

Illinois will soon be cicada central when two broods converge on state in historic emergence

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When his youngest daughter was born early in the summer of 2004 in Washington, D.C., John Lill and his wife could hear cicadas singing from inside the hospital.

"That's how loud it was," he said. "So my daughter, who was just an infant at the time, didn't get to experience it. She missed it. She was just a baby. But 17 years later, her crazy parents had to drag her out, and she got to see all of it."

Lill's family history has been marked by these noisy insects. His wife was born in a year of a big cicada emergence, so she is a "cicada baby," too. A biology professor at George Washington University, Lill has dedicated decades of research to these creatures, sharing his fascination both at work and at home. In a few months, he plans to visit Illinois to experience and study a historical cicada event that is only happening here.

This summer, millions of periodical cicadas will emerge simultaneously across the United States. They belong to Brood XIX, four species that appear every 13 years in the Southeast, and Brood XIII, three species that appear every 17 years in northern Illinois.

"The confluence of space and time is happening in the state of Illinois in particular," Lill said. "Any single spot in the entire state will have cicadas, as far as I can tell from the maps ... (in) the suburbs and the cities, any place there's trees."

It will be the first time in 221 years that these two specific broods come above ground at the same time and in such proximity. The last time this happened was in 1803 when Thomas Jefferson was president, and Illinois had yet to become a state. The broods will not necessarily overlap but emerge adjacent to each other in the Springfield and Urbana-Champaign metropolitan areas.

Periodical cicadas exist in only two other countries: One species emerges in the islands of Fiji every eight years, and another one—the "World Cup cicada"—emerges every four years in northeast India, coinciding with the international soccer tournament.

In the United States, there are 15 broods of periodical cicadas, each of which dig their way out from underground on different 13-year or 17-year cycles. Other broods have emerged at the same time in the past decade but not in the same place. Experts consider this year unusual because two broods are co-emerging in neighboring areas in Illinois for the first time in more than two centuries.

"This contact area will see all seven species at once," said Martha Weiss, a professor of biology at Georgetown University who researches cicadas with Lill. "So [evolutionary biologists](#) are going to be very interested to be at this zone of contact because that happens very rarely."

Despite their clockwork cycles, an added unknown for this year's double emergence is exactly when it will occur. Generally, cicadas come out in Illinois in late May or early June, but the unusually warm winter could push those dates forward.

In the meantime, cicada lovers and experts like Lill and Weiss are trying to broaden interest from the general public, starting with children. Though the insects may look scary and have a bad rap as invaders, they have been around—mostly underground—for millions of years.

"We want more than coexistence," Weiss said. "We want appreciation, admiration for the cicadas. They don't hurt you. They can't bite you. They can't sting you. They're not poisonous, and they are just making use of the space that they've been living in. ... We'd like people to feel lucky to live in a place where periodical cicadas come up because this is such a cool and rare life history."

Long development time

Not only are periodical cicadas harmless—they are also vulnerable as prey. Experts believe they have evolved to emerge at the same time and overwhelm possible predators with their sheer numbers, thus ensuring their survival.

"They hardly have any behavioral traits that protect them from being eaten," Lill said. "So they're pretty defenseless, and they're quite nutritious and pretty much sitting ducks for anything that wants to eat them, including us, if you're so inclined."

These insects spend most of their lives—over 90%—hidden underground. Each cicada has a small mouthpart shaped like a needle, which it inserts into the root of a tree to drink and feed from its sap for over a decade.

"But they're there the whole time," Weiss said. "And every single cicada is down there by itself, in a little mud cell with its little beak stuck into a root."

While cicadas might be spotted above ground every summer, some are annual cicadas, which hunker down in the soil for only about two years. Because their population is not synchronized, some mature annual cicadas will emerge every year.

Periodical cicadas have a different emergence cycle and one of the longest development times of all insects, according to Lill. They grow underground until they are ready to come out to mate and breed. Sometimes, a few individuals known as stragglers may emerge a few years before if they reach maturity early.

As they prepare to emerge, cicadas begin making tunnels toward the

surface. To the human eye, small holes about the diameter of a nickel will start appearing near trees under which cicadas have lived. Sometimes these holes will have a little turret, like miniature sandcastles.

Weiss said those who are curious can head out with a flashlight once they notice these little holes in the ground and might be able to spot the insects weeks before they come out.

"If you catch them at the right time," she said, "you'll see a little cicada with red eyes, kind of peeking up from the side of the tunnel."

Because they survive off nutrients from tree roots, cicadas don't emerge in lawns, agricultural land or anywhere where trees might have died or been cut down. Once the soil rises to a certain temperature after the spring, periodical cicadas use it as a cue.

"They come out at night. So it's very much a nocturnal event, which really makes it even all the more exciting," Lill said. "(They) crawl out and then climb up a tree or a bicycle or your pant leg—whatever vertical surface. They're not picky."

They then begin a laborious process. The cicada's shrimplike shell cracks open, and a ghostly white creature with red eyes leans back into a "diving board pose," Weiss said.

"This is the most dramatic part," she said. "John (Lill) and I were both here 17 years ago with little kids, and having the kids watch this transformation was magical for them and magical for us."

After a few minutes, the cicada does "a mighty situp" and spreads its wings. A few days later it'll look like an entirely different creature, dark-colored and hardened instead of white and soft.

That's when the main attraction begins. Male cicadas perch on tree branches to sing—well, the sound is rather more like the vibration of a drum. Each species has a distinctive call, and the racket the males make attracts female cicadas from their own species.

So even if periodical cicadas from different broods emerge at the same time in approximate locations, they have evolved in such a way that their song pitches are distinct—not to the human ear but certainly to other cicadas—to prevent interbreeding and hybridization.

After a short dance and successful mating, the female cicada will lay her eggs inside the tree branches. This whole process takes about three to four weeks.

"Then there's big piles of dead, stinky cicadas on the ground for a long time. And then everybody forgets about it," Weiss said.

Six weeks later, the eggs will hatch. Tiny nymphs, or young cicadas, will float down like snowflakes and burrow underground, where they will stay for the next 13 or 17 years depending on the cycle of their brood.

"How do they tell time? These little tiny things go into the ground, and how do they know without their watches, without their iPhones, without their calendars?" Weiss observed. "Everybody is by themselves, it's not like they're going to meet at the coffee machine or the water cooler to chat about how your summer vacation was up there."

Biologists believe cicadas keep track of the years as they feed from a tree's sap, sensing patterns from the seasonal flow of water through the tree, Weiss said; the insects probably have a molecular mechanism that allows them to follow this passage of time.

Effects of climate change

Periodical cicadas will stay underground until the soil 8 inches deep reaches a temperature of 64 degrees. In Illinois, that typically occurs around the last week of May or the first week of June.

But climate change may throw a wrench in the plans of scientists and enthusiasts hoping to visit Illinois to study and view two cicada broods at the same time. After a warm winter, the soil might reach the necessary temperature earlier.

"We're kind of anxious because we're planning our trip to Chicago based on our best guess on when the cicadas are going to be emerging," Lill said. "And the kind of winter and spring that you guys are having there is making us ... nervous because we kind of thought we'd know when to come, but now we're not really sure."

Extremely cold winter and spring seasons in the past have pushed some cicada emergences to happen a few weeks later, Lill said. But it has rarely happened significantly earlier in a given year.

"That's one of the predictions of climate change," he said. "If (emergence) really is guided totally by soil temperature, and it's been a crazy warm spring, we'll see what's going to happen."

Some periodical cicadas, however, have emerged four years before or after their brood was supposed to, according to Chris Simon, professor of ecology and evolutionary biology at the University of Connecticut, who alongside a colleague maintains cicadas.uconn.edu, a website with data on periodical cicadas.

"With climate change, we're seeing more and more of them come out four years early," she said. "That happened in the Chicago area four years ago."

Because periodical cicada species have existed for millions of years, they have undergone and survived substantial periods of climate change in glacial cycles. But they have still been affected by past changes in climate patterns and will likely be affected by current and future [climate change](#) events.

If cues like soil temperature are disrupted by changes in climate, it might lead to more unexpected cicada emergences. Periodical cicadas might also experience permanent life cycle switches: For example, 13-year broods might come out four years earlier and become nine-year broods, or 17-year broods might come out four years later and become 21-year broods.

Permanent changes in life cycles can make these insects more vulnerable to predators.

Because of their vulnerability to climate, [periodical cicadas](#) can be considered an indicator species, Simon said. This means that, like a canary in a coal mine, they can signal environmental dangers.

Erasing misconceptions

Many experts are enthralled by cicadas and eager to erase popular misconceptions about the insects.

"There's often a lot of language that makes people scared of them or view them as some alien invader, enemy kind of thing," Weiss said. "First of all, they're totally harmless. They couldn't bite you if they wanted to. They can't sting. They're not spiny, they're not poisonous."

Hundreds of years ago, when early colonists in the United States encountered cicadas they confused them with locusts—grasshoppers that migrate in swarms and can be devastating to crops. The Bible and Quran

mention ancient locust plagues that caused famine and human displacement across the Mediterranean and North Africa.

"There was a misconception that the cicadas were actually eating agricultural crops and commodities, and that couldn't be further from the truth," Lill said. "(There's) no danger to Illinois soybean fields and no danger to your pansies and your marigolds and whatever you're planting in your garden."

He said small saplings might be somewhat vulnerable to cicadas laying eggs in their branches, but that can be avoided by covering the plant with netting for a couple of weeks.

"You probably could wrap trees effectively," Weiss said. "I think that it's not necessarily time or money well spent. (Cicadas) have been around for millions of years and we still have trees."

"There's a lot of people that want to make money off of fear," Lill said. "They're trying to sell pesticides, and the worst thing you could do is spray a bunch of chemicals on your yard because you're scared of cicadas. You're doing way more harm than good, and you're not going to really affect the cicadas, to be totally honest."

"Instead, we just encourage you to embrace (them), bring your kids out at night and watch this amazing phenomenon and get them excited," Lill continued. "And they will remember it for the rest of their lives."

Weiss said her daughter and her friends, who were 7 years old during the 2004 cicada emergence in D.C., still remember staying up until late at night to watch cicadas crawl up trees.

"When they see me, they say 'You made me eat chocolate-covered cicadas!'" she said. "They're 26 now. ... They say, 'Remember when the

cicadas came out and we got to go watch them crawl up?"

Now that their children are grown up, Lill and Weiss are hoping to keep working with educators and younger generations to show how these insects are cool and exciting rather than scary.

"We felt like it was almost entomological malpractice not to put together an education campaign," Weiss said.

The researchers have worked alongside Lill's wife to create a set of digital learning materials, available on their website at friendtocicadas.org, which includes lectures and workbooks about cicadas through the lenses of biology, history, music and art. It will soon be updated with information on Brood XIII and Brood XIX.

"The other thing that is important to recognize is that they are always here," Weiss said. "We've come in and ended up in their habitat ... They've been here the whole time, they're underground, they come up and say hello for a few weeks every 17 years, then they go back."

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