

Oil in the Caribbean: Refineries, Mangroves, and the Negative Ecologies of Crude Oil

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This article examines the collision of crude oil and mangroves in the Caribbean during the 1970s as one regional facet of a larger dialectic of hydrocarbon risk and environmental responsibility. Such a collision, I argue, offers a striking account of how the agency of the natural world became intelligible within the modern project. Beginning with the pivotal but often neglected place of petroleum in the Caribbean, I show how crude oil is still something that requires some explanation in the region. Using the local history of what became the largest refinery in the Western Hemisphere—the mammoth scale of this St. Croix refinery is dwarfed only by its neglect in popular and scholarly accounts of the region—I describe how fossil fuels were introduced to one

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colonial territory in the Caribbean and the social and environmental consequences of that introduction.¹ Over a dozen export-oriented refineries were built by U.S. oil companies in a similar fashion across the Caribbean between 1950 and 1970. As the United States moved significant portions of its hydrocarbon infrastructure offshore, the region became the world's largest exporter of refined petroleum products in the world, almost all of which went to the United States (United Nations 1980). Between 1950 and 1990, oil refineries became the largest site of capital investment in the Caribbean, a leading source of state revenue, and one of the region's largest employers, especially during the construction boom of refineries in the late 1960s and early 1970s (United Nations 1979; World Bank 1984; Richardson 1992). These events stand at odds with other accounts of what makes the Caribbean a unique and enduring cultural region. As the sugar plantation became the defining image of the Caribbean for critical scholars and national leaders alike, the expanding energy networks of the United States underwrote much of the area's contemporary aspirations.

This petro-economic boom unleashed its own petro-ecological bust. Caribbean refineries and the sharp uptick in supertanker traffic they invited to the region brought a new problem: coastal oil spills. From Florida to Guyana, the wider Caribbean experienced over thirty major spills during the 1970s and countless mundane releases of petroleum from ships and shoreline facilities. The Gulf of Mexico and Caribbean region hosted the four largest accidental oil spills in human history.² As pipelines leaked, wellheads blew out, refineries dumped effluent into lagoons, and supertankers discharged oily bilge or occasionally even collided with other tankers, all varieties of oil spill assailed the Caribbean. By 1976, marine-bound crude oil was designated “the pollutant of highest priority concern to the Region” by the United Nations Environmental Program and a commission of Caribbean representatives (Atwood et al. 1987: 540). The resulting initiative, called CARIPOL, faced an unexpected difficulty in reining in hydrocarbon effluent: the Caribbean Sea was so “chronically contaminated” with petroleum that it was next to

¹ This article draws on four months of ethnographic and archival research conducted in St. Croix in 2011 on the impacts of the Hess Refinery, and two weeks of archival research in San Juan, Puerto Rico on the *Commonwealth of Puerto Rico v. SS Zoe Colocotroni* court case, also in 2011. This research provoked new questions about refineries and mangroves that I worked to answer in extensive reviews of journalistic accounts of the building of the Hess Refinery and scientific publications on mangroves in the Caribbean.

² Excluding the militarized burning of the Kuwait oil fields during the first Gulf War, the four largest oil spills in human history have occurred in the wider Caribbean Region. Dos Bocas on the Mexican coast spilled approximately 420 million gallons in 1938; the BP Oil Spill in the Gulf of Mexico released about 175 million gallons in 2010; Ixtoc I off the coast of Mexico spilled some 145 million gallons in 1979; and the Atlantic Empress I off Trinidad's coast spilled approximately 88 million gallons in 1979. By way of comparison, the 1989 Exxon Valdez Spill—widely seen in the United States as a worst-case scenario oil spill—released a relatively modest 11 million gallons of crude oil.

impossible to determine a natural baseline against which to measure and manage petro-pollution (*ibid.*: 545). The wider Caribbean rather abruptly found itself awash in spilt oil.

The latter half of this paper describes the scientific response to the new-found problem of crude oil in the Caribbean Sea. As oil washed up in various Antillean locales, state-backed lawsuits brought sustained analytic attention to emerging concerns over the vulnerability and value of coastal ecologies. Tracking in and out of one prominent 1973 oil spill in Puerto Rico, this paper argues that the scientific response to these coastal oil spills fundamentally reformed the meaning of mangroves. In conversation with recent scholarship that has taken up the “liminal” quality of mangroves as a sharply Caribbean analytic, I show how mangroves offer a telling window into the recent social history of the West Indies (Price and Price 1997; Ogden 2011). My approach differs slightly from such work, however, by emphasizing one of the material venues within which the relationality of mangroves first became factual and operable: Caribbean oil spills.³ I show how the deleterious impacts of these spills became a kind of field laboratory for radically rethinking the agency of mangroves. The research done in the wake of such disasters grounded a new empirical appreciation for the ecological work and economic worth of mangroves in the Caribbean. This scientific valorization of mangroves undergirds much of the rising cultural celebration of mangroves as a new emblem of post-colonial identity in the Caribbean today.

This article, then, offers a Caribbean version of how nature continues to matter in the so-called Anthropocene. As the Anthropocene rattles and reframes scholarly debates over the constitution of modernity, fossil fuels have been taken up as the explosive bookends of industrial society. Fossil fuels first equipped industrial society to seize functional autonomy from the natural world (Sieferle 2001 [1982]; McNeill 2000; Crosby 2006). As the planetary consequences of this divorce come into impending focus, fossil fuels are seen as a key geochemical driver in the vengeful rebounding of the natural world and the endpoints it heralds for modern life (McNeill and Engelke 2016). In this popular story of the Anthropocene, fossil fuels are agent provocateur in the breathless genesis of modernity and in its cataclysmic terminus.

Yet the inaugurations and disruptions that have taken shape around fossil fuels are far from a singular beginning and end. While some suggest that the founding rupture of nature and society rendered modernity uniquely incapable of acknowledging the planetary catastrophe of its own making (Latour 2004)—indeed, many scholars now locate the most pressing form of critique in an analytical alignment with Indigenous ontologies presumed to be outside the modern episteme (Kohn 2013; Viveiros de Castro 2014)—such arguments

³ For a parallel argument about mangroves and climate change, see Vaughn *n.d.*

often overlook the complicated and contradictory terrain of environmental reflexivity within the modern project, much of it provoked by fossil fuels. Among other things, the negative ecologies of fossil fuels instigated fairly robust acknowledgement of the vitality of natural worlds within the modern project. The cresting consequences of fossil fuels have long contorted the basic biochemical conditions of life, whether in urban smog or acid rain, hydrochlorinated pesticides, or now, through climate change. Tilting the conditions of life just beyond the fixtures of modern society, fossil fuels have opened the door to new understandings of and new obligations toward those newly precarious conditions. Fossil fuels have not done away with natural worlds. Their destruction has unloosed new scientific and political desires for vital nature.

OIL REFINERIES AND THE (RE)MAKING OF THE MODERN CARIBBEAN

The studied Caribbean is, in many ways, a wager on the legacy of the sugar plantation. The late Sidney Mintz (1966: 925), resident dean of Caribbean scholarship, wrote at the beginning of his career: “The Caribbean region has been both ‘urbanized’ and ‘westernized’ by its plantations, oil refineries, and aluminum mines, more than by its cities.” Attentions to oil refineries and aluminum plants have long slipped out of focus as the plantation came to be seen as the ascendant site in the making of the contemporary Caribbean. As told through the intersecting aims of ethnography, literature, and nationalism, this turn toward “plantation economies” qualified the conceit that the modern Caribbean was not the distant imprint of some colonial design but rather the negotiated outcome of a decidedly regional history (Lewis 1954; Best 1968; Beckford 1972; Best and Levitt 2009). The essential infrastructure of the plantation (coerced migration of foreign labor, rural concentrations of labor and capital, a conscripted modernity, and racial orderings of status) and its social consequences (a reconstituted peasantry, the unease between the state apparatus and national identity, and creolized modalities of identity) are widely seen as the preeminent examples of what makes the Caribbean a special and enduring region (James 1989 [1939]; Williams 1944; 1970; Mintz 1966; 1975; Mintz and Price 1985; Trouillot 1992). And yet today, working plantations and export-oriented agriculture more generally are in noted decline across the region. The Caribbean Development Bank (2003: 4) recently reported that agriculture is in a “state of crisis” as the passing presence of tourists, finance, and petroleum have become the pillars in the region’s economy (Sheller 2003; Mauer 2004; Hughes 2013).

As the physical presence of sugar plantations recedes, many scholars continue to insist on the “haunting continuities” that fix contemporary social life on the now-immaterial foundation of the plantation (Chatterjee, Das Gupta, and Rath. 2010: 11). In today’s Caribbean factories and data centers some anthropologists hear echoes of slavery, and they presume that the plight of the present is best understood by first overlaying it with the social forms of the plantation

(e.g., Yelvington 1995; Freeman 2000). While the resulting insights can be fruitful, they often miss the generative manner in which the critique of the plantation itself has been used to justify alternative imperial interventions in the region. My point here is not to dismiss the plantation as a scholarly project and even less to deny the durability and mobility of the plantation's central architecture: racial hierarchies and single-use landscapes. Far from a simple rejection of the plantation, my aim, with reference to the sociology of critique (Boltanski and Chiapello 2007), is to describe how the critique of the plantation has, in itself, become an influential social actor in the contemporary Caribbean. Scholars in the Caribbean no longer have a monopoly on the critique of the plantation (if they ever did).⁴ Over the past century, colonial governments and oil companies have argued that refineries could overthrow the racial legacy of the plantation, catapulting the Caribbean out of colonial history and into a modern future.

During the twentieth century the Caribbean became a key energy outpost for imperial powers. As the Panama Canal brought new global shipping lanes to the region and as European navies and trading concerns retrofitted their fleets to run on bunker fuel, oil depots and refineries were built across the region (Ram-saran 1989). Unlike refineries built in the United States and Europe, designed to serve adjacent urban markets, these outsized Caribbean refineries were scaled to the oceanic merchant and military networks they supported. During World War II, the Royal Dutch Shell refinery on Curaçao became the largest refinery in the world, followed closely by Standard Oil of New Jersey's refinery on Aruba. These two massive Caribbean refineries provided over 80 percent of the Allies' aviation and naval fuel and attracted concerted attacks from German U-boats. Many of these early Caribbean refineries were designed to process Venezuelan and Mexican crude oil within "the solid European administrations" of Caribbean colonies (Hartog 1968: 308). As Fernando Coronil noted, Venezuelan leaders actively encouraged the strategic placement of refineries in the Caribbean "in order to avoid creating large concentrations of workers with their attendant labor problems" in Venezuela (1997: 107).

In the postwar period oil companies in the United States faced a similar dilemma. An upsurge of worker strikes at domestic refineries joined with rising regulatory concerns over municipal pollution to encourage some firms to seek competitive advantage elsewhere.⁵ For some oil companies, former

⁴ There are important distinctions to be made in the critique of the plantation. Caribbean scholarship has long presumed that its creative edge lay in exposing the deep commensurability between plantation pasts and the modern present. Many new imperial alignments have gained local justification in the wedge they drive between plantation pasts and modern futures.

⁵ The Oil Workers Strike of 1945—an event a federal official described as "the first nation-wide strike in the history of the oil industry" (Hoch 1948: 117)—and the formation of the two hundred thousand-member Oil, Chemical, and Atomic Workers International Union in 1955, demonstrated that the nation's petroleum infrastructure was not intrinsically immune to the demands of labor.

plantation land and freedman communities largely along the Mississippi River in Louisiana offered a racial exception to these new points of friction (Ottinger 2013; Misrach and Orff 2014). For other oil companies, the Caribbean became an attractive site to expand refining capacity while sidestepping the demands of organized labor and rising environmental oversight in the United States (Gorman 2001; Payne and Sutton 1984). The Caribbean's "political stability, its deep harbors, its lack of environmental regulations, and its proximity to major shipping lanes" provided an exceptional venue for offshored U.S. hydrocarbon infrastructure (Barry, Wood, and Preusch 1984: 89). Such a move to the Caribbean also paralleled a fundamental reorientation of U.S. energy infrastructure in the 1960s away from declining domestic reserves and toward a newfound dependence on imported crude oil. Until Nixon lifted it in 1973, domestic refineries were bound by the Mandatory Oil Import Program that imposed strict quotas for imported oil (designed to minimize dependence on foreign oil, the program set a maximum level of imports at about 12 percent of domestic demand). In 1965, U.S. territories in the Caribbean were granted exemptions from these quotas and soon refineries on Puerto Rico and the U.S. Virgin Islands became an advantageous route for cheaper imports to slip into the United States outside existing import controls. Moreover, that same year the U.S. Congress authorized a series of tax exemptions that encouraged domestic oil companies to build new export-oriented refineries and petrochemical plants in Caribbean territories (Dietz 1986). Over the next two decades, U.S. companies built more than a dozen entrepôt refineries on Caribbean islands.⁶

While the exceptionality of colonial territories provided their opening advantage, other events shored up the importance of Caribbean refineries. The World Bank and other international organizations actively encouraged Caribbean states to welcome this new "enclave-type" processing of petroleum products for export to the United States as a crucial step in developing Caribbean economies and disciplining its societies into the expectations of the modern economy (a vision the World Bank also applied to Singapore) (Chernick 1978: 139; World Bank 1984).⁷ The OPEC embargoes of the United

Refineries became an opportune place to strike. However, as Matthew Huber (2013: 62) has shown, the resulting upsurge of walkouts at refineries during the 1950s and 1960s gifted oil companies with an ironic insight: "Refinery Strikes Suggest Plants Can Be Run with Still Fewer Men," ran the title of a 1962 *Oil and Gas Journal* article. The postwar period also brought a new point of scrutiny for domestic refineries: water and air pollution. As expanding suburbs came to surround refineries, many cities and states began to turn a more critical eye toward the environmental and public health impact of refineries (Gorman 2001).

⁶ It is worth recalling that until the recent hydro-fracking boom, the last newly constructed refinery in the United States was built in the 1950s, with the noted exception of sizable expansions of a few existing port refineries in Louisiana and Texas in 1976 to better accommodate imports.

⁷ Sidney Chernick, the World Bank's Chief of Mission to the Caribbean, authored a plan for regional development that emphasized the key role of "enclave-type" processing of petroleum

States in 1973 and 1979 further consolidated the strategic importance of Caribbean refineries as they acted as a back door for OPEC oil to “leak” into the United States (Middle East 1974: 23). By 1990, roughly one-sixth of the oil consumed in the United States and “over half of the refined petroleum imported to the U.S.—including oil from African and Middle Eastern sources” passed through Caribbean refineries (Richardson 1992: 116).

To summarize: between 1950 and 1990 Caribbean oil refineries remade the political economy of the region and constructed an exceptional pathway for imported crude oil and petroleum products to enter the United States. These Caribbean refineries played a pivotal, if largely unrecognized, part in the imperial realignment around the properties of fossil fuels so aptly described by Timothy Mitchell in *Carbon Democracy* (2011). Around crude oil, Mitchell argues, the constituent field of empire changed from the racial ordering of labor to the techno-political ordering of energy flows (ibid.: 207–8). Joining domestic desires for energy-intensive lifestyles with a realignment of global energy infrastructures, crude oil heralded a fundamental shift in the texture and technique of U.S. empire. These “new and less visible forms of imperialism,” as C. Wright Mills described the changing scene (1959: 4), brought renewed importance to the Caribbean. The U.S. territories in the Caribbean became primary sites for retrofitting the U.S. empire around the oceanic distribution of crude oil. These island territories became, as one recent appraisal put it, “critical nodes” in the “networked empire” of contemporary U.S. power (Oldenziel 2011: 13).

While a number of scholars have examined the growing imperial inflections of fossil fuels in this era, they have often done so by showing how oil companies worked to violently safeguard foreign extraction sites from local discontent and nationalized outcomes (Watts 2005; Mitchell 2011). Yet the infrastructure that exempted crude oil from democratic concerns was far more expansive than policed wellheads and buried pipelines. Supertankers provided an unprecedented degree of flexibility. Refineries and petrochemical plants built in communities of color on freedman townships in Louisiana and in coastal ports in Caribbean territories constructed an exception to the growing rights of workers and the environment (Ottinger 2013; Misrach and Orff 2014).⁸ Militarized drilling sites, supersized tankers, enclave refineries,

products for export. Such refineries and petrochemical plants would enable a regional shift away from agriculture and begin formatting Caribbean society for the modern economy. While Chernick (1978: 139) acknowledged that “little value” might actually accrue locally, he argued that the most lucrative payoff might be the social discipline such industry imposed upon Caribbean societies. “To encourage enclave exports is not inconsistent with taking longer-term steps to transform the structure of the economy by developing stronger internal behavior.”

⁸ If racialized labor no longer provided the locus of power around oil, the empire of oil certainly did not do away with race. Rather, it introduced a new rubric of racial inequality: unequal exposure.

and suburban lifestyles worked in concert in the “imperial formation” that took shape around crude oil during the twentieth century (Stoler and McGranahan 2007). Scholarship that presumes that the imperial imprint of oil unfolds only within the geography of extraction can lose sight of the extensive investments in distribution, refining, and consumption that make the empire of oil possible.

As U.S. oil companies found the colonial status of many Caribbean ports advantageous to their global operations, the critique of the previous modality of empire—crystallized in the image of the sugar plantation—provided salient local justification for aligning Caribbean islands with an emergent modality of empire: the enclave refinery. In Puerto Rico and the U.S. Virgin Islands, the overthrow of the plantation was the leading argument made by the colonial government to welcome and legitimate the arrival of refineries and petrochemical plants. In St. Croix, for example, Hess Oil built the world’s largest petrochemical plant and second largest oil refinery in 1966. Such heavy industry would usher in, in the words of the appointed governor, a “bloodless revolution” that deposed the racial feudalism of the plantation and ushered in the colorblind modernity of industrial capitalism (Thurland 1979: 167). The premise was flawed and the promise failed. In the early 1960s, merchants and unions began a sustained campaign to finally overcome what the head of the Virgin Islands Labor Union called the “economic slavery” of agriculture (*Daily News*, 16 Feb. 1962: 10). The urban merchant class (with the help of the national Democratic Party in the United States) decided that aluminum and petroleum plants were the islands’ future, or at least the future of their own interests, since many local farmers had become quite adept at bypassing their levied mediation. Many elder farmers I spoke with in St. Croix recalled this moment with delight, relishing their independence from an urban elite. One retired merchant I interviewed had a different take: with noted displeasure, he criticized the insular attitude of these farmers, who lived and worked without regard for exports.

To right this, Colonial Governor Ralph Paiewonsky made an executive agreement first with Harvey Aluminum and then with Hess Oil to bring heavy industry to the southern shore of St. Croix. To encourage such development, the colonial government donated several hundred acres along the coast to the two companies and excused both from paying local taxes and following existing energy importation rules. They also expropriated land from local farmers and collective farms. In his memoirs, Paiewonsky reminisced that his primary goal in bringing industry to St. Croix was to transform the Virgin Islands “into a modernized Western society. [...] As a businessman myself, it was clear that my sympathies would be on the side of business” (Paiewonsky and Dookhan 1990: 219–20).

Under the banner of overcoming the regime of the plantation—“Governor Plans to Wipe Out St. Croix Feudal System” ran one headline (*Home Journal*,

30 June 1964: 1)—the colonial government actively contrasted the racial history of the plantations to the modern promise of the aluminum and petroleum industries. Such a contradistinction neatly overlooked the vibrant present of many island farmers. In a particularly nasty turn of events, colonial authorities seized the most fertile swathe of land on the island from small farmers and handed it over to the industrial coalition, claiming “St. Croix has had a sugar economy for long enough.”⁹ Most of the farmland usurped was simply fenced off and left empty for the next fifty years. Occasionally Hess Oil, which soon controlled the land, would sell a section back to the local government to build a prison or a public housing complex. One large section was paved over to welcome the island’s first shopping mall. As farmers and their allies protested throughout the 1960s, the colonial government routinely asserted that only the wages of modern industry could emancipate the island from the racial scourge of the plantation (*St. Croix Avis*, 12 Sept. 1963; *Home Journal*, 30 June 1964). It did not work out that way.

After the first batch of industrial workers recruited from former farmers on St. Croix went on strike demanding the wages and benefits they had been promised, both Harvey Aluminum and Hess Oil fired most of its native workers (*St. Croix Avis*, 30 Sept. 1964; *Daily News*, 9 Mar. 1965). One retired refinery official offered an airbrushed version of this history, stating, “Crucian blacks were unemployable at the refinery because they preferred to work for the government.”¹⁰ The companies began importing Afro-Caribbean workers from other Caribbean islands as a temporary workforce that could be politically disenfranchised and easily deported.¹¹ While unemployment among the island’s

⁹ This quote comes from a *Virgin Island Times* banner article of 18 June 1964. When local newspapers reported the widespread protests against the industrial takeover of St. Croix’s farmland, Harvey Aluminum responded by commissioning its own newspaper. The *Times* served as a cloaked mouthpiece for the industry’s interests, and though its editor was a Harvey vice-president and its entire staff were plant employees, it revealed nothing about its corporate affiliation. The paper promised “to be a happy newspaper, pointing out some of the brighter things that make life worth living. It will avoid a heavy diet of doomsday philosophy” (14 Nov. 1963: 4). With headlines like “Harvey Big Company?” and “VI Corp Is Fast Fading Away” (VI Corp was the central sugar factory and farming co-op), the paper celebrated industrial development and chastised any local politician who questioned the manufactured demise of agriculture. It compared one senator to Hitler and Stalin for organizing a rally of two thousand people in support of agriculture (19 June 1964).

¹⁰ This was a popular sentiment among many I interviewed. “No one really ever thought that cane cutters would suddenly be operating heavy machinery,” one Crucian recalled. But interviews with retired refinery workers who were recruited from other islands told a different story. “I had no skills when I was hired,” a retired Trinidadian worker explained, describing the extensive technical training he and other foreign workers received upon arrival on St. Croix in the 1960s. (They were also trained in the ease with which they could be deported if they caused any trouble.)

¹¹ “Bonded aliens,” as imported workers were classified, were housed next to the refinery in camps surrounded by barbed wire fences. These “bonded aliens” could not vote and were denied access to schools and other public services, and their employer could deport them at will. While these workers were initially brought in to serve the island’s seasonal tourism trade, the refinery quickly took advantage of this depoliticized class of worker. In 1968, as the refinery underwent

native residents was 3 percent in 1960, it spiked to over 10 percent in the years after the refinery and petrochemical plant arrived (Miller 1979). To stave off this crisis, the government began hiring, and it soon surpassed the refinery as the island's largest employer (*ibid.*). Flush with oil tariffs—by 1977 the Virgin Islands was processing roughly \$2.5 billion worth of petroleum products, while all non-petroleum exports totaled only \$70 million—St. Croix's petro-infused government became the largest employer on the island (*ibid.*). "The public sector comprised the largest portion of total employment," one 1983 study reported (Tri-Island Economic Development Council 1983: 22), noting that almost 40 percent of jobs in the Virgin Islands were in government. One employment study even suggested that during the 1970s over 75 percent of the new jobs created in St. Croix for citizens occurred in the public sector (Pobicki 1980). While the oil industry did little to help ordinary people (and much to harm them), it did create a sprawling government bureaucracy and, at least on paper, turned St. Croix into a robust economy. From the 1970s well into the 2000s, the U.S. Virgin Islands—based solely on what passed through this single mega-refinery—was regularly listed as one of the top ten sources of oil imported by the United States.

While the story of how St. Croix aligned with the new imperial geography of U.S. energy flows is particularly egregious, it is not an isolated incident. After the U.S. Congress created special tax exemptions for refineries and petrochemical plants built in Puerto Rico in 1965, oil companies like Tesoro, Sun Oil, Gulf Oil, Union Carbide, and Philips Petroleum constructed new facilities on the island's southern coast, largely designed to process Venezuelan oil and then ship the refined petroleum products to major cities on the Gulf Coast and Eastern Seaboard (Dietz 1986). That same year, the government of Puerto Rico declared petroleum refining and petrochemical industries to be the island's "top industrial priority" (quoted in Whalen 2001: 32). U.S. oil companies also built new enclave refineries and transshipment centers in Aruba, Antigua, St. Lucia, and the Bahamas (Paget 1985; Ramsaran 1989). U.S. firms increased their investments in the petroleum sector in the Caribbean by 400 percent during this period, and by 1980 the petroleum industry was "the largest U.S. direct investment in the Caribbean" (Barry, Wood, and Preusch 1984: 19). Across the Caribbean and on islands with no crude oil reserves of their own, "the fast growing refinery and petrochemical industry" promised to become, as one 1973 report on Caribbean development put it, "a focal point of the island's further industrial development" (Powell 1973: 39). As in St. Croix, this goal proved elusive. On many Caribbean islands the building of such refineries led to spiking unemployment, a metastasized state bureaucracy, and

a massive expansion, "bonded aliens" accounted for nearly half of the private sector workforce on St. Croix (Bonded Aliens 1968: 42).

fractured social unrest (Paget 1985; Pantojas-Garcia 1990).¹² While less commented upon, the introduction of enclave refineries also dramatically remade the coastal landscape of the Caribbean.

As colonial and national governments across the Caribbean aligned their futures with the promise of expanding hydrocarbon networks, “mangrove swamps” were widely seen as an opportune place to build. Brazil, Mexico, Venezuela, and many Caribbean nations embarked on mangrove eradication programs during the 1950s and 1960s, in many cases with the express purpose of developing industrial ports (Mumme, Bath, and Assetto 1988; Miller 2007). Mangroves, asserted a 1967 report on development in the U.S. Virgin Islands, were “cesspools of disease” that should be destroyed to make room for more productive applications like oil refineries and petrochemical plants (Virgin Islands Office 1967: 3). Alongside tax breaks and suspended regulations, the infamous “industry by invitation” (Lewis 1950) in Puerto Rico also rested on a more literal foundation: bulldozed and backfilled mangroves.

In St. Croix, the colonial government viewed the mangroves like it viewed the plantation: as a lingering anachronism best cleared out so the future of industrial modernity could finally arrive. Torn from the present, repressed agriculture and razed mangroves provided the physical coordinates that proved progress was happening. They both became history. When he announced the arrival of a world-class refinery on St. Croix, Governor Paiewonsky proudly noted how construction would wipe out the island’s largest mangrove forest. The mangroves were “worthless,” he said, noting that the area was “infested with mosquitoes and sand flies. It cannot be cultivated. But with this plant there, property values over the area will be enhanced” (*Daily News*, 7 Feb. 1962: 2). “Where a wild mangrove swamp once defeated practical land use, a new deep water port has been dredged,” one booklet about St. Croix development proclaimed, as it invited other industries to the island (Virgin Islands Office 1967: 32). The government paid Harvey Aluminum \$500,000 annually for the cost of dredging the port and clearing the area of mangroves (*Daily News*, 9 Feb. 1962: 1), an arrangement later expanded and extended to Hess Oil. A major tanker oil spill in 1971 along with chronic leaking at the bauxite facility and oil refinery further assailed the once vibrant tidal forests of St. Croix (*Daily News*, 15 June 1971: 2). For the time, such destruction of the mangroves was tolerated if not celebrated as evidence of progress.

¹² Between 1950 and 1970, refineries in Curaçao doubled their output of petroleum products while employment in the sector fell from eleven to three thousand. After Puerto Rico’s refining and petrochemical boom in the 1960s, unemployment shot up to 23 percent and would have been much higher if migration to the mainland had not provided a crucial outlet for unemployed workers (Powell 1973).

OIL SPILLS AND THE CHANGING MEANING OF MANGROVES

In March of 1973, the oil tanker S.S. *Zoe Colocotroni* left Venezuela full of crude oil for a refinery in Puerto Rico. With its navigation system broken, the ship proceeded by celestial reckoning. Eight hours after clouds obscured its navigators' vision of the stars, the tanker slammed into a reef on Puerto Rico's southwestern coast. The captain, after repeated attempts to reverse the tanker off the reef, ordered the crew to lighten the ship by dumping its load of crude into the sea. Soon the ship was dislodged and on its way. The next morning a large oil slick moved into the Bahía Sucia estuary, drifting into an extensive mangrove forest. Although much of the oil was eventually removed, many mangroves withered and began to die.

Local leaders and newspapers initially expressed relief: it was only mangroves that had been impacted. The oil slick had not reached any towns or popular beaches but instead had come ashore on a relatively uninhabited section of the coast. As marine biologists and a new environmental agency examined the site of the spill, however, they began to question that assumption. In the sudden absence of mangroves, disruptions to coastal life rippled outward. Puerto Rico commissioned a number of new studies to determine not only how the oil killed the mangroves but also the role, more generally, of mangroves in marine life. These studies and others like them laid the groundwork for a new empirical appreciation of the integral relationality of mangroves and their role in sustaining coastal ecologies and economies. Two years later, they also prompted Puerto Rico to file suit against the owners of the S.S. *Zoe Colocotroni* not only for the cost of cleaning up the oil but also, advancing a new kind of legal accusation, for the destruction of mangroves and the ensemble of marine organisms they fostered.

The matter of guilt was established early on. The ship was, after all, operating with the wrong maps, a damaged navigation system, and, as the court put it, "an incompetent crew."¹³ The legal debate that unfolded hinged on a separate issue: How can, or how should, the courts value mangroves? This question was key to the lawsuit and, at the same time, largely without precedent, for the bigger question was quite explicitly: How much is nature worth? While economists have long theorized about "natural capital" (e.g., Hotelling 1931) and common law and civil law both have a robust tradition of assessing damages to public resources like forests or fisheries, this case moved in a different direction. Instead of valuing nature through what *homo economicus* might make of it, this case asked how modern society infringed upon the independent life-support systems of nature. That is, it inquired into nature not as a potential commodity lying in wait

¹³ *Commonwealth of Puerto Rico v. SS Zoe Colocotroni*, 456 F. Supp. 1327 (1978).

but as a vital productivity in its own right. “To say that the law on this question is unsettled is to vastly understate the situation,” one judge remarked.¹⁴

Mangroves, as we now know, form one of the world’s most robust ecosystems. Characterized by their “strict fidelity” to the tidal zone in the tropics, they thrive in estuaries and other areas where fresh water mixes freely with the ocean (Tomilson 1986: 3). This ability, in turn, transforms that churning line separating land and sea into vibrant habitat. Mangroves establish “interface ecosystems, coupling upland terrestrial and coastal estuarine ecosystems,” drawing each into an unparalleled flourishing (Lugo and Snedaker 1974: 60). They are an emblematic case of what biologists now call the “emergent properties” of complex systems: that is, “those properties that arise from a system’s components acting in concert and may not be readily identified or understood by the study of those components in isolation” (Feller et al. 2010: 397). By bringing solar energy, atmospheric elements, dissolved nutrients, and a spectacular array of organisms into concert, mangroves foster an exponential increase in the productivity of the ecosystem. The resulting ecological society far exceeds the sum of its parts.

Recent UNESCO studies have found that, worldwide, “80 percent of marine catches are directly or indirectly dependent on mangroves” (Kjerfve, Lacerda, and Diop 1997: vi; see also Ellison and Farnsworth 1996). Although mangroves comprise less than a single percent of the earth’s surface, one recent estimate suggests their ecological import touches roughly half of the planet’s natural resources (Costanza et al. 1997). An astounding variety of birds, fish, shrimp, crabs, and other marine life thrive in the brackish tangle of mangroves. As Odum, McIvor, and Smith wrote, “At no cost to man, mangrove forests provide habitat for valuable birds, mammals, amphibians, reptiles, fishes, and invertebrates and protect endangered species, at least partially support extensive coastal food webs, provide shoreline stability and storm protection, and generate aesthetically pleasing experiences” (1982: 86). Teeming with life, mangroves have become the premier example of ecosystem services in a growing field of scholarship devoted to accounting for the worth of nature’s agency in our present (Costanza et al. 1997). The more we learn about mangroves the more we find ourselves in awe of their local and planetary significance.

Where did this rising appreciation of mangroves come from? It was, after all, not that long ago when mangroves were almost uniformly seen as a drag on development and a scientific outlier. A 1938 article in *Nature* described mangroves as the “freaks” of the natural world (Davis 1938: 556) and until quite recently many marine scientists found terms like “swamps,” “wastelands,” “curiosities,” or even “depauperate” appropriate for describing mangrove

¹⁴ Ibid., 628 F. 2d 652 (1980).

forests. John Steinbeck, on a marine science expedition in 1951, summarized the sentiment: “No one likes mangroves” (1951: 101). Today, a very different understanding has taken hold. Mangroves are widely celebrated as one of the earth’s most remarkable creatures. While many appreciations of them suggest that our rising regard for tidal forests is part of the progressive enlightenment of science, such a narrative misses the uneven material grounding of this new ecology of mangroves. Far from the steady march of reason, much of the research that gave empirical momentum to the vitality of mangroves took place in the wake of their crude eradication in the Caribbean.¹⁵

Mangroves once flourished along the coasts of every Caribbean island and populated the Atlantic Coast from New Orleans to Buenos Aires (Lacerda et al. 1993; Dean 1995; Miller 2003). Today, they are in spectacular decline. Recent estimates suggest that well over 50 percent of the world’s mangroves have been destroyed, the bulk of this decline occurring since 1950 (Feller et al. 2010). Today, the total extinction of mangroves remains a plausible future event (Duke et al. 2007). In the wider Caribbean this collapse is particularly stark (Ellison and Farnsworth 1996). Panama lost 40 percent of its mangroves by 1980 and Puerto Rico 85 percent, while in Venezuela some estimate that only 10 percent of the original mangrove forest remains (Lugo and Cintrón 1975; Ellison and Farnsworth 1996). As a botany textbook explains: “The chief factor that currently modifies mangrove distribution is the activity of industrial man” (Tomilson 1986: 61). While surprisingly resilient to changing conditions in the water and temperature and even to a variety of human encroachments, mangroves are extremely susceptible to the main ingredient of contemporary capitalism: crude oil. This “Achilles heel” of mangroves, as one report described it (Odum and Johannes 1975: 54), offers a novel interpretation of the crisis of tidal forests in the Caribbean: the rise of oil refining in the Caribbean mirrors the collapse of mangroves.

While many Caribbean refineries were built atop reclaimed tidal forests—a 1982 conference on protecting the tidal forests around the Hess refinery on St. Croix noted that until very recently “mangrove management meant reclamation” (Cintrón and Schaeffer-Novelli 1982)—the physical construction of refineries was only the beginning. As new refineries brought an influx of tanker traffic to the region, routine ballast discharges and an escalating series of tanker accidents released crude oil into the coastal environment. Refineries

¹⁵ While some described this rising appreciation for mangroves as environmental enlightenment spreading from First World to Third World, from metropole to colony—“The wave of environmental concern that began in the temperate regions is spreading to the tropics” (Johannes and Betzer 1975: 1)—the actual geography of insight is a good deal more muddled. While certain aspects of environmentalism, like concerns over clean air and water, do seem to have emerged from industrial cities in North America and Europe, others aspects like conservation (Grove 1995), climate science (Masco 2010), and as I argue here, interest in the ecology of mangroves, have deep roots in the experimental work of empire.

were also notoriously leaky—one study estimated a mid-sized refinery in 1960 leaked about fifteen thousand barrels of oil a year (cited in Gorman 2001). During the 1970s, the wider Caribbean experienced over thirty major oil spills and countless ordinary leaks and discharges. In 1979, two of the largest oil spills in human history unfolded as back-to-back disasters in the region. In February, two fully loaded supertankers collided in heavy fog just off the coast of Tobago and as explosions ripped the ships apart they spilled nearly 2.1 million barrels of crude oil. Less than a month later, an exploratory well in the shallows off the coast of the Yucatan experienced a blowout. Over the next 385 days, the Ixtoc I wellhead spewed approximately 3.6 million barrels of crude oil into the Gulf of Mexico. While the 1970s was capped with spectacular disasters, a litany of more modest spills and more mundane accidents continued to mar the marine environment of the Caribbean.

These oil spills and the damage they inflicted on coastal ecologies provided a telling environmental register of the realignment of Caribbean islands around imperial petro-networks. As the United States recalibrated its energy flows around imports and the spatial exceptionality of island colonies in the Caribbean, supertankers and offshore refineries became primary instruments in its petro-networks. While the pipeline may have opened the door to a new logic of energy infrastructure that bypassed labor and democratic action, as Timothy Mitchell (2011) has argued, supertankers and enclave refineries extended that flexibility into a new imperial apparatus. They also introduced a new problem that came to attract growing public attention: coastal oil spills. “Petroleum has become a devil in our civilization,” effused a 1967 *New York Times* feature on marine 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). By the early 1970s, and to the noted surprise of many observers, it was found that “the vast majority of United States oil spill incidents occur within coastal waters” (Gundlach, Hayes, and Getter 1979: 90). “Petroleum in the Marine Environment” was fast becoming a domain of official concern, as documented by a series of conferences and reports commissioned by the National Research Council (1975; 1985). This new oceanic orientation also registered in popular culture as the dominant imagery of oil spills in magazines and newspapers began shifting from gushing wellheads to sea birds coated in crude (Morse 2012). These oil spills invited unexpected scientific documentation and expansions of state responsibility to the emerging maritime routes of U.S. energy networks. The marine environment was, in many ways, coming to replace organized labor as the premier point of friction in these imperial petro-networks (Bond 2015).

In the Caribbean, these concerns came into sharp focus around the impact of oil on mangroves. Scientists who studied how oil spills affected Caribbean mangroves found descriptions like “catastrophic” and “devastating” entirely

appropriate (Burns, Garrity, and Levings 1993; Dodge et al. 1995). “There is no question,” a leading ecologist summarized, “oil kills mangroves” (Lugo 1980: 51). One study found 96 percent mortality among juvenile mangroves following diluted exposure to petroleum pollution, compared with near zero mortality in unoiled sites (Grant, Clarke, and Allaway 1993). In wide-ranging studies of how various coastal ecosystems are affected by spilled oil—many of which were conducted in the aftermath of Caribbean incidents—tidal forests quickly achieved the title of most vulnerable (Rützler and Sterrer 1970; Odum and Johannes 1975; Gundlach and Hayes 1978).¹⁶ Due to their sheltering nature, “mangrove forests are routinely sites where oil accumulates after a spill” (Lewis 1983: 171). Once accumulated among the buttressing roots, crude oil severely impairs the respiration of mangroves through a sort of induced “mechanical suffocation” (Snedaker, Biber, and Aravjo 1997: 2). Coating the roots and rhizomes of mangroves, crude oil effectively strangles tidal forests from the nutrient exchanges and biogeochemical cycles they depend upon, leading to “severe metabolic alterations” (Odum, McIvor, and Smith 1982: 80). The impact can be quite sudden. Oiled mangroves often defoliate and die within a matter of days.

Many of the first ecological surveys of these oil spills focused on a “dripping oil and dead-body count approach,” as one retrospective review put it (Snedaker, Biber, and Aravjo 1997: 1). Yet in the sudden and often persistent absence of mangroves after a spill, a more expansive definition of environmental harm took shape. For one thing, the impact was surprisingly long-lasting. For example, in 1968 a tanker broke up in a storm off Panama’s coast and slicks of crude wiped out whole sections of mangroves (Rützler and Sterrer 1970; Birkeland, Reimer, and Young 1976). Nearly thirty years later the estuary still bore the imprint of the injury: while the mangroves had begun recolonizing the estuary, trees in the heavily oiled areas remained visibly shorter and “with less overall biomass” (Duke, Pinzon, and Prada 1997: 9). That same study concluded that the durable impacts of oil spills on mangrove forests often cover an area five to six times larger than the area of immediate lethality (*ibid.*). As tidal forests failed to heal after spills in the Virgin Islands and Puerto Rico, scientists documented how mangrove skeletons and sediment foster anaerobic processes that concentrate the toxicity of crude oil in the marine environment for years if not decades (Lewis 1983; Corredor, Morell, and Castillo 1990). In 1986, a refinery accidentally released crude oil into a mangrove-lined lagoon on the Caribbean coast of Panama. A decade later, biologists described a wound still festering: the enduring impact was so apparent “that the affected site exhibited the appearance of having been subjected to an explosion” (Snedaker, Biber, and Arajo 1997: 3).

¹⁶ NOAA’s Environmental Sensitivity Indices, a popular environmental rubric used to prepare for and respond to oil spills around the world, lists mangrove forests as the tropical habitats most sensitive to hydrocarbon pollution (Hoff 2014).

Moreover, the impact extended beyond the physical forest. After an oil spill, the sudden absence of mangroves threw the quiet services they provided into stark relief. In 1976, Columbia witnessed local fisheries enter into a sustained period of decline after a tanker spill wiped out coastal mangroves (Hayes 1977). Other fisheries adjacent to oil-impacted mangroves in the Caribbean reported similar declines or collapses of species “independently of any effects of hydrocarbons on the organisms themselves” (Garrity, Levings, and Burns 1994: 327). In other areas, the years following an oil spill witnessed extensive coastal erosion after stricken mangroves loosened their grip on the shoreline (Dodge et al. 1995). From providing a crucial habitat for juvenile shrimp, crabs, fish, and other commercial species, to filtering agricultural or urban runoff, to absorbing dangerous storm surges, these oil spills offered an effective window for witnessing how mangroves contributed to coastal ecologies and economies.¹⁷

The oil spills that beset the Caribbean triggered pioneering scientific studies of mangroves as such. In a curious way, oil spills grounded a new ecological appreciation of mangroves. Mangroves do not fit neatly into the given taxonomies of species or commodities, but the ways in which they do not fit turn out to be of crucial importance for the ensemble of life gathered within tidal forests. “Unlike other terrestrial communities that can be lived in, managed, or exploited by man, mangroves offer only a few direct uses, which may account for man’s historical ambivalence concerning their value,” observed one of the first major scientific review articles on mangroves (Lugo and Snedaker 1974: 39). This article, “The Ecology of Mangroves” published in the *Annual Review of Ecology and Systematics* in 1974, was written by two scientists who had studied the destruction of mangroves in the *Zoe Colocotroni* spill in Puerto Rico and provided expert testimony in the subsequent trial. In fact, many of the principal early ecological studies of mangroves were instigated (and funded) not by strictly academic concerns but by new legal questions regarding injury inflicted by Caribbean oil spills (e.g., Odum and Johannes 1975; Nadeau and Bergquist 1977; Gilfilian et al. 1981; Lewis 1983; see also Odum 1970 for a more academic arrival at the ecology of mangroves). Taking a wide range of Caribbean oil spills as a coherent field of study

¹⁷ Oil spills were by no means the only venue that sparked this new scientific regard for mangroves. However, many of the other sites that formulated a newfound ecological appreciation of mangroves also had deep connections to their wanton destruction. This disastrous epistemology of the mangrove also has roots in Vietnam, where Agent Orange devastated 250,000 acres of tidal forests during the war, in Brazil and Singapore where exploding coastal cities expanded on land “reclaimed” from mangroves, in Bangladesh where many have suggested the devastation of the 1970 cyclone (which killed an estimated 450,000 people) would have been greatly moderated had coastal mangroves been left standing, and in countless other tropical estuaries where mangral habitats were razed and cordoned off into private shrimp farms. While oil spills in the Caribbean were far from the only disaster by which the ecology of mangroves became factual and operable, they formed one of the key laboratories for scientifically documenting the worth of mangroves.

(Getter, Scott, and Michel 1981), these disasters came to voice and valorize a new understanding of the agency of the natural world within an era of hydrocarbon endangerment.

This turn to oiled mangroves is but one regional constellation of a much wider shift in the natural sciences. In the postwar period, the natural sciences began to study life not in some contrived isolation from modernity but life altered by modernity (Beck 1986). While much has been made about the rise of biotechnology in facilitating this shift (Rabinow 1996; Rose 2006), perhaps the more substantial historical subject has been the material afterlives of nuclear weapons and hydrocarbon fuels. We are just beginning to grasp the key role radioactive fallout played in enabling and equipping the earth sciences (Masco 2010). The parallel role of hydrocarbon pollution in shaping the object and practice of environmental science—indeed in providing an empirical outline of “the environment” itself (Bond 2013)—has yet to receive the critical and comparative attention it deserves. So much of what we know of, and how we have come to care for, the conditions of life like clean air and clean water and now a stable climate, rests on how fossil fuels first disrupted them. These insights are far from a universal process of enlightenment. The analytic and ethical definitions of vital nature instigated by fossil fuels remain uneven and rooted in particular experiences of harm. In the Caribbean, this had everything to do with oil spills and mangroves.

The *Zoe Colocotroni* case was argued in the courts for over a decade and came to catalog the changing meaning of mangroves. As one of the defendants complained, these new questions had made “a court case, not out of the oil spill itself, but of the biological effect of the oil spill” (quoted in Lugo 1980: 55). The legal debate in this case came to rest on the value of mangroves. The market, the court concluded early on, was not the best means to assess the value of nature, stating: “Many unspoiled natural areas of considerable ecological value have little or no commercial or market value.”¹⁸ From fresh air to clean water, the court recognized that certain vital elements of life exist outside of market valuation. As petroleum infringed upon these independent life support systems, the court was pressed to come up with a convincing method to calculate damages to them. Marine biologists, questioned again and again on how mangroves matter, answered in ways that shifted the measure of value from the indexed exchange to ecological work. When asked by trial lawyers how much mangroves were worth, marine biologists described what mangroves do. Walking the court through the new studies of mangroves—a great many of them conducted in the wake of Caribbean oil spills—these marine scientists testified to the centrality of mangroves in coastal ecologies. “The mangrove components of these systems are of prime importance,” the court eventually concluded. “These areas are breeding,

¹⁸ *Commonwealth of Puerto Rico v. SS Zoe Colocotroni*, 628 F. 2d 652 (1980).

feeding, and nursery grounds for substantial populations. [...] Additionally the mangroves themselves, and in particular the red mangrove, are the primary food-producing agents of the organic materials available to the aquatic food chain.”¹⁹

The final *Zoe Colocotroni* verdict was written in 1979, the same year that the two record-breaking oil spills hit the wider Caribbean. “In recent times,” the ruling stated, “mankind has become increasingly aware that the planet’s resources are finite and that portions of the land and sea which at first glance seem useless, like salt marshes, barrier reefs, and other coastal areas, contribute in subtle but critical ways to an environment capable of supporting both human life and the other forms of life on which we all depend.”²⁰ An earlier guilty verdict was upheld and the court awarded Puerto Rico a record \$6 million dollars in damages to restore 20 acres of mangroves.

As oil development and oil disasters impaired the coastal ecologies of the Caribbean, a new definition of mangroves emerged. Their exuberant productivity—long known to marginal coastal communities (Miller 2003)—gained new scientific and political intelligibility through the encroachments of crude oil. Today, many nations and territories expressly protect mangroves. Thanks to recently changed laws and expansions of government authority in the Bahamas, Guyana, Panama, Puerto Rico, Trinidad, and beyond, countries are now acting to safeguard their tidal forests. In doing so, they often first reference the ecological services that mangroves provide to coastal communities (Lugo 2002). As climate change brings new attention to coastal vulnerabilities, many Caribbean nations are working to align their coastal infrastructures with the labor of mangroves (Vaughn n.d.). On many islands, the image of the mangrove has become synonymous with Caribbean environmentalism. The U.S. Virgin Islands recently began giving an annual award for the most environmentally friendly organization operating there, and the trophy is in the figure of a mangrove.

The mangrove, of course, has a longer presence in the Caribbean imaginary. “In brackish dialect” and “boiling with life,” mangrove forests form the unfolding easel at the center of Derek Walcott’s (1986) incisive 1973 poem, “Another Life.” “*Mangrove reste un miroir*,” wrote Aimé Césaire (1990) in his 1982 poem “*La condition-mangrove*,” “*La dodine celle du balancement des marées*” (The mangrove is a mirror... The rocking chair at the balancing of the tides). But as Richard and Sally Price have observed, the mangrove has begun shifting from poetic backdrop to insurgent symbol in the postcolonial Caribbean (1997). Today, the figure of the mangrove is wielded across the Caribbean to mobilize the tangled histories of the region to reimagine political belonging in the present. As Caribbean writers turn to the mangrove as an

¹⁹ Ibid.

²⁰ Ibid.

emblem of postcolonial identity, they often do so by first consulting new ecological recognitions of the mangrove.

In Édouard Glissant's elegant reflections, postcolonial Caribbean identity is folded into the ecology of mangroves: "Submarine roots: that is free floating, not fixed in one position in some primordial spot but extending in all directions in our world through its network of branches" (1999 [1981]: 67). In their trenchant treatise *Éloge de la Créolité*, Jean Bernabé, Patrick Chamoiseau, and Raphaël Confiant describe the ascendant qualities of being Creole as "*la mangrove profonde*," the profound mangrove (1989: 51). They write, "*La Créolité est notre soupe primitive et notre prolongement, notre chaos original et notre mangrove de virtualités*" (Creoleness is our primordial soup and continued sustenance, our founding chaos and our mangrove of possibilities) (ibid.: 28). This image of the mangrove has been artfully mobilized in the *créolité* literary movement across the Caribbean Basin. In such poetics and politics, the mangrove has come to evoke an anti-essentialist modality of life in the Antilles. "This land is mangrove," writes Raphaël Confiant, "The people are mangrove. The language is mangrove" (quoted in Price and Price 1997: 24).

This cultural mobilization of the ecological mangrove has also been put to work in social research. Richard and Sally Price (1997) have found the mangrove to be a uniquely Caribbean rhizome from which to theorize the present, as have others. "The metaphor of the mangrove guides my theoretical argument," writes Laura Ogden (2011: 90) in her investigation of the "confusing, nonlinear networks" (ibid.: 30) in the entanglements of the Florida Everglades. At one level, the mangrove bears resemblance to Eduardo Kohn's Amazon forest, an "emergent and expanding multilayered cacophonous web of mutually constitutive, living, and growing thoughts" (2013: 77). Like the Amazon, tidal forests are seen as a vital life force still outside the modular purview of modern purpose. As such, these unbowed forests are uniquely suited to voicing critiques of modernist orderings of people and landscapes. Verdant and vibrant places like the Amazon rainforest and Caribbean mangroves offer proof that another ontology is possible, one where cooperation trumps competition, where biosemiotics defy the sovereignty of the liberal individual, and where the emergent qualities of interaction surpass any inscribed hierarchy of species. At another level, however, these properties of the forest are brought into political being by the very forces they stand against. Regenerating in the tides of empire, the ontological purchase of the Caribbean mangrove grows out of the disasters of oil imperialism.

The empirical opposition many ontological arguments presume between the disenchanted modern and its spirited opposite are often effective to the extent they avoid historical questions of encounter (or more often, bracket the historicity of difference as a uniquely modern curiosity). In this, ontological venerations of alternative ecologies can sidestep histories of empire which so often provide the grounds upon which epochal oppositions of modern and its

other were first articulated and violently inscribed on people and landscapes (Wolf 1982). As Ann Laura Stoler and Tim Mitchell have demonstrated time and again, the modern project has always unfolded within a wider colonial field. Theoretically robust oppositions of the modern and its other can easily lose sight of this wider field, taking the effects of colonial encounters as the starting point of scholarly critique without inquiring much into their formation (Bessire and Bond 2014). The ecology of the mangrove may very well offer a scathing evaluation of modernization in the Caribbean, but we should be skeptical of claims that authorize their critiques by the purity they claim from the histories of our present.²¹ The ecological mangrove did not precede the empire of oil in the Caribbean. The ecological mangrove became a forceful counterpoint within and against the destruction of that imperial project.

As the mangrove becomes globally celebrated in this new era of planetary precarity, perhaps reassessing the imperial histories that enliven the ecological mangrove might once more bring the Caribbean into the fore in the making of the contemporary. The Caribbean has long been recognized as a historic crucible in the formation of colonial modernity and its creolized discontents (James 1989; Mintz 1986). With reference to refineries and mangroves, this article has argued that the Caribbean is also an unfolding crucible in the formation of petro-modernity and its ecological discontents.

CONCLUSION: THE ENDS OF OIL

This article has linked up the imperial history of fossil fuels in the Caribbean with the disastrous history of the ecological mangrove as one regional articulation of a wider dialectic of hydrocarbon risk and environmental responsibility. Describing the local histories of aligning the Caribbean with U.S. petro-networks and the ecological fallout of that alignment, this paper argues that fossil fuels have done much to reorganize both the region's economic and environmental landscapes. These concerns continue to work themselves out in consequential ways. Over the last few years growing environmental actions—many centered on the region's imperiled mangroves—have helped close oil refineries in the Caribbean. Between 1992 and 2009, the five major refineries on Puerto Rico ceased operation. "I helped shut down the last refinery on Puerto Rico," one Environmental Protection Agency official proudly told me. Recalling a litany of environmental problems, he added: "These refineries were built on sensitive coastlines that

²¹ In a parallel vein, Deborah Thomas (2016) has shown how the living histories of the Caribbean confound many ontological veneration of alterity. In the Caribbean, difference is never innocent of the violences of modernity even as such difference is never fully contained within the modern. While we differ on how to pose the question of origins in the contemporary Caribbean (and where to look for answers), there is much to be learned in Thomas' sharply argued essay.

should never have been developed. They should have been set aside and protected.” On St. Croix in the U.S. Virgin Islands, the mega-refinery that once shipped more oil to the United States than did Kuwait was abruptly shut down in 2012.²² Today, Caribbean islands that once linked their future prosperity with the imperial energy networks of the United States are finding themselves further isolated from that receding future. Yet, as environmental concerns have unexpectedly circumscribed the imperial networks of crude oil, other possibilities are taking shape. Today, many renewable energy organizations are looking to the Caribbean as a new laboratory for green energy. Due to the astronomical cost of petro-electricity,²³ many islands are among the few places where renewable energy can compete with fossil fuel energy without subsidies.

The story of oil in the Caribbean also speaks to wider debates around the so-called Anthropocene. Lately, much has been made of the modern society’s great divorce from nature, especially around the intellectual impoverishment of nonhuman vitality and the subsequent humanistic hamstringing of politics and ethics. Yet such scholarship strangely obscures the role of fossil fuels in this crisis. While it is widely recognized that fossil fuels instigated and may very well terminate industrial society’s functional autonomy from the natural world, social research has largely turned a blind eye to the subsequent work

²² As refinery workers recalled in interviews, the refinery had a frightful history of environmental disregard. Benzene and other carcinogenic hydrocarbons were occasionally vented out without flaring and dangerous emissions were routinely released under the cover of storms or night. This was on an island where many residents still get their drinking water from rain catchments and cisterns. Until OSHA posters displaying the dangers of chemicals to workers were put up in the 1980s, mercury was routinely flushed down a drain that emptied into a nearby lagoon near a popular local fishing spot. While fires were a reoccurring problem at the refinery—the refinery had long housed its own firefighting squad, in part to specialize in refinery fires and in part to keep problems off the public radar—in 2011 a series of huge explosions rattled the island and shut down nearby schools. These explosions drew new scrutiny from the Environmental Protection Agency, which uncovered a disconcerting history of toxic releases and environmental shortcuts. Facing potentially record-breaking fines, HOVENSA settled with the Agency. The refinery agreed to pay a \$5.3 million dollar fine (\$5.1 million of which went to the federal government) and, in lieu of penalties for its extensive history of contamination on the island, negotiated a settlement committing the plant to spend \$700 million in capital improvements targeted at efficiency updates and environmental protections (Environmental Protection Agency 2011). About ten days after the agreement was signed, the refinery announced it was closing and thereby avoided paying for capital improvements and environmental protections.

²³ The energy needs of Caribbean islands that accommodated enclave refineries were underwritten by the glut of crude oil passing through. In this, the Caribbean became one of the few regions in the world (alongside the Middle East) to generate the majority of its electricity from burning petroleum. As Caribbean refineries have begun closing, these energy infrastructures are proving to be quite inflexible to new realities. Nearly 100 percent of St. Croix’s electricity now comes from petroleum-fired power plants (Energy Information Administration 2016a). In Puerto Rico, 51 percent of electricity is generated by burning oil, in Haiti 80 percent, and in Jamaica 92 percent (in the United States it is 0.8 percent and the worldwide average is closer to 5 percent) (Energy Information Administration 2016b; World Bank 2017). This is why the Caribbean pays some of the highest rates for electricity in the world.

of fossil fuels and the conditions of possibility they enable. Today, this is beginning to change. The groundbreaking work of Fernando Coronil, Timothy Mitchell, Michael Watts, and others have shown how the shape and trajectory of our present carries the deep imprint of fossil fuels. While their work is instructive, the main thrust of their critiques rests on linking the material force of hydrocarbons to positive forms of capital and state power. But what of the negative ecologies of fossil fuels? The force of hydrocarbons is not fully expended in the moment of combustion nor is it wholly transferred into accumulations of corporate profit or state violence. In cancerous bodies, asthmatic populations, scarred landscapes, rising sea levels, and distorted atmospheric systems, fossil fuels disrupt the relationality of life on cellular and planetary scales. For each of these scholars, such destruction provides a useful backdrop en route to the main event: the accruals of power and profit in the empire of oil. Yet such destruction provides another accrual in the empire of oil: knowledge of environmental precarity and vitality. This knowledge is refracted with political possibility, whether as a new terrain for power to operate upon or as a new subject that power must negotiate with.

The ends of oil are far more prolific than a forecasted conclusion to industrial society. Over the past century, hydrocarbon harm has instigated a new science and politics of environmental vulnerability and value. In sharp and subtle ways, fossil fuels have assailed the underlying relationality of life and, by disrupting it, have opened vital ecologies to new forms of understanding and care. While the rising prominence of the Anthropocene solicits rapt attention on the impending foreclosures heralded by hydrocarbon emissions, such a project frequently sidesteps the longer history of acknowledging and managing the disastrous qualities of fossil fuels (Appel, Mason, and Watts 2015; Bonneuil and Fressoz 2016). The disasters of oil are more than a looming catastrophe; they are also a fractured history of our present and its possibilities. The collision of oil and mangroves in the Caribbean described here is but one site to begin exploring some of these themes.

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Abstract: This article links up the disastrous history of fossil fuels with the celebrated ecology of mangroves. Building on ethnographic and historical research in Puerto Rico and St. Croix, it outlines the often neglected but quite consequential place of crude oil in the Caribbean. Following the construction of what became the second largest refinery in the world, I describe how the imperial energy networks of the United States first came to the Caribbean. Troubling a popular origin story of the Caribbean, colonial and industry leaders voiced a robust critique of the plantation in order to justify the introduction of these enclave refineries. Imperial energy networks welcomed an unprecedented problem to the region: coastal oil spills. The scientific and legal response to these spills brought new attention to the vital relationality of mangroves. Rather perversely, the destruction of the mangroves in the Caribbean—in which crude oil played the leading role—opened mangroves up to new forms of knowledge and care. While many claim that fossil fuels helped cultivate a modern disregard for the natural world, I show how the negative ecologies of fossil fuels also instigated new scientific and political appreciations for the liveliness of the natural world. This story of oil in the Caribbean has implications for scholarly debates around the so-called Anthropocene. Against scholarship that looks at the coming disaster of crude oil as an epochal break in thought and politics, this paper instead describes the long history of acknowledging and managing the disastrous qualities of fossil fuels.

Key words: crude oil, oil spills, refineries, mangroves, plantations, St. Croix, Puerto Rico, Caribbean, empire, nature