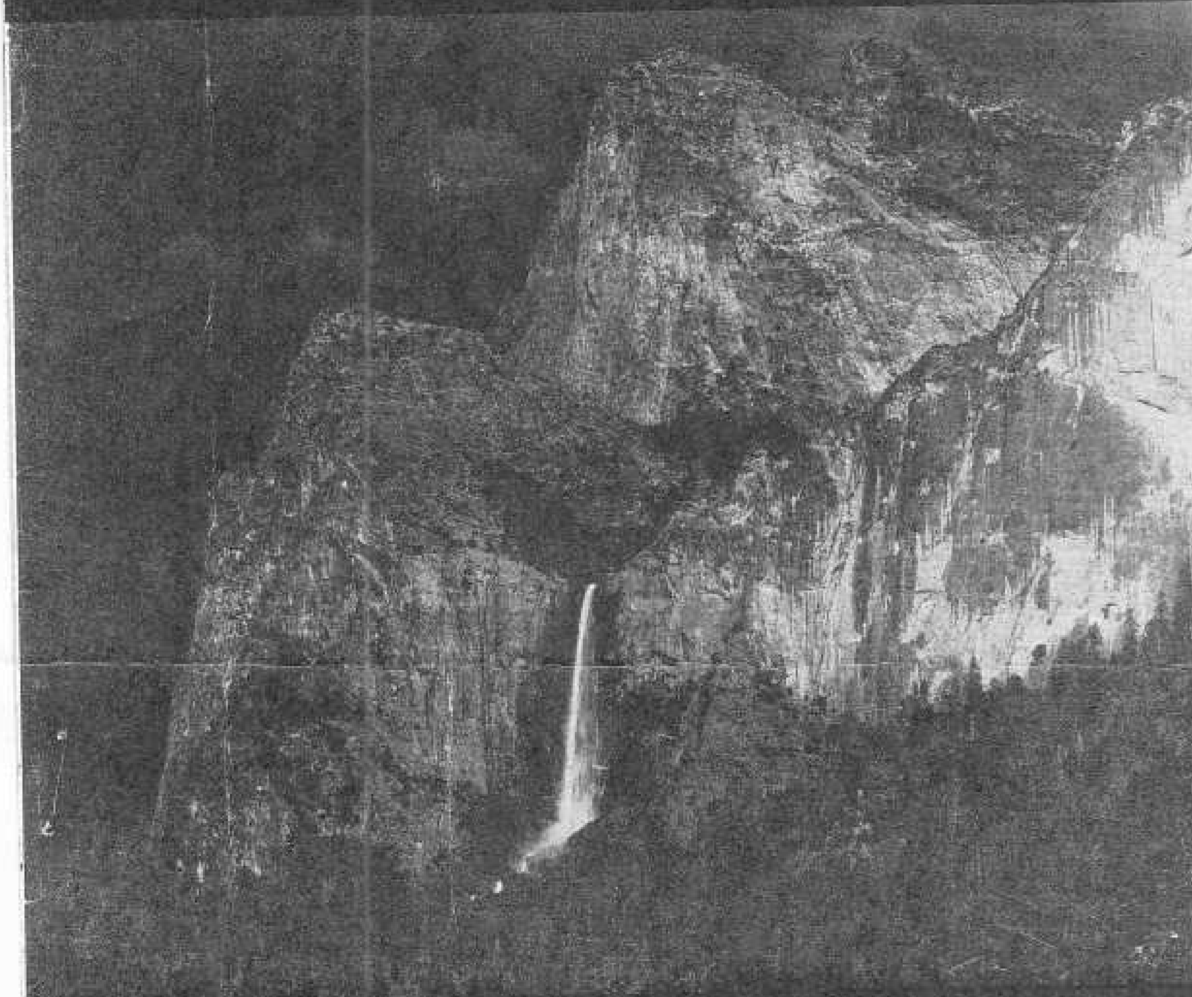
osemite Nature Notes



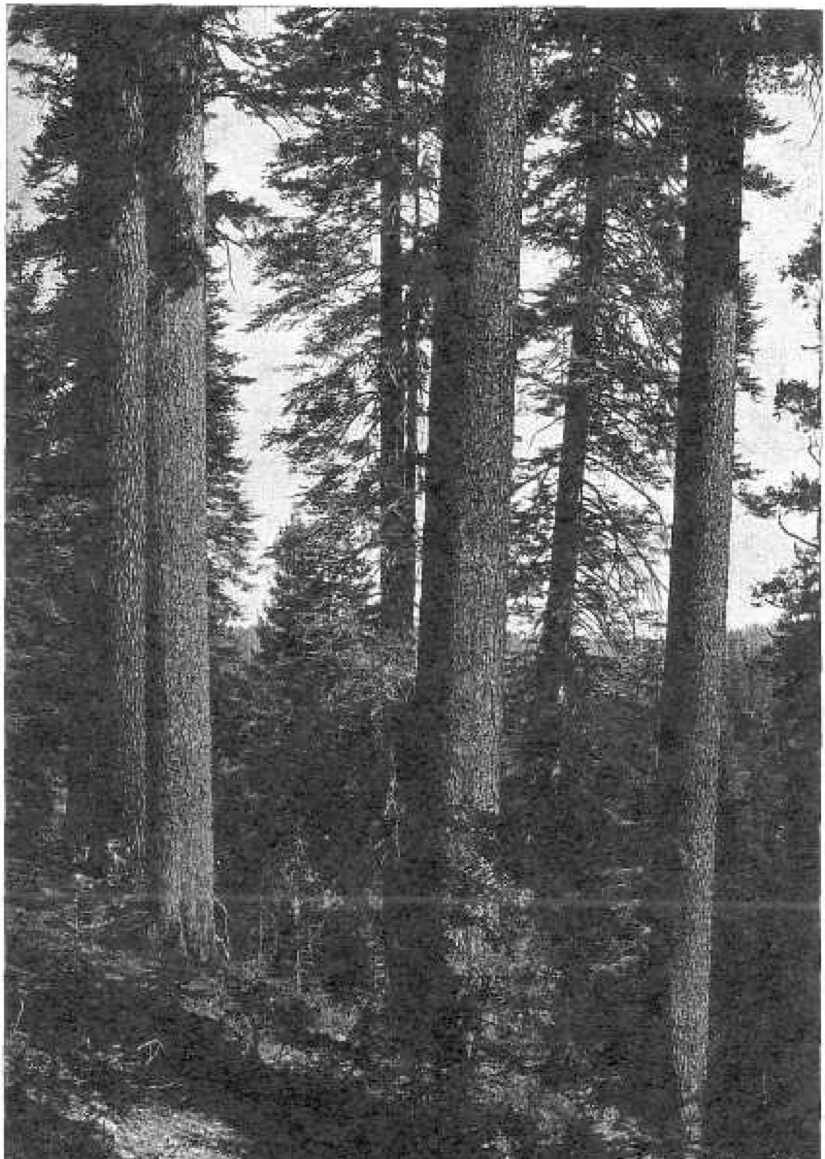


Photo by Willard G. Van Name, courtesy of Emergency Conservation Committee.

Mature sugar pines in Yosemite National Park. Size of trees indicated by man on left.

Cover Photo: Bridalveil Fall and Cathedral Rocks, thunderstorm, Yosemite Valley. By Ansel Adams from "Yosemite and the Sierra Nevada," text by John Muir, 64 photographs by Ansel Adams. Reproduction by kind permission of Houghton Mifflin Company.

Yosemite Nature Notes

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THE WHITE PINE BLISTER RUST

By Thomas H. Harris, Forester[1]

"What is the purpose of those strings I see running everywhere through the woods?" That's a question asked of the park rangers a hundred times a day during the summer (we're conservative!). "They are used to guide crews controlling the white pine blister rust" is the correct though perhaps meaningless answer. "What in thunder is that—some kind of bug?" comes next. Well, let's get down to business—what is this blister rust? What does it do? Why are we controlling it?

First, let's set down a few facts. The white pine blister rust is a bark disease of white pines. It is caused by a fungus, one of a group of primitive plants which include the molds, blights, mildews, mushrooms, and the like. This fact dispels any connection with the insect world. Scientists have a name for it: *Cronartium ribicola* Fischer. White pines are those pines that bear their needles five in a bundle and have fine-textured, easily worked wood. No other forest trees are attacked by this disease. Another important fact is that the blister rust, having been unwittingly introduced into this country from Europe, is not native here; consequently, our white pines, having no natural immunity to the disease, are highly susceptible to its attacks. Though an unwanted alien in worse disrepute than a Communist, blister rust is fast becoming naturalized. It is generally distributed in white pine districts in northern California, but has not yet been found in Yosemite. Control work in the park is in this respect preventive.

The blister rust fungus belongs to a group of highly specialized parasitic fungi that require two hosts for their existence. For the white pine blister rust these hosts are the white pines on one hand and the currant and gooseberry bushes on the other. Currants and gooseberries are classed by botanists in the genus *Ribes*, and hence have come to be called "ribes" (pronounced ry-bees) collectively by blister rust workers everywhere. In Yosemite, as indeed throughout California generally, the white pine hosts include that largest and noblest of all pines, the sugar pine (*Pinus lambertiana* Douglas); the western white pine (*P. monticola* Douglas); and the whitebark pine (*P. albicaulis* Engelmann). Sugar pine grows in our mixed coniferous forest at elevations between 4,000 and 7,000 feet; the other two species are essentially high-mountain trees growing above 7,000 feet. In Sequoia and

1. Bureau of Entomology and Plant Quarantine, United States Department of Agriculture, Berkeley, California. Photos in this article by courtesy of Division of Plant Disease Control.

Kings Canyon National Parks the foxtail pine (*P. balfouriana* Murray) and the limber pine (*P. flexilis* James) are also white pine hosts. The bristlecone pine (*P. aristata* Engelmann), which grows on the desert ranges east of the Sierra Nevada, is the only other white pine in California.

The two principal ribes hosts in Yosemite are the Sierra gooseberry (*Ribes reezli* Regel) and the Sierra currant (*R. nevadense* Kell.). These grow in the coniferous forests of the middle elevations in company with sugar pine. Other hosts of less importance growing at the higher elevations in Yosemite are the sticky currant (*R. viscosissimum* Pursh), the wax currant (*R. cereum* Dougl.), the whitestem gooseberry (*R. inerme* Ryab.), the gooseberry currant (*R. montigenum* McCl.), and the woollyflower gooseberry (*R. lasianthum* Greene).

Is the white pine blister rust an entirely new kind of thing to our American flora? No. We have its counterpart right here in Yosemite. A relatively harmless native rust, the pinyon blister rust (*Cronartium occidentale* Hedgcock, Bethel & Hunt), is so similar to the white pine rust that it, too, lives part of its life on gooseberries and currants. Indeed the stage on ribes can be distinguished from white pine blister rust only by microscopic means, and then not always for certain. The principal host is that interesting tree, the singleleaf pinyon (*Pinus monophylla* Torrey and Fremont), which played so prominent a part in the economic life of the Yosemite and other California Indians. But it is not necessary to protect pinyon against the pinyon blister rust because the pine is not greatly damaged by the rust's attacks.

By this time the reader is probably thirsty (we hope!) for more facts on the domestic life of white pine blister rust. In what sort of relationship does it live with its hosts? How does it travel from one host to another? And so on. Let's start with the rust on a sugar pine. The fungus is definitely parasitic. The microscopic, filamentous threads forming its body (comparable to the roots, stem, and leaves of an ordinary plant) pervade the cells of the growing layer—or cambium, which lies just beneath the bark—of the pine. These threads feed upon the sap and cells of the cambium layer, slowly destroying the life of the tree. After spending about three years beneath the bark, the fungus, like all other living things, begins to prepare for multiplying its kind. The filaments multiply and concentrate at a certain point, the branch or stem thickens, the bark swells, and we have an abnormal growth called a canker. From April to June fine cracks, within which are white-walled sacs, appear on the surface of the canker. The sacs grow larger until on some warm day they burst and release into the air myriads of minute, orange-colored spores, each capable under the proper conditions of starting a new fungus plant. These sacs, full of brilliantly colored spores, resemble blisters when they burst; hence the name blister rust. The spores, which in mass look like rust-colored powder, sufficiently account for the rust part of the name. From 18 to 36 months may elapse between the first outward sign of a canker's formation and the production of the first aeciospores, for such they are called; a canker may produce spores for several years. The limb or stem of the pine beyond or above the canker eventually dies and the needles turn a reddish brown, forming what is called a "flag." Death is due to the

Blister rust canker on trunk of white pine. Note white spore sacs breaking through bark.

destruction of the cambium layer at the point where the canker forms; the flow of sap is cut off. This action is commonly called "girdling." The flags and the cankers are outward signs of the presence of the fungus in a white pine, which may have many cankers on both limbs and stem depending on the intensity of the infection. Cankers may be from a few inches to two or three feet in length and sometimes encircle the stem or limb.

The thick-walled aeciospores produced on the pine can travel long distances in the air, sometimes several hundred miles, and remain alive. They are wind-borne, and being generated in enormous numbers, they soon permeate the air currents. One significant fact about them—the key to the control of the disease's spread—is that these aeciospores cannot infect white pines—they have the power to infect only currant and gooseberry plants. When a spore is carried by the wind to the undersurface of a ribes leaf, and when ample moisture is present and the temperature is right, the spore may germinate and enter the leaf tissue. On ribes the fungus lives only in the leaves and has no more than a defoliating effect on the shrub. After about two weeks small orange-yellow pustules appear on the undersurface of infected leaves. These release a second kind of spore, called the urediospore, which may infect ribes leaves on the same and nearby shrubs. Its purpose is to intensify the rust on the currant and gooseberry hosts during the summer. In the fall the fungus develops brownish, hairlike columns on the underside of the leaves composed of a third kind of spore, the teliospore. The teliospores germinate and produce a fourth (!) kind of spore, called the sporidium, capable of infecting only white pines. Since these last stages take place only in the presence of plenty of moisture, the disease's spread to white pines depends upon fall rains. The thin-walled sporidia are delicate and short-lived. They, too, are wind-borne, but because of their frailty they usually cannot survive an air voyage of more than a few hundred feet from their source on a ribes.

When a sporidium (the pine-infecting spore) falls upon the needle of a white pine, it may germinate in the presence of moisture, and its germ tube may enter the needle tissue by way of a stoma—one of the breathing pores of a leaf. The filamentous threads grow down through the needle and enter the limb, there to establish the fungus in the vital cambium layer beneath the bark. This is the point where we started on our trip through the life cycle of white pine blister rust.

On pines the fungus may live for many years, or until the tree is killed. In contrast to this, the parasite is confined to the leaves of ribes, and disappears each autumn with the falling of the diseased leaves.

How, then, is blister rust controlled? Control rests upon two simple, well-founded, but none-too-obvious facts. (1) The fungus cannot spread directly from one white pine to another. Aeciospores produced on a diseased white pine can infect currant and gooseberry plants only. The fungus must spend an intermediate stage on these hosts before spreading to white pines. (2) The short-lived pine-infecting spores produced in the fall on ribes can carry the rust to pines only over very short distances. These distances are usually a matter of only a few hundred feet or yards. Removal of ribes from the vicinity of white pines will interrupt the cycle and prevent the spread of the disease back to pines. By this action control is achieved.

Control consists, then, in the destruction of currant and gooseberry bushes within and near white pine stands chosen for protection. It is accomplished by crews of men who grub out the ribes by the roots with special forked pick-mattocks. This is called "hand eradication" and may be done either by government-employed crews or by private individuals under contract. Since nearly all ribes must be removed to give the degree of protection desired, the stand of timber to be protected is systematically laid out with guideline strings to ensure complete coverage. Hence the presence of those baffling string lines in the woods that awaken the curiosity of many park visitors.

Where ribes are numerous or are

Ribes eradication crew working between string guide lines.

difficult to dig out, chemicals are often used. The plant-hormone weed killers, 2,4-D and 2,4,5-T, are sprayed on the plants with power equipment or are applied by hand to individual recalcitrant bushes.

Because some plants are missed by control crews and because new plants grow from seed lying dormant on the forest floor, several workings or "eradications" at periodic intervals may be needed.

How destructive is blister rust to white pines? Naturally one wants to know the magnitude of the danger from which protection is sought. Blister rust spreads back and forth between white pines and ribes each year, causing an accumulation of cankers on the pines. The fungus kills by girdling the trunks and branches, and sometimes in severe infections by killing all the twigs. It kills small trees quickly, largely because, their crowns being nearer the ground, they are closer to ribes; and because, being smaller, they are easier to kill. A few cankers on a small tree will do what it would take hundreds to do on a large tree. Since blister rust is particularly damaging to small trees (those up to 30 years old or 15 to 20 feet high, known in the forest as "reproduction"), it prevents the natural restocking of white pine forests. Infections are heavy where the ribes hosts are abundant; they are less heavy where the hosts are more scattered. Unfortunately, the disease is deceptive, for infections on pines cannot easily be noticed until damage is severe.

Large trees are killed slowly; in commercial stands they can normally be salvaged without complete loss. In national parks the objective is to preserve the existing stand for its manifold intangible values, hence salvage would be meaningless.

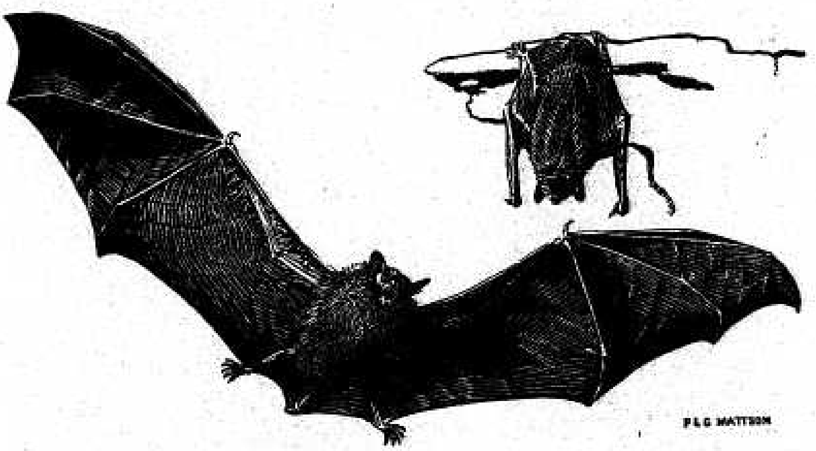
In this little sketch we have tried to set down some of the main facts about white pine blister rust: That it is caused by a fungus; that its rather complicated life history can be reduced to simple terms; that it can be controlled; and that uncontrolled it is severely damaging to young white pines. The next time you see those strings in the woods you will know the why of them!

SOME NOTES ON FLIGHT

By Allen Waldo, Senior Ranger Naturalist

While watching a particularly beautiful sunset during the musical portion of the Camp 14 naturalist program this summer, I noticed about a dozen bats in flight. With some surprise I saw that the bats were in two very distinct layers. One group was flying around Camp 14 at elevations of from 10 to about 150 feet from the ground. The second group was flying, over a larger range, at elevations of approximately 300 to 400 feet above the Valley floor.

Having made the observation of the two distinct groups, I began to notice how different was the flight of these mammals from that of most birds. A bat's wings flap in constant motion. At no time do bats glide, as most birds occasionally do. With one wing flap a bat is able to make very sudden changes of 90° or more in direction, never maneuvering by swooping curves up, down, or sideward, as birds so typically do. At times they come to a sudden, almost complete stop in the air.



Little Brown Bat (*Myotis lucifugus*). From **Mammals of Lake Tahoe** by Robert T. Orr. Courtesy of the publisher, California Academy of Sciences.

Another interesting difference between birds and bats, which may account in part for the difference in the flight habits of the two, is in the body outline. Bats have round, stubby looking tail structures consisting mainly of a membrane of skin stretched between the hind legs, whereas birds have more or less elongate, feathered tails which they spread in flight and use to help guide themselves. Perhaps this lack of a comparable tail in the bat makes possible its sudden reversals of direction, while the elongate tail of the bird causes it to perform a sweeping turn.

An additional flight note was made during the middle of a bright afternoon in the naturalist living area at Camp 19. While several of us were seated, talking, a flying squirrel *(Glaucomys sabrinus lascivus)* appeared. This was unusual, since these animals are normally nocturnal. It made several "flights" before it finally escaped our view. Its flight, of course, is not truly a flight at all, but merely a glide.

It was interesting to observe the methods employed in this gliding "flight," and the way the squirrel prepared for it. The glide is possible because of a thin fold of skin which extends along each side of the body between the fore and hind limbs of the squirrel. If the four legs of the animal are spread out as far as possible, this flap of skin is stretched broad and flat around the body, thus nearly tripling the planing surface exposed, and at the same time making a flat—instead of the normally rounded—body outline.

For gliding, a high "take-off" point is, of course, essential. Thus the squirrel would scamper up the trunk of a tree until he was nearly at the top. Here he would make a big leap. After he had been in the air a second or so and was well clear of the tree branches, he would spread his legs out, stretching his skin fold. Immediately his downward fall was checked, and a slanting glide was started which he was able to control very completely. He did it in such a way as to plane directly toward the lower,

Flying Squirrel. From **Mammals of Lake Tahoe** by Robert T. Orr. Courtesy of the publisher, California Academy of Sciences.

branchless part of a tree trunk. Upon approaching the trunk he raised his forefeet and the front part of the flap. This brought his head end up suddenly, and at exactly the right time, so that his body was vertical and parallel to the tree trunk at just the instant at which he struck it. So he hit the tree head-up and practically scampering. No time, thus, was lost in starting for the top of the tree to make his next glide. He did this four times. At the end of the last "flight" he ran high up the tree and disappeared from view.

The final "flight" noted was that of the bear, or I should say four bears. It is true that bears all-too-seldom flee. These four bears were a mother and her triplet cubs who were invading our campground for the purpose of helping us all get rid of our groceries.

The first bear to be discovered was one of the cubs, and we thought that it was the only one present. Two well-placed small rocks on the posterior of the cub elicited loud bawls of protest, and he started up a tree. Since there was no desire to have him noisily hanging around camp for several hours, attack was stopped. He soon came down and started on his way, with loud urging on our part.

It was then that the other two cubs and their mother were observed. It was clear then that we had best be careful how we handled the cubs and that we should not get between the mother and any of the three. It was also apparent that if we were to have safe food we would first have to get all three cubs around the mother, and then get her moving on her way.

Five of us, therefore, started a herding process from three directions. We soon drove the scattered cubs to their mother. Then with much shouting, and several very poorly placed rocks, all of which missed her, we got the mother moving away, closely followed by her three small progeny. Thus is recorded the "flight" of the bear.

TRACKING THE CAT FAMILY IN LOWER TENAYA CANYON

By C. Dewey Youngblood, Field School, 1950

During the first two weeks of July several careful observations were made of animal tracks around and above Mirror Lake in the lower Tenaya Canyon. The tracks found and studied were those of wildcat, mountain lion, fox, bear, coyote, and squirrel. Casts were made of the wildcat, mountain lion, and the bear tracks. This article deals only with the wildcat or bobcat *(Felis rufa californica)*[1] and the mountain lion or cougar *(Felis concolor californica)*.

The wildcat is not a gentle animal. It is typically a cat and is difficult to tame. I have observed wildcat kittens in captivity and they appear to be independent and resourceful even when very young. When they grow to adulthood in captivity, they do not become domesticated as does the house cat.

The wildcat tracks observed around Mirror Lake were about 2 inches in diameter and were numerous in the muddy and loose sand

1. Simpson, G. G. (1945) *The Principles of Classification and a Classification of Mammals*. Bull. Am. Mus. Nat. Hist. 85. *Lynx rufus californicus* of most authors.—Ed.

near and away from the lake. Observation disclosed the tracks near the nesting places of the robins which nest in considerable numbers just above the lake. It was evident that the cat was making early morning and late evening forays into the robin nesting territory and many a feast probably resulted when a young robin became careless or when a nest of young was found to be accessible. Scattered feathers were found which point to this fact. Observations made during the first two weeks of August did not reveal as many tracks as were found in early July. The conclusion can be drawn that the wildcat had been taking the fullest advantage of the plentiful source of food earlier in the summer.

It is interesting to note that the wildcat was a frequent visitor to an area used by so many people as is Mirror Lake in the middle of the summer. Even though it fears man, it does not hesitate to hunt in such areas if it can find its food supply there.

The food habits of the wildcat or bobcat are diversified. Its food consists of all the birds it is able to kill, including chickens and turkeys, rodents of all kinds, rabbits, lambs, fawns, turtles and other reptiles, fish, insects, and carrion. The wildcat is useful to man at least in keeping down the rodent and rabbit population.

Casts were made of a mountain lion or cougar track found near Mirror Lake. This measured about 4½ inches in length. Evidently the cougar had been making one of its far-ranging hunting circuits because its track was not again found during several subsequent observations. The animal apparently was running almost at full speed because it was slipping in the soft mud, using its claws for surer footing. It might have been after a deer at the time since many deer frequent the area above Mirror Lake.

California Mountain Lion

Cougars forage over a large area, the distance covered depending on the abundance of their food supply. Where deer are plentiful the cougar will live principally on deer meat. They tend to remove the weak or sickly deer from a given herd and in this way actually improve the local deer population.

The cougar is difficult to observe since it seldom allows itself to be seen by man. I have seen only one mountain lion in all of my trail and mountain hiking of many years. A few years ago I saw one race across an open meadow in the Cuyamaca Mountains 50 miles east of San Diego. It was fascinating to see the big cat running for several hundred yards in plain sight. Often on cold winter days with the ground covered by a light snow I have observed the signs of a race between a deer and a pursuing mountain lion, and I have tracked their course to the point where the deer had outdistanced the hungry feline. Evidently the big cat had chosen a healthy deer for his meal that day but was forced finally to seek a weaker animal. Most of the dead deer I have found which I was convinced were killed by a mountain lion were small deer.

Harry C. Parker, Associate Park Naturalist of Yosemite National Park, has told me that he is of the opinion that this park area does not have a sufficient number of mountain lions to kill off the surplus, unhealthy deer. Where the mountain lion has been eliminated from deer range in other parts of the country, the deer have suffered heavily from starvation and disease brought about by overpopulation and the resultant overuse of their natural food supply. One large area in Arizona had to import the mountain lion in order to improve the deer of the region. Apparently the mountain lion has its role to play in the great balancing program of Nature.

Photo by Ralph Anderson

California Wildcat

CORRECTION

Our readers probably were mystified by the missing name of the new mouse reported for the park by Ranger O. L. Wallis in his article on page 97 of the October 1950 issue of **Yosemite Nature Notes.** A printer's error that caused the omission requires correction to clarify the article. The eighth line as it is printed is out of place, so that the second sentence should read: "Stopping to examine the animal, I discovered it to be a California pocket mouse *(Perognathus californicus)*, a mammal which had not previously been collected within the boundary of Yosemite National Park."—Ed.