



Negative Ecologies

*Fossil Fuels and the Discovery  
of the Environment*

David Bond



UNIVERSITY OF CALIFORNIA PRESS

*To William and Meredith,  
for the revolutions they bring*

University of California Press  
Oakland, California

© 2022 by David Bond

Library of Congress Cataloging-in-Publication Data

Names: Bond, David, 1979- author.

Title: Negative ecologies : fossil fuels and the discovery of the environment /  
David Bond.

Description: Oakland, California : University of California Press, [2022] |  
Includes bibliographical references and index.

Identifiers: LCCN 2021046117 (print) | LCCN 2021046118 (ebook) |  
ISBN 9780520386778 (cloth) | ISBN 9780520386785 (paperback) |  
ISBN 9780520386792 (epub)

Subjects: LCSH: Fossil fuels—Environmental aspects—North America. |  
Ecology—Environmental aspects—North America. | Climatic changes—  
North America.

Classification: LCC TD887.F69 B66 2022 (print) | LCC TD887.F69 (ebook) |  
DDC 363.738/7097—dc23/eng/20211012

LC record available at <https://lccn.loc.gov/2021046117>

LC ebook record available at <https://lccn.loc.gov/2021046118>

Manufactured in the United States of America

3 1 3 0 2 9 2 8 2 7 2 6 2 5 2 4 2 3 2 2  
1 0 9 8 7 6 5 4 3 2 1

## Contents

List of Illustrations	ix
Introduction: The Promise and Predicament of Crude Oil	i
1. Environment: A Disastrous History of the Hydrocarbon Present	23
2. Governing Disaster	69
3. Ethical Oil	93
4. Occupying the Implication	114
5. Petrochemical Fallout	123
6. The Ecological Mangrove	147
Conclusion: Negative Ecologies and the Discovery of the Environment	175
Acknowledgments	183
Notes	187
References	215
Index	247

## CHAPTER I

### Environment

*A Disastrous History  
of the Hydrocarbon Present*

Is the environment worth the effort? The environment often seems far too easy, far too obligatory, and far too footloose a concept to warrant serious attention. It somehow evokes both bookish abstraction and populist rousing, it cobbles together science and advocacy only to blunt their conjoined insights, and it continues to elude fixed definition even while basking in stately recognition. The banalities of this mess can give the impression that the environment has no real history, has no critical content, and heralds no true rupture of thought and practice. The environment, in the eyes of some, is mere advertising. If there is a story to the environment, others suggest, it's largely one of misplaced materialism, middle-class aesthetics, and first world problems. Such has been the sentiment, such has been the dismissal.

In the rush to move past the environment, few have attended to the history of the concept. This is curious, as the constitution of the environment remains a surprisingly recent achievement. In the late 1960s and early 1970s, the environment shifted from an erudite shorthand for the influence of context to the premier diagnostic of a troubling new world of induced precarity (whether called *Umwelt*, *l'environment*, *medio ambiente*, *huanjing*, *mazingira*, or *lingkungan*).<sup>1</sup> While the resulting recognition of the environment largely consisted of bringing existing problems together under one umbrella—factory pollution, urban sewage, radioactive fallout, automobile emissions, garbage disposal, and even climate change—the resulting synthesis was powerful.<sup>2</sup> It was

almost as if a light had been switched on to reveal a whole new world of toxic trespass. Such illumination—what historian Joachim Radkau has called “a New Enlightenment”—posed an unsettling provocation: perhaps progress was not achieved autonomy from the natural world but waves of profit and power undermining the very basis of life. As shorthand for the resulting crisis of life, the environment became an insurgent field devoted to understanding damaged life and taking responsibility for it. Despite scholarly attempts to bury the term within more established histories, the environment signaled something profoundly new for outraged citizens, concerned scientists, and savvy politicians.<sup>3</sup>

The novelty of the environment did not pass without notice. Celebrating its recent arrival, *Time* magazine named the “environment” the issue of the year in 1971. When fifty paperbacks on the discovery of the environment were published in 1970 alone, a *New York Times* reviewer described being “inundated by books on the environment” (Shepard 1970: 3). While drawing very different conclusions, these books almost uniformly noted how the environment drew the ailing “life support systems” of Earth into unsettling focus. Privileging the pragmatics of human survival over inherited precepts, the environment introduced an impending future as the new guidebook to moral conduct and political action in the present. A French minister called *l’environnement* an “imperialist” term for how quickly it infiltrated the country, demanding new oversight within the most ordinary of places and practices (Poujade 1975: 27). The family automobile, dishwashing detergents, and plastic bags found themselves suddenly shot through with planetary significance. Astounded at the range of the concept, ecologist Paul Shepard (1970: 3) insisted the environment “is genuinely new in its planetary perspective and connection to war, poverty, and social injustice.” The novelist Isaac Asimov (1970: A9) summarized the sentiment in 1970: “Environment has become a magical word,” he wrote, drawing together the ordinary and the planetary, our present plight and our future ends.

During the 1970s, the environment rather suddenly became “a household word and a potent political force,” as one White House report reflected (CEQ 1979: 5). Prompted by a somber announcement from the secretary general that “it is apparent that if current trends continue, the future of life on Earth could be endangered,” the United Nations (UN) organized a conference on the human environment in 1972 (UN 1969: 10; Ward and Dubos 1972). Within two decades nearly every government had commissioned a new agency or ministry to protect the environment. In the United States, environmental studies was inau-

gured on college campuses across the nation, and major newspapers added an “environment beat.” Whole subfields in environmental law and environmental science sprang up almost overnight. The *environment*—a term “once so infrequent and now becoming so universal,” as the director of the Nature Conservatory commented in 1973 (Nicholson 1970: 5)—soon came to monopolize popular and scientific understandings of damaged life and the state’s obligation to it. Visualizing the synthetic webs at once underlying and undermining the modern project, the environment advanced a theory of entangled life beyond the nature/culture dualism. Vividly documenting the basis of life slipping just beyond the fixtures of modernist control, the environment offered a precocious theory of the Anthropocene. To the great misfortune of contemporary scholars scrambling for the title of first author, this early theory of manufactured disarray was most substantially advanced by the state.

While much has been made about how this crisis of life helped lay the affective groundwork for the rise of environmentalism (Gottlieb 1993; Worster 1994; Sellers 2012), much less attention has focused on the underlying materiality of this crisis.<sup>4</sup> As the resulting social movement holds the attention of scholars and citizens alike, the physical ruptures these campaigns responded to has drifted out of focus. Many of the specific problems that provoked what became known as “the environmental crisis” had their basis in what Rachel Carson (1962: 11) once called “the wonder world” of hydrocarbon innovation in post–World War II America. As two leading public health officials noted in 1955: “The recent advent of the atomic age, the era of synthetics, and the petroleum economy, when combined with epidemiological observations, indicate that a general population hazard is of more than theoretical significance” (Kotin and Hueper 1955: 331). By the 1960s, ecologists were learning to see just how thoroughly two icons of modern power—fossil fuels and the atomic bomb—had infiltrated the very fabric of life. Christened “our synthetic environment” by Murray Bookchin (1962), this scientific recognition of porosity and precarity punctured the modernist swagger of modular control. While the specific instances of injury were incredibly wide-ranging, the cause was surprisingly uniform: hydrocarbon emissions, petrochemical runoff, and radioactive fallout. In other words, the material basis of American prosperity and power in the twentieth century.

Resituating the environment around American ascendance places the emergent crisis of life and resulting structure of feeling on a more

imperial foundation of disruption.<sup>5</sup> Rather than starting with the instigated social movement—environmentalism—and grasping the world from within its mobilized outlook or starting within the resulting domain of objectivity—environmental science and policy—and grasping the world from their already normalized overlay of toxicity and life, this book begins with the surplus of synthetic force that sparked the founding crisis. Emphasizing the messy materiality of “the environmental crisis” of the late 1960s can situate the protests and institutions that gave rise to the environment in the 1970s without too tightly bounding scholarly inquiry to their “post-material” suburban and state forms (Inglehart 1981). However provisionally, this also brings American empire into focus as an early provocateur of what Jane Bennett (2009) calls “vital matter” and others have taken up as the earth-shattering insight of nonhuman agency.

Many contemporary scholars newly smitten with the agency of the material world are swept up in a kind of utopian outlook, where a profound pessimism of the political conspires with a newfound optimism of the physical. Such work collapses all frustration with the shortcomings of existing politics into the fogged vision of human exceptionalism, suggesting that if we can only recognize the vibrant liveliness of the worlds beyond the human, a truly emancipatory politics will bloom organically from the rubble of the modern episteme. The most radical task, then, is to simply understand the world differently, to bracket the few centuries of history, in fact and in theory, as comprehensive failure and look forward to the worlds to come. Perhaps this may hold promise with the ontological force of mushrooms, rivers, forests, and mountains, to name a few of the more consequential reworkings of materiality in anthropology today. But the sweeping optimism of this current of thought often ignores the more destructive agencies that enliven our present (or worse, may find misplaced optimism in their destructive capacities). What of the ontological force of toxic destruction and pandemic disease? Is the celebration of their agency also emancipatory? Or, paraphrasing Taussig (2018: 18), what if it is the viral terror of the contemporary that has endowed the natural world with a vitality that scholars only grasp in proliferating agencies divorced from history? The explosive force and “slow violence” of fossil fuels and nuclear weapons bring a very political history to these questions of agency, one saturated with the petrochemical and radioactive foundation of American empire in the twentieth century (Nixon 2011; Immerwahr 2019). Yet today, this history of synthetic force in the imperial rise and reach of



FIGURE 2. 2014 Peoples Climate March. Photo by author.

the United States, writes Adam Hanieh (2021: 28), “sits elephant-like within the ecological crisis of the present.”

Such critical connections were closer to the surface during the rise of the environmental crisis. For writers like Rachel Carson and Barry Commoner, America’s rising reliance on fossil fuels and nuclear weapons introduced a profoundly destructive agency into the world. This haunting corrosion of life came into analytical focus precisely for the open-ended harm it caused, and by foregrounding the entangled webs of harm unleashed by the fallout of petrochemicals and radioactivity, their public scholarship sketched out a still unfinished critique of American empire. In sharp contrast to the new materialism of contemporary scholarship, their writing disallowed any deferment of history in the reckoning with the futures already at work within us and refused any celebration of an emancipatory politics from the mere recognition of material agency. Moreover, the legacy of their work also demonstrates how a radical opening to material agency and entangled life did not, in itself, conjure a revolutionary politics so much as authorize new scientific and regulatory fields of technocratic control within the nation-state.

## THE NEGATIVE ECOLOGIES OF POWER

In so many ways, the sudden and widespread realization of the environment was underwritten by the excessive synthetic materiality of American power. As many have argued, the properties of fossil fuels and atomic energy introduced a new material basis for coercive accumulation and authority and a new infrastructure for imperial projections of structural retribution and cultural aspiration that helped align the world with designs for a new American order.<sup>6</sup> Yet the unique properties of fossil fuels and atomic energy reached far beyond the coffers of corporations and the clenched fist of the state. Something of their force exceeded capture within positive iterations of wealth and influence. Something of their force made its way beyond capitalism and state power and into the fabric of life itself. And as they defied existing jurisdictions and disciplines and came to suggest worlds of consequence in gross surplus of their cause, these problems came to demand a new accounting.

Centering negative excess has a pedigreed intellectual genealogy. In 1947, Max Horkheimer and Theodor Adorno posed new questions about the excessive underside of modern power. Whether in trench warfare, administrated genocide, or suburban ease, an unprecedented union of “machines, chemicals, and organizational powers” ([1947] 2002: 184) promised to launch human might beyond the gravity of history and nature. For Horkheimer and Adorno, the concerted effort toward escape velocity inaugurated a new “epoch of the earth’s history” (184) founded on the divorce of jagged historical realities from the scientific pursuit of unfettered power, the privileging of a life of ease over any obligation to care, and the repression of an imploding present under the banner of a more perfect future. Reason metamorphized from a ladder of critical enlightenment into the author of oblivious annihilation. Almost as if self-driven, the resulting “motorized history” (xv) rushed ahead of any political accountability, let alone revolutionary resistance. By way of the automobile, DDT, and atomic weapons, Horkheimer and Adorno sketched out “the calamity which reason alone cannot avert” (187). Instead, they wrote of the postwar moment: “The hope for better conditions, insofar as it is not an illusion, is founded less on the assurance that those conditions are guaranteed, sustainable, and final than on a lack of respect for what is so firmly ensconced amid general suffering” (186). And it is from the dark alleyways and deformed lives of the catastrophic ascendance of instrumental reason that such promising disrespect resides. (As Adorno wrote at the time, “automobile junk

yards and drowned cats, all of these apocryphal realms on the edges of civilization move suddenly into the center,” quoted in Buck-Morss 1977: 189). Such work resituates the negative not as a fundamental lack but as a provisional grasp of reality in defiance of tyrannical rationality.

Twenty years on, and Theodor Adorno only deepened his conviction of negativity as the most philosophically astute, politically uncompromised, and empirically potent realm of the contemporary. “After the catastrophes that have happened, and in view of the catastrophes to come, it would be cynical to say that a plan for a better world is manifested in history and unites it,” wrote Adorno in *Negative Dialectics* ([1966] 2007: 320). Recoiling at the human fodder readily fed into the crackpot utopias of both liberalism and state socialism did not mean admitting critical theory could not counter the crisis at scale. It meant rooting critique in the historical necessity of change inoculated from the corporate dogma of technical progress. If no overarching spirit of redemption unified recent historical experience, there was still the possibility of a more encompassing home for critical theory. “No universal history leads from savagery to humanism, but there is one leading from the slingshot to the megaton bomb” (Adorno 2007: 320; see also Vázquez-Arroyo 2008; Chakrabarty 2009). Whether in lingering memories of concentration camps or rising fears of impending nuclear war (or, we might add, all of those places where the Cold War was anything but), a jilted sensibility of unbound destruction had become ordinary. “Absolute negativity is in plain sight” (Adorno 2007: 362). Such negativity may be ubiquitous, but such realities were also conceptually invisible. Negative realities were obscured by the omnipotent optimism of instrumental reason projecting redemptive futures. Yet for Adorno, the negative does not exist within the shadow of the positive. The rippling losses are not secondary, peripheral, subordinate, or ancillary to the promised growth. The losses were fast becoming the more definitive reality. How might centering negativity help prick the positivist plague of instrumental reason and stage a more potent politics of transformation? Not only is nonsensical destruction the direct consequence of the teleological pursuit of capital, but the injuries sustained grossly exceed the amassed gain. Unloosed ruin is the very landscape upon which categorical progress gains viral force and, on pain of waking up, cannot acknowledge. With revolutionary demurrer, Adorno looked to negativity as proliferating instances tripping up the imperial conceit of progress. Against the omnivorous ideological appetite and relentless synthetic acceleration of capitalized history, a modern whirlwind that seemed capable of bending any inkling of conceptual optimism into

widening projects of dispossession and devastation, the negative alone refused easy recruitment. Standing just outside the infectious mantra of mutually assured redemption through unrestricted destructive ability, the negative rebuffed philosophical appeasement and political reconciliation. It glimpsed an entirely different reality. Negative dialectics, for Adorno, roots inquiry and intervention within “the extremity that eludes the concept,” for anything else would merely provide “musical accompaniment” to annihilation (365).<sup>7</sup> Far from a political identification with the forces of destruction or celebration of the baptism of coming catastrophe, laying the emphasis on negativity gave credence to the present impossibility of current arrangements. Prioritizing the bruised and broken came to seed grand delusions of fueled progress with “epitomes of discontinuity” (320) that tripped up the otherwise relentless acceleration of history. Inhabiting experiences of negativity offered critical theory a way to grasp the present from within its historical momentum but not determined by it: experiences of negativity repulsed incorporation into instrumental reason, anchored the apprehension of reality in common destruction without validating utopian redemption, and opened a doorway to seize upon radical possibility from within a motorized history already derailed. In this insistence on the priority of the negative, Adorno was not alone.

Eugene Odum’s classic textbook, *Fundamentals of Ecology* (1953), oriented the emerging science of ecology toward the relations that energized life. Documenting a cycling between animate and inanimate, ecology found life suspended within intricately balanced circulations of matter.<sup>8</sup> A decade later, a number of scholars and writers turned Odum’s insights away from the isolated mountain ponds that populated his textbook and toward the manufactured present. Rachel Carson, Barry Commoner, and others drew on ecology to query vital biochemical cycles being thrown into disarray by the noxious excess of factories, power plants, automobiles, fertilizers, and nuclear testing. Observing the ease with which petrochemical pollution and radioactive waste joined the chemistry animating life, often to disastrous effect, they centered their inquiry on “the webs of life—or death—that scientists know as ecology,” as Rachel Carson (1962: 189) put it. This was an ecology that refused an outside to the industrial and militarized landscapes of the contemporary world. The subject of this renegade ecology was resolutely present tense: the split personality of American postwar society, possessed of both synthetic prosperity and biological precarity for which there was little precedent. Turning toward the historical

present, ecology became “a subversive science,” as Paul Shepard put it in 1969.

If the rise of ecology brought new emphasis on the biochemical relations that condition the possibility of life (McIntosh 1987; Golley 1993) and cultivate a sum flourishing in excess of its parts, Rachel Carson, Barry Commoner, and others showed how ecology could move just as easily in the opposite direction: the pulsing relationality of life could also be its undoing with flippant toxic releases, generating subtractions well in excess of the component parts. This synthetic hijacking of what Georges Bataille ([1967] 1991: 27, 10) once called the “chemical operations of life” bent energetic excess away from “the effervescence of life” and toward its caustic dissolution. In this new genre of engagement, a provisional commensurability took hold in worlds sundered from the modern teleology of enlightened progress and unified by their scientific proximity to ecological collapse. There was a negative ecology, bearing witness to how rising waves of hydrocarbon emissions, petrochemical runoff, and radioactive fallout spilled into the fabric of life, contorting such vital relationality into new intimate and planetary infections of injury and destruction. Reviewing the destruction underway in the name of progress, Rachel Carson (1962: 99) wrote, “The question is whether any civilization can wage relentless war on life without destroying itself, and without losing the right to be called civilized.”

With reference to petrochemicals and atomic bombs, in 1966 Adorno sketched out the emergence of negativity within the philosophical history of Western capitalism. As *Negative Dialectics* took shape, Rachel Carson and Barry Commoner were documenting a similar plot within the emerging ecological crisis of American prosperity. “We are living in a false prosperity,” Commoner (cited in Egan 2007: 141) told American audiences in 1970. “Our burgeoning industry and agriculture has produced lots of food, many cars, huge amounts of power, and fancy new chemical substitutes. But for all these goods we have been paying a hidden price.” That price, Commoner concluded, was the systematic corrosion of life itself. For Carson and Commoner, the generalized toxicity of DDT and radioactive fallout had come to outweigh whatever technical domination they heralded in the specific eradication of insects or enemies. While Adorno turned to negativity at the commanding heights of theoretical prowess, it inspired few protests and even fewer policies. In *Negative Dialectics* Adorno carefully leaves room for negativity to become “a creative force in itself,” as Susan Buck-Morss (1977: 36) has written, but Adorno himself did very little to either cultivate or delineate

the insurgent possibilities of the negative (see also Gordillo 2014). Carson and Commoner brought the negative into view in a way that inflamed popular enthusiasm for systematic change. Both Carson and Commoner privileged the sprawling webs of destruction in the wake of synthetic might as a way of defrocking the modern conceit that nature and history could be easily shed. And in so doing, they opened new fields of science, policy, and protest premised on first acknowledging the unbearable weight of multispecies suffering. If emphasizing negativity offered a philosophical counterpoint to the tyranny of capitalized rationality, it also offered an ecological counterweight to the American fantasy of petrochemical prosperity and thermonuclear stability.

Yet if Adorno was equally suspicious of both revolution and science, the work of Carson and Commoner would provide new cause to join their forces. Against the complicit sciences of extraction and extermination, a revolutionary science of care was born. Rejecting the “little tranquilizing pills of half-truth” found in the petrochemical industries patronizing claims to unrivaled scientific authority, Rachel Carson (1962: 13) insisted on a science attentive to mending the broken world. In accepting the National Book Award, Carson said the notion “that science is something that belongs in a separate compartment of its own, apart from everyday life, is one that I should like to challenge. We live in a scientific age; yet we assume that knowledge is the prerogative of only a small number of human beings, isolated and priestlike in their laboratories. This is not true. The materials of science are the materials of life itself. Science is part of the reality of living” (cited in Gottlieb 1993: 122). This science, what Barry Commoner (1967) later called the “science of survival,” came to privilege the empirical weight of destruction over the imperial banner of progress, and also came to prioritize urgent care for the world over any discussion of institutional capacity or costs disproportionate to profit. Such a science was revolutionary not for its active use of the term but because in centering the negative excess of power, such work gave rigorous scientific definition to an emerging crisis whose only solution would be the radical transformation of society itself. “Our system of productivity is at the heart of the environmental problem,” wrote Barry Commoner (cited in Egan 2007: 141). And overturning that system of productivity would be essential to any real solution.

The massive industrial, militarized, and then consumer expenditure of energy in twentieth-century America—an expenditure for which there is no precedent in human history (McNeil and Engelke 2016)—unloosed

a synthetic excess that frayed the fabric of life. These expenditures, as Donald Worster (1994: 340) put it, quickly called into question “the elemental survival of living things,” a profoundly new personal and planetary fact. As hydrocarbon and nuclear excess infiltrated interwoven existence, Rachel Carson, Barry Commoner, and other ecologists helped solidify an emergent sense of the vital interconnectivity of life and the recent achievement of its dire precarity. The resulting vision not only brought the ends of life into disconcerting focus, it also opened the routes, accruals, and cascading effects of those very ends into new scientific visibility and political responsibility. The resulting ecological accounting of power learned to see how elemental cycles that foster life were being infiltrated and impaired by synthetic force. It was a realization that brought empirical clarity to the historical contingencies of life on Earth and their groundbreaking possibilities once properly recognized. And soon enough a new field of science, a new jurisdiction of law, and a new social movement sprang up in this radical realization and what it demanded of the contemporary.

For many writers, scientists, and activists working in the 1960s, this dawning contradiction of life was brought into crisp focus by two compounds: DDT and strontium 90.<sup>9</sup> As the “most striking petrochemical technology success story of the postwar era,” DDT was used extensively as an insecticide across towns and fields in the United States in the 1940s and 1950s and in many tropical regions (Gottlieb 1993: 82). In the 1950s, enough DDT was sprayed in America “to give every man, woman, and child in the country their own one-pound bag” (Dunlap 2008: 5). Despite targeted uses in the extermination of pests, DDT readily accumulated in living tissues of a wide variety of animals, including humans, “with the result that many unforeseen, irrevocable, and undesirable side effects have arisen on a sizeable scale,” noted a report from the first American Medical Association congress on environmental health (White 1964: 729). A 1964 survey in the United States revealed that the “storage of DDT-derived material in body fat averaged 12.9 ppm for the general population” (White 1964: 729–30). DDT, an insecticide engineered from chlorinated hydrocarbons, is mistaken by the digestive tract of mammals for an ingredient of body fat and stored in fatty tissue. Unlike organic body fat, however, chlorinated hydrocarbons resist being broken down by internal enzymes and used as energy by the body. Once stored, they can become a permanent (and often perverse) part of the body. Bioaccumulation of DDT can contort reproductive functions, leading to high rates of miscarriages and birth defects. By the

1960s, DDT was showing up in most forms of life on Earth, including polar bears and penguins.

Conjured in the alchemy of nuclear detonation, strontium 90 dusted entire hemispheres (Rudd 1964). As “a chemical relative of calcium, it takes a similar biological course” (Commoner 1967: 15), moving from fields to dairy cows to human bones and teeth with startling rapidity.<sup>10</sup> Moving through the “soil-plant-milk-human chain,” strontium 90 accumulated at alarming levels in the fast-growing bones of breast-feeding infants and developing fetuses, a process attributed to the rising incidents of leukemia in US children during the 1960s and 1970s (Kulp, Schulert, and Eckelmann 1957: 1249; Newcombe 1957; Eckelmann, Kulp, and Schulert 1958; Kulp, Schulert, and Hodges 1959; Kulp, Schulert, and Hodges 1960; Kulp and Schulert 1962). These discovered linkages led to the widespread collection and study of baby teeth as a crucial indicator of the spread and density of radioactive fallout in human bodies (Reiss 1961). Once unloosed upon the world, DDT and strontium 90 leaked out of projects of engineered control and into the operating system of both the planet and its inhabitants.<sup>11</sup> In their novelty and then ubiquity, in their promise and then perversions, DDT and strontium 90 inaugurated a recognition of the very fabric of planetary unity and, at the same time, the manufactured power that actively threatened it. The negative excess of DDT and strontium-90 turned the invincible reason of synthetic power into its opposite while foregrounding the urgency of planetary care.

As wholly fabricated substances, DDT and strontium 90 were “tracers,” as ecologist George Woodwell (1967: 24) put it, that cast new empirical light on planetary systems and their interplay with food chains and cellular metabolism. Following DDT and strontium 90 gave new proof of the earthly entanglements of air, water, and soil that animated life. They also showed such earthly entanglements were never innocent of history. As a UN report later summarized, the observed pathways of DDT and strontium-90 “provided a solid basis for a completely new appreciation of the unity, interdependence, and precariousness of the human condition” (Ward and Dubos 1972). This novel empirical window of negative entanglement cracked open the possibility of an insurgent new science of the contemporary world. As DDT and strontium 90 helped revolutionize planetary and cellular optics, those same analytical advances bore witness to a subtle if systematic unraveling of life. Many of the resulting observational infrastructures—newly calibrated to measure and monitor the biochemical composition of planetary systems—

laid the groundwork for understanding climate change (Edwards 2010; Masco 2010; Lepore 2017; Collier and Lakoff 2021). DDT and strontium 90 traced out a radically new understanding of a shared biosphere only to simultaneously show exactly how it was coming undone. Such an impact, at once historical through and through and yet just outside the registers of historical reason, wounded life not by frontal assault but by infiltrating the biochemical nexus that grounded life’s possibility. This entangled reality trips up the reifications of the autonomous self and revered distinctions of nature and society that charter modernist projects of accumulation and authority. DDT and strontium 90 identified the filaments that stitched together spraying fields and fatty tissue, nuclear detonation and baby teeth, modern power and cancerous bodies. Such linkages were always more than a network revealed, for they also described a mutinous harm now freed of the existing script of near and far, subject and object, meaning and matter. As Rachel Carson (1962: 189) reflected, “There is also an ecology of the world within our bodies.”

“The fallout problem,” as Commoner (1958) so aptly named it, demonstrated how easily hydrocarbon and nuclear excess traversed disciplinary strictures, militarized borders, and species hierarchies to achieve near universal contamination (see also Masco 2021).<sup>12</sup> Such fallout also provoked an unsettling recognition: the force of fossil fuels and atomic energy is not fully expended at the moment of use nor wholly annexed into national wealth or military might. After the explosion, disruptions rippled across the fabric of life, making terms like *commodity* and *weapon* but flickering events in much more extensive landscapes of dissonance.<sup>13</sup> In their roving mobility, geological persistence, and affinity for cellular systems, the negative ecologies of DDT and strontium-90 overwhelmed modernist fantasies of modular control that directed their use. Not only did this suggest worlds of consequence far in excess of their founding form, but such dissonance provincializes materialist critiques still wed to the labored dimensions of the commodity, still anchored to the physical immediacy of violence.<sup>14</sup>

Nor was human life exempt from these forces. As Barry Commoner told students on the first Earth Day in 1970: “You are the first generation in the history of man to carry Strontium-90 in your bones and DDT in your fat: your bodies will record in time the full effects of environmental destruction of mankind.” Defying any easy separation of nature and culture, these insights showed how easily hydrocarbon pollution and radioactivity could move through earthly mediums to injure distant

plants, animals, and humans. As low-level exposure to petrochemicals and radioactive fallout was linked to cascading species decline and sharp upticks in cancer rates, such contamination came to prefigure a catastrophic universalism.<sup>15</sup> “Toxicity to humans is but one aspect of the pollution problem,” ecologist George Woodwell wrote in 1970, “the other being a threat to the maintenance of a biosphere suitable for life as we know it” (431). In planetary fact if not yet in political theory, the negative surpassed the positive.

Although rarely framed in such a manner, growing concern with these “agents of death,” as Rachel Carson (1962) described DDT and strontium 90, also advanced a recusant theory of materiality. DDT and strontium 90 commandeered the interdependence of life.<sup>16</sup> Unlike more recent reformations of materiality authored around cyborgs, microbes, mushrooms, rivers, and Indigenous cosmologies, the physical force of DDT and strontium 90 was not so easily allied with or channeled into projects of gain.<sup>17</sup> Theirs was a negative agency, one that by interrupting the conditions of life illuminated the contingencies of life, one born of power but never contained by it, and one whose near universal reach revoked any return to purity. Although rarely stated concisely, this emerging grasp of negative materiality also turned the relation of nature and culture into a historical dialectic whose impending synthesis would either be revolution or the end of life.

#### IMPERIAL FALLOUT

These negative ecologies—or “chains of evil,” as Rachel Carson (1962: 2) named them—brought rising petroleum prosperity and thermonuclear statecraft into focus not as the pinnacles of American supremacy but as its very opposite: an unchecked regime of degenerative life. Fossil fuels and atomic bombs poured the concrete foundation of American swagger in the twentieth century. If the physical properties of sugar, cotton, and other cultivated goods helped shape previous iterations of empire (Mintz 1985; Beckert 2015), the twentieth century witnessed US ascendance taking shape in accordance with the physical properties of fossil fuels and atomic weapons. During World War II, extensive deposits of uranium in the American West and abundant reserves of crude oil in California, Oklahoma, and Texas helped catapult the prowess of the US military to new planetary scales of mechanized violence. “Oil is ammunition,” ran one government poster during the war (cited in Huber 2013: 71). Petroleum gave the US military unprecedented mobility in

the oceans and skies of every continent, while nuclear weapons provided unprecedented powers of regional annihilation at the flip of a switch. After World War II drew down, concerted efforts to keep the profitable spigot flowing engineered that same surfeit of crude oil into a new American infatuation with big cars, suburban ease, and cheap food, while a surplus of nuclear weapons encased rising domestic prosperity within the promise of invincible security.

By fate of geography, North America happened to be home to some of the richest deposits of crude oil in the world. In 1945, “two of every three barrels of oil was produced in the United States” (Moore and Patel 2018: 176), and up until 1970 oil production in the United States dwarfed that of every other nation. In contrast to almost every other major oil-producing nation, this American bonanza was rarely exported after the war (EIA 2021). Instead, its excess was channeled into every facet of American life, where the relative cheapness of energy propped up an infectious feeling of momentous progress and birthed a new benchmark for the good life: a house for every family, car in every driveway, and meat on every plate. As Matthew Huber (2013: 56) documented, in the 1950s American policies, advertising, and common sense all “equated petroleum consumption with a high standard of living.” In 1965, the United States consumed a whopping third of the world’s energy despite comprising only about 5 percent of the world’s population (McNeill and Engelke 2016: 10). After World War II, US per capita energy expenditure rose to nearly seven times the world average, and twice as much as comparable European nations (Rosenbaum 1977). This abundance of fossil fuels was built into the design and operation of the American suburbs—“the greatest misallocation of resources in world history,” according to James Kunstler (2005: 233)—and its condition of possibility: mass ownership of the automobile (Mumford 1963; Reisman 1964; Jackson 1985; Wells 2012). In 1972, half of the largest corporations in America derived the bulk of their revenues from this oil-automobile-suburbs complex, while employing a significant portion of the American working population (Sweezy 1972). The American automobile and suburban home were both incredibly energy inefficient compared with European and Japanese counterparts. Yet inexpensive petroleum and plastics allowed both to provide oversized ways of living for the masses, helping shift the political priorities of labor from claiming the collective power of production to defending private palaces of consumption (Cohen 2004; Huber 2013). A deluge of cheap energy helped catapult a new aristocracy of labor into a splendor

previously only available through imperial theft of resources from elsewhere (DuBois 1915; Lenin 1920; see also Bond 2021c). While this fueled complex provided uplift for many white, semiskilled workers, most Black and agricultural workers were barred from participation in this charged American Dream (Davis 1986). Suburbs may be “bourgeois utopias,” as Robert Fisherman (1987) once quipped, but they are utopias that only came to feel within reach for the white working class through prodigious expenditures of energy.

While American housing and transportation were privatized through the glut of petroleum, the pliability of petrochemicals instigated a new autonomy from natural resources (Schnaiberg 1980: 120). Through the alchemy of petrochemicals, synthetics came to replace rubber, quinine, cotton, and a host of other tropical resources built into modern progress as “the laboratory replaced the land as the source of materials” (Immerwahr 2019: 274; see also Hanieh 2021). “A New World,” effused a Mobilgas Ad, “is Being Born in America’s Petroleum Laboratories!” (cited in Sheller 2019: 66). Or, as Shell Oil executives championed, “Plentitude from Petroleum” (cited in Huber 2013: 90). If petrochemicals lessened the need for colonial plantations in the tropics, they intensified the cultivation of domestic land through supercharging agriculture with industrial logics and chemical coercion. Turning fossil fuels into cheap food happened first through the mechanization of cultivation (Fitzgerald 2003) and then through hybridized crops that could forgo human care with generous application of petrochemical fertilizers and pesticides (Kloppenborg 1988). Reviewing this history, Matthew Huber (2013: 87) concludes, “The American food system has been completely fossilized.” In this trial run of the Green Revolution, Jason Moore (2015: 251) has pointed out, labor inputs in American agriculture “fell by more than two-thirds” between 1935 and 1970, while “fertilizer and pesticide inputs increased by an extraordinary 1,338 percent.” Massively inefficient in terms of energy use but obscenely profitable in terms of capital returns, these dynamics helped push nearly four million farms into insolvency while consolidating control of agriculture into a handful of corporations. Pointing to the “petrochemical-hybrid complex” at the heart of industrial agriculture in America (and at the heart of the developmental model the US exported to the world on pain of financial ruin in the Green Revolution), Moore (2015: 251) and others identify the capitalized synergies between petrochemicals and cheap food as the launchpad of American influence in the twentieth century.<sup>18</sup> Whether through the profitable inefficiencies of eight-cylinder cars, suburban

detachment, or carnivorous meals, the American Dream was brought to life in the secular catechism of fossil fuels as abundant, cheap, and inconsequential.

Securing this American effervescence was the muscular threat of excessive nuclear expenditures elsewhere. In the two decades following World War II, the United States both exponentially increased its stockpile of nuclear weapons—from 300 in 1950 to nearly 20,000 in 1960—while controlling roughly 90 percent of the world’s nuclear weapons (Norris and Kristensen 2010). This amassed atomic firepower grossly exceeded any tactical military purpose. In a recently declassified report from the dawn of the arms race, scientists at Los Alamos estimated “it would require only in the neighborhood of 10 to 100” concerted thermonuclear detonations to wipe out the human species (quoted in Bienaimé 2016: 1). By 1975, the United States had 27,500 nuclear weapons. For most of the Cold War, the United States had enough nuclear firepower constantly at the ready for instant launch from air, sea, and land—and encased in an archaic system of automated and irreversible authorizations prone to error (Schlosser 2013)—to annihilate a dozen planet Earths. Flexing this weight of unimaginable devastation helped persuade a new form of global compliance. Whether in reserves of crude oil or arsenals of nuclear weapons, such abundance of synthetic force inaugurated a lifestyle of consumer bliss backed by world-ending violence.

This American infatuation with synthetic force advanced a new imperial methodology for resources without colonies and coercion without occupation.<sup>19</sup> So long as ample supplies of uranium and petroleum were secured, the United States “replaced colonies with chemistry” as the primary engine of American ascendance, as Daniel Immerwahr (2019: 271) argues. At the same time, a global network of military bases supported flying fortresses and submarines that threatened catastrophic violence everywhere. Fossil fuels and nuclear weapons appeared to emancipate projects of accumulation from any reckoning with earthly matters. American empire hit its stride on the world stage dripping with the harnessed might of petrochemicals and radioactivity.

Thermonuclear statecraft and petro-capitalism poured the material foundation of US empire in the twentieth century. Yet even as they underwrote the global conceit of American power, each mapped America’s imperial structure in strikingly different ways. Each took momentous shape toward a divergent purpose, with distinct fields of operation, conceptual architectures, and amassed influence. The vast expenditures required to manufacture, store, and launch the atomic bomb are hard

to explain within accounts that take capital as the only game in town. The atomic bomb requires some acknowledgment of the autonomy of the state. On the flip side, fossil fuels are nearly impossible to explain without a view of capital and the transnational corporation.

Scholarship critical of petroleum prosperity as the engine of US empire looks to the primacy of capitalistic extraction, petrochemical bounties of cheap food imposed at home and abroad, critique blunted by suburban accumulation, and the transnational corporation as the ascendant iteration of American empire. Scholarship critical of thermonuclear statecraft as the engine of US empire turns to the relative autonomy of the state, political logics of protection and destruction, critique blunted by the affective cultivation of fear, and the patchwork of presences that place the US military within striking distance of anywhere and anyone as the ascendant iteration of American empire. Critical social research has often followed this bifurcation in critical explanations of US empire in the twentieth century. There may very well be analytically distinct explanations (not to mention opposed political priorities and theoretical implications) for emphasizing either the role of petro-capitalism or the role of thermonuclear statecraft in the rise of US empire. But there is striking commensurability in their ecological effects.

Whether from carbon heavy forms of suburban life, petrochemical infusions of cheap food, or radioactive shadows of flexed military prowess, the fallout of American power commingled in an emergent condition of degenerative life. Crude oil and nuclear weapons, in different ways, were enlisted into the American project for their positive accruals of profit and power. Yet the negative ecologies of that project soon exceeded existing measures of gain and infrastructures of control. Despite overwhelming release within American-backed efforts, DDT and strontium-90 were readily detected in nearly every population on Earth by 1970. Rachel Carson is one of the first to grasp this conjoined field of impact as a new field of scientific inquiry, embedded ethics, and political engagement.<sup>20</sup> Many have followed her opening.<sup>21</sup> Privileging the overlapping negative ecologies of fossil fuels and nuclear weapons as a unified crisis moved toward a revolutionary science, for the resulting grasp of reality made the impossibility of the status quo as clear as a lit stick of dynamite.

This unsettling grasp of the unified fields of petrochemical and nuclear fallout provided the charter jurisdiction of the environment. When leading academic journals proved reluctant to publish scientific reports on the proliferating instances of “fallout”—whether from pesticide runoff,

automobile emissions, factory effluent, or nuclear blasts—Barry Commoner started his own journal to do just that. Its name? *Environment*. The environment, as scholars have noted, brought together the “conceptual association of various risks” (Radkau 2014: 100); in it “a whole cohort” of problems “were grouped together and labeled” environmental (Mahrane et al. 2012: 128). This has led some, like David Harvey (1996: 118), to bemoan the environment’s “fundamental incoherence as a unitary concept.” But in giving provisional thematic unity to the manifold examples of fallout coming into focus, perhaps such apparent incoherence was also its analytical and political strength. As Raymond Williams (1976) once quipped, words that matter most are those whose definitions we cannot agree upon, for in their definitional disputes they signal fights still unresolved in meaning and in matter. For these reasons, Williams famously named *nature* as the most complex word in the English language, and also perhaps the most potent. But as Christopher Sellers (2012: 9) notes, “since the midsixties, the term ‘environment’ has made a run on nature’s crown” as most convoluted. Part of this certainly revolves around the unstable figure of fallout in providing the coordinates of the environment, but we should also note: these definitional questions emerge alongside the rise of twentieth-century US empire.

America’s predilection to bend reality to its interests through generous applications of petrochemical and atomic force comes into view as an ecological debacle already on its way to extinguishing human life on the planet. And it is in the disastrous effects of petrochemical prosperity and thermonuclear statecraft—what I call the negative ecologies of power—that the environment first takes empirical shape, first as the working title of the resulting crisis of life and then as a revolutionary science firing shots across the bow of reckless American materialism. Only later does the confrontational politics of negative ecology shift to the concessional politics so familiar in environmental science and policy today.

Summarizing the implication of this empirical awakening to the ecological reach of power, Donald Worster (1994: 341) has written: “The only appropriate response was revolution.” Tracing out the compounding impacts unloosed by the indiscriminate use of petrochemicals or nuclear weapons amassed overwhelming evidence of the scientific necessity of radical rupture. What is perhaps most surprising about this call to arms, Worster (22) notes, is that this insurgent movement was led not by artists or intellectuals but “by people within the scientific community.” While perhaps not conversant in critical theories of revolution

and moved more by facts than slogans, this “science of survival” nonetheless advanced an incisive grasp of the accelerating impossibility of the present and the absolute necessity of breaking with the synthetic pedestals of US power: fossil fuels and atomic weapons.<sup>22</sup>

In this, the negative ecology of Carson, Commoner, and others prompts a critical question: perhaps the world is becoming materially enlisted in the orbit of American power less by exploitation than by exposure. It is not always what is extracted that defines contemporary imperialism. James O’Connor (1998) has argued that fossil fuels are the greatest labor-saving device ever devised. As fossil fuels shift the wellspring of accumulation away from the exploitation of labor to the extraction of energy, they also shift the terrain of contradiction (O’Connor 1991; Foster 2009; Harvey 2014). The exhaustion of soil and the worker’s body that define Marx’s metabolic rift here become uncoupled from venues of exploitation: factories and fields. The existential coordinates of the metabolic rift become a more generalized condition (Foster 2000; Moore 2015), a condition that exceeds even the geography of capitalism (Brown 2013). The drift of pesticides, the heavy haze of smog, the scars left by extraction, and the hemispheric fallout of the bomb introduce sprawling new coordinates of the exhaustion of life. As Commoner described it, “the environmental crisis is an extension of the problems that were once confined to the workplace” (quoted in Egan 2007: 147). Whether in the rippling reach of fossil fuel combustion or nuclear explosions, exposure opens a new “scientific standpoint” from which to critique contemporary operations of power without either normalizing their structure or imagining an utopian outside to them (Lukács 1971). Centering the newfound vulnerability of life in theory and practice necessarily demanded a toppling of the structure causing it. Moreover, the radical standpoint enabled by the viral destruction of radioactivity and petrochemicals was broadly available in historically unprecedented ways. As the *New Left Review* commented on socialist debates over the nuclear bomb in 1982 (viii): “Planetary destruction affects all classes, as it does all societies. It poses the question of a common humanity *before* the advent of the classless society that socialist thought has always insisted could alone realize it.”

The first Earth Day was a big tent organization, including both revolutionary and reformist orientations. Barry Commoner routinely showed how the environmental crisis might provide a “common ground” for all other progressive social movements in the late 1960s (Egan 2007: 13). For it was in the unique ability of the environmental crisis to identify

the material structure of US power that specific instances of injustice—“racial inequality, hunger, poverty, and war”—might be effectively linked and confronted together (Egan 2007: 118). Commoner argued that confronting the source of petrochemical and radioactive fallout would necessarily strike at the engine room of American empire. Moreover, Commoner saw the real crisis could be found not in population explosions but in the “civilizational explosion” found exporting the American way of life as the global benchmark of progress (Egan 2007: 125). If the Cold War taught Americans to be afraid in ways that amplified the authority of the security state (Masco 2008), Carson, Commoner, and other ecologists worked to introduce a fear that only the empowerment of people could solve.

In documenting the negative ecologies of petrochemical and atomic fallout, Carson, Commoner, and others cracked open a radical new understanding of the materialist basis of American imperialism and its ecological discontents. And in the long shadows cast by America’s fueled ascent, negative ecology identified a chink in the armor. Of course, neither Carson nor Commoner nor those they inspired worked out the implications of negative ecology in this way. But their work gestures in this direction, and however tentatively, sketches out a new subversive science of American empire. If fossil fuels and nuclear weapons advanced new methods for manufacturing resources without colonies and exerting influence without occupation, they also introduced a new terrain of theft to empire.

As Timothy Mitchell (2011) has argued, the fueled autonomy from the commercial primacy of natural resources helped shift the primary domain of governance from colonial empires to national economies. Backed by coercive monetary exchanges underwritten by the cheap abundance of American crude oil and new global institutions safeguarding American interest, after World War II the United States came to champion decolonization (provided it didn’t disrupt the American legacy of settler colonialism and chattel slavery) and came to espouse a theory of the nation-state as the exclusive locus of political sovereignty and economic growth. Unlike accumulation premised on imperial conquest, the newly consecrated national economy “could expand without getting physically bigger” (Mitchell 2011: 139).

In this energized transformation of America, however, perhaps the imperial coordinates of accumulation did not disappear so much as they morphed from surface registers to subterranean and temporal ones. As Jason Moore (2015: 253) has argued, the twentieth-century rise of

American dominance is marked by a “subterranean thrust” that coercively secures “prodigious volumes of cheap energy and cheap water.” The geography of imperial accumulation shifts “from the primarily horizontal to the primarily vertical,” Moore (2015: 254) writes, “not from one continent to another [...] but—primarily—from one geological layer to another.” Crude oil is at the center of Moore’s (2015: 252) account of this longer imperial history of the Green Revolution, as is the resulting “toxification” of the land. We might also add a temporal dimension to the physical footprint of American empire. With reference to nuclear winter and global warming, the energetic ascendance of the United States during the twentieth century may have avoided the colonial theft of land in the flexing of its imperial might, but it did so by stealing from the future.

Such theft is readily visible in the lives brutally shortened by exposure to uranium mining on Navajo lands in New Mexico (Pasternak 2011) or nuclear blasts in the South Pacific (Johnston and Barker 2008), to the petrochemical runoff of industrial farms in migrant communities in the Central Valley (Holmes 2013; Horton 2016), to the asphyxiating emissions in the Black neighborhoods lining refineries along Cancer Alley in Louisiana (Allen 2003; Singer 2011) or hazardous waste incinerators across America (Bullard 1990; Checker 2005; Ahmann 2018), to the leaky borders of nuclear weapons laboratories (Masco 2006; Brown 2013), to the corrosive shadow of the plastics industry (Altman 2022), to the toxic housing provided to victims of natural disasters (Shapiro 2015), to the catastrophic offshoring of the American petrochemical industry into more pliable places (Fortun 2001), to the generational violence of Agent Orange in Vietnam (Wilcox 2011), to the chemical defoliation tactics of drug enforcement in Latin America (Lyons 2020), to the exported dependence on petrochemical fertilizers and pesticides under the banner of a Green Revolution (Shiva 1989), to cheap packaged food and the surge of health issues in Belize and beyond (Moran-Thomas 2019), to the burning of electronic waste discarded by America (Little 2022), to the American-fueled and -armed Israeli occupation of Palestine (Weizman 2007; Stamatopoulou-Robbins 2019; Khayyat 2022), and to the blasted warzones in Iraq and Afghanistan now seeded with uranium-tipped shells and the toxic detritus of American war (Logan 2011; Jones 2014; MacLeish and Wool 2018; Lutz and Mazarino 2019; Rubaii 2020). Such pillaging of the future is now equally visible in the historical contortion of earth systems now tilting just beyond the conditions of multispecies flourishing and human dignity, whether in melting

Arctic homelands (Krupnik and Jolly 2002; Watt-Cloutier 2015), ominous sea level rise (Marino 2015; Cons 2019), epidemics of extinction (van Dooren 2016; Parreñas 2018), ocean acidification (Kolbert 2006), untamable droughts (Bessire 2021), runaway firestorms (Petryna 2022), or a growing frequency of brutally destructive superstorms. Fossil fuels and nuclear weapons promised easy progress, yet such promises continue to fall on deaf ears within the lives and landscapes cut short by the negative ecologies of power. In the most intimate and planetary of scales, the synthetic might of American imperialism in the twentieth century did not displace the physical footprint of empire so much as shift the coordinates of savage accumulation from the theft of space to the theft of time. The environmental crisis of the 1970s—with its unapologetic emphasis on the diminishing future as a new basis for contemporary ethics and politics—voices, however provisional, a critique of this newfound domain of imperialism.

#### AMERICA FIRST

The crisis of life brought into focus by the fallout of American power soon became a public event. As a genre and a mood, negative ecology resonated with a public that felt a newfound vulnerability amid relentless prosperity and progress, even if they did not yet have a firm grasp on its specific cause and consequence. Drawing attention to the conditions of life imperiled by fossil fuels, petrochemicals, and nuclear weapons, the work of Rachel Carson, Barry Commoner, George Woodwell, and others helped catapult “pollution” to the top of public concerns in opinion polls in the United States and Europe. Whether in sprawling cities and manufacturing hubs suffocating in smog, in plantations and farmlands saturated in pesticides that refused to stay put, in suburbs and slums doused in insecticides, or in swathes of entire continents and island homelands dusted with the seething remnants of nuclear detonation, this moment was marked by a grim awareness that the world was beset by emergent forms of generalized harm. As Ulrich Beck (1993: 72) has written of this rising apprehension, the disenchanting world of modernist control found itself newly enchanted by toxicity: “The role of spirits,” Beck writes, is “taken over by invisible but omnipresent pollutants.” For many Americans, oil spills became a potent image that conveyed a new reality of living in a prosperity overcome with its own crude waste. Disasters like the 1967 *Torrey Canyon* tanker spill or 1969 Santa Barbara blowout provided a potent visual for the rising awareness

of living in a world haunted by synthetic toxicity. As two contemporary observers noted in 1973: “Oil slicks generally are more easily perceived than is the presence of toxic substances and visibility precipitates and intensifies public indignation” (Lleyellyn and Peiser 1973: 4). “Petroleum has become a devil in our civilization,” effused one 1967 *New York Times* profile of a new kind of disaster: coastal oil spills: “Whether in a single dramatic incident or slowly, by default, it is fouling the seas, creating a survival issue both for sea life and for man himself” (Rienow and Rienow 1967: 25). Oil spills in Santa Barbara and elsewhere provided a searing aesthetic “fusion of fact and feeling, science and spectacle,” writes historian Finis Dunaway (2015: 43–44), as national coverage “described blackened beaches and oil-covered wildlife as evidence of the escalating dangers of the environmental crisis.” Oil spills distilled the image of life drowning in the muck of American excess. Prominently covered on front pages and broadcast into American living rooms, oil spills provided a salient dialectical image to the negative ecology of American power (Benjamin [1940] 2002; see also Taussig 2000).

If oil spills provided the popular aesthetic, ecology provided the analytical lexicon and affective register. As ecologists began tracing out the intersecting routes and intimate accruals of petro-prosperity and thermonuclear statecraft, they found a host of problems lurking just beyond the pale of cognitive genres, moral codes, legal strictures, and political institutions. In what Raymond Williams (1977) might call a “structure of feeling,” an anxious mood rose up in the widening gap between the calm assurances of the state and the worsening state of the world.<sup>23</sup> Although here the negative ecology of Rachel Carson, Barry Commoner, and others surpassed the literary imagination to give a new language, experiential orientation, empirical texture, and moral outrage to this emergent haunting.<sup>24</sup> With fifty new paperbacks on the environmental crisis in 1970 and *Time* magazine awarding the “environment” the issue of the year in 1971, these issues found a broad audience. With varied arguments, evidence, and conclusions, this welter of popular attention to the environment brought the ailing “life support system” of Earth into stark, scientific focus. The feasibility of the future, displacing the precepts of the past, came to enthusiastically orient a wave of new moral conduct and political action in the present. Drawing what appeared to be dislocated injuries into wider networks of attribution, negative ecology advanced a new vocabulary of pathways of exposure (*fallout*, *bioaccumulation*, *web of life*) and zonal injuries (*excess deaths*, *sacrifice zones* and *dead zones*), while terms like *contamination* and

*pollution* enlarged their meaning from policing the sexual boundaries of race to policing the biochemical boundaries of toxicity. While these fears reanimated fantasies of an untouched past, they also turned many toward present protests and questions of how to survive an impending future. “The entire ecology of the planet is not arranged in national compartments,” wrote George Kennan in 1970 (191–92). Pleading for partisan national, military, and corporate interests to stand down, Kennan (198) argued that we must place the survival of humanity—and our “animal and vegetable companions”—at the heart of the present crisis in order to privilege the necessary transformation. New publics cohered around these toxic uncertainties and fierce aspirations to change things, sometimes within a posture of solidarity as broad as the planet but just as frequently with one scaled to existing hierarchies of race, class, and citizenship.<sup>25</sup>

It is no surprise that many of these concerns first found voice in the United States. Perhaps no other society in human history has developed such a ravenous appetite for energy as the United States in the wake of World War II, when the relentless wartime expenditure of fossil fuels, petrochemicals, and atomic energy did not ratchet down after hostilities ceased but shifted weaponized force into suburban affluence. In postwar America, petroleum-saturated consumption and nuclear overtures of security became the distinctive American way of life in the twentieth century (Huber 2013; Masco 2015). Whether by reason of robust unions, embedded liberalism, or family values, many intellectuals and political platforms in the United States look back at postwar prosperity as the model of the good life that we should continually strive to recreate. For the Left and the Right, the 1950s often anchor the normative format of American political possibility. But perhaps the more material explanation of postwar prosperity lies in the unbroken American glutony for crude oil and new development projects that dressed up unequal ecological exchange in the language of humanitarianism (Hornberg 1998; Martinez-Alier 2002: 214), yet even this exchange was powered by the new fossil-fueled capacity of oceanic transportation and the new place of petrochemicals in export-oriented agriculture.

In the postwar era, the United States came to consume a mind-bogglingly massive amount of crude oil. Consumption grossly exceeded historical need as new expenditures of energy were dreamed up willy-nilly: new homes, new technologies, new diets, and new cities were built on the possibilities of this unending surplus: “Petrochemical America,” as one apt review has called this new regime of life (Misrach and Orff

2014). As Henry Ford II quipped, “Minicars make miniprofits” (quoted in Egan 2007: 143).

In 1970, this turbocharged model of accumulation crashed into two unexpected roadblocks. Previously taken as boundless, the physical properties of crude oil screeched into view from two sides: the event of scarcity relative to soaring domestic demand and growing analytical recognition of the ecological fallout of unrestricted energy use. In 1970, domestic supply of crude oil in the United States peaked. Indifferent to such matters, petroleum-fueled lifestyles and social infrastructures continued unabated. The resulting scarcity took shape in the collision of flattening domestic supply and a relentless surge of heedless consumption. During the decade when American crude production began to falter and fall, overall American consumption of petroleum actually doubled. As others have argued, this was not a natural limit so much as a scarcity manufactured in the profitable inefficiencies of eight-cylinder cars, meat with every meal, and the suburban atomization of consumption (Mitchell 2011; Jacobs 2016; Novy 2020). While the federal government ordered spigots of major oil fields opened wide, the stupendous American reserves of crude had passed their prime. As Bryon Tunnel, chairman of the Texas Railway Commission, commented at the time “Texas oil fields have been like a reliable old warrior that could rise to the task, when needed. That old warrior can’t rise anymore” (quoted in Egan 2007: 151). The secretary of commerce put it another way: “Pop-eye is running out of spinach” (quoted in Egan 2007: 151). Discoveries in Prudhoe Bay, Alaska, and new exploration in the depths of the Gulf of Mexico promised to alleviate the crunch, but both would take years to come online, and neither could do more than slow the deficit. Something had to give.

At the same time, the cumulative impacts of a flippant reliance on petrochemicals, fossil fuels, and nuclear weapons lurched into broad public view. The percolating work of Rachel Carson, Barry Commoner, and so many others convincingly traced out a new world of consequence to the petro-prosperity and nuclear security of postwar America. This new mood was widely distilled in the spectacular imagery of oil spills (Morse 2012). The nation faced a dilemma: either recognize natural limits or compel oil from elsewhere (Jacobs 2016). The United States debated whether to redesign American life around alternative sources of energy, efficiencies achieved through federal investments in public housing and transportation, and drastically curtailed military expenditures of fuel, all of which were key platforms of the first Earth Day in 1970 (Gottlieb

1993; Rome 2013), or, in the other direction, to throw the weight of the federal government into the deregulation of the oil industry, military support for transnational oil companies, and a more imperial pursuit of foreign oil.

For many progressives, this proved the perfect storm to provide an enthusiastic mandate for the great transformation. The fossil fuel “energy system” was “cannibalizing” US society, as Barry Commoner described it in an interview with Studs Terkel (1979: 1). Reviewing the overwhelmingly ecological and economic case for breaking America’s addition to fossil fuels and investing in a more sustainable future, Commoner thought a revolution was within reach. The sweeping ferment of Earth Day in 1970 demonstrated broad excitement for change, bringing together a startling array of constituents—white and Black, urban and rural, students and workers, young and old—under the banner of foregrounding the environmental crisis and transformation of American society it demanded (Gottlieb 1993; Rome 2013). “The energy crisis signals a great watershed in the history of human society,” Barry Commoner commented (quoted in Egan 2007: 155).

President Richard Nixon opted for the salvation of foreign oil. As one White House adviser put it: “Conservation is not a Republican ethic” (quoted in Jacobs 2016: 43). Previously spurned, imports of crude oil doubled between 1967 and 1973 and came to provide “a safety valve” to defuse the reckoning that beckoned (Jacobs 2016: 39).<sup>26</sup> The subsequent Organization of the Petroleum Exporting Countries (OPEC) embargo of 1973–74 did not dissuade this energy policy so much as it enlisted the American military into it. It also realigned organized labor to the right of the environment. While Earth Day had garnered the support of many unions—who sensed the overlay of conditions inside the factory and conditions outside the factory—the OPEC embargo tilted many industrial unions toward a more hawkish support of foreign policy in the place of environmental commitments (Gottlieb 1993; Jacobs 2016). American dependence on foreign oil came to take on its own imperial geography of extraction as the per capita consumption of petroleum in the United States continued its unearthly rise. The global pursuit of more oil encouraged an even more deliberate overlay of American foreign policy and transnational oil corporations (Coll 2012). Not only was the American domestic addiction to petroleum now reliant on oil from abroad, but so were the American armed forces. Since the 1970s, the US military accounts for between “77 and 80 percent of *all* US government energy consumption” (Crawford 2019: 4).

The American armed forces constitute the largest single institutional consumer of hydrocarbons in the world (Nuttall and Brazilian 2017). As General David Petraeus said in 2011, “Energy is the lifeblood of our warfighting capabilities” (quoted in Crawford 2019:1; see also Sheller 2019). Today, the US Army, Navy, and Air Force comprise “one of the largest climate polluters in history, consuming more liquid fuels and emitting more CO<sub>2e</sub> (carbon-dioxide equivalent) than most countries” (Belcher et al. 2019: 76). The planetary reach of the US military—essential to American efforts at a lighter touch of exerting influence without invasion—itself became dependent on more thuggish means of compelling cheap oil from elsewhere (Harvey 2003).

As Nixon opened the floodgates to cheap foreign oil, his administration also inaugurated the new responsibility of government to manage the emerging crisis of life (hoping, rather cynically, to deflect young voters’ attention away from the debacle in Vietnam). As the contradiction between those two commitments of the state grew, the Nixon administration worked to defuse the more revolutionary potential of negative ecology by bending its insights away from assailing the material foundation of American empire and toward a more accommodating science providing modest guardrails for uninterrupted consumption: the environment we recognize today.<sup>27</sup> Reflecting on Barry Commoner’s disappointment as the status quo marched on, biographer Michael Egan (2007: 155) writes, “American optimism was incapable of recognizing limits.”

Whether in the suburban home, the ubiquitous automobile, the industrialized farm, the sprawling city, or the globetrotting military, the model of society in the United States was completely retrofitted, inhabited, and proudly held up as a universal model of prosperity on the trending assumption that hydrocarbon energy was cheap, copious, and inconsequential.<sup>28</sup> Since at least 1970, each of those assumptions has been persuasively dismantled. Yet consumption of fossil fuels in the United States continues skyward. How? As the Nixon administration intervened in the energy crisis of life during the 1970s, environmental science and policy came to separate the underlying addiction from the resulting impairment, effectively ignoring the underlying materiality of the problem. The disastrous properties of power were externalized as autonomous fields of measurement and management.<sup>29</sup> These innovations privileged regulatory jurisdiction over ecological relations, engineered neutrality over material confrontations, and complicit facts over revolutionary science as they sought to erect technical barriers to the

most egregious levels of pollution. Drawing together an older genealogy of thresholds with new pedagogies of technical planning, these new fields of science and law displaced the radical implication of the environmental crisis to objectify the problem entirely within a new administrative domain: the environment. These nationalized fields of science and law melded with surging public anxiety as the environment became not just an analytical operation but also a moral disposition aimed at ensuring prosperity while preventing the worst.

Insisting that we only measure what was within the ability of power to mend, negative ecologies were domesticated into environmental science and policy. If negative ecologies brought scientific illumination and popular attention to a haunting materiality just beyond the ability of companies and states to resolve without undermining the basis of their own authority, the official recognition of the environment came to tether effective knowledge of these problems to pathways of action that left the pedestals of power wholly intact.<sup>30</sup> The environment shifted from a revolutionary reality striking at the heart of American power to an administrative domain to deepen the material dependence on fossil fuels without toppling the unsteady structure built atop it. The insurgent science of survival became an institutionalized science of concession. Much of this transition had to do with the consecration of two methods that together objectified the environment for defanged science and policy: thresholds and impact assessments.

#### THRESHOLDS OF TOXICITY

Peter Sloterdijk (2009: 18) claims that the environment came into being on April 22, 1915, in Northern France. He writes: “The discovery of the ‘environment’ took place in the trenches of World War I” with the advent of gas warfare. For it was when the basic conditions of human biology like breathing were turned into weapons that “the primary media for life [. . .] became an object of explicit consideration and monitoring.”<sup>31</sup> Perhaps. But just as battlefield forces were learning to wage war with air and water, new government agencies were learning to regulate the toxicity of those same mediums inside the factory. While those on the battlefield sought to mobilize toxicity toward military ends, new regulation of the workplace sought to hold toxicity within certain prescribed levels of acceptable exposure. Here, the environment was brought into political being not as a weapon but as an administrative domain that might better contain toxicity.

Like so many other stories of our present, much of this began in the factory. It was here, as historians like Christopher Sellers (1994, 1997) and Michelle Murphy (2006) have documented, that a new form of scientific expertise took shape around toxic exposures in industrial production that previews many of our contemporary environmental protections. “Modern war,” an oft-repeated newspaper slogan summarized during World War I, “is largely a matter of chemistry and engineering” (Herty 1916: 4821). Such chemistry was at once vital to the war effort and fraught with medical misgivings in its manufacture.<sup>32</sup> As workers were sickened in munitions factories, refineries, and petrochemical plants, rising incidents of “industrial disease” moved to the forefront of the federal agenda as the US Department of Labor authorized new interventions into factories as a part of urgent efforts toward “conserving industrial manpower” during war. Alice Hamilton (1919: 248), one of the first doctors commissioned by DOL to study the “dangerous trades” during World War I, placed six medical students “well trained in laboratory methods and in making clinical observations” of workers inside munitions factories.<sup>33</sup> Embedded on shop floors for “one to two months,” there was a concerted effort to understand the ailments that afflicted workers in a more methodical and precise manner (Hamilton 1919: 248).<sup>34</sup> These investigations helped give rise to industrial hygiene, a new medical science that placed toxic exposures in the workplace at the root of a peculiar family of ailments. During World War I and in the years after, industrial hygienists came to usurp the role of the factory physician and the union health clinic and inserted a new form of medical expertise whose authority rested on its independence from labor and capital.<sup>35</sup>

As industrial hygiene developed, its focus turned from the clinical inspection of workers’ bodies to the technical monitoring mediums of exposure. Armed with new chemical detection devices, industrial hygiene transformed factories into an experimental field within which specific “industrial poisons” could be objectified in the air and water for more exacting analysis and administration.<sup>36</sup> For industrial hygienists, the safety of the workplace was achieved not through staking out a political position on toxicity or through advocating for a certain class of people but by determining the line at which key industrial ingredients became dangerous industrial diseases. This was accomplished largely through defining an empirical boundary between safe and unsafe concentrations of specific chemicals and then assembling devices to monitor those thresholds inside factories, whether as “toxic limits”

(Schereschewsky 1915), “safe concentration” (Sayers, Meriwether, and Yant 1922), “maximum allowable concentrations” (Cook 1945; Elkins 1948), or “threshold limit values” (Coleman 1955). Such thresholds, as historian Christopher Sellers (1997: 2) demonstrates, offered a crucial precursor of environmental governance, as they were “the first to tabulate lists of threshold concentration levels, and the first to devise the kinds of precise delineations between the normal and abnormal that underlie today’s environmental law and policy, as well as its science.” These boundaries, unaligned with class interests and presented as biochemical fact, came to inform factory design as insurance companies, trade associations, and municipal building codes took them up as enforceable guidelines. This analytical stabilization of the factories’ interior provided a novel means of holding industrial chemicals and workers’ health at arm’s length and policing the mediums, like air, that brought them into consequential contact. Displacing a long-standing point of friction between labor and capital, the science of industrial hygiene helped transform the politics of working conditions into a simple matter of compliance.

Industrial hygienists sometimes described how they would find potentially dangerous factories in unfamiliar cities. They would look up and follow the telltale smoky emissions to the source. The engineered fix to workplace toxicity, as historians like Joel Tarr (1996) have shown, was simply to vent the problem out of the factory. As environmental engineers often say, dilution was the solution. This, of course, did not so much solve the problem as displace it. Having mastered chemical afflictions inside the factory, industrial hygienists soon found themselves in the homes of workers, where children and neighbors suffered similarly without having ever stepped into the factory. As industrial emissions drifted into adjacent neighborhoods, industrial hygienists were called to the scene, first for the fog disasters that seemed to plague industrial cities in the 1930s and 1940s and then within municipal governance in the 1950s and 1960s, working to rein in what became known as the pollution problem. Los Angeles, Detroit, Denver, Pittsburgh, New York, and other large cities hired teams of industrial hygienists to help hold air pollution within certain limits. Most prominently, industrial hygienists helped establish urban thresholds for carbon dioxide, sulfur oxides, soot, ammonia, nitrogen oxides, aerosols, ozone, hydrocarbons—and sometimes radiation and pollen. Nearly all of these chemicals, it should be noted, have a single source: they are by-products of fossil fuel combustion.

The devices and disciplinary practice of industrial hygiene helped make petro-pollution visible within the city limits. As in the factory before, managing pollution was premised on first creating a field of scientific legibility against which the problem of pollution could be seen in a more objective light. Sidestepping the specific sources of toxicity like actual smokestacks, petrochemical plants, and automobiles, governance turned instead to stabilizing the mediums of exposure. Here, the management of urban pollution came to hold the public and industry at arm's length and began policing the air and water that might bring them into consequential contact. And again, as in the factory before, this was effective to the extent that a direct confrontation between citizens and industry was rendered difficult if not impossible.

The history of toxic exposure is also a history of analytic containers. In some ways, the emergence of "the environment" is the story of how the biological reach of petro-pollution came into focus outside the built mechanisms of control like the factory or the city. In the 1960s and 1970s industries eluded regulations by designing bigger smokestacks, flushing waste downriver of the city, or simply building new plants just beyond municipal jurisdiction. As lakes were declared dead, rivers caught fire, and mountains were shorn of vegetation as rain turned acidic, the effects of diffuse pollution became a rising national crisis. At the same time, there was a growing realization that the impact of fossil fuels emissions was not confined to the place of combustion and that the impact of petrochemicals was not limited to the place of application. As both started showing up in lung tissue, blood samples, bird eggs, farm produce, lakes and streams, and atmospheric systems, there was recognition of the sprawling negative ecologies of hydrocarbons. Here, thresholds offered a novel means of sidestepping any reckoning with these ecological webs and their radical implications. Thresholds turned attention exclusively to the mediums of exposure like air and water, treating them as autonomous fields in which pollution could be measured and managed without bothering with the relationality of contamination. As researchers working for Ralph Nader noted in 1970, "The largest single source of air pollution, the automobile, was never mentioned in federal legislation" until the late 1960s (Esposito 1970: 22).

Following the model of the factory and the industrial city, the turn to the environment established a national jurisdiction for the implementation and enforcement of thresholds. By the 1960s, pollution was polling second only to crime as the greatest threat to American well-being (Markowitz and Rosner 2002: 155). In 1969, less than 1% of Americans

prioritized the environment. Two years later, a quarter of all Americans believed protecting the environment was of crucial importance (Whitaker 1988). At first this formed a crisis without a constituency, a lack both Democrats and Republicans were eager to amend.<sup>37</sup> In a flurry of one-upmanship, Democratic leaders in the Senate shepherded two major expansions of federal power into law—the Clean Air Act (1970) and the Clean Water Act (1972)—while President Nixon consolidated the tasks of enforcing these nationalized definitions of air and water quality into an emboldened and strikingly unbehelven new agency: the Environmental Protection Agency (EPA).<sup>38</sup> Both parties clamored to claim the environment.

In 1971, the federal government established enforceable national air standards (with a new enforcer, the EPA) for five pollutants, all of them emissions from fossil fuels: sulfur dioxide, particulates, hydrocarbons, carbon monoxide, and photochemical oxidants. Initially, these standards attempted to balance historical averages of emissions with health concerns, but a number of lawsuits compelled the EPA to privilege health concerns. As investigations began to show the chronic harm from even low-level exposure, federal standards for each of these pollutants were quickly ratcheted down. By 1973, there was growing debate about whether hydrocarbon emissions should be tolerated at all. Under pressure from citizen lawsuits and the courts to let science dictate policy, the EPA called for drastic reductions in fossil fuels use in seventeen states and major cities like Denver, New York, and Pittsburgh. The EPA suggested these cities build mass transit systems and start rationing gasoline to bring their air quality into compliance with the national standard. Los Angeles was ordered to reduce gasoline use by 82 percent during summer months. In Philadelphia and Pittsburgh, city leaders were told to remove 200,000 cars from the road. By the end of 1973 and with the OPEC embargo looming, President Nixon stepped in. Addressing the nation, Nixon (1973) demanded that Congress provide him with the exceptional authority "to relax environmental regulations on a temporary case-by-case basis, thus permitting an appropriate balancing of our environmental interests . . . with our energy requirements, which, of course, are indispensable." This confrontation quickly formalized around crude oil and vertically ranked what were now two entirely separate technical properties of petroleum: an external science of gain (the economy) and an internal science of harm (the environment). Whether by the coercion of the US-led developmental loans or by the elective choice of national leaders, such thresholds soon became the basis of environmental

governance in nations across the world. As in the United States, the vast majority targeted the emissions of fossil fuels.

#### ASSESSING THE IMPACT

In 1963, a professor of government at Indiana University penned an essay titled “Environment: A New Focus for Public Policy?” (Caldwell 1963). The paper, circulating widely in legislative circles in Washington, DC, was disarmingly straightforward: in response to a growing crisis of life, the basic conditions of life should be administered as a distinct federal domain with its own institutional apparatus. Rachel Carson’s *Silent Spring* had been published the year before, causing a firestorm of concern about the disconcerting and disruptive reach of new petrochemicals into the fabric of life. Amid a tidal wave of interest, this essay argued that, properly conceptualized, the environment should offer triage for the worsening conditions of life.

Lynton Caldwell, the author, was soon invited to DC to draft the first federal environmental policy, the National Environmental Policy Act (NEPA) of 1969. Caldwell’s reflections on crafting this policy and on the wider necessity for environmental governance offer a window into the conceptual and administrative shift the environment entailed.<sup>39</sup> In response to growing evidence that the “life support capabilities” of the planet were at risk, Caldwell (1998: 5) later reflected on how political scientists, lawyers, and biologists gathered in Washington, DC, to “reconceptualize the environment in relation to the responsibilities and functions of governance.” The reverse was true as well, as many elected officials worked to upgrade the capacity of the federal government in response to the growing recognition of the environment.

As “the introduction of chlorinated hydrocarbons and radioactive isotopes into food chains” so effectively exemplified, Caldwell wrote (1970: 82), the present was beset by threats that did not abide by existing jurisdiction or bend to inherited wisdom. For Caldwell, this crisis of life demanded a new infrastructure of governance. The former rubric of managing the natural world—the conservation of natural resources—was ill-equipped for the present crisis. The point was not, Caldwell wrote, to preserve some “ecological islands” among wider “biophysical ruin.” Conservation was too human centric, too reliant on industrial reasoning, and too, well, conservative. What was desperately needed was not just to safeguard future extraction or protect isolated areas but to stabilize the conditions of life itself. Early attempts at

this stabilization were proposed at the level of rights. An early draft of NEPA stated: “Each person has a fundamental and inalienable right to a healthy environment.” As early as 1966, Caldwell himself had broached the idea of instilling “public (or private) rights in environments-as-such” (659), that is, making the environment a rights-bearing subject itself. (This was not as far-fetched as it may sound; Supreme Court justice William O. Douglas’s 1972 dissent in *Sierra Club v. Morton* pointedly raised the possibility of granting the environment the same rights as a corporation.)<sup>40</sup>

Unable to overcome questions of how such rights would actually work, and somewhat smitten with the rising role of economics in influencing federal policy, another position won out. Instead of an expansion of environmental rights, NEPA worked to interject environmental expertise into the everyday functions of governance. With the viability of earthly life hanging in the balance, the management of the environment, as Caldwell (650) had written in 1966, had to move beyond democratic debates to make those decisions “that a society knowledgeable of its own needs, interests, and potentialities *ought* to make.” This, for Caldwell and the authors of NEPA, involved explicating the contingencies of life and bringing that knowledge into high-level decision-making. Cultivating such enlightened decision-making was actively contrasted to that other genealogy of the environment: thresholds. While thresholds provided an “external policing mechanism” to protect the environment, NEPA aimed to “internalize” the environment within federal decision-making (Liroff 1976: 18–19). In a division of labor Michel Foucault would have found fitting, thresholds threatened punishment, while NEPA disciplined from within.

Modeled on how the “the economy” had come to inform, orient, and discipline policy independent of democratic deliberation, NEPA sought to introduce scientific knowledge of life’s precarious balance into every aspect of governance (and, as with the economy, sought to do so not on the shoulders of popular sovereignty but by equipping technical expertise to override democratic practice). Parts of NEPA were literally copied and pasted from the Full Employment Act of 1946, which introduced “the economy” into federal governance and brought a new cadre of economists into the White House in the form of the Council of Economic Advisors. As Timothy Mitchell (1998), Donald MacKenzie (2008), and Koray Caliskan and Michel Callon (2009) have all argued about the economy, it is often the methods of fact production and genres of interpretation that instantiated the socio-material field (not the other

way around). Here too, the methods and genres of the environmental impact assessment came to instantiate the socio-materiality of the environment itself.

If the economy introduced a scientific regime of scarcity into governance, the environment introduced a scientific regime of vulnerability.<sup>41</sup> Even as the economy and the environment have come to stand in stark opposition to one another, they should be understood as mirror formations: each produced an expertise whose authority was realized in its achieved distance from embedded and embodied knowledge, each formatted life for state rule, and each sought to discipline the present according to its modeled vision of the future. (This conceptualization leans heavily on Timothy Mitchell's (1998) incisive archaeology of "the economy," even as it should be noted that "the environment" was never able to shake the weight of materiality in the same way the economy was.)

NEPA advanced two methods of bringing this new science of vulnerability into governance: a new presidential council of environmental experts and, in what is likely "the most imitated U.S. law in history," the environmental impact assessment (Yost 1992: 6). The former brought new environmental expertise into the White House, while the latter distributed a new kind of environmental calculus to each and every governmental project.<sup>42</sup> The environmental impact assessment was described by Caldwell in 1966 as the "drawing up of a balance sheet of ecological accounts by which the true costs and benefits of alternative decisions might be compared" (524). This novel environmental ledger has since become a ubiquitous technique and cultural icon, mocked in *New Yorker* cartoons and late-night quips about the nanny state. Yet its intervention should not be discounted. It opened previously invisible decision-making processes and their implications to public inspection (while limiting what the public might do about them), and soon became a bureaucratic lever upon which enormous fortunes might rise or fall. It also conjured a new consequential field of fact production, modeled futures, and institutional morality.

As envisioned by Caldwell, the environmental impact assessments would usher in a new regime of "surveillance" that would produce untold amounts of data on the conditions of life.<sup>43</sup> Taking stock of the likely effects of a project on nearby water quality, air quality, species habitats, ecosystems, and more, such impact metrics required an objective definition of normal as the baseline against which potential disruptions could be measured and managed. Impact assessments would, in Caldwell's words, "establish ecological baselines – parameters, ranges,

and gradients for sustaining life" (1970: 84). Not only would these baselines help determine if a project should go forward, but the resulting knowledge could also help manage those projects as they unfolded, providing an early warning detection system if things started to go awry, as well as a road map for restoration if needed. Instead of coming up with a universal or national baseline of life, NEPA distributed that task to the specific locales where disruption was anticipated. Each new project would require its own accounting of the localized conditions of life it might infringe upon, its own project-specific definition of vulnerable life. Crucially, such work does not unify an official understanding of normal life, but provokes a proliferation of normative definitions. Each new project reifies the constitution of normal life in its shadow.

In 1970, this "major revision of the administrative functions of the U.S. Government," as the lone dissenting voice in congressional debates bemoaned, passed nearly unanimously, without much fanfare, and with little appreciation of the minor revolution in bureaucratic procedure it was instigating (Liroff 1976: 30). Few perceived the sheer breadth of its implications or anticipated the entire industries of environmental law and consulting that would take shape in and around its guidelines. Indeed, interviewed years later, many key participants shared the sentiment of one congressional staffer who commented, "If Congress had appreciated what the law would do, it would not have passed" (Liroff 1976: 35). In the years since, the environmental impact assessment has proliferated worldwide as a basic tool of governance in cities, industries, nations, and international organizations. As Michael Watts (2005) and others have observed, perhaps no industry has become as heavily invested in environmental impact assessment as the fossil fuel industry.

#### ENVIRONMENTAL SCIENCE AND POLICY

Over the past fifty years, the environment has taken forceful shape around two instrumental genealogies: thresholds of toxicity and environmental impact assessments. Both emerged in response to the negative excess of American power, and both initially promised radical new forums to reckon with and rein in that excess, whether by privileging health concerns or by emboldening rights. Yet as they developed into federal policy, both turned their backs on the negative ecologies of American power as they worked to stabilize the effects as an entirely separate matter of concern already secondary to the amassed gain. Thresholds and impact assessments proved key to this tempered detachment. As

they became taken up by the state, both worked to stabilize a new field of objectivity and operation within which the new disciplines of environmental science and environmental law took root. The negative ecologies of fossil fuels and nuclear weapons—as a unified web of synthetic destruction—drifted out of focus as the environment rendered the fallout a fractured family of autonomous fields of fact production and regulatory compliance. A wounded world was given new coherence not by the materiality of its injury but by the methods for its accounting. As mediums of exposure and fields of impact became premier field laboratories for the specialized measurement and management of harm, the underlying materiality of fossil fuels was evacuated except for its outlying effects. The fuzzy edges became the only thing that mattered. Such work can be ruthlessly proficient, and instantiations of the environment along these lines have been instrumental in saving lives and reducing pollution worldwide. Yet by turning their backs on the negative ecologies of fossil fuels, the possibility of a more fulsome confrontation with the underlying cause of the crisis of life became exceedingly difficult to imagine, let alone enact.

These thresholds and impact assessments also underwrite the normative criteria for environmental critique. Environmental protections displace a politics of confrontation as they push effective action against fossil fuels into the realm of standardized methods, certified results, acceptable levels, and codified assessment models. This has serious consequence, for not only does the environment divorce measures of harm from measures of gain, but the category has found its most forceful definition through moralizing and managing an ahistorical, moderately contaminated, and exceedingly technical understanding of life.

Yet the environment was never fully contained by a single expertise. Unlike the economy, no single discipline or institutional authority gained priestly privilege over the environment. Even as the environment took forceful shape around thresholds and impact assessments, these instrumental technologies were never fully monopolized. Their technical application formed its own political field at the intersection of agency hubris, corporate interests, and organized advocacy. While the environment may have displaced a politics of confrontation, it did not render the environment a purely apolitical forum: conflict and rigorous debates continue to shape the content and implementation of environmental protections. Environmental science, as so many of its practitioners readily admit, is also a political practice.

Although it has long shed the revolutionary possibilities that attended its conception, environmental science has not shed its public relevance. The birth of environmental science, writes historian Samuel Hays (2000: 137), “is one of the most significant developments in science in the last half of the twentieth century.” Even as environmental science has become massively instrumental to state policy and extractive projects, it so often remains a derided field of study and scholarly engagement. “Applied” is wielded as an intellectual insult even as the public relevance of environmental science continues to rise. Immense fortunes now ride on the findings of environmental science, as does the drafting and implementation of huge swathes of local, national, and international law. Fielding contributions from academics, state agencies, corporations, and consultants, environmental science journals can have far greater readership than flagship disciplinary journals and impact factors that go far beyond scholarly citation. Yet to our great misfortune, we primarily understand environmental science through how it lacks the prestige of pure academic science. Environmental science has real purchase in the world, yet that overt worldliness is often the very reason many dismiss it. The disinterested pedestal of academic disciplinary science remains paradigmatic in our understanding of the practice of science, to the great impoverishment of our grasp of the political field of environmental science. Historians have drawn attention to the way universities became a new locus of scientific production in postwar America, pulling the laboratory away from the nuclear state and raising the status of fact production in relation to its disinterest (Egan 2007: 25). Such an account, however, sometimes misses the shift of fact production back to government, industry, and above all consultants post-1970 (scientific education still unfolds almost within the university, but the production of certified knowledge by science is increasingly outside the university system). The rise of environmental science exemplifies this shift. Many environmental scientists find lucrative work in the oil industry monitoring compliance with thresholds and preparing impact statements, while the EPA has become the “largest civilian arm of the US government,” and state-level environmental agencies are some of the largest public employers in their states (Guha 2000: 83). Environmental science unfolds not within the relative institutional autonomy (and political insulation) of the academy, but within government agencies, corporate offices, courtroom litigation, and a veritable army of consultants. Environmental science “begins with the assumption that human health and industrial poisons can co-occur,”

write Kroll-Smith and Lancaster (2002: 204); it is premised on the notion that the environment and bodies “are sufficiently disparate” as to allow a quantitative science to unfold in the space between them. However questionable its founding assumption, environmental science nonetheless retains a fierce sense of analytical ethics, an objectivity forged not from denying politics but from acknowledging it. Environmental science has never been disinterested; the robustness and effectiveness of its produced knowledge comes far more from being pinned down in a cross fire of interest than from somehow imagining itself to rise above the swirl of baser motives. Environmental science has developed into a science comfortable within the mess of the world. It does not aspire to purity, whether in the disciplinary insulation of inquiry or as an empirical goal of research, but roots itself in the necessity of a factual basis of action. It is, as Samuel Hays (2000: 151) has described, “a decision science.” Yet there is a political struggle at the core of the field, one centering on the direction of application: Is the environment a field of science that provides the secular ethics of extraction or a science that insists on the priority of care in a broken world?

The political conflicts at the core of environmental science unfold almost entirely upon the terrain of technical legibility authorized by thresholds and impact assessments, and rarely reach for a more direct confrontation with the historical materialism of the cause. As these conflicts have proceeded, they have deepened the technical qualification of environmental protections, abstracting them further and further from the manner in which people actually live the problems they regulate.

The environment also exceeded technical expertise in another way. The underlying problem, both in the open-ended ecological harm unloosed by the imperial rise of America and in the movements that gathered around the eroding conditions of life, routinely exceeded the fixtures of technical control. Even as thresholds and impact assessments engineered the authoritative objectivity of the environment, the fallout of American power continued to defy such enacted stability and partial measures. The negative ecologies of fossil fuels were never fully captured by the format of the environment, as so many living downstream of extractive projects, on the fence lines of petrochemical plants, or near where the infrastructure breaks know all too well. Their voiced protest in the lived dimensions of pollution often demonstrate the impoverishment of thresholds and impact assessments. Yet rather than countering the technical foundation of the environment, the felt parameters of pollution often end up working to give new ethical momentum to administrative

techniques aimed at objectifying vulnerable life. Gaining any traction in environmental protection requires first disciplining experiences of profound harm into the acceptable measures of harm. The felt shortcomings of the environment paradoxically bolster its legitimacy, widen its reach. This disjuncture has become the experiential field of injustice around fossil fuels, dictating the manner in which people live under the weight of both negative ecologies and the official legibility of their effects. The ethnographic chapters that follow inhabit this disjuncture—its barricaded possibility, the complicity it requires to begin work on incremental improvement, and the rage that still overflows—across the contentious sites of fossil fuels in contemporary North America. It is no coincidence that the rise of the environment mirrors the consumption of fossil fuels in the United States. And it is also no coincidence that the environment has not so much checked the addiction to fossil fuels as provided acceptable parameters for it to deepen and expand.

The crisis we face today is not that the United States monopolized these techniques of synthetic might and institutionalized blinders, but that America pioneered them.<sup>44</sup> “Oil civilization began in the USA,” John Urry (2013: 10) writes, and if the resulting American Dream becomes the global measure of the good life “it would take at least five planets to support it.”

#### DECOLONIZING THE ENVIRONMENT

It could have been different. As mentioned previously, prompted by an announcement from the secretary general in 1969 that “it is becoming apparent that if current trends continue, the future of life on Earth could be endangered,” the UN organized a conference on the human environment in 1972 (cited in Kennan 1970: 191; Ward and Dubos 1972; UN 1972). Initially, the conference had the aim of authorizing planetary thresholds and routinizing environmental impact assessment at a global level. A very different debate unfolded in Stockholm. Representatives from the rest of the world agreed that there should be a universal human right to “adequate conditions of life” but insisted that threats to life have both biochemical and historical roots. Such a move brought American empire into disconcerting focus. “In this respect,” notes the conference report, “policies promoting or perpetuating apartheid, racial segregation, discrimination, colonial and other forms of oppression and foreign domination stand condemned and must be eliminated” (Ward and Dubos 1972: 4) as part of environmental protections. Here, “a

world-wide harmonization of standards” (26) and a planetary network of “baseline stations” sits uneasily next to a political accounting of the ecological debts of racism, colonialism, and underdevelopment. Under the umbrella of “the environment,” many representatives at the UN conference insisted on “a new liberation movement” to confront toxic pollution *and* the ecological effects of empire as a conjoined threat to the conditions of life on Earth. While the UN added a Program on Environment with headquarters in Kenya soon afterward, its work drifted away from the promise of a historical reckoning and soon came to focus on widening the reach of thresholds and impact assessments.

#### POSTSCRIPT: HISTORY AS ANTHROPOLOGICAL THEORY

This chapter has drawn historical attention not only to *what* we know of the environment but also *how* we have come to know the environment. Just as the term was being enlisted to govern the crisis of life in the 1960s, Eric Wolf (1965: x) described the environment as a “watertight” concept compared with the stress fractures emerging in the concept of culture as that core concept of American anthropology found itself pulled into consequential public relevance. Wolf, perhaps, was a bit too retrospective with the environment, looking toward the deep intellectual roots of the term, not its rising political scope. As an erudite emphasis on the influence of context, environment—US social science’s first translation of Auguste Comte’s *milieu* and Wilhelm Dilthey’s *Umwelt*—has a rather distinguished intellectual pedigree.<sup>45</sup> Perhaps more akin to culture than Wolf realized, in the 1970s the scholarly problem soon became one of a concept coming to matter a bit too much. The ecological crucible described in this chapter, and the instrumental genealogies brought to bear on it, drastically recast this rather highbrow academic frame as the technical field that could best regulate the negative excess of modern power.<sup>46</sup> As the ethical and political action oriented by the environment exceeded its scholarly purchase, the technical authority of the concept rose in inverse relation to its intellectual foundations. Its coherence came to lie far more in the practical consequence of its application than in its empirical content or theoretical definition.

As it was taken up worldwide, the environment also came to displace efforts to center the unbound crisis of petro-capitalism and thermonuclear statecraft as it shifted attention instead toward equipping states to manage their effects. This shift, burying the interwoven materiality of the

crisis underneath the disciplinary fields of calculating and administering effects, mirrors a trend in social theory. For this moment of history also heralds the beginning of a broad turn in social theory toward the preferential treatment of the symbolic, the interpretive, and above all, the discursive, in the ordering of social life. Materiality, within the terrain of state administration and social theory, was pushed into an ancillary effect. That project, one that formed a good part of my graduate education, would focus attention on the realities incarcerated by various forms and forums of objectivity. The effects of objectivity marked the starting point of theoretical significance and ethnographic description in the anthropology of science. While hugely generative, such a stance too easily dismissed materiality as secondary and science as ideology. As historians John McNeill and Peter Engelke (2016: 210) have written of the cultural turn in the social sciences and humanities and its studied avoidance of ecological crisis: “The intellectual flight from reality made it slightly easier for those in positions of power to avoid facing up to it.” Writing in 2002, Mike Davis put a slightly sharper spin on it: “Although the academy may still favor the esoteric relativity of postmodern textualism, vulgar economic determinism—which begins and ends with the superprofits of the energy sector—holds the real seats of power. We don’t need Derrida to know which way the wind blows or why the pack ice is disappearing” (417).

The displacement of the primacy materiality shaped many ethnographies of communities living with the toxicity of fossil fuels. Many monographs either worked to make frontline communities’ suffering more legible to the modular objectivity of thresholds and impact assessments, or they worked to downplay those instruments of the state in order to privilege the subjective experience of contamination over any field of material reckoning. In both cases, the biochemical routes and accruals of harm drifted into the background as the objectivity of thresholds and impact assessments served to frame the significance of environmental ethnography and its pursuit of justice, whether by tactical inclusion or theoretical omission. The environment, as a historically constructed scientific and legal field of fairly recent vintage, remained largely unfazed: it remains the main stage upon which various local, moral, and disciplinary dramas played themselves out. As an active force, materiality remained backstage.

A striking thing has happened in the past few years. Materiality has come roaring back to life, and with it a new appreciation for the life force of the nonhuman and the wonder of science. This current of materialist

thought reduces the significance of the past to examples of a flawed and failed epistemology while flattening all questions of historical contingency and political struggle into accounts of uniformly bad philosophy. The truly critical task, for this current of anthropological thought, is to properly grasp the liveliness of the material world unadorned with modernist form, an emergent apprehension that promises to create the world anew. Curiously, this resurgent materiality in theory and research now accuses the environment with preventing just such a revolutionary understanding. For many scholars of this moment, the environment is now coming into focus as the impediment that long blocked more emancipatory insurgencies. Environmental protections, write Jason Moore and Raj Patel (2017: 40), “rest on the historically bankrupt idea of immutable human separation from nature.” This nature/society dualism, they argue with many others, stands both complicit and condemned in the face of planetary crisis. The environment, writes Kregg Hetherington (2019: 5), inferred that “problems and the people who suffered from them could always be localized.” The environment implied there was “an intellectual outside” to the problem, that could then inspect problems as a contained phenomenon. “The conceit of Anthropocene,” Hetherington writes, has no such outside. “In place of ‘environment,’ there is now the Earth system,” argue Bonneuil and Fressoz (2016: 20), as the Anthropocene fundamentally breaks with the technical modalities of the environment.<sup>47</sup> Again and again, the impoverished constitution of the “environment” provides a point of scholarly departure to finally give our contemporary upheavals a more epochal definition.

In many respects, these scholars are undoubtedly correct. The environment severely constrains our view of our present crisis. Yet the resulting sense of scholarly revelation is premised on bad history. The negative ecologies of petro-capitalism and thermonuclear statecraft that came into focus in the 1960s and 1970s defied any simple division of nature and society. Rachel Carson, Barry Commoner, and others strove for a new analytical and political vocabulary beyond such impoverished dualisms, dualisms they too found dangerously complicit. Even as the environment displaced the radical implications of their negative ecology, it did not return to these dualisms. Thresholds and impact assessments do not reify the boundaries of nature and society so much as manage their overlay.

Nor were the founding problems of the environment considered individualized or insular. DDT and strontium 90 were not “localized” problems by any stretch of the imagination. As Commoner wrote in 1967:

“The new hazards are neither local nor brief” (28). It was clear to scientists, citizens, and state officials at the time that the afterlives of fossil fuels and nuclear weapons defied every existing jurisdiction. Nor does the Anthropocene represent a straightforward break with the environment. Many of the approaches being advanced to hold back the worst of climate change, from “planetary boundaries” (Rockström et al. 2009) to the Intergovernmental Panel on Climate Change’s (IPCC’s) emissions scenarios (2014, 2018) seem not to break with toxic thresholds and impact assessments so much as to deepen and widen their scope beyond the state.

The environment may very well be the conceptual barricade that prevents our owning up to the present crisis of life and prosecuting the profiteers of destruction. But it should be recalled that the environment was also the engineered solution to just such a revolution. The resurgent materialist theories in social research often presume that if only we might bring our thinking in alignment with the agencies beyond the human, a new politics would become possible to free us from this bind. The formation of the environment in the 1960s and 1970s seems an instructive case to temper such promise, both in its founding attention to negative ecologies of modern power and in how radical possibilities of that science were so quickly enlisted into an overwhelmingly technocratic solution. It’s curious to see how the crisis of life that provoked the environment—a history I have sketched out in this chapter—carried so much of the vital materialism, planetary orientation, and clamor over a new ethical and political vocabulary that is now being taken up today as proof of our unprecedented condition. At that earlier moment, an emerging crisis of life brought into sharp focus an understanding of petro-capitalism coursing through the veins of an ecologically interconnected planet as life veered toward rampant destruction. Those earlier claims were read widely and provoked new policy and public awareness. Even as they gestured toward revolutionary resolution, such popular insights were soon given an institutional definition that domesticated the negative excess of power as a side project of the instrumental reason of the state. My sketch of this history is less a finished project than a preliminary effort to brush away the accredited nonsense clamoring to contain the frontline laments of contamination and to provide a much deeper historical and theoretical credence to their complaints. Such work is not aimed at getting away from the present but at providing new coordinates for ethnography to come closer still to the ecological crisis of now.

Instead of privileging the possibilities of materialist theory over historical realities, we might return to the flawed and fatal ground upon which we still live. Besieged by war, toxins, climate, and pandemics, negative ecologies of all variety assail our present. Attention to the materiality of these widening webs of injury tempers the ontological optimism of contemporary anthropological theory and insists on explanations adequate to those lives bruised by the worsening condition of the world. Theory should bring us closer to the world at hand, not with an aim to naturalize its forms but to better understand the contingencies of those forms and the manner in which they might be overcome now. Possibility is not the unique property of utopian futures. The historical grounds we inhabit—its haunting insights, blind alleys, and lost causes—also advances anthropological theory for a better world today.

## Notes

### CHAPTER 1. ENVIRONMENT: A DISASTROUS HISTORY OF THE HYDROCARBON PRESENT

1. For the first half of the twentieth century, “environmentalism” was a distinguished current of thought within US social science, one emphasizing contextual explanation in scholarship. As the US social sciences’ first translation of Auguste Comte’s *milieu* and Wilhelm Dilthey’s *Umwelt*, the term *environmentalism* foregrounded the influence of surroundings in understanding of social phenomena. Environmentalism was not a substantive problem, a regulatory project, or a stable scientific field; it was a generic privileging of context in social explanation. As “environment” became the premier diagnosis of the crisis of life in the 1970s, the intellectual history of the term fell by the wayside as the operational coordinates of the environment came to reign supreme. This etymology is explained later in this chapter (see note 45).

2. James Hansen’s 1988 testimony is widely celebrated as a watershed event, introducing climate change to federal governance (*Hearing on Greenhouse Effect and Global Climate Change* 1988). Ten years earlier, the second EPA administrator, Russel Train, who was appointed by Richard Nixon, wrote in *Science*: “There is growing scientific concern over the buildup of atmospheric carbon dioxide from the combustion of fossil fuels with potentially significant impacts on global temperature and climate. All of this suggests that coal (sometimes described as America’s energy ‘ace in the hole’) may be a very uncertain foundation upon which to base long-term energy policy. [. . .] The world will have to turn away from fossil fuels long before usable coal reserves are exhausted” (1978: 322). Indeed, climate change was also on the docket in

congressional hearings about the National Environmental Policy in 1968 and 1969, where “the contrary possibilities of rising world temperatures as a result of carbon dioxide build-up or falling temperatures as a result of smog and jet contrails” were introduced as possible fields of responsibility for the governance of the environment (*Hearing on Environmental Quality* 1969: 15486). The White House commissioned a report on pollution in 1965. In a chapter entitled “Carbon Dioxide from Fossil Fuels: The Invisible Pollutant,” the report stated “the data show, clearly and conclusively” that global CO<sub>2</sub> levels were rising in tandem with fossil fuel consumption (White House 1965: 116). Noting “the extraordinary economic and human importance of climate,” the report described the unregulated burning of fossil fuels as “a vast geophysical experiment” (126) that needed to be addressed to “counteract” the planetary effects of burning fossil fuels (127). It is not the recent discovery of the direct connection of fossil fuels and climate change that should hold our attention but the ease with which that long-standing fact has been forgotten.

3. For example, see Mahrane et al. (2012) and Warde, Robin, and Sörlin (2018).

4. Many scholars have equated the rise of environmentalism with middle-class aesthetics, whether by setting aside certain ideals of nature for weekend consumption or the suburban bastions of organizing in affluent countries (Radkau 2014; Sellers 2012). Others have located the true birth of environmentalism in the way peasant land ethics came to protest the arrival of extractive industries (Taylor 1995; Guha 2000; Martinez-Alier 2002). My point here is that the field this social movement organized around—the environment—first gained operable form primarily in relation to the negative ecologies of contemporary power. This book presumes that many of the social movements that have cohered around the environment in a variety of local, national, and international contexts have long tripped up and exceeded the technical constitution of the category, even as the state-backed objectification of the environment has animated the analytical and ethical justification of those movements. More recently, scholars have turned attention to the environment itself (Warde, Robin, and Sörlin 2018), yet they do so primarily through the history of ideas set apart from the material problems and institutions that instantiated the environment.

5. Perry Anderson, in an interview with Raymond Williams, defined structures of feeling as “the field of contradiction between consciously held ideology and emergent experience” (1979: 167). Perhaps, and Williams certainly wrote of his intention to brush aside overly formalist explanations that seem to abstract social life so that critical scholarship, like literature, might grasp “meanings and values as they are actively lived” in the taut gap between the official version and everyday life (1977: 132). But this formulation may shortchange the creative materialism at the very core of Williams’s project. In response to Anderson, Williams pushed against the “rabid idealism on the left in the sixties and seventies” (1979: 167) and the manner in which “great blockbuster words like experience” (1979: 168) all too quickly fence off materialist fields of inquiry and analysis, holding all manner of things at bay. In a discussion long neglected in the subsequent popularity of the term, Williams recentered structures of feeling on specific material ruptures that find themselves, as he had written

in *Marxism and Literature*, “at the very edge of semantic availability” (1977: 134). Structures of feeling, Williams wrote, “initially form as a certain kind of disturbance or unease, a particular type of tension, for which if you stand back or recall them you can sometimes find a referent” (1977: 134; 1979: 168). One thinks of the novelty of country estates in *Country and the City* (1973), the arrival of railway in the Welsh Trilogy, and perhaps ecological crisis in his later reflections on nature. For Williams, these disruptive material referents at the core of structure of feelings are always tethered to the expanding history of capitalism. With DDT and strontium 90 I wonder if we might allow for a disruptive materialism in excess of capitalism and see a sprawling structure of feeling taking shape around the negative ecologies of hydrocarbon prosperity and thermonuclear statecraft.

6. The turn to supplement the sun’s seasonal energy with geologically stored deposits of hydrocarbon energy—first with coal and then crude oil—conspired with new logics of profit and practices of rule to spark uneven transformations within human society. While scholars continue to debate what part of this transformation was due to fossil fuels and what part was due to capitalism (Ruddiman 2005; Malm 2016), it is clear that fossil fuels profoundly shaped the texture and trajectory of the modern world. Stored deposits of hydrocarbon energy helped fuel mechanized production in factories, concentrated misery in cities, and helped expand the geography of markets while vastly increasing the scale of what could be transported and to where. While the narrow conduits of coal provided the technical basis of broad social democracy, the more imperial and flexible conduits of crude oil provided its limits (Mitchell 2011). The “privatized mobility” of the automobile, as Raymond Williams put it, transformed the city, exiling the vibrant public life of urban streets to private interiors (Norton 2011). The car also underwrote the construction of the suburbs, with new petrochemical lifestyles and plastic subjectivity (Huber 2013). As Max Weber ([1990] 2002: 123) once noted with a qualifier on social theory that we have yet to fully reckon with, perhaps this iron cage will hold “until the last ton of fossil fuel is burnt to ashes.” Rather than relitigating this robust and still unfolding debate, my point here is to simply note how the consequences—the negative excess of fossil fuels and nuclear weapons—exceeded the existing frameworks of capitalism and the state. While we may require a thorough theory of capitalism and the state to understand how fossil fuels and nuclear weapons were put into play, their effects soon exceeded the analytic capacity of those theories.

7. Theodor Adorno ([1966] 2007: 5) insisted that things “do not go into their concepts without leaving a remainder,” and a new critique might be born from attention to that haunting excess of commodification. With attention to peasant frontiers around the world (Wolf 1969, 1982; Taussig 1980, 1991, 2018; Ong 1987; Stoler 1995), the dark shadows cast by the commodity have long been at the forefront of anthropological critiques of capitalism. Today, negativity, as an experience and a condition, is moving from anthropological histories of commodification into the wider landscapes of violence and dispossession (Bessire 2014, 2021; Gordillo 2014; Masco 2015; Navaro 2020). The negative, as existential approximations of losses that defy the reason of gain,

remains uniquely accessible to ethnographic description and at the forefront of one genre of ethnographic critique. Defying the positivist methodologies of sister social sciences, anthropology can reflect on the existential and historical dimensions of negativity without first presuming its technical resolution as the baseline of apprehension.

8. Ecosystems, the basic unit of study for Odum, were defined as “a stable system in which the exchange of materials between living and nonliving parts follows a circular path” (Odum 1953: 9). Negative ecology identified a temporal frame more than a spatial location for the crisis at hand: the planetary present. Rachel Carson (1962) wrote: “The central problem of our age has therefore become the contamination of man’s total environment.” Changes held together by contamination no longer bound by a stable system nor a well-defined place are unloosed, at large, in ways big and small.

9. While they were by no means the only discordant things to capture broad attention, DDT and strontium 90 became the premier examples of the ecological underside of petro-prosperity and atomic might. A number of studies in the 1960s indicated that pollution had penetrated into the deepest recesses of human biology: debilitating levels of lead from gasoline emissions were readily found in blood samples in cities across the United States; autopsies in Pittsburgh, Montreal, and New York City revealed roughly half of the bodies examined had tumors from asbestos in their lungs (cited in Esposito 1970: 15); carbon monoxide from automobiles and dissolved nitrates from fertilizers both inhibited the human body’s ability to absorb oxygen, artificially stunting the functions of various vital organs (Carr 1965; NAS 1969); a radioactive isotope of strontium, released into the atmosphere in nuclear tests, rather quickly found its way into human bone marrow and developing fetuses (Kulp, Ecklemann, and Schuler 1959); and hydro-chlorinated pesticides like DDT were rapidly accumulating in the fatty tissue of nearly every human on Earth (White 1964; Rudd 1964). See Fowler (1960); Commoner (1967), Rudd (1964), and above all others, Carson (1962).

10. Strontium 90 accumulated at alarming levels in the fast-growing bones of breastfeeding infants and developing fetuses, a process that the rising incidence of leukemia in US children during the 1960s and 1970s was attributed to (Newcombe 1957; Eckelmann, Kulp, and Schuler 1958; Kulp, Schuler, and Hodges 1959, 1960; Kulp and Schuler 1962). These discovered linkages led to the widespread collection and study of baby teeth as a crucial indicator of the spread and density of radioactive fallout in human bodies (Reiss 1961). As Joseph Masco (2016) demonstrates, this most unnatural injection of radioactivity has now settled into the comforts of natural background level, where its potency winds down over geological timescales but is no longer seen as an event.

11. Although set in motion by Cold War bluster, technoscience bravado, the belligerence of development, and blithe suburban consumption, the disruptive afterlives of DDT and strontium 90 exceeded the geographies of those projects and their analytical jurisdiction. Empire, capitalism, and the state may be required references in understanding how DDT and strontium 90 first were set loose in the world, but once unloosed they required a new science to fully grasp.

12. This “Age of Fallout,” as anthropologist Joseph Masco (2015, 2021) has aptly named it, introduced a new kind of “invisible injury” that heralded profound ruptures of life but unfolded on scales and temporalities just beyond the registers of human experience, whose very visibility was deeply reliant on national security and yet always exceeded the operational capacities of that increasingly dated political form (whose very “datedness” was in no small measure a result of problems like this), and whose analytic and affective texture prompted political subjects to remake themselves in relation to a future-oriented form of historical reckoning only “made visible in negative outcomes.”

13. Such a conception stands at odds with critical appraisals of crude oil (and nuclear weapons). Distilling a popular current of social research and scholarly critique, Matthew Huber (2013: 3) has written of oil: “My wager is that *it* doesn’t do anything. Oil has no inherent power outside the social and political relations that produce it as such a ‘vital’ resource.” This approach to the embedded power of oil has proved critically incisive in many ethnographies of oil, whether by locating the material question of oil in the field of Indigenous politics (Sawyer 2004; Cepek 2018), the neoliberal family and consumer citizenship (Shever 2012; Huber 2013), the cultural reach of state power (Apter 2005; Rogers 2015), the temporality of development (Limbert 2010; Weszkalnys 2014), or the infrastructural life of extractive capitalism (Barry 2013; Appel 2019). I have no disagreement with this prerogative to attend to the embedded social constitution of oil’s power – indeed, I continue to learn from and teach with this accomplished body of scholarship – as long as it is lodged in the world *before* combustion. In the aftermath of combustion, fossil fuels gain a force that is neither empirically nor theoretically contained within the labored dimensions of the commodity nor in the social format of neoliberalism, that actually does seem to be rooted in the agentive physicality and functional autonomy of the thing. Capitalism and the state are requisite histories in any serious account of how fossil fuels and nuclear bombs come to exert such influence in the contemporary world. But what happens after the commodity, after the weapon, stands in ecological excess of those histories. The aftermath unfolds with a causal force that will continue inflicting disruptions to life regardless of the subsequent rise or fall of capitalism or American empire or humanity itself.

14. Nuclear fallout grossly exceeded the intended violence of the weapon. The World Health Organization commissioned a report in 1983 that aimed to measure the health effects of nuclear war. The report found that in an “all-out nuclear war” 1.1 billion people would die within the first few hours of the war, and another 1.1 billion would be permanently disfigured, while every major city in Europe, the United States, and the Soviet Union would be rendered uninhabitable for generations (WHO 1983). As Carl Sagan responded to this alarming report in *Parade Magazine* in 1983, “Unfortunately the real situation would be much worse” (4). Coining the term “nuclear winter,” Sagan summarized the emerging atmospheric science and planetary modeling of nuclear war. The explosive blasts merely provide the opening skirmish of the global tsunami of destruction. Through supercharged firestorms that would consume entire landscapes, smoke and dust suspended in the stratosphere that would obscure the sun for years, and toxic fallout that would contaminate prime agricultural land,

nuclear war would render the entire planet burned, dark, cold, radioactive, and inhospitable to life. “Except for fools and madmen, everyone knows that nuclear war would be an unprecedented catastrophe,” Sagan wrote (1983: 4, 7), yet “fools and madmen do exist, and sometimes rise to power.” The analytical grasp of this unbound destruction of nuclear weapons initially moved in two opposite directions. Within the state, a new expertise arose focused on how to survive it domestically—an expertise that came to privilege vital infrastructure over people and redesigned much of American life accordingly (“reflexive biopolitics,” as Collier and Lakoff 2021 have perceptively described it)—and how to weaponize it externally. Realizing the ecological shockwaves were far more destructive than the initial blast, many military scientists worked to better aim and amplify fallout as the real weapon of atomic explosions (Hamblin 2013). Recoiling in shock over the same emerging scientific picture and planetary dimensions of fallout, many academic scientists became convinced that rampant militarization of synthetic force might actually snuff out life on Earth (Commoner 1971; Crutzen and Birks 1982; Grover and Harwell 1985). They built a compelling scientific case for radical structural change. As Donald Worster (1994: 339) has written of this moment, “For the first time in some two million years of human history, there existed a force capable of destroying the entire fabric of life on the planet.”

15. The theory of lively materiality offered by the ecologies and outrage over the atomic bomb remains unexplored. There are, however, a few provocative openings. “The Bomb is, after all, something more than an inert Thing,” wrote E. P. Thompson (1982: 4). Nuclear weapons are an unprecedented menace, they are embedded in highly automated systems programmed to override human reflexivity, and they are a force that once unleashed quite soberly promises totalizing extermination. A decade or more before such phrasing entered the lexicon of critical theory, Thompson concluded: “Weapons, it turns out, are political agents” (7).

16. While they were by no means the only discordant things to capture broad attention, DDT and strontium 90 became the premier examples of the dark ecological underside of contemporary imperialism. A number of studies in the 1960s indicated that leaded gasoline, carbon monoxide, sulfur dioxide, iodine 131, cesium 137, and other forms of contemporary pollution also had penetrated into the deepest recesses of human biology (LI 1969; Carr 1965; NAS 1969).

17. Rachel Carson (1962: 188) wrote: “The new environmental health problems are multiple—created by radiation in all its forms, born of the never-ending stream of chemicals of which pesticides are a part, chemicals now pervading the world in which we live, acting upon us directly and indirectly, separately and collectively. Their presence casts a shadow that is no less ominous because it is formless and obscure, no less frightening because it is simply impossible to predict the effects of lifetime exposure to chemical and physical agents that are not part of the biological experience of man.”

18. This petrochemical-hybrid complex neatly packaged and exported in the Green Revolution should also be seen as counterinsurgency by other means. As tractors and petrochemicals helped displace family farms and consolidate

agriculture at industrial scales, we should recognize that the synthetic productivity of the Green Revolution made the countryside of the Global South newly dependent on American agribusiness and petrochemical firms while simultaneously emptying the countryside of pesky peasants and their penchant for agrarian revolution in the twentieth century (Shiva 1989; Davis 2006). Deriving nitrogen from natural gas actually “makes fertilizer production the largest energy input into US industrial agriculture,” Moore and Patel (2018: 174) write. In so doing, the Haber-Bosch Process has allowed “meatification” of global diets (Moore and Patel 2018: 174).

19. This emphasis on synthetic might is neither to dismiss nor to downplay the ongoing colonial occupation of Native lands; the military invasions of Afghanistan, Bosnia, Grenada, Guam, Iraq, Korea, Kuwait, Panama, Marshall Islands, Vietnam, and elsewhere; the clandestine terrorism of the CIA across Africa, Latin America, the Middle East, and South Asia; and the financial terrorism of US-backed structural adjustment across the Global South. Rather, it is to emphasize a primary material pedestal from which American empire came to flex its might in the twentieth century, one that helped give rise to the notion—for adherents as much as critics—that American imperialism exemplified a different kind of empire.

20. As Rachel Carson’s editor wrote to her about the manuscript that became *Silent Spring*, the proverbial lightbulb flipped on with the recognition of “fall-out” as the perfect concept to hold together the analogy of atomic bombs and petrochemicals (Radkau 2014: 75).

21. For example, Paul Crutzen, who coined the term “Anthropocene,” rose to prominence for his analysis of the “climatic effects of nuclear war” (1987) before becoming one of the premier atmospheric chemists studying the climate effects of rampant consumption of fossil fuels and petrochemicals.

22. Precursor of our contemporary, the recognition of the negative ecology brought the hard-nosed sciences into practical demands for revolution, while those presumably schooled in radical social change—the progressive social sciences—seemed to drift either into liberal compliance or esoteric irrelevance to the more material questions of crisis at hand.

23. As an analytic concept, “structures of feelings” insists upon change. “Perhaps the dead can be reduced to fixed forms,” Raymond Williams wrote, “but the living will not.” The present is always at the cusp of a confluence of archaic forms, the existing order, and new things. Standing within a quickening current without an agreed upon course, the present unfolds as a passionate affair not yet weighed down in the formal dress of “definition, classification, or rationalization” (1977: 132).

24. Raymond Williams privileged art and literature for their early depictions of these ruptures rippling out across a society before either the state or the sciences had a name for such changes. Such novels or works of art, Williams wrote, “produce a shock of recognition” among their contemporaries (1979: 164). “What must be happening on these occasions is that an experience which is really very wide suddenly finds a semantic figure which articulates it” (1979: 164). Surely literature has no monopoly on such presence. While some scholars have commented on the astounding popularity of *Silent Spring*

by referencing the wider anxieties of the Cold War and racial strife, I might also insist on a more literal reading. *Silent Spring* provided a new language of empirical and moral discontent around the suspicion that the massive chemical expenditures fueling headlong prosperity might also be undermining the possibility of life within such relentless progress. Science introduced a new vocabulary to grasp the massive changes underway.

25. While initially many of these new threats showed the privilege of the suburbs to be no shield against toxicity, the proffered solution frequently rested precisely on securing just that privilege. If DDT and strontium 90 helped first illuminate these concerns, today toxins like atrazine, dioxin, PFAS, plastics, and above all CO<sub>2</sub> do similar work. They act as tracers that illuminate the poverty of our existing structures for fostering life and illustrate how interwoven life is even as they draw its induced endpoint into focus. And they pose the ethical dilemma: that there is no solution that rests on barricaded islands that disregard the remainder of humanity. So can we recognize and build a politics adequate to the commonality of need, or will we continue following the promise of walls until everything falls apart?

26. After World War II, abundant reserves of crude oil in California, Oklahoma, and Texas provided for America's growing addiction to cheap energy. Yet after huge discoveries of oil were made in the Middle East in the 1940s and 1950s, President Dwight Eisenhower launched the Mandatory Oil Import Program (MOIP). At first, these overseas discoveries flooded the domestic market with cheap Middle Eastern oil, collapsing the domestic prices of crude. It was a market reality that threatened to bankrupt US oil companies, many of which were invested heavily in aging domestic reserves that required costly interventions to keep them producing. Imposing strict quotas for oil imports at around 12 percent of total domestic consumption, from 1959 to 1973 MOIP aimed to minimize dependence on foreign oil while propping up the solvency of oil extraction in the United States. With the resulting public investment in their profitability, those oil companies pivoted to an expanded presence in foreign oil. Between 1940 and 1967, "US companies increased their control of Middle Eastern oil reserves from 10% to close to 60%" ("Editorial" 2002: 2). When the next energy crisis hit—first the depletion of domestic reserves and then the OPEC embargo of 1973 and 1979—those same oil companies lobbied to do away with import controls and used the pretext of the crisis to more effectively deregulate the oil industry and more effectively decouple its vitality to the economy from its destruction of the environment. This also led to a significant consolidation of the industry: by 1970, 70 percent of the oil consumed in the United States was provided by just twenty oil companies, most of whom were more firmly organizing themselves as transnational corporations (Jacobs 2016).

27. Some scholars suggest deeper connections between the new militarized US expeditions around the world and the rise of environmental consciousness. For at this moment Americans "began to see the whole planet—the Earth itself—as in some ways American" (Robertson 2008: 584). The environmental mantra "think globally" coincided with US interventions at that very scale.

28. Energy, of course, is only one of the contradictions that gave rise to this formation. This image of prosperity was also underwritten by racial exclusions,