



## Fresh Water

The amount of moisture on Earth has not changed. The water the dinosaurs drank millions of years ago is the same water that falls as rain today. But will there be enough for a more crowded world?

By Barbara Kingsolver

We keep an eye out for wonders, my daughter and I, every morning as we walk down our farm lane to meet the school bus. And wherever we find them, they reflect the magic of water: a spider web drooping with dew like a rhinestone necklace. A rain-colored heron rising from the creek bank. One astonishing morning, we had a visitation of frogs. Dozens of them hurtled up from the grass ahead of our feet, launching themselves, white-bellied, in bouncing arcs, as if we'd been caught in a downpour of amphibians. It seemed to mark the dawning of some new aqueous age. On another day we met a snapping turtle in his primordial olive drab armor. Normally this is a pond-locked creature, but some murky ambition had moved him onto our gravel lane, using the rainy week as a passport from our farm to somewhere else.

The little, nameless creek tumbling through our hollow holds us in thrall. Before we came to southern Appalachia, we lived for years in Arizona, where a permanent runnel of that size would merit a nature preserve. In the Grand Canyon State, every license plate reminded us that water changes the face of the land, splitting open rock desert like a peach, leaving mile-deep gashes of infinite hue. Cities there function like space stations, importing every ounce of fresh water from distant rivers or fossil aquifers. But such is the human inclination to take water as a birthright that public fountains still may bubble in Arizona's town squares and farmers there raise thirsty crops. Retirees from rainier climes irrigate green lawns that impersonate the grasslands they left behind. The truth encroaches on all the fantasies, though, when desert residents wait months between rains, watching cacti tighten their belts and roadrunners skirmish over precious beads from a dripping garden faucet. Water is life. It's the briny broth of our origins, the pounding circulatory system of the world, a precarious molecular edge on which we survive. It makes up two-thirds of our bodies, just like the map of the world; our vital fluids are saline, like the ocean. The apple doesn't fall far from the tree.

Even while we take Mother Water for granted, humans understand in our bones that she is the boss. We stake our civilizations on the coasts and mighty rivers. Our deepest dread is the threat of having too little moisture—or too much. We've lately raised the Earth's average temperature by .74°C (1.3°F), a number that sounds inconsequential. But these words do not: flood, drought, hurricane, rising sea levels, bursting levees. Water is the visible face of climate and, therefore, climate change. Shifting rain patterns flood some regions and dry up others as nature demonstrates a grave physics lesson: Hot air holds more water molecules than cold.

The results are in plain sight along pummeled coasts from Louisiana to the Philippines as superwarmed air above the ocean brews superstorms, the likes of which we have never known. In arid places the same physics amplify evaporation and drought, visible in the dust-dry farms of the Murray-Darling River Basin in Australia. On top of the Himalaya, glaciers whose meltwater sustains vast populations are dwindling. The snapping turtle I met on my lane may have been looking for higher ground. Last summer brought us a string of floods that left tomatoes blighted on the vine and our farmers needing disaster relief for the third consecutive year. The past decade has brought us more extreme storms than ever before, of the kind that dump many inches in a day, laying down crops and utility poles and great sodden oaks whose roots cannot find purchase in the saturated ground. The word "disaster" seems to mock us. After enough repetitions of shocking weather, we can't remain indefinitely shocked.

How can the world shift beneath our feet? All we know is founded on its rhythms: Water will flow from the snowcapped mountains, rain and sun will arrive in their proper seasons. Humans first formed our tongues around language, surely, for the purpose of explaining these constants to our children. What should we tell them now? That "reliable" has been rained out, or died of thirst? When the Earth seems to raise its own voice to the pitch of a gale, have we the ears to listen?

A world away from my damp hollow, the Bajo Piura Valley is a great bowl of the driest Holocene sands I've ever gotten in my shoes. Stretching from coastal, northwestern Peru into southern Ecuador, the 14,000-square-mile Piura Desert is home to many endemic forms of thorny life. Profiles of this eco-region describe it as dry to drier, and Bajo Piura on its southern edge is what anyone would call driest. Between January and March it might get close to an inch of rain, depending on the whims of El Niño, my driver explained as we bumped over the dry bed of the Río Piura, "but in some years, nothing at all." For hours we passed through white-crusting fields ruined by years of irrigation and then into eye-burning valleys beyond the limits of endurance for anything but sparse stands of the deep-rooted *Prosopis pallida*, arguably nature's most arid-adapted tree. And remarkably, some scattered families of *Homo sapiens*.

They are economic refugees, looking for land that costs nothing. In Bajo Piura they find it, although living there has other costs, and fragile drylands pay their own price too, as people exacerbate desertification by cutting anything living for firewood. What brought me there, as a journalist, was an innovative reforestation project. Peruvian conservationists, partnered with the NGO Heifer International, were guiding the population into herding goats, which eat the protein-rich pods of the native mesquite and disperse its seeds over the desert. In the shade of a stick shelter, a young mother set her dented pot on a dung-fed fire and showed how she curdles goat's milk into white cheese. But milking goats is hard to work into her schedule when she, and every other woman she knows, must walk about eight hours a day to collect water.

Their husbands were digging a well nearby. They worked with hand trowels, a plywood form for lining the shaft with concrete, inch by inch, and a sturdy hand-built crank for lowering a man to the bottom and sending up buckets of sand. A dozen hopeful men in stained straw hats stood back to let me inspect their work, which so far had yielded only a mountain of exhumed sand, dry as dust. I looked down that black hole, then turned and climbed the sand mound to hide my unprofessional tears. I could not fathom this kind of perseverance and wondered how long these beleaguered people would last before they'd had enough of their water woes and moved somewhere else.

Five years later they are still bringing up dry sand, scratching out their fate as a microcosm of life on this planet. There is nowhere else. Forty percent of the households in sub-Saharan Africa are more than a half hour from the nearest water, and that distance is growing. Australian farmers can't follow the rainfall patterns that have shifted south to fall on the sea. A salmon that runs into a dam when homing in on her natal stream cannot make other plans. Together we dig in, for all we're worth.

Since childhood I've heard it's possible to look up from the bottom of a well and see stars, even in daylight. Aristotle wrote about this, and so did Charles Dickens. On many a dark night the vision of that round slip of sky with stars has comforted me. Here's the only problem: It's not true. Western civilization was in no great hurry to give up this folklore; astronomers believed it for centuries, but a few of them eventually thought to test it and had their illusions dashed by simple observation.

Civilization has been similarly slow to give up on our myth of the Earth's infinite generosity. Declining to look for evidence to the contrary, we just knew it was there. We pumped aquifers and diverted rivers, trusting the twin lucky stars of unrestrained human expansion and endless supply. Now water tables plummet in countries harboring half the world's population. Rather grandly, we have overdrawn our accounts.

In 1968 the ecologist Garrett Hardin wrote a paper called "The Tragedy of the Commons," required reading for biology students ever since. It addresses the problems that can be solved only by "a change in human values or ideas of morality" in situations where rational pursuit of individual self-interest leads to collective ruin. Cattle farmers who share a common pasture, for example, will increase their herds one by one until they destroy the pasture by overgrazing. Agreeing to self-imposed limits instead, unthinkable at first, will become the right thing to do. While our laws imply that morality is fixed, Hardin made the point that "the morality of an act is a function of the state of the system at the time it is performed." Surely it was no sin, once upon a time, to shoot and make pies of passenger pigeons.

Water is the ultimate commons. Watercourses once seemed as boundless as those pigeons that darkened the sky overhead, and the notion of protecting water was as silly as bottling it. But rules change. Time and again, from New Mexico's antique irrigation codes to the UN Convention on International Watercourses, communities have studied water systems and redefined wise use. Now Ecuador has become the first nation on Earth to put the rights of nature in its constitution so that rivers and forests are not simply property but maintain their own right to flourish. Under these laws a citizen might file suit on behalf of an injured watershed, recognizing that its health is crucial to the common good. Other nations may follow Ecuador's lead. Just as legal systems once reeled to comprehend women or former slaves as fully entitled, law schools in the U.S. are now reforming their curricula with an eye to understanding and acknowledging nature's rights.

On my desk, a glass of water has caught the afternoon light, and I'm still looking for wonders. Who owns this water? How can I call it mine when its fate is to run through rivers and living bodies, so many already and so many more to come? It is an ancient, dazzling relic, temporarily quarantined here in my glass, waiting to return to its kind, waiting to move a mountain. It is the gold standard of biological currency, and the good news is that we can conserve it in countless ways. Also, unlike petroleum, water will always be with us. Our trust in Earth's infinite generosity was half right, as every raindrop will run to the ocean, and the ocean will rise into the firmament. And half wrong, because we are not important to water. It's the other way around. Our task is to work out reasonable ways to survive inside its boundaries. We'd be wise to fix our sights on some new stars. The gentle nudge of evidence, the guidance of science, and a heart for protecting the commons: These are the tools of a new century. Taking a wide-eyed look at a watery planet is our way of knowing the stakes, the better to know our place.

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