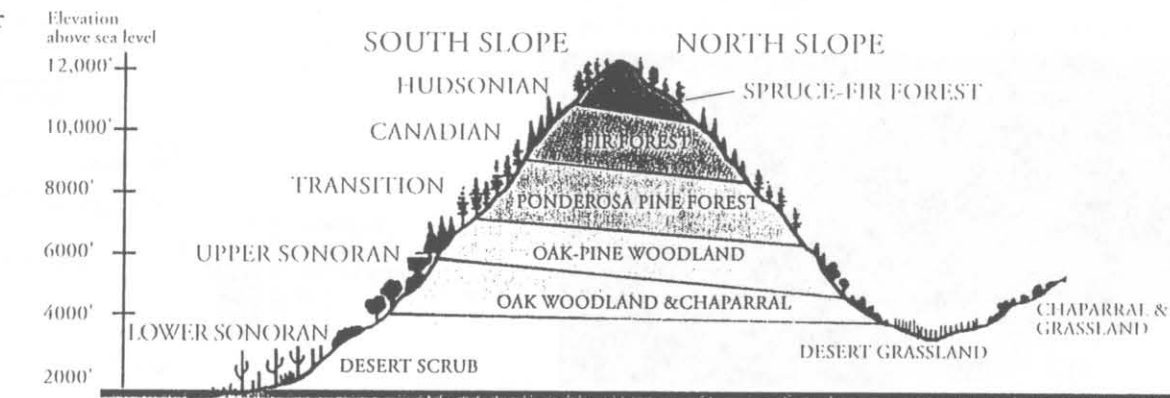


GUIDE TO THE MT. LEMMON HIGHWAY

The Santa Catalina Mountains are Tucson's skyline, point of reference, and great escape to whatever it is that's missing down below—usually cool weather, water and tall trees. Most of us occasionally make this escape, heading, usually, for a specific destination—a picnic ground, a meadow, a fishing hole. The Mt. Lemmon highway is the way we get there. Actually, the highway can be not only a means to an end but an end in itself—a worthy and remarkable journey, which offers an experience available almost nowhere else.

What is so remarkable about the trip is obvious: the great elevation difference between summit and base. True, all mountains share this characteristic, but the Santa Catalinas are exceptional. At 9157 feet, its summit, Mt. Lemmon, is one of the highest around, and the Tucson valley is low (about 2200 feet); so the difference between high and low points is extreme. This elevation difference, of course, means a



Life zones and biological communities on a typical southern Arizona mountain

difference in climate. For every 1000 feet of elevation gain, the temperature drops 3°F and the precipitation increases as well: 100°F in Tucson, 77°F on the mountain; 12 inches annual precipitation in Tucson, 27 inches at Summerhaven.

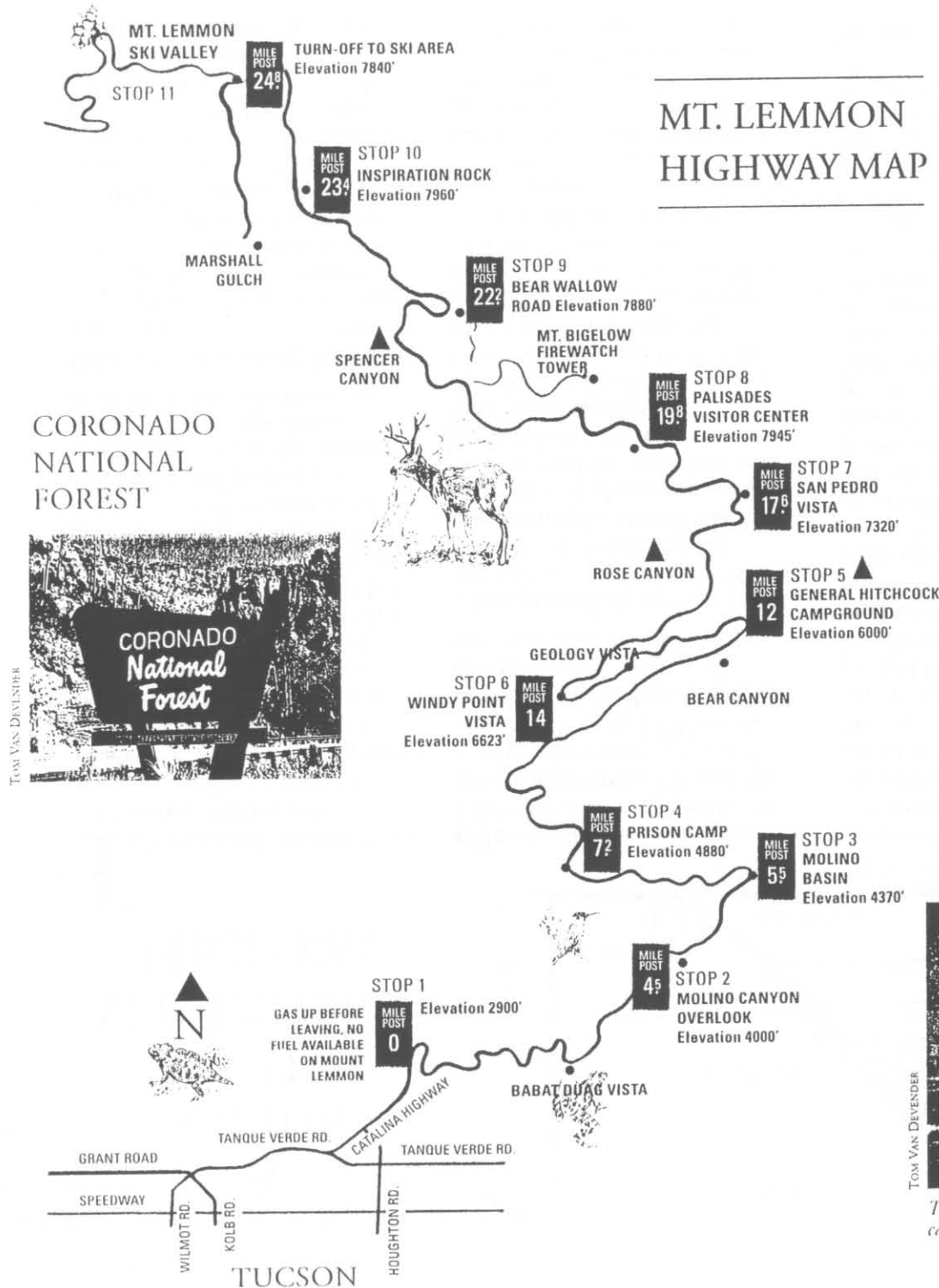
These gradual changes in temperature and moisture result in a vertical series of biological communities—identifiable assemblies of plants and animals, each adapted to conditions at a particular elevation. In the Southwest, these were first described on the San Francisco Peaks near Flagstaff by C. Hart Merriam in 1889. Merriam noticed something interesting: that these vertical communities were the equivalent (in life forms if not actual species) to the communities one would encounter if one drove north to Canada. In fact, he observed, a journey up 1000 feet equals a trip of about 300 miles north. Merriam called these communities life zones and gave them

names reflecting the relationship between elevation and latitude: the desert at the bottom, for example, he called Lower Sonoran, the fir forest near the top, he called Canadian. The stacked biological communities have been described in many mountains in the West, including the Santa Catalinas, although other observers do not always use Merriam's life zone terminology, preferring other descriptions, such as those used in this article. The correspondence between the life-zone system and ours is shown in the figure above. The figure is highly simplified, however. In nature, the zones are never so perfectly delineated or in such orderly sequences. Climate is very local in both its causes and its effects. Climate is influenced by such factors as wind current, soil, slope, exposure (shady north-facing; hot, sunny south-facing) or cold air drainage. And climate directly affects what kinds of things live where.

The Mt. Lemmon highway is a biological trip—from Mexico to Canada in 30 miles. There are few places in the world where one mountain can take you from subtropical desert to boreal forest. The highway is also a trip in time—in geologic time, from yesterday's mudslide to the birth of the Catalinas and beyond.

This issue of *sonorensis* is a guide up the Mt. Lemmon highway, beginning at milepost 0 at the bottom of the mountain, and ending at the top. Each stop invites you to get out of the car and look around. For each stop, we've included a checklist of the characteristic (or sometimes special) plants and animals you might see depending on time of day and year, and on your luck. Field guides and binoculars would be handy to have along. We hope this guide will be useful and interesting, whether you travel in an automobile or an armchair.

MT. LEMMON HIGHWAY MAP



CORONADO NATIONAL FOREST



TOM VAN DEVENDER



STOP 1
MILEPOST 0
Elevation 2900'

A little past milepost 0 is a pull-off to the left. This is a good spot for orientation. The Santa Catalinas vary in elevation from almost 2900 feet here to 9157 feet at the top of Mt. Lemmon. They are shaped like a pyramid and cover about 200 square miles. They are divided into a southern Forerange, which you see and which forms Tucson's skyline, and the taller main dome behind, which includes Mt. Lemmon. (You cannot see Mt. Lemmon from here, because you are too close to the Forerange.) The two parts are separated by an east-west valley that includes the upper reaches of Sabino Canyon.

From this spot, you can begin to



TOM VAN DEVENDER

The Santa Catalina Mountains as seen from Tucson. The large canyon is Ventana Canyon.



Milepost 0. Arizona Upland habitat in the foreground (saguavos, palo verdes, mesquites). Desert grassland covers the highest ridge.

see the remarkable series of habitats stacked one on top of the other. You are in the hottest, driest part of the mountain, in that subdivision of the Sonoran Desert known as Arizona Upland, which is characterized by saguaros and foothills palo verdes, and by the other plants you see here: prickly pear, cholla, ocotillo, brittlebush. Except for the saguaro, plants are not especially tall, and they are well-spaced, making it easy to see the terrain which is rocky and sloping, as it is here at the top of the bajada (the sloping, sediment-covered skirt of the mountain). Behind you, on the lower bajada where the soil is deeper, are groves of tree-sized velvet mesquite.

On the rocky slopes just above, you see mesquite bushes mixed

with palo verde; the mesquites indicate that Arizona Upland is giving way to desert grassland. On the highest visible ridge above, the transition is complete, and desert grassland dominates, though the dark green dots within it are probably oaks, suggesting the next highest zone—oak woodland. One other habitat deserves mention: that denser, greener band of plants lining the road. Here are found plants which need more water than those away from the road; they get it from runoff and from condensation under the pavement. The plants here are mainly grasses and desert broom, which typically grow along washes. Watch for the roadside effect with different plants all the way up the mountain.

CHECKLIST OF THE MOST COMMON SPECIES STOP 1

(Milepost 0)

PLANTS

- velvet mesquite (*Prosopis velutina*)
- saguaro (*Carnegiea gigantea*)
- foothills palo verde (*Cercidium microphyllum*)
- Engelmann prickly pear (*Opuntia engelmannii*)
- chainfruit cholla (*Opuntia fulgida*)
- staghorn cholla (*Opuntia versicolor*)
- ocotillo (*Fouquieria splendens*)

ANIMALS YOU ARE MOST LIKELY TO SEE DEPENDING ON TIME OF DAY AND YEAR

- desert spiny lizard (*Sceloporus magister*)
- western whiptail (*Cnemidophorus tigris*)
- zebra-tailed lizard (*Callisaurus draconoides*)
- regal horned lizard (*Phrynosoma solare*)
- leopard lizard (*Gambelia wislizenii*)
- red coachwhip (*Masticophis flagellum piceus*)

- Sonoran gophersnake (*Pituophis melanoleucus affinis*)
- tiger rattlesnake (*Crotalus tigris*)
- western diamondback (*Crotalus atrox*)
- blacktailed rattlesnake (*Crotalus molossus*)
- mourning dove
- white-winged dove
- black-throated sparrow
- Gambel's quail
- cactus wren
- verdin
- Harris' antelope squirrel
- rock squirrel
- mule deer

OTHER SPECIAL FEATURES

- gneiss



Cactus wren

A BRIEF HISTORY OF MT. LEMMON

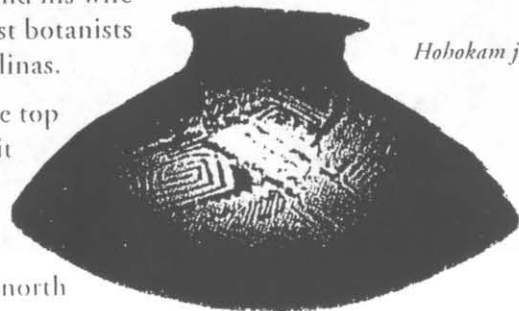
Native people used the mountain for thousands of years before the arrival of white settlers, but we don't know much about their experiences. Hohokam sites, dating from as early as 1200 years ago, cover the bajadas of the mountain; there are rock drawings and grinding holes a little above Molino Basin, and potsherds are said to have been found near Bigelow Peak. In the 19th and 20th centuries, western Apaches used the mountain for hunting and for gathering acorns, and Tohono O'odham gathered agaves there—for food and for making rope.

In 1697 Father Kino christened an Indian village near the Catalinas. He named both village and mountain range Santa Catalina, or Catarina, perhaps in honor of St. Catherine on whose day he first visited the area. The tallest peak is named after Dr. John G. Lemmon and his wife Sara, among the first botanists to explore the Catalinas.

The first road to the top was built in 1920; it still exists: a dirt road which approaches Mt. Lemmon from the north

of the mountain, via Oracle. The Mt. Lemmon highway was begun in 1933, was completed in 1950, and was built by convicts. It is sometimes called the General Hitchcock highway after a prominent citizen and proponent of the road's construction. Currently the Federal Highway Administration is reconstructing the entire highway, widening it from 22 to 28 feet.

In 1902 the Santa Catalinas were set aside as "forest reserves," and they became part of Coronado National Forest in 1908. The Forest Service has granted special use permits for radar stations, radio and TV sites, observatories, residences and ski areas. In 1978 the Pusch Ridge Wilderness Area was established; it is south and west of the Mt. Lemmon highway and includes all of the Forerange, which it protects from development.

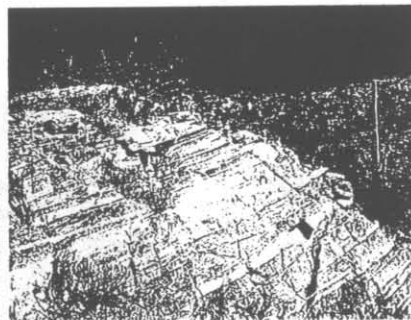


Hohokam jar

Mileposts 0 to 3

You are driving through Arizona Upland habitat. Notice the large stands of mature saguaros, some perhaps 150 years old. Often the largest individuals are in canyon bottoms (such as near mile .6) where they receive extra water.

The rock exposed by the road-cut is gneiss, recognized by its light and dark bands, which along this part of the road tilt to the southwest. Gneiss is a metamorphic rock which formed when granite was stretched and heated during a major faulting 17-30 million years ago when great sheets of rock that once overlay the Catalinas were pulled off to the southwest.



TOM VAN DEVELDER

The Forerange Anticline: light and dark layers of Catalina gneiss tilt to the southwest.

Milepost 3 Elevation 3720'

After milepost 3 the highway turns north into Molino Canyon which it follows for several miles. This is the first large canyon on the trip to Mt. Lemmon.

Mile 3.3

Notice that the light and dark layers of gneiss in the roadcuts and cliffs now appear level or horizontal instead of tilted. You have come to the top, or axis, of an anticline. The anticline is an upward fold of rocks. As you proceed you will notice around mile 4.3 that the rock layering tilts to the northeast, completing the anticline, which has a shape like a hump or an arch. This is the Forerange Anticline. The spine of the Forerange and Pusch Ridge follows the axis of the fold.

Mile 3.8 Elevation 4000'

For almost a mile now, the saguaros have been thinning out, giving way to a desert grassland community. The saguaros will continue to thin until Molino Basin, where they disappear. At this elevation (4000') prolonged winter freezes kill the young saguaros and sometimes even the mature ones. Only those in the sunniest, warmest places will survive. Begin looking for the last saguaro. Below, on the right, a riparian area borders Molino Creek.

Mile 4.2 Elevation 4100'

Notice the first oaks on the canyon slopes to the right.



STOP 2
MILE 4.5
MOLINO CANYON
OVERLOOK
Elevation 4000'

Several different communities can be seen from this stop—some determined by elevation and some mainly by slope. On the slopes across the road behind you, you will see a bit of desert grassland—large expanses of brown or green grass

(depending on season), dotted with shrubs or cacti: mesquite, shindagger, sotol, ocotillo, beargrass and cactus such as Engelmann prickly pear. A few lonely

saguaros can be seen on slopes where they get morning sun.

In front of you, across the canyon on cooler, wetter, north-facing slopes, there's an oak woodland. The trees there are primarily Mexican blue oaks and junipers. The small yellow-green bushes are turpentine bush. There are some



An oak woodland covers north-facing slopes in Molino Canyon.

of these near the parking lot too. Crush the leaves and smell why the plant got its name.

Take a short hike down the trail, and you'll discover a hidden world, a world very different in its sights, sounds and smells from the desert. Here Molino Creek makes its way over the rocks, leaving behind puddles in tinajas (bedrock basins) and deep pools among the boulders. Often during the year, there is water in the creekbed, and always it's just below ground, supporting a green line of water-loving trees: cottonwood, sycamore, Goodding willow, velvet ash, Texas mulberry. The water

also invites animals not seen elsewhere on the mountain: raccoons or gartersnakes, for example. Listen for the strange croak of the canyon tree frog, the calls of birds, the trills of flying insects. Search the pools for their aquatic inhabitants.

CHECKLIST STOP 2
MOLINO CANYON OVERLOOK

PLANTS

- turpentine bush (*Ericameria laricifolia*)
- Fremont cottonwood (*Populus fremontii*)
- ocotillo
- sycamore (*Platanus wrightii*)
- fairy duster (*Calliandra eriophylla*)
- Arizona rosewood (*Vauquelinia californica*)
- coral bean (*Erythrina flabelliformis*)
- velvet ash (*Fraxinus velutina*)
- wait-a-minute bush (*Mimosa biuncifera*)
- velvet mesquite
- sotol (*Dasyvirion wheeleri*)
- shindagger (*Agave schottii*)

ANIMALS

- water strider
- waterboatman
- water scorpions
- whirligig beetle
- predaceous diving beetle
- dragonfly
- damselfly
- canyon treefrog (*Hyla arenicolor*)

- red-spotted toad (*Bufo punctatus*)
- Clark's spiny lizard
- ornate tree lizard (*Urosaurus ornatus*)
- greater earless lizard (*Cophosaurus texanus*)
- western collared lizard (*Crotaphytis collaris*)
- black-necked gartersnake (*Thamnophis cyrtopsis*)
- rock wren
- lesser goldfinch
- Costa's hummingbird
- broad-billed hummingbird
- canyon wren
- ash-throated flycatcher

OTHER SPECIAL FEATURES

- pegmatite dikes (coarse-grained granite)



HOWARD LAWLER

The black-necked garter snake is rarely found far from water. You might find it along Molino Creek hunting fish or amphibians.

Mile 5.1

The narrow canyon we've been driving through has opened into a wide valley. This is Molino Basin. It marks the separation between the Forerange to the south and the main mountain mass to the north.



STOP 3 MILE 5.5 MOLINO BASIN CAMPGROUND Elevation 4370'

Park in the campground parking lot and spend some time looking at the plants and animals.

Molino Basin at almost 4400 feet elevation is in the Oak Woodland zone. The area receives moderate rainfall and frequent winter freezes (and sometimes snow). It's too cold for desert species but just right for oaks. The parking lot is surrounded by oaks of three kinds: Mexican blue, Arizona and Emory. (Across the highway a trail leads to a densely vegetated spot of interior chaparral, a community which is discussed at the next stop.)

Look at the differences in the vegetation on the

slopes surrounding you. North-facing slopes receive less direct sun, so they're cooler and retain moisture longer. They support an oak woodland. Warmer, drier, south-facing slopes above the basin are covered with desert grassland, the species of which require less water and are perhaps less cold-hardy than those of oak woodland.

Soil also influences which species grow where. Thinner or coarser soils such as those on slopes hold less water and support a more arid plant association than the deeper or finer soils in the basin where you stand. The oaks grow noticeably larger here than on the slopes, and riparian elements such as soapberry trees are also present.



MARK DIVARITT

Blue oak

CHECKLIST STOP 3

MOLINO BASIN
CAMPGROUND

PLANTS

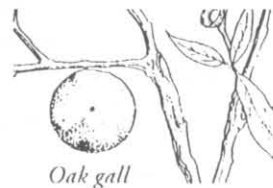
- Mexican blue oak
(*Quercus oblongifolia*)
- Arizona oak
(*Quercus arizonica*)
- Emory oak
(*Quercus emoryi*)
- mountain yucca
(*Yucca schottii*)
- manzanita
(*Arctostaphylos pungens*)

ANIMALS

- black-necked gartersnake
- Arizona black rattlesnake
(*Crotalus viridis cereberus*)
- Great Plains skink
(*Eumeces obsoletus*)
- rock wren
- bridled titmouse
- ash-throated flycatcher
- acorn woodpecker
- Bewick's wren
- Scott's oriole

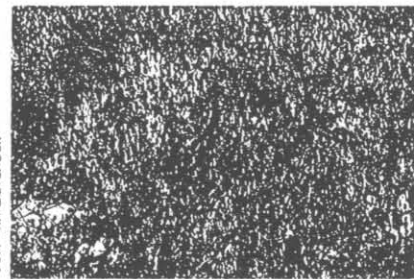
OTHER SPECIAL FEATURES

- oak galls



STOP 4 MILE 7.2 PRISON CAMP Elevation 4,880'

Chaparral and oak woodland have taken turns dominating this stretch of highway, and both can be seen here: oak woodland in the moister basin, chaparral on the hillsides. The graceful, red-stemmed manzanita is the primary chaparral plant in the Santa Catalinas.



TOM VAN DEVENDER

Manzanita

Chaparral is characterized by shrubs which grow close together and are densely branched, with small evergreen, leathery, resinous leaves. The resins reduce water loss during the hot dry summers. They also render chaparral explosively flammable, but the chaparral plants readily resprout after fire. The California coast supports extensive chaparral with a diversity of plants. Mt. Lemmon supports an interior chaparral with only manzanita

and a few other shrubs.

This spot is one of the places prisoners stayed while they worked on the Mt Lemmon highway.

CHECKLIST STOP 4 PRISON CAMP

PLANTS

- manzanita
- skunkbush (*Rhus aromatica*)
- Arizona oak
- Emory oak
- Alligator juniper
(*Juniperus deppeana*)
- border piñon
(*Pinus discolor*)

ANIMALS

- mountain short-horned lizard (*Phrynosoma douglasii*)
- Madrean alligator lizard
(*Gerrhonotus kingii*)
- Great Plains skink
(*Eumeces obsoletus*)
- Southern plateau lizard
(*Sceloporus undulatus tristichus*)
- Arizona mountain kingsnake
(*Lampropeltus pyromelana pyromelana*)
- Arizona black rattlesnake
(*Crotalus viridiscerberus*)
- black-tailed rattlesnake
- red coachwhip
- Sonoran whipsnake
- white-tailed deer



Arizona Oak

HABITAT PAIRS:

As you drive through several biological communities on your trip to the top of the mountain, you can observe an interesting phenomenon. In adjoining habitats you may find closely related animal species or species similar in appearance or lifestyle. For instance, as you drive through desert scrub and desert grassland you may see mule deer. But, as you enter oak woodland, riparian forest or pine forest, you will see

white-tailed deer. Mule deer prefer open habitats, white-tailed deer closed habitats. Where desert grassland meets oak woodland you might find both species.

A bird watcher can see subtle avian pairings between oak-dominated forest and pine-dominated forest. Compare the following habitat pairs as you might see them during the summer.

Oak (Prison Camp)

Elf owl
Common poorwill
Strickland's woodpecker
Gray-breasted jay
Bewicks wren
Hutton's vireo
Black-throated gray warbler
Bridled titmouse

Pine (Mt. Lemmon)

Flammulated owl
Whip-poor-will
Hairy woodpecker
Steller's jay
House wren
Solitary vireo
Grace's warbler
Mountain chickadee



Gray-breasted jay



Steller's jay

Milepost 8 Elevation 5,000'

The highway crosses a saddle between Molino and Bear Canyon. You can spot alligator bark juniper and border piñon pine here, part of the oak woodland community.

Milepost 8.4

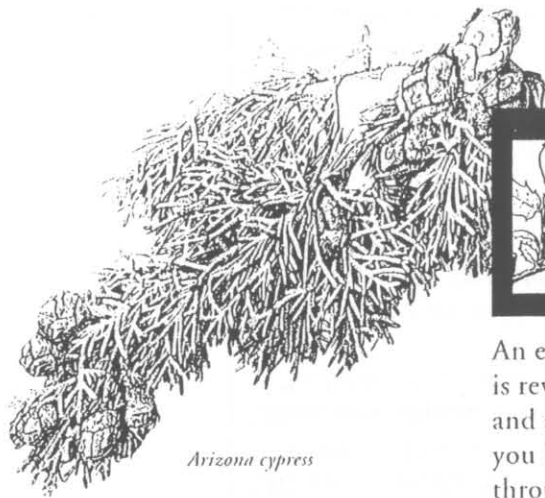
You have a good view of the interior valleys which separate Forerange and main dome.

Mileposts 8 to 10

You can view Bear Canyon from one of several pullouts on the left of the road between mileposts 8 and 10. Bear Canyon is a steep, interior canyon; it has water many months of the year. Sometimes you can see the Seven Cataracts (waterfalls) across the canyon. Conditions in the canyon are cooler and wetter and support a plant community quite different from those away from the canyon.

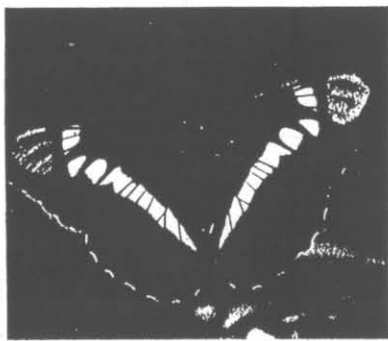
Milepost 10

At about mile 10, the highway no longer runs above Bear Canyon but actually begins to cut right through it. The environment looks very different from anything that has come before. It's dark, shady and cool here, and



Arizona cypress

there are amazing trees: huge sycamores with their distinctive, mottled bark; and most impressive of all, Arizona cypress, with their drooping, blue-green branches. Perhaps the most magnificent stand of these trees on the whole mountain occurs right here—in fact, the largest Arizona cypress in the country grows in this section of Bear Canyon (circumference 240"; height 93').



J. P. BROWN

The Arizona sister (*Adelpha bredowii eulalia*) is one of many butterflies found in oak woodlands. The adult comes frequently to damp soil. Its larvae feed on oak leaves.



**STOP 5
MILE 12
GENERAL HITCHCOCK
CAMPGROUNDS
Elevation 6000'**

An exploration of the parking lot is rewarding in terms of the plants and animals you might find. If you have time for a hike, walk through the campground and take a trail which goes up the creekbed through the oak woodland.

Because you have been driving in and out of canyons and across different slope exposures, you have entered, left, and re-entered various vegetative communities: chaparral, riparian, oak woodland and pine forest. At this elevation dense oak woodland clothes all slopes. A fourth major oak species—silverleaf oak, the oaks with lichens on the trunks—joins the other three you've been seeing: Mexican blue, Arizona and Emory oaks. Other common trees are ponderosa pine, Chihuahua pine and alligator bark juniper.

The oaks are a genus of about 600 species distributed throughout the northern hemisphere and into the mountains of the tropics. They are mostly New World; only 27 species occur in Europe. They range from shrubs to tall forest trees and may be either deciduous or evergreen.



HOWARD LAWLER

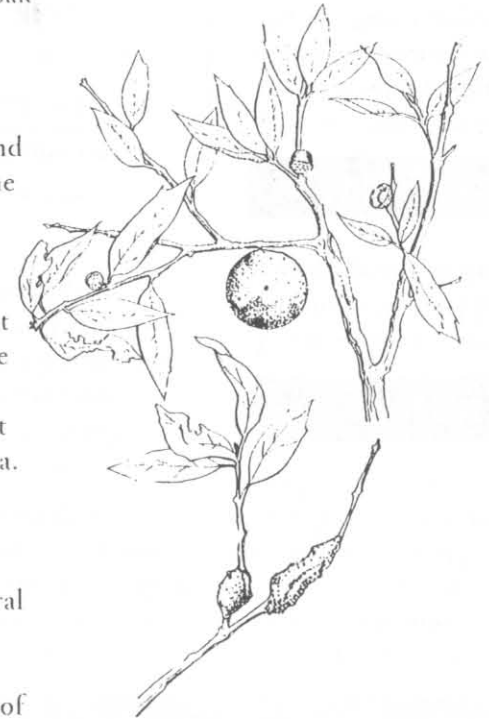
Chokecherry trees here may be covered with the silken shelters of tent caterpillars. In May and June, the tents will be filled with caterpillars, which leave them at night to feed on the leaves of the tree.

Many species provide excellent lumber; the bark of a European oak is the source of cork.

Look for oak galls. These are abnormal growths of different sizes and shapes on the leaves and stems of the oaks, induced in the plant by a gall insect, usually a wasp of the Family Cynipidae. The wasp larva either hatches from an egg laid inside the plant or burrows into the plant. There it produces a growth regulating hormone which causes the plant to grow the gall around the larva. The gall grows with the larva, providing both home and food for the developing wasp. One wasp species can parasitize several related oak species, but not others. Regardless of which oak the wasp chooses, the structure of the gall is always the same, always characteristic of that particular wasp. The same oak produces

different galls in response to different wasps. In fact, it is often easier to identify the wasp by looking at the gall than by looking at the wasp.

Oaks produce acorns in the late summer and early fall. These nuts are large and frequently abundant; they figure prominently in the ecology of many birds and mammals: black bears (there are a few in these mountains), acorn woodpeckers and gray-breasted jays, squirrels and deer, to name a few.



Galls produced by a silverleaf oak in response to two different wasp species.

CHECKLIST STOP 5

GENERAL HITCHCOCK
CAMPGROUND

PLANTS

- Mexican blue oak
- Arizona madrone
(*Arbutus arizonica*)
- silverleaf oak
(*Quercus hypoleucoides*)
- Arizona oak
- Emory oak
- Arizona grape
(*Vitis arizonica*)
- Arizona ponderosa pine
(*Pinus ponderosa*
var. arizonica)
- border piñon pine
- mountain yucca
- poison ivy (*Rhus radicans*)
- Arizona walnut
(*Juglans major*)
- alligator juniper
- Chihuahuah pine
(*Pinus leiophylla*)

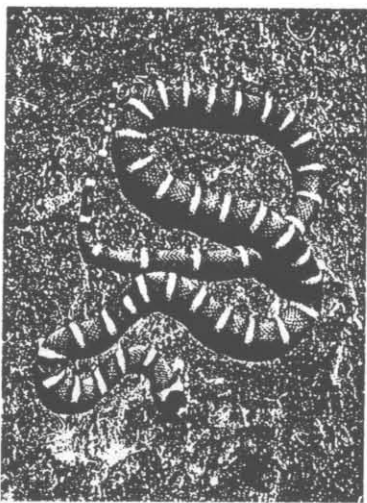
ANIMALS

- Arizona black rattlesnake
- black-tailed rattlesnake
- Arizona mountain
kingsnake
- mountain short-horned
lizard
- Madrean alligator lizard
- hermit thrush
- American robin
- painted redstart
- black-headed grosbeak
- greater pewee

- black-throated gray warbler
- Hutton's vireo
- gray-breasted jay
- acorn woodpecker
- Virginia warbler
- cliff chipmunk
- rock squirrel
- Arizona gray squirrel

OTHER SPECIAL FEATURES

- webs of tent caterpillars
- acorn woodpecker granaries
- oak galls
- granite boulders in
streambed

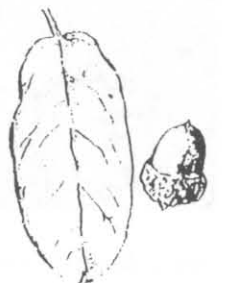


TOM VAN DIVERBIE

Bright red bands distinguish the Arizona mountain kingsnake from the more familiar, common kingsnake which is black and white or black and yellow. The mountain kingsnake is found all the way to central Mexico. On Mt Lemmon, you might see it in riparian areas and canyon bottoms above 4000'.

OAK IDENTIFICATION

MEXICAN BLUE OAK
(*Quercus oblongifolia*) leaves
oblong, rarely notched,
usually distinctly bluish with
a bloom above, paler
beneath; veins not obvious



SILVERLEAF OAK
(*Quercus reticulata*)
leaves white, wooly beneath, edges
roll under



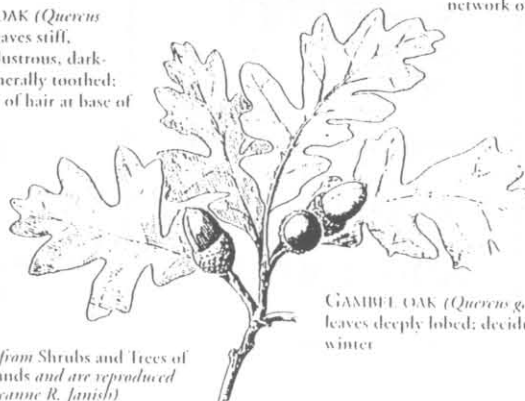
ARIZONA WHITE OAK
(*Quercus arizonica*) leaves
fuzzy beneath, dull
greenish-blue above; veins
visible especially below



EMORY OAK (*Quercus
emoryi*) leaves stiff,
leathery, lustrous, dark-
green; generally toothed;
small tuft of hair at base of
leaf



NETLEAF OAK (*Quercus reticulata*)
underside of leaves have prominent
network of raised veins



GAMBEL OAK (*Quercus gambelii*)
leaves deeply lobed; deciduous in
winter

(Most drawings are from *Shrubs and Trees of the Southwest Uplands* and are reproduced with permission of Jeanne R. Janish)

You'll see squirrels of different kinds all up and down Mt. Lemmon. In the lower desert sections live Harris' antelope squirrels. They burrow underground, are active year around, and eat desert fruits and the seeds of desert trees. One species of chipmunk lives in the Santa Catalinas—the cliff chipmunk, which also burrows and eats fruits and seeds, but which hibernates in winter. When you reach the first oaks, you'll see the first chipmunks, and you'll find them all the way to the top. Rock



JOHN HOFFMAN
cliff chipmunk



JOHN HOFFMAN
Harris' ground squirrel

Harris' antelope squirrels are ground squirrels, not chipmunks, though they look like them. One way to tell the difference is that chipmunks have white stripes on their faces.

THE SQUIRRELS OF THE SANTA CATALINAS

squirrels are plain, gray ground squirrels that look like tree squirrels. However, they spend their time on the ground or in burrows. You will see them in rocky outcroppings in any habitat along your journey. They tend to be inactive during the winter. The most spectacular squirrel here is a tree squirrel—the Abert's, or tassel-eared, squirrel. It is dependent on ponderosa pine



P. VAU BERQUIST
Abert's squirrel

trees. It eats the maturing pine cones during the summer, the seeds in the fall, the inner bark of twigs in winter, and the pine flowers in spring. It also eats pine forest fungi. The Abert's squirrel builds its huge nest of pine boughs high in a ponderosa pine. Abert's squirrels naturally occur in all the large ponderosa pine forests of Arizona except the mountain islands of the southeast. They were introduced to the Santa Catalina mountains in 1940 and have done well.

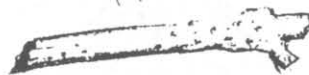
The Arizona gray squirrel is a native tree squirrel, primarily found in the riparian areas of the mountain, forested with sycamores, walnuts, ashes, oaks, chokecherries, and junipers. It feeds on the mast of these trees and on fungi. It is gray with a white belly and white-fringed tail.

SQUIRREL SIGN

Even if you don't see Abert's squirrels, they leave plenty of signs on the floor of a ponderosa pine forest.



In summer, they eat the green maturing pine cones, then drop the stripped cones to the ground.



In winter, they eat the bark of twigs, first clipping the bundles of needles and dropping them to the ground. Under a ponderosa pine you'll find signs of this activity—clusters of twig tips with their bundles of needles and 3-inch, pencil-thick pieces of bare wood.

OAK TREES AND ACORN WOODPECKERS

In oak country a tall tree or a dead limb with thousands of dime-sized holes each stuffed with an acorn or a piñon nut is the granary of the acorn woodpecker. (Look for one on the south side of the parking lot. More can be found about twenty minutes up the trail leading from the campground.) These granaries are the centers of acorn woodpecker society.

That society is most unusual, at least among birds. While with most species it is usual to speak of breeding pairs, with acorn woodpeckers one must talk of breeding groups. The group may consist of up to 15 adult birds, all cooperating to raise the young at one nest. Typically the adults might include as many as four breeding males, one or two breeding females and as many as ten nonbreeding offspring from prior nests. Thus a breeding group of acorn woodpeckers could be monogamous (one male and one female), polygynous (one



PELU BERGUNT

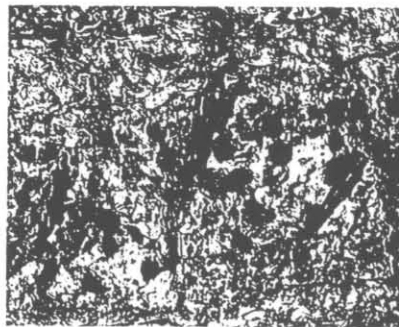
Acorn woodpecker. This is a male. Females have a black band separating the red and white on their foreheads.

male and two females), polyandrous (one female and multiple males) or polygynandrous (multiple males and two females). Each group defends a territory, maintains at least one granary and cooperatively produces one nest at a time.

The breeding members of a group are usually related, but only within each sex. Because of an incest taboo, males never become breeders in a group where their mothers, sisters or aunts are breeders. The same goes for females. Nonbreeders can become breeders within the group only when all related members of the opposite sex have died or left the group. Or, if they prefer not to wait, nonbreeders may invade another group.

The size, composition and reproductive success of an acorn woodpecker group depend on how many acorns and piñon nuts it can store. In the fall, wood-

peckers gather the nuts directly from the tree and firmly wedge each one into its own hole in the storage tree. Old holes are re-used and new ones drilled—typically in dry, dead wood or in thick, porous bark. This keeps the nuts dry and fresh for nearly a year, until the next crop comes along. Granaries holding 50,000 acorns have been reported, but 2,000 acorns would be more typical. Since the granary is usually on a nearly inaccessible tree trunk or limb and since the nuts are firmly-wedged in individual holes, they are safe from rodent and jay thieves. Just to make sure, woodpeckers also defend the granary ferociously.



TOM VAN DERVINDER

Acorn woodpecker granary

Large stores of acorns can sustain adults through the winter and still provide food for them while they raise young in the spring. The young are fed a more nutritious diet of flying insects, which their caretakers spend much time and energy catching.

Mile 12.3

The north-facing slope on the left of the road is covered with pine forest (mainly ponderosa pine, Chihuahua pine and Douglas fir); on the right the drier conditions support chaparral.



**STOP 6
MILE 14
WINDY POINT
Elevation 6623'**

Windy Point is a good spot to think about geology (just as good, and maybe better than the Geology Vista up ahead) because the evidence of so many geologic processes can be seen from here.

GEOLOGY OF THE CATALINAS

In the Santa Catalina Mountains you can see evidence of four eras of geologic history. The mountains themselves were formed comparatively recently—during the last 100 million years. But the rocks that make up the mountains date almost to the beginnings of Arizona geologic history.

PROTEROZOIC ERA

1700 to 570 Million Years Ago

The oldest rocks in the Catalinas were formed in a lofty mountain range. Not a trace of high country

remains from those early mountains—they were eroded an inch every thousand years, until they were gone. Only a flat plain remained, at sea level, formed on the beveled schists and granites of the mountains' roots. These are the basement rocks of the Catalinas. One of them, the

Oracle Granite.

Late in the Proterozoic, after the ancient mountains had succumbed to erosion, inland seas covered the flat land, depositing sedimentary layers. These can be seen, much metamorphosed, in the Bear Wallow area near mile 22.



View from Windy Point

Oracle Granite, is about 1450 million years old. A portion of the granite was later metamorphosed and incorporated into the Catalina Gneiss. Thick light and dark bands of Catalina Gneiss make up Pusch Ridge, which is the mountain ridge between Windy Point and Tucson. This gneiss is visible in most roadcuts along the first four miles of the Mt. Lemmon Highway. The darker bands are thought to be metamorphosed remains of

The Proterozoic rocks were buoyed up to the top as the mountains rose. They include tan quartzites and silvery schists, not the schists of the ancient mountains but the product of much more recent metamorphism acting on the Late Proterozoic sedimentary rocks.

PALEOZOIC ERA

570 to 250 Million Years Ago

In the Southwest, the Paleozoic Era is characterized by a succession of inland seas, each of which

brought various sediment layers. For example, the flat-lying layers of the Grand Canyon were formed in this way. Similar layers covered southern Arizona, stacked on top of the worn down Proterozoic sediments and basement rocks.

Paleozoic sedimentary rocks can be seen in the distance from Windy Point, on the flanks of nearby mountains. They can be seen a little closer from San Pedro Vista, our next stop. No longer horizontal, the rocks were later broken by faulting and tilted away from the mountain top.

MESOZOIC ERA

250 to 65 Million Years Ago

Ever-increasing volcanism and igneous activity culminated in the formation of the main body of Catalina rocks, the Wilderness Granite, during the late Mesozoic and early Cenozoic Eras. At least one giant volcanic eruption took place 70 million years ago on the flanks of the Catalinas. A caldera eighteen miles in diameter opened with a force a thousand times as great as the 1980 eruption of Mt. St. Helens. The rocks at our feet at Windy Point are Wilderness Granite, originally formed about eight miles deep in the crust.

CENOZOIC ERA

65 Million Years Ago to Present

During the Cenozoic, our region

was subjected to stretching, or extensional tectonics. This was manifested in two ways, with dramatic results that produced the present-day landscape seen from here.

By middle Cenozoic time, the crust here was thin, hot and stretchable. New granites were slowly crystallizing in their magma chambers at the roots of the Catalinas. The stretching caused horizontal sliding of the upper crust, called detachment faulting, like spreading a stack of magazines on a coffee table. The giant caldera volcano, now long extinct, moved westward off the rising top of the Catalinas.

The Tucson Mountains that we see just west of Tucson are none other than the huge volcano that actually erupted near or on the present site of the Catalinas. It was transported as the top "magazine" was pulled westward over the stretching granites beneath. Uncovered, these granites began to rise, ultimately forming Mt. Lemmon. As the volcano was pulled over the rising granites, the rocks were heated by friction and stretched, metamorphosing the top couple miles of granite into gneiss. This is the Catalina Gneiss which has the appearance of "stretched granite." Notice also that "stretch marks" in the granite at your feet all point toward the

geology (cont.)

Tucson Mountains in the distance.

Toward the end of the Cenozoic, the crust here had cooled and thickened. Continued stretching had a very different effect: instead of detachment faulting, the land broke in horizontal north-south faults, forming discrete blocks averaging perhaps fifteen miles wide in the east-west dimension and sometimes fifty miles from north to south. Alternate blocks foundered in the stretching crust, forming the basins that characterize our area, such as the Tucson Basin on the far side of Pusch Ridge. Fault-block mountain ranges paralleled the basins, giving our landscape its final structure: the Basin and Range Physiographic Province of North America. From here you can easily see the Tucson Mountains, Santa Ritas, Baboquivaris and the basins which separate them. Subsequent changes have been minor: erosion and the final uplift of the Catalinas. Granite, on average, is of lighter weight than surrounding rock types. So it tends to "float" upward through the broken crust. This last upward movement, perhaps continuing today, gave Mt. Lemmon its current 9157-foot elevation.

Mileposts 14-16



TOM VAN DEVENDER

hoodoo

the roadside from Windy Point to Geology Vista and beyond are called hoodoos. They form when weather attacks fractured rocks, rounding off corners and eating into horizontal cracks to form pedestals of grotesque or humorous form. The word is of African origin, related to voodoo, and refers to the animal and other spirits evoked by these weird formations.

Milepost 17

Just ahead is the entrance to Rose Canyon Campground and Picnic Area in the ponderosa pine forest.

This stop offers a view of the San Pedro River Valley below and the basins and ranges beyond: the Galiuro Mountains and then the Pinaleños with Mt. Graham as their highest peak (and the highest peak in southern

Arizona). Every now and then you run into a word whose sound just fits its meaning. The oddly-shaped pillars of granite and gneiss along

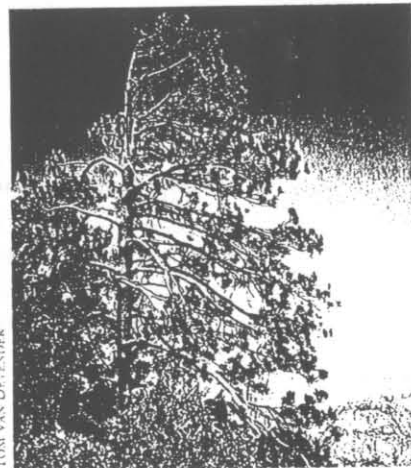
STOP 7 MILE 17 SAN PEDRO VISTA Elevation 7320'

The San Pedro River runs north from Mexico and flows into the Gila River near Winkelman. The San Pedro and the Santa Cruz rivers carry sediment from the Catalinas to the Gila, west to the Colorado, and down to the Gulf of California. If you could return in 200 million years, this whole mountain would be beach sand.

Fifteen million years ago there was no San Pedro river, and this basin had no outlet. Large lakes formed, and evaporate minerals like gypsum concentrated in the salty water. The gypsum is now mined for sheetrock for the housing industry. Other mining in the valley targets the rich copper deposits in the vicinity of San Manuel. You can see the smelter and tailings ponds.

A few of the nearby trees have been struck by lightning, leaving spiral scars down the trunks. A struck tree often survives, though sometimes it is blown apart and set afire.

Several of the trees have been shaped by the wind. Guess which way it usually blows.



TOM VAN DEVENDER

Wind-shaped ponderosa pine at San Pedro Vista.

CHECKLIST STOP 7

SAN PEDRO VISTA

PLANTS

- Douglas fir
(*Pseudotsuga menziesii*)
- silverleaf oak
- nectleaf oak
(*Quercus reticulata*)
- ponderosa pine
- Southwest white pine
(*Pinus strobiformis*)

ANIMALS

- white-throated swift
- cliff chipmunk
- rock squirrel
- Arizona black rattlesnake
- black-tailed rattlesnake

OTHER FEATURES

- tilted Paleozoic sedimentary rock on cliffs between here and mine tailings
- distant desert grassland slopes
- distant oak woodland slopes

Fire is a significant component in the ecology of all Southwestern communities above the desert, and lightning was the major cause of fires before humans arrived. Most fires burn only the understory; crown fires that kill large stands of mature trees are rare. All of our nondesert species must cope with fire in one way or another. Mature trees typically have thick bark that insulates the living tissue. Many shrubs and grasses resprout from below ground after burning. Some plants grow only in rock outcrops or thin soils where the vegetation is too sparse to carry a fire. Still others have fire-resistant seeds; some species' seeds cannot germinate until they have been scorched and left exposed to the sun in an ash-covered clearing.



Fire is not an immediate threat to most animals because they can outrun or outfly it,

or retreat underground where temperatures do not increase as a fire burns overhead. In the first couple of seasons after a fire, the

reduced vegetative cover increases the risk to prey species, which is in turn a boon for predators of open habitat. Fire alters the productivity of the community and therefore the food supply. Green forage is obviously reduced for a season, but the seed bank in the soil is little affected. Soils are enriched by the ash and often encourage

a flush of productivity in herbs and grasses. Fire-adapted communities rebound quickly following even an all-consuming crown fire, and within a few years a dense and productive though usually different species mix has developed on the burned area.



TOM VAN DEVENTER

Lightning scar on living Douglas fir, San Pedro Vista

The widely separated, high ranges of the Southwest are often called mountain islands, which in fact they are, almost as surely as if they were surrounded by water. On a clear day you can see other mountain islands across the "ocean" of desert or grassland valleys. While many birds and some insects can easily fly between mountains and some larger mammals can migrate across the valleys on foot, the majority of animals are less mobile and tend to

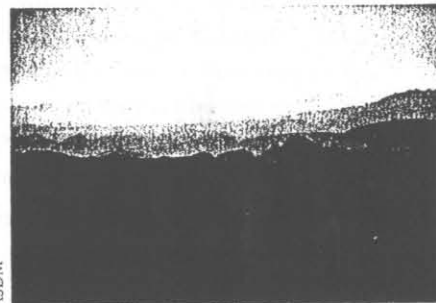
stay out of the lower, hostile (to them) habitats. The plants too are isolated except for species with seeds that are small and wind-dispersed or are adapted to being transported on or in migratory animals. Surprisingly, not much speciation has occurred on the mountain islands, because the current level of isolation has existed for only about 9000 years. The isolation of each island does, however, result in some mysteries: chipmunks on all mountains in the vicinity, but not on the Huachucas; no voles in the

MOUNTAIN ISLANDS

Catalinas; Mexican chickadees only in the Chiracahuas.

The mountain islands in this part of the world are part of a chain (the Southwest or Madrecan archipelago) which includes 42 mountain ranges: 27 in the US, 15 in Mexico. This archipelago can be said to lie between two "continents"—the Rocky Mountains, which end above the Mogollon Rim, and the

Sierra Madre Occidental in Chihuahua and Sonora. The biology of the islands is influenced by both continents. Most oaks, for example, derive from the Sierra



ASDM

Chains of "mountain islands"

Madres, and Douglas fir from the Rockies. In addition, the islands receive plant and animal species from the Great Plains (notably grassland species), and West Coast chaparral plants also make an appearance.

Arizona is remarkably rich in plant and animal species. That diversity is due primarily to these mountain islands which receive living contributions from diverse regions and then provide just the right spot for them in the varying conditions along their steep sides.



STOP 8
MILE 19.8
PALISADES VISITOR
CENTER
Elevation 7945'

You are in the thick of the ponderosa pine forest, perhaps the most distinctive community on the whole mountain. It's easily recognized by its open park-like feeling and the almost complete domination of this tall, beautiful tree.



Arizona ponderosa pines

You can estimate the age of individual ponderosa pine trees by their size and by the color and condition of their bark. Juvenile trees are less than 1 foot in diameter. Trees less than 150 years old are 1 to 2 feet in diameter and have black bark. At 150 to 200 years, the bark acquires a distinctive look: it is deeply furrowed with large yellow or cinnamon-red scales. The trees may live 400 to 500 years. You can hardly resist touching the trunk of a big ponderosa pine or identifying the shapes of its scales. Smell the bark; it reminds most people of vanilla.

Mt. Lemmon has two different kinds of ponderosa pines: the 5-needled Arizona ponderosa pine and the 3-needled Rocky Mountain ponderosa. The Arizona ponderosas extend south to Chihuahua and Sonora in the Sierra Madre Occidental. And, as their name implies, the Rocky Mountain ponderosas are the southern extension of the trees found north through the Rockies to the Pacific Northwest. As one would suspect, on Mt. Lemmon the Arizona subspecies is found at lower elevations, such as here, while the Rocky Mountain trees are on the summit.

Although ponderosa pines (also called yellow pines) are found all over the western US, they are especially abundant in the

Southwest, where they are the most common forest tree. Although now so common, the ponderosa pine is a relative newcomer to the US. About 11,000 years ago, when the last Ice Age ended and warmer temperatures and regular summer rains became established, the ponderosa pine spread north from Mexico. But during the glacial periods, this whole community was missing; mixed conifer forest came right down to meet piñon-juniper woodland.



The deeply-furrowed bark of an old ponderosa pine



Abert's squirrel

CHECKLIST STOP 8

PALISADES VISITOR CENTER PLANTS

- Douglas fir
- Arizona ponderosa pine
- Gambel oak
- bracken fern
(Pteridium aquilinum)

ANIMALS

- Arizona mountain kingsnake
- Arizona black rattlesnake
- Arizona black-tailed rattlesnake
- mountain short-horned lizard
- Great Plains skink
- Steller's jay
- Abert's squirrel



STOP 9
MILE 22.2
BEAR WALLOW RD.
Elevation 7880'



TAMI VAN DEVELDER

The forest in Bear Wallow

Take the Bear Wallow road to the right to a campground a short way up the road. You are now at nearly 8000' elevation and have driven the equivalent of 1600 miles northward. You could well be in Michigan, in just such a forest of mixed conifers and hardwoods. Many of the plants here are the same as those found in the Rocky Mountains and in eastern forests. These include box elder, raspberry and red osier dogwood. Bigtooth maple is closely related to, and may even be a variety of, the eastern sugar maple. Gambel oak is the western member of the eastern red oak group.

Although many trees bear scars attesting to frequent summer lightning and its often lethal

results, the forest here is moist enough to inhibit fires. The air is cool even in midday, full of promise of cool nights, and frigid winters. The ground never heats up enough to blister feet or force animals into nocturnal activity. The light filtered through trees, branches and leaves is comforting after the harsh glare of the desert sun. Deep shadows alternate with bright patches and needles glitter on backlit conifers. Melodic bird calls are punctuated by the shrill buzz of broad-tailed hummingbird wings or the strident cries of Steller's jays.

Here soils are well developed and a rich dark brown in color, and have the uneven, churned look caused by the freezing and thawing of snow-covered, saturated ground and the tunneling of pocket gophers. Leaf litter and conifer needles and cones



E. NISHIDA

Lactarius deliciosus is a widely distributed fungus found under conifers in the US and Europe. It is distinguished by its orange color, its giving off an orange "latex" where cut, and its tendency to turn greenish wherever bruised or injured.

abound, giving the forest its clean, earthy smell. Nutrients are recycled into the soils primarily through decay processes and the actions of fungi, not termites as in deserts or grasslands. Logs rot into islands of enriched soil.

Spring is delayed so long here that it merges with summer into a single warm growing season. In the summer, the ground is carpeted with green, mostly from Canadian violets, bracken ferns, grasses and sedges.

CHECKLIST STOP 9

BEAR WALLOW RD.

PLANTS

- Arizona ponderosa pine
- Douglas fir
- white fir (*Abies concolor*)
- southwestern white pine
- bigtooth maple
(*Acer grandidentatum*)
- golden aspen
(*Populus tremuloides aurea*)
- box elder
(*Acer negundo*)
- raspberry (*Rubus strigosus*)
- red osier dogwood
(*Cornus stolonifera*)

- Gambel oak
- bracken fern

ANIMALS

- Arizona mountain kingsnake
- Arizona black rattlesnake
- Arizona black-tailed rattlesnake
- mountain short-horned lizard
- Great Plains skink
- broad-tailed hummingbird
- Steller's jay yellow-rumped
- warbler red-faced warbler
- hermit thrush
- American robin
- house wren
- white-breasted nuthatch
- mountain chickadee
- violet-green swallow
- northern goshawk
- cliff chipmunk
- Abert's squirrel

OTHER FEATURES

- Abert's squirrel nest high in pines
- Abert squirrel sign (see p. 11)
- bear sign (for example rolled rocks, rubbed trees, tracks, scat)



Black bear



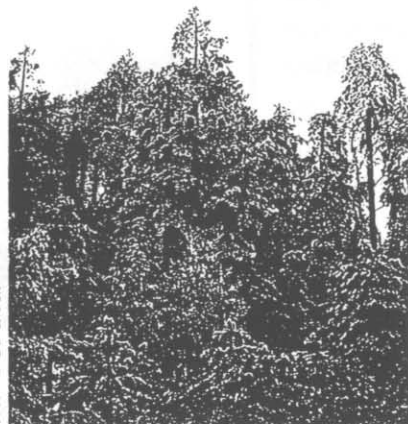
**STOP 10
MILE 23.4
INSPIRATION ROCK
PICNIC AREA
Elevation 7960'**

From the parking lot, walk out to Inspiration Rock. This is a well-named rock, for many reasons. It offers a wonderful view of the mixed conifer forest across the canyon, with its perfect cone-shaped Douglas fir trees. The rock itself is inspiring as well. It is pegmatite—a coarse-grained granite—covered with lichens of many colors, with mica in huge pockets and in smaller foliated bundles called “books,” with veins of quartz, and sprinkled with tiny red garnet crystals. It’s a rock well worth contemplating.



**STOP 11
MILE 24.8
TURN-OFF TO
SKI AREA
Elevation 7840'**

Take this turn-off which leads to the top of the mountain. The rocks of the road-cut here are distinctive and interesting. The darker rock is granite-like Leatherwood Quartz Diorite. This igneous rock is the same age as the Tucson Mountains volcanoes, about 70 million years. Light-colored dikes of fine-grained



TOM VAN DEVENDER

Mixed conifer forest, Mt. Lemmon

granite cut through the diorite.

The roadside vegetation here is tall and dense. As you drive along, practice your identifications of firs and pines. You’ll see patches of aspen with their white bark and bright, fluttering leaves, and Rocky Mountain maple, distinguished from bigtooth maple by its coarsely-toothed leaves.

Pass by the ski lift and restaurant (elevation 8320 feet) and drive



ASDM

You've a good chance of seeing a short-horned lizard on Mt. Lemmon. It's well adapted to cold and can live at high elevations and in latitudes as far north as Canada. It bears live young—likely an adaptation to cold climates.

beyond the gates and up the mountain road to the top. You are nearing the end of the Mt. Lemmon highway, the summit of the mountain, and the climax of the trip. The mixed conifer forest, which has appeared here and there in small patches, finally takes over, as the road switches to a northern exposure. As you round the next to last turn, you’ll find yourself in an isolated stand of corkbark firs. This is the highest and coldest section of the forest.

Mt. Lemmon doesn’t have enough area above 9000 feet to support the high-elevation, spruce-fir community, except for the corkbark fir which grows only on the cold, north face of this mountain. It is easily recognized by its very straight and smooth gray trunk, in contrast to the deeply furrowed, rough bark of the white fir and Douglas fir. The bark gives, like cork, when you press it with your fingers.

The Forest Trail Parking Lot is as far as you can go by car. But you can take a trail to a meadow or to the Lemmon Rock Lookout (about .6 mile) for a view of the Wilderness of Rocks. Or just enjoy looking at the birds and plants around the parking lot. You’re in a different world. The elevation here is 9000'. You are 6500 feet above Tucson, and 2200 miles north. You are in southern Canada.

**CHECKLIST STOP 11
SKI AREA ROAD**

PLANTS

- Douglas fir
- white fir
- corkbark fir
(*Abies lasiocarpa*)
- Southwestern white pine
- golden aspen
- red-osier dogwood
- bracken fern
- snowberry
(*Symphoricarpos oreophilus*)
- New Mexican locust
(*Robinia neomexicanus*)
- mountain spray
(*Holodiscus dumosus*)
- Rocky Mountain maple
(*Acer glabrum*)
- Columbine
(*Aquilegia chrysantha*)

ANIMAL

- mountain short-horned lizard
- house wren
- black-headed grosbeak
- Steller’s jay
- yellow-eyed junco
- western tanager
- pygmy nuthatch
- American robin
- Mexican spotted owl
- northern (red-shafted) flicker
- hermit thrush
- Abert’s squirrel

GUIDE TO THE EVERGREENS OF MT. LEMMON

PINES

KEY TO ALL PINES:

needles in bundles with thin "sheath" holding needles together

cone scales thick

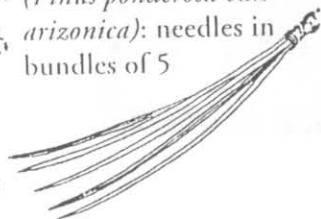
cones woody

Rocky Mountain ponderosa pine (*Pinus ponderosa*): needles in bundles of 3

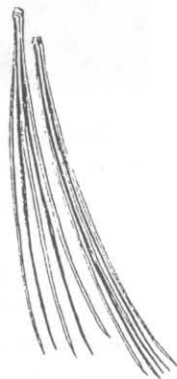
bundle sheath is long and persists



Arizona ponderosa pine (*Pinus ponderosa* var. *arizonica*): needles in bundles of 5



Southwestern white pine (*Pinus strobiformis*): needles long (3-4"); bundles of 5, tips of cone scales curve back



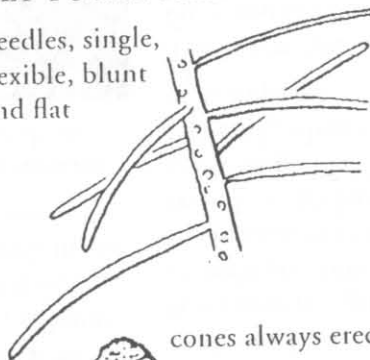
border piñon pine (*Pinus discolor*): 3 fairly short needles, whitish cast on inner surface



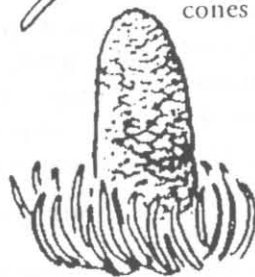
FIRS

KEY TO ALL FIRS:

needles, single, flexible, blunt and flat



cones always erect



central axis of cone stays after scales crop off



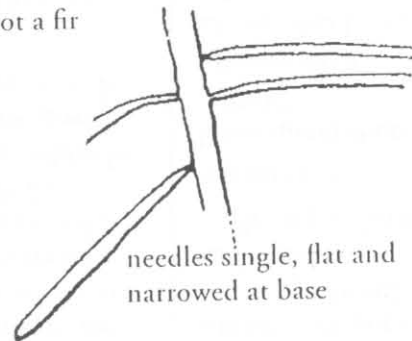
white fir (*Abies concolor*) bark is thick, gray, deeply furrowed with age

corkbark fir (*Abies lasiocarpa* var. *arizonica*) soft, spongy bark which is thin, smooth and gray
bluish needles

DOUGLAS FIR

Douglas fir (*Pseudotsuga menziesii*):

not a fir



needles single, flat and narrowed at base

cones hang down



identifying feature:
3-pointed "mouse-tail" bract on cone

