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The Invention of Nature: Alexander von Humboldt's New World
by Andrea Wulf
Knopf, 473 pp., $30.00

After Nature: A Politics for the Anthropocene
by Jedediah Purdy
Harvard University Press, 326 pp., $29.95

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Alexander von Humboldt, 1803

Humboldt's hog-nosed skunk, the Humboldt penguin, the Humboldt squid, and more than a hundred other animal species; Humboldt's Lily, Humboldt's Schomburgkia, and three hundred other plant species; the minerals *Humboldtit*, *Humboldtilith*, and *Humboldtin*; Humboldt Limestone, Humboldt Oolite, the Humboldt Formation, the Humboldt Current; Humboldt Redwoods State Park, Humboldt-Toiyabe National Forest, Parque Nacional Alejandro de Humboldt; Mont Humboldt, Humboldt Mountain, Humboldt Peak, and Humboldt ranges in China, South Africa, and Antarctica; Humboldt Falls, Humboldt Glacier, Humboldt Bay, the Humboldt River, the Humboldt Sink, the Humboldt Salt Marsh; four Humboldt counties and thirteen Humboldt towns in North America alone, the Humboldt crater and Mare Humboldtianum on the moon, and asteroid 54 Alexandra, orbiting the sun.

The Prussian naturalist Alexander von Humboldt (1769–1859) is all around us. Yet he is invisible. "Alexander von Humboldt has been largely forgotten in the English-speaking world," writes Andrea Wulf in her thrilling new biography. "It is almost as though his ideas have become so manifest that the man behind them has disappeared." Wulf's book is as much a history of those ideas as it is of the man. The man may be lost but his ideas have never been more alive.

Humboldt's legacy appeared certain at the time of his death, when he was the most famous scientist in the world. His funeral in Berlin was the grandest ever accorded to a private German individual; a procession of tens of thousands of mourners followed for a mile behind his hearse, pulled by the king's horses. American newspapers eulogized him as the "most remarkable man ever born" and lamented the end of the "age of Humboldt." His portrait hung on the walls of state buildings from London to Bangkok.

A decade later, on the centennial of Humboldt's birth, parades, concerts, and firework shows were held in Moscow, Alexandria, Buenos Aires, Mexico City, Melbourne, and dozens of American cities. Fifteen thousand marched in Syracuse, President Ulysses Grant joined a huge celebration in Pittsburgh, and 25,000 assembled in Central Park, in the midst of a euphoric citywide bonanza. *The New York Times* devoted its entire front page to the global festivities.

Times changed. Anti-German sentiment after World War I, the specialization and Balkanization of the sciences, and the passage of time conspired to dilute Humboldt's public standing, particularly in the United States. He was eclipsed by devoted disciples—among them Charles Lyell, Charles Darwin, Henry David Thoreau, George Perkins Marsh, Ernst Haeckel, and John Muir—who developed his insights in new ways. But times have changed again. In our Anthropocene age Humboldt's theories read like prophecy. More important, they offer wisdom about the way forward. It is impossible to read *The Invention of Nature* without contracting Humboldt fever. Wulf makes Humboldtians of us all.

Humboldt was born during the era in which human beings stopped fearing nature and began to control it. The steam engine, the smallpox vaccine, and the lightning rod were rapidly redefining man's relationship with the natural world. Timekeeping and measuring systems became standardized, and the few blank spaces remaining on world maps were quickly filling in. In New England, the colonists spoke of "reclaiming" North America from the wilderness, a project inextricable from the propagation of democracy. The jurist James Kent, seeking a legal basis for seizing land from Native Americans, argued that the continent was "fitted and intended by Providence to be subdued and cultivated, and to become the residence of civilized nations." Explorers like James Cook and Louis Antoine de Bougainville circumnavigated the globe and published their journals, which Humboldt read avidly as a boy.

Humboldt's father was a chamberlain in the Prussian court and a confidant to the future king, who was godfather to Humboldt; his mother, the daughter of a wealthy manufacturer and member of the Prussian civil service, was of Huguenot descent. Alexander and his older brother Wilhelm spent winters in Berlin and summers at the family castle in Tegel but their childhoods were lonely. Their father died when Alexander was nine and their mother was severe and cold. Though the brothers were close, and remained so their entire lives—Wilhelm would become a linguist and philosopher—their only companions were the private tutors who gave them a rigorous education in the classics.

Humboldt was desperate to escape this claustrophobic environment but afraid to abandon his mother. "There is a drive in me," he wrote in a letter, "that often makes me feel as if I'm losing my mind." He likened this drive to being chased perpetually by "10,000 pigs." After university he became an inspector in the Ministry of Mines, a job that satisfied his mother's desire for him to ascend the ranks of the Prussian civil service, while allowing him to travel widely across the kingdom and conduct personal experiments in geology, anatomy, and electricity. It was not until his mother's death of cancer in 1796, when he was twenty-seven, that he felt free. He did not attend her funeral.

Supported by the windfall of his inheritance, he abandoned his mining career and planned a "great voyage" to a distant location. The destination did not seem to make much difference—he considered the West Indies, Lapland, Greece, and Siberia, before settling on South America, once he was offered a passport to the Spanish colonies from King Carlos IV himself. Nor did he have any specific object of study. He would analyze everything, from wind patterns and cloud structures to insect behavior and soil composition, collecting specimens, making measurements, and taking temperatures. He wanted no less than to discover how "all forces of nature are interlaced and interwoven." He took as the premise of his expedition that the earth was "one great living organism where everything was connected." The insights that followed from this premise would be worth more than all of the discoveries he made.

This is not to discount the value of those discoveries, which were later collected in his thirty-four-volume *Voyage to the Equinoctial Regions of the New Continent*, published between 1807 and 1826. On his voyage Humboldt explored Venezuela, Cuba, Mexico, Colombia, and Peru, visiting many regions never before observed by a scientist. He identified two thousand new plant species at a time when only six thousand species were known. (More plants, animals, minerals, and places are named after Humboldt than anyone else.) He discovered the magnetic equator. He was the first European to explore and map the Casiquiare River, the only natural canal on earth to link two major river systems, the Orinoco and the Amazon. He was the first to conduct experiments on electric eels, which he dissected and held in his hands, enduring violent shocks.

Humboldt carried this kind of hands-on experimentation to manic extremes in his voracious quest for total knowledge. He drank river water (the Orinoco was particularly disgusting, while the Atabapo was "delicious"), chewed bark, copied and translated scientific manuscripts, made astronomical observations, gauged the blueness of the sky with a cyanometer, transcribed the vocabularies of indigenous tribes, and sketched Incan monuments and hieroglyphs of ancient civilizations deep in the Amazonian rainforest. He studied his own lice with a microscope.

At times *The Invention of Nature* reads like pulp explorer fiction, a genre at least partially inspired by Humboldt's own travelogues. On the Chimborazo volcano, 17,000 feet above sea level, we find Humboldt crawling along a two-inch-wide ridge between a sheer icy cliff and a thousand-foot drop with "almost perpendicular walls…covered with rocks that protruded like knife blades." Humboldt bathes in the Orinoco among crocodiles, gigantic boa constrictors, herds of capybaras, and jaguars. He contracts fevers, dysentery, blood infections, and nameless horrific Amazonian diseases. With his companion, the naturalist Aimé Bonpland, he scales every peak he can see in the Andes. When his shoes disintegrate, he continues barefoot. While traveling from Cuba to the Atlantic seaboard he sails straight into a hurricane,

which lingers overhead for six days, inundating the ship so that the passengers must swim through the captain's cabin, while sharks circle in the turbid waters.

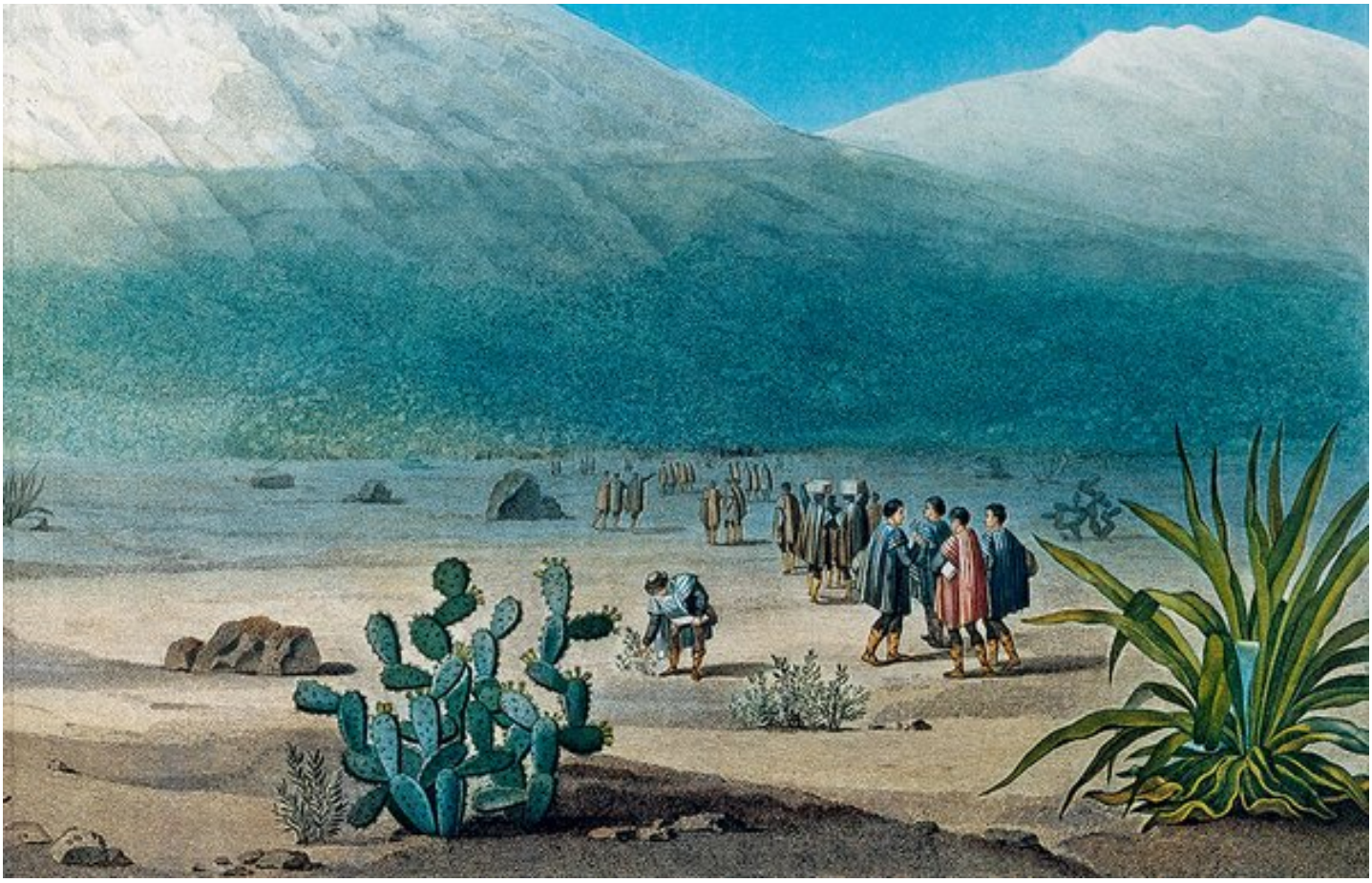
Wulf, a design historian at the Royal College of Art in London and the author of two histories of gardening, seems liberated to have exited the garden. She has gone to near-Humboldtian lengths to research her book: traversing the Venezuelan rainforest, walking around Walden Pond "in deep freshly fallen snow," hiking in Yosemite, and even climbing Chimborazo. She visited archives in California, Berlin, and Cambridge, where she read Humboldt's dozens of books in German, Darwin's copies of Humboldt's books, and his personal files. (Humboldt, as manic in his correspondence as in all else, wrote more than 50,000 letters and received more than twice as many.) Wulf sought out, 12,000 feet high on Ecuador's Antisana volcano, the dilapidated hut where Humboldt spent a night in 1802, and in Quito she found his original Spanish passport.

Rediscovering Humboldt is by this point a subgenre unto itself—recent entrants include *Humboldt's Cosmos* (2004) by Gerard Helferich, Laura Dassow Walls's *The Passage to Cosmos* (2011), and Aaron Sachs's valuable *The Humboldt Current* (2006), which traces Humboldt's influence on American environmental thought. But Wulf offers a more urgent argument for Humboldt's relevance. The Humboldt in these pages is bracingly contemporary; he acts and speaks in the way that a polyglot intellectual from the year 2015 might, were he transported two centuries into the past and set out to enlighten the world's benighted scientists and political rulers.

After his five-year voyage through Latin America, Humboldt landed in the United States in May 1804. He spent a week in Washington, regaling President Jefferson, Secretary of State James Madison, and Treasury Secretary Albert Gallatin with information about the Spanish colonies, which to that point had largely been closed to American contact. Jefferson was then in a border dispute with Spain over the land between the Sabine and Rio Grande rivers. Humboldt convinced Jefferson that the land—today the state of Texas—despite its deserts and savanna, was worth fighting for. "We have little knowledge" of the Spanish colonies, a grateful Jefferson told Humboldt, "but through you."

Humboldt settled in Paris, where he set to writing and lecturing about his voyage. He skipped meals and barely slept. His hand couldn't keep up with his brain: he crammed the margins of his handwritten pages with ideas for other chapters and essays. When he ran out of space, he continued to write on his desk itself, carving his thoughts into the wood. He delivered a series of widely attended talks at the Académie des Sciences, in which he "jumped so quickly from one subject to another that nobody could keep up." The Jardin des Plantes exhibited some of his botanical specimens, but not all: he had brought back 60,000. His maps, political essays about the colonies, and the data he collected about agriculture, manufacturing, geology, botany, zoology, fluviology, and meteorology revolutionized each of those fields.

He met often with politicians, scientists (including Georges Cuvier and Jean-Baptiste Lamarck), and the aristocracy. He appears to have been nearly universally adored, with one exception. "Napoleon," wrote Humboldt, "hates me." Wulf suggests that Napoleon might have envied Humboldt's success. *Voyage to the Equinoctial Regions of the New Continent* was published at nearly the same time as Napoleon's *Description de l'Égypte*, a twenty-three-volume study compiled by two hundred scientists who had accompanied Napoleon's troops during the 1798 invasion of Egypt. Humboldt had achieved more on his own.



Wellcome Library, London

Alexander von Humboldt and Aimé Bonpland collecting plants at the foot of Chimborazo in today's Ecuador; aquatint from Humboldt's Vue des Cordillères et monuments des peuples indigènes de l'Amérique*, 1810–1813*

Humboldt's most consequential findings, however, derived from his conception of the world as a single unified organism. "Everything," he said, "is interaction and reciprocal." It seems commonplace today to speak of "the web of life," but the concept was Humboldt's invention. Into the seventeenth and eighteenth centuries, thinkers like René Descartes, Francis Bacon, and Carl Linnaeus were still echoing Aristotle's view that "nature has made all things specifically for the sake of man."

Particularly heterodox was the implication that the decline of one species might have cascading effects on others. The possibility that animal life might not be inexhaustible had been proposed by the German anatomist J.F. Blumenbach (who taught Humboldt at the University of Göttingen), but was not widely accepted. "Such is the œconomy of nature, that no instance can be produced of her having permitted any one race of her animals to become extinct," declared Thomas Jefferson in 1784, an opinion shared by most naturalists. Convinced to the end of his life that mastodons still existed in North America, most likely in the "unexplored and undisturbed" regions of the continent, Jefferson urged Lewis and Clark to look for them during their expedition.

Humboldt traveled so far, saw so much, and observed so closely that he began to notice similarities across continents. Rhododendron-like plants on the mountains near Caracas reminded him of alpine trees in the Swiss Alps; a sea of cacti, seen from the distance, recalled the grasses in the marshes of northern Europe; a moss in the Andes resembled a species he had found growing in German forests.

This comparative approach allowed him to take staggering intellectual leaps. He looked beyond the characteristics of organisms and tried to determine the structures underlying nature, leading him to formulate the idea of ecosystems. He was the first to understand that climate emerged from the "perpetual interrelationship" between land, ocean, wind, elevation, and organic life. He introduced the idea of classifying plants by climate zones instead of taxonomy, taking into account altitude, temperature, and other conditions related to location. He invented isotherms, the lines used on maps to connect regions with the same average temperature and atmospheric pressure. The similarity of the coastal

plants in Africa and South America led him to postulate an "ancient" connection between the continents, anticipating plate tectonic theory by more than a century. He also studied how different systems interacted with one another. Nobody before Humboldt, for instance, had been able to explain how forests, by releasing oxygen, storing water, and providing shade, have a cooling effect on climate.

In the Llanos, the vast grasslands that stretch from the Andes to the Amazon River, Humboldt noticed with wonder how many species found food or protection from the occasional Mauritia palm tree. It sheltered insects and worms from the wind, provided fruit to monkeys and birds, retained moisture and soil, and generally spread "life around it in the desert." The Mauritia palm was what, two centuries later, would come to be known as a "keystone species," an organism on which the health of an entire ecosystem depends.

If everything in nature interacted, then it stood to reason that the natural world was not stable but prone to dynamic changes. It followed that man, by disrupting the natural order, might inadvertently bring about catastrophe. Humboldt was among the first to write of the perils of deforestation, irrigation, and cash crop agriculture, asserting that the brutal repercussions of man's "insatiable avarice" were already "incalculable." During his yearlong expedition to Russia in 1829, he gave a speech at the Imperial Academy of Sciences in St. Petersburg calling for a vast international collaboration in which scientists around the world would collect data related to the effects of deforestation, the first global study of man's impact on climate, and a model for the Intergovernmental Panel on Climate Change, assembled 160 years later.

The idea that human beings might be interfering with the natural order of things was a radical rejection of prevailing views about man's dominion over nature. These views were most forcefully expressed by the French naturalist Georges-Louis Leclerc, comte de Buffon, who wrote with disgust of primeval nature; his *Natural History* is replete with words like "grotesque," "filth," "nauseous," "pestilential," and "terrible." Buffon's views were echoed by William Bradford, the first governor of the Plymouth Colony, who described the new world as "a hideous and desolate wilderness, full of wild beasts and wild men," and the English naturalist John Ray, who wrote of man's duty to bring nature in line with God's design through settlement and cultivation. To Humboldt, however, man was "nothing" in the larger scheme of things. Wulf notes that nowhere in his five-volume magnum opus, *Cosmos*—his attempt to summarize his thinking on the natural world, the universe, and the entirety of human history—does Humboldt mention God.

By casting aside religious and political ideology, Humboldt was able to diagnose plainly the cruelties of colonial rule. The sight of the slave markets in the Spanish colonies made him a fervent abolitionist. He told Americans (though not Jefferson himself) that slavery was a "disgrace" and that the oppression of Native Americans was a "stain" on the nation. Humboldt was the first to make the correlation between colonialism, with its crude emphasis on extracting resources and disregard for indigenous populations, and ecological devastation.

Humboldt wrote figuratively, with high emotion, of the beauty he found in wilderness. Wulf calls his rhapsodic *Views of Nature* "a blueprint for much of nature writing today." Just as his scientific views influenced Darwin and Marsh (who warned in *Man and Nature* that "climatic excess" might lead to the "extinction of the [human] species"), Humboldt's lyricism served as a model for Thoreau, Haeckel, and Muir. Wulf dedicates a chapter to each of these figures, all of whom idolized Humboldt and drew liberally from his work.

Darwin stands out as the most slavish of his acolytes, writing in his journal that Humboldt "like another Sun illumines everything I behold." Darwin wrote that it was Humboldt's *Personal Narrative*, a seven-volume subsection of *Voyage*, that inspired him "to travel in distant countries, and led me to volunteer as naturalist in her Majesty's ship Beagle." He brought his copy of the *Personal Narrative* on the Beagle with him and read in it Humboldt's discussion of the "gradual transformations of species." Humboldt wrote that plants and animals "limit each other's numbers" through "long continued contest" for nourishment and territory, with only the strongest surviving—an idea, Wulf notes with some understatement, "That would become essential to Darwin's concept of natural selection." Wulf also points out that the final, crowning paragraph of *Origin of Species* is a nearly verbatim plagiarism of a passage in *Personal Narrative*.

Humboldt also exerted a profound influence on Goethe (with whom he had a deep friendship), Charles Lyell, William Wordsworth, Samuel Taylor Coleridge, Jules Verne, Carl Friedrich Gauss,-Flaubert, Pushkin, Emerson, Poe, Whitman,

Aldous Huxley, Ezra Pound, Erich Fried, Justus Liebeg,-James Lovelock, and Rachel Carson, yet Humboldt makes only a passing appearance in Jedediah Purdy's otherwise instructive *After Nature: A Politics for the Anthropocene*. Purdy, a professor of law at Duke, sets out to do two things in his monograph. He first charts the history of modern man's relationship to the natural world, focusing on the American perspective—a recapitulation of Roderick Nash's classic *Wilderness and the American Mind* (1967) and William Cronon's "The Trouble with Wilderness" (1995).

Second, and more ambitiously, Purdy attempts to imagine a political system that might be capable of addressing the urgent, existential questions posed by our current environmental crisis. That we need a new way to think about the natural world is indisputable: despite best intentions and righteous rhetoric, global carbon emissions continue to rise precipitously. Naomi Klein and others have argued persuasively that capitalist democracies are uniquely incapable of resolving these problems. Authoritarian governments have fared worse. What is to be done?

Purdy defers those questions in the first four fifths of his book, which he devotes to his American history of "nature"—a concept that "has been a vessel for many inconsistent ideas." His survey begins with John Evelyn, John Ray, and the argument that man had a providential duty to transform wilderness—originally a pejorative term, synonymous with "waste"—into orderly agricultural plots. Land cultivation was codified in colonial law, which "deployed Americans as an army of development…through a scheme of opportunity and reward." Claiming land from nature, and exploiting it for profit, was enshrined as a foundational American right—a view that persists to this day.

It was not until John Muir ("How intensely I desire to be a Humboldt") popularized Thoreau's romantic views of the natural world that Americans began in large numbers to see wilderness as a spiritual and meditative refuge from the bustle of modern life. But this idealization of nature was counterproductive, protecting "a few cathedrals" like Yosemite and Yellowstone while devaluing the more pedestrian swathes of nature that made up most of the continent. The preservation movement was eclipsed by the more pragmatic conservation movement. Figures like Theodore Roosevelt, Walter Weyl, an editor of *The New Republic*, and Gifford Pinchot, first chief of the United States Forest Service, proposed a bureaucratic, utilitarian approach, designed to ensure that the natural world was accessible for both recreation and the extraction of resources. But when these two interests came into conflict, preservationists lost—most notably in the battle over the Tuolumne River in Yosemite's Hetch Hetchy Valley, dammed in 1923 to provide water to San Francisco.

In the late 1960s and 1970s, the politics of nature evolved to reflect a growing (Humboldtian) awareness of ecology. Concerns over air and water pollution, land development, resource extraction, species extinction, drought, wildfires, and even roadside littering were consolidated under the single rubric of "the environment." "Once invented," writes Purdy, "the environmental crisis could encompass many crises." This view still dominates environmental politics, though it has been complicated by a new appreciation of the profound ways in which man has reconfigured the natural world to our own specifications. In political calculations about the environmental crisis, romantic appeals to nature's glory have been supplanted by a rigid cost-benefit analysis. Echoes of the Hetch Hetchy debate can be seen in the battle over the Keystone Pipeline, new EPA methane and carbon dioxide emission regulations, and drilling in the Arctic Circle.

In his final chapters, Purdy identifies the familiar challenges we face. He explains, for instance, why cost-benefit analysis breaks down when applied to the climate: the cost of meaningful, long-term change will fall heavily on the people trying to solve the problem, while the benefits will be reaped by generations not yet born. Concerns over hotter summers may trouble consciences but they don't stop people from driving cars.

Purdy proposes that we have a moral obligation to the natural world and that "a clean environment…should not be negotiable in terms of the marginal dollar."-He argues that our democracy is too beholden to the influence of money, that the processes we use to produce energy and food should be made more transparent to the public, and that technological solutions are unreliable and will not bring about the greater change of consciousness that is necessary to solve our most pressing problems.-He urges an ethic of self-restraint and a new worldview in which human beings are no longer "the figure at its center."-Most environmentalists already share these views.

Purdy is slightly more audacious in his suggestion that we must think with greater imagination about our relationship to the natural world. It is crucial, he writes, that we imagine "alternative landscapes, alternative economies, alternative ways of living." More specifically, he proposes that we embrace "an aesthetics of damage," defined as "a way of living

with harm and not disowning the place that is harmed." Elsewhere he describes this as accepting the "uncanniness" of our fallen world and our uncertain future. A source of this uncanniness is the knowledge that there is no longer such a thing as true wilderness—no acre of the world has escaped the presence of man. Our fingerprint has entered the fossil record, inscribed in cesium, plutonium, and plastic.

An aesthetics of the uncanny already exists—you can see it, for instance, in Edward Burtynsky's photographs of industrial landscapes, the eerie underwater reef sculptures of Jason deCaires Taylor, and Margaret Atwood's futuristic MaddAddam novel trilogy. But Purdy's uncanniness can also be detected in new technologies, such as the use of genetic tools to bring back extinct species, create drought- and pest-resistant crops, and grow artificial human organs in a lab. Purdy doesn't try to imagine exactly what the future we're creating will look like. But someone will have to do it. It may take a new Humboldt. Until then, the original Humboldt will do fine.
