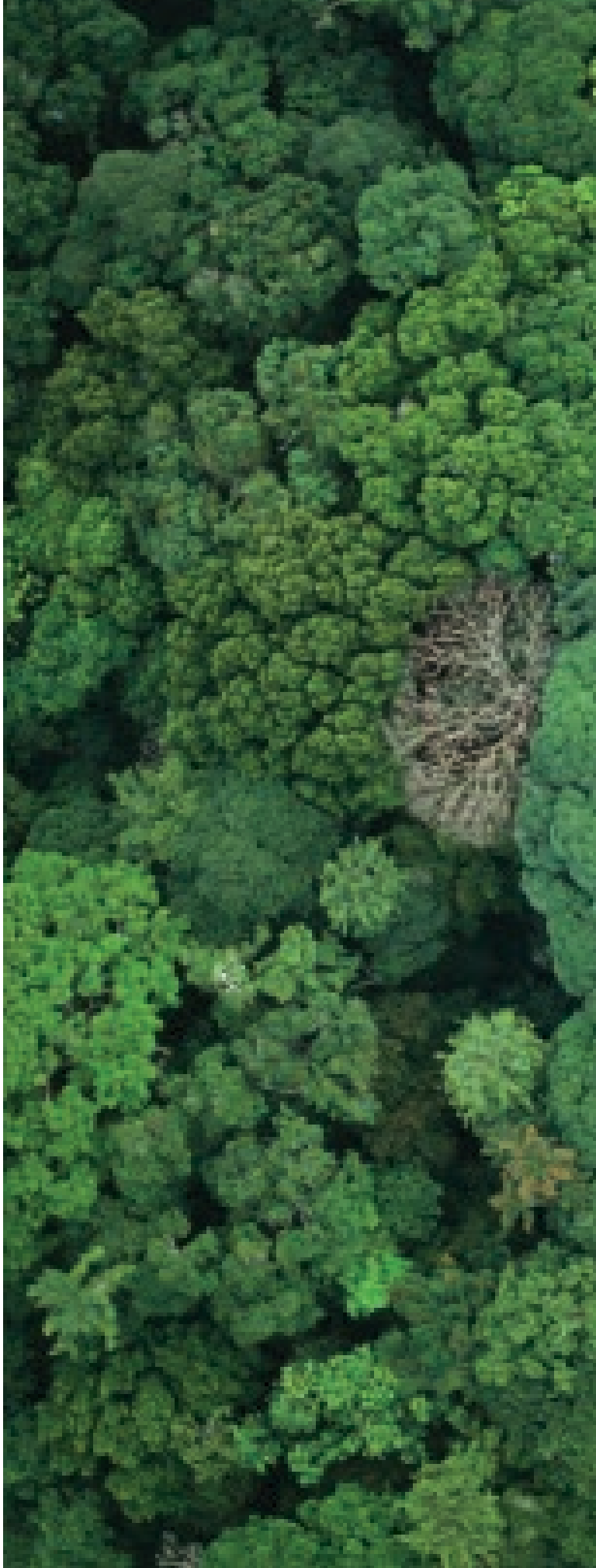
A new approach to conservation is turning the spotlight on overlooked habitats, finds **Steve Nadis**

Life on the edge



OCEAN VERT/GAMMA

Beyond the rainforest: life flourishes on the margins

EVERYONE'S heard of the Amazon, but can you name the world's second largest rainforest? It covers an area twice the size of France, contains 20 per cent of all known plant and animal species, and is the only place on Earth where you can find bonobos living in the wild. The Congo rainforest may be less familiar than its South American counterpart but it is no less endangered. Africa is particularly vulnerable to the effects of climate change, with its confluence of poverty, rapidly growing human populations and shortages of water and food. So you may be surprised to discover that this region of central Africa is at the cutting edge of conservation.

Three decades ago, ecologist Norman Myers argued that conservation efforts should focus on "biodiversity hotspots" – threatened areas such as rainforests that contain an exceptional richness of species. The idea has since been extended to recognise the value of rare, unusual species, too. But in central Africa, some conservationists have a radically different approach to identifying areas for preservation. They are looking beyond existing biodiversity, to the underlying processes that create and sustain it. And they are finding that evolution can ›

"Species that inhabit the periphery face different selection pressures. To survive, they must adapt"

DANA KLUCHINSKI

The Mbam Djerem park has what it takes to create novel species

Cauldron of biodiversity

The Congo rainforest is home to around a fifth of all plant and animal species, but you can see new ones in the making on its scrubby margins in the Mbam Djerem National Park

flourish in surprising places.

The first inkling of this came from a 1997 study of a small bird called the little greenbul that lives in and around the Congo rainforest. Thomas Smith, who now directs the Center for Tropical Research at the University of California, Los Angeles, and three colleagues examined a dozen populations of greenbuls – six from the central rainforest and six living in the transition zone between rainforest and savannah. This region, known as the ecotone, is up to 1000 kilometres wide in places and looks like a scrubby mixture of forest and grassland. The team found striking differences between the two groups. Ecotone birds sang at a different pitch than their rainforest counterparts, were heavier, had longer legs and wings, and deeper bills. Such changes could confer advantages such as making these birds better able to avoid aerial predators in a more open environment. They might also make the birds more likely to breed with one another than with the rainforest greenbuls.

Smith and his collaborators concluded that they were seeing the early stages of speciation. And the greenbul was not an isolated case. The researchers subsequently spotted similar changes in ecotone-dwelling populations of two other birds and a lizard in Cameroon – plus another lizard in Australia called the leaf-litter skink. The phenomenon has even been observed in primates. Katy Gonder of Drexel University in Philadelphia, has found that a subspecies of chimpanzee she discovered in the 1980s is divided into two genetically distinct groups, one occupying the forests of western Cameroon, the other living in the woodland/savannah ecotone of central

Cameroon. "It just speaks to the universality of this phenomenon," says Smith. "We're now seeing it in multiple taxa. As we add more species, we see the same patterns."

It makes perfect sense. Species that inhabit the periphery face different selection pressures, including different temperature and precipitation patterns. To survive, they must adapt. That's why ecotones are such hotbeds of evolution.

Despite the mounting evidence, these mixed habitats have failed to inspire mainstream conservationists. "It's human nature to protect things we can easily classify – such as pure forest and pure savannah – which means that transition areas are often overlooked," says Smith. "But we can show they are very important, and they will become more important still in the face of climate change."

He likens the situation to investing in the stock market: "You want to maximise the diversity of your stocks because you don't know what the future will bring," he says. In conservation terms ecotones are crucial because the species within them exhibit diverse forms. "The hope is that some of those will have a better chance of adjusting to a changing climate."

JOEL SARTORE/NATIONAL GEOGRAPHIC CREATIVE

Congo bird: ecotone greenbuls are evolving into a new species

Cutting-edge conservation

It's not easy to identify the best areas for conservation, though. We need to protect both ecotones and biodiversity hotspots, but as the climate changes their locations will shift. The best strategy, according to Smith, is to conserve areas that are big enough to buy us some time. In 2000, he pioneered this approach when he persuaded the World Bank to finance the Mbam Djerem National Park in Cameroon, which covers 400,000 hectares, encompassing the entire transition zone, along with dense forests in the south and savannah in the north (see map, left). Although not immune to illegal hunting, logging and grazing – all widespread problems throughout the continent – Smith considers the park a success. However, he admits that the decision to designate the area as a park as based on very limited information – mainly about a single bird species, the little greenbul. Now that knowledge gap is being filled.

In 2012, the US National Science Foundation (NSF) began funding a five-year, $5 million project in central Africa. The research team, headed by Smith, Gonder and Nicola Anthony of the University of New Orleans, includes scientists from Africa, the US and Europe. To identify hotspots of evolutionary change, they are mapping the distribution of representative organisms from nine different taxa, ranging from plants and insects to chimpanzees, and using genomic techniques to determine genetic variation among different populations of each species. The analysis also incorporates maps displaying the best available climate projections to assess how things might change in the future. And this data is being combined with information about human activities throughout the region, including mining, logging, agriculture and construction, to ensure that land designated for protection is not already destined for another fate, such as becoming an open-cast cobalt mine.

It's a cutting-edge approach with a practical aim: "The challenge is to translate our findings into concrete recommendations for conservation action," says Anthony. From the start, the researchers have been meeting with environmental ministers from Cameroon and Gabon, and with representatives of NGOs committed to land preservation. Recently, the Cameroonian government announced a plan to create 10 new protected areas within the next decade. At the same time, Gabon has initiated a nationwide assessment of land use. And, although funding for the NSF project ends in 2017, the researchers have already scheduled additional workshops and training programmes to run beyond that.

Smith is confident that this programme is more than a flash in the pan. "It will help bridge the gap between science and decision-making and really accelerate things here," he says. That could make all the difference as climate change really kicks in. "We don't have a lot of time," says Smith. ■

GREG HAROLD/AUSCAPE

Outside its comfort zone, the leaf-litter skink must adapt

Steve Nadis is a writer based in Cambridge, Massachusetts