"Reveals the surprising—and surprisingly fascinating—arboreal secrets hidden in the canopies of ordinary trees . . . Haskell [leverages] three remarkable strengths—vast scientific knowledge, prodigious literary gifts, and a deeply meditative approach to fieldwork." —*Outside*

"Here is a book to nourish the spirit. *The Songs of Trees* is a powerful argument against the ways in which humankind has severed the very biological networks that give us our place in the world. Listen as David Haskell takes his stethoscope to the heart of nature—and discover the poetry and music contained within." —Peter Wohlleben, author of *The Hidden Life of Trees*

"David George Haskell may be the finest literary nature writer working today. *The Songs of Trees*—compelling, lyrical, wise—is a case in point. Don't miss it." —Deborah Blum, Pulitzer Prize–winning director of the Knight Science Journalism Program at MIT

"David Haskell does the impossible in *The Song of Trees*. He picks out a dozen trees around the world and inspects each one with the careful eye of a scientist. But from those observations, he produces a work of great poetry, showing how these trees are joined to the natural world around them, and to humanity as well." —Carl Zimmer, author of *A Planet of Viruses*

"With a poet's ear and a naturalist's eye, Haskell re-roots us in life's grand creative struggle and encourages us to turn away from empty individuality. *The Songs of Trees* reminds us that we are not alone, and never have been."
—Neil Shea, writer, *National Geographic*

"A wise and eloquent reminder of the interconnectedness of all things and a lesson in how being open to the wisdom of trees, the great connectors, can help us understand ourselves and our place in the world."
—*The Minneapolis Star Tribune*

"Haskell writes with a poet's ear and a biologist's precision. . . . like Rachel Carson's *Silent Spring* and Stephen Jay Gould's *Wonderful Life*, *The Songs of Trees* is greater than the sum of its parts: it forces readers to consider complex, interrelated networks of the natural world, the scope and sweep of evolution, and the measurable effects of humanity on both."
—*The Knoxville News Sentinel*

"A tour de force of sound and symbol. Read. Listen. Learn."
—Paul D. Miller aka DJ Spooky

The Songs of Trees

Stories from Nature's Great Connectors

David George Haskell

PENGUIN BOOKS

Cottonwood

Populus angustifolia ?

Populus deltoides ?
monilifera

Denver, Colorado
39°45'16.6" N, 105°00'28.8" W

A young cottonwood tree stands on the bank of a creek in Denver's urban center. The tree reaches only as high as my chest, a dozen thumb-thick stems sprouting from a clench of roots. The roots are lodged in a crack among a disordered pile of quarried stone blocks, part smothered with river sand. A municipal garbage receptacle stands on a concrete walkway next to the tree. On the other side of the tree, a meter-wide stretch of sandy gravel leads to fast-flowing, shallow waters where Cherry Creek runs into the wider, deeper South Platte River. The tree stands in the accumulated sediment in the concavity of the creek's arc. The cottonwood's companions in this narrow band of vegetation between walkway and water are shrubby willows, pointing downstream like the cottonwood, bowed by a long-sunk springtime flood. Shreds of plastic bag and willow stem are trapped in the cottonwood's lower branch axils.

On a warm afternoon, bicycle chains *twhir* as they pass the spattering sounds of wind-clapped cottonwood leaves. One or two bikes

pass every minute. Runners scratch a percussive beat on sandy concrete. Stroller wheels grind. Mayflies rise from the river's surface and are plucked by chittering barn and cliff swallows. The birds sweep up into the recesses of the Fifteenth Street bridge, where they have daubed their mud nests onto metal girders. In the water dozens of children shriek, whine, and whoop. A young man cannonballs into the South Platte, a stinging *whump* of skin on water. He bobs, then swims for the bank, his long black hair a gleam of shedding water drops. Kids—black, Latino, white, Asian—float in the shallows, foot-splashing from within inflated plastic tube creatures. On a rock under the cottonwood, a tattoo-vined couple watch, share a cola, and laugh. Their toy dog, clipped into a yellow life vest, refuses to swim. Cottonwood leaves yaw in the gusting breeze.

It is a sunny weekday in late summer and at least 150 people are in Confluence Park, named for the union of the South Platte and Cherry Creek. But the confluence here is of more than water.

Cherry Creek is the translated Arapaho name for the chokecherry, *bíino ni*, that grew on what are now paved walkways. French trappers and traders gave the Platte its name, for the "flat" water of its lower reaches in Nebraska. The tumble of vowels against consonants in the Arapaho name, *niinéniiniicíihéhe*, is a better representation of the river's sonic and visual qualities in this more lively stretch. Arapaho trails converged here and the riverbanks hosted encampments of thousands. The exact size of these communities before contact with white violence and disease is unknown. The Arapaho were swiftly pushed out by colonists and, following the Sand Creek massacre in 1864 and relocation to Oklahoma, living Indian presence here was obliterated. Today the Arapaho are acknowledged in street names, historical signs, and wall art, but not in restitution of land and power. Encampments continue, though. Dozens of homeless people sleep on cardboard in the willow thickets. An outdoor recreation store overlooks the park and a sign inside reads "we

love to get outside and play, and we know first-hand the importance of quality outdoor gear."

Denver's nineteenth-century colonists arrived by river and on trails alongside the banks of the South Platte. They built, as had the Arapaho, at the confluence. Many built *in* the confluence, erecting houses and business offices on the sandy open ground alongside the river. Flash floods repeatedly smashed through these monuments to riverine ignorance. When thunderstorms hit the upstream reaches or snowmelt came suddenly, the plash of the creek turned to a roar powerful enough to carry downstream, in various decades, City Hall, Denver's first bridges, and the three-thousand-pound printing press of the *Rocky Mountain News*. Dozens died in these floods. For decades eastern immigrants rebuilt in the pathway of the water until, in the early and mid-twentieth century, upstream dams dampened the floods' vigor and building codes edged structures away from the riverbed. Today Confluence Park is set lower than the surrounding apartment buildings and stores, a *Y*-shaped catchment for the rare two-meter surges that dams cannot contain. On most days, when the water runs low, the park's design has an unintended acoustic consequence. Although Interstate 25 cuts through within ten minutes' walk and some of the city's most busy streets demarcate the park to the north and south, the clamor of tire and piston largely overshoots the basin, opening a space at the center of the city for the purl of water and the voices of children, cottonwoods, and birds. Here the city is a low drone spiked with sirens and motorbike pipes. The river cuts a middle way between these extremes of rhythm, loudness, and tone: the weir is a bass roll with splashy grace notes, its steadiness unifying the tapered riffs of animal and plant voices.

Cottonwood depends on temperamental flow. Floods scour the high ground along the river, leaving moist, sandy beds for the trees' seeds. The "cotton" that wraps these seeds carries them on wind and water.

Only on bare ground can the seeds germinate and grow. In established vegetation the flecklike seeds are too puny to compete. When the river drops, the seedlings squirm roots into bare sand, chasing the falling water table. The tree grows upward too, but the pursuit of water is the seedlings' focus. After a few weeks, the shoot may be as tall as a finger, but the roots are arm-length deep. If they fail to keep up with the ever-sinking layer of sandy moisture, the young trees wither on the desiccated riverbank. Seedlings that germinate when the river is low are usually washed downstream on the first flood. Only those that start life high on the riverbank, on the ebb of a flood, grow into mature trees.

Suppression of floods was the primary objective of Denver's first dams. Dams change the pulse of the river from an irregular beat, with great floods coming at unpredictable intervals, sometimes years apart, to a regulated, even flow, punctuated by regular washes from dam discharges. Below dams cottonwood often disappears from riverine forests, replaced with Eurasian tamarisk, a species that thrives in the new water rhythms. Around Confluence Park there are few young cottonwoods. The river is edged with tended lawns and concrete walkways. High water here now departs with few seedlings in its wake. In the slivers of unmanaged vegetation and riverside riprap, though, the old order persists. Seedlings find the spot moist enough to grow yet high enough to stay rooted. Park managers lend a hand, planting young trees at the edges of mowed lounging areas, replacing the force of the river with the foresight of humans.

At the park I push the curfew to its edge. No overnight camping or loitering is allowed, although the homeless find ways around the rules. Adonis tinkles as he packs his wineglass, bottle, and book into a leather shoulder satchel, then mounts his titanium road bike. Water wrestlers, three teenage boys in Mexican flag T-shirts, shake themselves dry and jostle on the bank before slapping their flip-flops up the concrete ramp to the bridge. A mother pleads one more

photograph from the fussing, petticoated infant posed on a rock pedestal in Cherry Creek's bubbling swirl. An old man grunts as he rolls down the legs of his shorts. He shoulders a white shirt as he stands, his sun splay on the bench over for the day. A cat carrier's door clicks shut as a lawn-wandering boa is caged. A muscular, goateed man gently lifts the boxed snake and walks to a bus stop. The bridge's bilious security light fizzes with an unsteady, insectile spark. Their sandbar freed, mallards preen and chuckle under cottonwood stems. Then, a bark I know from coastal marshes, *rwonk*: a black-crowned night-heron glides above Cherry Creek and drops into the jumble on the rock island in the middle of the South Platte. The heron edges out of the rocks and treads its long toes to the water's edge. There it stares down into the reflected streetlight shine of its silver plumage. I crouch behind the cottonwood, the better to observe without alarming the bird.

Over the next two years, I'll learn that I had no need of stealth. The night-heron is indifferent to human fluster and palaver. The whir of speeding commuter bikes along Cherry Creek or babble of children near South Platte's rocks do not draw the bird's red disk eyes from their fish-dagger stare. Here are the Galápagos in downtown Denver: birds in whom the inner voice of fear has quieted. Annie Dillard called the approachability of Galápagos animals "pristine ignorance," their welcome when they investigated her "the greeting the first creatures must have given Adam." The islands were a world where animals had not yet been defiled by the touch of fallen humanity. The Denver night-heron confounds this allegory. These same Edenic qualities live in the heart of a city that humans not just touched, but built.

I return to the tree in winter and find a haze, a dome of urban incense. On cold, sunny days millions of spinning tires are censers, flicking road salt particles to the air. There they join exhaust fumes

and ozone to make a cloud of pollution over the city. From a distance, Denver genuflects its smoky offering at the foot of the glass-aired Rocky Mountains. The bright, diverse paintwork of cars is unified by a veneer of gray brown powder. Tree trunks are smutted with dirt-rusty taupe, the color of moles and mined earth.

Denver's road salt comes from Utah, an old seabed hauled from its sanctuary through kilometers-long tunnels the height of houses. During an average winter, road crews scatter nine thousand kilograms, ten U.S. tons, of pulverized Utah rock salt per mile of Denver road lane. Downtown, to reduce dust, the crews use a spritzed brine of magnesium chloride. Two decades ago the cloud was thicker. Then, salt and sand were sprinkled at three times today's volumes. Breathing was a geologic experience, wet alveoli of lungs muddied by hovering rock strata. Now road managers use salts in a much more efficient manner, but even today power lines are sometimes shorted by salt accumulations. The "perpetually brilliant" sunshine and "tonic, healthy" atmosphere promised by Colorado's nineteenth-century boosters are dulled by our collective desire for rubber to meet asphalt with speed and surety, whatever the weather.

Snowmelt and rain clear both streets and air. But terrestrial clarity comes at the price of aquatic turbidity. The South Platte and Cherry Creek receive much of the salt, sand, and silt. Their waters, inflamed by runoff, are the phlegmy cough of the city. The flow in front of the cottonwood, usually clear as tap water, runs opaque and stained when winter snows melt. Denver's waters briefly become mine tailings.

A range map of the plains cottonwood species is an irregular oval in the center of the North American continent, hundreds of kilometers from any coast. Yet droughty soils have adapted the tree to periodic inundation by salt. Cycles of shallow rain and desiccation draw salt from deeper layers of soil. Every shower dissolves the soil's salt, then the sun moves these solutes higher as water is pulled by

Populus deltoides monilifera (?)

evaporation and the capillary grip of soil particles. A thorough soaking will leach salt away, but abundant rains are infrequent over much of the cottonwood's range. The ancestors of western cottonwoods therefore have some experience of salty soil, and the survivors passed this knowledge to the present generation. The trees cannot match sabal palm for their tolerance, but cottonwood cells can sequester salts within compartments, produce defensive chemicals to buffer themselves against the water-drawing power of salt, and grow roots that burrow lower than salty superficial layers of soil. Cottonwood roots also fuse themselves into salt-tolerant fungal networks, tapping the water, nutrients, and defensive chemicals of their partners. Like the ponderosa pine, the aboveground cottonwood shoot is the smallest part of the tree, a flagpole raised by an underground community.

Animals in the rivers and creeks have likewise inherited some resilience from their ancestors. But there is a limit. If chloride, magnesium, or sodium from road salt becomes too concentrated, fish and aquatic insects are sickened or killed. Billows of sand and silt can sink or smother wads of snagged dead leaves and mats of algae, burying the food that sustains the aquatic community. Trout get much of the attention in these waters, but their lives depend on alga-grazing and leaf-munching insects. These downstream effects of road treatments are part of what caused Denver's road managers to change what they loaded into salt trucks. The old sand/salt mixture sluiced far more particles and salts into waterways than do the newer Utah mine salts and brined magnesium chloride. Denver has a goal of returning every waterway in the city to a state in which fish can thrive. Thoughtful road management is one reason that people have dusted off their fishing poles along some Denver waterways. Other creeks await further progress. Now bullhead, catfish, shiner, chub, sunfish, dace, suckers, and even some trout live at the confluence of Cherry Creek and the South Platte. Unlike decades ago, line-swinging anglers are often seen standing in the water's flow.

With healthier rivers and creeks come new dangers for urban trees. Early in the first winter of my time with the cottonwood tree, I walked to the South Platte and saw the municipal trash can standing alone. All the tree's trunks were gone. I rummaged in the willow thicket and found ankle-high stumps. On each, pencil-thick grooves etched the slope of an angled cut. A spill of cottonwood chips circled the amputee. A few willow stems were nipped. Beavers had felled the tree's trunks and dragged them to their lodge downstream in the South Platte. City workers had finished the rodents' work, tidying with smooth lopper slices the skinny trunks that the beavers had ignored.

By the next summer, the tree was taller than the year before, just over two meters of multistemmed growth. In October the beavers returned for their winter provisions. They leveled the tree once again. Next spring: new cottonwood sprouts. The chisel-toothed rodents are rough managers of their trees. Most human foresters would not approve of such hard-driving, short-term rotations for a coppiced woodland. The cottonwood, though, seems to keep ahead of the game, growing a little taller each year. If the beavers let up, the tree would get big enough to undermine and crack the pavement. Such unruliness would likely cause park managers to remove the tree. The beavers' vigor, for this one individual cottonwood, therefore might ensure a longer life.

My conversations with the people who clear the snow from the paved river pathways, keep the trash cans empty, and tidy the discards of human visitors confirm that beavers live in many of Denver's urban creeks and rivers. Ted Roy, who has worked for the city for more than two decades, reveled in listing for me the animals that he sees on his rounds: beavers, coyotes, muskrat, foxes, hawks, snakes, bears, and "penguinlike birds," presumably night-herons. What gave him particular pleasure was seeing how much change had happened during his time with the city. Denver's waterways now host more wildlife, have better facilities, and are visited by many more people. Mr. Roy, riding in a municipal truck piled with garbage bags, is part of the river's memory and intelligence. His guffaw and backchat in the cab are the sounds of water wisdom, Baker's *Peregrine* translated to city life.

To better understand the cottonwood in Denver, I followed the South Platte just over one hundred kilometers upstream, to Eleven Mile Canyon in the mountains. On a late-summer afternoon, a young American dipper stands on a granite boulder in the river's headwaters and shrills a repeated, jabbing note. The bird's parent toad-climbs from the water's tumult, feathers shedding mercurial liquid, and twists a clump of mayfly nymphs into the squalling youngster's beak. The begging recommences before the adult has time to turn and submerge, grip footed, to its work on the river bottom. The dipper needs its crampon feet and finlike wings. Here the South Platte guns through its raceway of billion-year-old granite, a teenage river on a smash, ram, and whomp of a run from its elderly parents. The ruckus jams all sound from ponderosa or willow. Only the newly fledged dipper outbawls the river, the bird's call a high note vaulting the water's roar.

Late summer's fecundity is all around. On the meadows that tumble down slopes to the water's edge, mule deer does browse in the company of their brawny offspring, now outgrown the spots of fawnhood. A merganser duck sits with her brood next to a water riffle below the bouldery rapids. Seed-fat grass heads line the trails; canyon walls droop with cones. In air spiced with pine and river spray, the only sounds are of birds, water, and wind. Ah, the mountains. Here, John Muir tells us, after we have "bathed in the bright river, sauntered over the meadows, conversed with the domes, and played with the pines," we may finally shake "the last of the town fog" from our bodies and minds.

The only other humans are fly-fishing in the calmer reaches of

the river. Some stand in national forest waters, others behind reflective metal advertisements, Private Fishing, No Trespassing, No Parking. The fishers cast their lines with arms encased in the UV-resistant, breathable fabric of well-engineered shirts. Many-pocketed vests hold the fly box, nipper, zinger, hemostat, nail-knot tool, fly-floatant powder, tapered leaders, and tippet spools. Their hats are wide brimmed, sturdy but foldable, and water sandals or wading boots keep feet as steady as waterbirds' on the uneven river bottom.

I'd guess that each trout fisher has about one thousand dollars' worth of kit. My clothes are no match, but the sound-fishing and light-luring electronic equipment in my backpack cost as much as their gear. We have the leisure to take a day away from jobs or families, money for entrance fees and gasoline, and cars reliable enough to climb from the plains to mountain canyons. All of us are male and seem to have a few decades of employment savings in the bank. And, using Ta-Nehisi Coates's pithy summation of race in early-twenty-first-century America, we all believe ourselves to be white. Formerly our seeming unity would have been sliced into hierarchies, "Catholic, Corsican, Welsh, Mennonite, Jewish." But now we white dukes, inheriting privilege through birth, go to the woods and streams and there, like Shakespeare's duke, "exempt from public haunt,/Find[] tongues in trees, books in the running brooks,/Sermons in stones, and good in every thing."

The same trees and stones have other tongues, other books and sermons.

Writing of her family road trip through the open spaces of the American West, Judy Belk recalled her son's reaction on first hearing of the trip. "Four black folks from Oakland" on the Montana back roads seemed, to him, "nuts." His was one expression of what Carolyn Finney calls "geographies of fear." American history, combined with the current state of racial inequity, reserves the feeling of wholesome ease in the outdoors for only a small segment of humanity. As

an older white man, I approach the woods, the river, and uniformed, potentially armed rangers in a very different context from that of a black teenager. "Don't bird in a hoodie. Ever" is one of J. Drew Lanham's "9 Rules for the Black Birdwatcher."

The woods, creeks, and mountains are where many have disappeared. This too is the forest unseen, unheard. The lonely creek is where white men dump the bodies of those they have killed. The trees are hung with Billie Holiday's "strange fruit." The "outdoors"—fields, forests, and green spaces—carry with them memories, and present-day threats, of violence. When the National Park Service's Bill Gwaltney told his family that he planned to be a ranger, his father, who had lost friends to the noose, replied with a warning: "There are a lot of trees in those woods, and rope is cheap." The journalist and mountaineer James Edward Mills calls the legacies of past and present dangers a "cultural barrier forged in social memory." As a result, he reports that he is often the only black person in attendance at conferences and meetings about outdoor recreation.

It is not just racial injustice and violence that produce geographies of fear. A recent survey of scientists found that outdoor research sites were "hostile field environments" where 26 percent of women, compared with 6 percent of men, had been sexually assaulted. Red Riding Hood is partly a map of the geography of violence and fear. The tale also reinforces patriarchal cultural norms: girl, to be safe, don't wander into the forest or a man will have to rescue you from other men. Cheryl Strayed could walk the Pacific Crest Trail, in part, by telling "myself a different story from the one women are told. . . . I willed myself to beget power." Terry Tempest Williams, reflecting on her experience of human evil in the mountains, describes the process of "growing beyond my own conditioning." It is not, she writes, the lips of princes that will oppose and reshape geographies of fear, the "things that happen to young women in the woods," but "our own lips speaking."

Racism of conservationists

The water of the South Platte flows through Eleven Mile Canyon in one channel. But several rivers are present here.

In the national forests and national parks of the United States, cultural geologies, the processes that create geographies of attraction and of fear, have been exclusionary from the start. These institutions were born from philosophies of Nature that reveled in the imagined supremacy of whiteness and masculinity. Muir, the leading advocate for the national parks, praised the "brave and manly and clean" mountaineers, men superior to the people in "crowded towns mildewed and dwarfed in disease and crime." A strong-willed white man, Muir believed, "would easily pick as much cotton as half a dozen Sambos and Sallies." Muir's Indians were "dark-eyed, dark-haired, half-happy savages" leading lives "strangely dirty and irregular . . . in this clean wilderness." Gifford Pinchot, founder of the national forests, was an avid supporter of the eugenics movement. He compared "races" of people to separate species of tree, "pines and hemlocks, oaks and maples," each human "race" living "in certain definite types of locality . . . in accordance with definite racial habits which are . . . general and unfailing."

Aldo Leopold used slavery in Homeric Greece as an example of an ethic that humanity had outgrown, but he treated the racial injustices of his own day with silence or ambivalence. Writing in 1925 at the height of Jim Crow, he argued that wilderness must be "segregated and preserved." Even as government policies were forcibly assimilating the American Indians of his time into white culture, he wrote that the "supply of wilderness" was unlimited when the Pilgrims landed.

These attitudes are enshrined at the entrance to the American Museum of Natural History in New York City. To enter we pass a twice-life-size equestrian bronze of Theodore Roosevelt. The statue's message is of unambiguous white superiority. Two men stand just behind the rider, both half naked, unlike the well-clothed president

June 2020 - decision made to take the statue down

above them. The heads of the black man and the American Indian reach only as high as Roosevelt's buttocks.

It is perhaps, then, not surprising that the *Negro Motorist Green Book*, a publication designed to help black travelers avoid "difficulties" while vacationing in a segregated United States, makes little mention of parks and forests but instead lists private homes, hotels, and restaurants in cities. "Green" was the publisher's name, not the color of the recommended destination. In the 1949 edition, the closest safe hotel was sixty miles away from the environmentalists' darling, Yosemite. This despite the fact that black "Buffalo Soldier" cavalrymen were the guardians and caretakers of the Yosemite Valley and other western scenic areas before whites took over as these lands became national parks.

Century-old photographs of the Colorado Midland Railway, the mountain-climbing track that brought sightseers through Eleven Mile Canyon from Colorado Springs, show only white faces among the passengers, with an occasional black railroad worker. The South Platte may be a young river, but its channel is an old one, running through cultural granite.

Back in Denver later in the year, I walk on the South Platte shore on a rimy December morning. My boot soles are like twisting pepper grinders as they break the frost welds among sand grains. At the water's edge, an ice shelf juts over the lapping river wavelets, concentric milky circles marking its overnight growth. I step too close and part of the formation shatters, a window break that alarms the mallards, gadwalls, and hooded merganser ducks cruising the waters of the confluence. Then comes another startle of birds, a slap-panicked sound that resolves to a whistled hiss as one hundred pigeons bolt from their roost on the bridge. An adult bald eagle rows its dark wings with easy power. It has no interest in the corkscrewing silliness of pigeons but swings its head to eye the flat waters downstream

of the weir. The eagle sees no stunned fish so continues its path, following every bend in the water. I hear the *whoff* of its wings as it punches a little extra power to clear the high struts of the bridge.

Gulls and Canada geese follow the same aerial path along the South Platte. Gulls snatch glances at the same fish-pregnant water as the eagle. Geese keep their eyes on more distant targets. Water from the irrigation sprinkler is the goose's Moses, come down from the mountains through reservoirs and pipes, opening a promised land. Half of Denver's water is used for watering ornamental plantings. In the sun-leathered parch of the western plains, Denver's lawns and the suburbs' well-landscaped office complexes are all that grass-grazing geese could ever desire: impounded water, thousands of hectares of fertilized and watered grass, and shrubbery in which to secrete their nests. The sky is seldom missing a skein, especially in winter, when flocks of residents and winter visitors use rivers and creeks as guides among the many feeding opportunities.

Humans too once again follow the river. By building more than 130 kilometers of walking and biking trails within the city, most of which follow waterways, Denver has aligned the movements of people with many of the other animals that inhabit the city. This confluence creates more than convenient or pleasant places for people to commute, play, or relax. People who are present along the river tend to become advocates for the river.

When human movement patterns start to realign with the patterns of other species—eagles, mayflies, geese, muskrat—our awareness rejoins the community of life into which we are born but which our built environments too often hide from us. In this unity of flow and bodily movement, belonging is no longer abstraction but is manifest through living choreography. The choreographer, though, is not an individual but the relationships among a multitude. The river is not a passageway for lifeless water molecules but is a life-form. I hear

the Amazonian Sarayaku activist's words: *Rivers are alive and sing. This is our politics.*

Humans are part of this multitude. The South Platte and Cherry Creek flow from many upstream impoundments and diversions. The spreadsheets and management plans of Denver Water affect every drop of the river's flow. Do these manipulations by humans tame the river, somehow draining it of wild nature? No. The hand that writes water-management plans, the page or screen on which words appear, the engineers who devised dams, and the flow of the South Platte in the city are as wild, natural, and at home in this world as the waters within the upstream, federally cordoned "protected" area. We too are nature. Unsunderable.

To believe otherwise is to impose a duality on the world. The South Platte runs through a land created by this fissured imagination. The river gathers its first waters from mountain national parks, forests, and wilderness areas. For some people these areas are places for a grand escape, sacred groves in which to visit Nature, and the last refuge of imperiled ecosystems. For the indigenous and other peoples who were removed and barred from reentry before the federal government enacted "protection," the same areas are postapocalyptic landscapes. Cormac McCarthy's *The Road* runs through each one: Trails of Tears leading out of dehumanized lands. The Wilderness Act of 1964 preserves lands in their "natural," "primeval" condition where "the earth and its community of life are untrammeled by man." Indigenous communities in other parts of the world see the consequences of this philosophy that excludes "man" from the "natural" community of life. The Sarayaku oppose national parks in Ecuador, knowing the endgame of that idea. They prefer the term "living forests," where Life is understood to include people and the knowledge that dwells within people's many relationships with other species.

In unpeopled mountains the South Platte has its headwaters. Then the river flows to the city, where it encounters another manifestation of our philosophy of nature: pipes dumping effluent. When we believe in duality, we create duality in the world. If we think that the city is unnatural, then it follows that urban river water has fallen from its natural condition. Being already "trammeled," the water may then serve as a garbage chute. The corollary of the depopulated, protected "natural" area is, then, the industrial dump. By the 1960s, downstream of the mountain parks, the South Platte in Denver was bermed with industrial waste, scrapped cars, and heaps of castoffs from a rapidly growing city. Factories piped untreated waste directly into the waterway.

Once established, a binary landscape of nature and nonnature reinforces itself. As the contrast between wilderness and reckless development grows more striking and alarming, the need for "wilderness" appears to grow while the rest of the landscape gets seemingly ever more unnatural. In such a world, cities are disdained by environmentalists but unpeopled parks, forest reserves, and designated wilderness areas are lauded. As the landscape's duality grows, it gets harder to perceive that humans belong in the world.

Hostility to cities runs deep within environmental, agrarian, and scientific traditions. Thomas Jefferson wrote that "mobs of great cities add just so much to the support of pure government, as sores do to the strength of the human body." Virtue resided in white, rural "husbandmen." Muir encountered Nature when he escaped "intercourse with stupid town stairs, and dead pavements." Aldo Leopold's "land" includes "soils, waters, plants, and animals" but no collection of human abodes. Indeed, for Leopold "man-made changes are of a different order than evolutionary changes" resulting in diseaselike disorganization. Within academia the ecology of cities was, until the last two decades, not a topic of much interest to ecologists, even

though the name of the discipline, *ökologie*, a German word coined by the nineteenth-century biologist Ernst Haeckel from the Greek *oikos-logia*, means the study of our dwelling place. Only in 1997 did the U.S. National Science Foundation add any urban areas to its flagship Long-Term Ecological Research program. Even today most biological field research stations are in areas remote from cities and towns.

The belief that nature is an Other, a separate realm defiled by the unnatural mark of humans, is a denial of our own wild being. Emerging as they do from the evolved mental capacities of primates manipulating their environment, the concrete sidewalk, the spew of liquids from the paint factory, and the city documents that plan Denver's growth are as natural as the patter of cottonwood leaves, the call of the young dipper to its kin, or the cliff swallow's nest.

Whether all these natural phenomena are wise, beautiful, just, or good are different questions. Such puzzles are best resolved by beings who understand themselves to be nature. Muir said that he walked "with nature," a companion. Many contemporary environmental groups use language that echoes Muir, placing nature outside us. "What's the return on nature?" asks the Nature Conservancy. "Just like any good investment, nature yields dividends." The masthead of the Royal Society for the Protection of Birds, Europe's largest environmental group, promises that the organization is "giving nature a home." Educators warn that if we spend too long on the wrong side of the divide, we'll develop a pathology, the disorder of nature deficit. In the post-Darwin world of networked kinship, though, we can extend Muir's thought and understand that we walk *within*. Nature yields no dividends; it contains the entire economy of every species. Nature needs no home; it is home. We can have no deficit of nature; we are nature, even when we are unaware of this nature. With the understanding that humans belong in this world, discernment of the

beautiful and the good can emerge from human minds networked within the community of life, not human minds peering in from outside.

It is midday in August and although the park's trees offer shade, most people sit or flop in the open. I lack their western toughness and park my plummy skin under the cottonwood, now two years into its annual beaver regimen of pruning and resprouting. Fourteen stems grow from the root fist, five of them over two meters tall, enough for a person-size pool of shade.

From my riverbank seat, I gaze up through the lime of cottonwood leaves. Each one hangs from a straplike petiole. The planes of leaves and straps are perpendicular, so when the leaf moves, it wags from side to side. Unlike the broad leaves of other tree species that bounce like hands petting a dog's head, cottonwood leaves sway like hands wiping a window. Its cousin, aspen, does the same but with a more furious rubbing motion. Puffs of wind set the cottonwood tree tapping, hard leaf edges batting one another. Stiffer wind brings slaps as the waxy leaves strike with glancing blows.

These are the sounds of a fast-growing cottonwood tree. Despite the heat and low air humidity, the slap of the leaves reveals their full hydration. I'm thirsty and feel an inner shrivel, but the cottonwood leaves are fat with water, their discourse with the air full of wet vigor. Roots, now likely ten or more meters long, plug into many layers and patches of soil, diversifying the supply chain to ensure a continuous and abundant flow of water. This cottonwood grows in a manner that is as close to hydroponic farming as one can find outside of a greenhouse. Unclouded sunshine illuminates the tree on most days. Water percolates around roots, keeping them moist at all times. A slow drip of dissolved nutrients comes from the river and the leaching of higher layers of soil, including runoff from a fertilized lawn. In such abundance a tree should spread the light throughout its body,

maximizing the flow of energy to its cells. Cottonwood leaf flutter achieves this end. Motion in the upper branches gives the topmost leaves a break from the sun's overwhelming power while opening a flickering supply of photons to lower leaves. The whole tree feeds.

The Confluence Park cottonwood's annual lancing recovery from beavers demonstrates its vitality. Unsurprisingly, cottonwood and its relatives are the favorites of geneticists breeding fast-growing trees for biofuel plantations. Along the river the cottonwood also is the favorite of leaf-chewing insects, nesting birds, and shade-seeking mammals. Without it riverbanks lose a keystone that holds much of the rest of the community in place. Unless upstream dams are managed to mimic the flows that nurture young cottonwoods, many species decline or disappear. Fortunately, this management strategy is now, very slowly, replacing the old ways, which focused on human needs only.

As the afternoon Sun blasts its heat onto the park, the metal receptacle behind me starts to ripen and release its trash-can smell. Although the aromas of foods, soils, and forests vary across the globe, public trash receptacles converge on one aroma, humanity's sensory common denominator. Robust undertone of apple rot. Fecal grace notes, no doubt from dog baggies here in fastidious Colorado. The prickly odor of microbial mats on the metal bottom, urban stromatolites. The cottonwood inhales this mix through its leaf pores and white slits on the soft skin of its green trunk. What the tree makes of this no one knows, but surely some of the odoriferous molecules bind to its cells, waking strange plant thoughts. What I make of the smell is clearer: time to move and, in this heat, take a dip.

The first lesson of my swim is that watery confluence takes time. Cherry Creek is pleasantly tepid. The South Platte punches the breath out of me when I reach its flow. Only after several minutes' downstream swim do the waters merge. My skin is learning Colorado hydrology. I'd studied the maps, but full immersion brings

home the lesson. The South Platte comes from the mountains, shock cold. Dams held and warmed the water, but cold water sinks, so any reservoir release from below the superficial water layers retains a chill. Cold water holds abundant oxygen; insects and fish thrive in the gill-pleasing river. Cherry Creek has its headwaters on the plains at Castlewood Canyon, a slice of wetness in an otherwise dry landscape. The creek then runs in a shallow channel through much of Denver and its outskirts. The creek's origin and pathway are over hot rocks and concrete. At Confluence Park little kids always choose to paddle in Cherry Creek, their feet bathed in warm water.

An exfoliation of my knees and elbows brings the second lesson. The South Platte's bed is a tumble of scoured rock. This creates agony for limbs kicking and pulling against the water's sweep, finding stone where water should be. Teenagers bold enough to run the upstream rapids without a tube or kayak have great fun, until they start their rock-strewn swim back to shore after the ride. Their curses are manifestations of a river that retains its power. In impounded rivers, silt sags out of the drowsy water, smothering water-carved rock with soft mud. Not so in the South Platte. No wonder mayflies rise from the surface at Confluence Park. The favored rocky habitat of mayfly young is in abundant supply, at least in this stretch of the river.

Cherry Creek is bedded with sand, some of it from the slow erosion of tributaries in the fields and canyons but much of it from the bleed of soil and subsoil that accompanies the building of any city. As I walk back to the tree from my swim, I step on deposits that likely originated in jackhammered city street repairs, land cleared for a mall, and the combined trickles of dozens of housing subdivisions.

Yesterday I would not have stepped into Cherry Creek. A thunderstorm to the east turned it to a turbid, choppy speedway. Today the creek's bed is marked with the scallops and curves left by the surge, meter-long aquatic dunes running crosswise to the current.

With the silt and sand came swarms of living cells. Whatever went down the city's storm drains flowed through the creek, including *Escherichia coli* bacteria, the denizens of warm-blooded intestines. Denver's Department of Environmental Health monitors concentrations of these fecal bacteria and posts the results to a map. Although *Escherichia coli* itself is only sometimes dangerous, the species is easy to monitor and serves as an indicator of the many other pathogens that rain carries from streets and escaped sewage. A click on my social media account tells me whether it would be wise to dunk in this effluvium. After a city-washing rain, Cherry Creek is tagged on my computer screen with a red pin, meaning that bacterial counts are above the safe limit for recreation. When runoff from the storm abates, the pin disappears. The South Platte sometimes also receives high scores, depending on the condition of urban tributaries and storm-water drains. That either waterway is ever swimmable, let alone swimmable for a large portion of the year's bathing suit days, is a revolutionary change from the past.

As the river becomes more friendly to human and nonhuman life, new sources of *Escherichia coli* arrive. One hundred Canada geese loafing upstream of Confluence Park will, in one day, extrude from their active cloacae more than ten kilograms of goose droppings. A bulky animal that maintains itself by tearing at grass has a gut with a profligate rear end. On some days one hundred is a low goose count. The wildlife on Mr. Roy's list all make their own contributions to the flow.

Unhoused people join the geese. The South Platte's dense willow thickets make good bedding places for those whose lives have become untethered from sewage pipes. Some are homeless. Others define home not as a roof but as the community that lives in interstitial spaces of the city. For many of these members of Denver's human population, the river and its parks are attractive places to include in

goose poop

Homeless

their routines. Without access to toilets connected to the municipal sewage plant, the bushes along the river must suffice. No matter how careful people might be, water quality suffers after rains.

As it was for the Arapaho and the first settlers from the East, the river is a gathering place and a camp. At sundown young travelers gather on the knoll just north of the cottonwood tree, an ingathering to greet, share, and plan for the night. In the morning, under the Fifteenth Street bridge, a gray-bearded man who had been "on the road for many years" told me that he started each day at the river with a rubdown for his body and a wash for his clothes. Like most of the travelers I spoke to at the river, he was happy to share some of his story but held his tongue about routes and sleeping places. Self-preservation requires circumspection. A young couple in smart hipster clothes, seemingly indistinguishable from other seventeen-year-olds, broke camp from under a cottonwood higher on the riverbank. The river was great, they said, much safer than many other parts of town. But settle in any one place for too long, and the human predators will find you. The geography of fear followed the river from the mountains and takes a new form in the city.

In winter the number of people who are sleeping outdoors becomes evident. Cottonwoods drop their foliage, revealing beaten-down leaves and cardboard-mattressed nesting sites all along the South Platte. Officially, a camping ban is in place, and police will move people on. But Denver's policies have vacillated. Portable toilets next to the river kept the water in better condition but attracted more sleepers to the park. Then the toilets were removed with the hope that the park's magnetism would diminish. A 2012 citywide ban on sleeping outside with "any form of cover or protection from the elements other than clothing" criminalized homelessness but has been unevenly enforced. A survey of Denver's homeless found that three quarters had been turned away from shelters for want of space,

Homeless...

despite increases in the number of beds. One third of those surveyed in winter said they had tried to circumvent the city's ban by sleeping in their clothes only, with no cover. Such exposure must be hard in Denver's winter, but it meets the letter of the law. Denver's beavers and other river rodents now have better lodging than the river's people, an urban novelty that is less than Edenic.

In the early 1970s, Joe Shoemaker did not buy the idea that nature was to be found by heading out of town. He and his friends launched their boats into the South Platte, planning an excursion through the waterways of Denver. As the water received their boat hulls, a municipal dump truck backed to the river. Joe stopped the dump truck from unloading its trash into the river and devoted much of the next four decades to giving the river "back to the people." With his fellow river visionaries, he used aesthetics as a guide, focusing not on preservation of the pretty spots but on reweaving life's community in the ugliest places on the river, including what is now Confluence Park.

Denver's Greenway Foundation now continues this work. The foundation's informal motto, inscribed on office equipment and inked into some skin, is "MSH." Make Shit Happen. *Escherichia coli* is not what they have in mind, although bacterial counts have declined thanks to the foundation's work. Instead, Shit Happens through meetings with city officials, alliances with state government, fundraising for riverside projects, management of youth education and internship programs, meetings with owners of downstream water rights and upstream dams, and advocacy for and celebration of the river through public events and the media. A philosophy underlies all this work: people and the river are not separate. If people acknowledge and act on that fact, good will emerge. Beauty and ugliness are guides in this work.

Joe Shoemaker was a Republican state senator and chair of the

state's Joint Budget Committee and Senate Appropriations Committee. He was a master of MSH, achieved not through solitary heroics but through working within the human social network to change the river and its lands. His insistence that parks should be accessible to all, even when they were in less attractive parts of town, was a vision of social justice. Beyond justice in the human community, he understood reciprocity in political ecology. People don't just visit the river; the river becomes part of people. In political terminology, he built an energized constituency for the river. In ecological terms, human politics is part of river dynamics, and the river is part of people's being. Strengthening connections ensures the survival and future vitality of the network, even as individual people, parks, or dams pass away. The public memorial celebration of Joe Shoemaker's life and work was held at Confluence Park in 2012. State dignitaries and Joe's friends stood on the walkway in front of the beaver-nipped cottonwood tree and added their voices to the flow of stories that is the river.

Shoemaker and the Greenway Foundation are not alone in their work. Other charitable groups, local governments, and Denver businesses now compose an ecosystem of river advocates. The river's voices are not all political movers. The engineers who puzzle over the best ways to repair old sewage and storm-water pipes, the geologists who plan water-cleaning retention pools, the biologists who manage the microbial communities of wastewater treatment plants, and the teachers who bring their students to the water are the network of quiet action that keeps the rivers alive.

The fallacy of believing that the human community dwells outside of nature is exposed at Confluence Park. City policies that emerge from primate minds affect the movements of all life-forms—people, bacteria, beavers, and cottonwoods—and meet in Cherry Creek and the South Platte. In the nineteenth century City Hall was washed away by the river. Now, from higher dry ground, local

government is one part of the confluence of relationships from which the river is made.

On an August afternoon at Confluence Park, a busload of disabled children arrive with half a dozen kayaking instructors. They head to the chute of rapids and swirling pools that engineers built into the South Platte when they designed the park. One after another, the children paddle the rapids in tandem with an instructor. An African American seven-year-old uses his blade leg to jump into the boat. He leans forward as the bow raises a spray. His mouth turns from an apprehensive frown to a big *O* of surprise, then to an openmouthed smile of delight. Lifted from the boat by another instructor, he high-fives his kayaking mentor. The run over, the boy then turns his attention to the sands of Cherry Creek, dodging among rocks to poke for shells, a favorite activity for kids at the park. John Muir might have paused awhile and smiled, seeing, as Joe Shoemaker did, beyond the "doomed . . . toil in town shadows while the white mountains beckon."

Later in the afternoon, a Latino family sets their blankets and bagged picnic on the grass near the cottonwood. The mother supervises, positioning grandparents and youngsters, delivering food to her charges. Two girls gulp their sandwiches, then break away from the group, drawn by the river. With self-forgetting pleasure they fall to work building a sand castle on Cherry Creek's foreshore. Whispering a secret to each other, they top their turrets with a sprig of cottonwood and a small sunflower plucked from the willows.

Warren, J. M., J. R. Brooks, F. C. Meinzer, and J. L. Eberhart. "Hydraulic Redistribution of Water from *Pinus ponderosa* Trees to Seedlings: Evidence for an Ectomycorrhizal Pathway." *New Phytologist* 178, no. 2 (2008): 382–94.

Weed, A. S., M. P. Ayres, and J. A. Hicke. "Consequences of Climate Change for Biotic Disturbances in North American Forests." *Ecological Monographs* 83, no. 4 (2013): 441–70.

Westerling, A. L., H. G. Hidalgo, D. R. Cayan, and T. W. Swetnam. "Warming and Earlier Spring Increase Western US Forest Wildfire Activity." *Science* 313, no. 5789 (2006): 940–43.

Zachos, J., M. Pagani, L. Sloan, E. Thomas, and K. Billups. "Trends, Rhythms, and Aberrations in Global Climate 65 Ma to Present." *Science* 292, no. 5517 (2001): 686–93.

Zhang, Y. G., M. Pagani, Z. Liu, S. M. Bohaty, and R. DeConto. (2013). "A 40-Million-Year History of Atmospheric CO_2." *Philosophical Transactions of the Royal Society A: Mathematical, Physical and Engineering Sciences* 371, no. 2001 (2013), doi:10.1098/rsta.2013.0096.

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Barbaccia, T. G. "A Benchmark for Snow and Ice Management in the Mile High City." Equipment World's Better Roads, August 25, 2010. www.equipmentworld.com/a-benchmark-for-snow-and-ice-management-in-the-mile-high-city/.

Belk, J. 2003. "Big Sky, Open Arms." *New York Times*, June 22, 2003. www.nytimes.com/2003/06/22/travel/big-sky-open-arms.html. Source of "Four black folks . . ."

Blasius, B. J., and R. W. Merritt. "Field and Laboratory Investigations on the Effects of Road Salt (NaCl) on Stream Macroinvertebrate Communities." *Environmental Pollution* 120, no. 2 (2002): 219–31.

Clancy, K. B. H., R. G. Nelson, J. N. Rutherford, and K. Hinde. "Survey of Academic Field Experiences (SAFE): Trainees Report Harassment and Assault." *PLoS ONE* 9, no. 7 (July 16, 2014), doi:10.1371/journal.pone.0102172. Source of "hostile field environments."

Coates, T. *Between the World and Me*. New York: Spiegel & Grau, 2015. Source of "Catholic, Corsican . . ."

Conathan, L., ed. "Arapaho text corpus." Endangered Language Archive, 2006. elar.soas.ac.uk/deposit/0083.

Davidson, J. "Former Legislator Joe Shoemaker Led Cleanup of the S. Platte River." *Denver Post*, August 16, 2012. www.denverpost.com/ci_21323273/former-legislator-joe-shoemaker-led-cleanup-s-platte.

Dillard, A. "Innocence in the Galapagos." *Harper's*, May 1975. Source of "pristine . . ." and "the greeting . . ."

Finney, C. *Black Faces, White Spaces: Reimagining the Relationship of African Americans to the Great Outdoors*. Chapel Hill: University of North Carolina Press, 2014. Source of "geographies of fear."

Greenway Foundation. *The River South Greenway Master Plan*. Greenwood Village, CO: Greenway Foundation, 2010. www.thegreenwayfoundation.org/uploads/3/9/1/5/39157543/riso.pdf.

———. *The Greenway Foundation Annual Report*. Denver, CO: Greenway Foundation, April 2012. www.thegreenwayfoundation.org/uploads/3/9/1/5/39157543/2012_greenway_current.pdf.

Gwaltney, B. Interviewed in "James Mills on African Americans and National Parks." To the Best of Our Knowledge, August 29, 2010. www.ttbook.org/book/james-mills-african-americans-and-national-parks. Source of "There are a lot of trees . . ."

Jefferson, T. "Notes on the State of Virginia." 1787. Available at Yale University Avalon Project. avalon.law.yale.edu/18th_century/jeffvir.asp. Source of "mobs of great cities . . ." and "husbandmen."

Kranjcec, J., J. M. Mahoney, and S. B. Rood. "The Responses of Three Riparian Cottonwood Species to Water Table Decline." *Forest Ecology and Management* 110, no. 1 (1998): 77–87.

Lanham, J. D. "9 Rules for the Black Birdwatcher." *Orion* 32, no. 6 (November 1, 2013): 7. Source of "Don't bird . . ."

Leopold, A. "The Last Stand of the Wilderness." *American Forests and Forest Life* 31, no. 382 (October 1925): 599–604. Source of "segregated . . . wilderness."

———. *A Sand County Almanac, and Sketches Here and There*. Oxford: Oxford University Press, 1949. Source of "soils, waters . . ." and "man-made changes."

Limerick, P. N. *A Ditch in Time: The City, the West, and Water*. Golden, CO: Fulcrum, 2012. Source of "perpetually brilliant" and "tonic, healthy."

Louv. R. *Last Child in the Woods*. Chapel Hill, NC: Algonquin, 2005. Source of "nature deficit."

Marotti, A. "Denver's Camping Ban: Survey Says Police Don't Help Homeless Enough." *Denver Post*, June 26, 2013. www.denverpost.com/politics/ci_23539228/denvers-camping-ban-survey-says-police-dont-help.

Meinhardt, K. A., and C. A. Gehring. "Disrupting Mycorrhizal Mutualisms: A Potential Mechanism by Which Exotic Tamarisk Outcompetes Native Cottonwoods." *Ecological Applications* 22, no. 2 (2012): 532–49.

Merchant, C. "Shades of Darkness: Race and Environmental History." *Environmental History* 8, no. 3 (2003): 380–94.

Mills, J. E. *The Adventure Gap*. Seattle, WA: Mountaineers Books, 2014. Source of "cultural barrier . . ."

Muir, J. *A Thousand-Mile Walk to the Gulf*. Boston: Houghton, 1916. Source of "would easily pick . . ."

———. *My First Summer in the Sierra*. Boston: Houghton, 1917. Source of "dark-eyed . . ." and "strangely dirty . . ."

———. *Steep Trails*. Boston: Houghton, 1918. Source of "bathed in the bright river," "last of the town fog," "brave and manly . . . and crime," "intercourse with stupid town . . . ," and "doomed . . ."

Negro Motorist Green Book. New York: Green, 1949.

Online Etymology Dictionary. "Ecology." www.etymonline.com/index.php?term=ecology.

Pinchot, G. *The Training of a Forester.* Philadelphia: Lippincott, 1914. Source of "pines and hemlocks . . . general and unfailing."

Revised Municipal Code of the City and County of Denver, Colorado. Chapter 38: Offenses, Miscellaneous Provisions, Article IV: Offenses Against Public Order and Safety, July 21, 2015. municode.com/library/co/denver/codes/code_of_ordinances?nodeId-TITIIREMUCO_CH38OFMIPR_ARTIVOFAGPUORSA.

Roden, J. S., and R. W. Pearcy. "Effect of Leaf Flutter on the Light Environment of Poplars." *Oecologia* 93 (1993): 201–7.

Royal Society for the Protection of Birds. "Giving Nature a Home." www.rspb.org.uk (accessed July 28, 2016).

Scott, M. L., G. T. Auble, and J. M. Friedman. "Flood Dependency of Cottonwood Establishment Along the Missouri River, Montana, USA." *Ecological Applications* 7, no. 2 (1997): 677–90.

Shakespeare, W. *As You Like It.* 1623. Available at http://www.gutenberg.org/ebooks/1121.

Strayed, C. *Wild.* New York: A. A. Knopf, 2012. Source of "myself a different story . . ."

The Nature Conservancy. "What's the Return on Nature?" www.nature.org/photos-and-video/photography/psas/natures-value-psa-pdf.pdf

U.S. Code, Title 16: Conservation, Chapter 23: National Wilderness Preservation System.

Vandersande, M. W., E. P. Glenn, and J. L. Walworth. "Tolerance of Five Riparian Plants from the Lower Colorado River to Salinity Drought and Inundation." *Journal of Arid Environments* 49, no. 1 (2001): 147–59.

Williams, T. T. *When Women Were Birds: Fifty-four Variations on Voice.* New York: Sarah Crichton Books, 2014. Source of "growing beyond . . . ," "things that happen . . . ," and "our own lips speaking."

Wohlforth, C. "Conservation and Eugenics." *Orion* 29, no. 4 (July 1, 2010): 22–28.

Callery Pear

Anderson, L. M., B. E. Mulligan, and L. S. Goodman. "Effects of Vegetation on Human Response to Sound." *Journal of Arboriculture* 10 (1984): 45–49.

Aronson, M. F. J., F. A. La Sorte, C. H. Nilon, M. Katti, M. A. Goddard, C. A. Lepczyk, P. S. Warren, et al. "A Global Analysis of the Impacts of Urbanization on Bird and Plant Diversity Reveals Key Anthropogenic Drivers." *Proceedings of the Royal Society of London B: Biological Sciences* 281, no. 1780 (2014), doi:10.1098/rspb.2013.3330.

Bettencourt, L. M. A. "The Origins of Scaling in Cities." *Science* 340, no. 6139 (2013): 1438–41.

Borden, J. *I Totally Meant to Do That.* New York: Broadway Paperbacks, 2011.

Buckley, C. "Behind City's Painful Din, Culprits High and Low." *New York Times*, July 12, 2013. www.nytimes.com/2013/07/12/nyregion/behind-citys-painful-din-culprits-high-and-low.html.

Calfapietra, C., S. Fares, F. Manes, A. Morani, G. Sgrigna, and F. Loreto. "Role of Biogenic Volatile Organic Compounds (BVOC) Emitted by Urban Trees on Ozone Concentration in Cities: A Review." *Environmental Pollution* 183 (2013): 71–80.

Campbell, L. K. "Constructing New York City's Urban Forest." In *Urban Forests, Trees, and Greenspace: A Political Ecology Perspective*, edited by L. A. Sandberg, A. Bardekjian, and S. Butt, 242–60. New York: Routledge, 2014.

Campbell, L. K., M. Monaco, N. Falxa-Raymond, J. Lu, A. Newman, R. A. Rae, and E. S. Svendsen. *Million TreesNYC: The Integration of Research and Practice.* New York: New York City Department of Parks and Recreation, 2014.

Cortright, J. *New York City's Green Dividend.* Chicago: CEOs for Cities, 2010.

Crisinel, A.-S., S. Cosser, S. King, R. Jones, J. Petrie, and C. Spence. "A Bittersweet Symphony: Systematically Modulating the Taste of Food by Changing the Sonic Properties of the Soundtrack Playing in the Background." *Food Quality and Preference* 24, no. 1 (2012): 201–4.

Culley, T. M., and N. A. Hardiman. "The Beginning of a New Invasive Plant: A History of the Ornamental Callery Pear in the United States." *BioScience* 57, no. 11 (2007): 956–64. Source of "marvel."

de Langre, E. "Effect of Wind on Plants." *Annual Review of Fluid Mechanics* 40 (2008): 141–68.

Dodman, D. "Blaming Cities for Climate Change? An Analysis of Urban Greenhouse Gas Emissions Inventories." *Environment and Urbanization* 21, no. 1 (2009): 185–201.

Engels, S., N.-L. Schneider, N. Lefeldt, C. M. Hein, M. Zapka, A. Michalik, D. Elbers, A. Kittel, P. J. Hore, and H. Mouritsen. "Anthropogenic Electromagnetic Noise Disrupts Magnetic Compass Orientation in a Migratory Bird." *Nature* 509, no. 7500 (2014): 353–56.

Environmental Defense Fund. "A Big Win for Healthy Air in New York City." *Solutions*, Winter 2014, page 13.

Farrant-Gonzalez, T. "A Bigger City Is Not Always Better." *Scientific American* 313 (2015): 100.

Gick, B., and D. Derrick. "Aero-tactile Integration in Speech Perception." *Nature* 462, no. 7272 (November 26, 2009), doi:10.1038/nature08572.

Girling, R. D., I. Lusebrink, E. Farthing, T. A. Newman, and G. M. Poppy. "Diesel Exhaust Rapidly Degrades Floral Odours Used by Honeybees." *Scientific Reports* 3 (2013), doi:10.1038/srep02779.

Hampton, K. N., L. S. Goulet, and G. Albanesius. "Change in the Social Life of Urban Public Spaces: The Rise of Mobile Phones and Women, and the Decline of Aloneness over 30 Years." *Urban Studies* 52, no. 8 (2015): 1489–1504.

Li, H., Y. Cong, J. Lin, and Y. Chang. "Enhanced Tolerance and Accumulation of Heavy Metal Ions by Engineered *Escherichia coli* Expressing *Pyrus calleryana* Phytochelatin Synthase." *Journal of Basic Microbiology* 55, no. 3 (2015): 398–405.

Lu, J. W. T., E. S. Svendsen, L. K. Campbell, J. Greenfeld, J. Braden, K. King, and N. Falxa-Raymond. "Biological, Social, and Urban Design Factors Affecting