Peter Shaw Ashton stepped into his first Asian tropical forest 50 years ago last March. For what he has accomplished in those steamy reaches, he has been awarded the Japan Prize in the category of “Science and Technology of Harmonious Coexistence.”

He had his most formative harmonious encounter in the tropics just at the start of his career, with high-spirited forest-dwellers. “I was a fresh graduate of Cambridge University, and I wanted to be a grad student under my professor, naturalist John Corner,” says Ashton. “He told me, ‘Look, if you want to work in the tropics, you can't go out for three months on a research grant and do something quick and come back and make some great generalization which will get you through a doctoral dissertation. You've got to get yourself a job.’ How was I going to do that? This was the end of the colonial era. I said, ‘The last thing they need is Brits out there at a time of all this change.’ ‘Don't worry,’ said Corner, ‘every now and then a letter comes from someone who wants a botanist in some remote place in the world.’

“Meantime, I worked at a gas station,” Ashton continues, “where I was soon fired for technical incompetence. I then knew that forest botany was my sole ability, and fortunately the opportunity was not long in coming.” After about six months, Corner got a letter from the sultan’s government in Brunei. “‘They’re looking for a botanist to document the timber trees,’ he told me. ‘Would you be interested?’ Unbelievable! Forest botanist to His Highness, the Sultan of Brunei! It sounds like something from the nineteenth century, and indeed in a way it was. So I went off by ship and worked for His Highness Sultan Omar for five years. Those first years are always the best.”

Brunei, on the island of Borneo, is about the size of Rhode Island. At that time, says Ashton, “more than 70 percent of Borneo was covered in primeval, uncut, forest. Now, little remains, even to the mountain tops, except in the national
parks—themselves threatened by illegal harvesting—and inaccessible limestone peaks." Yesterday's forest, "with about 800 tree species and teeming with crit-
ters," he says, "has been converted into a forest with a single tree species, most
often oil palm, and the brown rat—and barn owls and king cobras."

Ashton set about writing taxonomic accounts of the timber trees, particu-
larly the dipterocarps: what used to be called Philippine mahoganies, huge
trees that dominate the canopy. No one knew which or how many species were
there. He ended up with descriptions of 156 dipterocarp species and rough
records of many other species. "There are about 3,000 tree species in Brunei,"
he says. "In other words, 10 times the number of species in the United States. So
it was a huge task."

In the process of doing the job, he
spent 28 months in
longhouses or under canvas with the in-
digenous Iban Dayak, a tribe once known
for their headhunting achievements. "I
learned my botany from them. I had no
library, just a couple of books and no
herbarium. I had four Dayak collectors
and tree climbers. They didn't have any
English, and I jumped in at the deep
end. They were wonderful people, good
company, with a robust sense of humor
and a theology close to my own. They
would climb these trees—70 meters,
you know—sit out on a branch, smoke a
cigarette, speak to the gibbons, and pos-
sibly urinate on you if you were sitting
close by on the ground." A couple of
these Dayak colleagues were in the audience when Ashton accepted
his Japan Prize at a ceremony in Tokyo (see page 37). "They were to-
tally marvelous, with tattoos down their necks, and I was in a wing
collar." He saluted these early masters in his acceptance speech.

Ashton made a major discovery
in Brunei. Although no rig-
gorous research into the matter had been done, the then current wis-
don of John Corner and other leading tropical botanists held that
the extraordinary coexistence of so many tree species in a tropical
forest is the result of a random distribution process—that the mix
of species changes with each new generation of trees as the image in
a kaleidoscope changes with a twist of the barrel, and that the rea-
son a few dominant species don't take over the forest and drive di-
versity out is that the seeds of forest-tree species are not widely dis-
persed, but fall close to their parents. The random-mix theory
implies that the species are ecologically complementary, which has
implications for speciation and evolution, says Ashton. It also sug-
gests that forest managers can't do much to encourage one species
over another. But Ashton began to realize that the forests he
tramped through were not just a random mix. As he moved onto dif-
ferent soils—sandstone or shale—more than half the species
changed. He noticed that each hill possessed a distinct species as-
semblage, repeated on other hills with similar soil nutrients and
drainage. "I got permission from the forest service to put in some
small study plots and analyze them by methods current at that
time," says Ashton. "I was accepted eventually as a graduate student
and went back to Cambridge and clunked away with a hand calcu-
lator on my data. I showed quantitatively that indeed there
was
a re-
lationship between habitat and the species composition of forests,
and that was hugely important."

He moved his attention to Sarawak, next door to Brunei, and con-
ducted similar studies in a much bigger area, about the size of New
England. "I was doing a lot of field work, but I was married by then
and had small children and education priorities and so forth, and so

A dipterocarp,
shot in Borneo
by Harvard
ornithologist
Tim Laman, a
former Ashton
student.

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I started looking for other jobs. I began to realize to my great disappointment that my only choice might be to go into academia, kicking and screaming—into the ivory tower as opposed to the green forest, to lose the smell of resin in the air, other than from the waxing of the floor. And that’s how it worked.

As Ashton truly loves the tropics. He gave an interview to U.S. public radio after he won his Japan Prize and was asked to recall his favorite moment in the forest. “Just to go along those ridges at about 3,000 feet in Borneo day after day, with a basket with your food on your back,” he replied, “and to listen to the water cascading down in those valleys, to look at the clouds accumulating on the ridges, knowing that it’s going to pelt with rain by midday and that you’ll strip of everything but your sneakers and your underwear, put all your clothes in a plastic bag, and walk on with that streaming rain all over your body until it stops an hour or two later, then put your clothes back on again and think, ‘Wow, this is the tropics, and there’s no better place in the world.’”

Ashton gave up capsizes in the rapids, pit-viper encounters, and camps pulverized by storms to take a steady job as a lecturer in botany within the ancient stone walls of the University of Aberdeen in Scotland. During the following 12 years there, he trained many Asian students who would inherit stewardship of their countries’ forest resources—in India, Sri Lanka, Burma, Malaysia, and Indonesia.

In 1978, he came over to New England with his wife, Mary, and their three children to take on the posts of director of the Arnold Arboretum and Arnold professor of botany. The arboretum, established in 1872, is an oasis of 265 acres in the Jamaica Plain section of Boston, landscaped by Frederick Law Olmsted in collaboration with its first director, Charles Sprague Sargent. It has a mission to be schizophrenic. First, it was founded to grow every tree and shrub, indigenous or exotic, that can be grown in the open air in hard-climate Boston. Such a living museum collection was for many years considered by botanists to have great research value. Second, through a creative leasing arrangement, the arboretum became part of Boston's park system, although Harvard remains in control of the collection. The park is open to the public, free of charge, from dawn to dusk every day of the year; the public has always loved it.

When Ashton came, the arboretum was in the grip of financial hard times. Among the vigorous remedial initiatives he launched was a spot of truck farming: a scheme to grow squash, melons, corn, and raspberries for profit on the Case Estates, Harvard land in nearby, prosperous Weston. “Endowment income goes down with inflation,” he told this magazine at the time, “but the price of raspberries goes up.” He told the dean of the Faculty of Arts and Sciences that he looked forward to creating a Raspberry Professorship at Harvard. Alas, he recalls, “The raspberries were a failure.”

He had another problem more difficult to quantify than the state of the exchequer. In essence, it was that the arboretum’s collection, unquestionably a horticultural treasure, was no longer so greatly valued by the botanists of the day, in part because if they wanted to study dawn redwoods, they wanted to go where dawn redwoods grow wild, to see them as part of a forest...
Into the tropical forest, there came in the early 1980s a challenger. “I am a dirt forest botanist,” says Ashton, “look at my fingernails.” (They look respectable.) “At the University of Iowa, later at Princeton, was a theoretician, Stephen Hubbell, who mathematically demonstrated the plausibility of sustaining 1,000 tree species in mixture over time because of constraints in how far their seeds will disperse. He got his data from a really big plot for this sort of demographic work, on Barro Colorado Island in Panama, a research island of the Smithsonian Tropical Research Institute. Steve came out with a conviction opposite to mine. He said that in fact the old boys were right, a tropical forest is a random mix. There was a meeting in Leeds, England, on tropical ecology. He gave a lecture; I was scandalized and invited him out to a pub for a few pints. We fought it out. We were both really right. He had studied a rather uniform piece of terrain, whereas I had looked at a heterogeneous one. If I had chosen one habitat within my Brunei landscape, I would have come to the same conclusion as he. In the pub, we decided that we needed much more data. That was the good part. We resolved to go to the National Science Foundation and try to get some money to establish a plot in the Far East that was a replica in size of his plot in Panama. I negotiated with the Forest Research Institute of Malaysia. I have always tried to keep an umbilical cord of collaboration, as an equal, with former Asian graduate students of mine—I correspond with them, write papers with them—to foster science in these areas vital for the conservation of the world’s resources. It was a relatively easy thing to say, ‘We’ve got this new idea. If I help raise funding, would you provide in-kind support—people, space, so forth? Would you be interested?’ They agreed enthusiastically.”

In 1984 Ashton and the Malaysians marked out a big study plot (50 hectares, about 124 acres) in the forest at Pasoh. His aim was to inventory all the trees in this plot that were as thick at breast height as his thumb, or thicker—to measure, identify as to species, and tag them; to map the area and to repeat the inventory every five years to see how the trees fared—which had died, which had prospered; and consider the lessons all this would teach.

One plot led to another. In 1990 Ashton and Hubbell cofounded the Center for Tropical Forest Science (CTFS) of the Smithsonian Tropical Research Institute. Today, CTFS manages 20 so-called Forest Dynamics Plots in 15 countries across the tropics in Asia, Africa, and Latin America. They hold a whopping four million catalogued trees of 6,000 species. Ashton coordinates work at the 11 Asian plots.

Although tropical forests account for just 12 percent of the earth’s total land area, they may be home to more than 50 percent of all forms of terrestrial life. Each research plot is a living library of plants and animals, like a Library of Congress where most of...
the books have yet to be opened. Each elucidates the wondrous biological diversity of tropical forests, so variously populated that one imagines that the forces of natural selection and survival of the fittest have been revoked. Together, the plots form the only natural-ecosystem global network of any kind in existence and promise to yield beneficial insights into some of the world’s big problems.

Ashton moved on from the arboretum’s directorship in 1987. He was professor of dendrology until 1991, when he became Bullard professor of forestry. He took emeritus status in 2004 but has yet to grasp the concept of retirement. Among his current undertakings, he is writing a book about rain forests for the nonspecialist, based on a lifetime’s learning about them close up in all but three of the nations of tropical Asia. He says it will be profusely illustrated with evocative color photographs that will portray his rain forests better than his words can do. He spends each fall semester at the Harvard University Herbaria in Cambridge, studying tropical forests with the aid of its vast library and more than five million specimens. The rest of the time, when he isn’t in the tropics, he lives in England. “Not for nationalistic reasons, I promise you that,” he says. “I’m strongly antinationalistic. I live there for two reasons. In England, you can go up on a hill and look down and see the palimpsest of human activity going back to the Neolithic. I live in the old traction-engine shed of a farm in Somerset that is in the Domesday Book.” When he’s working on tropical forestry at the Royal Botanic Gardens, Kew, he lives in London, in Chiswick, where he has a small garden “with a wild banana growing and a

Sinking Carbon-Sink Hopes?

The world was supposed to work this way: global warming would cause a burst of growth in tropical forests, and the trees would take up some carbon dioxide (CO₂) from the atmosphere and sequester it in plant tissue. Recent studies of conditions in Amazon forests did indeed show accelerated growth rates. But data from two forests in the Center for Tropical Forest Science (CTFS) network reveal that just the opposite has happened; the growth rates of the majority of tree species have slowed dramatically in the past 25 years, suggesting we had better not count on this “carbon sink” to suck away our global-warming problems.

Kenneth J. Feeley, an ecologist and postdoctoral fellow at the Arnold Arboretum, is the lead author of a paper published last spring in Ecology Letters that reports on a study of data from the first two Forest Dynamics Plots established by CTFS, on opposite sides of the planet—one at Barro Colorado Island, Panama, the other at Pasoh, Malaysia. Commenting on his and his colleagues’ findings, Feeley says that “slower tree growth in tropical rain forests will have very important implications for both the global environment and economy.”

Global biodiversity may be diminished. All the animals that live in tropical forests “depend on plant productivity as a source of energy,” says Feeley. “Decreased growth will reduce the amount of energy available, which could reduce the number of animal species that these ecosystems can support.”

Slower growth may reduce timber available for logging, and logged forests may take longer to recover. “In order for loggers to maintain current yields,” says Feeley, “they will have to increase either the intensity of the logging or increase the area of forest that they log.”

Feeley imagines an unfortunate environmental spiral: “Reductions in tree growth may result in reduced rates of carbon uptake from the atmosphere, which, coupled with the extra emissions of CO₂ from associated increases in logging and deforestation, could accelerate the increase of atmospheric CO₂ and global warming, causing even further reductions in tree growth, and so on and so on.”

Another Harvard scholar who may find surprises in CTFS data is Paul R. Moorcroft, professor of biology and a maker of terrestrial biosphere models. Such models indicate that human-induced increases in surface temperatures and rising levels of atmospheric CO₂ during the coming century will cause profound changes in tropical forests around the globe and, indeed, says Moorcroft, “will cause a collapse of Amazonian tropical forests in the middle of this century.” The biosphere models used to make such predictions contain detailed mechanistic representations of biological processes that govern the composition and functioning of ecosystems, but, says Moorcroft, their ability to represent such things accurately—to predict key empirical metrics such as the dynamics of tree growth, for instance, or the rates at which carbon and water are exchanged between the tropical forest canopies and the atmosphere—have, so far, remained largely untested. “The measurements collected by
“We are beginning to compensate forest owners for their carbon sequestration, but remain free riders for their genetic information.”

Much primeval tropical forest has been lost to logging, “so our efforts are now focused,” says Ashton, “on strengthening general theory in order to actively manage those remaining islands in which most of Asia’s biodiversity is becoming confined.” He and his colleagues have come far, he believes, in understanding how the diversity of trees is sustained—and with it the ark of insects and micro-organisms that depend on the trees and that comprise the bulk of a forest’s biodiversity. When researchers get the whole story, they will be able to show, he says, that “each rain-forest tree species, notwithstanding their superficial similarity in many respects, possesses at least one attribute by which it competitively succeeds, proving fitter than the rest in a certain respect.” He wants to learn more about the interactions between tree species, and how the action is mediated by pollinators, or seed dispersers, or seed predators. For instance, the forest can be seen in one aspect as an exquisitely regulated clock. Certain trees flower in a sequence with other trees, timing critical to their mutual success because they share the same insect pollinator and avoid overwhelming it by flowering seriatim. Ashton also needs to know more about pathogens, which he predicts will be seen to play the lead role in sustaining the diversity of the forest: when any tree population gets too dense, a pathogen knocks it down, providing the single major means whereby other species can fill the vacant space created, thereby building diversity.

In a talk he gave in Tokyo about what science can do to sustain biodiversity, Ashton did not leave the lectern until he had suggested what policymakers should do, and quickly. “Tropical rain forests have declined so rapidly because the value to their owners is as capital to liquidate, but [that value is] low in the medium term in comparison to tree crops—rubber, oil palm, industrial wood and fiber species. Their value is, rather, to us—to offset our carbon emissions but, more particularly, for their genetic information…This genetic diversity is irreplaceable. It will eventually prove vital to its owners, as it is for us now. We are beginning to compensate forest owners for their carbon sequestration but, so far, remain free riders for their genetic information, of which we in the industrialized world will be principal beneficiaries.” Ashton had in mind, for instance, that those diverse trees have developed diverse chemical defenses, of potential pharmaceutical and other value. “Unless we get used to the idea that we have to pay some rental to protect that biodiversity,” he says, “I’m not optimistic for the future.”

With the continuously assembling database from CTFS’s research plots, “we’re now getting a capacity to monitor change at a very precise level,” says Ashton. “This gives us the obligation to look at unidirectional change in the dynamics and distribution of biomass not just in these individual forests, but on a regional and global basis. Then we must look for possible causes—changes in the climate, atmospheric chemistry, the carbon level, and so forth. Starting at the particular—the interacting species—and then working out to general questions of global change, is the rigorous way to proceed. There’s no one else doing anything like that, certainly not on a global scale. So the Arnold Arboretum is bang in the middle of one of the most important fields of research of our time, having in a way been just a pretty place to visit on a Sunday afternoon for many years. I’m very proud of that. That’s what I wanted to do originally. It’s taken me 30 years.”

Christopher Reed is executive editor of this magazine.