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SOME EFFECTS OF VOLCÁN PARÍCUTIN ON VERTEBRATES

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THE Mexican volcano, Parícutin, was born February 20, 1943, after a long series of terrific earthquakes which nearly drove the inhabitants of nearby villages to distraction. Those who could, left the Michoacán villages of Parícutin, San Juan Parangaricutiro, (subsequently called San Juan), Zirosto, and Angáhuán for more distant places. Others remained because they had no place to go. Subterranean explosions sent volcanic ash upwards thousands of feet. Coarse particles came to earth nearby, but finer bits drifted as far as Mexico City to the east and into the Pacific Ocean to the west. The ash settled gently on vegetation, buildings, land. Like a mantle of black snow it accumulated, until branches broke from trees and roofs caved in. Small ground vegetation and perhaps ground-dwelling animals also were buried. Gradually, silently—except for the ominous rumbling from El Volcán—the countryside became a barren waste.

Volcanologists were quick to realize the importance of the event and to seize the opportunity for study. The late Ing. Ezequiel Ordoñez, then Dean of Mexican geologists, was one of the first and most persistent of those who were to study the growth of Parícutin. The late Dr. William F. Foshag, then mineralogist at the Smithsonian Institution, was in México on other work at the time. He turned nearly his full attention to Parícutin. Thanks to Ing. Ordoñez and Dr. Foshag, as well as a score or more of others who joined the throng, a fairly complete record of the early growth of the cone and of the various lava flows was made (see Hatt, R.T., 1950, for bibliography through 1947). Much of the credit for a continuous record must go to a Tarascan Indian who lived in San Juan. This Indian, Celedonio Gutiérrez, had kept a diary since long before Parícutin was a puff of gas issuing from an open field. He continued to keep this diary and was soon employed by Ordoñez, later by the Geological Society, to

help visiting scientists and to make observations when no one else was around.

The Geological Society of America, in cooperation with the Comisión Impulsoria y Coordinadora de la Investigación Científica de México, set up a program of study. Later, a United States Committee for the Study of Parícutin Volcano was formed under the auspices of the National Research Council at the invitation of the Comisión Impulsoria. Dr. Richard Fuller headed the American Committee and Ing. Ordoñez headed a similar committee in México. The physical aspects of the volcano were studied by specialists in many fields, but the biological aspects did not receive attention by the committee as first set up.

In July, 1944, I accompanied Dr. A. N. Goddard of Detroit and Dr. and Mrs. Robert T. Hatt of the Cranbrook Institute of Science on a short visit to the volcano (see Hatt, R. T., 1944). We were there slightly more than a week, and I was able in this time to make a small collection of mammals and gain general acquaintance with the area. The only facilities near the volcano at that time were to be found in the Tarascan Village of Angáhuán. The geologists had constructed a small shelter on an old volcanic cone within one-half mile of the active volcano. This was called the Upper Casita and was used by the geologists for an occasional overnight vigil. We stayed in Angáhuán where we found the Indians, whose countryside had been almost completely ruined, to be most hospitable. Through a Mexican geologist, Sr. Eugenio Sotomayor, living quarters were arranged in the village where Sr. Diaz, the head man (jefe), generously allowed Dr. Goddard and me to share his home.

After returning from our first look at the area around Parícutin, we, at the University of Michigan, decided to initiate a program to study the effects on the animal life within the sphere of influence of this new volcano. Funds from the Rackham Foundation, and from our museum budget, enabled us to return for three months in 1945 and again in 1947. Dr. Erling Dorf, paleobotanist, and Dr. Willis A. Eggler, neobotanist, made visits to study the plant life. These were the only other biologists to spend any time in the area. By 1945 a prefabricated building had been erected near San Juan by the Geological Society. The Committee graciously gave us space there for our equipment and for living quarters. The Secretario de Agricultura y Fomento kindly issued the proper permits to collect scientific specimens.

During the first summer, 1945, we attempted a survey of the

vertebrate animals within 20 to 30 miles of the cone. One of our objectives was to gain some idea of the kinds of animals that survived and the abundance of each. Another, and a more difficult one, was to determine if possible some of the critical factors involved in the local extermination of some kinds and not of others.

Two years later, 1947, most of our efforts were directed toward a comparison of the vertebrate fauna, at stations previously established, with what it was two years before. Plant names used in this report and some of the effects of the volcano on the plant life of the area are taken from reports by Egger (1948*a* and *b*; 1959).

LOCALITIES STUDIED, AND THE TIMES SPENT AT EACH

ANGÁHUAN.—July 21–23, 1944; mountain north of village (elevation 3300 m.); ash depth 18–20 in.; pine forest.

SAN JUAN.—April 23–May 2 and June 14–23, 1945; June 19–21 and July 6–24, 1947; ash depth 20–24 in. at Lower Casita, ½ mi N San Juan (2300 m.), about 2 in. at Corupo; chiefly pines and oaks on slopes and ridges; several shrubs along old stone fences and banks; small patches of Bermuda grass (*Cynodon dactylon*) in 1945, larger patches in 1947; prickly poppies (*Argemone platyceras*), *Bouvardia*, and *Mirabilis* were conspicuous on the otherwise bare ash; some shrubs and trees were bearing fruits in 1947; more oaks and pines were dead in 1947 than in 1945; deer mice (*Peromyscus*) were fairly common along stone fences even near the lava front.

BARRANCA SECA.—May 2–7, 1945 (1860 m.); ash depth about 8 in.; few pines, some dead; had been grazed and farmed for most part; fairly large patches of Bermuda grass; shrubs and most trees undamaged; many old pocket gopher mounds, but no new ones.

LOS REYES.—May 31–June 2, 1945 (1280 m.); ash less than 2 in.; lower edge of pines; large stream; grazing and farming; vegetation not harmed.

APO.—June 6–11, 1945; June 25–July 2, 1947; ash, 4–5 in. deep; pine-oak forests on slopes and ridges, firs higher up; bunch grass and chaparral. Camped at Rancho Escondido, about 2 mi N Apo (2110 m.).

URUAPAN.—July 24–30, 1944; May 10–18, 1945; June 17–18, 1947 (1675 m.); ash less than 2 in.; chaparral, grass, small trees. Trapped at upper edge of the Parque Nacional Barranca del Cupatitzio, at airfield, about 2 mi E Uruapan, and 7 mi S Uruapan. Permission to trap in the Parque Nacional was graciously given by Ing. José García Martínez and Sr. Manuel Valencia, in charge.

LOS CONEJOS.—May 19–27, 1945; (1750 m.); ash depth, 3–4 in.; heavily grazed; vegetation apparently not harmed; also known as Nuevo San Juan, a new village for former residents of Parícutin and San Juan. Pocket gophers common, other rodents scarce.

SOME GENERAL EFFECTS

Everything was destroyed in the area of lava flows (Fig. 1). Beyond this, the ash that fell destroyed nearly everything for a distance of

five miles to the south and west and about three miles to the north of the cone. Lesser damage was done farther away. The ash mantle thinned out rather rapidly as one went away from the source, and different plants were affected variously by depth of ash (Eggler,

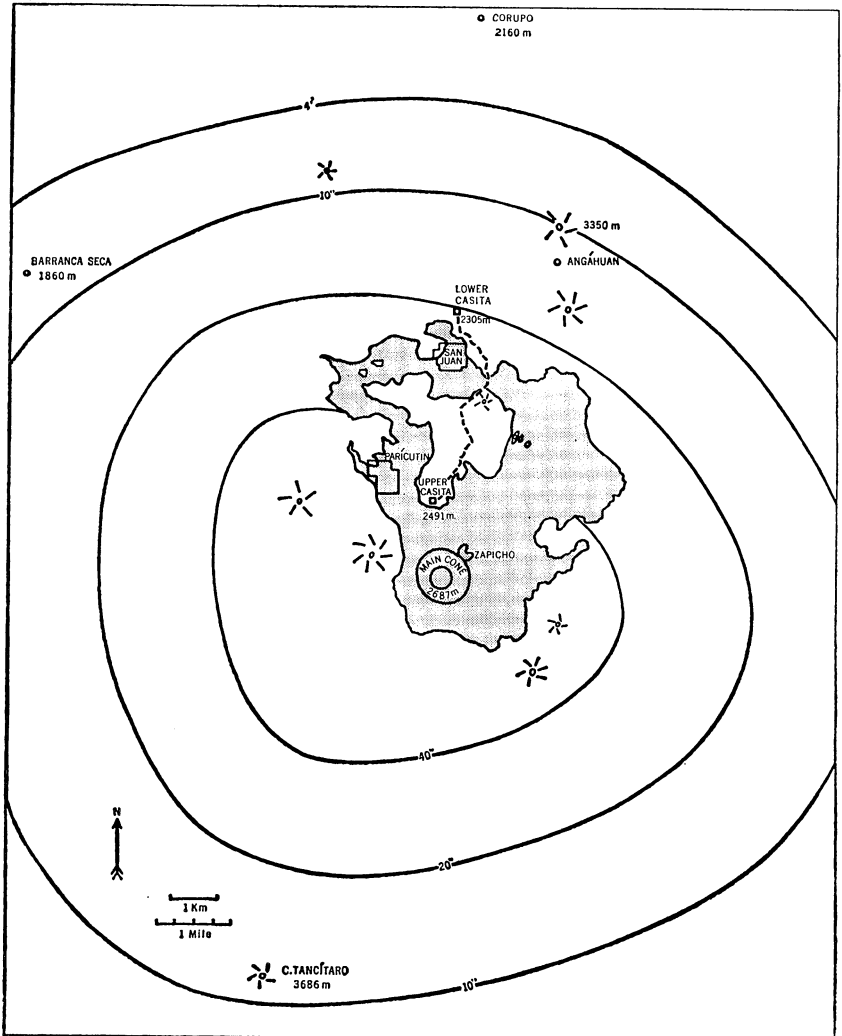


FIG. 1. Map of area surrounding cone to show lava flows (stippled area) and approximate depths of ash. Modified from Eggler (1948*b*) and a field map prepared by Howel Williams and Adán Perez Pena in 1945. Apo and Los Reyes are off the map to the west; Uruapan and Los Conejos to the east.

1959). Practically all vegetation in 1944 appeared dead where the ash was three feet or more in depth, on the level. During the long dry season, as the ash fell it accumulated on the branches, weighted them down, and, within this zone of three or more feet of ash, broke most of them. This alone undoubtedly was enough to kill the trees, especially the larger pines (see Egger, 1959), but it is possible that there was some chemical action also. The long-leaf pines, with branches unbroken, were killed in some places where the ash depth was no more than eight inches. Some branches were broken on pines where there was no more than twelve inches of ash. If not broken, they usually were bent downward (Pl. I). Small trees, better able to bend without breaking, were bent over and their tops were buried in the ash. Oaks naturally withstood the weight of the ash better than did the pines. When the rains came, most of the ash was washed from the small branches and the trees had some relief. The rate of fall of ash also was slowing up. At this time (1944), the San Juan lava flow was still advancing. Prickly poppies, *Mirabilis*, *Bouvardia*, and a few other plants that were able to keep their crowns above the ash added color to otherwise barren ash plains which formerly were corn fields. The animal life, except for man and domesticated kinds, was practically non-existent where the ash was six or more inches deep. There were a few insects, many of which had been carried in by the wind, on which a few kinds of birds were feeding. About the only birds seen were occasional jays flying through the area, ravens, two of which flew around the cone nearly every day, and Brown Towhees. The Brown Towhee is a bird of the villages in that area—comparable to the House Sparrow and Starling except that the towhee is a native bird that has adapted to city life. In 1944, these birds were numerous along the hot advancing lava front at San Juan. They commonly alighted on the still warm lava or ran near the advancing wall. I had no means of collecting examples for food determinations, but I suspect they were subsisting chiefly on insects and a few seeds that might have been carried in by the wind. These perhaps were individuals that had inhabited San Juan. With most of the village under lava, the population was concentrated in the remaining portion and along the lava front.

Few signs of native wild mammals were seen closer than about four and one-half miles from the cone where the ash was about ten inches thick. Here, with considerable effort, I was able to get two individuals of a small deer mouse (*Peromyscus maniculatus*). They were taken about fifteen feet apart along an old stone fence. There were mice in

the Upper Casita, but at that time we were not certain what they were; only their tracks and sign were seen.

No reptiles were seen near San Juan, but a small amphibian (*Tomodactylus angustidigitorum*) was present along the old stone fences where the ash depth was about eighteen inches. This then was the dismal picture of a considerable area around the cone after a year and five months of continuous volcanic activity.

One year later, in 1945, Dr. N. E. Hartweg and I returned. The San Juan flow had stopped about a week after my departure in 1944, and a new one—the Parícutin flow—had come down to the west and joined the San Juan flow in the deep barranca to the west of the village of San Juan. The fall of ash had not been heavy. The addition of ash was about compensated by the packing down and erosion of that already deposited. On the steep slopes, much of the ash had been carried away by the torrential rains—the original soil was exposed in small areas.

Some rather spectacular changes were at once apparent. The trees, chiefly pines and oaks that had not been killed, were making a remarkable recovery; there was new luxuriant growth, especially on the pines. Small pines that had been bent into arcs and had their tops buried in the ash were sending up new branches along the arched trunks; each branch vying with the others for leadership, so it appeared (Pl. II). No new reproduction was seen, but Bermuda grass had survived in a few spots and was beginning to spread out over the adjoining ash surface. Prickly poppies, *Bouvardia*, and *Mirabilis* were still about as abundant as formerly on the ash-covered flats.

Near San Juan, there were probably less than a dozen kinds of birds a year before, we now found 32 kinds. They were mostly insectivorous or frugivorous (25 kinds). The few seed-eaters were subsisting for the most part on insects and fruits. A few of the birds were patently migrants, and some of the others, seen but once, undoubtedly were wandering within the general area. The common birds that were seen nearly every day were hummingbirds (two kinds), flycatchers (3), swallows, jays, ravens, chickadees, curved-billed thrashers, tanagers, grosbeaks, house finches, siskins, towhees, and juncos. Brown Towhees, although still present and nesting, were less numerous than they had been a year before when the lava front was still active at San Juan.

There were fewer kinds of mammals than of birds, but in this group also there was a marked change. Deer mice (*Peromyscus maniculatus*) were now abundant along and near the lava front. Lava that a year before was red hot now served as shelter for these mice. One even

lived out in the middle of the lava stream along a horse trail. The only food available was the offal from the horses and an occasional insect or seed that might be carried in by the wind. I believe that the population of these mice was near the peak in 1945. Near the cone, at the Upper Casita, where tracks had been seen the year before, I caught one *P. maniculatus* and two females of a larger species (*P. hylocetes*). I believe I exhausted the mouse population there. The small one was a young animal that most likely was on the prowl and ended up at the only place where there was shelter and food. The other two might have been the same individuals that were there the year before. I suspect that they had been able to survive because of the shelter and food afforded them by the scientists and tourists. Both were adult females and neither showed signs of having bred. The nearest other place that this species was taken in 1945 was on Cerro Tancítaro where the ash was about six inches deep. One tree squirrel had ventured into the pine-oak forest at the Lower Casita and a cottontail lived thereabouts. The ash there was about two feet deep. Pocket gophers (*Cratogeomys varius*) were found south of Corupo, but their occurrence stopped abruptly where the ash was six inches deep. A gray fox ranged through the area; its tracks were seen within one-half mile of the cone.

The little tree toad was more numerous than before; apparently it had been able to breed, but no lizards were found closer than Angáhuán.

Two years elapsed before our next visit to Parícutin (1947). Again we were to see some rather startling changes. The ash deposit had not been sufficient to keep up with erosion and settling; lava flows had built up around the cone and were now covering much of the island formed by the San Juan and Parícutin flows. Prickly poppies, *Bouvardia*, and *Mirabilis* were noticeably less evident, there had been no replacement of those that had died. The pines were either luxuriant or dying. There was considerable pine reproduction in ash nearly two feet thick; one young oak, still getting nourishment from the acorn, was seen. The Bermuda grass had formed patches fifteen to twenty feet across in a number of places, and some trees were again bearing fruits.

Nearly all of the familiar birds were still there. Only one of the hummingbirds (*Hylocharis leucotis*) was encountered, flycatchers were less numerous as were grosbeaks and tanagers. But a few species were added. Acorn Woodpeckers, not seen in 1945, were fairly common in 1947; one Red-Shafted Flicker and two Hairy Woodpeckers were seen

in 1945; in 1947 flickers were common, but Hairy Woodpeckers were still rare.

Cliff Swallows, whose old nests on the church were evidence of former occupancy, were not there in 1944 or 1945. They had returned by 1947. A colony of 20 or 30 individuals was nesting on the church. I suspect that availability of mud for nest material was one of the more important factors involved in the presence or absence of Cliff Swallows. Rains had washed the ash from many of the old adobe walls in San Juan thereby making mud available. Another species that depends on mud for nest building is the American Robin. In 1945, a few robins, probably young itinerants, were seen shortly before our departure. In 1947, the American Robin was one of the most conspicuous birds of the area. No nests were found, but young birds were seen, and collected, and adults were common throughout the forest.

Other additions to our previous list, but still not common, were: Sharp-shinned Hawk, Whip-poor-will (one heard), Horned Lark, Bewick Wren, Rock Wren, Gray Silky Flycatcher, Loggerhead Shrike, House Sparrow, and Vesper Sparrow.

The composition of the mammalian fauna had changed quite noticeably in the two years that had elapsed. The small deer mice, (*Peromyscus maniculatus*), so numerous before, were still there, but apparently were fewer. The larger species (*P. hylocetes*), taken only on Cerro Tancitaro and at the Upper Casita before, had come in and was, in places, more numerous than the smaller representative. Cottontails (*Sylvilagus*) and tree squirrels (*Sciurus*) were more numerous, but still fairly scarce. Rock squirrels (*Citellus*) had found the cooled lava to their liking and were back in San Juan in force. Attracted chiefly by the garbage pit back of the Casita, and possibly by the increased natural foods, the coyote was back. There were at least two individuals that ranged near the Casita. Bats of at least two kinds were flying in San Juan and along the lava front nearly every night. South of Corupo, pocket gophers (*Cratogeomys*) had advanced a few rods closer to the cone, but still were not beyond the zone of six or more inches of ash. The Indians, also, were planting corn and beans on the Corupo plain about one-half mile closer to the cone than was true in 1945. As wind and water removed the ash so they could get their seeds down in the original soil, they followed closely with their plantings.

Some kinds of mammals that were taken previously on Cerro Tancitaro, but which we failed to take, are *Sorex*, *Neotomodon*

alstoni, *Nelsonia neotomodon goldmani*, and *Neotoma mexicana*. With the destruction of ground-living invertebrates, shrews (*Sorex*) would undoubtedly succumb. The rodents mentioned above should have survived along with *Microtus*, *Reithrodontomys*, and *Peromyscus*. Perhaps we just missed them.

One of the most startling and interesting of our 1947 discoveries, was a salamander (*Pseudoeurycea bellii*) in what was remaining of San Juan. Dr. Hartweg found these salamanders by the hundreds in the old adobe and stone walls and beneath boards that had been left scattered about when the Indians vacated the town. None had been encountered on our previous trips. There seemed to be no possibility of ingress from adjoining areas. These salamanders must have carried over in the shelter of stone walls or within the adobe walls of the houses. They are capable of breeding without free water. One individual was found in an old stone wall across the lava stream that nearly surrounds San Juan. No others were seen except in San Juan proper. The little tree frog had also made its way into San Juan and was everywhere more numerous than it had been previously. A lizard (*Sceloporus torquatus*) had found its way from Angáhuán, the nearest place previously seen, to the lava front opposite San Juan. These lizards could have followed stone walls, with occasional stretches of open ash to cross, nearly all the way from Angáhuán to San Juan.

To recapitulate briefly, during the first year of activity, when the ash fall was greatest, practically all the plant life was killed for distances of three to five miles from the cone, depending primarily on the amount of ash that fell. Ash depths of three feet or more seemed to be fatal. Most of the animal life was exterminated distances of five to eight miles from the cone or out to the zone where less than about eight inches of ash fell. Some plants and animals were affected as far as one hundred miles distant, but these effects were slight and probably temporary.

With the lessening of the ash fall and the coming of the rains, there was relief for the plants as well as for certain animals that had been able to survive in sufficient numbers to breed when conditions again became favorable. Some of these small animals, with their natural enemies removed, built up their populations to peak proportions in short order. Still others, probably there before the holocaust, started filtering back into the area. Those affected most were the ground-nesting or ground-dwelling kinds. Although trees and other perennials that were able to keep their crowns above the ash had survived fairly close to the cone, the small plants and annuals were destroyed much

farther out. With the ground cover gone and nothing left but shifting ash, this was no place for animals that could not seek refuge in the trees or in the few old stone fences that were still partly exposed.

In addition to affecting the animals adversely by making the habitat generally unsuitable for many that lived in the area, there were more subtle influences on those that were able to persist in spite of the heavy mantle of ash. One of these was the abrasive effect of the ash. The only noticeable effect on the birds was the wearing off of the tail feathers in the woodpeckers. During the time between molts, these feathers, in many instances, wore down to short stubs one-half the original length. But new feathers came in and this probably had little if any effect on the life-span of the individual bird. In mammals, this abrasive effect showed up in the teeth. We have specimens of young opossums in which the last molar teeth had but recently erupted yet the premolars are worn nearly to the roots. An old opossum has the crowns of the teeth completely worn away and only the roots remained. Several bats have incisors and canines worn to the gums; in two, abscesses had formed beneath the teeth. Others that showed excessive wear on the teeth were *Bassariscus*, *Urocyon*, *Sciurus*, and *Sylvilagus*. Inasmuch as the survival of a wild mammal depends on the life of the dentition of that individual, it is quite evident that the normal life-span in these animals must have been shortened. This, in turn, would affect the populations adversely by cutting down on the breeding stock. The larger, slower breeding mammals would be affected most. I imagine the same effect would be seen in domestic stock and, to a lesser extent perhaps, in the Indians of the immediate area. Regardless of how careful they might have been, particularly during the dry season, ash would get into their food and the result would be shorter life of their teeth. To my knowledge, there was no one studying the effects of the volcano on the human inhabitants of that area. It would have afforded a wonderful sociological study of re-adjustment.

LIST OF BIRDS

Blake and Hanson (1942) reported on the birds of a Cerro Tancítaro-Río Tepalcatepec transect. From Cerro Trancítaro, they reported 33 species that we did not obtain. These were scattered among all the families of birds with no one group conspicuously absent. We encountered 39 species from the area that were not recorded by them. These are indicated with an asterisk* before the name. Dr. H. O. Wagner was with us much of the time and his knowledge of the birds

and the country was invaluable. Without his help the following list would have been much shorter. For scientific and common names Friedmann *et al.* (1950) and A. Miller *et al.* (1957) were followed.

Cathartes aura. Turkey Vulture.—Turkey Vultures were seen near Apo on several occasions. A horse had died up slope from camp (1945) and two of these vultures made the best of their opportunity.

Accipiter striatus. Sharp-shinned Hawk.—This graceful bird was seen only near San Juan. A male was shot as it swooped for a falling flycatcher that had just been shot in flight. The stomach contained remains of a small bird. It is the resident race, *suttoni*.

Buteo jamaicensis. Red-tailed Hawk.—Two birds that I took for Red-tailed Hawks were seen at the lower edge of the firs near Apo, June 30, 1947.

**Buteogallus anthracinus*. Crab Hawk.—One specimen was taken 2 mi E Los Reyes, May 31, 1945. Another, apparently the same species, was seen flying with a snake hanging from its talons.

Ortalis vetula. Common Chachalaca.—Chachalacas were fairly common near Apo in the chaparral of the steep slopes.

**Dendrotyx macroura*. Long-tailed Partridge.—This elusive game bird was encountered only at Apo where it inhabited the dense chaparral and pine-covered ridges.

Columba fasciata. Band-tailed Pigeon.—These pigeons were numerous, especially in an area where poke berries were ripening near Apo in 1945. None were seen nearer the cone in 1945. Pigeons were apparently less numerous and more widely distributed in 1947. The season was late and the poke berries were not yet ripe—this might have resulted in a lack of concentration. They were seen, and one was collected, near the San Juan lava front. A female weighed 322 grams.

**Zenaidura macroura*. Mourning Dove.—The only one seen was taken near the Lower Casita, May 1, 1945.

Scardafella inca. Inca Dove.—One female was taken at Los Conejos, May 26, 1945. None were seen closer to the cone. Blake and Hanson (1942) reported them from Cerro Tancitaro.

Rhynchopsitta pachyrhyncha. Thick-billed Parrot.—These parrots were seen and heard in the fir belt of Cerro Tancitaro near Apo. They were also seen, and heard, flying high over the Lower Casita in flocks of up to forty or more. One day, a large flock was flying in a circle that moved slowly from north to south. Usually, these flocks passed over at about 10:00 A.M.

**Geococcyx californianus*. Road-runner.—While going from Uruapan to Los Conejos by bus, I saw a Road-runner beside the road. This was at an altitude of slightly over 5000 feet, and where the ash had not killed the vegetation.

**Chordeiles acutipennis*. Texas Nighthawk.—A male was shot 2½ mi E Uruapan, May 17, 1945, while flying over the same field with individuals of *minor*. It was extremely fat.

**Chordeiles minor*. Nighthawk.—A female taken 2½ mi E Uruapan, May 17, 1945, had well-developed ovaries. Another, taken 2 mi E Los Reyes, June 1, 1945, also had large ovaries. The stomach of the latter was full of June beetles.

**Caprimulgus vociferus*. Whip-poor-will.—Whip-poor-wills were encountered in 1945 at Los Conejos, where two males and a female were taken. An adult male (wt., 48 grams) and a young individual (wt., 44 grams) were taken near Apo. None were seen in 1947, but one was heard at Cerro Cuitzeran, north of San Juan.

**Cynanthus latirostris*. Broad-billed Hummingbird.—This hummingbird was taken at San Juan, Barranca Seca, and 2 mi E Los Reyes. They were feeding on *Bouvardia* for the most part. None were taken in 1947.

Hylocharis leucotis. White-eared Hummingbird.—This was the most common hummingbird of the area near San Juan. None were taken at the other localities except near Uruapan. These birds were feeding, in part at least, on aphids and small insects. They also fed on *Bouvardia*. This was the only hummingbird taken in 1947.

**Selasphorus platycercus*. Broad-tailed Hummingbird.—One male was taken near San Juan, April 25, 1945, as it was feeding at a *Bouvardia* flower. None were encountered in 1947.

Trogon mexicanus. Mexican Trogon.—A few were seen near Los Conejos in 1945. One male was taken (wt., 68.5 grams). None were seen in 1947.

Colaptes cafer. Red-shafted Flicker.—One male was taken 2½ mi NE San Juan, June 21, 1945. No others were seen this close to the cone. In 1947, several flickers were seen near San Juan where one was taken in the pine-oak woods on June 21. It was not in breeding condition. The tail feathers of both birds are worn off for about one-fourth their lengths.

Melanerpes formicivorus. Acorn Woodpecker.—In 1945 a specimen was taken near Apo and another (wt., 67 grams) 2 mi E Los Reyes. From May 2-7 a pair was seen storing food in a dead tree near Barranca Seca. Another was seen 2 mi W San Lorenzo, but none were observed near San Juan. In July, 1947, there were several of these woodpeckers in the pine-oak woods north of San Juan—three were taken. One, from near Apo, has the tail feathers worn away for about one-third their lengths.

Dendrocopos villosus. Hairy Woodpecker.—This species was rare. Two specimens were taken in the pine-oak forest north of San Juan; another near Apo (wt., 51.0 grams). None were in breeding condition. All were taken in June, 1945. One specimen with new lateral tail feathers coming in has the central feathers worn to about one-half their normal length; another to about two-thirds normal length.

Dendrocopos scalaris. Ladder-backed Woodpecker.—Taken only on the road about 5 mi E Angahuan and at Los Conejos, where a young bird was taken May 22, 1945. Two of the birds have the tail feathers worn off for one-third to nearly one-half their normal lengths.

**Sayornis nigricans*. Black Phoebe.—Seen only at Los Reyes where three males were taken June 3, 1945. Two of them weighed, respectively, 17.2 and 19 grams.

**Pyrocephalus rubinus*. Vermilion Flycatcher.—Two males and a female were taken near an artificial lake east of Uruapan, May 16, 1945. They were seen at no other locality.

Tyrannus vociferans. Cassin Kingbird.—A common bird at the lower elevations. None were seen near Apo, but specimens were taken at Los Conejos, near San Juan, and at Barranca Seca. They apparently were breeding in the area. Several pairs were seen and the males were singing much of the time. Still about as common in 1947.

Myiarchus tuberculifer. Olivaceous Flycatcher.—In April, 1945, these flycatchers were common along a barranca about ½ mi N San Juan. A male, taken April 25, had testes which measured 4 by 8.5 mm, apparently in breeding condition. Specimens were taken also at 2 mi E Los Reyes, near Apo, and near Uruapan. A male weighed 18.5 grams and a female 19.5 grams. In June and July of 1947, they were not seen north of San Juan.

**Contopus sordidulus*. Western Wood Pewee.—One male was taken at Barranca Seca, May 3, 1945.

Contopus pertinax. Coues Flycatcher.—Three were taken at Los Conejos in May and one near Apo in June, 1945. The latter, a female, weighed 35.0 grams.

**Empidonax traillii*. Traill Flycatcher.—One female was taken 2½ mi E Uruapan, May 16, 1945.

**Empidonax affinis*. Pine Flycatcher.—One male (wt., 10.5 grams) was taken near Apo, June 11, 1945.

Empidonax difficilis. Western Flycatcher.—This was a common flycatcher in most localities. Specimens were taken at Uruapan, Los Conejos, ½ mi N San Juan, and near Apo. They inhabited chiefly the pine-oak forests. Specimens taken near Uruapan, May 20, 1945, were in breeding condition. A male and female, taken near Apo, June 11, 1945, weighed, respectively, 9.5 and 10 grams.

Empidonax fulvifrons. Buff-breasted Flycatcher.—One was taken in a pine forest near Uruapan, May 18, 1945, and two at Barranca Seca and near Apo (wt., 6 grams each).

**Eremophila alpestris*. Horned Lark.—One was taken, May 27, 1945, 2 mi N Uruapan. Another, breeding female, was taken on the ash-covered plain about 2 mi S Corupo. These were the only Horned Larks seen.

**Progne subis*. Purple Martin.—On two occasions I saw Purple Martins, at close range, near the Lower Casita—once in 1945 and again in 1947.

**Petrochelidon pyrrhonota*. Cliff Swallow.—In 1945, the old nests of these swallows were unoccupied on the church at San Juan. No Cliff Swallows were in evidence. Upon our return two years later, they were again nesting on the church. I suspect that the reason for their absence in 1945 was the unavailability of mud in the vicinity. By 1947, the adobe walls of some of the remaining structures had been exposed to the rains and were crumbling. This, then, was a source, but I am not certain that the swallows utilized it. At any rate, they had procured mud somewhere, had built nests, and were feeding young birds. There were 25 or 30 adult birds in the colony. One specimen was preserved.

**Stelgidopteryx ruficollis*. Rough-winged Swallow.—Large groups of these swallows were seen in May, 1945. Specimens were taken 2 mi E Los Reyes and 2½ mi E Uruapan.

**Tachycineta thalassina*. Violet-green Swallow.—Two were taken in May, 1945; one near San Juan and the other at Barranca Seca.

Corvus corax. Holarctic Raven.—A pair of ravens flew about the Lower Casita and around the cone in 1945. A female was shot as the pair flew over the Lower Casita, May 29, 1945. A pair nested near the Lower Casita in 1947. They were seen nearly every day, with a young one, near the garbage pit. Ravens were also flying near the cone. I suspect they were after dead insects that were common on the ash and even on the sides of the cone near the top.

Aphelocoma ultramarina. Mexican Jay.—These jays were more apparent, possibly because of size and what seemed to be a nearly continuous vocal display, than any other bird. They were seen usually in groups as they passed through the pine-oak forests. A young jay, just out of the nest, was taken at San Juan, June 20, 1945. On occasion, a number of adults were seen with a group of young—a sort of communal affair. Dr. Wagner was of the opinion that there was communal feeding among the adults. Jays were as much in evidence in 1947 as they were in 1945. They were seen at all localities visited. Stomach contents revealed mostly insects in the diet.

A female weighed 116 grams and two males weighed 143.5 and 150 grams, respectively.

Cyanocitta stelleri. Steller Jay.—In 1944, a Steller Jay was seen passing through the tops of the dead trees at the Upper Casita. They were next seen at Apo, in the fir zone, where an adult female was taken, June 8, 1945, and another, June 28, 1947. These jays were found only in the higher parts of the mountains.

Parus sclateri. Mexican Chickadee.—This species was common in the pine and mixed pine-oak forests wherever the trees were still alive. There was no apparent difference in abundance from 1945 to 1947. Singing birds and a young male, taken at Los Conejos, May 27, 1945, indicated that they were breeding in the area. Specimens were also taken near Apo and San Juan.

Psaltriparus minimus. Plain Bush-tit.—Although not numerous, this species was present in both 1945 and 1947. Individuals or small groups usually were working the tops of the pines. Two juveniles were taken on May 23, 1945, and June 22, 1947, respectively. An adult male with enlarged testes was taken April 26, 1945. Specimens were taken at Los Conejos and near San Juan.

Sitta carolinensis. White-breasted Nuthatch.—Two juvenal males were taken at Los Conejos, May 24, 1945. None were encountered near San Juan. Blake and Hanson (1942) found them fairly abundant on Cerro Tancitaro.

Cinclus mexicanus. Dipper.—Dippers were seen on several occasions in the small stream that has its source at Los Conejos. They were seen also just below Tzararacua Falls, about 7 mi S Uruapan. Blake and Hanson (1942) reported them from Cerro Tancitaro.

Campylorhynchus gularis. Spotted Wren.—Four males were taken near Los Conejos from May 21 to 27, 1945. Here, they were inhabiting the mixed forest. None were seen at other localities nearer the cone.

Thryomanes bewickii. Bewick Wren.—There were two and possibly three pairs of these wrens near San Juan in 1947. A male and female were taken. A small wren, possibly this species, was seen here in 1945, but we were not able to get close to it. When approached, these wrens would fly out over the rough lava where it was nearly impossible to follow them. I am fairly certain that they were nesting, although no young were seen and no nests were found.

Troglodytes brunneicollis. Brown-throated Wren.—An adult male and female were taken in the pine forest near Uruapan, a young female (wt., 9 grams) was taken near Apo, June 5, 1945, and a male was taken 8½ mi E Angáhuán on July 23, 1947. None were seen around San Juan.

*? *Salpinctes obsoletus*. Rock Wren?—A pair of these wrens were probably nesting in the lava at San Juan in 1947. They remained on or at the edge of the lava most of the time and when startled would fly out onto the lava flow.

Melanotis caerulescens. Blue Mockingbird.—This beautiful song bird was encountered at Los Conejos, Barranca Seca, and near Apo. Young, recently out of the nest, were seen at Los Conejos and Apo in late May and early June, 1945. They were still near Apo in 1947.

Troxostoma curvirostre. Curve-billed Thrasher.—This was a common bird at Los Conejos, Barranca Seca, and San Juan; fairly rare at Apo. One female, taken at Apo, June 27, 1947, is distinctly darker throughout than specimens from lower altitudes. Thrashers were particularly common around villages. At the horse stables, near San Juan, there were several pairs both in 1945 and 1947. In April, 1945, they were rare near San Juan, but in June of that year they had become common. They came to the five-gallon gasoline cans that were used for water, sat on the edges, and stuck their beaks into relatively small holes in the corners of the cans to obtain much needed water. In July, 1947, a pair of old birds regularly brought one young to the yard of the Lower Casita where we placed food for the birds each day.

Turdus migratorius. American Robin.—In April, 1945, there were no robins in the forests between Angáhuán and San Juan. In late June, a few were seen. I suspect that they came from farther away. In 1947, however, these robins were breeding in the pine-oak forest near San Juan. A juvenal male was taken, July 9, 1947, and many others, adult and young, were seen. At this time they were feeding primarily on wild cherries. Others were taken at Barranca Seca and Los Conejos in 1945.

Turdus assimilis. White-necked Robin.—Not seen close to the cone. A young male with tail feathers just starting was taken near Apo, June 9, 1945. A juvenile was taken near Uruapan, May 15, and an adult male with testes 11 mm in greatest diameter was collected near Los Reyes, June 1, 1945. None were taken in 1947.

Catharus aurantiirostris. Orange-billed Nightingale-thrush.—A fairly common, but not numerous, bird. One male (testes, 9 mm) was taken at Los Conejos in May, 1945, and a female near Apo in June, 1947. They often were heard singing along the barrancas.

Myadestes obscurus. Brown-backed Solitaire.—The clear, beautiful notes of the Brown-backed Solitaire were heard near Apo, in the hills north of San Juan, and at Barranca Seca where one bird was taken.

**Sialia sialis*. Eastern Bluebird.—At the lower elevations, this was the bluebird to be found. Specimens were taken near Uruapan and Los Conejos. A young male, recently out of the nest, was taken at Los Conejos, May 26, 1945.

Sialia mexicana. Western Bluebird.—The Western Bluebird was encountered at elevations of 6500 feet and above. In 1947, these birds were breeding within a mile of San Juan. A young male, just out of the nest, was taken on June 23, 1947. Groups of four to eight, mostly young, were common on the Corupo Plain

and in the scattered pines near San Juan in July, 1947. In 1945, two adults were seen on the barren ash within a mile and half of the cone.

**Regulus calendula*. Ruby-crowned Kinglet.—Kinglets were often seen with chickadees and warblers working their way through the pine-oak forests within three miles of the cone. Two were taken $\frac{1}{2}$ mi N San Juan in April, 1945.

**Bombycilla cedrorum*. Cedar Waxwing.—A small flock of Cedar Waxwings was seen near San Juan, April 26, 1945. At Barranca Seca, several large flocks were seen between May 2 and 7. None were seen in 1947.

Ptilogonys cinereus. Gray Silky Flycatcher.—In May, 1945, we found this species only at Los Conejos where a male and female were taken. In July, 1947, two were taken in the pine-oak forest north of San Juan, within about $3\frac{1}{2}$ mi of the cone.

**Lanius ludovicianus*. Loggerhead Shrike.—No shrikes were seen around the volcano in 1945. In 1947, a pair was seen on the Corupo Plain, another pair on the road between Angáhuán and San Lorenzo, and another on the ash north of San Juan. One specimen was taken at the latter place, July 23, 1947.

Vireo solitarius. Solitary Vireo.—Two males were taken in a pine forest near Uruapan, May 18, 1945.

Vireo gilvus. Warbling Vireo.—Specimens were taken at Uruapan, Barranca Seca, and near Apo. Apparently distributed throughout the pine-oak forests of the area.

Vermivora superciliosa. Hartlaub Warbler.—A male was taken near Apo, June 6, 1945.

Peucedramus taeniatus. Olive Warbler.—A male was taken in a pine forest near Uruapan, May 20, 1945.

**Dendroica nigrescens*. Black-throated Gray Warbler.—One specimen was taken in the pine-oak forest $\frac{1}{2}$ mi N San Juan, April 26, 1945.

**Dendroica graciae*. Grace Warbler.—Two males were taken in the pine forest near Uruapan, May 18, 1945.

**Oporornis tolmiei*. MacGillivray Warbler.—An adult female was taken at Los Conejos, May 19, 1945.

**Chamaethlypis poliocephala*. Ground Chat.—An adult male (testes, 7 mm) was taken at the edge of a cane field 2 mi E Los Reyes, June 2, 1945.

**Wilsonia pusilla*. Pileolated Warbler.—In April, 1945, several of these warblers were seen feeding in the tree tops along the barrancas immediately north of San Juan. When we returned in June they were all gone. An adult female was taken, April 24, 1945.

**Setophaga picta*. Painted Redstart.—A female was taken in a pine-oak forest near Los Reyes, June 1, 1945.

Myioborus miniatus. Slate-throated Redstart.—This species was common in the thick chaparral near Apo. A male (wt., 10 grams; testes, 6 mm) was taken here on June 9, 1945.

Basileuterus belli. Bell Warbler.—An adult female (wt., 12.5 grams) was taken near Apo, June 11, 1945.

**Basileuterus rufifrons*. Rufous-capped Warbler.—An adult female was taken at Los Conejos, May 22, 1945; another (wt., 10 grams) 2 mi E Los Reyes, June 3, 1945. Apparently, this species occupies the lower areas and *belli* the higher reaches of the mountains.

**Passer domesticus*. House Sparrow.—There were a few pairs (breeding) around the stables near San Juan. A young male was shot in front of the Lower Casita, July 9, 1947.

**Molothrus ater*. Brown-headed Cowbird.—As we were leaving the Lower Casita for our return trip home, in 1945, I saw a single cowbird near the horse stables.

**Piranga rubra*. Summer Tanager.—One was taken in the pine-oak forest north of San Juan, June 9, 1945.

Piranga flava. Hepatic Tanager.—Several of these tanagers were seen near Barranca Seca. Two males were taken on May 3 and 6, 1945.

**Piranga ludoviciana*. Western Tanager.—One was taken at Barranca Seca, May 7, 1945. Another was seen ½ mi N San Juan in July, 1947.

Piranga bidentata. Swainson Tanager.—An adult male (wt., 40 grams) was taken near Apo, June 5, 1945.

Carpodacus mexicanus. Common House Finch.—From April 23–28, 1945, no finches were seen around the Lower Casita, but a few were at the church in San Juan. In late May and in June they were quite common at San Juan and were at this time breeding. In 1947, there were several pairs breeding in the village of San Juan—they also were seen commonly around the Lower Casita where, on June 21, a male and female were brought down with a single shot as they perched close together near the top of a small pine. Specimens were taken also at Barranca Seca and near Apo. Finches were common all through the area.

Spinus pinus. Pine Siskin.—Siskins were seen nearly every day in the pines north of San Juan. One, with enlarged testes, was taken, April 25, 1945. Siskins were still about as common in 1947, but none were taken.

Spinus notatus. Black-headed Siskin.—Two males were taken, respectively, 7 mi S Uruapan and at Los Conejos in May, 1945. None was seen higher in the mountains. Blake and Hanson (1942) took one on Cerro Tancitaro.

Loxia curvirostra. Red Crossbill.—An adult female was taken at Los Conejos, May 23, 1945; a young male (wt., 39 grams) was taken near Los Reyes, June 3, 1945. Others were seen high in the pines near Apo.

Phœnicurus melanocephalus. Black-headed Grosbeak.—In 1945, this was a common bird at most localities, especially at Barranca Seca and near San Juan. They were apparently breeding, but we saw no young. In 1947, there were still birds around San Juan, but they were noticeably fewer. Two nestlings were brought into camp near Apo, June 26, 1947.

**Sporophila torqueola*. White-collared Seedeater.—Two were taken 2 mi E Los Reyes, June 3, 1945 (wt., 10.5 and 11.0 grams).

Atlapetes pileatus. Rufous-capped Atlapetes.—An adult male was taken near Apo, June 10, 1945. A fairly rare bird. We saw none at the lower elevations.

Atlapetes virenticeps. Green-striped Atlapetes.—A male (wt., 36 grams) and a female were taken near Apo on June 5 and 6, respectively, 1945. A fairly common finch in the heavy chaparral.

Pipilo ocai. Collared Towhee.—The Collared Towhee was encountered at Barranca Seca, Los Conejos, San Juan, and Apo. A nestling was taken at Barranca Seca, May 7, 1945. Not a common bird, it is fairly uniformly distributed over the area. Those taken at lower elevations have more white on their throats than do those taken near Apo.

Pipilo fuscus. Brown Towhee.—This was perhaps the commonest bird of the region. It was most numerous in and around the villages. In 1944, the Brown Towhee was the only bird seen along the San Juan lava front which was at that time actively progressing into and around the town. In 1945 (April 28), a nest was found (with two eggs) not more than 200 yards from the San Juan lava front, which was then inactive. The nest was about 10 feet above ground in a tree. It was made up of small pieces of vegetation, straw (probably from the stables), and two pieces of tissue paper. One specimen was taken at the Upper Casita, less than a mile from the cone, where all the vegetation was dead. It was subsisting, apparently, on dead insects and refuse left by the tourists. In 1947, these birds seemed to be less numerous around San Juan than they were two years before.

**Pooecetes gramineus*. Vesper Sparrow.—One was taken near San Juan, June 23, 1947.

**Aimophila rufescens*. Rusty Sparrow.—One male was taken at Los Conejos, May 24, 1945; the testes measured 5 mm in greatest diameter. This was the only place where this large sparrow was taken.

**Aimophila ruficeps*. Rufous-crowned Sparrow.—This species was encountered only at the station 2 mi E Los Reyes where two males and one female were taken between May 31 and June 3, 1945. One male weighed 20 grams, the other had testes 9 mm in greatest diameter.

Junco phaeonotus. Mexican Junco.—Juncos seemed to be least affected of any of the birds of the area immediately surrounding the volcano. At least they were found in all situations where there were remaining live trees. Males were singing from tops of trees within a mile of the cone in situations where there was no low ground vegetation and where the ash was at least five feet deep. Young birds, with streaked plumage of the underparts, were taken at Apo in June, 1945. Two adults with a young bird regularly came to a feeding station near the Lower Casita in July, 1947.

Spizella passerina. Chipping Sparrow.—Near Uruapan, Los Conejos, and Barranca Seca, these sparrows were common in the fields and pine forests. We saw none near the volcano. Blake and Hanson (1942) took them on Cerro Tancitaro.

LIST OF MAMMALS

Hall and Villa (1949) published a list of mammals then known from Michoacán. Some of the collections on which their list is based were made in the area of Cerro Tancitaro by expeditions from the U.S. Biological Survey (Nelson and Goldman) and from the Chicago Natural History Museum (Hoogstraal). While we were in the area we were joined for short periods by Bernardo Villa R., from Mexico City, and by A. Starker Leopold, Emmet T. Hooper, and J. A. King. All of the above, as well as H. O. Wagner who was collecting birds primarily, helped in the collecting of mammals. The following arrangement, in part, follows that in Miller and Kellogg (1955).

Didelphis marsupialis. Opossum.—A young individual was taken at Uruapan in 1944; others, young and adult, were taken near Apo in 1947. The Uruapan specimen, having recently acquired its full dentition, showed extreme wear on the teeth. M¹ was worn nearly to the roots, M² had the cusps worn off, and the lower occluding teeth showed similar wear. This young individual shows more wear on the teeth than does any old adult, in our collection, from elsewhere. A slightly more advanced young opossum from near Apo had M¹ worn to the roots, M² nearly to the roots, and M³ with cusps worn off. An adult from the same locality had all molars and premolars worn to the roots; there were no crowns remaining.

The abrasive quality of the volcanic ash is apparent in the opossum teeth. I would expect a shortened life span as a result.

Myotis velifer. Cave Myotis.—These bats were taken at Los Conejos and Barranca Seca in 1945. In four of the five specimens, the incisors, canines, and premolars are worn nearly to the roots.

Myotis subulatus. Small-footed Myotis.—Specimens taken at San Juan in 1947 did not show wear on the teeth.

Eptesicus fuscus. Big Brown Bat.—Two females taken near Apo on June 27 and 29 had active mammae. Their teeth show excessive wear.

Lasiurus cinereus. Hoary Bat.—Specimens taken at Los Conejos and Barranca Seca in 1945 had the teeth moderately to badly worn. One had an abscessed lower jaw.

Lasiurus borealis. Red Bat.—Taken only at Los Conejos in 1945. One specimen shows severe wear on the teeth and three show slight wear.

Tadarida brasiliensis. Mexican Freetail Bat.—Slight wear is shown on teeth of specimens taken in 1945 near Uruapan and at Los Conejos. A specimen from Pátzcuaro shows no wear.

Eumops underwoodi. Mastiff Bat.—Near Apo, in 1945, several bats of this species were seen feeding over a definite area shortly after sundown. They flew high and in a fairly straight course back and forth over a narrow strip. A female, taken June 7, 1945, weighed 57.6 grams and contained one embryo. Another female, taken on June 11, had an abscess under M¹. Both specimens had the tips of the

incisors and canines worn off and the cusps worn off the cheek teeth. The last molars showed least wear.

Procyon lotor. Raccoon.—These were encountered only near Los Reyes along a stream where they were common. They were feeding on small immature toads and frogs.

Bassariscus astutus. Ringtail.—Common near Uruapan. No signs seen closer to the cone. The molars are worn nearly to the roots.

Conepatus mesoleucus. Hognose Skunk.—Encountered only at Los Reyes in 1945. Recorded from Tancitaro by Hall and Villa (1949).

Canis latrans. Coyote.—Coyote tracks were often encountered on the ash between San Juan and the cone. They came regularly to our garbage pit near the Lower Casita.

Urocyon cinereoargenteus. Gray Fox.—Tracks of the gray fox were seen several times on the ash not far from the cone. They were encountered near Apo in 1945 and 1947, and at Los Conejos in 1945. Teeth showed excessive wear.

Citellus variegatus. Rock Squirrel.—In 1947, these squirrels were prospecting the lava front at San Juan. They were fairly common at Angáhuán, near Apo, and at Los Conejos. There was no excessive wear on the teeth.

Sciurus poliopus. Tree Squirrel.—Where there were living pines there were still a few of these squirrels in 1945, near San Juan. Near Apo, they were more numerous in both 1945 and 1947. Teeth showed excessive wear on some, moderate wear on others. Three melanistic specimens were taken near Apo.

Cratogeomys varius. Uruapan Pocket Gopher.—These gophers were common near Uruapan and at Los Conejos where there was less than four inches of ash and the vegetation had not suffered noticeably. Near the volcano, they had been eliminated in all areas with six inches or more of ash. On the plain south of Corupo, and north of San Juan, was a dramatic example of the apparent effect of depth of ash on these mammals. The yellow mounds, from the original soil, were conspicuous and abundant in the fields south of Corupo, but they stopped abruptly where the ash was six inches deep. No excessive wear was noted on the teeth. These gophers have six mammae.

Zygoeomys trichops. Michoacán Pocket Gopher.—One specimen taken near Apo; no unusual wear on teeth.

Reithrodontomys megalotis. Western Harvest Mouse.—Taken at Los Conejos and near Apo in 1945 and near San Juan in 1947. I suspect that the destruction of ground cover eliminated these mice in some areas. In the mountains NNW of San Juan, where some ground cover had reestablished, one specimen was taken in 1947. There is no noticeable wear on the teeth.

Reithrodontomys fulvescens. Fulvous Harvest Mouse.—These were taken at Uruapan in 1945. There was a good ground cover of grass. None were taken closer to the cone. No evidence of excessive wear on teeth.

Reithrodontomys sumichrasti. Sumichrast Harvest Mouse.—Present near Apo in 1945 and 1947; one was taken in Uruapan in 1947.

Peromyscus melanotis. Black-eared Mouse.—One specimen was taken 3½ mi ENE Apo, June 30, 1947.

Peromyscus maniculatus. Deer Mouse.—These mice were apparently able to survive along stone fences even though most of the ground cover was destroyed. In 1944 I took two on the mountain near Angáhuán and in 1945 and 1947 they were fairly common near the lava front. An immature individual was taken at the Upper Casita where the only food available was what visitors might have left in the way of scrap, the offal from horses, and possibly some dead insects that had blown in. They were about as numerous along the lava front in 1947 as in 1945. No excessive wear is indicated on the teeth. From three to five embryos were found in pregnant females. They have six mammae.

Peromyscus boylei. Brush Mouse.—This species was taken at Los Reyes and at a locality seven miles S Uruapan. At neither place had the ash affected the ground cover. These mice apparently were much less tolerant of the ash than were other species of *Peromyscus*. Females have four mammae.

Peromyscus hylocetes. Southern Wood Mouse.—Two adult females were taken at the Upper Casita in 1945. They were also taken near Apo the same year and again in 1947. In 1947 they were common on a small mountain 2 mi NNW San Juan. One of the natives was trying to grow corn on the side of this mountain where much of the ash had eroded away.

Baiomys taylori. Pygmy Mouse.—None were found closer to the cone than Los Reyes and Uruapan. At both places there was good ground cover of grass and herbs.

Oryzomys palustris. Rice Rat.—Specimens from Los Conejos and Uruapan show more wear on the teeth than does one from Los Reyes. None were taken near the cone.

Sigmodon hispidus. Hispid Cotton Rat.—In 1944 and 1945 these rats were encountered near Uruapan. In 1947 they were taken 8½ mi E Angáhuán. Heavy ground cover appears to be essential for these rodents.

Microtus mexicanus. Mexican Vole.—No specimens were taken until 1947 when two were trapped near Apo. Here there was considerable ground cover locally and these voles had been able to survive.

Sylvilagus floridanus. Cottontail.—Cottontails were taken in 1947 near Apo, at Barranca Seca, Los Reyes (a cream colored mutant), Los Conejos, and San Juan (teeth showed unusual wear). A female taken June 2 contained three embryos; a half-grown individual was taken near Angáhuán on June 15.

Lepus. Jackrabbit.—Two were flushed from their forms, about ten feet apart, near Los Reyes in 1945. They were probably *L. mexicanus*.

LITERATURE CITED

BLAKE, EMMET R., AND HAROLD C. HANSON

- 1942 Notes on a collection of birds from Michoacan, Mexico. *Field Mus. Zool. ser.*, 22: 513-51, Pls. 17-20, Figs. 39-40.

EGGLER, WILLIS A.

- 1948a The effect of Parícutin upon vegetation. *Pap. Mich. Acad. Sci. Arts, and Letters*, 32 (1946): 261-63.
1948b Plant communities in the vicinity of the volcano El Parícutin, Mexico, after two and a half years of eruption. *Ecology*, 29: 415-36, 16 figs.
1959 Manner of invasion of volcanic deposits by plants with further evidence from Parícutin and Jorullo. *Ecol. Monogr.*, 29: 267-84, 10 figs.

FRIEDMANN, HERBERT, LUDLOW GRISCOM, AND ROBERT T. MOORE.

- 1950 Distributional check-list of the birds of Mexico, *Pac. Coast Avifauna*, 29, pt. I: 202 pp.

HALL, E. RAYMOND, AND BERNARDO VILLA R.

- 1949 An annotated check list of the mammals of Michoacán México. *Univ. Kan. Publ., Mus. Nat. Hist.*, 1: 435-72, Pls. 4-5, 1 fig.

HATT, ROBERT T.

- 1944 A biologist may look at a volcano. *Cranbrook Inst. Sci., News Letter*, 14: 2-12, illustr.
1950 A bibliography of Parícutin volcano. *Papers Mich. Acad. Sci., Arts, and Letters*, 34 (1948): 227-37.

MILLER, ALDEN H., HERBERT FRIEDMANN, LUDLOW GRISCOM, AND ROBERT T. MOORE

- 1957 Distributional check-list of the birds of Mexico. *Pac. Coast Avifauna*, 33, pt. II: 436 pp.

MILLER, GERRIT S., JR., AND REMINGTON KELLOGG

- 1955 List of North American Recent mammals. *U.S. Natl. Mus. Bull.*, 205: xii + 954 pp.

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PLATE I

Pine tree with limbs broken by ash accumulation



PLATE II
Young pine with tip buried in ash and new growth along arched trunk