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Ripple Marks

The Story Behind the Story

BY CHERYL LYN DYBAS

A River Runs Through It: Catwalk to a Heron Rookery

The first rays of sunlight steal across Virginia's James River near a jumble of rocks known as Pipeline Rapids. On a road above the roiling waters of the James, biologists pull into a small gravel parking lot off 12th and Byrd Streets in Richmond. At this pre-dawn hour, theirs is the only car.

Soon they make their way through dew-covered grass that surrounds a now-empty pumphouse. Fewer than 100 meters along a floodwall that parallels the river, they creak open a gate—and come to a dead stop. Peering over the edge, it's a long drop.

A metal ladder with no rungs on its last section is the only connection between floodwall and river. It lies between the scientists and their destination: the Pipeline Rapids walkway, so named as it straddles a large city water pipe. In the half-light, they shimmy down the ladder, then leap onto a catwalk: the walkway. A train whistles; above the catwalk is a CSX railway viaduct, according to Ralph White, director of the James River Park along Richmond's waterfront.

The biologists might be burglars casing their next job. In fact, they're searching for what may be the country's—if not the world's—most unusual great blue heron rookery.

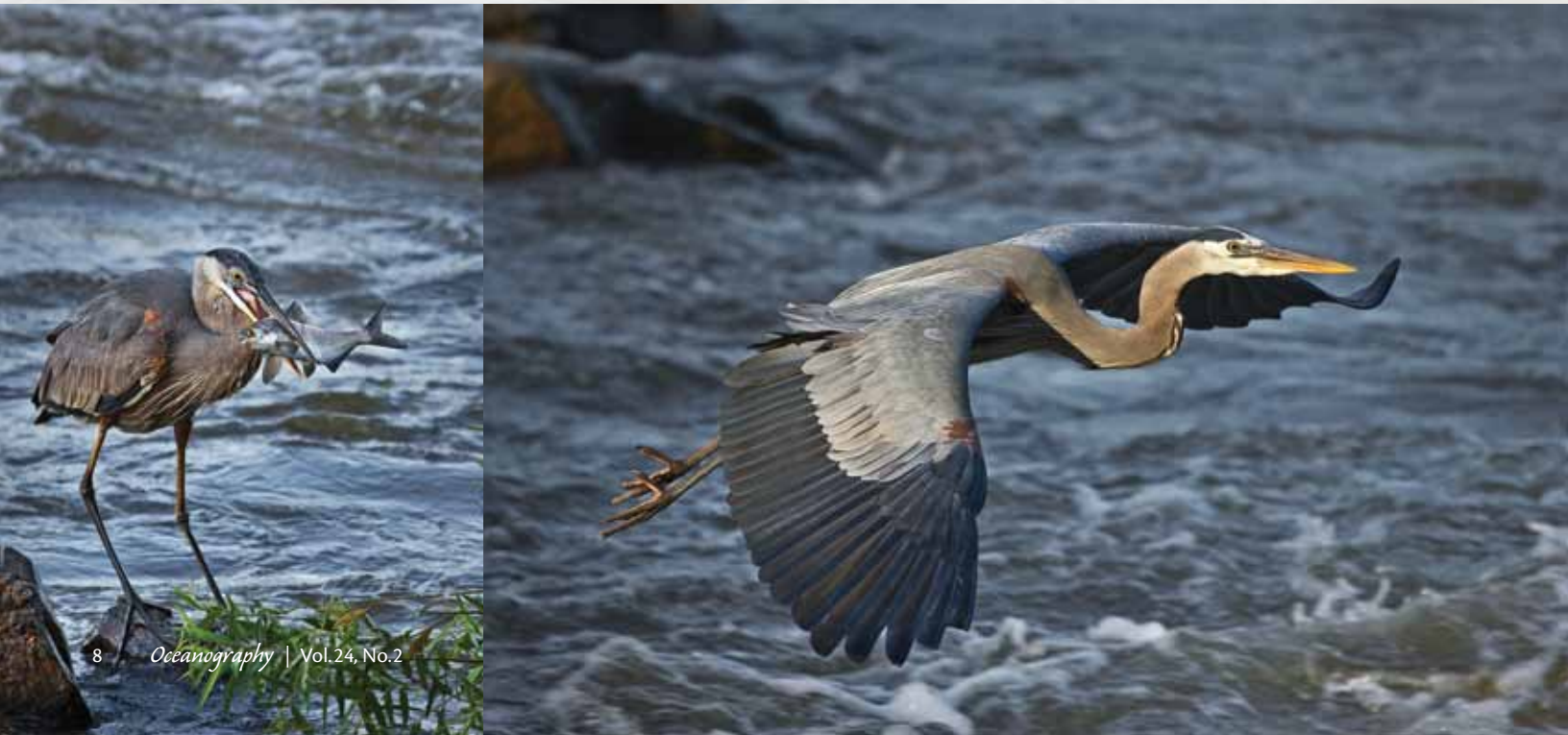
A few more feet along the narrow walk, then the researchers rest behind two huge bridge posts.

They hear the herons before they see them. An early-morning squawking announces the birds' presence. The herons vie for space in nests perched in trees on islands in the middle of the river.

It's mid to late May, and even the youngest herons are fledging, returning to the nest only infrequently. Adult birds, their gray-blue feathers backlit in the morning sun, stalk the shallows near the pipeline. They are hoping for a James River delicacy: a silvery American shad.

American shad, blueback herring, striped bass, and other anadromous fish have declined in the James and throughout the Chesapeake Bay watershed. These species once spawned far upstream—until two dams built long ago cut off more than 650 km of the river and its tributaries. In the 1990s, government agencies and private organizations began restoring historic spawning areas. A fishway was constructed at Bosher's Dam near Richmond, providing shad and herring access to 220 km of the James and 270 km of its tributaries for the first time in almost 200 years.

By the light of an early morning in May, a great blue heron spears a silvery shad from Virginia's James River. The fish—and the herons—are returning to the river, a result of more than a decade of efforts by scientists. *Heron photos courtesy of Ilya Raskin.*



The great blue herons were not far behind.

The first herons showed up in 2003, and the rookery has grown each year since. It started with one nest, then four, and is now 40 or more, according to Ralph White. He and other researchers are keeping a close eye on the birds.

Residents in nearby condominiums—such as the Riverside on the James—are doing the same, but the herons nonetheless feel safe, believes White. They are isolated by the river and its rapids, he says, and an island with tall trees.

"Most heronries are in remote areas. This one is very unusual. Herons are usually skittish around people, but they've chosen to take up residence right next door."

For the herons, X marks the spot here. "These great blues have the best feeding place on the entire river," says White. "Shad and river herring arrive in springtime and school at the beginning of Pipeline Rapids. It's good pickings for herons, and a great place for a rookery. The birds can almost fall out of their nests and go fishing."

As if to prove he's right, an adult heron lands in the shallows near the catwalk and peers into the river. Standing stock-still, it moves not a feather. Suddenly, its long neck juts forward and spears the catch of the day: fresh shad. A flash of silver, and the meal is gone, sliding down the heron's long throat.

The nests of a great blue heron rookery festoon trees on islands in the James River. Herons are in the area from mid-February through mid-June, making their homes in the middle of downtown Richmond.

Catwalk photos by Cheryl Lyn Dybas.

Great blue herons (*Ardea herodias*) are large wading birds common near the shores of open waters and in wetlands across most of North and Central America, as well as the West Indies and the Galápagos Islands. The great blue is the largest North American heron. Its primary food is fish, although it opportunistically feeds on shrimp, crabs, aquatic insects, amphibians, reptiles, and smaller birds. Herons locate their food by sight and often swallow it whole. Great blues are usually solitary feeders, but on this run of the James River there are dozens in view, standing on rocks in the river or wading in pools and riffles.

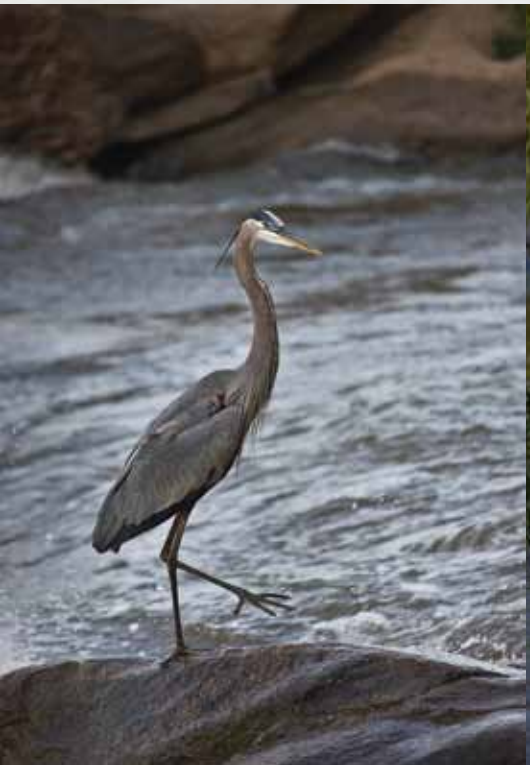
Great blue herons build bulky stick nests, with the females laying three to six pale blue eggs. One brood is raised each year. Both parents feed the young by regurgitating food. Adult birds consume four times as much food when feeding chicks.

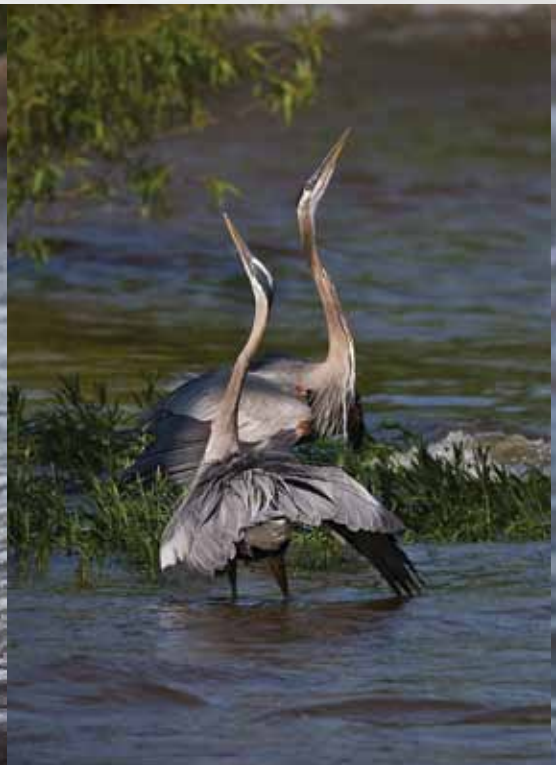
The eggs are incubated for 28 days; newborns fledge about 60 days later. The peak time for seeing the herons of Pipeline Rapids on their nests is late February through late March, with young birds fledging by the middle of June.

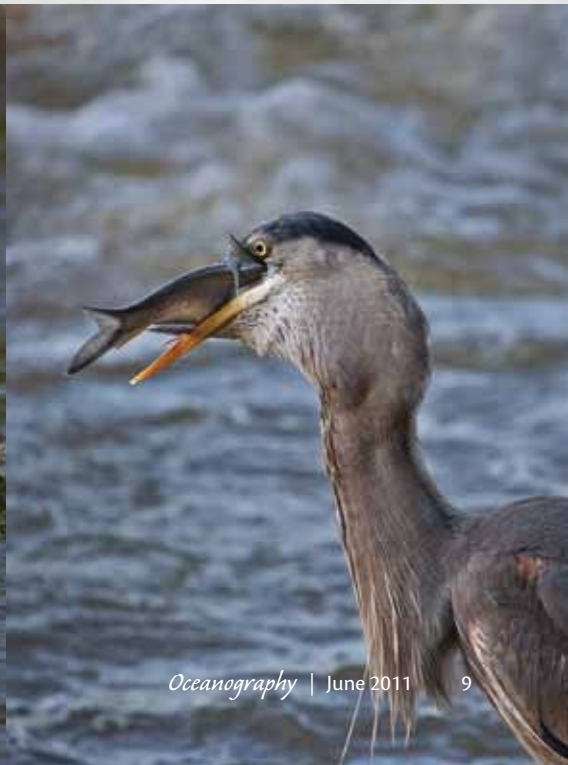
When the immature herons first take flight, they must be able to make it from the island to the river's banks, where quiet waters flow. Directly beneath the nests, the waters of Pipeline Rapids whirl by, moving too fast for a young heron learning to spear shad. The rapids also challenge the most experienced human fishers. Strong safety warnings are issued to anyone intending to brave this section of the James.

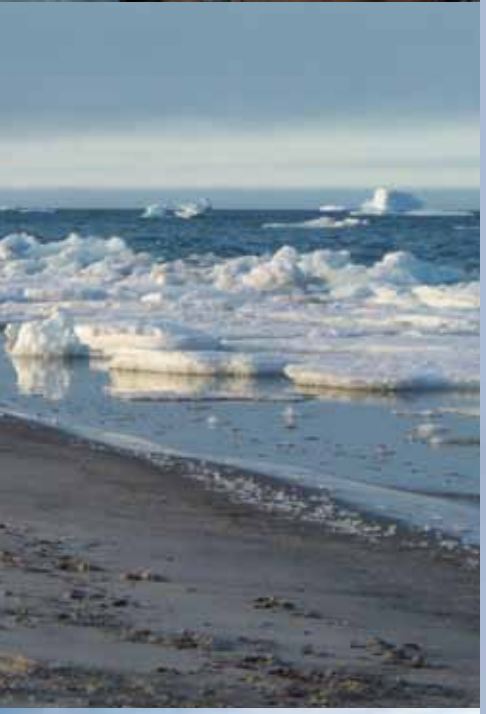
For the herons that await breakfast across from the rapids, however, and the growing number of biologists and nature-lovers who catwalk atop a water pipe to join them, X indeed marks the spot.

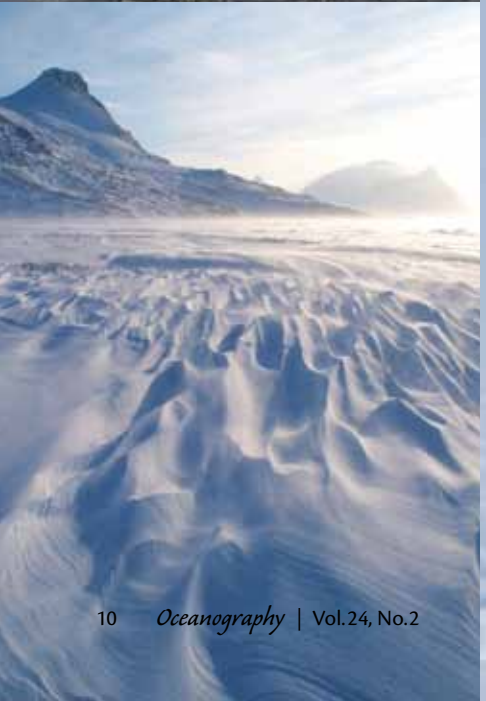
"You're only a few blocks from the Virginia State Capitol," says White. "But with the beauty of this river teeming with life, it feels like you're in another world."











The Wind By Any Other Name: Inuit Observations Reveal Changes in Weather Variability

Ugjunguaq. Nirliviliit. Kananasiktu.

They may not sound like the words of science. But in fact they are.

They are terms the Inuit of Nunavut, Canada, and other far northern places use to describe weather. What they convey, it turns out, is more reliable than the most sophisticated weather model.

Ugjunguag are long, thin black clouds that form just above the horizon. These altocumulus lenticularis clouds, in meteorological language, are "those that resemble the bearded seal" to the Inuit. Once the clouds have appeared, the Inuit say, one shouldn't make plans to hunt on the ice as it will soon move with the wind.

Nirliviliit are high clouds "that resemble the roof of your mouth." They bring *piqsiq*, a blizzard.

Kananasiktu are clouds that roll in from the northwest, ferrying windy weather.

Singuuriq, the star Sirius, predicts weather and severity of temperatures. When it will soon be very cold, the star turns reddish. If it does not twinkle, milder weather will come. And when the wind is about to blow, the star behaves like a flame exposed to a draft.

Now, however, the Inuit way of observing weather—and its day-to-day changes—may be disappearing as fast as melting sea ice, according to scientists Betsy Weatherhead, Shari Gearheard, and Roger Barry of the University of Colorado at Boulder.

Inuit hunters and elders have raised an issue that hadn't been fully addressed in the scientific literature, the scientists say: the increased variability and unpredictability of weather.

Since the 1990s, residents from around the Arctic have reported changes in weather predictability and in the dependability of age-old observing methods, says Weatherhead. "But environmental measurements haven't, until now, described what local inhabitants have been reporting, in part because prior studies didn't focus on the persistence aspects of weather."

She, Gearheard, and Barry looked at hourly weather data for Nunavut. For local spring, which usually arrives in June when seasonal snowmelt is over, temperature persistence has changed dramatically in the last 15 years, with some years showing a strong drop in persistence in spring afternoons.

"These changes may have implications for human health, agriculture, and ecosystems in the Arctic—and beyond," says Weatherhead.

The Inuit share her concerns. "We have a game where you juggle three rocks, and keep changing the rocks from one hand to the other," says *Attungala*. "The weather is sort of like that now: it's being juggled, it keeps changing so quickly and dramatically."

Traditionally, Inuit honed their skills in weather forecasting at a very young age, says Gearheard, who lives in Nunavut. Adults and children "*anijaaq*," or go outside each morning to observe the skies. When they return, they describe wind direction, cloud patterns, sky condition and other factors in detail.

"These are skills they continue to develop and refine through a lifetime," says Gearheard.

But Inuit forecasts today are not as accurate, and sometimes don't work at all, due to a mix of changing traditions and changing

(top left) Inuit hunters constantly check the weather and ice conditions while traveling. (middle left) East Baffin Island coastline in summer. (bottom left) Uqalurait, drift-like snow formations created by the wind and used by Inuit hunters to help navigate, especially in low-visibility weather. (background photo) A hunter checks ice conditions. *Photos courtesy of Shari Gearheard*

weather. *Anijaaq* is not practiced as it one was, though many elders and older hunters still check the weather each morning, if only, says Gearheard, through a window.

In Nunavut, experienced Inuit forecasters point to the 1990s as the time when they realized that their abilities had begun to fail.

Had their knowledge truly waned, or was the answer in the weather itself?

"Sometimes I would guess that it would be a clear day," says *Qaqqasiq*, "then all of a sudden bad weather came. My predictions used to work and I used to give advice to younger people, whether to go out or to stay home. But I can't do that anymore."

Nunavut's changes in daily temperature persistence, Weatherhead and colleagues found, are a fact. "And as global and local temperatures continue to increase," Weatherhead says, "highly variable conditions may become the new norm."

Inuit hunters traveling on sea ice need continuous below-freezing temperatures to make long journeys; biological systems need rain at regular intervals for survival. How often precipitation occurs may be more important than changes in annual totals.

Changing weather is intricately linked to the environment—sea ice, snow, animal populations, and vegetation. The Inuit are trying to adapt. Hunters now take precautions, such as carrying extra supplies in anticipation of bad weather.

Tapping into different sources of knowledge, Gearheard says, "is a complex task, but the observations of Inuit hunters and elders are leading to new discoveries."

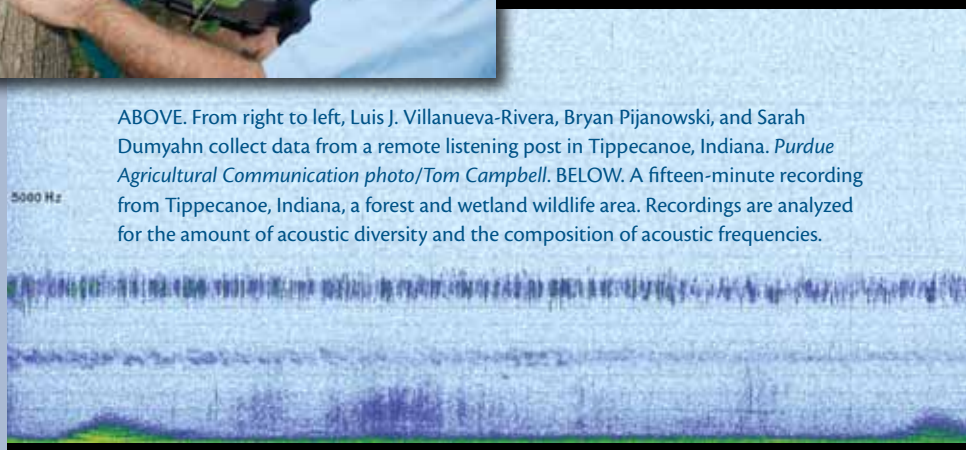
Merging indigenous knowledge with scientific methods has unexpected benefits for both, says Weatherhead. "Indigenous knowledge is different from scientific knowledge, but neither is a superior form of understanding."

Whether one finds out that high winds are ending by watching *tulugait* (ravens)—or peering at a computer model—a storm is still on the wane.

The Landscape (and Seascape) Have a Heartbeat: To Hear It, "Soundscape Ecologists" Spawn New Field

Far more important than the places I have seen or what I have done or thought about is the possibility of hearing the singing wilderness and catching, perhaps, its real meaning.

— Sigurd Olson, American author, environmentalist, and advocate for wilderness



ABOVE. From right to left, Luis J. Villanueva-Rivera, Bryan Pijanowski, and Sarah Dumyahn collect data from a remote listening post in Tippecanoe, Indiana. *Purdue Agricultural Communication photo/Tom Campbell*. BELOW. A fifteen-minute recording from Tippecanoe, Indiana, a forest and wetland wildlife area. Recordings are analyzed for the amount of acoustic diversity and the composition of acoustic frequencies.

Geophony. Biophony. Anthrophony.

Unfamiliar words. But they shouldn't be. We are surrounded by them morning, noon, and night, says ecologist Bryan Pijanowski of Purdue University.

The early-morning chirps of robins. Running water and whistling wind. Planes, trains, and automobiles.

Biophony is the music created by organisms like birds; geophony is the composition of nonbiological sounds like wind, rain, and thunder; and anthrophony is the conglomeration of noise from humans.

What they add up to is a cacophony—a mix of sounds made by our environment, and by ourselves. A background to which most of us have become tone-deaf.

"Another word for it is 'soundscape,'" says Pijanowski.

He and colleagues are leading an effort to create a new field called soundscape ecology. It would use "nature's music" as a way of understanding the ecological characteristics of a landscape—or seascape—and reconnect people with Earth-sounds.

"Natural sound could be the 'canary in the coal mine,'" says Pijanowski, lead author of a paper on soundscape ecology in the March 2011, issue of the journal *BioScience*. "Sound might be the critical first indicator of environmental changes such as climate and weather patterns, or the presence of pollution."

The dawn and dusk choruses of birds, for example, are characteristic of a certain location. If the intensity or frequency of these melodies change, "there's likely something causing it," says Pijanowski. "Ecologists have largely ignored

"Soundscape Ecologists" continued

the ways in which sound can help determine what's happening to an ecosystem."

Since Rachel Carson's far-reaching 1962 book *Silent Spring,* the sounds of nature have been linked with environmental quality.

"Over increasingly large areas of the United States," wrote Carson in *Silent Spring*, "spring now comes unheralded by the return of the birds, and the early mornings are strangely silent where once they were filled with the beauty of bird song."

Carson's observations turned out to be right. What began as her observation of sound—or its absence—ultimately led to the ban of DDT, the insecticide responsible for precipitous drops in numbers of bald eagles and their avian relatives.

The study of soundscapes can yield valuable information about different landscapes and seascapes, say Pijanowski and colleagues like Bernie Krause of Wild Sanctuary, Inc., in Glen Ellen, California, and Almo Farina of Urbino University in Italy.

"Biophonies, together with geophonies, comprise the voice of the natural world," says Krause. "While a picture may be worth a thousand words, a natural soundscape is worth a thousand pictures."

Pijanowski has mapped soundscapes in wetlands and agricultural fields in Tippecanoe County, Indiana; near burbling streams and in high-wind chaparral in Sequoia National Park, California; and in the bird-song-filled forests of Tuscany's mountains.

During a two-month study among the beech trees of Italy's Apennine National Park, he and other scientists collected eleven three-hour recordings from 6:00 to 9:00 a.m. each day. Some 13 species of birds—such as the European robin (*Erithacus rubecula*), the chaffinch (*Fringilla coelebs*), and the blackcap (*Sylvia atricapilla*)—chirp their hearts out in this forest. "We used an acoustic complexity index and interpolation software to create soundscape maps," says Pijanowski.

Data from the acoustic recorders were used to construct "soundtopes"—three-dimensional maps of acoustic complexity plotted across the landscape. The 11 daily maps for this landscape show that large seasonal changes happen in the beech forest. "We anticipated that the maps would be similar," says Pijanowski. "But that wasn't the case."

The breeding period of every bird species has different timing, the scientists found, and each one needs specific resources like food, shelter, and singing spots. The soundtope, therefore, shifts across the environment.

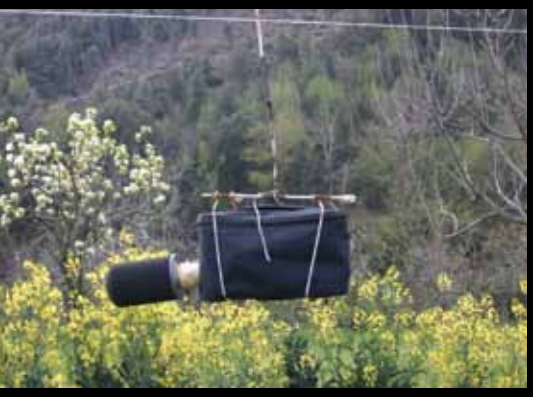
Recordings like those made in Apennine National Park will become tomorrow's "acoustic fossils," says Pijanowski, "possibly preserving the only evidence we have of ecosystems that may vanish in the future because of a lack of desire or ability to protect them."

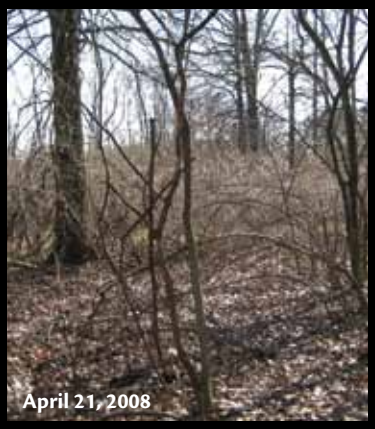
Soundscapes, he believes, represent the heritage of our planet's acoustic biodiversity, and reflect Earth's assemblages of organisms. "Natural sounds are an auditory link to our environment," says Pijanowski, "one we need. Society's growing 'nature deficit disorder' is likely to increase as we replace them with the din made by humans."

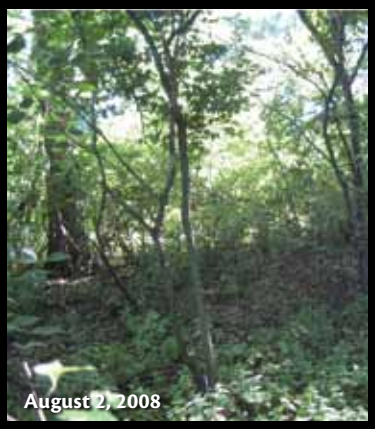
Almost 50 years ago, Rachel Carson highlighted the dangers of pesticides and their potential threats to wildlife, and to us. A half-century later, "the unintended silencing of organisms by human activities is an indication of our continued impact on the planet's ecosystems," says Pijanowski.

Through soundscape ecology, he hopes to record and study Earth-music—while there's still time.

Sing, bubbling brook and spring robin, sing.







ABOVE. Suspended microphones are used to record "soundscapes." RIGHT. On-the-ground photos of the Tippecanoe forest study area show vegetation change over time, which can be correlated to the changing soundscapes.

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