What did Jurassic forests sound like?

Researchers spent years recreating calls and here's what they learnt. **Annie Roth** reports

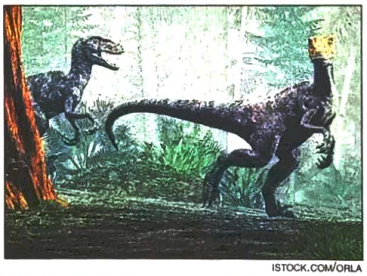
Chirps, trills and clicks — these were the sounds of Earth's forests 165 million years ago. Prehistoric insects, relatives of modern-day crickets and katydids, created sound by rubbing their wings together. By studying their fossilised wings as well as the bioacoustics of their living relatives, researchers were able to use computer modelling and machine learning to replicate their calls.

They say this cacophony is the best evidence-based approximation of a Jurassic soundscape ever created. The work was published in the journal *Proceedings of the National Academy of Sciences*.

For decades, palaeontologists have tried to figure out what dinosaurs sounded like. But the soft tissues responsible for producing the sounds, like lungs, throats and mouths, rarely fossilise. The insects living alongside these dinosaurs, however, present a better acoustic chance — scientists have unearthed dozens of fossilised insects from the Jurassic whose sound-producing wings were perfectly preserved.

Over a decade ago, Jun-Jie Gu, who is a professor of entomology at Sichuan Agricultural University in China, and his colleagues got their hands on 20 such specimens. Their bumper crop of fossils, which were found in Inner Mongolia, China, contained nine species of cricket and katydid ancestors, all of which had unique structures on their front wings.

Although these bygone insects are millions of years diverged from their modern relatives, they share many characteristics, including size and shape. Like their cricket and katydid relatives, they had comblike ridges on one wing and a scraping structure on the other. When rubbed together, the scraping structure catches the ridges, creating a series of rapid clicks that blend together to form a continuous chirp.



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To reconstruct the calls of these long-extinct insects, the researchers started by mapping how their living relatives make sounds. They used high-speed cameras and a technique known as laser Doppler vibrometry to measure the precise movements and vibrations of the insects' wings. Then they used this data to create and test a computer model that could predict how a wing's structure influences the sounds it makes.

Finally, the researchers plugged 2D models of the insect wings into their computer model, along with information about each species' relationship to the living insects whose movements and songs they had already studied. The result was a collection of nine distinct calls that straddles the line between familiar and otherworldly.

The insect chirps spanned the frequency spectrum, but one particular species — known as *Sigmaboilus peregrinus* — went beyond what humans can hear, producing a high-frequency ultrasonic call.

"The first time we reconstructed the song and saw it was over 20 kilohertz, we were so excited," Gu said. Scientists have long theorised that insects developed ultrasonic communication to evade their newly evolved adversaries — bats. However, bats did not make their debut on Earth until roughly 100 million years after the end of the Jurassic period.

Gu and his colleagues challenge the long-held view that bats were the primary drivers of ultrasonic communication in insects, arguing that insects in the Jurassic had ample reasons to evolve the ability. One reason, Gu proposed, is that these insects wanted to "have their own channels". If every insect in the forest sang their songs at the same frequency, all their messages would have gotten muffled.

Another explanation is that these insects evolved ultrasonic calls to avoid detection by early mammals and other predators.

"It's a very plausible hypothesis," said Rex Cocroft, a professor of biological sciences at the University of Missouri, US, who was not involved with the new study. "Predation is a major force in the evolution of communication."

Said Gu, "Before, all the sounds of the Jurassic came from films like *Jurassic Park*, but those sounds are not real. They come from artistes. This is the first reconstruction of the acoustic landscape of insects in ancient forests based on scientific methods and real fossil materials."

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