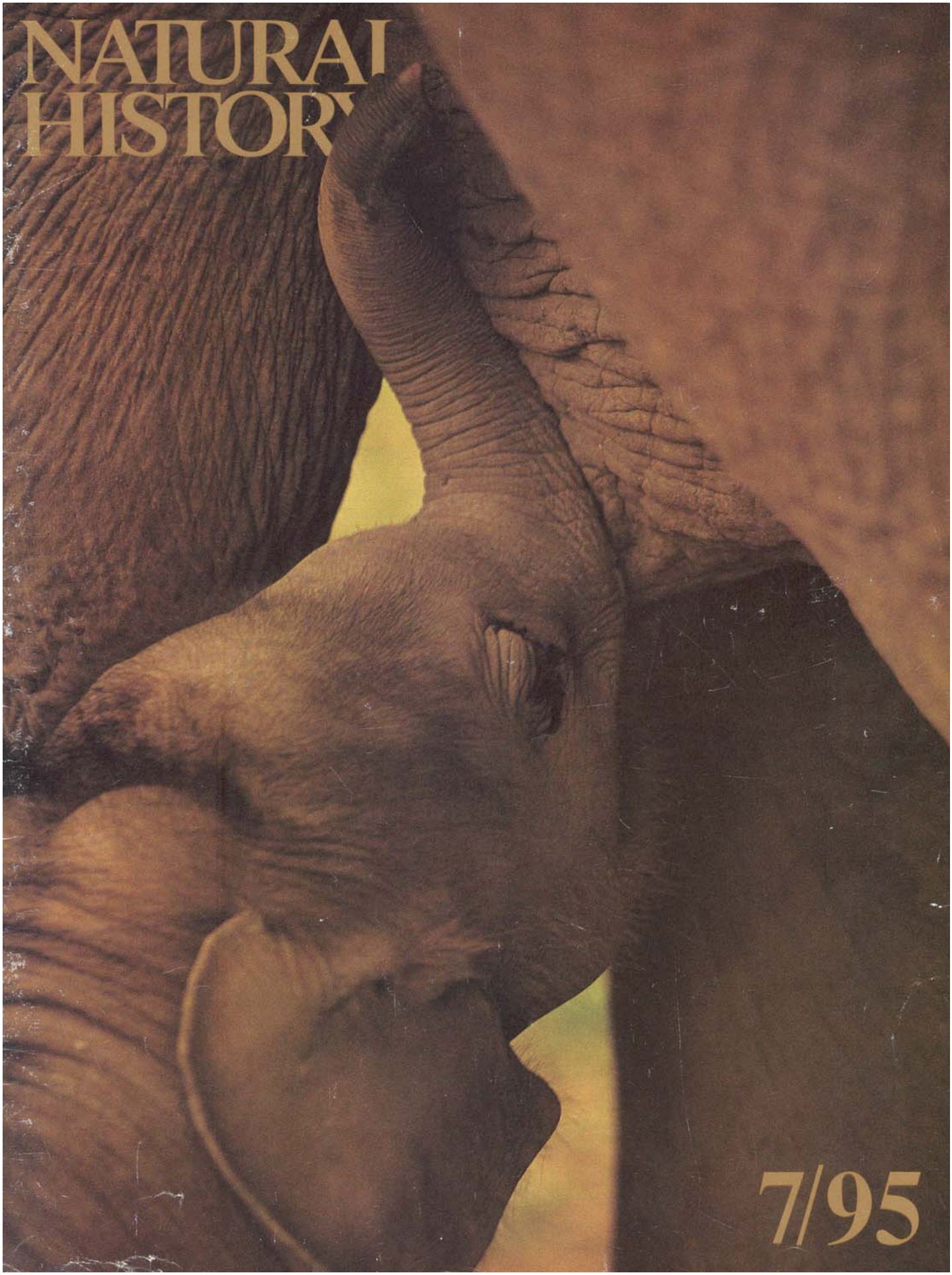
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Elephant Raiders and Rogues

The more Asian elephants raid crop fields, the more the farmers' traditional tolerance is put to the test

by Raman Sukumar

Darkness engulfed the natural amphitheater of Hasanur village, nestled picturesquely amid the lush green Biligirirangan hills of southern India, as I drove out from my camp for a rendezvous with two bull elephants that had been raiding local crop fields. It was July 7, 1981. During this time of year—the southwest monsoon season, when rainfall is sparse—not many farmers cultivate crops, leaving the bulls with a limited choice of fields for their nocturnal excursions and thus making it easy for me to find them.

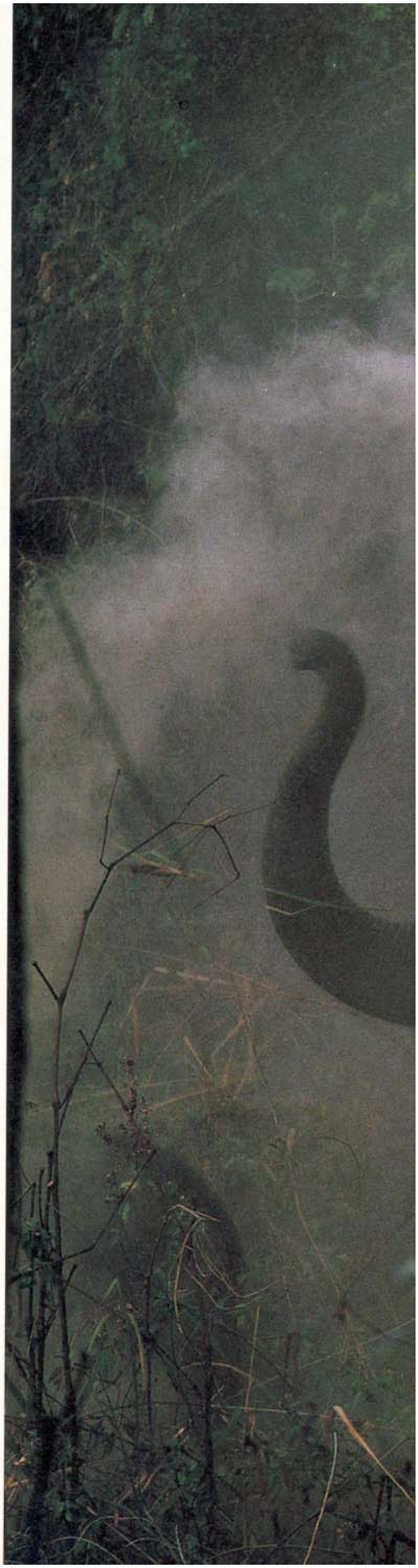
As I neared a farm close to the jungle and scanned the maize field with a spotlight fitted to my jeep, I made out two dark shapes rising above the ripening plants. Tusks gleamed softly as the elephants turned toward the light. One, a little smaller than the other, quickly turned back and faded into the darkness. The larger bull stood his ground for a while, then ambled back a short distance to the farm boundary, where he fed sporadically on grass, ignoring our battery of lights and the shouts of the farm laborers attempting to drive the marauders away.

This bull, its left tusk shorter than its right one, was familiar to me. During the month of April, I had seen him regularly at Karapallam pond, five miles to the north. For the next hour and a half, I watched him as he worked his way through the fields. Then I returned to my camp. Soon after I departed, he rushed at the laborers, who were forced to seek refuge inside a building for the rest of the night.

When new settlements arise in river valleys that elephants have used for millennia, conflict is inevitable.

A few months later, in early November, Hasanur was a sea of ragi (finger millet), watered by the heavy northeast monsoon rains. Ever since the ragi had begun flowering in October, bull elephants had been feasting on this staple food crop. Up to six bulls were coming into the area at night. Hasanur's most persistent and destructive marauder was undoubtedly Vinay, a large bull easily recognized by his short right tusk, which was broken off near the lip.

On the night of November 3, my tracker Setty and I waded through the ragi fields to a treetop platform, where we spent the night watching Vinay systematically pulling out the succulent plants with his trunk, biting off the flowering shoots, and discarding the stems and roots. For two hours, the farmer whose fields were being



In Assam, India, an Asian elephant is enveloped in a dust cloud of its own making.
Gerald Cubitt

Only male Asian elephants have tusks. Adult males live on their own or with other bulls for most of the year, congregating with family groups (females and immature males) primarily when they are in musth, a period of intensified sexual interest.
Raman Sukumar

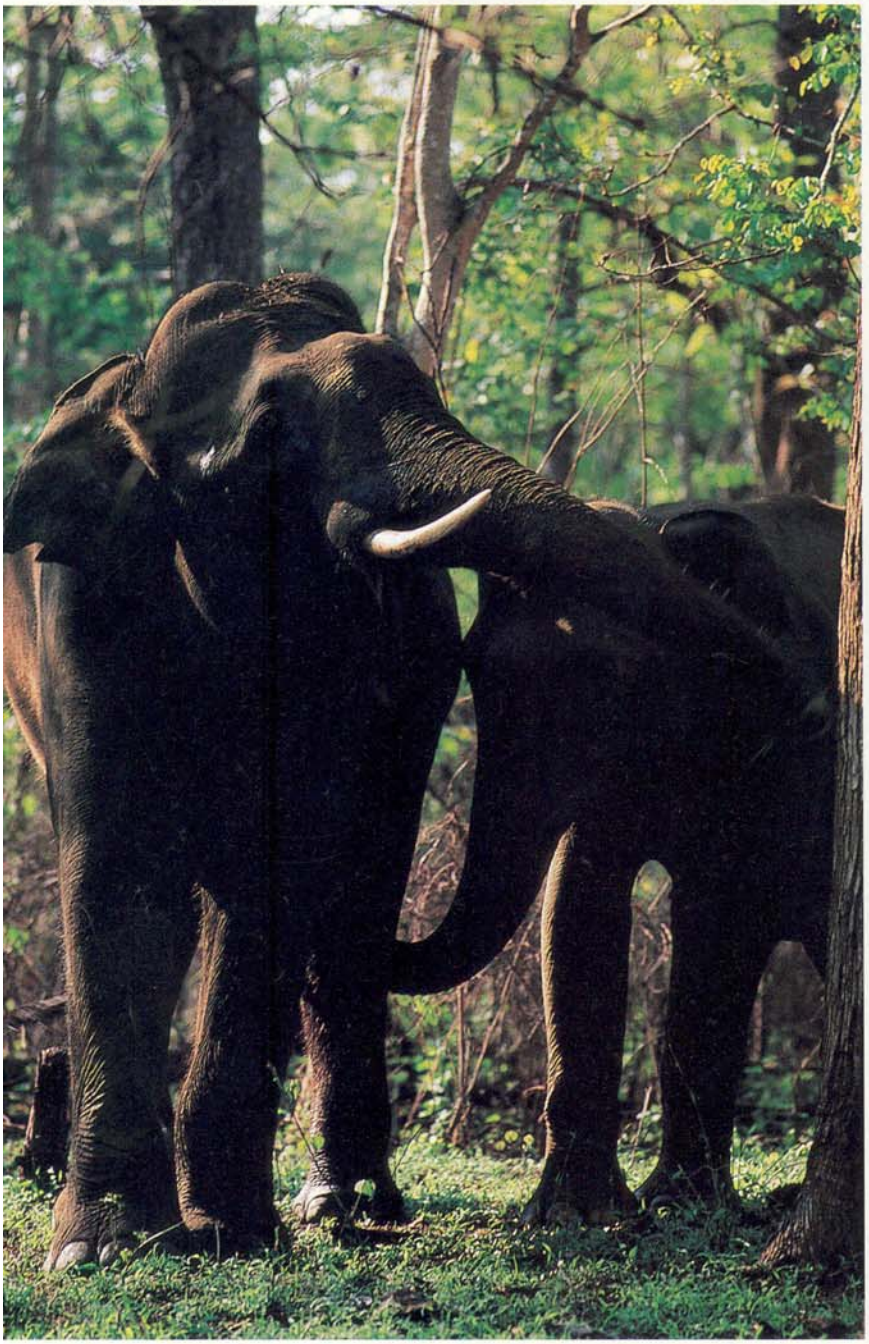
The stakes are high for males in the elephant mating game, and bulls may be willing to take risks to increase their chances of mating.

demolished tried to chase Vinay away; he and his men shouted and shined their flashlights at him but it was all in vain. Vinay's calm behavior surprised me, for he was an aggressive bull that had, in the past, charged farmers, stuck his single tusk through the mud wall of a hut, pulled down thatched structures, and even killed a man.

Vinay left abruptly just before dawn, a barrel-shaped mass engorged with about 550 pounds of millet. With such a bellyful, the elephant would not need to feed much in the forest during the day. With the coming of night, however, as his appetite returned, he would head back to Hasanur, as he did for about 120 nights that year.

Elephants probably first began raiding crops shortly after farmers started planting them in traditional elephant habitat. The Gajasastra, ancient Indian elephant lore dating back perhaps 2,500 years, tells of wild elephants ravaging agricultural fields in a kingdom that is now part of the northern state of Bihar. As agriculture expanded and human settlements grew, the problem of elephant–human conflict intensified; in general, the problem diminished only in local areas from which the elephant was eliminated. Currently, farmers across Asia, and Africa as well, lose millions of dollars' worth of crops each year to elephants. Many human lives are also lost when the elephants come into settlements.

In India's Nagarahole National Park, a cow sniffs a bull in musth, when males secrete fluids from their temporal glands and dribble urine. Elephants living within park boundaries are less likely to become crop raiders than are those whose habitats abut fields.
Jean-Pierre Zwaenepoel



The elephants, of course, are also suffering. Traditionally, Indian farmers tolerate, even revere, elephants and are reluctant to harm them. As the problem worsens, however, and farmers see their livelihoods, and even their lives, threatened, they sometimes trade in their flashlights for guns. Efforts to save the elephant thus require the cooperation of local people who now share its habitat, and such cooperation is possible only if the impact of the elephants on humans and their crops can be minimized.

In an effort to contribute to this effort, I set out in 1980 to answer the fundamental question, Why do elephants raid crops? At the time I began my work, several popular explanations were floating about, including degradation of habitat, competition for water and vegetation, and severing of traditional migration routes. All these factors are undeniably important, for when new settlements arise in river valleys that elephants have used for millennia, conflict is bound to arise. Elephants would naturally consider newly cultivated tracts as part of their original home range. And if habitats become denuded of vegetation as a result of human activities, the elephants are forced to turn to cultivated land to satisfy part of their enormous appetites. Sometimes, simply to quench their thirst, the elephants must cross cultivated enclaves en route to a nearby lake or pond.

These explanations, however, cannot be the whole story, for some of the marauders live amid an apparent surfeit of natural resources. Some seem to consider human settlements their second home, even when they appear to have plenty of room elsewhere. To gain some insight into these puzzles, I decided to take a closer look at just what the elephants were eating. I analyzed both cultivated crops and wild plants and found that cultivated crops, such as cereals and millets, had twice as much protein as the wild grasses available to elephants during the same season. They had even higher levels of minerals, such as calcium and sodium. This finding was not surprising—after all, humans have selected these plants for their superior nutritional qualities.

Cultivated crops—such as succulent millet and sweet sugar cane—are also more palatable

Raman Sukumar

Alain Compost; Bruce Coleman, Ltd.

Some farmers erect towers in their fields, top, to keep watch for elephants at night. Once a raid begins, as in this cornfield in Sumatra, bottom, there is little farmers can do but make noise and try—often without success—to chase the marauders away.

Farmers across Asia and Africa lose millions of dollars' worth of crops each year to elephants. Many human lives are also lost.

than wild grasses, which become coarse and abrasive after a few months' growth during the rainy season. Developing a taste for such nutritious fare would potentially benefit an elephant in evolutionary terms: the better the diet, the healthier the animal; the healthier the animal, the more likely it will be to reproduce successfully and pass along copies of its genes (including some, perhaps, for selecting nutritious food) to future generations.

All elephants would thus potentially profit by adding cultivated crops to their diet, but not all elephants are equally likely to do so. Some of the elephants in my study visited fields regularly; others rarely or never at all. Within a few months of starting my research, I realized that male elephants were more persistent raiders than females and that, although the bulls made up only 7 percent of my study population, they caused disproportionately greater damage. Much of the explanation lies in elephant social structure, which is organized around matriarchal families consisting of one or more adult females and their female and immature male offspring. Within families, the decision to raid or not to raid is probably made by the matriarch (generally the oldest fe-

The wild population of Asian elephants is only 36,000 to 50,000 individuals—10 percent that of the African elephant.

Decline of a Giant

The total population of the Asian elephant (*Elephas maximus*) is less than 10 percent that of the African elephant (*Loxodonta africana*), yet the latter has received far more attention in international conservation circles. The Asian elephant is still widespread in the tropical forests of south and southeastern Asia, but its total population in the wild is estimated to be only 36,000 to 50,000 individuals dispersed through thirteen countries: India (20,000 to 24,000), Bhutan (60 to 150), Bangladesh (200 to 350), Myanmar, or Burma (5,000 to 6,000), Thailand (1,300 to 2,000), China (150 to 300), Laos (2,000 to 3,000), Cambodia (1,000 to 2,000), Vietnam (500 to 1,500), Malaysia (1,000 on the peninsula and 500 to 2,000 on the island of Borneo), Indonesia (2,500 to 4,000 in Sumatra and a small number in Kalimantan, Borneo), and Sri Lanka (2,500 to 3,000).

An additional 15,000 Asian elephants are found in captivity, mostly in Myanmar (5,000), Thailand (4,000), India (3,000), Laos, Sri Lanka, and in zoos in Europe and North America. In many Asian countries, the elephants continue to play a crucial role in logging operations; they are also used to transport tourists inside nature reserves.

The gradual, insistent decline of the Asian species is due to the loss of habitat and to the capture of elephants in large numbers to replenish captive stocks (captive breeding efforts have been grossly inadequate). The remaining elephant habitat is fragmented. Hydroelectric dam projects submerge river valleys, prime elephant habitat; canals and roads impede the movement of elephants; commercial plantations of tea, coffee, oil palm, rubber, wattle (Australian acacia), and blue gum replace natural forest; and slash-and-burn shifting cultivation creates vast areas of degraded habitat. Poaching of male elephants for ivory (female Asian elephants do not possess tusks) has resulted in unequal sex ratios in parts of India and continental Southeast Asia.

In many parts of Asia, the elephant has long been venerated as a religious symbol. This tradition of respect, combined with a growing awareness of the animal's plight, has led the governments of some Asian countries to develop specific conservation programs to save their elephant populations. India launched Project Elephant in 1992 to consolidate the elephant's habitat, reduce conflicts between elephants and humans, and insure the proper management of captive elephants. Peninsular Malaysia has an active program of capturing and translocating small, isolated herds trapped in nonviable habitats. As the first step toward preparing a conservation plan for its country, Myanmar has sought the assistance of the World Conservation Union's (IUCN) Asian Elephant Specialist Group in surveying its elephant population. All this attention is welcome and, with hard work and political will, it may help secure this great species' survival well into the twenty-first century.—*R. S.*

male in the family). She has not only her own safety to consider but also that of her entire family, and this may make her cautious.

Males, in sharp contrast to the females, typically leave their natal families when they are ten to fifteen years old to fend for themselves or join up with other bulls. Once on their own, males are much more likely to raid crop fields. On average, during my study, an adult bull entered fields forty-nine nights in the year, as compared with only eight raids by a family herd. And annually, the bulls obtained nearly 10 percent of their dietary needs from crops, while for the herds, the figure was less than 2 percent.

But elephants are individuals, not just slaves to their gender. Behavior in highly social, intelligent animals is not only genetically coded but also learned from elders and peers and thus culturally transmitted. Whether raiding crops or acting aggressively against humans, elephants behave as individuals, their actions depending on a complex interaction of their genes and their history. There was considerable variation among the bulls in my study. Some appeared infrequently in the villages; others—such as the Karapallam bull, the Akkurjorai bull (named after a patch of forest where he often sought refuge), one bull with no tusks at all, and Vinay—were regular visitors. A few were notorious: Vinay and the Akkurjorai bull, for instance, were responsible for 40 percent of all the damage caused by bulls.

Some bulls seemed to take up residence in the vicinity of villages specifically for the purpose of raiding crops. Their standard modus operandi was to enter after dark and depart before sunrise. Often they paired up or formed larger groups of three or four. By measuring the size of footprints left by the bulls on the soft soil in the fields, I was able to estimate their ages. I discovered that younger bulls were especially likely to team up, often with an older, presumably more experienced bull, before embarking on a raid. The reason seemed clear enough: when a young bull did venture into the fields on its own, farmers were able to chase it away before it could cause much damage. Even older, experienced bulls joined forces sometimes; any bull is better able to tackle

antagonistic farmers when it is part of a gang.

The males' more solitary lifestyle is only one explanation for their more frequent appearance in farmers' fields. For another, consider one basic difference between male and female elephants. On average, a female gives birth to about seven or eight calves over the course of her life, although a cow that survives into old age can raise up to a dozen. A much higher variation in reproductive success exists among males, with dominant bulls potentially siring many more offspring than subordinates, some of which may fail to reproduce altogether. The stakes are thus high for males in the elephant mating game, and bulls may be willing to take greater risks to increase their chances of mating.

Dominance among males is determined largely by size, which in turn is a function of good nutrition (as well as good genes). Bulls also enjoy a boost in rank and attractiveness to females when they come into musth, a rutlike physiological state that usually occurs once a year. Different bulls in the population may come into musth at different times. Musth, however, is an expensive proposition. The level of testosterone (the male sex hormone) in the blood rises dramatically, and bulls begin to secrete a fluid, also containing testosterone, from their temporal glands (situated on the sides of the head, just above and behind the eyes). A bull in musth shows little interest in feeding; his mind is fully occupied with seeking out cows in estrus, mating with them, and keeping rival bulls away.

By the time the musth flow has ceased several weeks later, the bull is in relatively poor condition. To sustain the exhausting demands of musth, a bull must be in good shape to begin with. Perhaps this explains the willingness of many bulls to venture into fields; if they can feast on enough millet and other nutritious crops, they

In 1993, a herd of elephants walked more than a hundred miles into West Bengal, raiding paddy fields as they went. Crowds of people followed their every move. The elephants were turned back only thirty miles from Calcutta.
Bhaskar Paul

Given the opportunity, elephants bathe daily and drink prodigious amounts of water. Any field that cuts off their access to water is likely to be trampled.
Manoj Shah; Tony Stone Images

Efforts to save the Asian elephant require the cooperation of local people who now share its habitat.

may significantly increase their chances of mating successfully. Their strategy is one of high risk, high gain. Of course, taking risks is no guarantee a bull will sire more offspring; he may instead suffer a grievous wound or be killed by an angry farmer. Win or lose, however, marauding bulls are a product of evolution, their behavior shaped by natural selection.

A different explanation must be found for raids conducted by females and their herds, which, though less frequent, sometimes take place on an impressive scale. About a decade ago, elephant herds began wandering tens or hundreds of miles away from their native habitats in different regions of India. In 1983, for example, several matriarchs and their families left their original home in the Hosur Forest Division in southern India and went north into the state of Andhra, where wild elephants had not been seen for well over a century. In Andhra they ravaged crops, killing people ignorant of the dangers of getting too close to elephants.

A few years later, elephant herds from the state of Bihar began to make deep, seasonal forays eastward into West Bengal and westward into Madhya Pradesh, where elephants had been wiped out two centuries ago. In November of 1993, as one army of elephants, some fifty-strong, advanced, the excited media reported daily on their exploits in the paddy fields. By the new year, the elephants reached the Hooghly River; across the river, just thirty miles away, lay Calcutta. Only a determined effort by the authorities and the villagers acting together succeeded at last in getting the elephants to turn back toward their "home."

Both at Hosur and in Bihar, denudation of habitat contributed to the elephants' excursions. Severe weather and climatic aberrations may also play a role. In 1983, a persistent El Niño caused one of this century's most severe droughts around the globe. This could have been the proverbial last straw triggering the elephants' movements. Similarly, the Bihar elephants first made their most decisive moves during 1987, another year of drought.

Over the centuries, the response of people throughout Asia to crop-raiding elephants has depended on technologies available to deter them, on cultural and religious attitudes, and on the conservation laws of the particular society. Today, in Asia, conservationists are seeking ways to reduce the conflict. Various measures are being tried, such as digging trenches along the boundary where forests meet cultivated fields and installing electrified fences, all with only limited success so far. Any solution that seeks to accommodate both elephants and people will have to be based on respect for the intelligence of these highly social creatures, which are capable of creative responses to new situations. □