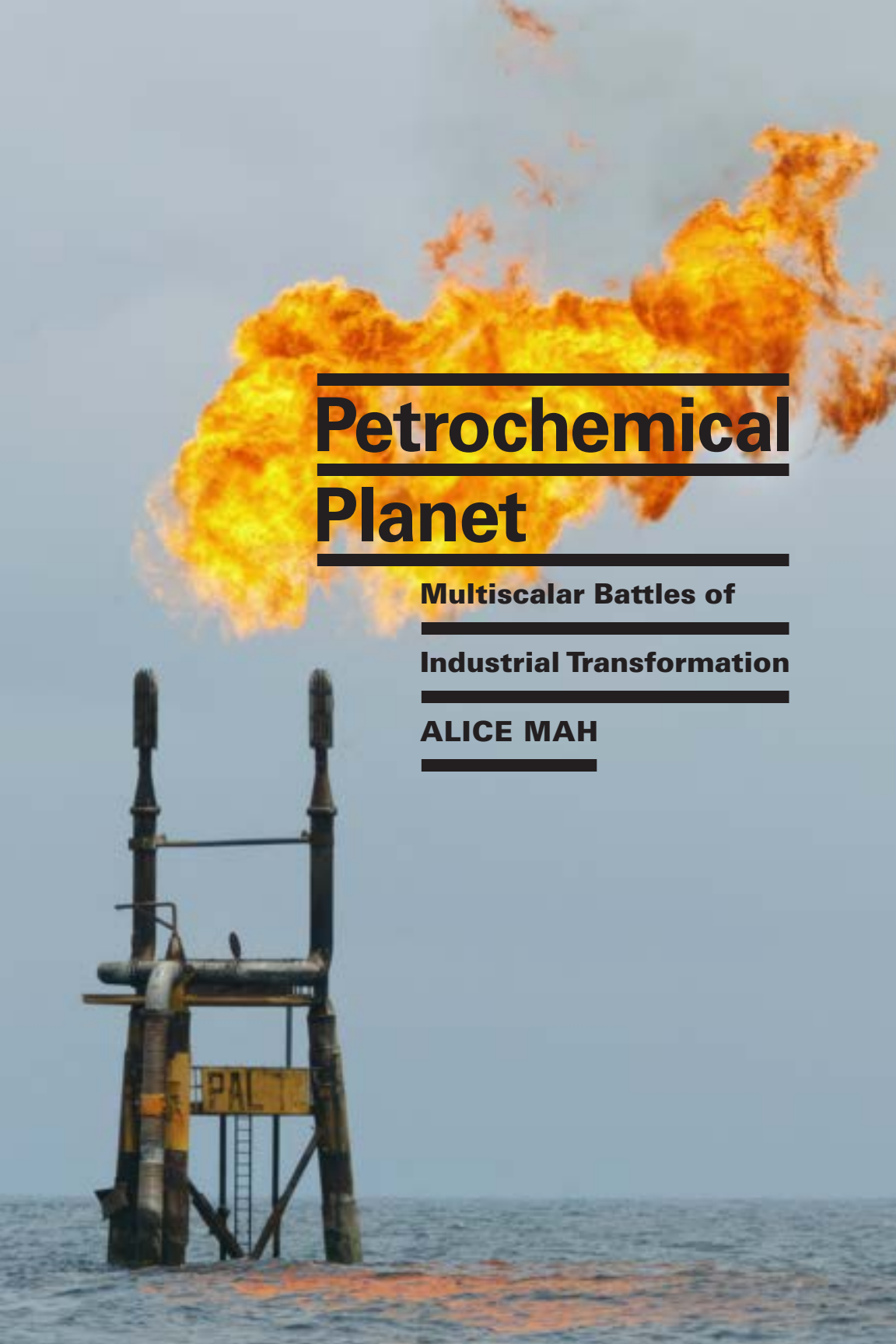


The background of the entire cover is a photograph. The upper half shows a massive, bright orange and yellow fire or explosion billowing into the sky. The lower half shows a dark, industrial structure, possibly an offshore oil rig or a flare stack, with a yellow sign that partially reads 'PAL'. The structure is situated in the ocean, with a reddish-brown oil spill visible on the water's surface in the foreground.

Petrochemical Planet

**Multiscalar Battles of
Industrial Transformation**

ALICE MAH

Petrochemical Planet

BUY

Petrochemical Planet

**Multiscalar Battles of
Industrial Transformation**

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DUKE

**UNIVERSITY
PRESS**

DUKE UNIVERSITY PRESS

Durham and London

2023

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ABBREVIATIONS

2-BE	2-Butoxyethanol
BP	British Petroleum
BPA	bisphenol A
BSR	Business for Social Responsibility
BTEX	benzene, toluene, ethylbenzene, and xylene
BTX	benzene, toluene, and xylene
CCS	carbon capture and storage
CDP	Carbon Disclosure Project
CEFIC	European Chemical Industry Council
CIEL	Center for International Environmental Law
CNOOC	China National Offshore Oil Corporation
COP21	United Nations Climate Change Conference (Paris, 2015)
COP26	United Nations Climate Change Conference (Glasgow, 2021)
COP27	United Nations Climate Change Conference (Sharm el-Sheikh, 2022)
COTC	crude-oil-to-chemicals
DDT	dichlorodiphenyltrichloroethane

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EPCA	European Petrochemical Association
ESG	environmental, social, and governance
GAIA	Global Alliance for Incinerator Alternatives
GMO	genetically modified organisms
ICI	Imperial Chemical Industries
IEA	International Energy Agency
ILO	International Labour Organization
IP Week	International Petrochemical Week
IPCC	Intergovernmental Panel on Climate Change
LNG	liquified natural gas
MTBE	methyl tertiary butyl ether
NPRA	National Petroleum Refiners Association (United States)
OCAW	Oil, Chemical, and Atomic Workers (United States)
OECD	Organisation for Economic Co-operation and Development
PCB	polychlorinated biphenyls
PESTEL	political, economic, social, technological, ecological, and legal
PFAS	per- and polyfluoroalkyl substances
PFOA	perfluorooctanoic acid
PPE	personal protective equipment
PVC	polyvinyl chloride
PX	paraxylene
SABIC	Saudi Basic Industries Corporation
TEK	traditional ecological knowledge
VUCA	volatility, uncertainty, complexity, and ambiguity
WBCSD	World Business Council for Sustainable Development

PREFACE

While plastics are highly visible in everyday life, the petrochemicals that comprise them are less visible. Derived primarily from fossil fuels, petrochemicals are the building blocks of polymers, found in thousands of consumer products, from phones, cars, and computers to windows, food packaging, and medical equipment. Many petrochemicals are toxic.

Petrochemicals sound dirty, but they are also technical and confusing. Not many people know what they are exactly, or how they relate to oil, other kinds of chemicals, or plastics. A full understanding would take advanced knowledge of polymer science. An industry spokesperson once told me, with a sense of frustration: “You will not believe how many people I meet that say, ‘Wah, petrochemicals, that must be the dirty stuff that makes the feathers of the ducks blue, the BP Deepwater Horizon thing.’ We say, ‘No, it’s not, first of all, and secondly, did you know your iPhone contains petrochemicals and the windmill blades?’”¹ She failed to mention that the petrochemical 2-Butoxyethanol (or 2-BE for short) was an additive in the oil dispersant that was used in the 2010 Deepwater Horizon oil spill, and particularly toxic to aquatic life.²

The first time I saw a petrochemical plant up close was in April 2013. I was in New Orleans, doing research on labor struggles in the port, driving with a longshoreman to a crawfish boil at a seafarers’ center along the Mississippi

River. We drove past fields, churches, and old plantations. Then, seemingly out of nowhere, we came across a massive petrochemical plant, metallic and looming. It felt like a scene out of a dystopian novel.

I was struck by how alive the plant was. For years, I had been researching the impacts of industrial decline and postindustrial change, including the toxic legacies of the abandoned chemical industry in Niagara Falls. But I had only ever tackled the ruins and embers of manufacturing.

As I soon learned, this was just one of 150 petrochemical plants clustered along an 85 mile stretch along the Mississippi River between New Orleans and Baton Rouge, infamously known as “Cancer Alley.” The plants are located on former slave plantation land, which was sold to oil and chemical companies in the early and mid-twentieth century, attracted by cheap natural resources and low taxes. Since the 1980s, Cancer Alley has been at the forefront of environmental justice battles over high levels of toxic pollution in rural Black communities on the fenceline of industry. Yet for all these efforts, the toxic industrial landscape remains.

My introduction to Cancer Alley sparked the beginning of a new journey. Months later, I noticed similar petrochemical complexes, from a distance, along the maritime fringes of other port cities: Marseille, Liverpool, Antwerp. Most large petrochemical facilities are located in coastal regions, near to ports, for access to shipping lines. Tightly enclosed behind security gates, they resemble cities with tall towers and giant cylindrical storage tanks. Many have their own hospitals, fire brigades, and contractor villages. They flare and steam and crackle.

How do these petrochemical plants relate to the ports? How do they work? How are they regulated? And what drives their operations? Who are the main global corporate players? Who are the biggest polluters? How do the environmental justice movements in Cancer Alley compare with activism in different petrochemical communities around the world? These questions informed my next research project, “Toxic Expertise: Environmental Justice and the Global Petrochemical Industry,” which ran from 2015 to 2020 and was funded by the European Research Council. It was a five-year multi-sited sociological study of the global petrochemical industry in relation to corporate social responsibility and environmental justice. This book is an attempt to bring together and to extend the myriad findings of the research, which spanned high-level industry meetings, petrochemical plant tours, and polluted communities in the United States, China, and Europe—the top three petrochemical-producing regions in the world.

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Engaging with questions of environmental justice requires a recognition of the ground that you stand on and your relations with land, people, histories, and multispecies worlds. So too does ethnography as a practice. In this book, I draw on both traditions, albeit unconventionally, across multiple sites, scales, and perspectives. It is difficult to describe the ground that I stand on in relation to a complex, vast, and extensive global industry, but I will try. The only way I can find is circuitous.

I am a third-generation, mixed-race Chinese Canadian, and I grew up in a small forest-dependent town called Smithers in northern British Columbia on the unceded land of the Wet'suwet'en people. I am also a naturalized British citizen and have lived in Coventry, once known as the United Kingdom's "motor city," for the past decade. Despite my training as a sociologist, I have often felt uncomfortable about personal questions of identity. When I was a doctoral student at the London School of Economics and Political Science, researching the industrial decline of shipyards in Newcastle-upon-Tyne, chemical factories in Niagara Falls, and textile factories in Ivanovo in Russia, a professor once asked me what my "real story" was. He was trying to identify some aspect of my personal history that could explain my research interests. I resisted this line of questioning, responding that I had no personal ties to any of these places, and that my research was motivated by questions about the uneven geography of capitalist development. I cannot remember how the conversation ended, just the impression that I had provided an unsatisfactory answer. Since then, I have come to realize that the professor was right. The personal connection was not to specific places, as such, but to working-class experiences of deindustrialization. My maternal grandfather, of Irish-settler descent, was a millworker, and my mother spent her childhood moving from one mill town to another across Canada. They eventually settled in Mackenzie, a sawmill town in northern BC. Mackenzie went through decades of decline as a one-job town tied to the fortunes of the mill. When I visited my grandparents, aunts, uncles, and cousins in Mackenzie as a child, I found it depressing, infused with the smell of pulp and cigarettes. Somehow it was too close to look at directly.

This is just one story, though, a journey from the mill towns of northern BC to the abandoned chemical factories of Niagara Falls to the petrochemical plants of Cancer Alley. Perhaps it is a little too neat. There is another, more troubling personal story, which is perhaps more telling. Early in 2019, I was

in my office at the University of Warwick, reading through Toxic Expertise researcher Thom Davies's field notes about resistance mobilizations over the construction of the Bayou Bridge oil pipeline in Cancer Alley.³ As I searched for media articles about the pipeline, a related news story caught my attention: the Wet'suwet'en people in northern BC were demonstrating over the construction of the Coastal GasLink Pipeline, designed to cross 190 kilometers of their lands, including my hometown. The natural gas pipeline would carry fracked gas from northeast BC to the northwest coast for export to petrochemical markets in Asia. The Wet'suwet'en land defenders set up a blockade to prevent the pipeline construction and were forcibly removed from their territory by armed Canadian police officers, sparking solidarity protests from Indigenous groups and climate activists around the country. A rally was held in Smithers in January 2019 in support of the Wet'suwet'en people. It was a strange feeling to see photos of my hometown on the international news, embroiled in fierce battles over environmental justice, with the familiar snow-covered mountain in the background.

After reading about the Wet'suwet'en pipeline resistance movement, I started digging. I discovered a book called *Shared Histories* written by the geographer Tyler McCreary, who was in my brother's class at school, about the history of Wet'suwet'en and settler relations in Smithers.⁴ I learned some disturbing things about the history of my hometown. I knew that the town was on Wet'suwet'en territory, but I knew little else. I found out that the house that I grew up in was part of a planned modernist subdivision built in the 1970s, which had displaced the Wet'suwet'en settlement known as "Indiantown" in Smithers. In all my years, I had never heard of Indian-town. It was a settlement that had grown on the fringes of Smithers since the 1920s, the only place where the town authorities permitted Wet'suwet'en people to live, and had high levels of poverty due to systemic discrimination, including a lack of access to basic public services such as waste collection. Indiantown was completely destroyed by town development between the 1960s and 1970s. The adjacent local elementary school that I attended was also part of this planned displacement, along with a companion Christian school, a senior citizen's home, and leafy cul-de-sacs, all designed to foster a middle-class sense of community and public safety. I actually felt sick reading about my childhood landscape in McCreary's book, as if the ground beneath me had sunk.

Smithers has an idyllic quality, nestled in a valley surrounded by mountains, glaciers, forests, canyons, lakes, and rivers, a thirteen-hour drive northeast from Vancouver. It was founded in 1913 as the divisional headquarters of

the Grand Trunk Pacific Railway and incorporated as a town in 1967. My parents moved to Smithers in 1975, attracted by the idea of starting a family in a small town. My father came from suburban Toronto, venturing west, contrary to the expectations of his Chinese Canadian family, and he met my mother during a summer job in Mackenzie. They married young, and my father joined an accountancy firm in Smithers, while my mother stayed home to raise four children before finding work in the primary school. It was in this forest-valley town built on a swamp, teeming with folk and country music, where I gained a strong sense of place. I can still trace the contours of the valley in my mind, the way the snow crept down the mountain as winter approached, the winding dirt backroads and forest trails. But I also wanted to escape.

Smithers is a majority white town with a population of 5,300. It is located on Highway 16 between Prince George and Prince Rupert, a 725-kilometer corridor known as the “Highway of Tears” because dozens of Indigenous women have gone missing and been murdered along its length since the 1970s. Growing up, I often felt a sense of unease. There were so many judgments and assumptions in the public spaces of the town, and violence was never far from the surface. I did not encounter many incidents of explicit racism, despite being half Chinese, or at least I did not recognize them as such at the time. There were occasional barbed comments, but mostly I managed to ignore them. More often, I faced racist attitudes due to being mistaken for an Indigenous person. I will not recount these experiences here, as they never felt like my own stories to tell. They did give me some insights, though, into racism.

Despite the rhetoric of multiculturalism that was taught in the schools, there was tacit racism in the white settler community toward Indigenous people, and tensions between Smithers and the nearby Wet’suwet’en village, which was located on the reserve. One time, when I was about fifteen, a Wet’suwet’en feast was held in my high school, led by an Indigenous leader, a rare occasion for cultural exchange. The leader’s opening speech was full of accusations against the white settler community, in ways of speaking that I had not heard before. I do not recall any of my classmates or teachers talking about it afterward; they just shared the food and went on with their day. Looking back, I wish I had asked more questions. It is clear to me now that the whole history of the settlement of the town, like many other communities across Canada and around the world, is one of environmental injustice.

This book asks difficult questions about entanglement and complicity in the fraught relationships between petrochemicals, toxicity, injustice, and our

planet. The violence of settler colonialism, systemic racism, and dispossession runs deep through the reckless global expansion of toxic and wasteful petrochemicals and the unfolding climate catastrophe. As the chapters in this book will detail, this violence is founded on willful ignorance, half-truths, and detached justifications. Confronting these questions has compelled me to move into further uncomfortable ground, through “studying up” and examining corporate petrochemical worldviews and logics, with the aim of identifying levers for change. It has not been an easy journey to home in on the sources of injury and destruction, only to find that they are even worse than I had imagined, deeply rooted in a calculated war mentality.

Throughout the waves of the COVID-19 pandemic, I have sometimes felt as though a snake was encircling my head, slowly tightening its grip. This book has been an ordeal to write, getting under my skin and giving me nightmares. It has caused me to question long-held beliefs about human nature. I like to believe in the possibilities for transcendence, in a Buddhist sense, and do not believe in the idea of “evil” in this world. It has been a difficult position to sustain. Yet this book is not only about conflict and injustice; it is also about the possibilities for repair through interconnection, across multiple sites and scales, from the personal to the planetary, and from the human to the forests and mountains.

My search for interconnection through this project led me beyond North America and Europe to China. Over the past two decades, China has emerged as the largest petrochemical producer and consumer in the world, and it has also faced tremendous problems with toxic pollution. When I first designed the Toxic Expertise project in 2014, anti-PX (paraxylene) protests were dominating the news headlines in China, peaceful mass “strolls” across cities and regions throughout the country, with people protesting the development of petrochemical projects. In subsequent years, the anti-PX protests subsided, under the tighter societal controls of Xi Jinping, and the research brought us instead to heavily polluted but less controversial petrochemical peri-urban areas in Nanjing and Guangzhou. There were many differences between these petrochemical areas in China and Cancer Alley in Louisiana, but there were also striking parallels, as this book will discuss. There was also a more personal connection. The city of Guangzhou in south China, a major petrochemical hub, is located only a few hours’ drive away from the village where my grandfather’s family came from, a place I had never been before.

In March 2018, I accompanied Toxic Expertise researcher Loretta Lou on a trip to Guangzhou. We walked along the dirt roads of the petrochemical villages on the outskirts of the city, talking with local migrant workers,

food vendors, and villagers. As Lou has evocatively described, the villagers took pains to “unnotice” the pollution in their everyday lives, faced with few other choices.⁵ The air was so noxious that I lost my sense of smell for weeks. On our travels from Guangzhou to another petrochemical city in the region, we stopped to visit my family’s ancestral village. Although I had no living relatives there, remarkably this rice-producing village was still inhabited by the Mah clan. There was something profoundly restorative about that journey of return. It was weirdly familiar, with a veneer of tranquility overlaying a century of trauma and rupture, echoing the unease that I once felt in my hometown.

The notion of return brings me back to the present moment, in my adopted city of Coventry, a place of incredible diversity and hidden gems, which has often been stigmatized in the national public imagination as a concrete cityscape marked by social deprivation. Since the start of the pandemic, like many other people, I have come to appreciate the parks, community spaces, and uncrowded streets of the city, but I have also been saddened to observe the devastating local impacts of the global health crisis on gender-based violence, food and fuel poverty, social inequalities, unemployment, and mental health.

The ground that we stand on is constantly shifting. This is a lesson of contingency, which opens up possible worlds. What started off as a book about global environmental injustice and the toxic impacts of the petrochemical industry has slowly expanded into a meditation on the wider stakes of ecological crisis, including the climate implications of doing research. The urgency of the task has propelled me to swing between registers of despair and hope, writing during the pandemic, which has magnified existing social and environmental inequalities. Within the context of profound ecological crisis, this book examines the possibilities of radical and just industrial transformations, despite the many barriers. This involves recognizing obligations to past, present, and future generations, and the consequences of the stories that we tell ourselves.

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Introduction

■ The global petrochemical industry is at a crossroads. As an essential modern industry but also a major polluter, it faces threats to its core business. Petrochemicals surround us in thousands of everyday products, yet they pose health and climate risks across every stage of their lifecycle. On the eve of the COVID-19 pandemic, the petrochemical industry was facing mounting public pressure to address issues of climate crisis, plastic waste, and toxic pollution. The coronavirus pandemic and the historic crude oil crash of 2020 turned the industry upside down, temporarily casting sustainability issues to the sidelines. If the industry had been preparing for a fossil fuel endgame scenario already, what would the future after the pandemic look like in the global “Race to Zero”?¹ This book argues that a profound planetary industrial transformation is

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underway, challenging the reigning age of plastics and fossil fuels, and opening new but tenuous possibilities for ecological alternatives. Century-old corporate and state alliances are being shaken as oil and chemical giants fight battles on multiple fronts to retain their power.

Drawing on multi-sited research on the global petrochemical industry between 2015 and 2022, this book examines multiscalar battles over the stakes of transforming a toxic yet essential industry. The petrochemical industry has long viewed the world in terms of militaristic corporate strategies: to conquer markets across its value chain, deny responsibility for harm, and mitigate risk. In response, polluted communities living adjacent to industrial facilities, known as “fenceline communities,” have fought numerous battles with companies for recognition and redress.² One of the key battles has been over the issue of social and ecological “expendability”: Whose voices and lives matter?³ Following global patterns of environmental injustice, the burdens of toxic petrochemical pollution are unequally distributed, heavily concentrated in low-income, working-class, and minority ethnic communities living on the fenceline of industry.⁴ For the past half century of environmental justice struggles, we have witnessed a “double movement,” Polanyi’s concept underlying the “great transformation” of the Industrial Revolution, between the destructive forces of capitalism and the salving counterforces of society.⁵

David and Goliath metaphors of capitalist conflict abound, but they have taken us only so far. Despite decades of struggle, fenceline disputes over petrochemical pollution have rarely posed fundamental threats to industry. Yet the pressure for industrial transformation is intensifying, coming not only from activists and regulators but also from investors and shifting geopolitical interests. Across our petrochemical planet, we face existential questions about societal and ecological values: What is “essential” or “expendable”? What is harmful or healthy? What is just and what are the alternatives? This book grapples with these important questions, building on debates in environmental justice, corporate sustainability, just transitions, degrowth, and anti-colonial ecologies.

A key contribution of this book is the concept of “multiscale activism,” a form of collective resistance that makes connections across diverse issues, sites, and scales of political struggle. Multiscale activism against the hegemonic power of the global oil, petrochemical, and plastics complex spans interconnected issues of environmental justice, climate, pollution, health, extractivism, land rights, workers’ rights, systemic racism, and toxic colonialism—across local, urban, regional, national, and planetary sites and scales. It has the capacity to raise the public visibility of separate

campaigns, but it can also pose political risks. The idea of multiscalar activism draws on Antonio Gramsci's account of "wars of position" to describe cultural struggles between hegemonic and counter-hegemonic groups, and Stuart Hall's related analysis of "articulation," the process of making connections between different elements to form a "unity," with the strategic aim of shaping political interventions in particular social formations.⁶

This book examines the obstacles as well as the openings for critical interventions in the complex, adaptive, and destructive petrochemical industry. Corporate executives routinely rally their troops in "a war to stay in the game," amid perceived threats from environmental regulators and activists.⁷ Industrial transformation toward a more just and sustainable planet is necessary, but it will not happen without a battle.

Petrochemical Planet

When I think of planets, I think of a visit to the Science Museum in London with my son when he was five years old, just before the start of the coronavirus pandemic, and his delight in watching the giant holograms of planets in the space exhibit and glimpsing the Earth from the International Space Station at the IMAX theater. Until recently, as an adult going about my everyday life, researching sociology rather than geology or archaeology or astronomy, I rarely reflected on the planetary facts that my son now finds so fascinating: the Earth is 4.54 billion years old; there have been five mass extinctions; the modern human species is about 300,000 years old; and humans began to make permanent settlements only around 10,000 years ago. Deep time scales are difficult to grasp and have an air of unreality about them. Yet at the start of a sixth mass extinction, in the face of melting ice caps, raging forest fires, deadly toxic pollution, and climate breakdown, it is becoming clear that deep-time thinking should not be just an abstraction. On the contrary, it speaks to urgent questions about planetary survival.

Over the past few years, there has been a turn toward planetary thinking in the environmental humanities and social sciences. Postcolonial scholar Gayatri Chakravorty Spivak makes a distinction between the globe and the planet, in the context of rapidly accelerating globalization. For Spivak, the globe is an "abstract ball covered in latitudes and longitudes," which is "in our computers" and "the logo of the World Bank."⁸ By contrast, "the planet is in the species of alterity, belonging to another system; and yet we inhabit it, indeed are it." In this context, Spivak proposes that we use "the planet to overwrite

the globe.”⁹ Historian Dipesh Chakrabarty makes a similar comparison between the global and the planetary, but more in relation to deep time.¹⁰ For Chakrabarty, the global relates to capitalism: to ideas of humanity linked to modernity, progress, equality, democracy, and freedom; and to the boundaries of recorded human history. The idea of the planetary challenges the global narrative of capitalist modernity by recognizing the role of humans as geological agents in the cumulative history of the Earth. Chakrabarty’s framing of the planetary engages with political theorist William Connelly’s influential work on planetary processes of change in complex nonhuman systems, and how understanding these processes could provide insights for changing capitalist systems.¹¹

This book draws attention to the material basis of the petrochemical planet and to the societal, political, economic, colonial, and ecological implications of pollution. In *Pollution Is Colonialism*, Max Liboiron proposes the concept of “plastics as Land” to underscore how multiple species live inextricably alongside plastics, as part of the entangled fabric of modern ecosystems, rather than thinking of plastics as only doing harm.¹² Many organisms in the ocean form synergistic relationships with microplastics, they note, and human lives have been saved with endocrine-disrupting plastic blood bags and medical tubes.¹³ This poignant reflection highlights the complex dilemmas of living in a toxic and interdependent world. But despite the problem of entanglement, and with careful attention to the ethical challenges, I do want to focus on petrochemical harm, both as a systemic problem of capitalism, colonialism, and environmental injustice, and as a call for radical industrial transformation.

My analysis of the petrochemical planet combines the dynamics of global capitalism and toxic colonialism with planetary deep time: the planet enmeshed in petrochemicals, which are quintessential fossil fuel creations of the modern industrial era; and the existential threat of escalating petrochemical expansion to multispecies life on Earth. Petrochemicals are ubiquitous, forming the building blocks of 95 percent of all manufactured goods, including plastics, rubbers, solvents, fertilizers, and other synthetic materials.¹⁴ Petrochemicals are also toxic, accumulate in bodies and ecosystems, and pose a significant threat to the climate.¹⁵ Toxic petrochemical exposures are associated with a range of health problems, including cancer, neurological damage, reproductive disorders, and other diseases. The petrochemical industry is the largest industrial consumer of fossil fuels, the third largest industrial emitter of greenhouse gases, and one of the top four “hard-to-abate” industrial sectors (alongside iron/steel, cement, and aluminum). It has considerable

“carbon lock-in” due to its long investment cycles, embedded infrastructure, and societal dependence.¹⁶ Some 99 percent of petrochemicals are derived from fossil fuels.¹⁷

Petrochemicals are produced through an industrial process called “cracking”: using extreme heat and pressure to break down heavy hydrocarbons into lighter hydrocarbons. Originally a satellite of the oil, gas, and chemical industries, the petrochemical industry emerged as a powerful industry in its own right during the Second World War, fueled by unprecedented wartime demand for synthetic rubber and polymerized high-octane gasoline.¹⁸ Since then, the industry has expanded to nearly every corner of the globe in its insatiable quest to create and dominate new petrochemical markets. Many petrochemical products have become “essential” to modern life and are found in medical equipment, computers, building insulation, and household appliances, but the biggest petrochemical market is for plastics (80 percent), particularly the most wasteful kind: plastic packaging, which accounts for 40 percent of global plastics production by volume.¹⁹

Unsustainable growth in petrochemical production shows no signs of abating (see figure I.1), despite the global momentum to address plastic pollution and climate change. According to the International Energy Agency (IEA), petrochemicals will be the main driver of oil demand during the energy transition, predicted to rise from 14 percent today to 45 percent by 2050.²⁰ Analysts from the IEA expect continual petrochemical growth due to rising global plastics demand and new markets for green technologies.²¹ However, IEA market forecasts are skewed to overestimate future oil demand, thus perpetuating fossil fuel investments.²² Indeed, anticipating these trends, many oil majors have started to branch further into petrochemicals.²³ In the business-as-usual scenario of global petrochemical growth, the amount of plastic entering the ocean each year is predicted to rise from 11 million metric tons per year in 2020 to 29 million annually by 2040.²⁴ Meanwhile, the levels of chemical and plastic pollution have already exceeded planetary boundaries.²⁵ We are facing a planetary petrochemical crisis, which is underpinned by two opposing dynamics: the escalating threat of the petrochemical industry to planetary life, and the threat of ecological crisis for the future of petro-capitalism.

In a guide to long-term thinking about how nuclear engineers envision the far-off future of the Earth, anthropologist Vincent Ialenti asks: How could we signal to future species that nuclear waste is dangerous? What recognizable signs, outside language, could create such a warning?²⁶ An analogy could be made with petrochemicals, which are toxic, bioaccumulate,

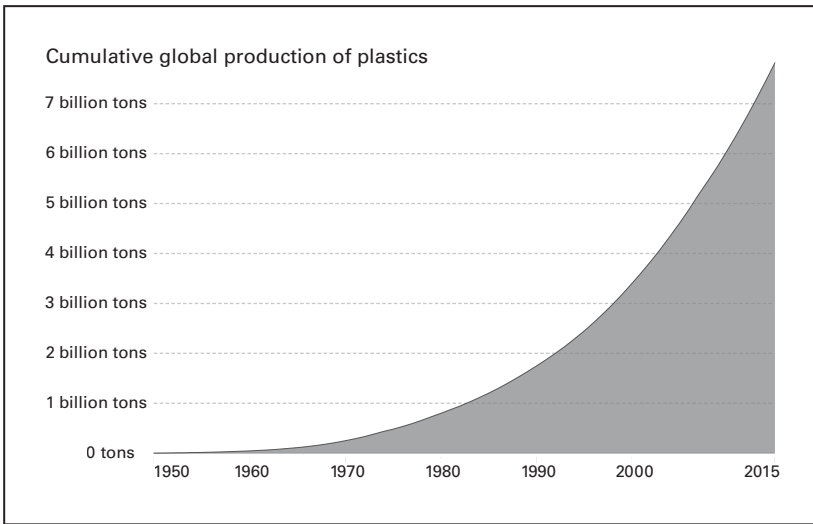


Figure I.1. Cumulative global plastics production, 1950 to 2015. Plastics production refers to the production of polymer resin and fibers. Source: Geyer, Jambeck, and Law, “Production, Use, and Fate of All Plastics.”

and persist in the environment, seemingly forever, at least in human time-scales.²⁷ The problem is not one of singular concentration, but precisely one of entanglement and proliferation across the materiality of the planet itself. Plastics will break down eventually, and so too will nuclear waste, beyond the wreckage of the sixth mass extinction. Some find planetary deep-time thinking terrifying, but I find it oddly grounding. Confronting existential questions about the future of life on the planet puts the present moment of ecological crisis into sharp relief.

The planetary petrochemical crisis raises profound ethical questions about responsibility, complicity, and resistance within unjust systems. London’s Science Museum, for example, has come under scrutiny from climate activists for taking funding from fossil fuel companies.²⁸ From a global vantage point, the edifice of the petrochemical planet seems unbreakable, built on the entrenched beliefs and complex systems of capitalism, colonialism, and modern science and technology. There are many different words to describe the nature of this edifice: racial capitalism; fossil capitalism; petro-capitalism; carbon capitalism; extractivism; toxic colonialism; and waste

colonialism—to name a few, which together convey the intimate connections between capitalism, colonialism, racism, and fossil fuel dependence. The petrochemical industry is a paradigmatic example of capitalism and colonialism in their most parasitic forms, constantly expanding to create more capacity and demand for toxic and wasteful products, inflicting harm on vulnerable communities and ecosystems. It is sustained through the exponential proliferation of petrochemicals around the planet, driven by the global imperatives of perpetual economic growth and consumer capitalism. From a planetary perspective, however, the petrochemical edifice is unstable, and despite appearances, it is showing signs of rupture.

Corporate Petrochemical Worldviews

When you enter the corporate world of the petrochemical industry, one of the first things that you encounter is a flowchart of the petrochemical value chain. “Petrochemicals make things happen” is the title of one of the most widely circulated flowcharts, produced by Petrochemicals Europe, an industry sector of the European Chemical Industry Council (CEFIC).²⁹ At the bottom are the raw material feedstocks: crude oil and natural gas. Stacked above are the refined gases and the petrochemical building blocks, divided into two main categories: olefins and aromatics. From these sprout branches of refined chemicals and polymers, culminating in stylized images of consumer end products along the top: smartphones, paints, bicycles, balloons.

Some petrochemical flowcharts include different details, such as the alternative feedstocks of coal and biomass. Others invert the perspective, with the upstream fossil fuels on top. But by and large, each flowchart follows the same script. Another popular petrochemical flowchart, produced by a market analytics company, highlights the “vital” role of petrochemicals, inviting viewers to “discover the chain that the goods we consume follow.”³⁰ For corporate representatives, the flowchart serves as a reminder of their dominant place in the complex system. For everyone else, it conveys a key political message: petrochemicals are essential for everyday life.

The petrochemical flowchart is a process map. Like other maps, it is based on the politics of knowledge and power. According to Timothy Mitchell, the map “signifies the massive production of knowledge, the accuracy of calculation, and the entire politics based upon a knowledge of population and territory that Foucault characterizes as governmentality, the characteristic power of the modern state.”³¹ This resonates with James Scott’s argument

that modern statecraft produced “maps that, when allied with state power, would enable much of the reality that they depicted to be remade.”³²

At first, I puzzled over the petrochemical flowchart, daunted by its intricate webs and unfamiliar chemical names. Then, slowly, it dawned on me: the petrochemical flowchart offered a useful guide to the terrain of petrochemical profit-making, both through what it included and through what it left out. Yes, it was complex, but it was not indecipherable. And not all the petrochemicals it covered were essential for everyday life.

As I followed the petrochemical value chain across its different sites and controversies, I started to highlight particularly toxic parts on the flowchart with sticky notes. First, there were the toxic gases: phosgene, so deadly that it has extremely high corporate barriers to entry, used in the production of foams and as a chemical weapon during World War I; and hydrogen cyanide, used in nylon, nail polish, gold mining, and by the Nazis in the gas chambers. Second, there were the BTX (benzene, toluene, and xylene) compounds, derivatives, and applications—the kind of things people use every day, such as polystyrene, polyester, and bisphenol A (BPA), variously linked to cancer, reproductive illnesses, and numerous other health impacts. Third, there were the flexible plastics including phthalates and other plasticizers, used in flexible polyvinyl chloride (PVC), found in pipes, flooring, and construction; these are linked to endocrine disruption and are legally banned in the United States and Europe in children’s toys. This was just the beginning.

Glancing at a petrochemical flowchart on my office wall, a visiting chemist commented that it was in fact a highly idealized representation. It was missing some of the most toxic parts, such as the heaviest crude oil residue, which never makes it into the refining process. He drew me a diagram of its typical molecular structure. I added another sticky note labeled “heavy, heavy crude” to the bottom of the flowchart.

Through simplified flowcharts highlighting the essential role of petrochemicals in everyday life, the industry conceals the destructiveness of its real-world operations. The relentless expansion of the petrochemical industry is systemically linked to the violence of human and ecological plunder. Sometimes the violence is overt: murders of environmental activists in resource frontiers; deadly explosions at chemical factories; repression of protests over petrochemical pollution; and devastation of wildlife and ecosystems. More often, petrochemical violence manifests in the everyday “slow violence” of toxic pollution, “a violence of delayed destruction that is dispersed across time and space, an attritional violence that is typically not viewed as violence at all.”³³

My analysis of corporate petrochemical worldviews takes inspiration from the work of James Scott on “seeing like a state” and James Ferguson on “seeing like an oil company.”³⁴ Scott’s study of the logics of modern statecraft in utopian state social-engineering schemes examined why these schemes failed in practice when confronted with the complexities of “real, functioning social order.”³⁵ According to Scott, these reductive logics applied equally to global capitalism. Ferguson countered this claim with the example of capital investment patterns in African mineral resource extraction, particularly oil, which frequently bypassed national grids of legibility and concentrated in highly risky countries with political instability. My research follows Scott by juxtaposing the logics of the petrochemical industry with their messy social consequences, and it follows Ferguson by focusing on dynamics within global capitalism that contradict societal expectations.

The petrochemical industry is a slippery object of study, located at the intersection of the upstream oil and gas industry and the downstream refining, chemicals, and plastics industries. The major players work across different parts of the value chain; some are vertically integrated oil companies like ExxonMobil and Chinese state-owned Sinopec, while others are multinational chemical companies, like BASF and Dow. The industry is dominated by a small number of powerful firms with a history of anticompetitive practices and lack of transparency.³⁶ It relies on complex global supply chains, which are rooted in histories of military and colonial supply lines.³⁷ Deborah Cowen details how the invention of the global supply chain was based on the old art of military logistics, as a “banal management science—a science that was born of war—in the recasting of the economies of life and death.”³⁸ The global petrochemical industry and its ways of seeing were also born of war, legacies that endure. The operational logic of the industry is militaristic, guided by efforts to gain geopolitical advantage, navigate risk and complexity, and annihilate opposition. Toxicity is deftly hidden behind arsenals of multiscale expertise, from the geopolitical to the molecular, and within multiple frameworks, from technological to financial and legal. Corporate responsibility is avoided at all costs.

Both value and supply chains are vital for understanding the way the petrochemical industry works. These chains overlap, with subtle differences. Value chains include all the activities that add value in the lifecycle of a product. They are fundamentally processes for profit maximization. By contrast, supply chains are networks of production and distribution between a company and its suppliers. The petrochemical industry uses supply chains to transport its materials and to offload its waste.

When confronted with public criticism, the petrochemical industry often deflects attention downstream along its supply chain. As one industry representative remarked on a public tour of the Fawley ExxonMobil petrochemical plant in the UK: “If you see a sulfur tanker sometimes dripping a bit of yellow stuff behind it, which is totally harmless but unsightly, it’s come from us, but it’s the sulfuric acid industry.”³⁹ In other words, the sulfuric acid industry bears responsibility for the petrochemical industry’s waste. Another corporate executive at a plastics conference in Antwerp blamed transporters for the heaps of tiny plastic pellets known as “nurdles” that wash up on industrial port shorelines.⁴⁰

Yet the petrochemical industry is protective of its value chain, with a long history of concealing and denying the harms of its toxic products. At the training workshops I attended on petrochemical markets, industry representatives lamented the decline of profitable toxic plastic markets, such as polystyrene and BPA, due to bans, regulations, and public controversies.⁴¹ I also observed how the industry protects its value chain through continually reinventing itself, seeking new technological solutions to its own problems, from “innovative” circular economy projects to green chemistry and sustainable packaging. A corporate executive at a petrochemical industry conference in 2016 reflected: “There are critical issues that we are facing as an industry. We became the bad guys; we became the non-sexy industry. We are not fashionable nowadays. But if well-addressed and properly debated, we can find potentially alternative solutions.”⁴²

The idea of industry proposing technological solutions to its own environmental problems is based on the modern belief in the power of technological innovation. It exemplifies what philosophy of science scholar Isabelle Stengers called the “techno-industrial capitalist path” to describe how the chemical company Monsanto promoted genetically modified organisms (GMO) in the 1990s as an innovative and risk-free “solution” to world hunger.⁴³ Industry leaders concealed industry-backed scientific studies about the risks of GMO crops to pesticide resistance in insects. Their true motivations were to profit through commodifying agriculture.⁴⁴ Stengers’s critique of the techno-industrial capitalist path echoes Ulrich Beck’s observations about the failure of techno-scientific rationality within what he calls “risk society.” Beck argued that “the sciences are entirely incapable of reacting adequately to civilizational risks, since they are prominently involved in the origin and growth of those very risks.”⁴⁵

Driven by the endless pursuit of profit, the global petrochemical industry has an imperialist logic of continual expansion and speculation, akin

to other extractive industries within global capitalism. The industry also holds a deep-rooted belief in the power of science and technology to generate profit as well as to fix problems, which it shares with other modern, technology-based industries.⁴⁶ However, the petrochemical industry is also distinctive, poised between upstream and downstream players, ubiquitous yet hidden across complex global value and supply chains, and at the nexus of overlapping social and ecological crises.

Petrochemical industry plans for perpetual toxic expansion have not yet failed, unlike Scott's state social-engineering schemes. However, like Scott's "state simplifications," corporate petrochemical logics are also simplifications, despite their basis in navigating complex systems. In the real world, the petrochemical industry interacts with multiple other complex social, political, economic, and ecological systems. While the ecological crisis intensifies, the industry is facing existential threats to its future survival. As Ferguson observes, "New times bring new dangers, and new dangers require new tools for critical analysis."⁴⁷

The Resonance of Environmental Justice

This book examines the oil, petrochemical, and plastics complex in terms of a multiscalar, planetary battle for environmental justice, with various points of articulation and struggle. It draws inspiration from a diverse range of scholarship and activism within environmental justice studies, particularly critical environmental justice studies and Indigenous and anti-colonial environmental justice studies.⁴⁸ Julie Sze writes that the "expanding resonance of the environmental justice movement framework is a concrete response to intensifying and interconnected conditions of pollution and inequality. . . . That perspective matters now more than ever, as communities face hydra-headed assaults."⁴⁹ In the spirit of expanding resonance, this book explores themes of interconnection across different movements, while recognizing the importance of diverse local and national contexts and struggles. It adopts a critical environmental justice studies perspective by focusing on enduring issues of systemic toxic injustice, rooted in long histories of racial capitalism and colonialism, but it also seeks to find pragmatic possibilities for ecological alternatives.

The petrochemical industry has a key role within the wider history of the environmental justice movement in the United States, which emerged in the 1980s in response to disproportionate toxic waste dumping and

environmental hazards in predominantly low-income Black communities. Many of the first major environmental justice cases in the United States relate to the environmental health impacts of the petrochemical industry, from the protests over the PBC (polychlorinated biphenyls) landfill site in Warren County, North Carolina, in 1982, to the contamination of water with DDT (dichlorodiphenyltrichloroethane) in Triana, Alabama, in the 1980s, to the grassroots struggles over toxic petrochemical pollution in the region nicknamed Cancer Alley in Louisiana, which began in the 1980s and continue to this day.⁵⁰

The problem of petrochemical pollution was also a defining issue in the mainstream US environmental movement of the 1960s and 1970s. Rachel Carson's publication of *Silent Spring* in 1962 brought international attention to the toxic implications of pesticides on ecosystems and public health.⁵¹ In 1978, the discovery of a toxic chemical dump buried in the residential community of Love Canal, New York, was a pivotal disaster that shaped environmental policy in the United States, leading to the creation of the Superfund Act of 1980, national legislation that taxed corporations to clean up hazardous waste sites.⁵² Arguably, the significance of the petrochemical industry as a serious perceived public threat to environmental health and safety was surpassed only by the threat of the nuclear industry at the height of the Cold War.⁵³ Public concern over these risks has changed over the past half century, with periods of outrage and alarm following disasters as well as with periods of relative calm. With rising concerns about the plastic, toxic, and climate crises in recent years, the petrochemical industry has come under scrutiny again.

This book situates the environmental injustices of the global petrochemical industry within a multiscalar approach, including a wider temporal perspective than it is typically framed by, within the context of five hundred years of colonialism, and in relation to planetary deep time. This may sound odd, given that the first petrochemical plants were developed only a century ago, built in order to find uses for the waste by-products of oil refining, and given that petrochemicals rose to become a major global industry only after the Second World War.⁵⁴ Even the use of fossil fuels as the engine of industrial growth is a modern capitalist phenomenon. Yet there are two reasons why a deeper temporal perspective on petrochemical injustice is warranted, one which relates to history, and another which relates to the future.

First, as many Indigenous scholars and activists contend, environmental injustice did not begin with the discovery of fossil fuels; rather, it can be traced to first contact throughout five hundred years of colonialism.⁵⁵ Indigenous

scholar and activist Dina Gilio-Whitaker argues that settler colonialism is itself a structure of environmental injustice, and she criticizes dominant environmental justice approaches for failing to address issues of decolonization. According to Gilio-Whitaker, environmental justice for Indigenous peoples “must be capable of a political scale beyond the homogenizing, assimilationist, capitalist State. It must conform to a model that can frame issues in terms of their colonial condition and can affirm decolonization as a potential framework within which environmental justice can be made available to them.”⁵⁶ This relates to the insightful observations by Kathryn Yusoff and Myles Lennon that energy transitions debates focus too narrowly on the history of fossil capitalism without acknowledging that the fossil fuel transition was made possible by first using human labor as a form of energy under slavery.⁵⁷

David Pellow’s framework of critical environmental justice studies also highlights the limitations of dominant environmental justice approaches that seek paths to justice through the state, particularly in the US context of state-sanctioned racial violence. The critical environmental justice studies framework is based on the idea of “indispensability,” which builds on the work of critical race and ethnic studies scholar John Marquez on “racial expendability” to argue that, within a white-dominated society, people of color are typically viewed as expendable. Furthermore, it is an intersectional approach that “recognizes that social inequality and oppression in all forms intersect, and that actors in the more-than-human world are subjects of oppression and frequently agents of social change.”⁵⁸ The role of scale in the production and possible resolution of environmental injustices is also central, not only in terms of size and space but also in terms of historical time, taking into consideration the European conquest of Indigenous lands and the enslavement of people of African descent.⁵⁹ Within this perspective, “environmental injustice is a form of violence created through systems of racial capitalism, settler colonialism, and enslavement that are sustained by the state.”⁶⁰

The second reason to consider a long temporal perspective relates to the future. Many environmental justice struggles are based on deep connections to land and ecosystems, which challenge destructive ways of thinking while offering hope for the future of multispecies relations on the planet. These struggles include Indigenous resistance mobilizations and other place-based ecological movements in defense of territory, particularly those with non-dualistic perspectives, which emphasize interdependent relationships between humans and the natural world.⁶¹ Arturo Escobar calls these struggles instances of “pluriversal politics,” encompassing efforts to move toward an alternative world, “a world where many worlds fit.”⁶² The “pluriverse” is

a response to interrelated crises of development, modernity, and dualistic thinking, which underlie capitalist and colonial systems. As Escobar writes, “Faced with crisis of our modes of existence in the world, we can credibly constitute the conjuncture as a struggle over a new reality, what might be called the pluriverse, and over the designs of the pluriverse.”⁶³

While there is a great deal of resonance between these perspectives, there are also some key differences. Aimee Carrillo Rowe and Eve Tuck argue for an “ethic of incommensurability” in the context of settler colonialism, rejecting the idea that all social rights and justice projects can be aligned with Indigenous land rights struggles.⁶⁴ On the theme of incommensurability, this book will discuss the importance of examining contexts of environmental injustice in which the concept of environmental justice is not an established discourse among environmental activists—for instance, in the case of China. Environmental groups in China tend to avoid the language of rights or justice, instead using more pragmatic and subtle modes of “embedded activism” within the constraints of an authoritarian state.⁶⁵

On the scale of the interconnected mesh of the petrochemical planet, this book extends the discussion of environmental injustice to the interconnected concepts of “waste colonialism” and “ecologically unequal exchange,” which relate to the petrochemical value chain, particularly its downstream consumption and waste streams. Many scholars, activists, and politicians have used the concept of “waste colonialism” since the 1980s, as well as the related terms “garbage imperialism” and “toxic colonialism,” to describe the unjust transnational export of hazardous waste from high-income to low- and middle-income countries.⁶⁶ Waste colonialism has renewed relevance today in debates about the transnational trade (and illegal transnational dumping) of hazardous plastic waste.⁶⁷ According to Liboiron, waste colonialism is based on the “assumed entitlement to use Land as a sink, no matter where it is,” and it extends beyond exporting the problem of waste itself to exporting waste management “solutions.”⁶⁸

The related concept of “ecologically unequal exchange” highlights how the structures of international trade and consumption shape the uneven global distribution of environmental harms, including deforestation, biodiversity loss, greenhouse-gas emissions, and pollution.⁶⁹ The mass overconsumption of plastics on a global level, particularly single-use plastics, is a major yet under-examined form of ecologically unequal exchange.⁷⁰ The later chapters in this book discuss the problem of mass overconsumption of petrochemical products, which is driven by the industry’s tireless project of manufacturing demand in new markets.

Petrochemical degrowth is crucial for transforming the industry: dramatically reducing the production of toxic, wasteful, and carbon-intensive petrochemical products. Just transition policies are also vital to assist displaced workers and communities and to ensure that low-carbon transitions do not have unequal benefits and harms.⁷¹ The wider imperative for both “degrowth” and “just transitions”—across the global capitalist system—is embraced in the environmental justice call for “just sustainabilities,” which Julian Agyeman, Robert Bullard, and Bob Evans define as “the need to ensure a better quality of life for all, now and into the future, in a just and equitable manner, whilst living within the limits of supporting ecosystems.”⁷² However, radical proposals for just and sustainable transformations of the petrochemical industry—involving deep decarbonization, decolonization, detoxication, and downscaling—have yet to gain traction in policy or practice. Many workers and residents rely on the petrochemical industry for their livelihoods, whether directly or indirectly.⁷³ Moreover, people around the world depend on the petrochemical industry and on its complex supply chains and interconnected industries for their food, transport, health, connectivity, housing, and consumer lifestyles.⁷⁴

This book addresses the dilemmas of deep industrial transformation. How can we tackle the complex “wicked problem” of a powerful, dirty, yet “essential” industry?⁷⁵ Unpicking dominant capitalist narratives and their power is one place to start. Another is through stepping up the level of resistance.

Multiscalar Battles of Industrial Transformation

Long-standing battles over the necessary transformation of the petrochemical industry are intensifying across multiple fronts, sites, and scales. By engaging not only with environmental justice movements but also with corporate worldviews, this book identifies some of the mechanisms of power and resistance for transforming planetary petrochemical politics.

My analysis of industrial transformation expands upon and brings together insights from two perspectives: first, critical political economy perspectives on global capitalism, racial capitalism, fossil capitalism, and historical transformation; and second, anti-colonial and de-colonial perspectives on environmental justice and alternative ecologies of “degrowth,” “indispensability,” “just transitions,” and the “pluriverse” in dialogue with a wide range of scholars. Both sets of critical perspectives are relevant for navigating the stakes and dilemmas of industrial transformation—on the one hand recognizing the

barriers of embedded state-sanctioned racial violence and the power of capitalist adaptation and cultural hegemony; while on the other hand recognizing the capacities for resistance and alternative ways of thinking, being, and living.

This book shows how the petrochemical industry engages in deceptive campaigns to avoid responsibility for toxic harms as well as in proactive “wars of position” in response to public concerns over the ecological crisis, through positioning itself as part of the solution within green transitions. Writing on the challenges of energy transitions in societies dependent on fossil fuels, Peter Newell draws on insights from Gramsci on the distinction between “trasformismo” and “transformation” in wars of position over hegemonic green capitalist ideas.⁷⁶ Gramsci’s concept of “trasformismo” describes a process of co-optation that “serves as a strategy for assimilating and domesticating potentially dangerous ideas by adjusting them to the policies of the dominant coalition and [which] can thereby obstruct the formation of organized opposition to established social and political power.”⁷⁷ The petrochemical industry deploys strategies of co-optation through highlighting its role in producing green technologies and aligning its discourse with sustainability policy buzzwords, including the “circular economy” and “net zero.”⁷⁸

This book also examines escalating forms of resistance to the petrochemical industry, on multiple fronts and levels. It draws attention to examples of multiscalar activism against the dominant oil, petrochemical, and plastics regime, a form of collective resistance that is articulated across separate but interconnected issues, sites, and scales.⁷⁹ Some fenceline petrochemical communities have aligned their struggles with broader campaigns over plastics pollution, climate justice, and Indigenous land rights, which pose increasingly existential threats to industry. While multiscalar activism can increase political visibility and solidarity across movements, there are often setbacks—and in many cases, toxic petrochemical pollution and proliferation continue. My analysis of multiscalar activism extends not only to scaling up resistance but also to “scaling wide,” across diverse networks, as well as to scaling down to less visible modes of activism.⁸⁰

In *The Mushroom at the End of the World*, Anna Lowenhaupt Tsing reflects on the problem with ideas of scalability for diverse practices. The “art of noticing,” of paying attention to specific local ecologies, does not scale up. This problem relates to scientific knowledge, but it also extends to modernity and capitalist expansion: “Progress itself has often been defined by its ability to make projects expand without changing their framing assumptions. This quality is ‘scalability.’” In order to make projects scalable, Tsing argues, they need to be able to change frames smoothly, to “be oblivious to

the indeterminacies of encounter; that's how they allow smooth expansion. Thus, too, scalability banishes meaningful diversity, that is, diversity that might change things.”⁸¹ Yet Tsing notes that both scalable and non-scalable projects can be either destructive or benign, pointing to the example of unregulated loggers as more ecologically harmful than scientific foresters. The main distinction between scalable and non-scalable projects, she suggests, is that the latter are more diverse.

Max Liboiron and Josh Lepawsky make a related intervention about the importance of scale. They argue that scale is “a way of understanding the relationships that *matter* to defining an issue, and thus of locating where and how interventions might best take place.”⁸² The problem with scale emerges from dominant and exclusive approaches to knowledge, which produce “‘scalar mismatch,’ where one instance is taken to be the whole phenomenon, or where one perspective is assumed to work in all cases.”⁸³ Scale is relational: “think of how gravity matters to elephants but doesn’t matter nearly as much to viruses, whose local movements are more influenced by the capillary action of their host liquids.” Nor is scale a continuum. Many things cannot “scale up” — “a skin cell cannot ‘scale up’ to become an arm” — because there are “disjunctures in scale when things *change*.”⁸⁴ There are practical implications of understanding scale as “relationships that matter within a situated context” for the kinds of multiscale interventions to be taken in addressing social and environmental problems.

Multiscale battles involve clashes over toxic injustices, including over diverse ways of seeing and constructing the world. There are deep conflicts, tensions, and sticking points in battles over green transformations, including powerful vested interests in fossil fuel-based economic growth; complex, interdependent systems with significant path dependencies and fossil fuel lock-in; and incommensurable values between different social groups. The clash between different values and ways of seeing the world is one of the most pivotal challenges for transforming the petrochemical industry.

Methodology

17

This book examines diverse perspectives, struggles, and sites across the petrochemical planet, focusing on major petrochemical-producing regions in the United States, China, and Europe. The book draws primarily on a selection of material from a wide body of research that was collected collaboratively for the project “Toxic Expertise: Environmental Justice and the Global Petrochemical

Industry” (2015–20), for which I was the principal investigator. The Toxic Expertise project examined debates about the environmental and health impacts of the petrochemical industry from multiple perspectives, including those of corporations and of communities and other stakeholders.⁸⁵

The research was undertaken in different stages by the project’s research team, with each researcher focusing on different questions across global, regional, and local levels. At first, I gravitated toward the global corporate ethnographic side of the project, which expanded to become the inspiration for this book. The corporate research was the least familiar, the most frustrating, and the most intriguing. It pushed me outside my comfort zone, and it involved many puzzles and unexpected turns. The findings propelled me to extend my study of the industry beyond the original scope of the project, tracing it through the first two years of the pandemic and the ever-intensifying plastics and climate crises.

Methodologically, my research on the petrochemical industry was influenced by studies on the material politics of oil in relation to global capitalism.⁸⁶ Within a global historical context, Timothy Mitchell’s work on “carbon democracy” follows the “oil itself,” including its material qualities and its locations of extraction and refining. Through exploring these connections, we discover “how a peculiar set of relations was engineered among oil, violence, finance, expertise and democracy.”⁸⁷ Tracing the emergence of disputes about the BP Baku-Tbilisi-Ceyhan oil pipeline, Andrew Barry’s *Material Politics* reveals how the implementation of corporate transparency, contrary to corporate expectations, fostered new forms of contestation.⁸⁸ Another insightful ethnographic study, Hannah Appel’s *The Licit Life of Capitalism*, examines how the US oil industry creates forms of legality and legitimacy within local contexts in Equatorial Guinea, and the complex entanglements of local populations who work and live in the vicinity of the industry.⁸⁹ The material politics of petrochemicals are intimately connected to oil, but they are more extensive yet elusive, at the intersection of complex supply chains and ecological crises.

Most research studies about toxic exposures in the petrochemical industry focus on single case studies of environmental injustice or movements in polluted fenceline communities. The few existing studies of the global petrochemical industry, in comparative perspective, are corporate and business histories.⁹⁰ This book aims to present a systematic sociological analysis of the global petrochemical industry in relation to debates about corporate responsibility and environmental justice. With such an extensive subject, the book is necessarily partial and selective, aiming to offer insights into the complex

struggles over petrochemical lifeworlds and transformations across multiple sites and scales. It approaches the question of scale from contrasting spatial and temporal viewpoints, juxtaposing the corporate imperative for expanding production with the importance of place-based contexts in environmental justice movements, and situating the question of industrial transformation within long planetary histories and futures. Multiscalar forms of activism present possibilities for traversing scales—finding points of convergence and solidarity, as well as tension, across environmental struggles.

Building on methods of comparative case-study research, which I explored in previous work, my research aimed to span micro and macro connections.⁹¹ Overall, the Toxic Expertise research project included 160 interviews with a range of different people in the United States, Europe, and China, including corporate representatives, policymakers, NGO representatives, environmental activists, lawyers, scientists, trade union representatives, petrochemical workers and managers, and community residents. In addition, the research included analysis of corporate reports, documents, trade magazines, and websites. The corporate ethnographic research involved participant observation at industry conferences, training events, official petrochemical plant tours, and multiple stakeholder events, conducted between 2015 and 2019 in locations in the United States, Europe, and China.⁹² Between 2020 and 2022, I conducted follow-up research to track rapidly changing petrochemical industry and fenceline community developments during the pandemic, attending virtual industry conferences and examining a wide range of reports, documents, and secondary literature.

Between 2016 and 2019, our research team conducted in-depth case studies in petrochemical residential areas in St. James Parish in Louisiana; Nanjing and Guangzhou in China; Grangemouth and Fawley in the United Kingdom; Antwerp in Belgium; and Porto Marghera in Italy.⁹³ Across these diverse petrochemical fenceline communities, we explored how people made sense of living with risk and pollution in everyday life; how people took action in response to social and environmental injustices; and how people perceived environmental threats, hazards, and politics. We also conducted studies of broader industry dynamics and environmental health impacts, including a corporate social and spatial network analysis of the global petrochemical industry; a regional analysis of pollution and health data related to the European petrochemical industry; and a meta-analysis of lung cancer incidence for residents living in close proximity to petrochemical facilities.⁹⁴ Finally, our research team compiled seventy-five qualitative case studies of petrochemical sites and controversies around the world, triangulated with

corporate network and emissions data, to create a public, collaborative online global petrochemical map.⁹⁵

Researching and writing this book has inspired many reflections about my own position and practice, through conducting research in diverse contexts of environmental injustice and through “studying up” to critically examine powerful corporations.⁹⁶ It has been a journey of continual learning, challenging some of my own assumptions, particularly in terms of recognizing embedded dualistic thinking, including within sociology. As I discussed in the preface, engaging with questions of environmental justice has required me to reflect on “where I stand,” including a closer examination of my relationship to the settler colonial history of my hometown in Canada. Working in collaboration with researchers and activists on a large project with many different parts, it took a long time before I felt that I had my own story to tell about the research. Initially, I thought it was far too complex to even try. Gradually, my own story came into focus, involving studying up but also across, connecting debates about toxic pollution, corporate responsibility, and environmental justice to existential questions about deep industrial transformations.

I should note that my research is critical of the petrochemical industry but on a systemic rather than an individual level. Many corporate representatives whom I spoke with seemed genuinely concerned about climate change and plastic waste, and exhibited cognitive dissonance between personal and organizational values. The corporate justification of plunder—of land, lives, and communities—lies in the detachment of responsibility across a complex system.

Complex Systems

Now we reach the crux of the “wicked problem” that the petrochemical industry presents: its complexity as a system. The problem of complex systems is methodological, concerning the nature of the object of study and the question of how to study the object. The problem is also political, concerning the challenge of how to critically intervene in complex systems.

The theme of complex systems emerged at the beginning of my research. From my first industry conference to my first visit to a petrochemical plant, to my first interview with a corporate executive, I was overwhelmed by the sheer complexity of the industry. The networks of the petrochemical industry include thousands of corporate sites around the globe, nested within

hierarchies of parent companies, subsidiaries, and manufacturing sites. Furthermore, the petrochemical industry is interconnected with upstream and downstream industries through myriad technical, economic, and logistical processes. Even at the level of specific sites, the concentrated geographies of petrochemical industrial complexes operate as highly complex systems, with integrated industrial infrastructure, waste processing systems, dedicated private emergency services, and zones for different uses: bitumen, liquefied petroleum gas, butyl polymers. Not surprisingly, given the scale of its operations, the petrochemical industry relies on the tools of complexity science (for example, modeling financial risk) as one of its many fields of expertise.⁹⁷

Yet complexity, in itself, was hardly an insight. In fact, complexity often prevents insight. How was it possible to understand such a complex industrial system? I sought to penetrate the complexity as I continued with my research, participating in many petrochemical conferences and training sessions, speaking with a wide range of industry stakeholders, visiting several petrochemical complexes and fenceline communities, and triangulating qualitative and quantitative sources of data about pollution, environmental health, and corporate responsibility.

Theories of complexity and complex systems have roots spanning several intellectual traditions, including biology, ecology, mathematics, and cybernetics. These roots later extended to socio-ecological systems theory, neoliberal complexity economics, and sociological systems theory. Complex adaptive systems are highly resilient and self-regulating through circular feedback, and they have the remarkable ability to absorb external shocks.⁹⁸ Many complex systems seem to share these autopoietic properties, from the biological cell to the global capitalist economy.⁹⁹

Arturo Escobar's vision of "designs for the pluriverse" draws connections between complexity theory and self-organizing autonomous Indigenous movements in Latin America.¹⁰⁰ These movements in defense of territory and place are based on relational ways of understanding the world, seeing all life as interconnected and part of complex systems, and as non-dualistic, with an ethics of communalism and care. The dominant capitalist and colonial worldview, by contrast, is based on simplifications and dualisms, and the failure to grasp complexity. The economist Kate Raworth makes a related point, noting that systems thinking is the most ecologically attuned way of understanding the economy as a dynamic, complex adaptive system, as

opposed to traditional economic models of the “economy-as-machine.”¹⁰¹ Decades of interdisciplinary research on socio-ecological systems have also focused on the interdependence of social and ecological systems, including complex adaptive systems.¹⁰² However, complex-systems thinking is also a key area of focus within neoliberal economics and science.

In the 1940s, the neoliberal philosopher Friedrich Hayek promoted complexity economics, based on the idea that complex systems such as the market are unknowable, with uncertain futures, and thus should not be subject to intervention.¹⁰³ Jeremy Walker and Melinda Cooper argue that in the twenty-first century, many corporations and governments have adopted similar models of “neoliberal systems thinking” in their strategies to manage uncertainty and complexity, by designing resilience into systems.¹⁰⁴ Examples include financial risk management; geo-engineering and climate science; Big Data and the new complexity science; and security responses to climate change, natural disasters, pandemics, and terrorism. For Walker and Cooper, neoliberal systems thinking is effectively “a call to permanent adaptability in and through crisis.”¹⁰⁵ The authors worry about the capacity for neoliberal complex systems to absorb critique, but they underestimate the volatility and vulnerability of these systems.

William Connolly proposes an alternative view of complexity theory that recognizes its contentious origins but emphasizes its political possibility for “experimental intervention in a world that exceeds human powers of attunement, explanation, prediction, mastery, or control.”¹⁰⁶ Connolly argues that economic markets are imperfect and volatile precisely because they interact in the real world with many other complex systems.¹⁰⁷ Writing nearly a century before, Gramsci made similar insights on the complexity of modern political systems. Stuart Hall observed that one of the most significant contributions of Gramsci was to point to the “increasing complexity of the interrelationships in modern societies between state and civil society. Taken together, they form a complex ‘system’ which has to be the object of a many-sided type of political strategy, conducted on several different fronts at once.”¹⁰⁸ According to Hall, this has implications for how “to unravel the changing complexities in state/civil society relationships in the modern world and the decisive shift in the predominant character of strategic political struggles.”¹⁰⁹ If disruption and unraveling are possible, then this points to limits in the capacity for complex systems to absorb external shocks. What is the critical point whereby a system (such as petrochemical entanglement and proliferation) could become destabilized?

Despite seemingly universal properties of complex systems, in reality of course, they are not all the same. They have different characteristics and breaking points. The petrochemical industry is a complex adaptive system, with the powerful capacity for self-reproduction even in the face of profound shocks. The industry is primed for responding to threats, from challenging negative perceptions of plastic waste and toxic disasters, to doing business amid economic sanctions and civil war. The industry navigates complexity at different levels, on the one hand through engineering it, and on the other hand through taming it. Thus, for the petrochemical industry, complexity represents both an opportunity and a threat. The challenge for everyone who is concerned about sustainability, justice, and public health is to find a way of disarming the harmful features of the system without destroying everything else in the process.

Loops are a recurring and recursive theme in complex systems. We need to break out of the loops that perpetuate excessive petrochemical consumption, pollution, and waste. Systematic multiscale approaches are required to address the complex systems underpinning environmental inequalities. To do so, we must first recognize the limitations. It is difficult to extend systematic analyses and critical engagements across different scales in terms of geography, in terms of values, and even in terms of ontology. It involves continually shifting attention between micro and macro levels, and grappling with conflicting forms of science, knowledge, and politics.

Structure of the Book

The global petrochemical industry is under considerable pressure to transform, but competing visions, interests, and values are at stake. The opening two chapters of this book juxtapose two opposing worldviews of the vast territorial expansion of the global petrochemical industry: the military-strategic vantage point of industry, and the grassroots resistance of polluted fenceline communities. Chapter 1 reveals that despite internal differences, the petrochemical industry has a collective operational logic based on geopolitical strategies to address a range of complex, uncertain, and risk-laden scenarios. This deep-rooted logic drives relentless expansion at the expense of disadvantaged populations, and it underpins the industry's responses to crisis. In stark contrast with corporate worldviews, chapter 2 shows how fenceline petrochemical communities around the world have witnessed firsthand the

unjust burdens of toxic exposure and employment blackmail. Grassroots activists have fought protracted battles to hold corporations accountable for the costs of clean up or relocation, with some victories but many failures.

For decades, fenceline environmental justice struggles have highlighted the toxic impacts of industry, but with few impacts beyond the level of individual corporations. However, as chapter 3 discusses, some people living in fenceline communities have widened their base of support through multiscale activism, connecting to broader concerns over plastic waste, climate change, toxic pollution, and land rights. Other fenceline community activists have adopted more subtle, microscale forms of resistance within contexts of political repression, gathering strength as they wait for opportunities for future escalation. Multiscale activism can be risky, but it can also raise the political visibility of fenceline issues, while exerting pressure on corporations from a powerful angle: the future survival of the industry. Chapter 4 confronts this existential angle head-on, examining the competing stakes of the planetary petrochemical crisis for the future of the petrochemical industry and for multispecies life on Earth.

The petrochemical industry is on a path of profound transformation, but its trajectory remains uncertain. Chapters 5 and 6 examine the dilemmas of just and sustainable petrochemical transformation, challenging the unsustainable capitalist growth imperative while recognizing the embedded problem of petrochemical dependency across multiscale material and cultural systems. There are significant barriers to radical industrial transformation, not least the powerful interests of petrochemical corporations. Multiscale activism is an important tool of resistance, but enforceable regulations and fundamental changes to growth and consumption-driven models of capitalism are also required. To conclude, this book sketches out a vision for an alternative petrochemical planetary politics.

NOTES

Preface

- 1 Interview with petrochemical industry representative, Brussels, May 3, 2016.
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Introduction

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Chapter 1. The Petrochemical Game of War

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