

Deadly Social-Climbing Ants

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# NATURAL HISTORY





# The Vervets' Year of Doom

*Can Amboseli's monkeys survive the predation of leopards and the loss of their favorite trees?*

by Lynne A. Isbell

The sky is clear in Amboseli National Park, Kenya, and Mount Kilimanjaro rises to meet it. On the plain, Newton, Charing Cross, Gorbachev, and the rest of the group of vervet monkeys stir from the sleeping tree to begin another day of eating, arguing, and grooming one another. Newton, an adult female with a distinctive white moustache, directs her attention to a large *Azima* bush sixty feet away that is thick with ripe berries. Approaching the bush could be risky, as the dense foliage might harbor a leopard or python. She scrutinizes the greenery for a long time, then climbs down the sleeping tree and passes by several smaller bushes, turning over elephant dung along the way to look for juicy insects. Suddenly, a blur of colors darts out from behind one of the bushes. Within seconds, a leopard grabs Newton by her neck, breaking it instantly. Charing Cross, witnessing the kill, emits a rapid series of sharp barks. To the vervets, its meaning is clear: "LEOPARD! LEOPARD!" The call is quickly taken up by the rest of the group as other individuals on the ground race up the nearest fever trees for a safe view. The cat carries Newton's body to a shady spot beneath the dense branches, where it consumes the meat. Charing Cross, Gorbachev, and the others will never see Newton again.

Anyone who visits the numerous national parks in East Africa quickly learns that dangers abound there. Parched bones liberally litter the ground. Many belong to gazelles, wildebeests, and other ungulates taken by lions, hyenas, cheetahs, and leopards. Some smaller animals, however, leave very few bones behind to remind us that they were once dynamic individuals that maneuvered their way around friends and enemies in an attempt to survive and reproduce. Vervet monkeys are the size of



*An infant vervet clings to its mother, opposite page, in Kenya's Amboseli National Park. Vervets prefer to sleep in fever trees, above, whose many vertical branches may deter leopards from climbing them.*

Mary Ann McDonald



domestic cats; when they are eaten by carnivores, particularly leopards, virtually nothing remains.

Although vervets are found throughout sub-Saharan Africa, they are restricted to savanna-woodlands habitat along rivers, lakes, and swamps. They live in cohesive groups, ranging in size from two to about twenty adult males and females, with accompanying juveniles. Following the typical pattern for Old World monkeys, female vervets usually live and die in their mother's group, while males leave to join other groups when they reach sexual maturity at five or six years of age. Females form the core of a stable but competitive social environment, and their relationships are strictly hierarchical. Whenever a conflict arises over food, grooming partners, or even seating locations on a branch, the

highest-ranking female and her daughters can push everyone around, while the lowest-ranking female and her daughters must give way to everyone. Because males are more transient than females, their place in the hierarchy is less fixed and less dependent on kinship.

Researchers have studied Amboseli vervets for three decades, during which they have learned about the kinds of foods vervets prefer during good times and bad, the role of kinship in gaining access to those foods, and how the animals steer clear of danger. Zoologist Tom Struhsaker first recognized that vervets in Amboseli give different alarm calls to different predators, documenting a vocabulary of sorts. Later, Robert Seyfarth and Dorothy Cheney systematically studied the vervets' responses to these alarm calls (see "In the

Minds of Monkeys," *Natural History*, September 1990). After recording alarm calls, Seyfarth and Cheney played them back to the vervets when predators were absent. When vervets on the ground heard the "snake" alarm, they stood on their hind legs and scanned the ground. When they heard "eagle" alarm calls, they dashed into bushes for cover. And, as on the day that Newton died, when vervets heard "leopard" alarm calls, they retreated quickly to the upper branches of trees.

Predation is a fact of life for vervets. They are vulnerable to pythons, eagles, leopards, and even baboons. Still, when I first went to Amboseli in 1986 to study the vervet's social system, I did not expect to witness the near annihilation of the entire study population. When I arrived, the vervet population consisted of seventy-six

At Lake Nakuru National Park in Kenya, a young vervet maneuvers through an acacia's thorny branches, left, to reach the small, edible white flowers. At the approach of a large python in Amboseli, below, vervets stand on their hind legs while excitedly repeating their "snake" alarm calls.

Richard Wrangham, Anthro Photo



on whose sap and seeds the vervets feed. The monkeys also use the trees as nightly roosts, descending each morning to forage for berries, insects, and other delicacies. (Fever trees grow quickly but live perhaps only 100 years. And as ecologists Truman Young and Keith Lindsay have pointed out, stands of fever trees usually contain individuals of similar age. Since the trees are aging simultaneously, they die within a few years of one another.) As their food supplies gradually dwindled, so did the monkeys. By the time of my study, however, the last of the fever trees had begun to die, dramatically affecting the lives of the remaining vervets.

As their responses to alarm calls attest, vervets also use fever trees for shelter, primarily when fleeing leopards. About six months into my study, I began to suspect that something unusual was happening after Newton and five juveniles from her group disappeared on the same day. The vervets seemed to be disappearing at a faster rate than in past years. Often, they simply vanished overnight, despite my extensive searches for signs of them. When I did find evidence, it was largely circumstantial. Animal tracks are easily seen in Amboseli's dust, and I sometimes found clues that told of vervets darting out of

their sleeping tree in the middle of the night and of a leopard among them. I could easily imagine the terror of the monkeys when they were startled awake by the big cat. Once I found something more substantial: the lower jaw and a clump of hair belonging to Tycho, a low-ranking female who was ten years old at the time of her death. Near her fragmentary remains were leopard tracks and the only pile of leopard dung I ever found in Amboseli.

At about the same time that the vervet population was rapidly shrinking, I began to see leopards more often than observers had in the past. In 1987, I saw leopards nineteen times, sometimes even without the help of the vervets' alarm calls. During the entire previous year, vervet researchers had observed a leopard only once. One of my sightings was an adult female with two cubs. Judging from the tracks I saw under the vervets' sleeping tree the morning Almond Joy and her four-year-old son, Hoola Hoop, disappeared, the female leopard had been hunting that night with at least one of her cubs. Twice I saw an adult female and an adult male leopard together, although most often I saw a lone adult male. Leopards live solitarily when they are adults, and because adult males do not share home ranges, I believe that my sight-

individuals living in six groups that were well habituated to human observers. Indeed, these vervets usually treated us as if we were just another species of gazelle—a neutral species, neither beneficial nor harmful. By the time my study ended more than two years later, the original population had been reduced by two-thirds, to twenty-five individuals in three groups. When I returned in 1992, only two small groups, totaling nine individuals, still remained. What happened to the luckless Amboseli vervets, and can their devastated population survive?

Struhsaker, who in the 1960s was the first scientist to study the Amboseli vervets, found upon returning there in the 1970s that the population had declined. He noticed, too, that there had been a decline of the fever trees, *Acacia xanthophloea*,



*Vervets eat a wide variety of seeds, fruits, flowers, sap, and insects. An adult in South Africa feeds on flame creeper blossoms, left. Below: An infant that has wandered a few feet away from its mother peers through the foliage in Nairobi Park, Kenya.*

Erwin and Peggy Bauer



ings were all of the same individual.

Sometimes the vervets' alarm calls and the directions in which they gazed led directly to my leopard sightings. Even so, I was not always able to see the predator that stirred the monkeys. While vervets are undoubtedly better at detecting leopards than I am, at times they also missed seeing the predator—with unfortunate results. Even though the number of observed alarm calls had risen sharply over previous years, the disappearance rate for vervets shot up to 65 percent in 1987. That was the year of vervet doom. During the ten previous years since Seyfarth and Cheney began the long-term project, the yearly average of “disappearing” individuals had been only 22 percent of the population. The increase in my sightings of leopards, the greater frequency of the monkeys' alarm calls, and the increase in such alarms during months when most vervets disappeared all pointed to sharply increased predation by leopards.

My frustration at not actually observing the cause of the vervets' disappearance was exacerbated by what Seyfarth and Cheney have informally labeled “the Nairobi effect,” referring to what seemed to be an increased tendency of vervets to disappear while observers went on short trips to the

Kenyan capital for supplies. (Fewer monkeys, it seemed, disappeared during the many weeks that fieldworkers remained in Amboseli.) But the Nairobi effect had been difficult to document over the years, partly because predation, although high relative to other primate populations, was still rather uncommon. Also, the behavior of other predators, such as pythons and martial eagles, was unaffected by the presence or absence of humans. With the dramatic increase in leopard predation during my study, however, ecologist Truman Young and I were able to show that the Nairobi effect was real.

At the beginning of my study, I saw leopards only rarely. When I returned from trips to Nairobi, however, vervets were nearly four times more likely to have disappeared than while I was present. Whenever I came back from the city, the leopards apparently took a couple of days to recognize that I was back to stay for a while because I saw them more often in the first two days after returning than at any other time. A ranger station on the edge of the study area had a similar effect in inhibiting the leopards; the closer the vervet groups lived to the ranger station, the fewer losses they suffered.

Then something changed. Eight months

into the study, my presence apparently no longer handicapped the leopards. Both leopard sightings and vervet disappearances increased dramatically, and vervets were no more likely to disappear during my trips to Nairobi than during my field days. My guess is that the male leopard was seeing me so often that he was becoming progressively less wary. In the early days, he ran away the instant we saw each other. In later months, he simply walked away whenever I arrived. Finally, on my last day in the field, I felt as though he had granted me a supreme honor when I watched him for over an hour before he casually yawned, stretched, and then ambled down from a tree in which, on many other nights, vervets slept.

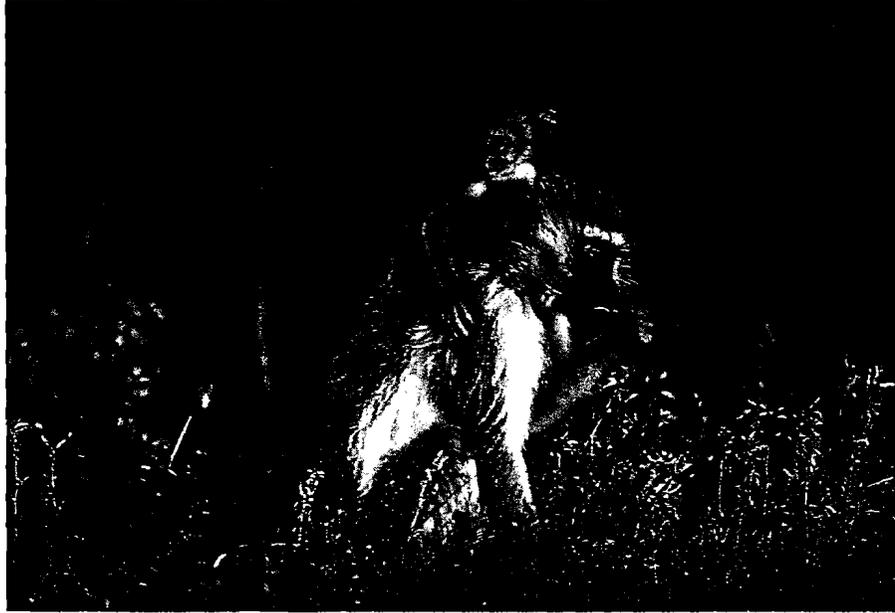
Why had leopard predation become more intense during my study than during any of the previous years of continuous research on Amboseli vervets? One explanation is that the increase in predation was a rare event, directly related to the loss of the fever trees, which had provided much of the vervets' food and shelter. Another possibility was that the short-term increase in predation was just another in a series of blips that have occurred repeatedly throughout the thousands of generations in which vervets and leopards have coexisted. Both explanations are likely to be partly correct.

This sudden rise in predation was probably an important event in the lifetimes of individual vervets—or researchers—but a common event in the evolutionary history of vervets as a species. In this case, we don't know whether the local leopard population had grown, whether a few were spending more time in the area, or whether a new individual with a decided taste for vervets had moved into the neighborhood. What we do know is that leopards caught more vervets and that at least part of the reason was the loss of the monkeys' favored fever trees.

As the groves of fever trees died, the vervet groups that had lived in the same small home ranges for generations began moving into new and unfamiliar areas. Between 1986 and 1988—with the year of

*Bearing her youngster on her back, a female vervet, below, feeds on ground plants in Amboseli. Opposite page: In Kenya's Samburu National Park, a leopard carries a vervet it has killed. Leopards usually seek a secluded spot or sturdy branch where they can feed undisturbed.*

Erwin and Peggy Bauer



vervet doom in the middle—we observed groups shifting their home ranges away from the dying fever trees and into the drier but healthier woodlands of *Acacia tortilis*, the umbrella tree. Vervet groups are aggressively territorial in Amboseli and do not share their home ranges with other groups. As the largest group moved into the umbrella tree woodlands, it drove out two smaller, neighboring groups that had been established there. These smaller groups were driven farther into umbrella tree woodlands where no other vervets lived.

The largest group gained access to three times as many trees as it had previously occupied; whereas smaller troops were forced to subsist on more limited resources. Regardless of the number of trees that any group acquired or lost, vervets were more likely to disappear when they moved into new and unfamiliar areas.

Many zoologists believe that animals benefit in some way from living in a familiar place. Most animals do not simply wander around randomly over the earth but instead use a much more limited area, their home range. Among mammals, vervets included, females tend to remain in the area where they were born, while males tend to disperse into new areas be-

fore settling down. On familiar ground, animals may benefit by knowing where to find food and shelter and by becoming adept at anticipating the behavior of familiar predators and conspecific competitors.

The cost of living in unfamiliar habitats showed itself in another way. Three of the six original vervet groups became so small as a result of predation and decreased reproduction that the straggling survivors abandoned their home ranges and joined neighboring groups. During the first six months of joining new groups, newcomers were more likely to disappear than the long-time residents who were familiar with the same habitat. Apparently, each newcomer has to learn about the new environment through direct experience; little, if any, of the residents' knowledge seems to be communicated. With time, however, any difference in mortality between newcomers and old hands declines steadily, as familiarity with an area appears to reduce an individual's vulnerability to predation.

The value of living in familiar surroundings has always made good intuitive sense. Our study, however, has documented its value in minimizing the risk of predation. Danger from such predators as leopards, however, must be viewed

against the larger background of ecology and cycles of vegetation.

If the fever trees had not died, Tycho, Almond Joy, Hoola Hoop, Newton, and more than thirty others might be alive today. Unlike umbrella trees, which grow slowly but live several hundred years, fever trees don't live very long. Long-term research in Amboseli suggests that vervets are intimately tied to the fever tree population's cycle of growth and death. When the trees are middle-aged and healthy, they provide vervets with abundant food. Vervets take advantage of this, reproducing every year. As a result, their groups may become large during the boom years. When the fever trees begin to die, however, females do not have enough food to sustain their high reproductive rates. Over time, vervet groups become smaller as older individuals are not replaced by younger ones. The final stage of decline may occur when the last of the fever trees die and vervets are forced to move into unfamiliar habitats. Vervets become even more vulnerable to predation than before, and if leopards are around to take advantage of the situation, vervet mortality increases until the monkeys become familiar with their new locations.

Newton didn't survive the change, but she left relatives to carry on. Her daughter, Nut Case, and a few individuals are managing to live and reproduce in the umbrella tree woodlands. As a species, vervets may be very good at surviving as long as there are alternative trees available for food and shelter. If the Amboseli ecosystem is not disturbed and fever trees eventually regenerate, Newton's descendants may one day venture into new fever tree woodlands and experience a new population boom. This dynamic cycle involving fever trees, vervets, and leopards may have been played out over and over throughout their coexistence in East Africa. Newton's ancestors probably faced the challenges she failed to meet, and her descendants may be faced with similar challenges one hundred years from now when a new crop of fever trees becomes old and dies in Amboseli. □

