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# Atmospheric Fixes

The one-room house Doña Iris shared with her *marido*, Don Pachi, was almost always exposed to the sun. It sat atop a knoll on the outskirts of Villa El Carmen, on a grassy swath of land that gave them enough room to run a few chickens. The sunlight seared away the moisture in the soil, making it easier for the chickens to forage for insects. When I first sat down for an interview with Doña Iris and Don Pachi, the three of us constantly had to adjust the location of our plastic chairs to keep them under the shade of one of the two trees that stood inside the barbed wire surrounding their property. Together, we formed a kind of human-plastic sundial.

Doña Iris, who had once worked at Montelimar as a clerical secretary and now served as AMBED's secretary-treasurer, was fond of what she called her *pedacito de casa* (her "little piece of home"). She and Don Pachi could raise the chickens alongside a few plants, and it was just a short walk to the town, where

they could get other basic foodstuffs or catch the bus to Managua for larger shopping trips. But Doña Iris and Don Pachi were also somewhat captive to the plot on which they lived because both had been weakened by kidney disease. Doña Iris was diabetic, and Don Pachi, a former cane cutter at Montelimar, had CKDnt. Excessive heat exposure is always dangerous, but for people with compromised kidney function, it is especially risky.[1]

Doña Iris and Don Pachi were in what I have come to think of as an "atmospheric fix." Their daily movements around the yard, keyed to the drift of the tree's shadow, illustrate that shade and sunlight, cool and heat, are social relations rendered into air qualities. The atmosphere that surrounded Doña Iris and Don Pachi was the outcome of human labor, what the geographer Mike Hulme calls "atmospheric cultivation," those "intentional, but not always sagacious, projects of improvement through which . . . the atmosphere bears the imprint of considered human thought, design and action."[2] The cultivation of monocrops has always entailed atmospheric cultivation. The effects of that cultivation are violent and uneven. As industrial farms grow, pesticides drift, dust storms become more frequent, and new forms of damage emerge, from antibiotic-resistant bacteria to cancer clusters.[3] Agricultural workers continue to bear the brunt of these negative feedback loops. In recognition of their atmospheric impacts, agribusinesses around the world have begun developing methods for cultivating more tolerable working conditions. These methods tend to focus on discrete atmospheric elements: offsetting greenhouse gases by planting trees, using sensors to monitor ozone and dust, or promoting the use of air filtration for homes and factories and personal protective equipment for workers.

These technical fixes are examples of what Joseph Masco calls "normalizing extremes," mobilizing technology and science to make long-established global capitalist projects fit within a changing planetary ecology.[4] The question is not how to make the planet reasonably safe for *every* body but to make it reasonably safe for *laboring* bodies, that is, those that produce value by doing legibly productive work.[5] In the sugarcane zone, even as these deliberate attempts at protection enabled work to continue, they perpetuated the kinds of environmental conditions that made it harder and harder for smallholders like Doña Iris and Don Pachi to protect themselves, and more and more dangerous for them to spend time outside. The World Bank estimates that average annual temperatures on Nicaragua's Pacific coast have risen by over one degree Celsius since the 1960s. Rainfall has decreased by 5 to 6 percent per decade over the same period.[6] There are simply not enough trees in the sugarcane zone to provide shade, to maintain an inhabitable hydrologic cycle, or to absorb the damage of unregulated aerial pesticide application.

But normalizing extremes is not the only means of cultivating atmospheres. There is another, which I call "atmospheric homework." Atmospheric homework is a form of both labor and collective study. It entails questioning how ecological damage creates dangerous atmospheric conditions that do not manifest as extreme. Such dangers are invisible to the industrial logics of environmental or health science. Through atmospheric homework, people make accretive environmental harm legible. Atmospheric homework entails everyday efforts to question what dominant systems, including those of industrial agriculture, treat as normal. To do atmospheric homework is to do things like cultivate shade in a rapidly deforesting landscape, to share worries about the smell and taste of air and water, to try to make life livable on terms that are not necessarily premised on productivity. Atmospheric homework is a form of intervention that centers bodies that work but also bodies that care, bodies that smell, bodies that tremble with anxiety. Atmospheric homework is still about *work*, but its politics emerge from those forms of reproductive labor, often coded as "women's work," that are excluded from the calculations of agribusiness, even though agribusiness has been dependent on them since the inception of the plantation. Doing atmospheric homework means asking modest questions and taking small, sometimes seemingly insignificant steps to improve local surroundings, despite the uncertain impact of agrochemicals, extreme heat, and a diminished water table.[7]

To explore the tension between normalizing extremes and atmospheric homework, and between macroscale planetary change and microscale survival practices, this chapter begins with a short history of atmospheric cultivation in the sugarcane zone.[8] I show how two key components of that atmosphere, agrochemicals and heat, came to prominence as social and environmental matters of concern long before the advent of the CKDnt epidemic. I then delve more deeply into the processes of normalizing extremes and atmospheric homework, following efforts to fix the atmosphere of the sugarcane zone in the wake of the epidemic. As heat mitigation has become the most prominent form of addressing CKDnt, what look like proactive steps by transnational scientists and corporations to protect a vulnerable workforce have ended up deepening the spatial and social bifurcations between plantation and nonplantation, work and nonwork.

## Making a Toxic Desert

The presence of toxic agrochemicals in Nicaragua's atmosphere is firmly embedded in the national imaginary. In "Lights," a 1979 poem that is sometimes quoted by scholars of Nicaraguan agriculture, the radical priest and poet

Ernesto Cardenal describes the "smell of insecticide" as the "smell of Nicaragua."[9] Cardenal's poem tells of his return from exile to witness the final push to overthrow the Somoza dictatorship. The poem is narrated from aboard an airplane that takes a circuitous route along the Pacific coast to avoid the Nicaraguan army's antiaircraft guns. From the window of the plane, the poet recognizes the lights of major cities—Rivas, Granada, Masaya, Managua—and the pilot points out the lights of Montelimar, the luxurious seaside redoubt of the dictator himself, Anastasio Somoza Debayle. By that point in the revolutionary struggle, Somoza was already on his way out of the country, fleeing the hand of Sandinista justice, but Montelimar remained, surrounded by sugarcane and cotton farms owned by the Somozas and their allies. It is likely that Cardenal could have seen, just behind the beachside estate, the lights of the sugarcane mill.

If you were to fly above the area today, as Cardenal did in 1979, you would be able to identify the villages amid the stands of cane by the telltale sign of defiant old trees. These forest islands stand out against the expanding monoculture. When Somoza Debayle's father, Anastasio Somoza García, took de facto control over the country in the late 1930s, small farmers and Indigenous people could still make a living by carving out modest subsistence plots, but today's home gardens provide a supplement, at best, to store-bought food. Though it is still listed in most guidebooks as a "tropical dry forest," most of Nicaragua's Pacific littoral today is something more like a man-made desert. The forests are nearly all gone. They were victims of a Green Revolution–inspired push to turn a "backward" economy of haciendas and small peasant farms into a modern, efficient industrial agricultural export engine.

The Somoza dynasty spearheaded this dramatic transformation. Between 1912 and 1933, Nicaragua was occupied by the US Marines, who were there, at least initially, to deter other global powers from attempting to build a transoceanic shipping canal in the country. The US-backed Panama Canal project had been preceded by several attempts to build canals across southern Nicaragua, whose lake and river systems offered a potentially more welcoming passage between the Atlantic and Pacific Oceans than those of Panama. During the occupation, the United States showed little appetite for economic development initiatives, even the colonial-style commodity crop plantations US interests had established elsewhere in Central America. Nicaragua's agricultural sector languished by comparison to those of its neighbors.[10]

The marines were finally driven out in 1933 after being worn down by the innovative guerrilla tactics of Augusto César Sandino's campesino army. Although Sandino was a deeply committed agrarian socialist, he entered an

alliance of convenience with the Liberal wing of the Nicaraguan landed elite, including Somoza, in order to ensure the ouster of the occupiers. The Americans left Somoza in charge of a US-trained military force, the National Guard. Not long after the US retreat, Somoza orchestrated Sandino's assassination and quickly mobilized the National Guard to consolidate his political power.

Though he was a slippery figure, Somoza gained a foothold in the wake of the US departure by positioning himself as a Liberal, which in the Nicaraguan political alignment of the time meant that he envisioned modern export-oriented commerce as the key to Nicaragua's future. The opposition Conservative Party was dominated by established descendants of the Creole gentry who preferred to keep farms as the semifeudal haciendas that they had inherited from their ancestors.[11] Somoza began putting his Liberal economic vision into place by first ensuring Nicaragua's support for the Allies in World War II. After the war, he oversaw an agricultural boom, underwritten by US capital.[12] The historian Hilary Francis describes the early years of this boom as a "fever" that temporarily ushered in a détente between Somoza and his critics within the Conservative Party.[13] Somoza successfully sold political leaders across the Liberal-Conservative spectrum on "a belief in the almost magical power of foreign, particularly US, technology" to realize his long-held vision of the country as "the granary of Central America."[14]

What Nicaragua's Conservatives shared with Somoza was a fervent anticommunist politics, one that identified campesinos like those that Sandino had organized in the anti-occupation struggle as potential threats.[15] Between 1951 and 1958, under the banner of the Nicaraguan Technical Agricultural Service, US and Nicaraguan agronomists rapidly built a modern agrarian-industrial complex, centered initially on cotton production. The National Guard used force to evict small farmers from their homes and to speed the process of cutting down trees to make way for cotton.[16] This dramatic transformation of the landscape accelerated in the 1960s with the help of the Alliance for Progress, the Kennedy administration's attempt to counter the rise of left-wing political groups in Latin America through a combination of development aid and support for militaries and governments sympathetic to the US position in the Cold War, including the Somoza regime.[17] As the environmental sociologist Daniel Faber explains, "Along Nicaragua's entire Pacific plain, cotton land expanded 400% between 1952 and 1967, while peasant lands devoted to corn, beans, sorghum, and other food grains dropped over 50%."[18] Small farmers and Indigenous groups were evicted from their traditional lands, old-growth forests and mangroves were destroyed, and numerous species of tropical animals were rendered nearly extinct.[19]

The cotton boom was a Cold War project through and through. In crude terms, fewer forests meant fewer small farms. Fewer small farms meant that formerly self-sufficient farmers had to seek employment in the cotton fields to survive.[20] For Somoza, this made campesinos into a much more legible and pliable constituency, one perhaps less likely to respond to the form of agrarian populism espoused by the intellectual and political descendants of Sandino. Early in his rise to power, Somoza worked to cultivate the loyalty of this emerging rural working class through the institutionalization of revised labor codes and workplace protections, including social security (see chapter 5).[21]

Somoza's regime enthusiastically embraced the new wave of commercial petrochemical pesticides introduced to the market after World War II.[22] Per capita, Somoza-era Nicaragua was among Latin America's biggest spenders on imported agrochemicals during the middle of the twentieth century. Even after Bayer Chemical's 1951 tests of methyl parathion (a derivative of a nerve gas developed by the Nazis during World War II) killed and sickened thousands of people around the city of León, Somoza, urged on by his cotton-growing cronies, opted to continue the use of the pesticide against boll weevils.[23] During this period, Nicaragua became a case study in the phenomenon of the "pesticide treadmill," in which insect and weed resistance leads to the progressive search for newer and harsher chemicals.[24] The residues of these substances persisted in soils, plants, and bodies. A 1991 study estimated that "the 700,000 people living in Central America's cotton region [had] more DDT in their body fat than any other population of human beings in the world."[25]

Ernesto Cardenal's observation that the smell of insecticide was the smell of Nicaragua may have been a bit of ironic nostalgia, but on the eve of the Sandinista revolution, heat and toxicity had become the defining features of the agrarian atmosphere, particularly on the Pacific coastal plain. Thanks to the loss of forest cover, residues that fell from crop dusters would swirl out of the friable soil, back into the air, and through lungs and cracked doorways. There was no escape.

When the Somoza dynasty was toppled by the popular Sandinista revolution in 1979, the atmospheric ravages of the previous three decades were plain to see.[26] By 1979, the cotton boom had been receding for some time, and Sandinista economic planners blamed the largely US-based petrochemical industry, which had insinuated itself into the fabric of the Somoza state, for the decline.[27] Even as they fought militarily against a US-backed counterrevolutionary force, the government of the Frente Sandinista de Liberación Nacional (FSLN) took on the project of undoing the ecological harms perpetrated under Somoza. Pesticides that had been legal to use under the old regime were finally banned in the early 1980s, in keeping with international norms, and it was in this

period that Nicaragua became an incubator of new forms of eco-friendly agriculture, perhaps most famously shade-grown, organic, and fair trade coffee.[28]

While the cotton plantations withered, sugar remained resilient. Sugarcane had been grown commercially in the Pacific plains for more than one hundred years, but by the 1980s, its prominence in the export economy had drastically increased. Under the FSLN, all the country's major sugarcane processing and growing operations were nationalized, including the Montelimar mill, which had been under Somoza's direct control. The choice to keep these large export operations intact as industrial monocultures was largely a practical one. Larger farms could provide preferential employment to combatants in the revolutionary and counterrevolutionary wars, many of whom were born as peasants but had entered the workforce as seasonal plantation workers. Even though the Sandinistas did actively work to restore access to quality farmland so that these workers and their families could make a living during the offseason, the long-term effects of deforestation and pesticide-driven agriculture had hollowed out the promise of subsistence or smallholder food production. In 1991, one year after the Sandinistas were voted out of power, marking the end of the revolution, Miguel Caseres, an adviser to the country's Institute for Natural Resources and the Environment, estimated that the soils of the Pacific plains were eroding at a rate of more than twenty tons per acre, which was more than four times the acceptable rate.[29]

## Energizing the Sugarcane Boom

Sugarcane operations expanded only modestly during the postrevolutionary period of the 1990s, as the state farms were sold back to private investors. By the turn of the twenty-first century, however, the political and policy winds were again blowing strongly in favor of monocrop expansion. In Nicaragua, this push was spearheaded in part by Enrique Bolaños, a politician who had made his fortune during the cotton boom and who was elected vice president in 1996 and president in 2001 on the Liberal Party ticket. Bolaños's administration was bookended by two key events. First was a protracted struggle by banana plantation workers to hold US fruit companies to account for the long-term health effects of workplace exposure to dibromochloropropane (DBCP), a carcinogenic soil fumigant that had been banned in the United States in 1977 but was used in Nicaragua by the Dole corporation until at least 1980.[30] In his first year as president, Bolaños presided over the passage of Special Law 364, which would allow workers who believed they had been injured or rendered sterile due to exposure to DBCP to sue Dole, Dow Chemical, and the Shell Corporation

for damages. Bolaños did this despite his deep ties to the agricultural and pesticide industries, and despite smear campaigns by his political enemies, who accused him of being in the pocket of the chemical industry (Bolaños's son did, in fact, work for the Monsanto Corporation).[31] Bolaños's willingness to take on the pesticide industry was part of his broader strategy to revive Nicaragua's flagging economy through a return to Liberal Party principles of free trade and export-driven development. Near the end of his term, he presided over Nicaragua's accession to the Central America–Dominican Republic Free Trade Agreement.

Less well publicized, though no less significant, was Bolaños's enthusiastic embrace of agricultural intensification for bioenergy development. In 2006, his last year in office, he signed Executive Decree 42, which was issued in response to "the need for global production of renewable, clean fuels."[32] Calling for increased investment in the sugarcane and oil palm sectors, the decree stated that, compounded with Nicaragua's existing resources, further investment in biofuels "put us at the forefront of the new paradigm for agriculture in the 21st century: Bioenergy."[33] Bolaños's decree was released around the time that the World Bank and the IFC were starting to invest in the global biofuel sector, including through loans to Nicaraguan sugar companies. The IFC's $55 million loan to Nicaragua Sugar Estates Limited (NSEL), which eventually led to global recognition of the CKDnt epidemic, was approved mere weeks after Executive Decree 42 was published.

Here, then, was a new atmospheric fix. At the time of the IFC loan and the executive decree, petroleum prices were steadily climbing, and in countries like Nicaragua, the accumulated effects of climate change were keenly felt, even by business-friendly leaders like Enrique Bolaños. For the IFC and the World Bank, more investment in sugarcane might not only perpetuate the country's gains in food export but also develop its capacity to produce homegrown sources of "clean" energy, including ethanol and biomass fuel generated from sugarcane pulp, or bagasse. The World Bank's report *Rising Global Interest in Farmland: Can It Yield Sustainable and Equitable Benefits?* (2011) proposed that the acquisition of land for energy-generating monocultures would yield both environmental gains, by reducing dependence on fossil fuel, and development gains, by giving rural people living and working in "inefficient" farm systems better-paying jobs.[34] In the name of closing what development policymakers had long seen as a "yield gap" or "productivity gap" between Euro-Atlantic and Latin American agriculture, the IFC supplied already-large Nicaraguan sugarcane firms with loans to acquire even more land.[35] These concerns about efficiency, yield, and productivity are consistent themes of

Nicaraguan agrarian history, dating back to the Somoza dynasty's anticommunist drive to industrialize in the 1940s, 1950s, and 1960s. Along with the decades-long process of pesticide-driven landscape transformation in the Somoza years, these concerns set the scene for the eventual medical and corporate response to CKDnt.

## Normalizing Extremes: The Spaceship in the Cane

As we saw in chapter 1, when Nicaraguan sugarcane workers first mobilized to address CKDnt, they were met with resistance from plantation companies. Company officials steadfastly denied that labor conditions were to blame for the epidemic. They asserted that some combination of behavioral and genetic factors must be the cause. An early victory of the patient advocacy movements that filed the CAO grievances at NSEL in 2008 and at Montelimar in 2015 was an agreement by sugarcane companies to allow epidemiological research on CDKnt to take place on plantations. The workers' expectation was that these studies would reveal a connection between the disease and pesticide exposure. They did not. Comparative, population-based epidemiology explored several potential causes of CKDnt, from behavioral choices (e.g., alcohol consumption, self-medication with nonsteroidal anti-inflammatory drugs) to genetic predisposition to pesticide exposure to heavy metal intoxication.

Among all the possible causes, heat stress has consistently been identified as the factor most amenable to systematic experimental scrutiny. Studies of the relationship between heat and CKDnt are now dominant in the pages of the scientific journals where CKDnt researchers share their work. In 2020, one prominent CKDnt scientist put it this way: "As in all chronic diseases, multiple conditions over the course of a lifetime will ultimately contribute to the risk of getting a disease, including low-dose exposures to toxic agents. However, regarding a driver of an epidemic, it is common sense to focus on the obvious rather than speculating that unknown agents, unidentified after decades of an epidemic, are persistently killing tens of thousands of people, mainly workers."[36] What is noteworthy about this statement, which appears in an article that makes a vigorous argument in favor of focusing CKDnt research on heat stress rather than "unknown" pesticides, is that it couches heat as "the obvious" factor at play.

What makes extreme heat exposure, and the dehydration and compromised kidney function that result from it, appear "obvious"?

One answer emerges from the long historical entanglement between normative ideas about work and scientific ideas about heat and energy. As the political theorist Cara Daggett explains, beginning in the nineteenth century,

a European quest for dominance over the extraction and control of petrochemical and biological energy sources in colonized areas was wedded to a quest to corral and manage the energetic inputs and outputs of industrial working bodies in the metropole.[37] The plantations of the American tropics and the coal-fired factories of North America and Europe were, from the start, thermodynamically connected to one another. The drive to replace fossil fuels with biofuels has done little to change this. During the early days of industrial capitalism, the capture of heat in steam engines helped push the limits of mechanical production, even as it reaffirmed those of biological reproduction. The bodies of factory workers in industrializing England, and later America, were fueled by plantation sugar.[38] As the historian Anson Rabinbach notes, the very concept of "fatigue" as a dissipation of labor power emerged in the nineteenth century through the coupled sciences of economics, social medicine, and mechanics. Early industrial machinery released tremendous, unprecedented amounts of heat not just into turbines or pistons but also onto the surrounding factory floor, into the atmosphere, and into the bodies of laborers. The confluence of medical and economic concern extended to a planetary scale. Industrial age social reformers expressed anxiety about the exhaustion not just of bodies and machines but of life itself. Citing the second law of thermodynamics, they were worried about "the heat death of the universe": the slow dissipation of natural *and* mechanical heat that would spell the end of all life.[39] Thermodynamics created "a new image of nature whose topos was 'conflagration'—a cosmos of fire, heat, and work."[40]

A more specific answer, however, emerges after a closer look at the environmental history of the sugarcane zone that I sketched earlier. Progressive (and near-total) deforestation, the draining of water resources, the enclosure of farmland for the production of pesticide-intensive crops, and the construction of an agricultural economy in which intense, low-paid work was often the only viable option for many campesinos all contributed to creating the "obvious" problem of heat exposure. Since the middle of the twentieth century, pesticides have been essential tools for converting the heat of the Nicaraguan sun into food and energy. The medium for this conversion was, and continues to be, the bodies of those who work and live in monocrop landscapes.[41] The landscape is hotter, in other words, *because* of pesticide-driven monoculture.

Heat is an obvious factor for a third reason. Heat stress is a known problem in occupational health, something that experts in the field are accustomed to studying, and as recognition of climate change has grown, heat has seemed even more like the "natural" place to begin intervening.[42] The idea that CKDnt might be a *climate*-induced illness may have actually helped convince Nicaraguan

sugar companies to acknowledge the epidemic. In mid-2017, NSEL's website reprinted an article by a *Vice News* journalist who had earlier helped to publicize a movement to boycott the company's signature product, Flor de Caña rum, in the wake of several damning press accounts of the CKDnt epidemic.[43] In the article, the journalist partly repudiates that boycott, pointing to studies of an association between heat exposure, rising global temperatures, and CKDnt in Central America, Sri Lanka, and India to argue that the disease was not a problem of Nicaraguan sugarcane production per se but of global climate change.[44] In these kinds of accounts, climate change becomes an externality, and rising temperatures emerge as an "obvious" threat not just to working bodies but to sugarcane production itself. What disappears is any notion that heat has a history—that the atmosphere now seen as dangerous for workers and companies alike was deliberately cultivated. Paradoxically, climate change emerged as a new atmospheric fix for a sugarcane industry beleaguered by accusations that its labor practices and use of pesticides had caused CKDnt.

In climate summits, grant proposals, and meetings among sugarcane industry insiders, the planetary health crisis consistently comes to look like a crisis of productivity. As an illustration of this point, a meta-analysis of heat-related disease published in the *Annual Review of Public Health* in 2016 found that "heat exposure . . . affects workers' capability to undertake physical activities without harm; in hot conditions, work capacity falls, leading to a decrease of labor productivity."[45] In 2015, management consultants at Verisk Maplecroft warned that rising temperatures could cut productivity in Southeast Asia by as much as 25 percent in the next thirty years.[46] States, insurance companies, and labor unions from California to Texas are rewriting occupational health rules to deal with the threat of heat to both health and productivity. The problem, as Sarah Horton explains in her anthropological account of heat-related death and illness in California's agricultural sector, is that there is scant evidence that such narrow policy prescriptions, which treat the "occupational" as a discrete category amenable to intervention and manipulation, actually save lives. The managerial imperative to maintain worker productivity, rather than occupational heat itself, is just as likely to be a source of morbidity.[47]

Based on the emerging scientific consensus about the heat stress hypothesis for CKDnt, a vocal group of occupational health specialists has begun working to mitigate the onset of the disease in workers. Around 2018, they convinced the owners of sugarcane plantations in several Central American countries, including Nicaragua, to permit a new round of epidemiological experiments. Unlike the earlier CKDnt studies, which were largely observational, the purpose of this newer round was to test the hypothesis that an active intervention, in the

form of the regular provision of water, rest, and shade to laborers throughout the workday, could stave off acute kidney injury caused by heat stress in the short term and prevent the onset of CKDnt in the longer term.[48] A corollary hypothesis is that the provision of water, rest, and shade would constitute a worthwhile (i.e., remunerative) investment on the part of sugarcane companies.[49] These experiments explicitly sought to close what policymakers had long seen as a "productivity gap" that kept agricultural economies in countries like Nicaragua lagging behind those of more developed nation-states.

In coordination with the multistakeholder trade organization Bonsucro, near the end of the 2010s, the CKDnt-focused nongovernmental organization La Isla Network launched the Adelante Initiative, an effort to test the theory that the provision of electrolyte-enhanced water and mandated rest periods in a shaded space could stem the onset of kidney injury.[50] The key experimental apparatus in the Adelante Initiative is the shade tent. One Adelante project report describes how, over a series of cane harvests, researchers iteratively adjusted the location of tents, their color, the angle of their orientation relative to the sun, and the number of workers who could occupy them at any one time.[51] The goal was to define the capacity of the tent and the electrolyte-enhanced water solution to provide relief.[52] In the absence of definitive knowledge about what causes CKDnt, Adelante patterned its work on the template of other "evidence-based" global health projects, "[proceeding] in such a way that project implementation becomes a form of experimental variable testing."[53] If the water-rest-shade experiments proved successful, project leaders believed that lessons learned could be translated to any sugarcane plantation that is accredited by Bonsucro's system for certifying "responsible" sugar producers and promoting their products to socially conscious consumers.

What was *not* under scrutiny in this experiment was the plantation itself; nor was the role of pesticides in creating the kinds of economies of scale that almost inevitably lead workers to become dangerously exposed to extreme heat. The experiment presumed that the plantation environment was and would remain extreme. The construction of a microclimate in the form of the tented refuge would make that extremity marginally more tolerable, or so went the Adelante hypothesis. Since 2018, the water-rest-shade protocol has been taken up across the industry, including at Montelimar.[54]

The shade tent is a space of exception. Like the microenvironment of a spacecraft, the microenvironment of the tent, in Valerie Olson's words, "simultaneously normalizes . . . bodies and the outer spatial milieus that they inhabit."[55] At the same time, it manages workers' bodies "not just as living bodies but as at-risk living systems seamlessly integrated with mechanical and

environmental systems."[56] The creation of what we might call, following the anthropologist Göçke Günel, a "spaceship in the cane," amounts to a "technical adjustment" to the plantation, a means of making sugarcane production viable "without interrogating existing social, political, and economic relations," including the embodied inequalities on which cane production depends.[57] The water-rest-shade intervention acknowledges the reality of climate change and the human cost of sugarcane production while deferring direct action on the root causes of either.

To be sure, there is much to admire in a project like Adelante, which has become a pillar of Bonsucro's global certification standards for responsible sugar production. Through a technical adjustment to management practices, it aims to adapt the particular conditions of sugarcane fields to the presumably universal condition of global warming. The next step, according to Adelante, is "to provide an incubator from which the standard for effective occupational safety and health can be . . . scaled to other industries and geographies."[58] As Gabrielle Hecht has argued, these kinds of international standards "aspire to . . . coevalness. . . . In principle, they [offer] ways of comparing procedures in distant places . . . against a benchmark. . . . In principle, they deny the legitimacy of displacing harm to spaces inhabited by marginalized people, asserting that all places should adhere to the same environmental and labor norms."[59] Hecht warns that while "international standards . . . can be devices for seeking remediation . . . they can also serve as permits to pollute."[60]

With this in mind, it is worth zooming out to see what this well-meaning shift in management practice might be an alibi for. What kind of planetary health is this? The introduction of this atmospheric fix extends the Green Revolution–inflected dream of closing the productivity gap between the Global South and the Global North. Implementation of the water-rest-shade protocol works on the principle of vertical transfer, from managers to field workers. In the words of a field manager interviewed by Adelante researchers, "Supervisory staff must be made aware first so they accept it first, so that they can pass it on to the fieldworker. Because if we, the supervisors, cannot first absorb the benefit that the program has, we will not be able to transfer it."[61] According to one economic analysis of the Adelante project, "For every dollar spent on Adelante, [a plantation] receives a return of approximately 22%."[62] Like other recent small-scale health care and development initiatives, Adelante introduces a new, low-cost device for keeping human bodies alive that is also a device for accumulating capital.[63] The paternalism of plantation production is fully preserved in this model. In a peer-reviewed qualitative study carried out by the Adelante Initiative, field managers at one plantation discussed the

challenges of implementing heat stress–aversion policies. For the managers, as the authors of this study explained, "the cutters appeared to be viewed like children who disregard their health and, hence, need to be reminded repetitively to become aware that their health is important."[64]

"Technoscience," as M. Murphy has written, "dreams the world it makes sense in."[65] Adelante's atmospheric fix reifies the familiar trope of the simple worker in the cane, the man-child who might even work too hard if not for managerial oversight. This protected cane cutter is an example of what Sylvia Wynter calls the "honorary human."[66] Ever since the era of the transatlantic slave trade, the humanity of racialized plantation workers has consistently been predicated on their status *as workers*.[67] Other possible forms of humanity (caregiver, thinker, kin) have been less readily available to them. At the root of the experiment are investment strategies championed by the World Bank, the US government, a range of pesticide companies, and successive Nicaraguan regimes, from Somoza to Bolaños to Ortega, that saw the expansion of monoculture as a pathway to human flourishing.

The problem is that while kidney disease is rife in the sugarcane zone, which makes bodies at risk available for occupational health experimentation, the number of actual sugarcane workers in Nicaragua is getting smaller every year. This reduction in the laboring population is deliberate. Paradoxically, thanks to tools like machine harvesters and aerial crop dusters, the geographic footprint of the cane industry is larger than it has ever been, even though just a fraction of the residents of the communities on the edges of the sugarcane zone will ever work directly in the industry, and only a few hundred of these people will work full-time. The disappearance of formal, recognized labor is very much by design. It limits liability and increases profits. The embrace of the heat stress solution by the ethically minded members of Bonsucro's expanding network of responsible sugar producers, then, creates what Hannah Appel calls a "spatial and phenomenological distance" between sugarcane plantations and the communities that are right next to them.[68]

## Atmospheric Homework and the "Rehydration Thesis"

Remarkably, very little of the scientific literature on CKDnt mentions Nicaragua's long history of pesticide-intensive agriculture. The latent toxicity and unavoidable dryness of the landscape have become accepted by those who set industrial standards at the national and international levels as part of life, as quotidian, as noise.[69] That said, not all scientists accept the premise that heat should be the "obvious" focal point for CKDnt research. The thesis that heat stress

causes dehydration, leading to compromised kidney function, has been countered by the suggestion that the problem is not dehydration but *re*hydration with potentially tainted water.[70] The problem is that given Nicaragua's toxic history, in which the residues of 2,4-D, paraquat, glyphosate, methyl parathion, DDT, and dozens of other chemicals mingle in the soil and groundwater, there is simply no scientific method for testing this hypothesis. A version of this "rehydration thesis" was kept alive, however, in villages like Valle Rojo, one of the dozens that sit amid the Montelimar cane fields. People kept this thesis alive through an alternative practice of atmospheric cultivation, which I am calling "atmospheric homework."

Doña Claudia lived in the center of the village, directly across from the community's main water source, a tube well that was installed by the Montelimar Corporation in the mid-2010s. Behind her house was a small river, which originated in the upland forest dozens of kilometers away and was interrupted at several points near Valle Rojo by low-head irrigation dams, built during the 1960s and 1970s. Those dams diverted much of the river's flow into open concrete irrigation canals, one of which flowed right through Valle Rojo, just on the other side of the tube well.

When we first met, Doña Claudia quickly told me two things. First, she said that while she had never worked in the Montelimar sugarcane fields, she had CKDnt, as did her uncle and her father, both of whom were former workers. That claim, like the claims of many women to be stricken with CKDnt, remains unverified, but as we will see later, that does not mean it was insignificant. Second, Doña Claudia explained that while it might look like Valle Rojo was surrounded by water, finding water was harder and harder. "The problem here," she said, "with the kidneys, with everything, it's in the water." Doña Claudia's second point reflects a common trope in environmental writing about Nicaragua, that it is "a thirsty country with lots of water."[71] In this country that contains Central America's two largest freshwater lakes and hundreds of rivers and rainforests, poor rural people are constantly looking for a safe way to hydrate.

Doña Claudia was a keen political ecologist. In one of our early meetings, she took Saúl, Don Alvaro Torres, and me to the riverbed behind her house and showed us several spots where people had dug wells over the years to access water for cleaning, crops, and animals. Few of these artisanal wells were serviceable now, and besides, in the dry season between January and May, the river would become nearly empty. In El Niño years (there were three straight between 2014 and 2016, another in 2019, and yet another in 2023), the problem got even worse.

Around the time of the string of El Niños in 2014 to 2016, residents in Valle Rojo convinced a local television station to come to the area to illustrate how the dry conditions were affecting them. The El Niños, combined with decades of deforestation and an expansion of industrial agriculture along Nicaragua's Pacific basin, made it easy for the journalists to link the plantation's appropriation of river water to women's struggles to keep up with their own washing and gardening. Nicaraguan media have been tracking this phenomenon for some time. In 2014, Ruth Selma Herrera, a former director of the country's national water utility, reported that 70 percent of the nation's water was consumed by large agricultural landholders, with just 6 percent going to human consumption.[72]

As we will explore further in chapter 3, the wells installed at Valle Rojo and other villages were the Montelimar Corporation's response to residents' anxieties about water access. They were a tidy piece of corporate social responsibility: an attempt to normalize the extremes caused by the confluence of El Niños, land consolidation, water appropriation, and deforestation. The story of this community's small protest over water access, bound up as it is in the problem of increasingly intense El Niños and long-standing environmental destruction due to industrial agriculture, is an example of what Eli Elinoff and Tyson Vaughan call "troubling the quotidian," the process of denaturalizing climate change by calling attention to the way in which climate disaster becomes an everyday experience for poor and marginalized people.[73] What was at stake for Doña Claudia and her neighbors was not an acute disaster—not exactly. Rather, it was the steadily increasing time and energy it took to carry out basic, everyday reproductive tasks—to forge a nonplantation living in the middle of the monoculture.[74] This human energy drain, linked to the evaporation of local water supply, was connected to a long history of deforestation and water theft.

Even though the installation of the wells happened at the height of the CKDnt epidemic, concern about kidney disease was not a significant element in the protest that was staged around the drying up of the riverbed. By that time, most people already assumed that the cane workers were getting sick because of agrochemical exposure. The coming of the well brought anxieties about chemicals together with anxieties about hydration. As it was in so many others, the Montelimar Corporation's crop-dusting helicopter, laden with the "ripener" that was almost certainly glyphosate, was a prominent figure in Claudia's narrative. Glyphosate is both a key reason why the sugarcane industry in Nicaragua has been able to cheaply expand and a key reason why the industry employs fewer and fewer workers. In many ways, the chemical—and the

difficulty of discerning what effect it might have on human health—has been an effective tool for widening the social and economic distance between the plantations and the villages in their midst.[75]

But pesticides don't tend to stay in place.

In one focus group of village women I organized, Doña Esther, one of Claudia's neighbors, explained, "We all drink from wells." She pointed to the one in the center of the village. "But when you draw water from that well, you notice that it has a smell, an odor. . . . They say it's from the fumigation." That smell did not have a specific chemical referent, but as Doña Esther implied, healthy water should not have a smell, or a color, or a taste. A sense of smell is a sort of sentinel function: smoke, putrefaction, and other odors signal, in a small and inconclusive way, a rupture to an ecological system. Seen in the right way, they could even signal something larger—maybe a change in climate.[76] To smell a chemical is a different way of finding oneself within a larger system, one that has affordances distinct from those of something like an international occupational labor standard. Smelling is a form of atmospheric homework, a physical act of letting something troubling in and contemplating it.

And while building shade tents and drinking electrolyte-enhanced water are means of preparing, talking about smells is a means of remembering. When we discussed the smell of the water, neither Doña Esther, nor Claudia, nor anyone else mentioned glyphosate specifically. I would bring it up, and though the villagers could name lots of poisons, what was difficult for them—what they in fact had trouble thinking of as their responsibility—was figuring out which chemical caused which problem, or carried which odor. Much as the movements around water scarcity knowingly referenced a deep history of deforestation and corporate appropriation by the sugar industry and its antecedents, the allusions to smell invoked a shared, layered history of toxic exposure, the kind of history referenced in Ernesto Cardenal's poem about the "smell of Nicaragua."

Later in our focus group conversation, Doña Esther described how, before offering water to her grandchildren, she would put a few drops of chlorine bleach into it. Chlorine is a standard treatment for water in places around Nicaragua where formal municipal gridded water service is available.[77] In Valle Rojo, where there was no municipal supply, she and her neighbors used bleach to, as she put it, "correct" the smell of the water that came out of the well that the corporation had donated after the riverbed protests. There were other methods. A neighbor down the road said that she would place buckets of water in the sun for several hours before drinking them, explaining that the smell would dissipate, even if much of the liquid would also evaporate.

## CKDnt beyond the Fields

A reasonable response to Doña Esther's account of improvised water correction might be that there is no causal relationship between the presence of chlorine, which neutralizes bacteria, and protection from agrochemical exposure. There is also no clear connection between the smell of water and the presence of agrochemicals. Glyphosate, after all, is virtually odorless. Suspending the impulse to do this kind of counterforensics, I want to suggest that what Doña Esther was describing was a method for developing awareness, a practiced tinkering with her atmospheric and hydrologic surroundings.[78] The bleach, whose familiar aseptic smell covered over the unsettling smell of whatever else might be lurking in the water, established Doña Esther's "awareness of the political ecology driving industrial harm."[79] She insisted on acting, however ineffectively, to mitigate an injury that the Montelimar Corporation would likely disavow.

Like Claudia, Doña Esther insisted that she, too, had CKDnt. As with the improvised application of bleach, this autodiagnosis meant little on its own, so I wonder why it was so common to hear women, who are frequently portrayed as less likely to contract CKDnt, linking their anxieties about water's availability and quality to the epidemic. One explanation is that CKDnt was an available and legible category, one that could draw attention to the enduring problem of water quality. An anthropologist, a corporate social responsibility officer, or an epidemiologist might have their interest piqued if vernacular reckonings of health were routed through an already known epidemic. But I don't know if I am convinced that these repeated claims to kidney disease are only about medicalization. They may also be about labor, specifically, the labor of managing all the excesses—the multiple forms of pollution, from the bacterial to the chemical—that are obscured by standardized medical approaches to late industrial problems, including the corporate embrace of workplace heat stress mitigation. This is the kind of labor that the next two chapters will discuss in detail.

Women's insistence that they, too, were affected by the disease was a means of claiming that that which lies beyond the plantation fields, that which is definitionally not productive, is also planetary, even if it does not read as extreme. Aside from dialysis, which is available to a limited number of Nicaraguan CKDnt patients, care for those who are diagnosed with CKDnt is provided almost exclusively by family members, mostly women. Women's roles as providers of care for the thousands of people who have the disease are, like Nicaragua's long history of pesticide-driven environmental violence, nearly unacknowledged in the medical literature on the disease.

Men tend to dominate the ranks of sugarcane farmworkers, who are already overrepresented in CKDnt studies. When they do work in the sugarcane fields, most men who live in villages like Valle Rojo find work only seasonally, during the five- to six-month harvest period. In the remainder of the year, they make a living tending to small subsistence plots. When men fall sick with CKDnt, this subsistence labor becomes the responsibility of their wives, sisters, and mothers, in addition to cooking, cleaning, and bathing. What I think the women of Valle Rojo were trying to do with their atmospheric homework was to "bring trouble" to this idea of quotidian, routinized, feminized care, the kind of care that is presumed to just exist in villages like theirs.[80]

So even as CKDnt debilitates and kills more men, and even as the overall size of the workforce in the Nicaraguan cane industry continues to get smaller, the disease has come to stoke a need for more work from women in places like Valle Rojo. Women who may never have set foot in the cane fields find themselves dedicating more and more time to looking for water to give to their family members, to feed plants and animals, to clean, and to bathe. Water is the tool that they need but cannot access to clean up the human and environmental mess caused by sugar production.

To suggest that CKDnt is both a problem of plantation work and a problem of "homework" on the outside of the plantation is not to dismiss the role of field labor conditions in the spread of the disease. When I asked, most women and men in the villages of the sugarcane zone welcomed international research projects like Adelante. Doing atmospheric homework means asking what else might be possible. Attention to how people pose such questions can help us find ways to include things that do not normally count as "extreme" in the stories we tell about planetary health. Atmospheric homework is a start. It is not a direct refusal or refutation of the premises of experiments like Adelante, but a refusal to treat everything that lies outside that experimental space as natural, as given, as noise. When village women talk about being affected by chronic kidney disease, when they speculate about what might be in the water, and when they perform their own experiments with bleach and sunlight and tell their own histories of dehydration, this is what they are doing. The term *chronic kidney disease* names not just the inability of one kind of body or organ to endure extremes but a breakdown in the capacity of many kinds of bodies (bodies of humans, bodies of plants, bodies of water) in historically particular places—the Pacific Basin of Central America, a nameless, minor river valley in a tropical dry forest—to absorb the atmospheric excesses of industrial agriculture.

CKDnt is a condition in which the vulnerability of the working body seems conjoined with that of the biosphere. It is a condition in which the effects of

overfarming and overexertion reverberate and resonate between persons and working environments. Among other things, CKDnt is an atmospheric condition: a dysfunctional relationship between a system and its surrounding context. It is a disease in which working bodies can no longer adapt to their surroundings.

The point of looking at CKDnt beyond the fields, as we will do in the next two chapters, is not simply to critique the hubris of global standards by offering the counterpoint of local contingency. It is rather to acknowledge that the work, however halting and individually failing, of trying to articulate what is troubling about everyday experience is also planetary work. A response to the sugarcane industry's systematic disavowal of responsibility for deforestation, for drought, and for toxicity could of course entail calls for regular water quality testing and redistribution (and it does), but residents of Valle Rojo and other villages have good reason to be suspicious that a straightforward toxicological approach to the health problems they face will get them anywhere. After all, they already know that their bodies have been used as dumping grounds for methyl parathion, DDT, and other chemicals. They make no claim or aspiration to purity; rather, they make a more radical claim: that as much as late industrial science and plantation economics would write them out of the story of modern sugar production, they are inextricably entangled with it. This entanglement is violent and unstable, and attempts to normalize it through conventional methods of environmental health surveillance do not necessarily lead to justice. Claims to save industrial workers from the excesses of global warming do little to answer the question of why, even as the vulnerability of those categorized as formal laborers becomes increasingly associated with a changing climate, that changing climate seems to be demanding that those outside the formal sector do more work.