

A WILD HOPE

TWO DECADES AFTER IT DISAPPEARED IN NATURE, THE STUNNING BLUE SPIX'S MACAW WILL BE REINTRODUCED TO ITS FOREST HOME

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CURAÇÁ, BRAZIL - In 1995, conservationists and scientists embarked on a desperate attempt to save the world's rarest bird, a blue-gray parrot called the Spix's macaw. The bird had scarcely been spotted since scientists first described it in the early 19th century, and it had taken on an aura of mystery, making it irresistible to parrot lovers - and to poachers. "For well over a century we just had this very, very weak information that there was this kind of mythical, rather beautiful blue bird," says Nigel Collar, a conservationist at BirdLife International. By the mid-1990s only a single individual remained alive in the wild, close to this dusty, small town in north-eastern Brazil.

From DNA in moulted feathers, researchers in the United Kingdom confirmed that the last wild bird was a male. At the time, fewer than three dozen birds were known to be held in collections and zoos around the world, and a decision was made to release a single female in hopes the birds would pair and produce offspring. The female was released close to where the male lived and seemed to quickly adapt to her new life, eating wild food and avoiding an attack by a falcon. She grew stronger by the day, flying farther and farther, and after little more than 2 months had paired with the male. Two weeks later, she mysteriously disappeared.

Years later, a local man said he had found the bird dead below a power line. "If that's really true, then that is just incredibly bad luck," Collar says. It is almost unheard of for parrots to hit power cables, he says, and in reality she might have been taken by poachers. "The world of Spix's macaw is full of very, very great uncertainties and a lot of people who say a lot of things that they don't necessarily really mean." The wild male vanished a few years later, and the Spix's fate seemed sealed - another species lost.

Now, conservationists are attempting to undo that fate. On 11 June, more than a quarter-century after the female flew into oblivion, they plan to release eight Spix's macaws from captivity into the wild. Twelve more are supposed to follow at the end of the year and still more in the years to come. If everything goes according to plan, these birds will be the vanguard of a new population of Spix's macaws in their natural habitat. The project, long hampered by infighting and overshadowed by controversy, had to overcome significant scientific hurdles to even come this far. But the biggest challenge still lies ahead.

"The Spix's project is unique in that they are reintroducing a species back into the wild that is currently extinct, has been extinct in the wild for over 2 decades," says Thomas White, a wildlife biologist at the U.S. Fish and Wildlife Service and a technical adviser to the project. "There's very few reintroduction programs around the world that have done something like that, none with parrots or macaws."

Few reintroductions of birds have been successful, and none was as ambitious as this one, says George Amato, a conservation biologist at the American Museum of Natural History. Yet for the Spix's it has to be tried, he says. "I hope it works, because we really have no other alternatives."

THE NATURAL HOME of the Spix's macaw is in the caatinga, a tropical dry forest in north-eastern Brazil that covers 10% of the country. In the rainy season, which lasts for about 3 months, everything appears lush and green. But the rest of the year plants here compete in shades of gray and white - caatinga means "white forest" in the Indigenous Tupi language. It is here that the Spix's macaws once nested in the hollows of old caraibeira trees growing along the creeks that cut through the caatinga, feeding on seeds and nuts.

It is impossible to know how many Spix's macaws existed in the past. By the time Western science discovered the bird, humans had already started to parcel large parts of the caatinga into ranches. In 1819, German naturalist Johann Baptist von Spix spotted the parrot on an expedition to the interior of Brazil. Spix noted that the bird appeared to be "very rare" - then shot it and brought it home to Munich, setting the tone for humanity's relationship with this striking bird going forward.

As the human footprint increased in the caatinga, the bird became even rarer. Tragically, this only made it more coveted by parrot collectors, who were willing to pay tens of thousands of dollars for a single bird. "The rarer it was, the more it became a kind of status symbol," Collar says. The bird became something akin to the exceedingly rare blue Mauritius stamp coveted by philatelists, says Roland Wirth, a conservationist at the Zoological Society for the Conservation of Species and Populations. "The very wealthy, very passionate collectors really wanted to have one, and they would do almost anything to do so."

Johann Baptist von Spix first described and painted the macaw that now bears his name in an 1824 publication. By the beginning of 1987, only three Spix's macaws were known to survive in the wild, and by the end of that year, poachers had taken two of them. After the plan to pair the last male with a captive bird failed in 1995, the male remained with a female of a different species, an Illiger's macaw, until he, too, disappeared in October 2000. The International Union for Conservation of Nature officially declared the Spix's macaw extinct in the wild in 2019, exactly 200 years after Spix had described it.

Even then, the bird retained its hold on the popular imagination. The story of the last lone male inspired songs - including one written from the perspective of the Illiger's female waiting in vain for his return - and two animated movies that together earned \$1 billion.



ARA hyacinthinus.

Le Perroquet à couleurs changeante de Saphir.

Tab. XXIII.

ON A HOT MORNING in February, Martin Guth, a bald and burly German businessman and parrot collector, stood in the spot where the Spix's will begin its new life in the wild. The nongovernmental organization (NGO) he founded, the Association for the Conservation of Threatened Parrots (ACTP), has taken on the challenge of bringing the bird back to the caatinga. ACTP, which houses more than 170 Spix's macaws in Tasdorf, near Berlin, built a facility just a few hundred meters from where Guth is standing and, in March 2020, flew 52 macaws to Brazil by private jet to take up residence there. In 2021, three chicks hatched at the facility, the first Spix's born in the bird's original home in more than 30 years.

But that morning, Guth was angry. Nearby, workers were busy constructing a huge U-shaped aviary where the birds will be able to fly longer distances than they can in their small cages inside the main facility. It was running behind schedule. "Even on the way here, the guy still said everything was finished," Guth grumbled. He was convinced that a rival who was previously involved in the Spix's project had something to do with the delay. The Spix's project may have high-minded goals, but its history is replete with jealousies and back-biting.

The idea of breeding Spix's macaws in captivity and reintroducing them to the wild began long before Guth's involvement, and even before the lone wild male had disappeared. In 1990, conservationists formed a committee to oversee a reintroduction program. That meant building up an adequate captive population, which proved to be a complicated and controversial process.

At first conservationists only knew of a few captive birds—and owners were reluctant to come forward, because the export of wildlife had been illegal in Brazil since 1967. But the Brazilian government agreed to grant amnesty to owners if their birds joined the breeding program, and "one by one, people came out and admitted they had Spix's macaws," says Wolfgang Kiessling, a businessman who founded and runs Loro Parque, a private zoo on the island of Tenerife that held some Spix's macaws for many years.

Lost ground

The Spix's macaw's native home is the caatinga, a dry tropical forest that is leafless most of the year. The forest has dwindled because of ranching, another obstacle facing the effort to reintroduce the macaw.

Still, by 1996 only 39 captive birds were known around the world. Making matters worse, most of them were closely related. Only nine of the birds had come from the wild, and 21 of the remaining 30 were offspring from a single pair in the Philippines, raising concerns about inbreeding. For the Spix's to have any future, birds from different collectors needed to be brought together to breed, but arguments over who would send a bird to whom under what conditions kept derailing the plans. "The rarer the animal, the more politics is involved," says Cristina Miyaki, a bird geneticist and a member of the advisory committee of the Spix's project. In contrast to the spirit of cooperation required for a successful recovery effort, Collar wrote in 1992, "ownership is a matter of jealousy, prestige and possessiveness that is fundamentally different in psychological origin."

Meanwhile, the constellation of owners kept changing. Starting in 2000, Sheikh Saoud Bin Mohammed Bin Ali Al-Thani of Qatar bought dozens of Spix's to keep at Al Wabra, his private wildlife preserve. In time, he came to own the vast majority of all known Spix's macaws in the world.

Guth entered the scene in 2005, beating out the sheikh to buy from a private Swiss owner three Spix's macaws that had not previously been part of the breeding program. "The three birds he had were the most important ones, because they could improve the genetics of the population," says Camile Lugarini, a veterinarian at the Chico Mendes Institute for Biodiversity Conservation (ICMBio), who leads the Spix's macaw project for the Brazilian Ministry of the Environment.

In May 2012, a meeting in Brazil's capital, Brasília, brought together representatives of all the important stakeholders. It was testy. One participant argued that Guth should have no part in the project because he had served a prison sentence and, this person claimed, had sold endangered birds illegally, in violation of the Convention on International Trade in Endangered Species of Wild Fauna and Flora. (Guth says that like other breeders and NGOs, ACTP sells some birds legally, but has never sold Spix's or other highly endangered birds, and that his offenses were committed decades ago and have nothing to do with the current project.) Tim Bouts, a veterinarian who was then the curator at Al Wabra and attended the meeting, says he spoke in defence of Guth, who was not present: "Let's be honest, this table here is full of criminals. Every single Spix's that came into captivity was illegal."

The meeting ended with no agreement.

Guth has pressed ahead, even as some have questioned his motives and methods, pointing to the lack of transparency around ACTP and its sources of funding. Guth says some donors prefer to remain anonymous and that he is trying to avoid the disputes over funding and credit that doomed the project in the past. "Yes, we are doing things differently," he says. "It certainly didn't work the way they tried it before."

Even some people who say they are intimidated by Guth acknowledge the effectiveness of his pushing, bullying, and cajoling. "He is a bit of a bulldozer," Wirth says. "But he gets things done." When the sheikh died suddenly in 2014 and the future of his Spix's macaws was in doubt, Guth stepped in through his NGO to bring the birds from Qatar to Tasdorf. In June 2018, Guth and Brazil's environment minister signed a memorandum of understanding in Berlin to build the facility in Brazil, transfer birds, and reintroduce them. (ICMBio and the Pairi Daiza Foundation were also signatories.)

"I wasn't born as a conservationist," Guth says. But as he became involved in the reintroduction effort, he grew determined to prove his critics wrong. "They said, 'He won't be able to breed the birds.' I did. They said, 'He won't send any birds to Brazil.' I did. They said, 'He won't reintroduce the birds.' We are doing that."

He has put himself in an interesting position, Collar says. "He is the one now who can go down in history as the person who saved the Spix's macaw. Or if he really messes up, then he goes down in history as the person who made it go extinct."

WHILE OWNERS WERE FIGHTING over control and credit, conservationists and researchers were fighting to save the species. When ornithologist Cromwell Purchase went to Al Wabra in 2010 to head its Spix's macaw program, he was told the species was "on the fence." At the time, 54 of 71 birds known worldwide were in Qatar, and the captive population faced twin threats: disease and a low birth rate.

The major disease threatening captive Spix's was proventricular dilatation disease, which affects the nerves in parrots' gastrointestinal tract and causes them to slowly waste away. A common scourge of pet birds, it had been known since the 1970s, but its cause was completely unclear. Then, in 2008, researchers identified a novel virus in the brains of affected birds: a type of bornavirus, a group known to cause brain disease in horses and sheep.

"We tested all known Spix's in the world for this virus," says Michael Lierz, a veterinarian at the Justus Liebig University Giessen. In Qatar, a traffic light system was implemented, with infected birds deemed "red" and separated from the others. This eventually eliminated the threat of avian bornavirus to the Spix's population.

The other problem was reproduction. Only a few pairs were producing chicks. At first a decision was made to keep them reproducing. "The goal was to produce as many animals as possible to keep the species from going completely extinct," Lierz says. Over time the focus shifted to making better matches, in order to preserve the Spix's genetic diversity and, therefore, its chances of survival. But birds with diverse genetics wouldn't necessarily form a pair. "Parrots are monogamous and very choosy," Lierz says.

So, veterinarians at Al Wabra considered artificial insemination. For many birds, including chickens, pigeons, and birds of prey, this is fairly straightforward, Lierz says. The technique involves massaging a male's cloaca from the outside with the thumb. ("A short and smooth thumbnail is advantageous for performing cloacal massage and protects the bird from accidental injury," one paper notes.) But this technique does not work on most large parrots. Around 2010, Lierz and his colleague Daniel Neumann developed a new method: inserting a small probe into the cloaca to deliver a weak electric current that stimulates a male bird to release sperm. "As kids we used to hold these 9-volt batteries to our tongues and it tingled, that's roughly how you have to imagine this," Lierz says.

With artificial insemination, the researchers could finally pair birds according to their genetics. But the timing was crucial: Females usually lay two or three eggs and the moment one egg is laid is the right time to inseminate the next one. Purchase says he and Neumann spent hours watching female Spix's macaws on video monitors. "As soon as we see the egg, we're out and we go from aviary to aviary and we catch the male that we want, male No. 1 on the list. We try and collect semen from him, and if we don't get enough ... then we go to male No. 2," Purchase says. In May 2013, the first artificially inseminated Spix's macaw chicks hatched. More followed. "That's what got us out of the genetic bottleneck," Bouts says.

THE MORNING AFTER GUTH was fuming about the aviary delay, Purchase walked into a large room at the facility carrying a gray plastic cage in each hand. He set them down on the tiled floor, opened the door of one, reached inside with a dark towel, and enfolded what was inside. Kneeling on the floor, he delicately unwrapped the towel. A gray head emerged first, then turquoise feathers covering the parrot's belly, and finally the rich blue of its back and tail.

Purchase carried the bird over to Francois Le Grange, a veterinarian, who began to examine it - a final check before it would join the other candidates for release in the not-quite-finished outdoor aviary. The bird's outraged "ca-á ca-á" echoed off the walls as Le Grange plucked a feather from beneath its wing. Then he listened to its heartbeat with a children's stethoscope. He swabbed the mouth and the cloaca and finally drew some blood from a vein in the neck.

The swabs would be tested for pathogens that might pose a risk to other animals after the birds are released. But the team is much more worried about the dangers these parrots themselves will face in the wild. After generations in captivity, their instincts for navigating and finding food have weakened, White says. There are predators, too, including opossums, snakes, and birds of prey. And, of course, humans - the species that drove the bird to extinction in the first place.

Together these challenges doomed some earlier reintroduction programs. One of the highest profile examples was an attempt to bring the thick-billed parrot back to Arizona, Amato says. This brightly coloured bird still lives in Mexico but has been hunted to extinction in the United States. Between 1986 and 1993, 88 of them (mostly confiscated birds originally trapped illegally in Mexico, but also some captive-bred birds) were released in the Chiricahua Mountains in Arizona. Many were killed by hawks or cats or starved to death. After 2 months, only about two-thirds of the wild-caught birds survived. But the captive-bred birds did much worse, as a paper noted in 1994: "Almost all individuals have been lost within a few days of release as a result of substantial deficiencies in basic survival skills." The program was abandoned in 1993, and the last time a thick-billed parrot was spotted in Arizona was in 1995. "The release program was a failure, even though a lot of money and effort was spent on it," Amato says. "After that, many biologists felt that release programs for parrots generally were unlikely to be successful."

Yet Amato notes some hopeful counterexamples: the feral populations of escaped parrots that thrive in many parts of the world, including London and New York City. "These are like accidental reintroductions that worked," he says. Some recent planned reintroductions have also had positive results, White says, including one he was involved in: the reintroduction of Puerto Rican parrots to El Yunque National Forest after they were wiped out by Hurricane Maria in 2017. Since 2020, 75 captive-reared animals have been released in the forest, which now hosts 34 birds. Four new nests were spotted this year, White says. "This was a true reintroduction and it has been very successful."

THAT NIGHT, as darkness descended over the caatinga, Lugarini headed out with a colleague to a creek near the facility. Wearing leather gaiters to protect against snakes, she followed the mostly dry creek bed, moving as quietly as possible. She stopped in front of a caraibeira tree, where a pair of Illiger's macaws had made their nest.

Illiger's macaws, also known as blue-winged macaws, play an important role in the plan to bring back the Spix's. Illiger's are more common and inhabit a larger area than the Spix's macaws, but in the caatinga the two birds' lifestyles overlap. Both nest in hollows in caraibeira trees and feed on the same fruits and nuts. When the eight Spix's are released, eight Illiger's macaws taken from the wild will be released with them. The team hopes this mixed flock will join up with wild Illiger's in the caatinga, allowing the Spix's macaws to benefit from their knowledge of how to avoid predators, find food, and navigate.

In the wild, Spix's macaws nest in the hollows of large caraibeira trees, which grow along streams in the dry forest of northeastern Brazil.

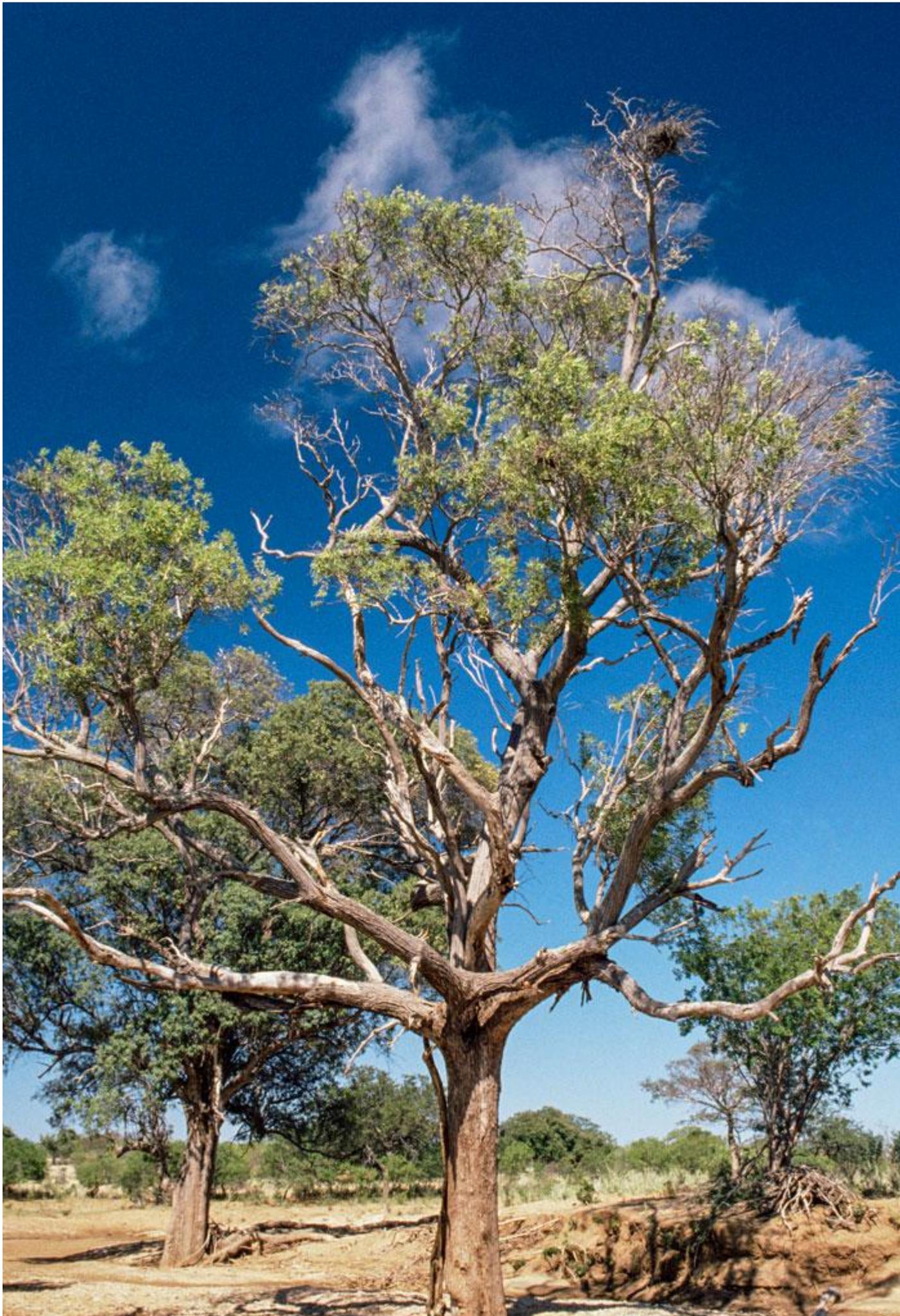
The team had already collected seven Illiger's, and Lugarini had come for the eighth. Her headlamp casting a red glow, she grasped a cord looped around a branch high in the caraibeira tree, fixed a rope to it and then used the cord to pull the rope over the branch and back down. Looking up, she sighed with apprehension at the sight of bats circling the tree. "That's worse than the snakes," she said. Yet she slowly ascended the rope, the red light marking her progress. Ten meters up she reached the nesting hollow and looked inside. No birds. The Illiger's macaws that had been nesting here were gone.

One clear lesson from previous reintroductions is that releasing more animals is better. That's because a bigger group can work together to spot dangers and find food. Finding a suitable mate is easier, too. For highly social species like macaws, numbers are especially important. "Let's say you release 20 individuals and they all go 20 different directions, well then you haven't reestablished a population," White says. "They need to live in a group." Combining captive Spix's and wild Illiger's thus solves two problems, White says. "We can actually increase the flock size without extra Spix's ... while using a native species which knows the habitat, knows the area, that can function as mentors."

Releasing birds of the right age can help keep them from scattering. Spix's macaws start to reproduce around age 4 and then tend to return to the same nesting site year after year. "The sooner that those released macaws start reproducing, the sooner they become anchored to that site," White says. "So you want to have birds that are entering or at reproductive age." Providing supplementary food and nest boxes may also encourage the birds to remain close to the release site.

When White and other researchers reviewed 47 releases of captive parrots into the wild, they found that the single biggest threat to success was predation. To reduce this risk, Purchase put metal bands around trees with nest hollows or nest boxes to keep predators like opossums from climbing the trees. To avoid tipping off would-be poachers, he put decoy bands around trees without nests, as well. The birds will also wear tracking collars.

After a long day, Lugarini headed back to her hotel in Curaçá. As the four-wheel-drive vehicle bounced over the dusty road, goats scattered and closed wooden gates slowed her progress. It was a reminder that the Spix's natural habitat barely exists anymore. A restoration project is ongoing but has been hampered by the lack of knowledge of this little-studied biome and by its location in one of the poorest regions of Brazil, where the goats that provide a lifeline for the local population have devoured much of the natural vegetation.



“In the beginning I did sometimes think, ‘Why are we putting all this effort into bringing back one species that is extinct when there are so many other species that we could still save from extinction?’” Lugarini says. “But you have to remember that this flagship species helps us preserve and restore the caatinga, and that helps many other species, too.”

Curaçá is home to about 30,000 inhabitants—and many homages to the Spix’s. Next to the gas station is the Spix hotel. The theater, restored with money from the Spix project, is bright blue. The city’s flag in front of the town hall includes a Spix’s macaw, though Lugarini notes “they got it wrong”: The bird has the yellow markings around the eyes and next to the beak that are typical of the Lear’s macaw, another threatened macaw that lives not far away.

One resident, Fernando Ferreira, wrote the song about the lovesick Illiger’s macaw. Wearing shorts and a T-shirt, his gray hair swept back in a ponytail, Ferreira sat down with a guitar and sang another song he wrote about the Spix’s macaw, known here as *ararinha azul*, or little blue macaw: “My wish is to see you fly, my wish is to see you come back,” he sang. On the afternoon of 11 June, Ferreira will perform this song at a ceremony at the theater. There will be a video, speeches, and a press conference. Earlier that day, in front of a small group of people, Purchase will open the door of the aviary to release the birds.

For those who have worked toward this for years, it will be a moment of joy and apprehension. “It will feel like a weight off my shoulders, probably,” Purchase says. But then comes the next weight—worrying about their survival. There is an element of guilt, Miyaki says, because humans drove the Spix’s to extinction. “We owe it to the species, for it to go back to the wild.” But the experience of 1995 still casts a shadow, she says. “The frustration after the first release of that female was so big,” she says. “I try to be optimistic, but I’m very anxious.”

The project estimates that between one-third and two-thirds of the birds will be lost in the first year. If the losses are higher, the birds may be taken back in. “You try to make sure that you have covered all of the bases and thought about as many possible options and outcomes as possible,” White says. “But the day you release those birds, the day they leave that cage, a lot of things are no longer within your control.”

Even if the effort to re-establish the Spix’s macaw in its native habitat in north-eastern Brazil succeeds, the bird faces a long-term threat: the dwindling of the tropical dry forest known as the caatinga. The caatinga is a mosaic of shrubs, cacti, and thorny bushes with creeks lined with caraibeira trees where the Spix’s macaw nests. Over decades humans have harvested wood, slashed and burned land for agriculture, and raised goats that eat many seedlings, including those of the caraibeira.

Researchers at the Centre for Ecology and Environmental Monitoring of the Federal University of the São Francisco Valley (Univasf) have been working for years to conserve and restore the caatinga. One project, funded by the Inter-American Development Bank, focuses on restoring habitat for the Spix’s macaw. But just protecting degraded areas isn’t enough in the parched, slow-growing caatinga. “If you leave a patch of the Atlantic rainforest it starts to grow back in 6 or 8 years,” says Renato Garcia Rodrigues, an ecologist at Univasf Petrolina. “That doesn’t happen here.”

Efforts to replant the forest have been hampered by lack of knowledge, however. In the beginning, researchers planted degraded areas with species that were thriving in healthy forest, but with little success. “We did not know the ecological succession,” says Garcia Rodrigues. In recent years he and colleagues have identified pioneer plants able to grow in degraded areas and pave the way for other, more demanding plants. Before planting an area, they use drones to assess its condition, then fine-tune their restoration plan.

In the next rainy season they plan to plant almost 50,000 seedlings of 26 different species, aiming to restore 100 hectares of the streamside woodland the Spix’s calls home, plus another 100 hectares of caatinga. Although some of the plants will provide food for the Spix’s macaws within a year, it will take decades before the birds or their descendants might nest in the trees being planted now.

The project will also involve the caatinga’s human inhabitants. For many generations, goats were their only source of protein, says Claudia Martins, a researcher who works with Garcia Rodrigues. “Many people here don’t have bank accounts. If they have an emergency, they sell a goat.” Getting rid of these animals is not realistic, at least in the short term. So the ecologists are careful to select plants that are not attractive to goats and fence off newly planted areas to give seedlings a head start against the goats. “We have to learn to manage goats and acknowledge people’s livelihoods and traditions if we want to have success in restoration,” Martins says.

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