

# EXODUS

The early spring sky is a deep saturated blue next to the muddy brown of the dry, scrubby hills of the San Miguel Mountains in southern California. Save for the thrum of a distant bulldozer, this open, unassuming place is quiet. It's visually calm, too, with few dramatic features: just sandy, sunbaked ground, gentle slopes, and low shrubs and grasses of varying russet shades. The hills seem to continue indefinitely into the distance, crisscrossed by rutted dirt roads and thin walking trails.

The creatures I've come to see are equally unassuming. *Euphydryas editha*, aka Edith's checkerspot butterflies, are so slight and unobtrusive that they would be barely detectable in any amateurish photograph I might shoot on the iPhone tucked into my back pocket. The plant they live and feed on, the dwarf plantago, is equally modest. It grows just a few inches high, with needle-like leaves and tiny, translucent white flowers on thin stalks. It's about as dazzling as dry grass. You could easily crush it underfoot—as I did—without noticing its presence at all.

The butterfly expert accompanying me—the perfectly named Spring Strahm—brought me here, bouncing along in her four-wheel-drive truck, over roads that had been closed to the public since 2015. Finding a checkerspot butterfly in these mountains, she tells me, is “kind of like seeing a unicorn,” but she's famously good at it.

We amble slowly into the hills, Strahm occasionally dropping to hands and knees to inspect some low-growing grasses for hidden butterflies and turn over a few leaves in search of caterpillars. After the better part of an hour, having acquired nothing beyond a few rivulets of sweat, she decides we've had enough. It's time to head back to the truck and try to find the elusive checkerspot elsewhere. I unscrew my water bottle for a quick swig, adjust my backpack, and follow her back down the trail.

A few minutes later, she stops short. She stands there unmoving, blocking the path. Then I notice she is staring at the wizened hiking boots on her feet. I look down. A low fluttering cloud of butterflies<sup>1</sup> hovers around our ankles.



I'd come to see the checkerspots thanks to Camille Parmesan. With her mane of dark curls and ice-blue eyes, Parmesan could pass as an earthy, compact version of Wonder Woman, if Wonder Woman liked dirt and bugs instead of lassoes and invisible jets and spoke in regional slang. Parmesan grew up in an Italian family in Texas. She freely uses the word *ain't* and prefers *honker* over *large*, and *out the wazoo* over *abundant*.

Parmesan first started studying checkerspots as a graduate student in ecology in the 1980s, after giving up on the study of birds (they wake up too early), lab-reared primates (too unnatural), and honeybees (too many stings). She liked butterflies, she says, because they were easy to watch in their natural environment and amenable to manipulation. She'd spent her childhood camping out with her mom, studying field guides and identifying plants and birds. Her mother loved botany but by profession was a geologist, working, like many in Parmesan's Texan family, in the oil industry. She'd provided her daughter with a uniquely geological spin on her camp-side botanical teachings. From her, Parmesan had learned about the deep history of wild species through geological time, about how they'd advance northward during warm periods and then retreat during cold ones, rising and falling along with the ice ages.

By the time she entered the world of checkerspot biology, conditions were dire for the field's diminutive subject. She knew, from dusty museum records and the prodigious personal collections of amateur butterfly enthusiasts, that the checkerspot had once been common, with colonies up and down the mountainous west coast of North America, from Baja California in Mexico to British Columbia in Canada. Legend had it that one enterprising butterfly collector had caught masses of them just by riding his motorcycle along the coast, one arm extended, butterfly net in hand. But for years their numbers had been declining.

The reason was pretty clear to most ecologists. The checkerspot was not able to really move much. As fuzzy black caterpillars, they rarely inched more than a handful of feet from the plants from which they hatched. Even after they unfurled their spotted wings, they stayed low to the ground and close to home, rarely flying more than a few meters from the scenes of their metamorphoses. Wind or rain would send them clambering with their thin spindly legs to the base of their dwarf plantagos, settling as low to the ground as possible to prevent their delicate bodies from being inadvertently swept away in a gust. They were widely known, in the field, as "sedentary," the entomological equivalent of homebodies.

Meanwhile they were getting squeezed. The dwarf plantagos they preferred were drying out in the southern part of their range, as the carbon-torched climate in northern Mexico grew hotter and drier. The urban sprawl of growing cities such as Los Angeles and San Francisco, meanwhile, swallowed up the gentle, sun-drenched slopes of the northern end of their range. Trapped between climate change on one end and urban expansion on the other, the checkerspot, most butterfly experts believed, was doomed.

It was a pretty simple story, being told in a range of variations across the globe. Parmesan had no illusions about changing the basic plotline, but she thought she might be able to document the specific ways in which the butterfly responded to the pressures it faced. A few

of the colonies might exhibit some subtle local adaptation, perhaps, or emit some striking signal before their inevitable collapse. If she conducted a proper census, then crunched the data, with some sophisticated statistical analyses she might be able to scrape a passable dissertation out of it. Her research would be, in a way, an elaborate documentation of a species' death throes, but that's what a lot of ecology had become in this age of mass extinctions. There were worse ways to get a PhD.

Plus, the butterflies hatched in glorious spring weather, didn't wake up until ten A.M., and were most easily spotted on sunny windless days. For four years, Parmesan spent her summers driving up and down the West Coast, hunting for butterflies by day and camping out in the mountains by night.

She didn't have particularly high hopes for her results—"I wasn't sure I would come out with anything at the end of it," she says. Then she started analyzing the data. The butterfly's numbers had contracted, compared to the historical records, which was what she'd expected. But there was something more, too: a signal in the noise, one that would upend her career and draw the attention of journalists like me from all over the world.

"I start looking at the pattern," she told me when we met at a Tex-Mex restaurant in Austin. "And I see that the extinction rate is really high in the south, and really low in the north and in the mountains. I was expecting this complex pattern, and I thought, this is really simple! ... I couldn't have gotten clearer data."

Like the wild species her mom had told her about on summer camping trips years ago, the butterfly had responded to the changing climate the way wild species had in millennia past.

It had moved.

"It's just shifting its range northward and upward!" she says. The finding, now more than two decades old, still fills her with surprised delight. She gathers her hair with both hands and tosses it behind her back with a little shimmy. "My goodness!"<sup>2</sup>



Parmesan published results from her butterfly survey<sup>3</sup> in 1996. At that time, only two other studies had documented a wild species shifting its range in response to climate change, one in plant communities on the tops of mountains in the Alps and another in sea stars and mussels in Monterey Bay. Those were "very good papers," she says, "but very small areas." They could be easily dismissed as anomalous. While life-saving movements in response to climate change seemed theoretically possible at the time, few scientists dared to hope that wild species would be able to accomplish them at any meaningful scale.

Parmesan's study of checkerspots, in contrast, showed a consistent pattern of movement across half of North America. She got a coveted single-author paper in the prestigious journal *Nature* and instantly ascended to the top ranks of climate change science. She became a member of the United Nations Intergovernmental Panel on Climate Change, a position that allowed her to review nearly a thousand other ecological studies, searching for the same

signal she'd found in the checkerspots. Indeed, the butterfly's poleward shift was no anomaly. The same pattern could be found in fifty-seven species of butterflies in Europe. And in marine organisms. And in birds.

Scientists who studied everything<sup>4</sup> from plankton to frogs started reexamining their data. They found that of the four thousand species that they'd tracked, between 40 and 70 percent had altered their distribution over the past handful of decades, around 90 percent into cooler lands and waters in sync with the changing climate. On average, terrestrial species were moving nearly twenty kilometers every decade, in a steady march toward the poles. Marine creatures were moving into cooler waters even faster, moving about seventy-five kilometers per decade on average. Those averages obscured some spectacular leaps among specific creatures. Atlantic cod, for example, had shifted more than two hundred kilometers per decade. In the Andes, frogs and fungi species had climbed four hundred meters upward over the past seventy years.

Even the most seemingly immobile wild species were on the move. Coral polyps, which over decades form the branching thickets and sprawling nubby plates of the world's coral reefs, may seem the picture of stately immobility. They are literally stone walls, absorbing the fury of the open ocean, protecting millions of fish species and seaside communities. And yet the coral reefs are moving, too. Scientists peering through glass-bottomed boats had been surveying corals around the islands of Japan since the 1930s. In 2011 scientists discovered that two species in particular—*Acropora hyacinthus* and *Acropora muricata*<sup>5</sup>—had been moving northward at a speed of fourteen kilometers every year.

In the meteorologist Edward Lorenz's famous formulation, the flapping of a butterfly's wings creates a minor atmospheric disturbance that, because of the complex interplay of interconnected factors, ends up altering the path of a distant tornado. That was a poetic metaphor for one of my favorite insights, that small changes can have unexpectedly large effects. The whole point of the metaphor is that a butterfly's flight is a seemingly insignificant factor, but still I figure he must have had something like the majestic intercontinentally migrating monarch butterfly in mind when he coined that turn of phrase. He couldn't have been thinking of checkerspots. Having met a few of these butterflies and witnessed their unimpressively slow, low flying, I doubt their collective flapping could cause even a whisper of breeze, let alone any kind of major meteorological event.

And yet the little butterfly had triggered an outsized effect of a kind, its unlikely journey lifting the veil on a dramatic global phenomenon. In Unalakeet, on the northwest coast<sup>6</sup> of Alaska, hunters find parasites from more than 950 miles southeast in British Columbia squirming under the skin of the wild birds they hunt. Red foxes spread north into Arctic fox territory. In Cape Cod boat owners encounter manatees from Florida casually sipping water from drainage pipes at their marinas.

A wild exodus has begun.<sup>7</sup> It is happening on every continent and in every ocean.



The towering Dhauladhar mountain range, with its eighteen-thousand-foot peaks, looms over the precariously perched village of McLeodganj, nestled on a forested ridge nearly seven thousand feet up in the foothills of the Himalayas. I arrived after a terrifying twelve-hour taxi ride from New Delhi. My driver, used to the sea-level pressure of the plains and dressed in a crinkled short-sleeve cotton shirt, was dizzy, cold, and fed up by the time we reached the center of McLeodganj late that night. He pulled over and discharged us, along with six months' worth of luggage, in the middle of the village square, several vertiginous kilometers from our hotel, and fled.

It seemed unforgivable at the time, but my attitude softened the following morning, as the mist burned off, revealing the town's heart-stopping panoramas. The Himalayan pine trees that cling to the mountainsides abruptly peter out in the rocky upper reaches of the peaks, creating a natural border known as the "tree line." Above the line rise barefaced cliffs, streaked by narrow waterfalls. Just hauling my body around at this altitude required substantive feats of navigational prowess and physical stamina. I wouldn't have wanted to try driving a rickety Delhi taxicab here either. The narrow, unmarked alleys were steep, the air thin, and deathly, unfenced precipices appeared around every corner. I arrived equipped with the latest in mountain gear, purchased at great expense from specialty shops for my brief stay in these mountains: a nylon jacket coated in polyurethane, sturdy waterproof hiking boots, special sweat-wicking woolen socks. They didn't do much to reduce the overwhelming feeling of being unprepared for the forbidding landscape. I huffed and puffed along the trails above the town, thankful that the sole witnesses to my growing discomfort were the rhesus monkeys scampering through the pines above, and the friendly local dogs that followed patiently behind me.

If any geographic feature should arrest movement, it is the Himalayas. They form an impassable wall, geographically speaking. On one side, the frigid air of the north collects, barred from reaching the tropical southern plains below. On the other, approaching monsoon clouds smash into the peaks, dropping their liquid interiors on the ridges as if released by a recently opened sluice.

And yet even here, up against this giant wall, living things inch, drift, and climb, untethered to any permanent anchors. Every year the young saplings<sup>8</sup> in the forests establish themselves a little bit higher up the slopes. When curious scientists marked a transect and measured the age of the trees along it, they discovered what was happening. Since 1880 the forests had steadily climbed the mountainside, moving nineteen meters uphill every decade. They bring with them the rhododendrons and apple trees, and the insects that live in and on them. People in Tibet, a high-elevation tundra on the northern side of the Himalayas, first reported suffering from strange itchy bites in 2009. It was the first time anyone there could ever remember being bit by a mosquito.

People are on the move here,<sup>9</sup> too, their migrant tracks wending into the valleys, around the curves of the mountainsides, and over the high alpine passes of the Himalayas. More than a hundred thousand people from the Tibetan plateau steadily trickle in to McLeodganj some

five hundred miles away, fleeing the Chinese government's persecution and repression. Many are Buddhist monks and nuns who followed the fourteenth Dalai Lama, who arrived in 1959 and now live in a run-down temple complex just down the narrow winding road from my modest hotel. I saw them in their bright saffron robes sipping cappuccinos in the local cafés and amiably ascending the steep rocky trails around town in their simple sandals and woolen shawls, chatting to one another on smartphones tucked into their robes. Unlike me, who arrived via airplane and taxicab, they had walked over the mountains to get here. Each of their perilous journeys over glaciers and high mountain passes took a month.



The news today—on any day—is full of stories of people on the move. African migrants fleeing starvation and persecution cram themselves onto leaky boats to cross the Mediterranean. Afghans and Syrians wilting in tattered camps are herded back to the bombs and beheadings they've fled. Women hauling toddlers on their hips walk hundreds of miles from Honduras and Guatemala to reach the U.S. border. As I write this, my phone buzzes beside me with breaking news: the governor of Florida has ordered the evacuation of more than a million Floridians, as a category four hurricane approaches, threatening disaster. The roads on the peninsula will soon be swarming with families seeking higher ground.

The movements of wild species are shaped primarily by the constraints of their own biological capacities and the particular qualities of the geographic features they encounter on their journeys, such as the steepness of mountainsides and the speed and saltiness of ocean currents. The paths taken by human migrants, in contrast, are shaped primarily by abstractions. Distant political leaders lay down rules based on political and economic concerns, allowing some in and keeping others out. They draw and redraw invisible lines on the landscape in biologically arbitrary ways. Transportation companies offer passage on certain routes and not others, depending less on the wind, weather, and tides than on which ones net them the highest margins of profit.

We move, nevertheless. More people live outside their countries of birth today than at any time before. The reasons vary. Between 2008 and 2014,<sup>10</sup> floods, storms, earthquakes, and the like sent 26 million people into motion each year. Violence and persecution in unstable societies stir other journeys. In 2015 over 15 million people were forced to flee their countries, more than at any time since the Second World War. For every person who crossed an international border, there were more than twenty-five others whose peregrinations had yet to impinge on one of those invisible lines. All these specific flows collapse into a broader one, shifting our populations from the countryside into the world's cities. By 2030 the accelerating movement of people into metropolises will result in the majority of us being city dwellers for the first time ever. And the extent of our movements is likely to grow for years to come. By 2045 the spread of deserts in sub-Saharan Africa is expected to compel 60 million inhabitants to pick up and leave. By 2100 rising sea levels could add another 180

million to their ranks.

These statistics, eye-popping as they are, offer only a partial snapshot of the scale and pace of our current era of migration. There is no central authority that collects data on human migration. People who cross international borders may get recorded by some authorities on one side or the other, but only in some places and some of the time.

Authorities mostly count who's coming in, shielding their eyes from the parades of people who leave. Many people on the move try to escape official notice, traveling furtively undercover; or they move within borders, avoiding surveillance altogether. Government officials may try to estimate<sup>11</sup> the number of people who cross their borders without permission, but the best they have are estimates, based on fragmentary evidence: the number of people border authorities catch in the act; the number of people caught in the act who admit they will try to do it again; the number who do, in fact, try again and are caught once more. Whole categories of human migrants—those who go back and forth over borders, for example, for seasonal work or harvests—are not included in any official statistics.

Given all this, the true number of human migrants is not fully knowable. But the central fact is clear: like our wild cousins, people are on the move, too.

Over the past handful of years, as the climate's grip on how we move has become increasingly apparent, now evidence of the centrality of migration in our biology and history has emerged. New genetic techniques have revealed how deep into the past our story of migration runs. New navigational technologies have uncovered the scale and complexity of both human and wild movements around the planet. While our coming migrations may not proceed fast enough to keep pace with our shifting climate, a growing body of evidence suggests they may be our best shot at preserving biodiversity and resilient human societies.



The next great migration is upon us. The trouble is, from the earliest years of childhood, we are taught that plants, animals, and people belong in certain places. It's why we call the goose the "Canada" goose, the maple the "Japanese" maple. It's why we use the camel to represent the Middle East and the kangaroo to stand for Australia. It's why we use our imagined or known continental origins as shorthand to describe ourselves in everything from our social interactions to our medical forms: we are "Americans," or "Africans," or "Asians," or "Europeans," a centuries-old marker encoded visually in the color of our skin and the texture of our hair, regardless of where we might happen to live.

By describing peoples and species as "from" certain places, we invoke a specific idea about the past. It traces back to the eighteenth century, when European naturalists first started cataloging the natural world. Assuming that peoples and wild creatures had stayed mostly fixed in their places throughout history, they named creatures and peoples based on those places, conflating one with the other as if they'd been joined since time immemorial.

Those centuries-old taxonomies formed the foundation for modern ideas about our

biological history. Today a range of fields from ecology to genetics and biogeography allude to long periods of isolation in our distant past, when species and peoples remained ensconced in their habitats, each evolving in their separate locales.

This stillness at the center of our ideas about the past necessarily casts migrants and migrations as anomalous and disruptive. Early twentieth-century naturalists dismissed migration as an ecologically useless and even dangerous behavior, warning of “disastrous results”<sup>12</sup> should migrant animals be allowed to move freely. Conservationists and other scientists warned that human migration, too, would precipitate biological calamity. The most predictable outcome of human migration—sexual reproduction between people who traced their ancestry to different places—would result in degenerated, mutant hybrids, leading scientists proclaimed.

The free movement of peoples would allow hungry hordes of foreigners to overrun the country, postwar population biologists said, pointing to their studies of population dynamics in butterflies and rats. Would-be human migrants, one wrote, would not “starve gracefully.”<sup>13</sup> They’d migrate, to our ruin. Wild species on the move,<sup>14</sup> late twentieth-century ecologists added, would trigger “environmental apocalypse.”

These ideas about migrants and migration were often based on flimsy evidence: mysterious female body parts that don’t, in fact, exist; hybrid monsters that have never been found; a storied spectacle of wild migrants leaping into the Arctic sea that never, in fact, happened; a phenomenon of crazed aggression and voraciousness produced by crowding that doesn’t actually transpire. For decades, they suppressed the truth about the promise of migration, regardless. Geneticists who discovered the fact of our common migratory history minimized its extent. Biogeographers puzzling over the wide distribution of species and peoples across the planet dismissed the possibility of active movement, presuming instead that ancient geological forces passively carried them around.

Scientific ideas that cast migration as a form of disorder were not obscure theoretical concerns confined to esoteric academic journals. They were widely disseminated in popular culture. They influenced the closing of the U.S. borders in the early twentieth century, inspired the fascist dreams of Nazis, and provided the theoretical ballast for today’s generation of anti-immigration lobbyists and policy makers.

They roil fear and panic about the next great migration today, reshaping the politics of the most powerful nations on earth. Conservationists warn of the “invasive” appetites of alien species moving into habitats already populated by native ones. Biomedical experts warn of migrant species carrying foreign microbes into new places, sparking epidemics that will threaten the public health. Foreign policy experts predict instability and violence as the necessary result of mass migrations forced by climate change. Antimigrant politicians speak of economic calamity and worse.

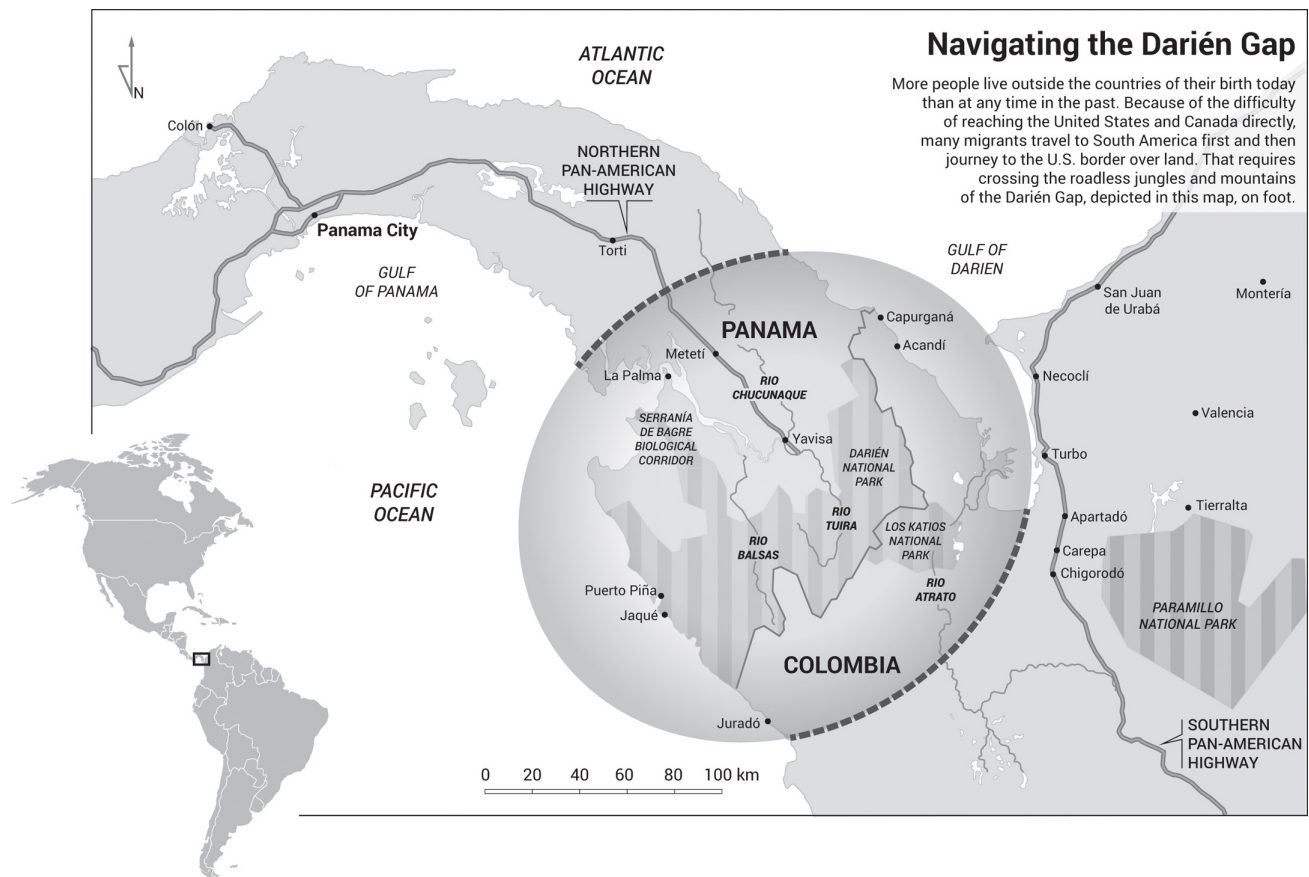


The idea of migration as a disruptive force has fueled my own work as a journalist. For years I reported and wrote about the damage caused by biota on the move. I investigated how mosquitoes flitting across landscapes and nations infected societies with malaria parasites, shaping the rise and fall of empires, and how cholera bacteria traveling across continents in the bodies of traders and travelers triggered pandemics that reshaped the global economy. The disruptive impact of these microbes out of place conformed to my sense of movement as aberrant, something anomalous that needed to be examined and explained. It echoed that other strange fact that required explanation, the incongruity of my own body in space, unmoored by the movement in my family's past.

My migratory past traces back to the late nineteenth century, to two fishing villages in Gujarat, along the western shores of India. These villages, with their coasts jutting into the Arabian Sea, had first been settled by migrants from Europe, Southeast Asia, and Africa. Since then they'd been repeatedly buffeted by waves of traders, invaders, and colonists who joined the locals: Persians, Macedonians, Mughals, and British, among others.

My great-grandfathers grew up in these villages. One was a hunchbacked peddler who hawked cotton saris; the other owned a small shop selling metal cooking vessels. They both grew up with customs designed to resist the migratory tides around them. One stricture, for example, held that they could marry only into families that followed the same sect of Jainism theirs did and who lived no farther than one village over. Considering that less than 1 percent of the population<sup>15</sup> of the entire state of Gujarat today are Jains of any sect at all, those rules likely made for some pretty slim pickings.

Their sons, my grandfathers, adhered to family custom and married the young daughters of wealthy village families, but that did not stop them from joining the nineteenth century's global migration from the countryside into the newly industrializing cities. One settled in teeming Mumbai, cramming his five children into a two-room flat in a *chawl* tenement, a new kind of building constructed specifically for the working-class migrants like him who had flooded the city. The other went south to Tamil-speaking Coimbatore, where he moved into a small house owned by the company that employed him. There, on a pile of mattresses in a sparsely furnished stone-floored room, my grandmother gave birth to eight children, of whom six survived to adulthood. In Coimbatore and Mumbai, these two now-far-flung families poured their resources into two of their eleven progeny: my mother and father, who each got an education and went to medical school.



A new migratory path opened up just as they graduated. Since the early twentieth century, U.S. borders had been closed<sup>16</sup> to people from Asia, Africa, and southern and eastern Europe, having been deemed by the then-cutting-edge science of eugenics to be mentally defective and biologically undesirable. But the need for medical workers to staff the newly established government programs of Medicare and Medicaid had created an acute shortage of physicians in the United States. Seated at the foot of the Statue of Liberty one crisp October day in 1965, President Lyndon Johnson signed a bill reversing the eugenics-based bans of the past, opening the borders to skilled workers from overseas. A year later my parents had so many offers for medical jobs in New York City that they resorted to evaluating them based on whether they included apartments, and whether those apartments had balconies.

My dad left for the United States first. Six weeks later my mother arrived at JFK Airport wearing a sari and *chappals*, her thin socks bunching up around their single-toe enclosures. They were among four thousand Indian migrants to the United States<sup>17</sup> that year, the vanguards of a new migrant wave.

Today, more than fifty years later, my parents' migration remains the central fact of their lives. It's why they will always long for the perfect mango, why the voice-recognition app on my father's phone will never understand his grammatically perfect English, why they have missed out on countless birthdays and arguments and family dramas. It's why they have been ever since, in some ways, severed from their past, related by blood to people who could no longer make sense of their lives. My grandmother used to cry when she heard that, in

America, her son washed the dishes after dinner. In the flat she'd raised him in, dishwashing was a job for the day laborers, who crouched on their haunches on the slimy tiled floors of the common washing area and slept on thin rough mats on the terrace.

I was born in New York City, a few years after my parents' migration, one of more than 4 million descendants of the migratory wave that carried them to the United States. The consequences of that deceptively simple prior event lodged deep in my bones, sending out pangs and throbs like a slightly off-kilter metal implant. On one hand, I was glad to be free of my parents' past. Their transoceanic move had snipped the threads that connected me and my sister to a way of life that I didn't always admire, lifting us away like balloons. I didn't want to have to memorize poems or prostrate myself to elders, as my cousins did, or be the subject of resigned sighs when some future husband, arranged through family connections, agreed with the then-consensus among our Indian relations that some wives needed beating. That was clear to me from a very young age. I remember, as a child, wandering through the high-rise apartment my parents had bought in Mumbai, which they planned to move into after having spent a few years in the United States. With its stunning vista over the sea, the flat vastly outshone our cramped subterranean apartment in Canarsie, Brooklyn. Still, when they decided not to move after all, I felt as if I'd dodged a death sentence.

At the same time, their migration instilled in me an acute feeling of being somehow out of place, one that's taken nearly five decades to quell. As a child, I was ashamed of even small things, like my preference for suspiciously fruity strawberry ice cream over the unimpeachably American chocolate for which the other children clamored. During visits to India, I felt equally ashamed for not tolerating spicy foods and overripe mangoes. Everyone seemed to know instantly I was not one of their own and seemed more than happy to say so. At home, people around me would look at my black hair and brown skin and refuse to accept my residence in various American cities and suburbs as authentic, asking to know where I was "really" from.

For years, I accepted their presumption of my occupation of space on the North American continent as in some way abnormal. Adopting their sense of my oddity, I pushed myself from the center to the margins. I never presented myself as a regular American person, but always some marginal permutation of one: a South Asian American, say, or an Indian American, perhaps. Even after living in Boston for more than a decade, I didn't publicly cheer when the Red Sox won or wail over the city's various tragedies. That felt presumptuous, because I didn't consider myself as being "from" that place, even though I'd borne both my children there. I still don't say I'm "from" Baltimore, though I've lived on the outskirts of this city for over a decade.

I became a migrant myself, for a few years. When my kids were small, my husband and I moved to northeastern Australia, where he had accepted a research job at a university. He hoped we'd stay and even secured citizenship for all of us. But as my sons acquired Australian accents and were subjected to the locals' skewed ideas about race, my enthusiasm for the transcontinental shift—never terribly great—started to flag. I began to understand

why my parents had always seemed to lack a certain confidence in their American-raised progeny, as if we were the product of some experiment they'd conducted and they were still analyzing the results. I didn't want to create another rift between the generations. Plus, my father cried on the phone when I called.

After a few years, we left, my misgivings about the turmoil caused by migration intact. It was easy enough to agree with the conventional wisdom, which located the source of that tumult in the migratory act itself and the seemingly contrarian impulses that drove it.

But then I started tracking migrant routes around the world.



With his chiseled features, dark stubble, and short, silver-specked hair, Ghulam Haqyar could easily pass as a Hollywood actor. Haqyar worked as a manager for an international NGO in Herat province in the northwestern corner of Afghanistan, enjoying a healthy salary and a comfortable home in Herat with his wife and four children. The family hoped to move to Germany at some point, where Haqyar's brother-in-law lived. When we met a few years ago, he and his son had been studying German for years so they could hit the ground running when they arrived.

Then one day insurgent militants from the Taliban movement captured and brutally murdered one of Haqyar's colleagues. Terrified that he'd be next, Haqyar and his wife quickly found a buyer for their house, selling it in two days for a quarter of what they'd paid for it. They packed up their things, including several of Haqyar's German-language textbooks, which they'd need when they arrived in Germany, rounded up their four children, and left. They traveled over the mountains into Pakistan, then into Iran. There hadn't been any time to obtain official documents. When police officers sought them out, these upstanding souls ran and hid. At one point, Haqyar's wife, who struggled with a thyroid condition, went into shock and Haqyar had to carry her on his back. Later one of his sons became so dehydrated that he nearly died.

Finally the family reached Turkey, where smugglers would provide, for a hefty fee, a seat on an inflatable dinghy to cross the Aegean Sea. It was a tantalizingly short journey: just a few miles of water separated Turkey and the Asian mainland from the Greek island of Lesbos and the rest of Europe. But while the narrow sea between Turkey and Lesbos ran shallow—during the last ice age, when sea levels were lower, it had been dry land—this migrant route could be treacherous. Many of those who tried it could not swim, and few of the smugglers equipped their boats with food, water, or safety gear. Sometimes the smugglers forced their beholden passengers into the dark, fetid spaces below deck, where toxic compounds burned their clothing and skin.

Haqyar and his family boarded one such precarious vessel. As it made its way across the waves, its engine abruptly died. The vessel drifted to and fro in the currents. Haqyar felt certain he'd drown with his children, as many others already had, their bodies washing up on

the beaches of charming seaside resorts across the Greek islands. Waiters and café owners who worked along the Lesbos coast had seen such things. A photographer had captured an image, once, of the lifeless body of a three-year-old child facedown, half buried in the sand, waves gently lapping at his unmoving feet, briefly capturing the world's attention.

Haqyar and his family did not suffer that fate. In the end, they made it across the sea. Haqyar's only casualties were several of the family's precious German-language textbooks, which they'd lugged over two thousand miles from Afghanistan across mountain ranges and international borders in preparation for their new lives in Germany. The Aegean's waters had soaked into their pages, rendering them sodden and unreadable.

Haqyar discarded the ruined books on a pile of rubble left behind by the hundreds of thousands of others who traveled this route, shedding their personal items on the shores of Lesbos so they could continue their journeys west and north less encumbered. The piles grew to the height of small mountains and ridges, their primary shade bright orange from the migrants' discarded lifejackets. They glowed like beacons.<sup>18</sup>



One of the most deeply carved migrant tracks leads out of an unlikely corner of the world, a tiny swath of land along the Red Sea on the eastern coast of Africa. In the Middle Ages it was known simply as Medri Bahra ("sea land"), later taking its name, Eritrea, from *Erythra Thalassa*, ancient Greek for "Red Sea." For decades the country's cruel, autocratic leaders<sup>19</sup> forced much of its population to serve its military, burying those who dissented in secret underground prisons. Every month five thousand people from this funnel-shaped country pick up and leave, the UN estimated in 2015, traveling farther and more frequently than almost any other group of migrants.

Mariam has a watchful way<sup>20</sup> about her, with deep-set eyes and a serious expression that suddenly breaks into girlish grins. She crept out of her parents' house in rural Eritrea, leaving behind her family and their small stable of livestock, at seven A.M. one morning. She'd told them of her plans, earlier. Her mother had begged her not to go, but she did anyway, she told me matter-of-factly. For nearly twenty-four hours, Mariam walked over lush mountains to the border with Ethiopia, dodging soldiers and their shoot-to-kill orders, in the first stage in what would become a nearly decade-long multinational migration. She was fourteen years old.

By leaving Eritrea, Mariam joined one of the most expansive and proportionally massive migrations in the world, its path sending out long, curling tendrils in all directions. Mariam went to Ethiopia first. Sophia, leaving behind her three-year-old daughter with her parents in the capital city of Asmara, paid a smuggler to take her by car northward to Sudan, then to Cairo. Many others from Eritrea join the treacherous track that Ghulam Haqyar traveled, across the Aegean Sea into Europe. Some of the most intrepid make their way across the Atlantic, in hopes of reaching North America. To get there, they first must traverse an uncharted, lawless jungle in Central America.



Because of the difficulty of reaching the United States and Canada directly, many migrants fly to countries in South America first, and from there make the journey to the U.S. border over land. That means crossing through the delicate squiggle of land that connects the two continents, in Panama.

Ever since it rose out of the sea a few million years ago, the S-shaped isthmus has been a thoroughfare for migrants of all kinds, creating the first land bridge between creatures long separated by the waves. Biologists call the dramatic mixing and reordering that followed the Great American Interchange. North American deer, camels, rabbits, and raccoons headed south to explore and settle in warmer climes. They passed, en route, monkeys, armadillos, and opossums heading north. Those first border crossers transformed ecosystems<sup>21</sup> on both sides of the boundary, sculpting the unique landscapes they're each famous for today.

Today the Panama Canal cuts through its middle, allowing ships to pass from the Atlantic to the Pacific in a few dozen miles, rather than detouring around the whole of South America to make the passage, a nearly eight-thousand-mile journey. Much of the country is crisscrossed by roads and highways, too. There's a road that runs direct from glitzy Panama City, on the country's Pacific coast, to run-down Colón, on its Caribbean side. I drove the distance, in my small white rental car, in about an hour. If I'd wanted to, I could have taken a similar road for most of the length of the country. One runs, from east to west, right up to the border with Costa Rica.

But on Panama's far eastern edge, near the border with Colombia, the roads abruptly end. There's a wide swath of untouched jungle, mountains, and swamps dripping with thick vegetation. Venomous snakes, prowling jaguars, and a maze of unmarked, mosquito-plagued trails lie within. The sultry tropical wilderness extends the entire width of the isthmus and spills over into Colombia. Because it forms the sole break in the nineteen-thousand-mile Pan-American Highway, which starts in Prudhoe Bay, Alaska, and ends in Ushuaia, Argentina, on the southernmost tip of South America, it's called the Darién Gap.

Navigating through it by vehicle is nearly impossible. Expeditionists have tried. One of the first attempts, in 1959,<sup>22</sup> enlisted eight mountaineers, four crewmen, and two custom-equipped Land Rovers. After 180 river crossings, the construction of 125 log bridges, three automobile rollovers, and several bouts of malaria, the intrepid explorers of the Trans-Darién Expedition pierced the gap. The journey of sixty-six miles took them four and a half months.

A faster route is by foot and by boat, which is how today's migrants travel across the Darién Gap. They come from a wide range of countries, from Eritrea, Pakistan, and Cuba. I met several who'd arrived there from Haiti, having hopscotched through Brazil, Venezuela, and other countries in South America, en route to North America.

Thickset thirty-year-old Jean-Pierre was one. He delivers his sharp, critical observations about human behavior, in French, Spanish, and Kreyol, in a low, bitter growl. He trained as an accountant in Venezuela, but his identity, first and foremost, is as a socialist and a writer,

and he sports the *de rigueur* goatee that proves it. He arrived at the edge of the Darién with his wife and seven-year-old son a few years ago, gathering with about one hundred other migrants at the port town of Turbo, Colombia. There, for a fee, a local boat owner would load them into some of their cargo boats for the three-hour boat ride to the Darién jungle. According to a reporter who'd witnessed migrants climbing onto Darién-bound boats in Turbo, few came prepared for the wilderness expedition that awaited them. A decent outfitter would require participants to bring, at the very least, medical kits, emergency communication devices, water filters, insecticide-treated apparel, sturdy boots, and rain gear for an expedition through this kind of wilderness. The gathered migrants in Turbo wore flip-flops. Many, like Jean-Pierre, carried small children in their arms.

By the time Jean-Pierre and his family stepped off the boat, their party had thinned significantly. Several of the boats, being overloaded and not designed to ferry people, had capsized along the way. As the unlucky flailed in Turbo's murky waters, the survivors ducked into the jungle. "The path was very narrow," remembered a young man named Mackenson, also from Haiti, who had taken the same route as Jean-Pierre. "You can't even get a horse through. People broke their legs on the trail and had to be left behind, probably to die." They walked for days. Some of Jean-Pierre's group fell from the narrow trails off the side of cliffs and into Darién's raging rivers, which swiftly swept them away. Others, straggling behind, were attacked by the drug smugglers and bandits who use the Darién's uncharted wilds for cover. At night Jean-Pierre's family slept uneasily, warding off snakes and listening to the sounds of unseen animals skulking nearby. Many migrants had resorted to drinking river water, but Jean-Pierre would not take that chance. At one low point during the journey, he, his wife, and their son drank their own urine.

After six days, they emerged out of the jungle, into a clearing not far from the road. The hundred or so others with whom they'd left Colombia had dwindled to just over fifteen. Jean-Pierre snapped a photo of the scene. Most of the frame is taken up by his wife, her back to the camera. She slouches, with her hands on her hips, in the universal posture of weariness. Her tattered top, peacock blue with white sleeves, hangs off her body in three-inch strips, exposing the dusty black bra she wears underneath. Her dark jeans are caked with mud. There are twigs in her short-cropped hair. "It was very cruel, my friend," Jean-Pierre tells me, recalling his days in the Darién. "Whenever my son thinks about it,<sup>23</sup> he cries."

Jean-Pierre's family sheltered in tents for a few days in Panama, recovering and making arrangements for the next stage of their journey. Their track did not end in Panama. It continued on, snaking through over half a dozen countries and thousands of kilometers, which they'd cross on buses, on trains, and on foot, toward its final terminus: the line that separates the United States from Mexico, the most-crossed international border in the world.



From where I stand in the grassy expanses of the San Miguel Mountains, butterflies flitting

around my feet, that border is about ten miles away, invisibly slicing through the valley between the mountains.

As I descend toward it, outlet malls, chain restaurants, and parking lots appear here and there at first, growing increasingly dense. Finally, within a few hundred yards of the border, the labyrinthine ramps and roadways and indeterminate concrete buildings seem to enclose upon themselves in a snarl, with various obscure configurations of gates and fences. Roads and freeways converge and coil, overhung with ominous signs. GUNS ILLEGAL IN MEXICO, says one; NO RETURN TO USA reads another.

One of the butterfly experts I've met grew up nearby. He remembers crossing the border as easily as a butterfly might, freely going to and fro for a fishing trip or to pick up a few lobsters for dinner. Jaguars, bighorn sheep, ocelots, bobcats, wolves, and bears regularly passed through the borderlands, seeking breeding grounds in the south and refuge from the tropical heat in the north. Birds and butterflies flew back and forth on their annual migrations, filling the skies. Today passing through the official border crossing can take hours, and it is not hard to see why. A stream of cars is backed up for miles.

Instead of joining them, I decide to park the car and walk across. Even that seems daunting. To do it, one must enter a mazelike concrete monolith, enclosed by gates and ringed by an obscure series of ramps. It reminds me of the kind of vast, multilevel parking garage that I try to avoid because I almost always end up driving in circles. The entry and exit are not easily detectable, but I successfully find the gate, and after wandering through covered walkways, up and down staircases, and across more gates, I enter a cavernous hallway where my papers are to be inspected and my bags screened. There are several booths where guards can examine documents, and stations of security screening equipment with conveyor belts.

It's empty. Nobody is there.

*Do I call someone?* I wonder. *Is there some dog-eared sign-in sheet fastened to a clipboard somewhere?* There are no signs offering any advice. Feeling discomfortingly illicit, I keep walking across the international border. Within moments, I can see the maze of shacks and high-rises amid the hills of Tijuana.

The northward flow of traffic, of course, is heavily regulated. Official border crossings—there are forty-eight, including nine in California, twelve in Arizona, and twenty-nine in Texas—dot the two-thousand-mile border between the United States and Mexico. They process the 350 million people who cross every year. Over 150 checkpoints, situated miles beyond<sup>24</sup> the crossings, spool out like a fishing net on a trawl, to capture migrants who might have slipped past the official crossings.

I pass through one, in South Texas. The signs that precede it, warning of K-9 units and federal agents, raise my blood pressure a tick despite the blue U.S. passport securely tucked in the backpack beside me. I can only imagine the dizzying spike that people such as Jean-Pierre and his family would have experienced, newly emerged from the Darién jungles, presenting themselves for inspection at one such station, in hopes of convincing officials they

are worthy of passage.

Many, wary of the demand for documents, choose other routes.

In South Texas, desolate two-lane roads are the sole veins through the miles of desiccated ranchlands that line the border. Migrants heading north who prefer to avoid the checkpoints must walk through this intimidating landscape instead. Beyond the barbed wire that encloses the ranches, the sun scorches prickly vegetation. I can see the salty white imprints of shallow lakes, now dried to puddles, around which a few animals scrape sustenance: a knot of horses, a few cows. They stand silently on the parched white sand that surrounds the flat disks of stagnant water. By the side of the road, wild hogs, black and round, plunge their snouts into the crunchy bleached grass, and a gang of vultures picks at roadkill.

It takes days to cross these uninhabited, parched lands. Young, strong Cesar Cuevas told me<sup>25</sup> he spent four days walking through the desert to make it north to the United States. He came prepared, carrying four gallons of water, dried meat, and tortillas. He was so good at it that the local traffickers known as “coyotes” wanted to hire him as a guide. For most others, just carrying sufficient water is tricky. The required volume—a gallon per day per person—can quickly add up to thirty pounds or more. Those who don’t carry enough with them must make do with the grimy water tanks that the ranchers set out for their cattle, or the blue bins that human rights groups are sometimes able to fill for passing migrants, scribbling GPS coordinates on the inside of their lids. If they take the wrong track and don’t encounter those water barrels, or fail to carry enough, or get left behind or lost, the desert sun will render them dehydrated within a few hours. It will kill them within days.

Don White, a tall gangly man with a bushy gray mustache, is a retired Motorola electronics expert and volunteer search-and-rescue expert. No one is paid to survey these desert lands along the South Texas border for stressed migrants who might need some help, so he volunteers to do it for the local sheriff’s office. Every few months he fills his hydration backpack, pulls on his complicated multipocketed safari vest, and heads into the desert for a few days. He starts by hunting for footprints in the sand left behind by migrants heading north. They leave ghostly trails, which I saw, too, from the comfort of my own home, by zooming in close on the satellite images shot by Google Maps. White decides which ones to follow based on his sense of whether the people who left them behind are suffering from exposure, dehydration, or any other insult leveled by days of wandering in the desert. Dehydration changes the gait. He can see its effect in the patterns of the footprints.

Once he finds a track to follow, he has to move fast. The desert is unforgiving to dawdlers. Once the sheriff’s office had received a call from a woman in Guatemala who explained that her nephew had been abandoned by smugglers near the South Texas border. All she knew was that it was somewhere near a salt lake. Ten days later White was camped out by that very lake, but he got there too late. When the wind shifted, he caught a whiff of decomposing flesh, which led him to the nephew’s body and the Bible neatly tucked into the young man’s back pocket.



A few years ago a robotics professor plotted fifteen years<sup>26</sup> of refugee movements on an animated map. You can play it slowly, over the course of a couple of minutes, or, if you're impatient like me, rapidly over a few seconds. Each red dot on the map represents about a dozen refugees. At first, the dots are scattered across the map, unevenly. As the animation starts, they begin to move. Soon the red dots fuse, forming thin red lines that skitter from one part of the map to another. As more people join the journey, the thin tracks thicken, split, and radiate, creating an intricate lattice between the continents and across the oceans.

Over the last few years,<sup>27</sup> biologists at the Max Planck Society created a similar video using data from eight thousand individual animals, fitted with GPS devices, as they roamed the planet. The visual effect of these collective journeys is mesmerizing. The migrant tracks move across deserts, up and down the coasts of continents, around islands in the Pacific, across oceans, and into the Arctic. Eventually they encase the planet in a delicate filigree of intertwined threads. They are everywhere.

And yet in our everyday lives, ensconced in airtight homes built on concrete foundations, we experience the landscape around us as essentially stable. Day after day I see the same faces in the grocery store aisles and wave at the same parents dropping their kids off at the school bus stop. The same scruffy squirrel runs along the top of the fence by my driveway, and the same weeds sprout out of the cracks of my front walkway. It is easy to be lulled into a sense of overwhelming sedentariness, in which the newcomer, the migrant, the intruder is the exception.

But life is on the move, today as in the past. For centuries, we've suppressed the fact of the migration instinct, demonizing it as a harbinger of terror. We've constructed a story about our past, our bodies, and the natural world in which migration is the anomaly. It's an illusion. And once it falls, the entire world shifts.