

Stroll Through a Avoyage of Chinese Painting

A Voyage of
Scientific Discovery
in Western Yunnan

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HE VIEWS ALONG THE OLD Dulong Road from Gongshan to the Qiqi forest station are superb. As we leave the rice terraces and, an hour later, the near-vertical cornfields perched precariously above the Pula River gorge, we enter the primeval forest of northwest Yunnan Province. Precious little such forest remains in China. This one, which 30 years ago was designated as a forest preserve, owes its survival to precipitous slopes too steep to cultivate and too tortuous to build a road fit for vehicles, especially logging trucks. In places, this road, built for mules, is only a couple of feet wide.

Our path has all the characteristics of a traditional Chinese painting: craggy cliffs covered in moss; lichen; ferns; the occasional tree, its roots exposed, clinging to the rock face; and waterfalls cascading into the white river swirling below. Wispy white clouds drift across the tree-covered mountain tops, and, in the early stages of the walk, a few isolated buildings, the corners of their roofs upturned like pagodas, peek through the foliage. But in place of the wizened sage sitting peacefully upon a rock, three unlikely graybeards make their ponderous way along the trail.

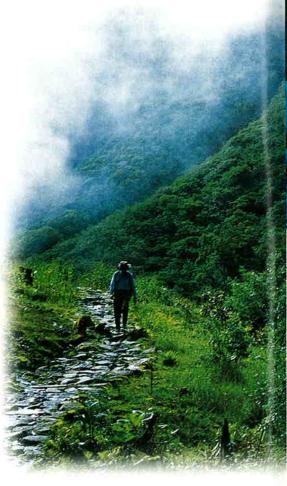
In the lead is Charles Griswold, curator of arachnids. He is followed by David Kavanaugh, director of research and a fellow entomologist. In the rear comes your correspondent: all three of us from the California Academy of Sciences (CAS). We are here as part of a joint venture headed by the Kunming Institutes of Botany and Zoology (KIB and KIZ) and the Academy to inventory the biodiversi-

ty of the Gaoligong Shan, a mountain range that runs along the border between China and Myanmar.

These mountains are at the convergence of two of the world's biogeographic regions, the Palearctic and the Oriental, which emerged after the Indian subcontinent rammed up against Asia some 50 million years ago. Isolation caused by the geological activity created the Indo-Burmese biota, which forms one of only 25 global "hotspots," threatened regions where high biodiversity coincides with unusually large numbers of endemic species.

The rest of the expedition—botanists, entomologists, donkeys, luggage, and provisions—are well ahead, and we are experiencing the four-dimensional, multisensory reality of the forest. Those graceful clouds bring rain too slight for the artist to capture but omnipresent to the pilgrim. After four hours, it has drenched everything we have and has turned the path to ankle-deep mud. The once-sheltering foliage now releases penetrating droplets. Waterfalls cataract over the trail. Though the route trends upward, rising about 600 meters, it repeatedly descends to the river's edge, only to climb again a hundred meters or so around the next cliff. And just as those masterpieces unscroll without end, so this soggy, slippery, rock-strewn hike to Qiqi (pronounced "chichi") seems eternal.

While the rocks are obstacles to us, to the farmers and porters who flit by they are steps to a well-known dance they learned as infants. Or words in a book they know by heart, but which, to us, is written in a foreign language.



We do meet with one sage. Professor Dong Dazhi, an entomologist with KIZ, strolls along the trail in dress shoes and pants, sporting a white shirt and carrying a collecting net, which he swishes regularly at the foliage. He walks effortlessly, stays clean and dry, collects an unusual Japanese bee, assists others with the harder crossings, and shapes hiking sticks, crutches for stumblers.



THE NEXT MORNING THE BOTANISTS I in the group spread out along the trails in search of their prizes. As this inventory is to include all the vascular flora the scientists can find, they target not just the individual botanical families they study, but anything in the process of flowering or fruiting, the time when a species can be most clearly identified. The leaves alone are rarely sufficient, It takes three long days to hike along the Dulong Road to reach the heart of the Gaoligong Shan's undisturbed forest.

although those of easily recognized species, referred to as "sterile vouchers," are sometimes added.

Leading the group is 71-year-old KIB professor Li Heng. She is the inspiration and primary force behind this whole venture. She has spent years trying to bring together resources from within China and from overseas to make a thorough study of the Gaoligong Shan, one of the most diverse and relatively unspoiled areas of Yunnan, if not all of China. Accompanied by her "volunteers," as she refers to them, assistants in various uniforms who seem continually at her service, she descends the trail on donkey back and begins to collect. After 30 years of research, she knows almost all the plants here intimately, but today she is concentrating on those with medicinal properties. The search for such plants is responsible for much of KIB's funding.

Elsewhere, Bruce Bartholomew, collections manager in the Botany Department at the Academy and a long time Sinophile, is scouring the trail for anything ripe for collection. Bartholomew first passed through Asia when he was 16, and has been fascinated with the continent ever since. Thanks to a lenient professor at Stanford, he was able to combine studies of botany and Chinese, and has put his twin fascinations to exceptional use. He is currently one of the editors of the Flora of China, an immense undertaking that will take 25 volumes and even more years to complete.

Peter Fritsch, assistant curator and chair of botany with CAS, has more particular destinations in mind. He has made a study of "disjuncts," similar species that appear in geographically distinct, and distant, places. In continental regions, such plants are almost always relict populations of a distribution that once covered a far wider area. A couple of good examples are found near Qiqi. One is Taiwania, a conifer belonging to Taxodiaceae, the family that includes redwoods and cypresses. It is the giant of the forest, a charismatic megaflora. Another, the storax tree, is more elusive; it grows 600 meters higher, and

Fritsch has to hike four hours to find it.

Before dinner, the botanists sit around analyzing and categorizing the day's "catch." For each specimen, they consider the plant's height, shape, color and details of the fruit or flower, as well as the altitude, slope, and exposure in which it grows. While Li Heng is in camp, she is clearly the authority.

Each collection comes in from the field in a folded newspaper. Ideally, there are eight cuttings of each specimen, one for each institution that has committed to the survey. The folded newspapers are stored between two flat pieces of wood in a field "plant press" that holds the plant in position.

As night falls, the researchers join the after-dinner "shala" party. There's no electricity here, and if people are to provide their own entertainment, they need a little Dutch courage. The favorite alcoholic drink in these parts is bai jiu, or rice wine. It comes in various strengths, but little, shall we say, refinement. One way to improve its palatability is to mix it with the meat or fish of the day and heat the liquid until the alcohol catches fire. Then pass it around, and when the shala takes effect, break into song, preferably one with an ethnic slant.

Meanwhile, the cliff wall outside the camp looks like a sacred grotto. Halos glow around lights that appear in small indentations in the rock face. They silhouette penitents at their devotions. Above the shadows, scores of smaller lights flicker on and off as if to carry prayers heavenward. But though their fervor is ardent, these people are definitely of this world. They are entomologists in their element. Although they have been shifting litter, scratching trees, and poking into crevices all day, collecting is often most rewarding at night. The lights come not from candles but from headlamps aimed at the stone. The biologists' concentration is on the minute spiders and insects that hide among the moss and lichen. The flickering lights above are fireflies.

Each collector holds a vial in one hand and an aspirator, affectionately known as a "pooter," in the other. The other end of the pooter is in the collector's mouth. Like a dog sniffing the ground, the free end of the pooter moves around the rock

as if independently searching for something to eat. When it spies an insect or, more likely, a spider, the victim disappears in an instant, sucked into the tube, only to be disgorged a moment later into a waiting vial. Mesh in the middle of the tube prevents entomologists from swallowing their prey, although they sometimes inhale some nasty fumes.

Many of the spiders here camouflage themselves with grains of sand before lowering themselves beside their webs to await dinner. But the disguises do not confuse our vigilantes.

"Collecting at night is like collecting in a cave," says Kavanaugh. In fact, just two days earlier he was doing exactly that. Forty kilometers north of Gongshan at the end of a narrow, partially paved highwaywith a 300-meter drop straight into the Salween River—is the village of Bingzhongluo. Just above the town is Pamuni Cave, a sacred place said to be the birthplace of the Lisu people, one of the many minority peoples in the region. Nowadays, it is home to lots of the spiders that operate in shadows, and, today, to a solitary bat, its wings fluttering nervously in the glare of a headlamp. Scattered around the cave are Griswold, Kavanaugh, Dong, arachnologist Yan Hengmei of Hunan Normal University, aphid ecologist-turned-carabid beetle rooter Liang Hongbin of the Institute of Zoology in Beijing, and Darrell Ubick, curatorial assistant at CAS.

Peering deep into the dark recesses of a tree buttress, Griswold discovers the distinct webs of four different spiders crowded together, one on top of the other yet none touching. Each is a different shape and each targets a different prey. Among them is a member of the family Symphytognathidae, a spider hardly bigger than the period at the end of this sentence. The searchers even find its eggs singly wrapped along the web. Such egg-laying methods have never previously been recorded, and if they hadn't been here in the monsoon season, when this spider broods, this strange behavior would never have been seen. Sometimes it pays to go out in the worst conditions.

THE DAY BEFORE THE QIQI EXPLORers left Gongshan, the other members of the inventory team—herpetologists,

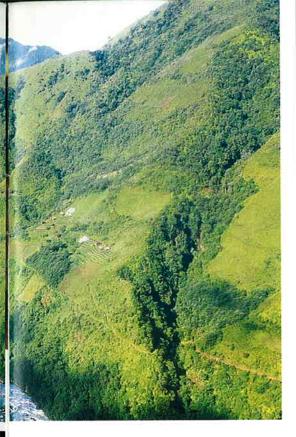




ichthyologists, and mammalogists—from CAS and KIZ began their collecting. They had departed Kunming a week earlier. Four of the intervening days were spent traveling. It should have been three, but they were delayed eight hours by a landslide. During the summer monsoon, landslides are an everyday occurrence. They are so frequent that the authorities see little point in investing in major road construction only to watch the product slide away into the river. Outside the towns, the

roads, despite quite heavy traffic, are made variously of cobblestones, gravel, and mud. The single road that clings to the cliffs beside the Salween or, in Chinese, Nujiang—Angry River—is especially prone to landslides, and that is the road the zoologists will spend much of the next three weeks negotiating.

The initial days not taken up traveling or waiting for the roads to clear were spent being introduced to various colleagues and officials. The Myanmar border area is a



Above: Dulong River, a major tributary of the Ayeyarwaddy and one of the most isolated regions of China, is a primary destination of the expedition. There is no flat land here, and even the steepest slopes are cultivated.

Left: This shield bug belongs to the family Scutellaridae. Its outer shell, or scutellum, is like that of a turtle for it compeletely covers its body, including the wings. Right: Platanthera sp. One of 266 species of orchids found in the Gaoligong Shan.

sensitive place and a group of Americans with cameras, global positioning systems, microphones, and obscure collecting gear need to be completely open about their activities. Hence a period of what Joe Slowinski, assistant curator in the herpetology department, describes as "banquet biology." If you have to partake in such a procedure, China is the place to do it. Meals are the critical features of the day, especially when they are coupled with entertainment. And we are entertained at every opportunity, with frequent and noisy toasts of bai jiu.

When the chance to collect finally arrives, the team's fish biologists locate what looks like a suitable stream, gather their gear, and head down to the water's edge. All tributaries to the Nujiang flow fast and, at this time of year, full. Still, most have an area near their confluence where there are pools and slower water where fish might collect. The leader of the ichthyologists is Carl Ferraris, adjunct curator of ichthyology with CAS. Ferraris had fished the waters of the southern Gaoligong Shan two years

earlier on an exploratory visit to the region, and has many years of experience in fish collecting. In fact, he has been entranced by fish since he was five, and when his sixth-grade teacher told him that careers existed in fish taxonomy, he knew that was what he wanted to do.

Assisting Ferraris are Dave Catania, ichthyology collections manager at CAS, and Chen Ziming and Chen Xiaotong, doctoral students at KIZ. Scuba diving first awakened Catania's interest in fish. As a volunteer at CAS, his computer skills became invaluable in organizing the collection, and he now does the job full time. Chen Ziming's parents are farmers and it was his responsibility to take care of the animals. His

enthusiasm led to a degree in zoology, but it was a tutor who inspired his interest in fish. Chen Xiaoyong, too, came to ichthyology through studies in animal ecology.

Fishing for science is not quite the same as fishing for sport. A fish's only chance is to be absent visiting friends. Ferraris climbs into chest-high waders, puts on rubber boots, gloves, and knee pads, and straps an electroshocker on his back. It consists of a generator, a control box, a metal rod with a 20-centimeter circle on the end (the anode) and a flexible steel cord (the cathode). By placing the anode and the cathode one to two feet apart in the water and causing a current to jump the gap, any living creature in the immediate vicinity is likely to be stunned or killed.

As a crowd of the curious gather, Catania and Chen Xiaoyong wait with large nets about three meters downstream. Ferraris switches on the current. In a stream replete with charge-conducting particles, organic and inorganic, a current of 200

volts or so is enough to complete the circuit. But in this stream, gushing straight from the forest even the rocks are scoured clean and it takes it takes almost four times that to make a contact.

The catch is meager, but this is not dinner we're looking for; all the fish are keepers. Most are catfish and suckers, fish that stay close to the riverbed and avoid the currents. Some are small loaches that slip between the boulders and hide in crevices. They are all taken back to the hotel where on the porch, to the puzzlement of the other guests, each right fin is snipped off for later DNA analysis and the fishes are pumped full of preserving formalin.

On subsequent days, visiting different streams along the valley and occasionally finding a relatively quiescent corner of the Angry River itself, they have more success. By the end of the expedition they will have collected over 800 specimens, including 14 species in 11 genera.

Later that afternoon, Richard Tenaza, mammalogist at the University of the



Pacific in Stockton, California, and a CAS fellow, and Ma Shilai, professor of mammalogy at KIZ and member of its Conservation Biology Center, are off to set traps. Tenaza, son of itinerant farm workers in California, was exposed early to the natural world, discovering aphids and beetles in











Academy botanist Bruce Bartholomew with Kunming Institute of Botany's Professor Li Heng, an expert on the plants of this region and the inspiration for the expedition.

the fields and watching the theater of the tidepools. Ma, the leader of the zoological contingent, grew up on a rubber plantation in southern Yunnan. The most conspicuous wild animals of his childhood were the bamboo rats that ate the roots of the rubber trees, but they were sufficient to get him started on a distinguished career in mammalogy. Ma published the first description of the Gongshan muntjac, an ungulate rather like a small deer.

The mammalogists are hoping to find rodents, most likely mice or shrews. Many rodent species are commensal with humans, which means they thrive near

Far left top: Botanist Peter Fritsch uses pole pruners to gather cuttings from tall trees. Far left bottom: Arachnologists Charles Griswold and Yan Hengmai search through leaf litter for spiders, which they suck into their "pooters" and then blow into collecting vials. Above left: Only small fish can survive in the streams that rush down the mountains. Using a handmade bamboo trap that works like a lobster pot, this young boy has found a way to catch fish in the few pools. Below left: In a tributary of the Nujiang, Academy ichthyologist Dave Catania uses an electroshocker to stun nearby fish. Chen Ziming and Chen Xiaotong wait to catch them as they float into their nets. Right: Spitting cobras were not known to exist in China. Photographer Dong Lin found out the hard way when one spat at his camera. Here he is more careful. This snake, of the genus Naja, may be an undescribed species.

people and so are relatively easy to collect. This team is looking for rarer stuff. It isn't easy to escape human influence in China, even in these mountainous regions, and a recent landslide, which blocks the only road heading west from Gongshan, has made it harder still. Tenaza and Ma climb the adjacent 45-degree slope looking for land that has at least escaped direct cultivation. Beyond the edge of a cornfield, they find some undergrowth and hide snares baited with peanut butter.

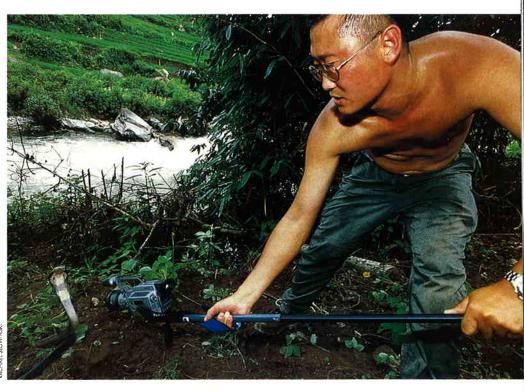
It's late evening before Slowinski and Rao Dingqi, a herpetologist from KIZ, set out in search of frogs. "We are the only discipline that can't trap our animals. We have to go out and find them," Slowinski grumbles. They are looking for a stream that is not too steep or narrow and is easy to negotiate. By the time they find one, ten kilometers from Gongshan, it is pitch black and pouring rain. Rain is a constant companion, but you don't notice it—except on nights like this when it's so hard, that even the frogs jump for cover. They only catch one, caught out in the rain.

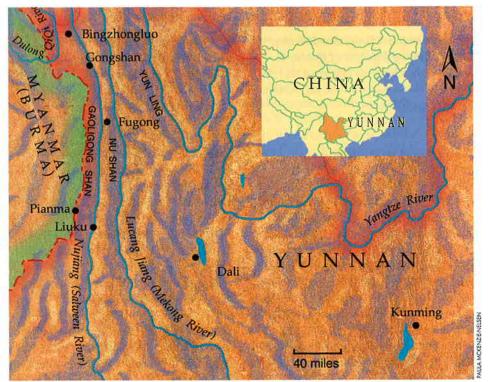
Throughout the next three weeks, frogs remain strangely elusive. We hardly ever hear one, let alone find one.

Fortunately, the zoologists do not have to rely exclusively on their own searches. The herpetologists' first acquisition comes on the road between Dali and Liuku. Out of the corner of his eye, Rao spots the movements of a snake just as it catches the aggressive attention of roadworkers. He stops the car and runs out to rescue it, or its bodily form, while it is still presentable. During breakfast in Liuku the following morning, another prize arrives. A villager in the kitchen is trying to sell a cobra for some future feast. Slowinski and Rao prevail.

The snake turns out to be a spitting cobra, a creature that scientists had not known existed in China. The farmer takes the herpetologists to the cave where he insists he found it, and later that afternoon, he comes around with another.

Recruiting the villagers and farmers plays a critical role in the herpetological collecting. Locals are willing to spend entire evenings looking for snakes, lizards, and frogs. Negotiations with each community take a little time, partly to establish our credentials and genuine interest in this unlikely request, but mostly because negotiations here always take a





long time. The experience of the interchange, the discussion, the development of trust are considerations that seem to be of equal and perhaps greater value than any money that might be offered. Sometimes villagers show up the next morning at the hotel with their bounty. More frequently, it requires a second and third tour to measure progress. In all, some 400 animals emerge this way. Most of the species live in the cultivated fields and around the houses, but all are duly gathered and inventoried.

The ichthyologists, too, try to co-opt the help of local fishermen—although that is not a widely practiced trade hereabouts; there just aren't that many fish, especially during the monsoon season. Most of the fish in the markets are farm-reared carp.

The first assist comes from a boy about eight years old who seems to be his village's sole fisherman. He places his traps strategically in the nearby stream. They are bamboo cones and work on the same principle as lobster traps: easy to get into, hard to get out of: To empty the fish, the young entrepreneur just unties the string around the narrow end.

Later, the team acquires fish from fishermen using scissors nets. They fish the Nujiang with wide nets affixed to two poles, which are brought together underwater. It takes many such dips to find a single fish, but the technique catches a different set of species. The ichthyologists acquire greater quantities from the local markets and from men using homemade electroshockers.

The mammalogists also turn to the local people for help. Around Fugong, some 130 kilometers south of Gongshan, they ferret out hunters who, once they were convinced that these curious inquirers were not going to expose them, gradually show them more and more of their accumulated animal pelts and bones.

Hotspots

THE GAOLIGONG MOUNTAIN range falls at the conjunction of two of the world's most biologically rich and most threatened environments. Known as Indo-Burma and South Central China, the two regions belong to a select group of 25 global "hotspots" hand-picked by a consortium of academics and conservationists.

Each hotspot contains at least 1,500 endemic plant species (species that can be found nowhere else), the equivalent of 0.5 percent of the world's known vascular plant species. But membership in this exclusive club is a dubious honor. Their dazzling assortment of plants and animals is offset by the precariousness—in some cases, the near obliteration of their environment. To qualify, each hotspot must have lost at least 70 percent of its primary vegetation.

With the entire world affected in some way by habitat destruction and pollution, conservationists now behave like triage surgeons, deciding which areas need the most immediate attention. They hope that these ravaged hotspots, which support an astonishing 40 percent of all plant species and 35 percent of vertebrate species (excluding fishes) in less than two percent of the Earth's land surface area, will get top priority.

"The long and short of the story is time is of the essence," says Kirk Talbott, head of the Asia Pacific Program of Conservation International, which helped develop the hotspot concept. The Indo-Burma hotspot, considered one of the eight "hottest" for its high numbers of endemic plants and vertebrates, has lost 95 percent of its original vegetation. "We've got to hold onto what's left or else it will be devastated," he says, blaming the destruction on illegal log-

ging and a "web of corruption and mismanagement."

But Talbott remains optimistic. "We're making progress," he says, pointing out that the Chinese government imposed a logging ban on 60 million hectares of the upper reaches of the Yangtze River after it flooded in 1998, possibly as a result of deforestation. The South-Central China hotspot, while it cannot compare to the endemism of tropical hotspots, is "very possibly the most biodiverse, rich, temperate area on Earth," Talbott says.

The group is working with local governments, other non-profit organizations, businesses, and citizens to protect hotspots. "It can be done," he assures.

For more information on hotspots, go to www.conservation.org/hotspots.

-Maggie McKee

The Angry River is not finished with us, and our plans are thwarted by yet another enormous landslide.

Many are from unusual and endangered animals: muntjac, takin, red coral, Chinese coral, dhole (a wild dog), serow (similar to a goat), red panda, flying squirrel, giant squirrel, palm civet, and leopard cat. It is an amazing collection composed of extremely rare species, many listed on CITES I (Convention on International Trade in Endangered Species), which forbids endangered species, alive or dead, from being transported between countries without special permission. This may mean that many of the pelts cannot be brought back to the United States.

To find such animals in the wild would take months, and besides, we don't have permits to catch them. Of course, neither did the hunters. Nevertheless, while any sort of firearm is extremely difficult to obtain in China, the crossbow has almost become the region's emblem.

Instead of capturing the animals, Tenaza has brought along camera traps. Anything that crosses a trap's laser beam will trigger the flash and shutter. But in such a populated country, how can traps be set so that they will not be discovered by humans? Led by a local guide, Tenaza trudges deep into the bamboo thicket looking for a trail used by animals, probably muntjac, the commonest wild animal here, but not used by people.

Meanwhile the botanists and entomologists have left Qiqi and hiked farther west to Dengshaofang. For many this is the high point of the expedition, both in altitude and success. "No one has collected from this alpine region in the summer before, when many of the plants are flowering," says Li Heng, reviewing all the cuttings as they arrive in Goonshan via donkey trains. "The results are very exciting." And the carabid beetle specialists finally have something to celebrate. At these elevations a high percentage of their finds are new species. "The beetle diversity here is fantastic," says Kavanaugh, "I wish we could stay here for a month!"

Inspired by their success, eight of them attempt an exploratory hike over the 2,960-meter pass and then 2,100 meters down the west slope of the Gaoligong Shan to the Dulong River, a tributary of the Ayeyarwaddy, and the original destination of the expe-

dition. It takes them 14 hours with little time for collecting.

NAKE! SNAKE!" SLOWINSKI IS OUT of the car and across the road before the Land Cruiser has a chance to stop. That has been Joe Slowinski's reaction to the sight of a snake ever since he can remember. "They found me at four years old holding a rat snake bigger than I was. As a kid I was like a mongoose when I saw a snake. Transfixed. Now, thousands of snakes later, I'm a bit more jaded."

If he is, it doesn't show. He has his boot on the animal's back and though the snake squirms, the Mongoose doesn't let go. It's not long before it is firmly in the grip of the snake stick. Slowinski recognizes it as a rare species of colubrid of unknown venom strength. He prefers to handle it beyond arm's length.

"We're on board!" he says, referring to the previously unmentioned fact that this is the first snake the group has actually caught unaided. This is a montane snake, which, unlike the cobras, shuns human contact. Over the next few days, patrolling the roads, where snakes like to warm up, and the stream beds where they search for food, the herpetologists manage to locate seven more snakes of four different species. Most of them are considered frog-eaters, yet there is neither sight nor sound of any frogs. Slowinski palpates the stomach of one and finds it's been living off snails. He wonders what happened to the shells.

This is the first time in two weeks that the zoologists have seen real forest. We're near Pianma on the Chinese-Myanmar border, and though the region has been heavily logged, we're higher up in the southern portion of the Nujiang Reserve. The reserve has three parts. The largest is on the north, around Qiqi where the botanists and entomologists have spent almost all their time. A smaller section lies west of Fugong, and a third in Lushui County between Liuku and Pianma.

There is a second reserve, the Gaoligong Shan Reserve, farther south.

Li Heng's ambition to record the biodiversity of this mountain range is actually only an incremental step toward her real dream, which is to create a national park encompassing all of the Gaoligong Shan. She acknowledges it will be a monumental task. The hardest part will be to ensure that the local inhabitants have a vested, financial interest in maintaining the integrity of such a park. If they are going to forego cultivation of these slopes and abandon surreptitious hunting of birds and mammals and commercial logging, there has to be a worthwhile alternative.

I was expecting to leave the Nujiang Valley along with the major part of the expedition that is heading south from Gongshan, having finally emerged from the northern reserve. However, the Angry River is not finished with us, and our plans are thwarted by yet another enormous landslide. While the entomologists turn their hotel rooms into makeshift laboratories to sort their specimens, I wait for news back in Liuku, and take time to walk in the garden across from the hotel.

The steep, artificially forested hillside has been embellished by strategically placed gazebos on the corners of the cliff face, while the path is along a staircase flanked by the traditional banister rails seen throughout China. It is an orchestrated climb, the staircase and garden designed to resemble those in ancient scrolls. But the park is full of litter and the smell of toilets. The sight of once-magnificent birds, monkeys, and bears caged in quarters so small they can hardly turn around is depressing. I yearn for the soaking, sweating, exhausting realism of the Gaoligong Shan forest.

Originally, the estimates were that the landslide would take five days to clear, but that was before Li Heng joined the waiting crowd. No one knows if her call to the county governor actually helps but our vehicles are the first ones allowed along the newly cleared road. If anyone can find a way to persuade the local people it is in their interests to preserve this magnificient ancient forest, this natural masterpiece, and make her dream of a national park a reality, it is this diminutive, constantly enthusiastic professor.