



**SCIENTIFIC
AMERICAN**

SUBSCRIBE

CONSERVATION

A Beautiful Insect That Buries Dead Bodies Is In the Middle of a Conservation Battle

Oil companies want the American burying beetle to be the first recovered insect taken off the U.S. endangered species list. But scientists say comeback claims are wildly exaggerated

By Hannah Nordhaus | Scientific American December 2017 Issue



Credit: Joel Sartore Getty Images

IN BRIEF

- **On the federal endangered species list** since 1989, the American burying beetle needs small animal carcasses to live.
 - **Beetle habitat** overlaps with oil and gas industry operations, and the industry wants the insect off the protected list.
 - **Arguments turn on whether** the beetle's current population is robust enough to survive in a habitat that includes more pipelines, drilling rigs and roads.
-

The beetle ranch is lovely: slate tile, a Viking range, knotty oak paneling and a wood stove with a preening taxidermy turkey on the wall above it. The porch is lined with rocking chairs that face out to a massive walnut tree and, beyond it, the pastures and thickets of southern Oklahoma's Lower Canadian Hills. Clover fields glow in the afternoon sun. A phoebe hollers from her nest; a scissortail flits between fence and field.

People working at the ranch carry all sorts of weapons. Amy Smith, a biologist who conducts research here, keeps a .38 handgun strapped to her waist. Preston Smith, an owner of the property (and no relation to Amy Smith), is a six-and-a-half-foot-tall Texan who wears a beautiful silver-and-black combination .45 and .410 revolver engraved with his name. Grace McNichols, an undergraduate research assistant at John Brown University in Arkansas, where Amy Smith teaches, carries a bowie knife. The ranch beyond the house covers 4,000 acres of beautiful but wild country, and the group totes weapons to protect themselves from rattlesnakes and feral hogs. "You packing?" Amy Smith asks her team. They pat their weapons and head out.

The nearby forest is fading to black as the researchers jump into a mud-spattered

Kawasaki Mule all-terrain vehicle loaded with coolers, plastic tubs and shovels. Smith takes the wheel and blasts through two fearsome puddles, then jostles up a ridge through scrub and woodland to a meadow speckled with coreopsis and Indian paintbrush. The women haul two buckets and a cooler to a spot underneath an elm tree. It's breezy this evening, with a faint whiff of death.

ADVERTISEMENT

The smell comes from the cooler, from which McNichols now pulls three dead animals—a small bunny, a large rat and a standard-sized quail—all decomposing. The women set down a wide plastic tub with the bottom cut out, weigh the animals and lay them against the edges of the plastic. In between the dead animals, Smith places a petri dish containing two stunning inch-and-a-half-long insects. They are American burying beetles (*Nicrophorus americanus* or ABB for short): black-and-orange-Rorschach-blotted creatures, with two orange puffballs at the tips of their antennae that recall, from a certain angle, handlebar mustaches. The beetles feed and breed on rotting carcasses, and this particular experiment is aimed at understanding what type of dead creatures the beetles prefer.

The beetles are on the federal Endangered Species Act list. A century ago they could be found across much of the U.S., but by 1989 their known population had dwindled to two spots: eastern Oklahoma and a small island off the coast of Rhode Island. The ranch—

officially, the American Burying Beetle Conservation Bank—represents an effort to stem that decline. Oil and gas producers, transportation agencies and others can drill or build in beetle habitat in Oklahoma, but in a trade-off, they are required to give money to conservation banks to create a beetle haven elsewhere. Amy Smith's job is to help make the ranch the best place a beetle could possibly live.

If all goes according to plan with Smith's experiment, the beetles will, by morning, have selected a carcass, buried it and mated. But arthropod activities don't always go according to human plans. Sometimes the beetles reject the carcasses and refuse to mate. “So,” Smith says, “I sing a little Barry White for them.” She hopes they will feel love coming on.

Not everyone, however, is so enamored of the insect. In Oklahoma, where beetle habitat overlaps the oil and gas fields that power the state's economy, congressional representatives, along with fossil-fuel industry groups, have targeted the beetle for removal from the list of federally protected species. “The listing of the American burying beetle unnecessarily places burdensome land-use restrictions to build roads, water resources, and energy infrastructure in many of our communities,” Senator James Lankford of Oklahoma said in a statement earlier this year. He and others argue that current beetle populations are stable and not under threat. In March of last year, responding to a petition by a group of fossil-fuel and property-rights advocates, the U.S. Fish and Wildlife Service (FWS) agreed to review the beetle's status on the federal list. The agency is expected to issue a preliminary ruling this month, and many people believe it is poised to say that the beetles are back.

Conservation scientists do not agree, however. “We have found more beetles because we’ve been looking harder,” Smith says. “But they’re still in less than 10 percent of their historical range.” She and other beetle experts fear that more disruptions to habitat will trigger new population declines. The dispute highlights the murky science around species recovery and its intersection with politics and policy. The pressure to delist the beetle reflects a disquieting trend in which political considerations may be every bit as important as actual data in determining a threatened species’ fate. “There is much more behind all this,” says Andy Middick, a consultant who tracks beetles for energy companies, “than the survival of a species.”



ADVERTISEMENT

MEET THE BEETLES

.....

The American burying beetle is one of the biggest and brightest insects in North America, but most Americans will never see one—and not just because it is endangered. The beetle spends much of its life underground, and the aboveground part takes place at night, in proximity to dead things. Even scientists who have devoted their careers to the species—there are a handful who stumbled into the field while studying something else—don't know a whole lot about the beetle. They know, thanks to extensive museum collections, that the insects were once found in 35 states and three Canadian provinces and that sometime around the 1920s their populations began a steep decline.

They also know that the beetles are habitat generalists—they can be found in forests, wetlands and grasslands but require a moist environment to survive. The animals are mobile, traveling a mile each night, on average. The beetles aren't especially picky about what type or size of remains they eat—mammals, birds and snakes are all fair game—but for breeding purposes, the dead animal's weight must fall between about four and 10 ounces. If the carcass is too big, the insects can't move or process it; if it's too small, it won't feed enough of the beetles' offspring. When beetles find a suitable carcass, they flip over, using their legs as a conveyor belt to shuffle the creature to a spot where the soil is right. They like loose, loamy, silty soil “that's easy to dig in,” Smith says. Like backhoes,

the beetles excavate the soil from under the critter and then, when it is fully buried, strip it of fur or feather and use an oral-anal secretion to transform the carcass into an orb of slime—a carrion meatball, if you will. Then the beetles mate. The female lays an average of 15 eggs. When the larvae hatch, male and female alike feed the young from the buried cache, much as birds nourish their chicks, mouthful by rotted, regurgitated mouthful. After an additional 45 to 60 days, the grown insects emerge from the ground and begin searching for their own moldering meals.



On the Hunt: Outside Stuart, Okla., biology consultant Andy Middick (*brown shirt*) checks an American burying beetle trap (1). A burying beetle crawls across animal fur (2). Middick photographs and measures a beetle during a population survey (3). Credit: Matt Barnard *Tulsa World* (1 and 3); Mark Moffett *Getty Images* (2)

There are still glaring gaps in our knowledge, though. Scientists and regulators do not, for instance, have any idea how many beetles there actually are in North America. Surveys of small locations do not shed much light on wider beetle populations. With other species, ecologists use a variety of assumptions to extrapolate total populations from trapped specimens, “but this beetle violates a lot of those assumptions because it’s so mobile,” Smith says. “If I extrapolated, it would just be a crapshoot.”

Populations also vary dramatically from year to year—Smith has found dozens of beetles in a spot one year and none the next. No one knows why. In 2007 husband-and-wife biologists Dan Howard and Carrie Hall discovered a population at the Tallgrass Prairie Preserve in northern Oklahoma, a 40,000-acre Nature Conservancy property. Earlier surveys had not turned up any beetles on the preserve; Howard and Hall believe that populations there are highly cyclical—teams will find thousands one summer and just a handful the next. “Life is hanging on the edge here,” says Howard, now at the University of New Hampshire. In the years since the listing, scientists have also found beetles in Kansas,

Nebraska, South Dakota, Arkansas and Texas.

“We are still trying to figure out basic life history information,” says J. Curtis Creighton, a biologist at Purdue University Northwest. They suspect the beetles live for about a year in the wild, but they aren't certain. “How often can they reproduce?” Creighton asks. No one knows. “What kind of carcasses can they subsist on?” That is the question behind Smith's rat-bunny-quail research and a higher-tech study Creighton has designed with Smith's help to analyze stable isotopes in beetle exoskeletons to see what they have consumed as larvae.



ADVERTISEMENT

The biggest unknown is why the beetles began disappearing in the first place. There are theories. After the beetle was first listed as endangered, Rhode Island Division of Fish and Wildlife biologist Christopher Raithel began wondering how the animals stuck it out on Block Island, the spot off the Rhode Island shore that is the only place east of the Mississippi where the beetles are still found. “I started asking, ‘What does Block Island have more of than anywhere on the mainland?’” What it had, Raithel concluded, was carcasses—ring-necked pheasants, introduced from Asia to North America in the 19th century and still plentiful on the island. On the mainland, right-sized carrion species had declined because of hunting, habitat fragmentation, and competition from raccoons and other carrion feeders that prosper on the edges of human habitation. One theory ties the

beetle's decline to the extinction of the passenger pigeon, which once blanketed the eastern half of the U.S. in massive, sky-darkening flocks of billions of birds. On Block Island, pheasants appeared to fill that hole in the food chain.

There were no comparable populations of pheasants in Oklahoma, but Raithel and other beetle specialists believe that the two environments do have some things in common. Like Block Island, Oklahoma is relatively dark: outdoor lights appear to disorient American burying beetles more than other species of nocturnal burying beetles, and electrification may have been a factor in their decline. And neither place has extensive agriculture—the beetles are not found among row crops. But as with many ecological puzzles, there is likely not one smoking gun to explain the beetles' decline. “Ultimately,” Creighton says, “it comes down to the fact that we’ve altered their habitat.”

RANGE ROVERS

.....

Academic scientists are not the only people interested in the American burying beetle's habitat. Federal regulators in Oklahoma will not issue permits for oil and gas wells, wind farms, roads, pipelines and transmission lines in potential beetle habitat unless those locations have been surveyed for the beetles. To do so, permittees hire consultants such as Middick, a large man with a large beard and a large, mud-specked white truck that stinks of decay. His firm is called Beacon Environmental Assistance. All throughout beetle season, roughly May through October, Middick keeps the bed of his truck loaded with coolers of decomposing chicken gizzards and hearts and a “secret proprietary concoction” of “rotten juice”—putrid gizzards soaked in water. “My neighbors love me,” he jokes.

Middick places his “gizzard gravy” in a pitfall trap, which consists of a five-gallon bucket staked down and then covered with a piece of wood with a hole in the top. The beetles, attracted by the carrion smell, fall through the hole and can't fly out. He sets 250 to 300 beetle traps a year on behalf of oil and gas and other clients seeking permits to disturb potential beetle habitat, putting about 30,000 miles on his truck during the summer. He goes anywhere a beetle might live and a driller might drill. As Middick steers his truck north out of Tulsa, the subdivisions and scrubby hill country give way to rolling tallgrass prairie—country utterly different from the buggy, muggy, densely vegetated forest farther south near the beetle bank. Beetles live here, too. What the two landscapes have in common, he says, are large, undeveloped tracts of land.

Where Beetles Roam

The American burying beetle once ranged over the entire eastern U.S. Today natural populations are confined to three regions. One encompasses eastern Oklahoma and touches bordering states, although in Texas, the insects have not been seen for years. Another is centered on Nebraska and South Dakota. The third is on Block Island, off the Rhode Island coast. Reintroduction attempts in Ohio and Massachusetts have failed to produce self-sustaining populations; Missouri is home to a small reintroduced group.

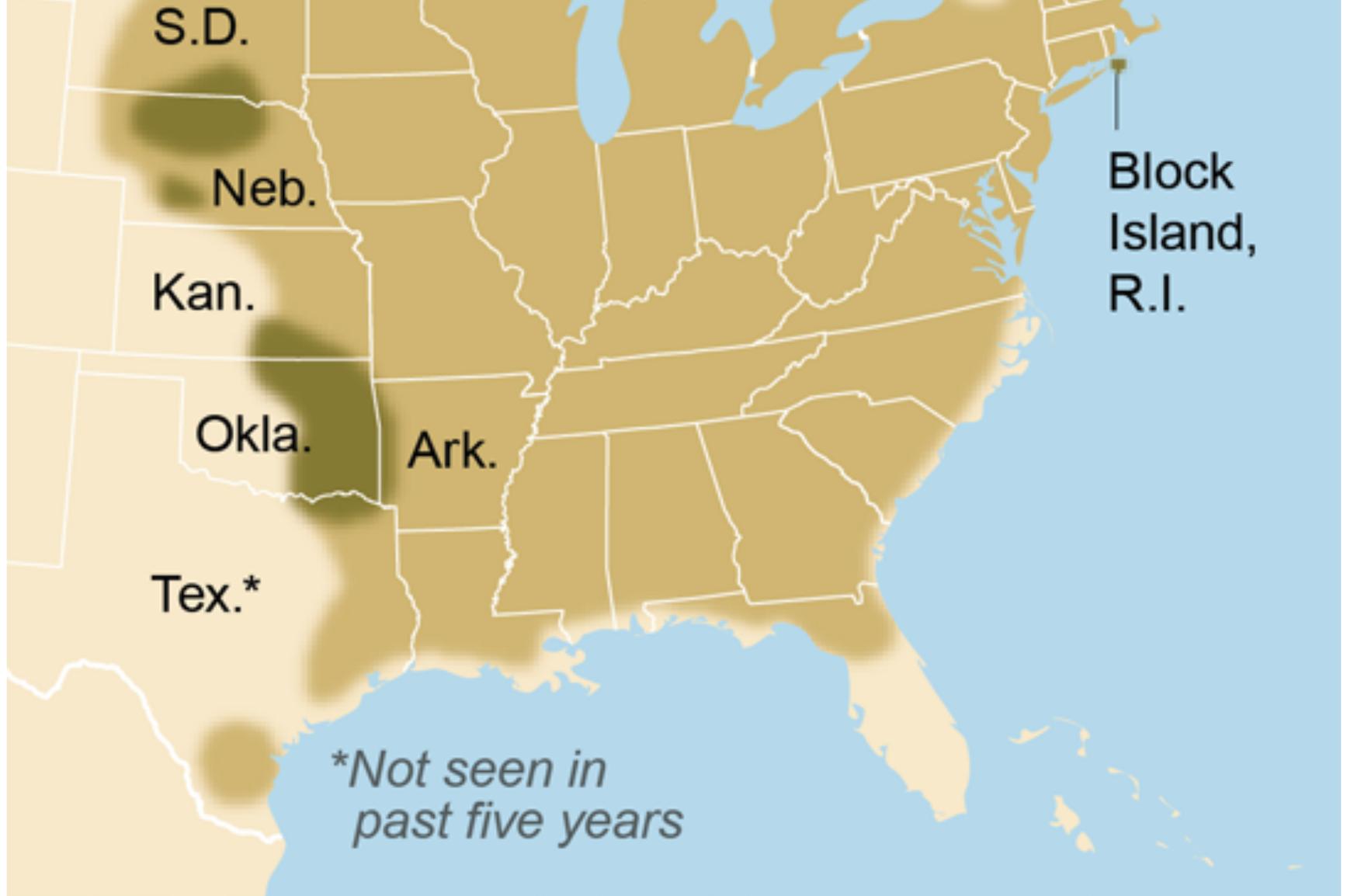


Historical distribution



Current natural distribution





Credit: Dolly Holmes; Sources: *COSEWIC Assessment and Status Report on the American Burying Beetle Nicrophorus Americanus in Canada*. Committee on the Status of Endangered Wildlife in Canada, 2011; Wyatt Hoback *Oklahoma State University (consultant)*

Those tracts aren't, however, as undeveloped as they used to be. Middick turns off a paved country road onto a smaller dirt one. It's an area he's surveyed often, a rural spot gone industrial—a tangle of derricks, frack tanks, drilling pads, flow lines, pipelines and rigs. A string of saltwater trucks hauling produced water from wells clatters past on the narrow road, coating Middick's truck in a layer of road dust, fine as baby powder. Oil country, Middick says, is also methamphetamine country, where a big man with a big beard hauling five-gallon buckets through the underbrush—the same type of bucket some people use to mix meth—has to be careful. He likes to place his traps in ditches on the sides of county roads hidden from nearby properties. “There are lots of guys kind of eyeballing me,” Middick says. “People are always out there stealing stuff, and they get pretty protective.” For insurance reasons, his clients prohibit him from carrying a gun. “But,” Middick says, “don't look in my backpack.”

ADVERTISEMENT

In his searches, Middick follows very specific instructions set out by the Fish and Wildlife Service. To ascertain whether beetles are present on any given property, he must lay traps on a minimum of five consecutive nights of good weather, at a maximum of one mile apart. There is nothing systematic about where he looks for them, however: “I go where the oil goes,” Middick says. If a pipeline or a drilling area expands to the west, his surveys expand to the west. If beetles are found, the known beetle range expands as well. Much of what we know about the beetle's range has come from surveys like Middick's, but the data, he says, “are very random.”

If Middick does find beetles, his clients have three choices: they can relocate their projects to beetle-free territory; they can buy their own beetle habitat to replace what they disturb; or they can pay one of Oklahoma's two conservation banks to do it for them. Both banks opened for business in 2014, and each protects around 4,000 acres. The money that permittees pay into the banks goes both to the acquisition of new beetle habitat and to long-term stewardship and maintenance of the property. Preston Smith says this kind of real estate speculation makes nobody rich. “I wouldn't put it up as a real highly competitive investment,” he says. “But the intangible side of this is rewarding as well.” Smith likes hunting on the property; he likes protecting beetles.

The beetles do seem to be prospering at the ranch. The land's previous owner had used it for

hunting. “He had some food plots in place, ponds, forested areas—he basically had accidentally managed for American burying beetles,” Amy Smith says. The conservation bank has improved on that happy accident, using prescribed fire to knock back invasive plants and open the tree canopy and reseeding native grasses. “It’s a little too soon to tell,” she says, “but the numbers are good.” Each year Smith has captured more beetles than she did the year before.

GROWING CONFLICT

The numbers aren't as good, however, for people paying into the banks. The credits are expensive—between \$8,000 and \$15,000 for every acre of beetle habitat disturbed, depending on location, timing, number of credits and duration of the disturbance. Small operators can sink a modest vertical well for less than \$100,000 in areas with the right geology. “When mitigation credits hit, and they’re \$60,000, that’s a big cost,” Middick says. Transportation projects, too, have encountered insurmountable beetle obstacles. One Oklahoma county had to scrap a planned road because the cost of mitigation exceeded its budget. The result has been a steady drumbeat of news articles about beetle frustrations. “It gets very nasty at times,” Middick says. “Most people don't understand why a beetle matters.”

It is those costs and conflicts that led to the push to remove the beetle from the endangered species list. “There are a lot of problems with regulating a species that's essentially invisible,” Raithel says. In the years since mitigation credits were introduced, local FWS officials have found themselves under enormous political pressure. In 2014 a U.S. Department of the Interior review found that senior officials in the FWS's Tulsa office used flawed models and misleading maps and downplayed the impacts of the pending Keystone XL pipeline on the ABB, then retaliated against scientists who objected. In 2015 Oklahoma's two Republican senators, Lankford and James Inhofe, attempted to attach a provision delisting the beetle to the National Defense Authorization Act. The measure did not pass, but Lankford did not give up. He directed the Government Accountability Office to investigate whether beetle mitigation funds were being misused. The final report, issued in January 2017, found no major malfeasance but recommended better monitoring.



ADVERTISEMENT

In August 2015 American Stewards of Liberty, a property-rights organization, filed its petition to delist the beetle, arguing that the historical range of the ABB was based on unreliable anecdotes and that existing populations were healthy. The petition was followed, a year later, by the FWS agreement to review beetle status. “Today we know that the species is residing in a lot of states, a lot of counties, more than 100-fold beyond when the species was listed,” says Margaret Byfield, executive director of American Stewards of Liberty. “It’s in more places than we knew.”

But the review appears to have only raised more questions about what and how we count when attempting to save a species that gets in our way. The delisting petition, for instance, included in the beetle’s current range not only those locations where the insect has been found since the initial listing but also three states where zoos and wildlife agencies have attempted to reintroduce it—Massachusetts, Ohio and Missouri. But the Massachusetts and Ohio populations have not done well. Scientists have seen more encouraging results in southern Missouri, where the Saint Louis Zoo began reintroduction efforts in 2012. But it is still far too early to call the effort a success. “The goal is to be able to walk away from it and say, ‘Here is a self-sustaining population,’” says the zoo’s Bob Merz, who heads the Missouri reintroduction effort. “We may find parameters that make reintroduction work, but at this point, it’s many years away.”

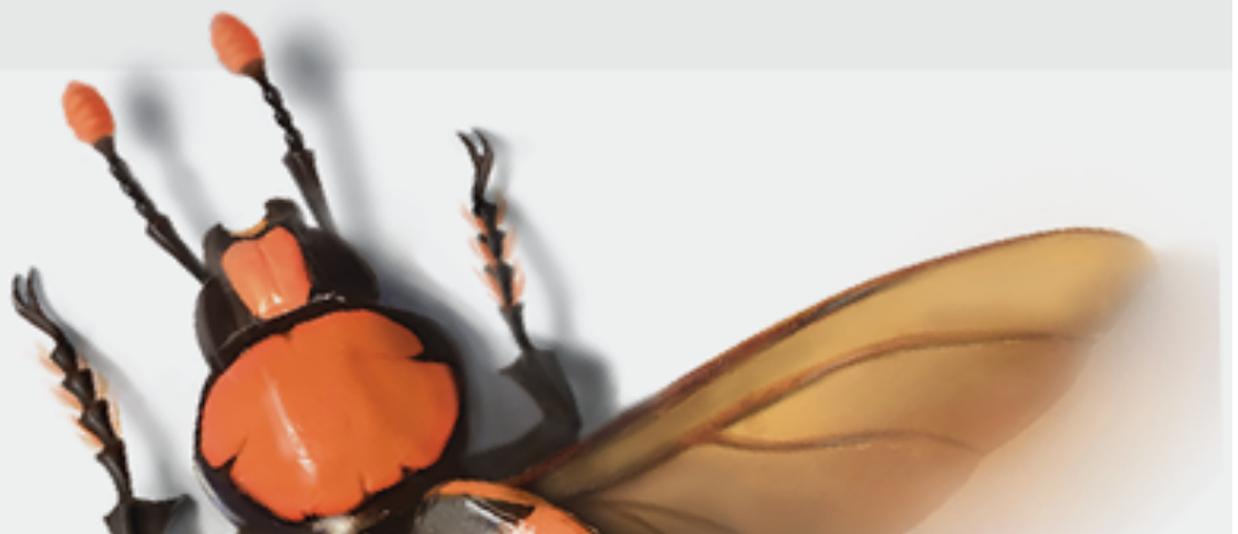
Are the beetles still endangered? It is true that they are found in more states now. But they are still gone from most of the places they once frequented. “I thought if we looked, we’d find them in other places,” Creighton says. “But we haven't.” Even with the new discoveries, the beetle is still missing from 90 percent of its historical range. “And in the few populations that we know of,” Creighton says, “at least two have disappeared.” One was in Texas, where the beetle has not been seen in about five years, and the other was in the Ouachita National Forest in Oklahoma, where a logging land swap knocked out what had been a robust population. “The data,” Creighton says, “are certainly consistent with a species that is in danger of disappearing.”

A Life in the Midst of Death

.....

The remains of small animals are essential for American burying beetle feeding and reproduction. Carcasses that range in size from prairie dogs to pigeons are ideal. The insects bury and preserve the dead bodies, mate on them and then tear off tiny bits of meat to feed their growing larvae.

*Nicrophorus
americanus*





- 1** After finding, transporting and burying a suitable carcass, the beetles clean the body of fur or feathers.





- 2** The beetles then coat the carcass with a mix of anal and oral secretions that preserves the meat and masks the smell from potential competitors.



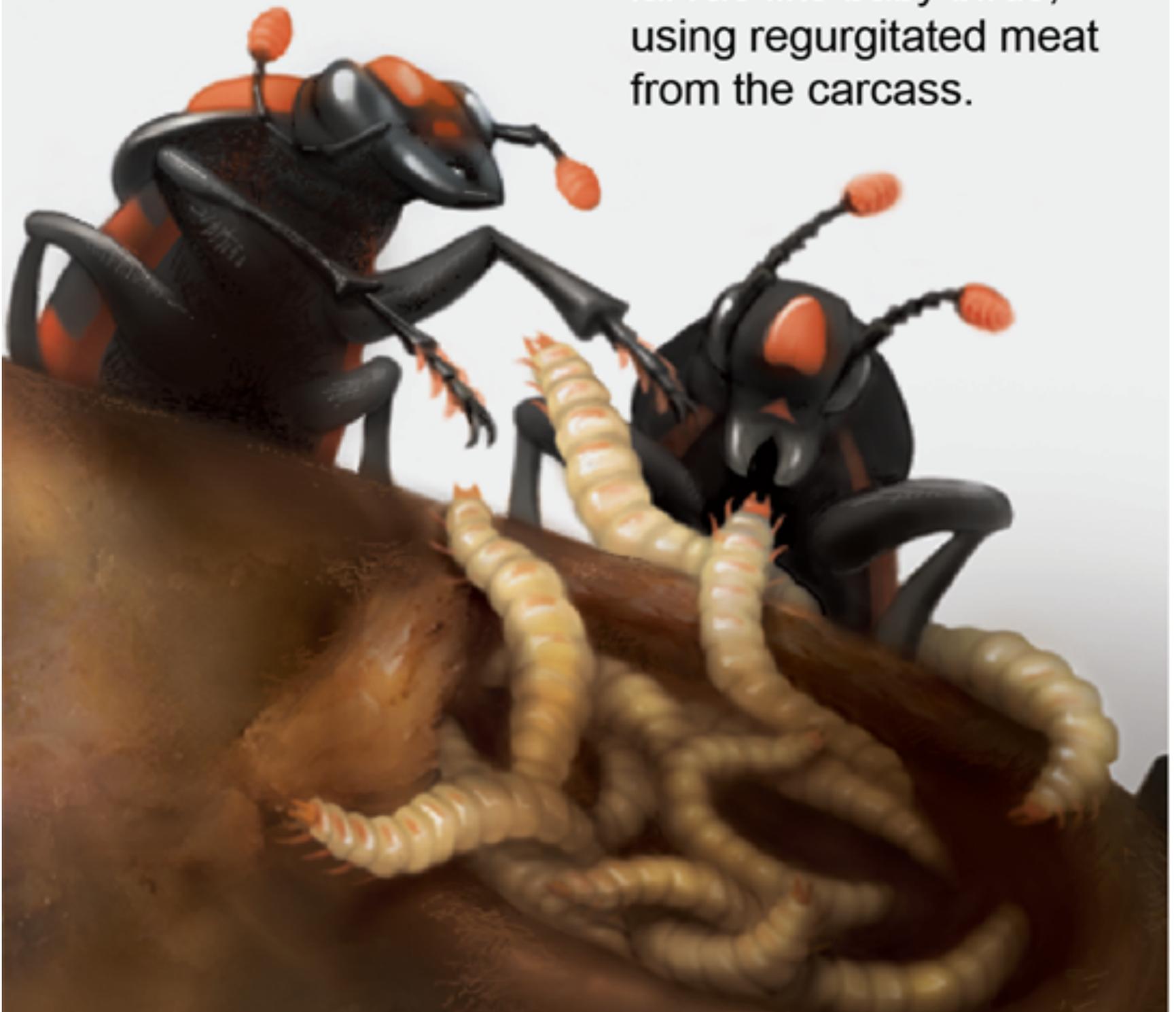


- 3** Underground, beetles mate on the carcass. The female lays eggs in a nearby tunnel. Larvae hatch within four days.





- 4** Both parents feed their larvae like baby birds, using regurgitated meat from the carcass.



- 5 Once the meat is consumed, the parents return to the surface while the larvae continue to mature in the soil. About two months later the young emerge in search of carcasses and mates of their own.





Credit: Kelly Murphy; Source: Wyatt Hoback Oklahoma State University (*consultant*)

The data grew even more convoluted this past summer, when the Fish and Wildlife Service circulated a draft Species Status Assessment for scientific review. The results surprised everyone. The assessment used geographical models to determine that current habitat, in terms of total beetle-friendly acres, is sufficient to support the beetle and that roads, pipelines and fossil-fuel projects that crisscross and disturb that habitat are minor impediments to the insect's survival. Beetle scientists question that logic, however. “I’m not convinced that such projects are really ‘minor’ when beetles need a large, unimpeded area,” says Oklahoma State University entomologist Wyatt Hoback. Beetles, he notes, rely on other creatures to breed, and those animals “also rely on unbroken areas.”

The report then went a step further. It used climate models to determine that the beetle was likely, over the next 80 years, to go extinct throughout the entire southern part of its range: Oklahoma, Arkansas and Texas. “It seems that when temperatures are high”—around 75 degrees Fahrenheit at midnight—“the beetles are not active or can't reproduce,” Hoback says. These observations are anecdotal, however; there has not yet been any research, peer-reviewed or otherwise, to prove them. “Historically,” he notes, “ABBs occurred down through southern Texas and Florida, so there is some debate.”

Tossing climate change into the equation bothers both fossil-fuel and beetle advocates. Oil and gas groups worry that regulators plan to use the climate change hypothesis to maintain federal protections for the beetle when other factors suggest it should be delisted. Beetle devotees, meanwhile, fear that the FWS will use the climate models to delist the species in the parts of its range where, conveniently, nobody wants it, rendering both the beetles and the Oklahoma conservation banks obsolete. “What's scary about that conclusion,” Hoback says, “is that they can say that the southern population of beetles is not worth trying to save.”

This month the FWS plans to issue a “12-month finding” on the beetle; it will not be clear

until then whether the conclusions match those of the draft assessment. Following a 30- to 60-day public comment period, the agency will then have a year to finalize its conclusions. Whatever decision the FWS makes, it is almost inevitable that the agency will be sued—by industry and property-rights groups if the beetle's status stays the same or by environmental organizations if protections are lifted. In September, in fact, American Stewards of Liberty filed suit because the FWS failed to issue a ruling within the required 12-month period after receiving the petition to delist. “Fish and Wildlife is going to end up in court regardless,” Hoback says.

AT THE BRINK

If the American burying beetle is removed from the federal list of endangered species, what will become of it? That will likely depend on its location—thanks to variations in climate both atmospheric and human. In 2015—the same year the delisting petition was filed—a group of Rhode Island third graders campaigned successfully to make the ABB the state's official insect. If the beetle loses federal protections, Rhode Island will almost certainly continue to shelter a bug that has become beloved in the state. Wildlife workers on Block Island provide carrion and discourage outdoor lighting; 40 percent of the island is protected open space; they teach about the beetle in schools all over the state. “We just spent 25 years monitoring and trying to protect this thing,” Raithel says. “We’re not going to walk away from it.”



Found: A beetle from Oklahoma walks on Middick's hand. Credit: Matt Barnard *Tulsa World*

The beetle's future is less certain, however, in Oklahoma and neighboring states. Small populations may persist for some time on protected lands such as the beetle banks and the Tallgrass Prairie Preserve. But, Hoback says, “the more habitat fragmentation that happens, the smaller the populations of ABBs remain, and small populations can't respond as well” to environmental threats. Then, Creighton adds, “it's just a matter of time before the beetle's gone.” There are many people in Oklahoma who are willing to live with that prospect.

The American burying beetle is not an easy creature to root for. It traffics in death. It gets in the way of human endeavor. It is expensive; it is inconvenient—less exoskeleton-and-hemolymph insect than symbol of all that opponents believe is wrong with American

environmental laws: land-use restriction, excessive regulation, infuriating delays, meddling bureaucrats and an industry of consultants such as Middick, with their coolers full of dead things to attract imperiled things that no one knows are there and no one is likely to miss.

Does an insect matter? Should we care for the smallest among us? These invertebrates do provide essential services to the rest of the world: nutrient cycling, pollination, pest control and decomposition. Sometimes the benefits are more direct: researchers are currently investigating the antimicrobial compounds that the burying beetles secrete for use as antibiotics or preservatives. The beetles also reduce breeding grounds for maggots. One dead mouse can spawn 15 beetles—or, alternatively, play host to 300 disease-transmitting flies. “The beetles are important,” Hoback says.

But of course, the vast majority of North Americans have survived for almost a century without the help of burying beetles. And if protections are removed and groups such as the American Stewards of Liberty are wrong about beetle population strength, we may have to live without them in the next. Saving an endangered species is an altogether human project—deciding as a nation that we should protect something at risk. Scientists and citizens labor in muggy dawns and dusks, in thickets teeming with chiggers and deer ticks, surrounded by the smell of death. It is an effort as peculiar as the beetle itself: underground, beneath notice, bearing a whiff of loss and futility.

This article was originally published with the title "Beetle Resurrection"

MORE TO EXPLORE

Short-Term Movement Patterns of the Endangered American Burying Beetle *Nicrophorus americanus*. J. Curtis Creighton and Gary D. Schnell in *Biological Conservation*, Vol. 86, No. 3, pages 281–287; December 1998.

Effect of Forest Removal on the Abundance of the Endangered American Burying Beetle, *Nicrophorus americanus* (Coleoptera: Silphidae). J. Curtis

Creighton et al. in *Journal of Insect Conservation*, Vol. 13, No. 1, pages 37–43; February 2009.

Petition to Delist the American Burying Beetle (*Nicrophorus americanus*) in Accordance with Section 4 of the Endangered Species Act. American Stewards of Liberty, Independent Petroleum Association of America, Texas Public Policy Foundation and Steven W. Carothers. Submitted to U.S. Fish and Wildlife Service, April 18, 2015. www.regulations.gov/document?D=FWS-R2-ES-2016-0011-0002

90-Day Finding on Petition: American Burying Beetle. U.S. Fish and Wildlife Service. ID No. FWS-R2-ES-2016-0011-0001. Posted online March 16, 2016.

Distribution and Habitat of Endangered American Burying Beetle in Northern and Southern Regions. Douglas R. Leasure and W. Wyatt Hoback in *Journal of Insect Conservation*, Vol. 21, No. 1, pages 75–86; February 2017.

FROM OUR ARCHIVES

Preserve the Endangered Species Act. The Editors; Science Agenda, April 2014.

ABOUT THE AUTHOR(S)



Hannah Nordhaus

Hannah Nordhaus is author of *The Beekeeper's Lament* (Harper Perennial, 2011), *American Ghost* (Harper, 2015), and “Cornboy vs. the Billion-Dollar Bug” in *Scientific American's* March 2017 issue. She writes about science, history and the natural world and lives in Boulder, Colo.

Credit: Nick Higgins

Recent Articles

A Beetle Is Destroying U.S. Corn, So Scientists Are Punching at the Insect's Genes

READ THIS NEXT

Protect the Endangered Species Act [Editorial]

April 1, 2014 — THE EDITORS



IN THE STORE

SCIENTIFIC AMERICAN
Scientific American Volume 317, Issue 6
\$6.99

Every Issue. Every Year. 1845 - Present

SUBSCRIBE NOW!

FOLLOW US



[Store](#)

[About](#)

[Press Room](#)

[More](#)

Scientific American is part of Springer Nature, which owns or has commercial relations with thousands of scientific publications (many of them can be found at www.springernature.com/us). Scientific American maintains a strict policy of editorial independence in reporting developments in science to our readers.

© 2017 SCIENTIFIC AMERICAN, A DIVISION OF NATURE AMERICA, INC.

ALL RIGHTS RESERVED.