and displays may give our territorial lizard some other options besides direct or sneak attacks. Threat displays can utilize any of the sensory channels available to a particular species of animal. That is, these displays can be visual (lizard push-ups), auditory (as in bird song), or olfactory (such as scent-marking in dogs and wolves).

The best way to discover how some species of iguanid lizards actually defend territories is to watch them. It is worth noting that not all lizards are territorial. The tiger whiptail lizards described earlier may sometimes treat each other aggressively but they apparently do not engage in territorial defense. Likewise not all members of the lizard family Iguanidae defend territories, but many, including the five species that reside in this mesquite bosque, are territorial species.

## *JULY*

It is the last day of July and today the weather has turned humid as well as hot. I have returned to the mesquite bosque during Arizona's so-called monsoon season. It is now more difficult to find adult tree lizards or long-tailed brush lizards. Both are still common, but lizards of both species do not seem to be spending as much time at the base of the mesquite trees. A lizard "camped out" at the bottom of the tree where he can prevent the entrance of territorial intruders might best defend a territorial mesquite tree. Since there seem to be fewer lizards in such positions perhaps territorial defense wanes as the seasons progress.

I watch as one female tree lizard sticks her snout slightly under a piece of curling mesquite bark and apparently snags a choice food item. I can't tell what it was, most likely a small beetle or an ant, but I have also seen tree lizards eat spiders, pseudoscorpions, butterflies, and even occasional bark scorpions. Bark scorpions are medium sized scorpions that live under the bark of mesquite, cottonwood, willows and other trees in a variety of desert habitats. Like most of their kind, bark scorpions are most active at night when they emerge to search their bark-covered homes for spiders, insects, and other juicy food items. Bark scorpions are slender and graceful as scorpions go, but their venom is quite toxic, and this species is even responsible for a few human fatalities. To the tree lizard, however, they are simply a meal. Apparently the scales covering the head and face of the lizard are more than adequate protection from the scorpion's defensive sting.

This particular female tree lizard is slowly making her way up the mesquite's main trunk apparently enjoying additional snacks as she travels. Ahead along her route of travel a male tree lizard is perched at a height of about eight feet, where the mesquite's main trunk splits into two smaller limbs. When the female tree lizard reaches a point about twenty-four inches from this male, his previously motionless form instantly springs into action. He turns his body sideways toward the approaching female, compresses his body laterally, and does a series of push-ups revealing his turquoise belly and bright orange colored throat. His display consists of a simple series of six push-ups. The first three push-ups last approximately one second. The three that follow are perhaps half as long as the first three. Other male tree lizards in this area seem to perform this display in almost exactly the same way, although sometimes one or two additional push-ups may be added to the end of their displays.

It seems likely, then, that the male lizard has identified himself to the female. The colors on his throat and belly announce that he is a male. The timing of the push-up elements of his display proclaims that he is a tree lizard.

I watch for the female's response. Will she run away? Will she respond with a display of her own? Oddly enough she does neither. She simply continues her own leisurely pace upward into the mesquite tree, eventually passing by the male, and then upward along the left fork of the mesquite's branching trunks. The male lizard follows her and again he performs an intense "push-up" display. Finally the female tree lizard responds with a display of her own. The timing of her "push-ups" is identical to her aroused male pursuer but her display differs from his in other ways. The display of the female tree lizard does not include compressing her body so that she looks larger nor does she reveal any ventral coloration. Instead her body is flattened so that she even appears smaller than normal nor

does she possess any blue color on her belly to advertise or identify herself. Nonetheless the male of her species correctly interprets her display, for he now begins a new display; his head begins to vibrate up and down rapidly as he now slowly approaches the female. As his head bobs up and down it is as if he is saying, "Yes, yes, yes!" But one should be aware of differences in communication and displays among different species.

The female tree lizard's display has functioned in a manner similar to the male's. She has apparently identified herself as both a female tree lizard and a suitable subject for what now appears to be a courtship display of the mesquite's resident male tree lizard. In this case, however, the female flees the amorous intentions of the male, who apparently gives up after what appears to be only a half-hearted chase.

I continue my walk through the mesquite forest impressed by how what appears to be such a simple display as the push-ups of tree and long-tailed brush lizards can be so complex and so important in their daily existence. It is now becoming slightly cooler as the sun's rays are at least partially blocked by some forming clouds that offer a slim hope for cooling rain in the form of a summer thundershower. The wind has begun to blow a little more as well, prophesying the approach of such an afternoon storm. As I watch the mesquite limbs begin to sway in the increasing breezes, I also notice several fat round-tailed ground squirrels high up in some of the larger trees. These stocky fellows seem completely out of place up in the trees. Unlike the long-tailed brush lizard they have a short round club-like tail that appears to be a poor tool for insuring arboreal balance. Yet the tasty mesquite pods have lured them to achieve relatively great heights as they consume these luscious delicacies far above the ground where they usually go about their busy daily schedules.

I yell up at first one and later another. "Come down before you are blown from the tree and get hurt. It's a long way down!" However, the foolish ground squirrels refuse to listen to my sage advice. Feeling ever so slightly offended that my words have apparently fallen upon deaf ears, I decide to leave the ground squirrels to their fate. They remind me of my children: once too busy and too young to listen to my generously offered words of prudence and common sense.

I continue my hike through the mesquite as the winds grow stronger and a few large drops strike the dusty ground and burst, forming tiny round spots of mud. I see few lizards now either in the trees or upon the ground. Most have apparently taken refuge in a tree cavity or other location hidden from human observation. Not so for the round-tailed ground squirrels who ignore both the raindrops and the wind, to continue stuffing their obese little bodies with more mouth-watering mesquite beans and pods. As the wind blows the ground squirrels cling to the ends of mesquite branches like fat furry flowers seemingly perfectly content to ride out a little bit of rain and wind in this fashion. Still I feel obligated to warn them one last time. "Look at the clouds coming in from the southeast," I yell. "Get down now or I won't be responsible for what happens to you!"

Despite the fact that I am a *Homo sapiens* ("man - the wise") the ground squirrels continue to disregard my warnings. I did the best that I could. If any fall and are injured it is not my fault. I have lizards to watch. I can waste no more time talking to imprudent and unwise little rodents.

I turn around and have walked about sixty feet closer to the river when it happens. I hear two, then several, squeak-like screams or scream-like squeaks. I pinpoint the source of the noise and am not surprised to see a round-tailed ground squirrel in obvious pain flopping around the ground. He is only about twenty feet from me, so I walk over toward the site of the squirrel and his agony.

As I tower above his still flopping figure a perverse feeling of smugness comes over me. I cannot resist speaking the words, "I told you so." Yet perverse self-satisfaction quickly gives way to guilt for so doing and then as quickly to compassion. I squat down alongside the injured ground squirrel

and start to reach my left hand out to see if I can somehow help the little fellow. For some reason, I hesitate. Perhaps it is because I realize there is nothing I can really do for the injured animal. Or perhaps it is because I see another creature in the corner of my left eye.

The image in my left eye is now clearer. In sharp focus is the gray scaly body of four feet of western diamondback rattlesnake. She is about sixteen inches from my left foot, my left hand, and my left buttock. Her black forked tongue is continually being thrust out and she leaves it out for a long time, allowing her olfactory senses to obtain information about the current location of her recently harvested meal of ground squirrel. She is moving very slowly forward toward the now deceased ground squirrel. Unfortunately this means that she is also moving slowly toward the squirrel's Good Samaritan as well.

It is at moments such as this that the importance of doing "good science" becomes altogether too obvious. A good scientist should always be open to alternative hypotheses. A good scientist should strive to make unbiased objective observations. I have done neither and as a result now face my current predicament.

I have been told or have read somewhere that a rattlesnake can strike up to about one-half of its body length. If true, I am well within the range of this one's ability to cause me considerable discomfort. Fortunately she seems completely and only interested in her next meal. I slowly rise to my feet and gently take a few steps backward. The rattlesnake crawls directly to the now still body of the ground squirrel and proceeds to examine it from one end to the other with her flickering black tongue.

I sit on an old mesquite stump comfortably several feet away from the feasting serpent. She swallows her meal headfirst. The whole process takes around ten minutes. When finished she turns around and proceeds leisurely off in the direction from which she came. I follow from a discreet distance. After traveling for approximately thirty feet she arrives at a rodent burrow. Her body disappears rapidly into its opening and then no trace remains of her or her recent visit to the surface world.

Still she has left her mark on the world above. There is now one less round-tailed ground squirrel and a large bipedal mammal is now a little more alert than it was a few minutes earlier. As I walk back toward my truck to leave the mesquite forest on this day I notice that I am now spending more time looking down at the ground and less time looking upwards into the mesquite branches. I note that many of the mesquite branches lying on the ground are shaped like snakes. Funny, I didn't notice that before. I also have this strange feeling that I am being watched. Perhaps the watcher has become the watched. The feelings are not nearly as pleasurable.

The afternoon thunderstorm never materialized. Only a few drops of rain fell and the winds have now died down almost completely. The round-tailed ground squirrels are still feeding in the tops of the mesquite trees. As I leave the mesquite forest on this day I yell up at one of them: "Stay up there where it's safe!"

## *OCTOBER*

Today is a typical late October day in the mesquite forest. It is now mid-afternoon and the temperature is still quite warm, around ninety degrees. Yet last night was quite cool and the temperature may have dipped into the high forties.

The tree lizards are still about and one still sees an occasional desert spiny lizard, but the long-tailed brush lizards seem to have disappeared from the mesquite forest completely. Where have they gone? Are they hibernating communally in deep tree cavities? Or are they moving to the ground and using rodent burrows for their winter rest? The answer to this question remains one of many still hidden in the mesquite forest.

Some dried pods hang from the mesquite branches but others have already fallen to the ground. Many of these pods contain tiny holes along their lengths. Some pods have many such tiny entrances while others have only a few and other pods have none at all. What or who made these holes?

The leaves of the mesquite trees are still green for the most part but quite a few terminal branches appear quite dead while others look green, alive, and normal. An examination of these dead terminal branches reveals a perfect circular ring on some of them, cut around the terminal limb, thus preventing nutrients and water from flowing to the tree's tissue beyond this girdle point. Who or what girdled these mesquite branches? What was his or her motive?

The answers to questions like the ones above can sometimes be found in books. See for example, Dr. John Alcock's engaging books, Sonoran Desert Spring and Sonoran Desert Summer. Despite the quality of these books and others, the best way to find the answers to these questions, and more importantly, to discover new questions and answers for yourself, is to visit and examine the mesquite forest for yourself. You are invited and strongly encouraged to do so. John Muir once wrote that a forested path is a gateway to the Universe. Maybe one such path and one such gateway can be found in the unique desert forests of Arizona.

## *DECEMBER*

Many months have passed since the events described in the words above. There are no leaves on the mesquite trees now, but most of the trees still stand, waiting first for the cool rains of winter and then the warmer rays of the spring sun. Each year more people come to this site to picnic, camp, or party. The U.S. Forest Service has helped by clearing away brush, weeds, and small trees. Larger trees have been trimmed. Some concrete picnic tables and stone benches and even some "sidewalks" have been added. The asphalt of a nearby parking lot now re-radiates the sun's rays back into space. These are the "improvements" of humans. They benefit humans and in some cases they benefit other species as well. The parking lot now confines and limits vehicles that previously penetrated to and upon the forest floor, ripping up the sandy soil and its young vegetation, carrying humans and their refuse to practically every nook and cranny of available riverbank. The picnic and camping areas now concentrate human activities somewhat and the area appears cleaner, more open and park-like. Vermilion flycatchers seem more abundant as they wait on exposed perches like scarlet ornaments adorning barren mesquite treetops. Perhaps the "wide open spaces" make it easier for them to snatch insect prey from the air.

Other bird species still fly in this humanized forest. Hawks still soar above it. Coyotes still pass through it, perhaps stopping occasionally in the parking lot to examine the strange metal beasts that sit very still before they roar and then move on. Lizards still roam the mesquite forest here. The tree lizard and the desert spiny lizard still dwell among the mesquite branches. But the most abundant lizard here twenty years ago is now almost gone. Long-tailed brush lizards have disappeared from this desert forest, perhaps unable to survive the human "improvements." Local population extinctions such as this one are probably the nature of things. If conditions change perhaps new long-tailed brush lizards from adjacent populations can once again invade this area. The problem is that fewer and fewer natural places and natural populations remain. Those that have survived are now often isolated into tiny islands surrounded by seas of humanly modified habitats.

What difference does one small population of lizards make anyway? There is probably no economic value here, no cure for AIDS or cancer to be found. The ecological fabric of the Sonoran desert can surely survive and repair this tiny tear. Why worry about the survival of lizards and bugs? What good are they? We live in the City of Scottsdale, Arizona. The natural populations that were

here before we built our homes and our office buildings are now gone. The wild plants and animals that were here before were not "good for anything." Raw desert is worthless as it is, so it must be developed. We can continue to suck water from deep in the ground and "make the desert bloom." We can transform the land through hard work. With the Grace of God we can make it valuable. We will all be better off for this.

Judging from our impact on the world, human beings like things simple. Our chief effect on natural ecosystems throughout the world has been to simplify them. It is now a better world for people who don't like to ask questions. There are now fewer natural places and fewer kinds of plants and animals to ask questions about. Future generations will not ask questions about habitats, plants and animals that they have never seen. They will be told or perhaps they will already believe that the plants and animals that do remain are obviously here solely for the use of human beings. It will be harder for someone to ask, "What good is that plant or that animal?" for only those species of economic import to humans will have survived.

Each year more land in the United States is covered with a layer of asphalt than is designated as wilderness area. Don't ask why? This is good. This is simple. Asphalt is much more simple than wilderness. You don't have to ask many questions about the purpose of asphalt.

Each year we cut down thousands and thousands of trees and convert them into millions and millions of pieces of junk mail, much of which is never read by anyone at all. Not just trees but whole habitats with their own natural populations are lost. You don't need to ask why, you already know the answer. These trees, plants, and animals are here solely to meet human needs. This is capitalism. This is marketing. This means jobs for lumberjacks.

Every year, more and more people come to the deserts of the southwestern United States not to try to live in harmony with this habitat but to alter it to suit their needs, and all too often, their whims. Yet here, as in other parts of the world, a few stubborn species fight back and by their very tenacity sometimes force us to question our basic assumption as to the creation of this planet solely for the benefit of the human species. The mesquite, the coyote, and a few other stubborn species have "stood up to humankind" and perhaps slowed down, if only briefly, the seemingly inevitable march of our own species toward total human biological domination.

Following World War II we discovered new and more powerful weapons to aid us in combat against the mesquite. The mesquite, after all, competed with our grasses necessary to grow our cattle. It was an age of chemical warfare. New anti-plant weapons were continually tested in exotic locations such as the jungles of Vietnam. These chemical "bombs" killed and mangled mesquite trees and other flora, but still the mesquite trees hung on, unwilling to go quietly into the night of non-existence.

Mesquite's durability has insured the survival of a whole multitude of animal species directly or indirectly dependent on the mesquite for food, shelter, and the other basic needs of life. For one hundred years, humans have dealt with mesquites without much compassion, common sense, or knowledge of the importance of these trees to the lives of many of the Sonoran Desert's animal inhabitants. For a century we poisoned them, burned them, chopped them down, or ripped them from the ground with chains, justifying our actions as necessary for "range improvement." The mesquite stood in the way of cattle, profits, and progress. Humans did not defeat the mesquite. Here was a tough and tenacious enemy. Today the mesquite tree remains a testimony to vegetative determination. In her branches she carries populations of many other desert species. Long may she continue to do so!

THE END.