

ANOTHER DIMENSION

Conservation photographer Scott Trageser believes his 3D scanning system can help protect endangered species. He explains the idea behind his pandemic brainchild

WORDS: GRAEME GREEN IMAGES: SCOTT TRAGESER

Success has often been a double-edged sword for Scott Trageser during expeditions in search of rare, threatened or 'new' species in the cloud forests of Ecuador. The American photographer and conservation biologist explains why.

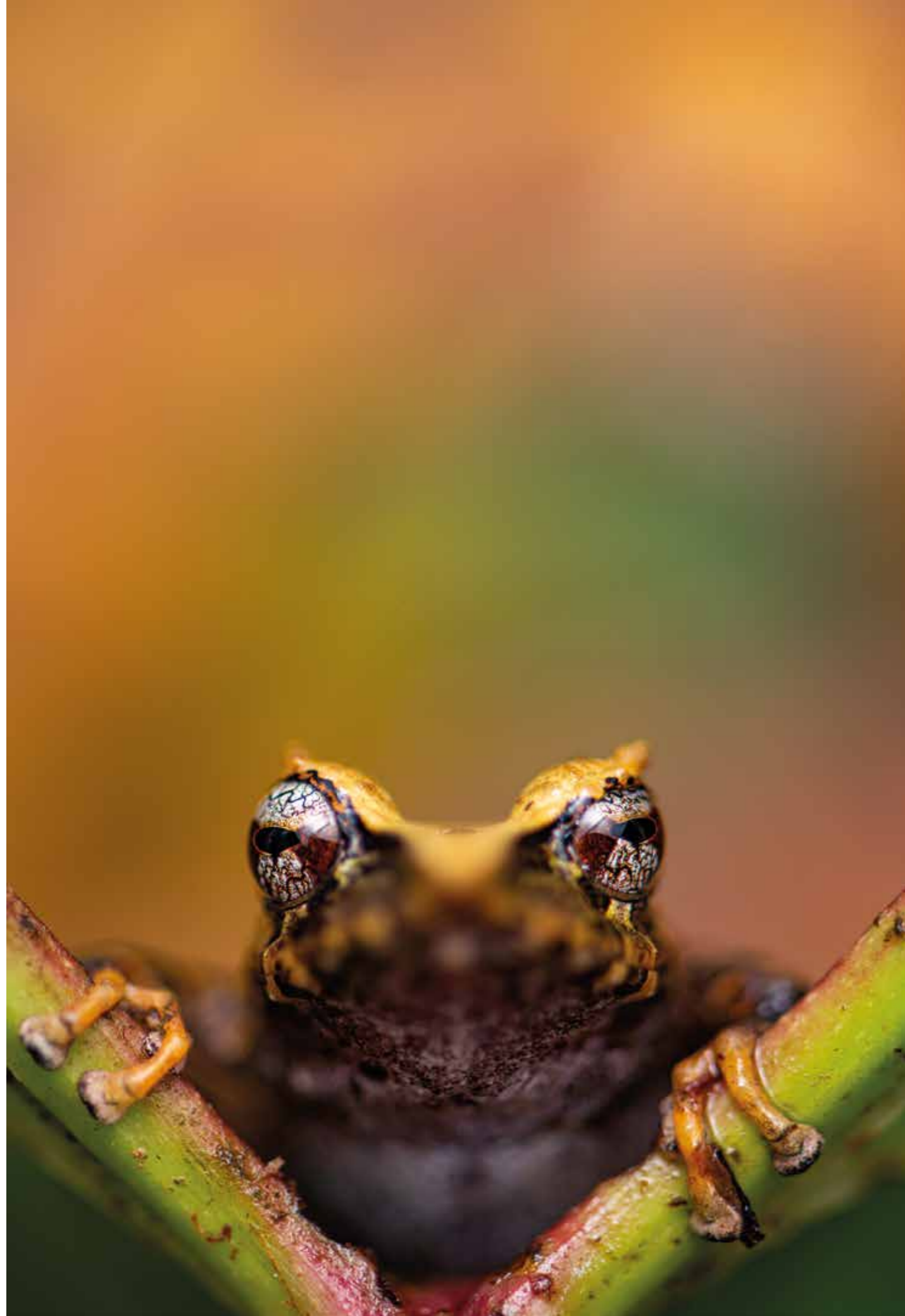
"When we discover something it's a celebration," he says. "We've rediscovered species that were thought to be lost. But then we have to draw straws for who has to euthanise the animal we rediscovered."

It is ironic that scientific research aimed at understanding and helping to protect wildlife, including rare and endangered species, often involves killing one of the animals as a specimen for taxonomic purposes. "When we find a species, we don't know if it's the last female on Earth," says Trageser. "If you have a threatened population of, say, just 10 and you take away one mature individual, it's a substantial hit. If we have an opportunity to avoid doing that, we should take it."

Trageser has developed a 3D scanning system – under the banner of The Biodiversity Group, the small non-profit organisation he leads – in collaboration with Sony Electronics. He hopes it will reduce the need for scientists and conservationists to euthanise animals whose species they are trying to study and save. Instead, he argues, they can scan it, take non-invasive DNA samples and release them unharmed back into the wild.

"When we discover something it's a celebration. We've rediscovered species that were thought to be lost"

Left
'Pinocchio rainfrog
(*Pristimantis appendiculatus*)'
by Scott Trageser



“It was a pandemic brainchild that maybe we could do digital specimens,” Trageser says, speaking from his home in San Diego. “It’s a gripe for many people that specimens often have to be euthanised. I understood taxonomists wouldn’t necessarily be super-happy. There are some old-school taxonomists who, for some good reasons, would be reluctant to accept a digital specimen.”

He tells me he had a phone call with a photogrammetry expert who has worked on Hollywood films such as

The Matrix (1999) and *Quantum of Solace* (2008).

Photogrammetry involves collecting 3D digital information about objects including terrain, architecture and human bodies from 2D photographs.

“People have used photogrammetry to create a lot of CGI in films or VFX artworks,” says Trageser. “You can take multiple photos of a 3D object like a rock, then import that into a scene you’re building. It turned out Sony had come out with a camera system where you can have everything in sync.

“In Hollywood you could have a giant set-up that costs hundreds of thousands of dollars to scan an actor”

This Hollywood photogrammetry expert had been wanting to play with it, so we talked to Sony and it ended up being something we could use, with a bit of tweaking, to take enough photos to create a 3D scan.”

While the technology already exists, Trageser’s innovation is to build a low-powered, portable system which can be carried in a 25-litre backpack and operated by a single person, even in remote settings.

“In Hollywood you could have a giant set-up that costs hundreds of thousands of dollars to scan an actor,” he says. “To do this out in the wild for conservation, there was nothing available. The portability of it is very new.”

Trageser describes the system as an inverted tripod with four cameras that rotate around the subject – which is on a fixed platform – taking rapid bursts of more than 100 pictures at a time at extremely high shutter speeds. That is followed by a complex, time-consuming editing process using specialist software.

Rather than a solitary sample displayed in a museum’s glass cabinet, the digital specimen can be shared worldwide, which Trageser believes has great potential for biodiversity conservation, science and education. Students and teachers can view the images and models through Virtual Reality and Augmented Reality.

“I hope we can bring it into a 3D immersive environment, so we can say, ‘Here’s a frog that hasn’t been seen in 40 years’, and people can interact with it. We need people to care about these animals, so they vote differently or bring out their wallet. That’s the bridge I hope to cross with these 3D scans.”

The 3D scans provide more information than 2D recordings, he says. “We can do volumetric measurements, such as the volume of an eye – something we’ve never been able to do before.”

Perhaps the most important use of the technology will be to prove the existence of a species, whether new, rare, threatened, or previously thought extinct. After three years of development, Trageser deployed the scanning system in Ecuador in 2023 and deposited the first ever digital museum specimens on online 3D science resource MorphoSource.



Left
‘Shining leaf chafer (Platycoelia sp.)’
by Scott Trageser

Below
‘Eye of a moss-backed tanager (Bangsia edwardsi)’
by Scott Trageser



“We used it on around a dozen species in the Rio Manduriacu Reserve in Ecuador, a reserve where we’ve made a lot of headway to protect it from mining. The Tandayapa Andes toad was the first species that was rediscovered there – it hadn’t been seen in 42 years. The Mindo glass frog was one we rediscovered recently, and we scanned that one too. We had a little glass frog, a couple of lizards, a snake ...”

Biodiversity data, including 3D images, can help influence conservation decision-making. “It’s a tool in our toolkit to be able to protect areas and species, to bring awareness and appreciation to threatened animals, and it adds to the science,” says Trageser.

Not everyone, though, is convinced by Trageser’s assertion that “for the first time in 300 years, researchers can conduct taxonomic research without euthanising animals.”

Dr Jeff Streicher, principal curator at the Natural History Museum in London, says, “3D photogrammetry in the field could be useful – it might capture colour, pattern and shape information that isn’t evident from 2D photography. While this is exciting, I remain sceptical about many of the claims.

“What I find most problematic is the idea that a swab of DNA and a 3D image replaces the need for whole specimens. Most types of data that specimens contain – diet, musculature, osteology, parasites, visceral anatomy – can’t be extracted from their 3D model. With narrow research goals, this method may be helpful for some people. It doesn’t ‘replace’ the need for collecting. Collecting specimens remains an essential tool in modern biodiversity science.”

Other organisations, including wildlife charity Re:wild, who Trageser will be working with in 2024, remain open-minded. “We’re excited about the potential of any non-invasive technologies that can help identify and confirm lost species,” says Christina Biggs, Re:wild’s lost species officer.

Dr Jane Goodall, founder of the non-profit conservation organisation The Jane Goodall Institute, is cautiously optimistic. “I applaud the development of non-invasive techniques to study animals,” she says. “In the past it

Right
‘Zebra-tailed lizard
(*Callisaurus draconoides*)’
by Scott Trageser

Below
‘Violet-tailed sylph
(*Aglaiocercus coelestis*)’
by Scott Trageser



“We need to develop ways that allow studying and conserving animals while respecting their needs as individuals”

Dr Jane Goodall

was taken for granted that we could send expeditions into the forest to shoot and collect large numbers of animals in the name of science or conservation. We now know, among other things through my study of the chimpanzees of Gombe, that animals have complex emotional lives and intelligence. We have indications that even invertebrates are sentient beings and octopuses certainly are.

“Therefore, as scientists we need to walk carefully. We need to develop ways that allow studying and conserving animals while respecting their needs as individuals. Innovations such as 3D scanning or high-resolution photography are an exciting step forward towards more compassionate science and conservation.”

Trageser has high hopes, but his prototype system is difficult to set up, with lots of custom-built pieces to put together, and use, meaning only he can operate it. He’s currently seeking funds and partners with technical

expertise to help develop Version 2, which he hopes will be possible for people to “3D-print most of the set-up anywhere in the world, then put it together IKEA-style.”

He also wants Version 2 to work on a wider range of species. “It can’t currently scan something like a shrew because it never stops moving. We’re trying to make Version 2 instant, so instead of having bursts, there’s one shot and it’s done. We’re trying to do that for underwater too, so you could scan marine creatures, like jellyfish.” And he also hopes to see AI replace the laborious, manual post-production work.

Trageser was born in 1987 just outside Los Angeles and raised in Tucson, Arizona, his parents both engineers. He was fascinated by wildlife from an early age.

“I’m told my grandma would take me out when I was two and I was always interested in all the bugs,” he says. He has been taking photos seriously since 2008.

He began a PhD in Biosystems Engineering but, frustrated at too much time spent indoors, quit to take a job as a biologist on construction projects, which meant being outside and looking for animals. In 2013 he headed to northeast Bangladesh where he co-founded and served as director of the Creative Conservation Alliance. “The jobs I was working on in California were enjoyable but didn’t have a lot of meaning,” he says. “I was searching for meaning. We did research programmes in Bangladesh, which quickly turned

into conservation. We studied anything scaly – pangolins, snakes, lizards...” He began going on expeditions with The Biodiversity Group, taking over the organisation in 2018 when the previous executive director left. “We don’t have any paid staff and I don’t get paid either, but I have great volunteers helping with many tasks.”

The Biodiversity Group has discovered 30 new species during global expeditions and helped get the Chinese crocodile lizard in Vietnam listed on the International Union

“I feel an obligation to make sure any photo is being used for more than just likes on Instagram”

for Conservation of Nature (IUCN) Red List of Threatened Species. The organisation’s greatest achievement under his stewardship as executive director, though, Trageser says, is research and imagery that has helped protect wildlife.

“Whenever we photograph an animal, we disrupt its life. I feel an obligation to make sure any photo is being used for more than just likes on Instagram. I make them available for conservation non-profits to use. With Rio Manduriacu Reserve, we gave photos and 3D scans to the non-profit managing the area so they can petition for more funds, which helped them double the size of the reserve.”

Many photographers dedicate time to nature’s giants such as lions, elephants and sharks. Trageser, a member of the International League of Conservation Photographers, focuses instead on smaller, lesser-known species.

“I’m interested in weird things,” he says. “I like to search for things too – the harder, the better. Finding one snake and photographing it is more personally rewarding than seeing 100 large mammals in a day. If you go to the African savannah, everyone else is photographing it so what am I going to contribute? I want to go to places where I can contribute more.”

Trageser wants his photography to make a practical impact rather than being purely visual art. “In 2021, Los Cedros Biological Reserve had the first mining concession that was defeated based on the Rights of nature, which are enshrined in Ecuador’s constitution,” he says. “We were told our photos, research and rediscoveries from Rio Manduriacu Reserve, which is a stone’s throw away, were able to be used in the court case to bolster their arguments that mining impacts would have devastating environmental effects.”

He adds, “These threatened species can’t defend themselves against the threats they’re facing. It’s been a personal challenge of mine to take photos of typically ‘scary’ animals like snakes and get people to say ‘That’s interesting’ or ‘That’s beautiful’. That’s when I feel I’ve done my job, when I’ve made life that’s overlooked stop being overlooked.”

Trageser will have a busy 2024, starting with a move from San Diego to Panama – “Less expensive than San Diego and they have more frogs.”

Left
‘Red-eyed tree frog
(*Agalychnis callidryas*)’
by Scott Trageser

Below
‘Tropical lightbulb lizard
(*Andinosaura oculata*)’
by Scott Trageser





In March he will return to Ecuador for what he calls an “undercover bioblitz”, the details of which need to remain secret for security reasons. “We’re riding a wave of momentum in Ecuador, where we’ve had several monumental wins against mining concessions,” he explains. “But now the lives of our colleagues down there – other conservationists and scientists – are being threatened, so they’re too afraid to testify in court, and local non-profits are scared in case they get their permissions revoked.

“So we’re going down with an international team of specialists who can study things like freshwater fish and insects. We’ll go down quickly and secretly, get the biodiversity data, get the 3D scans, and make sure we can describe the species that are there to prove that within this concession, if you made a mine here, it would cause an extinction, which is unconstitutional. The photos, 3D scans and data will be used in court proceedings and by local non-profits to help protection efforts.”

Later in 2024 he will travel to the North Molucca islands in Indonesia to search for Zug’s monitor lizard, one of 25 species mentioned in Re:wild’s ‘Search for Lost Species’ – an effort to find plants, animals and fungi lost to science for at least 10 years. The lizard was first described in 2005 from a single museum specimen collected on Halmahera Island, Indonesia, in 1980, but hasn’t been seen since.

“It’s the first time we’re targeting a species and using the 3D scanner, so we don’t have to harm the animal at all,” says Trageser. “Re:wild don’t allow anybody to euthanise animals on their expeditions, but they get pushback on that – people want specimens for their museums. Re:wild are excited to incorporate this 3D system into their programmes, so people have the option to say, ‘We can’t collect it, but we can digitally collect this. We don’t get internal morphology with that, but we get additional external morphologies with that.’”

Trageser is confident the Zug’s monitor lizard is there. “We have some good information that it’s being sold in the pet trade,” he says. “It’s very rare. To be able to ban it from

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Above
‘Former hunters from the Mro tribe in Bangladesh’ by Scott Trageser

Right
‘Manduriacu glass frog (*Nymphargus manduriacu*)’ by Scott Trageser



being traded on eBay or other platforms, we need to know it’s there. If we discover it inhabits certain areas, we can use that information to bolster protections. The Indonesian government have plans to use Zug’s monitor lizard as a flagship species. The Halmahera rainforest isn’t well-known, but it has the Wallace’s giant bee that [natural history photographer] Clay Bolt rediscovered a few years ago, and with Zug’s monitor lizard too, they can say, ‘This is an important forest’ and that these animals are a reason to protect the forest from expanding nickel mines and things like that.”

Trageser believes there will be many other instances where his 3D scans could help to protect threatened species. “To be able to get people to see and experience the beauty that I experience out in the field is really important to me,” he says. “I think it will help weigh the scales in favour of trying to protect species that desperately need our attention but aren’t getting it. That’s my hope.”

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