The frontiers of North America's fossil fuel boom: BP, Tar Sands, and the re-industrialization of the Calumet Region

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Abstract

This article focuses in on the ways in which the North American energy boom is reworking environments and livelihoods in the Great Lakes, focusing in particular on the expansion of BP's Chicago-area refinery as it has pivoted towards processing Canadian tar sands oil. In examining this 're-industrialization', the article contributes to an ongoing discussion about the relationship between fossil fuels, limits to capitalism, and the importance of frontiers in resolving capitalist crises. The first empirical section of the article looks at the early history of the Calumet's development as a hub for fossil fuel distribution and refining and, drawing from Moore's 'world-ecology framework', demonstrates the ways in the *appropriation of unpaid work/energy* - in particular the appropriation of the wetlands that make up the southern tip of Lake Michigan - serves as the underappreciated condition of possibility for the BP Whiting refinery's existence. Today, this combination of productivity and plunder continues in the region, illustrating urban metabolisms that are not confined to the city. In the second empirical section of the article, I argue that despite predictions of crises arising from declining ecological surpluses, in Calumet today, BP *is* finding new frontiers of surplus value production, both in the form of producing petcoke and in continued geographic expansion in the region. As a way of understanding the persistence and adaptive capacity of capital, even in degraded landscapes like Calumet, I consider Johnson's concept of 'accumulation by degradation' as an excellent tool for understanding dynamics in the region. The production of both petcoke and pollution – undesirable from a social and ecological perspective – sustain BP's industrial colonialism in the region because they ensure weakened competition and below market rents that allow for expansion and place-based longevity.

Keywords: tar sands, oil, refining, appropriation, accumulation by degradation, Chicago

Résumé

Cet article traite de la façon dont le boom énergétique nord-américain modifie les environnements et les moyens de subsistance dans les Grands Lacs, en particulier l'agrandissement de la raffinerie de pétrole de BP dans la région de Chicago, car elle a permis de transformer le pétrole canadien en sables bitumineux. En examinant un processus de "réindustrialisation", l'article contribue au débat en cours sur la relation entre les combustibles fossiles, les limites du capitalisme et l'importance des frontières dans la résolution des crises capitalistes. La première section empirique de l'article examine les débuts du rôle du Calumet dans la distribution et le raffinage des combustibles fossiles. Il s'inspire du "cadre d'écologie mondiale" de Moore et montre comment le travail non rémunéré et l'énergie est approprié, en particulier les zones humides qui constituent la pointe sud du lac Michigan. L'existence de la raffinerie BP Whiting repose sur des conditions sous-estimées. Aujourd'hui, cette combinaison de productivité et de pillage se poursuit dans la région, illustrant des métabolismes urbains qui ne se limitent pas à la ville. Dans la deuxième section empirique, je soutiens que, malgré les prévisions de crises découlant de la diminution des excédents écologiques, aujourd'hui à Calumet, BP trouve de nouvelles frontières en matière de production de plus-value. Ceux-ci produisent du coke de pétrole et développent leurs activités dans la région. Pour comprendre la persistance et la capacité d'adaptation du capital, même dans des paysages dégradés comme Calumet, je considère le concept de «l'accumulation par dégradation» de Johnson comme un excellent outil pour comprendre la dynamique de la région. La production à la fois de coke de pétrole et de pollution - indésirable d'un point de vue social et écologique - soutient le colonialisme industriel de BP dans la

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région, car elle garantit une concurrence commerciale affaiblie et des loyers inférieurs à la valeur du marché, permettant l'expansion et la longévité des activités de l'entreprise.
Mots-clés: sables bitumineux, pétrole, raffinage, appropriation, accumulation par dégradation, Chicago

Resumen

Este artículo se enfoca en las formas en que el auge energético está renovando entornos ambientales y medios de subsistencia en los Grandes Lagos, apuntando en particular a la expansión de la refinería de BP en el área de Chicago y su giro hacia el procesamiento de petróleo a partir de arenas bituminosas canadienses. Al examinar esta "reindustrialización", el artículo contribuye a la actual discusión sobre la relación entre los combustibles fósiles, los límites del capitalismo, y la importancia de las fronteras en la resolución de crisis capitalistas. La primera sección empírica del artículo mira a la historia temprana del desarrollo de Calumet como eje para la distribución y refinación de combustibles fósiles y, a partir del "marco de la ecología-mundo" de Moore, se demuestran las maneras en que la *apropiación de trabajo/energía sin remuneración* - en particular la apropiación de los humedales que conforman el extremo sur del Lago Michigan - sirve como una condición subestimada de posibilidad para la existencia de la refinería BP Whiting. Hoy, esta combinación de productividad y saqueo continúa en la región, ilustrando metabolismos urbanos que no están confinados a la ciudad. En la segunda sección empírica del artículo, argumento que a pesar de las predicciones de las crisis que surgen por el declive de los excedentes ecológicos, hoy en Calumet, BP encuentra nuevas fronteras de producción de plusvalía, tanto en la forma de producir coque de petróleo, como en la continua expansión geográfica en la región. A manera de entender la persistencia y capacidad adaptativa del capital, incluso en paisajes degradados como Calumet, considero que el concepto de Johnson de "acumulación por degradación" es una excelente herramienta para entender las dinámicas de la región. La producción de coque de petróleo y la contaminación - indeseables desde perspectivas social y ecológica - mantiene el colonialismo industrial de BP en la región ya que aseguran una competencia debilitada y rentas por debajo del mercado para permitir la expansión y longevidad en el lugar.
Palabras clave: arenas bituminosas, petróleo, refinación, apropiación, acumulación por degradación, Chicago

1. Introduction

This article explores what some local activists have called the 're-industrialization' of Chicago's Calumet region (Schnurr 2017), which stretches from the far South Side of the city into Northwest Indiana, hugging Lake Michigan's southern coastline. Much of this re-industrialization is tied specifically to the relatively recent boom in North American fossil fuel production, particularly the extraction of unconventional fossil fuels from Canadian tar sands and oil and gas extracted from shale formations.[2] The opening up of new extraction frontiers in turn necessitated (re)investment in distribution technologies, like pipelines and rail capacity, as well as the expansion and upgrading of refining capacity, both of which have had significant economic, ecological, and social impacts in the region.

For example, the Keystone XL and Dakota Access pipelines have drawn significant political attention as symbols of climate injustice, but are dwarfed in size by the already existing Enbridge Mainline pipeline system that crisscrosses the Great Lakes and delivers more oil per day from Canada than the U.S. imports from Saudi Arabia, Venezuela, and Mexico combined (Egan 2017).[3] Moreover, the Enbridge Mainline system is responsible for the largest inland oil spill in U.S. history, which spilled some 840,000 gallons (3.2m liters) of oil into a tributary of the Kalamazoo River in Michigan in 2010 (Schnurr 2017). This system is currently expanding to accommodate additional Canadian production, which raises additional threats to the drinking water supply for 40 million people (Egan 2017).

[2] The extraction of fossil fuels from tar sands and shale has largely been driven by high oil prices for much of the first decade and a half of the 21st century, as well as new recovery technologies – horizontal drilling, hydraulic fracturing, and in-situ bitumen extraction (pumping steam deep underground to mobilize tar sands oil). These have enabled previously costly and/or unproductive wells to become viable.

[3] The Keystone XL pipeline will deliver 830,000 barrels per day (bpd) and the Dakota Access Pipeline will move 470,000 bpd. The Enbridge Mainline (which consists of multiple pipelines) currently has a capacity of around 2.5 million bpd, with plans to expand to nearly 3 million bpd. This is roughly 20% of U.S. oil imports (Egan 2017).

These pipelines, and the storage facilities they connect to in places like Griffith, Indiana, outside of Chicago, in turn connect to refineries around the Great Lakes in both the U.S. and Canada, where the 'carbon bomb' (McKibben 2011) embedded in these unconventional fossil fuels is made accessible to consumers. The largest concentration of refineries in the U.S. is along the Gulf Coast between Texas and Louisiana, but the Great Lakes region is also an important recipient of unconventional fossil fuels. For example, the BP refinery just outside of Chicago in Whiting, Indiana, completed a US$4.3 billion renovation in 2013 specifically so that the facility could process the heavier tar sands coming from Alberta. The upgrades allow BP to process over 400,000 barrels of oil per day, 80% of which is now heavy Canadian crude, up from 20% in the past (BP 2014). The expansion of BP Whiting has important implications for the region that are explored in this article.

Drawing on political ecology and environmental history, this article focuses in on the ways in which the North American energy boom is reworking environments and livelihoods in the Great Lakes, focusing in particular on oil distribution and refining in the Calumet region of Chicago. I show that the new frontiers of North American energy are not only in western Canada, Texas, and places like the Bakken fields of North Dakota and Montana, but extend through the Great Lakes (and elsewhere) via the expansion of distribution and refining infrastructure necessary to bring these fuels to market. Like Cronon (1991), I seek to go beyond what Angelo and Wachsmuth (2014: 20) call 'methodological cityism' – the "naturalization of the city in studies of urban processes where the non-city may also be significant" – and towards a 'political ecology of urbanization', where "cities as research objects fade into the background, giving way to the multiple processes, materials and networks that constitute them" (ibid, 24). The changes happening in the Calumet region cannot be understood without understanding movements of capital, new technologies, movements of labor, and the extraction of raw materials elsewhere. The frontier of North American fossil fuel is a network rather than a singular place. In unpacking the formation and evolution of one particular node in this network via an historically-informed empirical analysis of investments in fossil fuel infrastructure and their impacts on the Calumet region, this article empirically demonstrates the complex metabolisms that constitute the political ecology of urbanization. Moreover, the empirics contribute to an ongoing discussion about the relationship between fossil fuels, limits to capitalism, and the importance of frontiers in resolving capitalist crises.

The first empirical section of the article tackles the technological, organizational, and spatial processes that were set in motion in the late 19th century and early 20th century that led to Calumet's development as a hub for fossil fuel distribution and refining. I demonstrate that what has often been a story of 'industrial' history is, crucially, following Cronon, always a natural history as well (1991; see also Castree 1995; Smith 1984 [2008]). The focus is on the evolution of the BP Whiting oil refinery (formerly part of the Standard Oil empire), the largest and oldest inland refinery in the United States. Drawing from Moore's 'world-ecology framework' (2015a), I demonstrate the ways in which the 19th and mid-20th century's *appropriation of unpaid work/energy* – in particular the appropriation of the wetlands that make up the southern tip of Lake Michigan – serves as the underappreciated condition of possibility for the BP Whiting refinery's existence. The Calumet region was once an ecologically vibrant habitat of wetlands and dune and swale along the shores of Lake Michigan, but over the course of the 19th and 20th centuries, it was transformed into one of the largest hubs of heavy industry in the U.S., where much of the country's steel, cars, and petroleum products were made. The dredging of dunes, wetlands and rivers, and the ensuing production of slag from industry, literally formed much of the land that industry sits on and as such, was crucial to successive rounds of accumulation in the region. Following Moore, I argue that while the question of what capital *does to* nature (the degradation question) is critical, it is also important to understand the work that nature *does for* capital (2015b: 27, italics in original).

While the 'free gifts' (Moore 2015a) of Calumet's geography allowed industry to prosper in the region historically, today the availability of 'cheap natures' (ibid) to appropriate seem scarcer. This has led Moore to argue that we are seeing the rise of what he calls *negative value* – barriers to continued capital accumulation arising from fewer opportunities to appropriate the 'free gifts' of both nature and unpaid labor as well from rising costs of production associated with the toxification of the biosphere (see also O'Connor 1988). For Moore, negative value signals an epochal crisis for capitalism, one in which capital is unable to reproduce itself through the kind of 'productivity and plunder' (2015a) that defined BP Whiting and the Calumet region's initial development. However, instead of positing toxicity and pollution as barriers to capital accumulation, I instead

consider Johnson's (2010) concept of 'accumulation by degradation' – where externalities act as tools for accumulation, as when melting ice caps create opportunities for Arctic oil exploration – as a better explanatory tool for understanding both dynamics in the region and the resilience of capital more generally. As I demonstrate in the second section, in Calumet today, BP Whiting *is* finding new frontiers of surplus value production, both in the form of producing petcoke and in continued spatial expansion in the region, as BP attempts to buy property and depopulate the nearby Marktown community of Northwest Indiana under the auspices of creating more 'green space' near the refinery. The 200 people still living in Marktown, a historic community built for steelworkers in 1917, face the prospect of enclosure, displacement, and continued bodily harm from expanded refining. Both petcoke and pollution – undesirable from a social and ecological perspective – create favorable conditions for the continued dominance of BP in the region because they make land acquisition and expansion cheaper while also making alternative land uses more difficult to envision. In short, degradation subsidizes capital.

The following section reviews the literature on crisis and the production of space and nature, and focuses in particular on Moore's discussion of appropriation as a useful concept for illuminating processes of urban metabolism. The subsequent empirical section focuses on the centrality of the historical appropriation for fossil fuel investment in the Calumet region. The article then turns to the contemporary energy boom's impact on the BP Whiting refinery and surrounding community as a way of exploring the nuances of frontiers of accumulation and accumulation by degradation. It concludes with a discussion of what this case study suggests about the future of renewable energy and the importance of energy democracy.

2. Frontiers of appropriation

Infrastructures such as refineries, pipelines, railroads, storage facilities, transmission lines, and power generation facilities form the crux of the modern 'hydrocarbon industrial complex' (Auch 2014). The hydrocarbon industrial complex represents the coming together of labor, knowledge, and materials in ways that have produced particular configurations of space and nature suitable to capitalism's energy needs. From the auto-dependent suburb to monocrops of soy and corn, if we look upstream from these processes we find landscapes of fossil fuel extraction, production, and distribution that enable them. The fixed capital of fossil fuel infrastructure represents the entrenchment of a particular way of organizing socionatural metabolisms that is deeply historical and geographical, linking city and hinterland, regions, continents, and the globe in ways that create increasingly problematic ecological, economic, and political path-dependencies. Because of these problematic trajectories, climate change chief among them, serious debates have emerged as to whether the historical pairing of fossil fuels and capital accumulation is beginning to unravel. Whether capital will locate new 'socioecological fixes' via the incorporation of geographical frontiers, new modes of enclosure, and new forms of commodifying nature (Castree and Christophers 2015; McCarthy 2015), or whether the present conjuncture indicates a terminal crisis for capitalism, is a subject of intense debate.

Moore has pursued this line of inquiry in a number of recent works culminating in his 2015 book *Capitalism in the web of life*, in which he ultimately suggests that capital is facing an epochal crisis in which continued accumulation is threatened. Crucial to his argument is the emphasis on the ways in which capitalism has historically required not only the exploitation of paid labor, but the appropriation of unpaid work/energy from outside the realm of production. In his terms, capitalism has always required frontiers where a dialectic of productivity (organization of the labor process, technological advances) and plunder (of 'women, nature, and colonies') (citing Mies 1986) are the motor force of history. In this dialectic, Moore marries traditional Marxist accounts of accumulation with those of feminist and green scholars, who have long argued that the exploitation of wage labor does not provide a full accounting of capitalist relations and crises (Federici 2004). Moore argues that successive waves of capital accumulation have rested upon the ability to seize upon what he calls 'cheap nature' – energy, labor, food, and materials – either for free or below their cost of reproduction. These cheap natures provide an 'ecological surplus' that temporarily counteracts the falling rate of profit, allowing for the substitution of capital investment with the 'free gifts' of unpaid work/energy. Over time, however, ecological surpluses become depleted, the organic composition of capital rises, and rates of profit decline, leading capital to once again pursue new frontiers of both exploitation and appropriation.

This is a powerful, but not exactly a novel, argument. Cronon, for example, recognized the centrality of appropriating nature's free gifts to the production of surplus value. Writing about Chicago's development in the 19th century, the frontier was crucial in that:

> the attraction of 'free land' was that people could turn its natural wealth into capital with less labor than elsewhere…Chicago's explosive growth was purchased at the expense of prairies and forests that had spent centuries accumulating the wealth that now made 'free land' so attractive. Much of the capital that made the city was nature's own. (1991: 150-151)

The dialectic of capitalization and appropriation are core processes of surplus value production and are the motor force of metabolism in which non-human natures are brought into the orbit of capitalist processes, which are inherently uneven geographically (Smith 1984 [2008]). In focusing on the work that nature does for capital i.e. 'cheap natures', Moore has reemphasized the importance of empirically situating metabolism within (urban) political ecology. I draw on this framework below to understand the forces – social, economic, political, or geological – that have shaped the appropriation and capitalization of nature across the Chicago region.

Of course, the appropriation of labor and nature cannot continue indefinitely, and much of the literature in political economy and political ecology deals with understanding how capital overcomes these numerous crises. For Moore, frontiers of appropriation are disappearing and the end of cheap nature has arrived. This does not mean an abrupt end to core processes of capitalist production, but rather "signifies the erosion of the model's capacity to deliver a *rising* stream of unpaid work/energy into commodity production" (2015b: 21; emphasis in original). Furthermore, the unpaid costs of the underproduction/exploitation of land and labor are now creating what Moore calls negative value: "forms of nature that are increasingly hostile to capital accumulation and that can be temporarily fixed (if at all) only through increasingly costly, toxic, and dangerous strategies" (Moore 2015b: 1). In agriculture, herbicide resistant weeds pose an existential threat to productivity, for example, while climate change signals a rapidly declining capacity of the atmosphere to safely absorb the 'wastes' of fossil fuel-based production. In short, negative value signals an epochal crisis for capitalism because of the fundamental mismatch between rising costs (which can no longer be externalized) on the one hand and capital's need for cheap inputs on the other.

Moore is no doubt correct in his analysis of the dialectic of capitalization and appropriation as being core processes of surplus value production. And indeed, it does appear that rising costs in a number of key areas of production are looming. Yet, as has been pointed out elsewhere, it may not necessarily be the case that frontiers are truly being exhausted (Out of the Woods 2016). Drilling for oil and gas in the Permian Basin in west Texas, for example, has been ongoing for a century, and yet because of today's new technologies the Permian contains more than twice as much recoverable oil that has been drilled over the last 94 years (Nocera 2017). And furthermore, an end to cheap natures and the absence of frontiers could simply mean sluggish economic growth rather than an end to capitalism itself (Out of the Woods 2016).

How capital overcomes crises and produces 'second natures' that provide the foundation for new regimes of accumulation (Smith 1984 [2008]) is a question that needs to be answered empirically. Predictions of capitalism's immanent decline are nothing new, and the ability of capitalism to produce sociospatial and indeed socioecological fixes to crises remains the one of the most salient elements of this system. McCarthy is correct to point out that:

> the incorporation of new elements of nature into circuits of capital – most notably through new forms of enclosure and dispossession, as well as major developments in the life sciences industries and the valuation and commodification of 'ecosystem services' – have in fact been central to efforts to restore a flagging rate of accumulation by finding a new sort of 'external,' generative domain for capital to appropriate and capitalize. (2016: 5; referencing Cooper 2008; Harvey 2014; Robertson 2004; Sunder Rajan 2006).

McCarthy and Castree and Christophers (2015) have suggested that large-scale investment in renewable energy infrastructure, for example, could present itself as exactly the kind of socioecological fix for capital's crises that might restore ecological surpluses. Wind, water, and solar-based forms of energy are, after all, 'free gifts' capable of generating an ecological surplus for capital. While it may be the case that "these contradictions *within* capital, arising from negative value, are today encouraging an unprecedented shift towards movements *against* capital" (Moore 2015b: 7), it seems just as likely that contradictions lead to movements that further entrench capital i.e. 'green capitalism.' If history is any guide, these tensions around limits, revolution, and reform are borne out in the realm of politics.

As a way into these debates, the following section describes how and why Standard Oil established a refinery in Northwest Indiana at the end of the 19th century. I show that the appropriation of cheap natures was central to the establishment of a midcontinental oil regime. And while the economic might of organized labor in the Calumet region as a whole has declined over the past half-century, the significance of oil refining and distribution has only grown. While significant upfront costs were required to transition to refining tar sands, BP is benefitting handsomely from captive Canadian suppliers who have no alternative other than supplying American buyers (Mikulka 2018). There is also a booming export market, the production and sale of petcoke, spatial expansion in the region, and the externalization of pollution costs onto the local environment, all of which are buoyed by the regulatory capture of the state.

3. Appropriating the free gifts of the Calumet: Standard Oil's Midwestern frontier

While the initial colonial encounter between Europeans and indigenous people produced dramatic social, ecological, economic, and political changes in the region (Cronon 1991), the roots of the contemporary oil refining and distribution boom in Calumet lie in transformations that began after the Civil War. The organizational, technological, and spatial links put in place there charted a course for economic growth that much of the country followed: increasingly integrated networks of producers and suppliers exchanged commodities between hinterland and metropole via waterways and railroads, creating agglomerations of related industries and concentrating expendable pools of immigrant labor. For example, steel mills situated on the Calumet and Chicago rivers relied upon iron ore, limestone, and coal arriving from Michigan and southern Illinois via port and rail (City of Chicago Department of Planning and Development 2001: 6), which in turn led to the development of the railcar industry in places like Pullman, which was a planned company town built to maintain labor efficiency (Mayer and Wade 1969: 188). The resulting hub of labor, transportation, and production spurred regional and continental flows of commodities and reworked livelihoods.

The rapid industrialization of the Calumet area has been recounted in many fascinating histories (Hurley 1995; Lewis 2008; Mayer and Wade 1969; Schoon 2016; Taft 2018; Walley 2013), and in this part of the article I focus on the transformation of the dunes and wetlands by Standard Oil as a process of appropriating value rather than degradation. Like the connections between Calumet steel foundries and hinterlands that provided key resources, the development of the Standard Oil refinery in Whiting, Indiana was also dependent on tight supply linkages between places. Over time, the geographies and materialities of these linkages have shifted, from the initial western Ohio 'sour' crude that the refinery processed in its early days to the unconventional Canadian tar sands that it handles today. Moreover, the changes in the refinery reflect broader changes in social practices, from kerosene lighting to automobility. What has remained constant throughout are the ways in which non-human nature has done 'unpaid work' for industry.

The Standard Oil Company of Indiana began operating its refinery in 1890 in Whiting, and the location of the site among lagoons and sand ridges made it desirable. But counterintuitively, Whiting was chosen as the site for the first oil refinery west of Ohio precisely because the dune landscape was inhospitable to other human activities, like agriculture. Historian Powell Moore described the Whiting area as "one of the most uninviting areas of the region" (Moore 1959: 197; quoted in Schoon 2016: 53), with the landscape alternating between high sand ridges and valleys of wet sand and shallow pools that made development difficult. But the choice of this 'uninviting' site for an oil refinery had everything to do with the physical properties of Standard's Midwestern oil supply at the time. John D. Rockefeller insisted on purchasing oil fields discovered outside Lima, Ohio in 1885 despite the fact that the oil was high in sulfur and produced an objectionable smell (Giddens

1955: 3). The smell of this 'sour crude' made it difficult to market, as oil at this time was primarily kerosene used for lighting and cooking in homes. 'Sweeter' crude oil with lower sulfur content was therefore the preferred resource. However, Rockefeller insisted that a method could be found to remove the sulfur from sour crude and by 1888 was storing 10 million barrels of Lima crude (ibid, 4).

In the meantime, Standard constructed a pipeline from Lima to Chicago with the intention to develop the refinery in the South Chicago neighborhood. When storage tanks for this high sulfur oil were erected there (prior to a refinery being built), the smell, as well as a spill and subsequent fire, generated enough opposition from residents that the company abandoned plans for the refinery in favor of moving a few miles southeast to Whiting (Calumet Region Historical Guide 1939: 229). "Compelled, as a 'nuisance industry', to refine its crude oil without offense to the inhabitants of Chicago" (ibid), Standard Oil built the largest refinery in the U.S. in the most 'uninviting' location in the region (Figure 1). Locating in Whiting allowed Standard Oil to escape Chicago's high taxes and capitalize on cheap land and ample water (Gidden 1955), but its unfavorable geography and geology added to the site's value precisely because it had kept population growth at bay.[4]

Figure 1: Dune dredging. Gary, Indiana 1906. Photo from United States Steel Corporation. In Mayer and Wade. 1969. *Chicago: growth of a metropolis*. P. 242.

As the first industry located along the lakefront in Northwest Indiana, Standard Oil's activities are suggestive of the wider ways in which the wetlands, lakes, rivers, and flat, sandy soils of Calumet were made available to the nexus of science, state, and capital that remade them in their image. As the writers of the Calumet Region Historical Guide put it, "the convenience of such a wasteland for vast mills and tanks…was not long to go unappreciated" (1939: 229). Along with Standard Oil, the Army Corps of Engineers and a host of railroad and steel manufacturing interests worked sometimes collaboratively, and sometimes independently, to rationalize the region's geography (Calumet Heritage Partnership 2016; Mayer and Wade 1969). As a recent history of the region notes, these public and private players

[4] In 1888, no more than 800 residents lived in Gary, East Chicago, and Whiting, Indiana (Calumet Region Historical Guide 1939, 229).

> …played a geomorphological role in rearranging the physical landscape of the region: they cut down the heights and filled in the low-lands and thereby flattened an already flat terrain. In the process, soggy land was made dry; shallow waters were made to run more deeply; and the boundary between land and water, formerly subject to great daily, seasonal, and annual fluctuations – if indeed a 'boundary' existed at all – was fixed tightly in place. (Calumet Heritage Partnership 2016: 43)

While the lakes, pools, and large sand dunes initially presented obstacles to development, their 'rearrangement' actually turned them into sources of value (Figure 2). First and foremost, Lake Michigan provided "abundant water for the insatiable thirst of the modern factory" (Mayer and Wade 1969: 234). Indeed, one of Standard's first construction projects was a large water intake pipe extending a half mile into Lake Michigan that supplied water first to the factory, and later to the incorporated town of Whiting (Giddens 1955: 21). The U.S. Geological Survey's data shows that today, Indiana's Lake County, where the BP Whiting refinery is located, is the largest industrial water consumer in the United States, with 1.12 billion gallons (4.24bn liters) of water consumed per day (USGS 2010). In 2016, BP Whiting consumed 89 million gallons (337m liters) of water per day, nearly all of which was from Lake Michigan (Indiana Department of Natural Resources 2016).

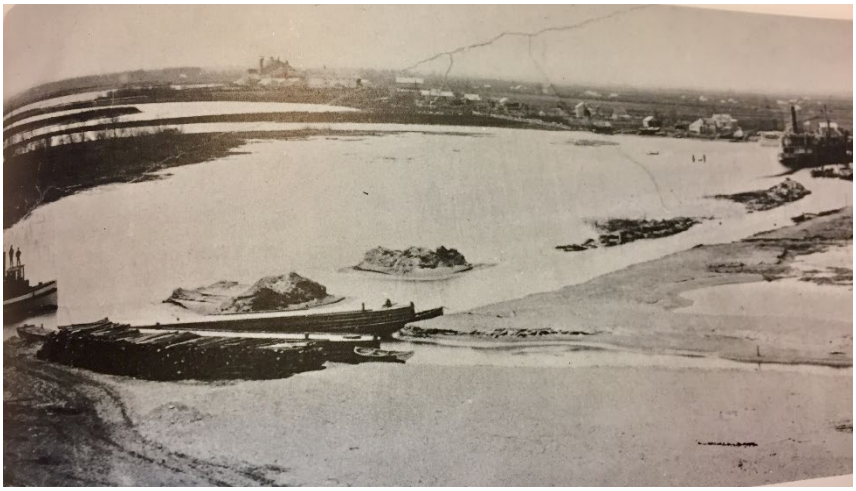

Figure 2: Calumet River, early 1870s. Photo from Chicago Historical Society. In Mayer and Wade. 1969. *Chicago: growth of a metropolis.* P. 236.

Moreover, water and soil were used as sinks for wastes; the loose sand was used to absorb liquid wastes, and any open water bodies were used for dumping the constant stream of waste produced by factories. Because of this, the Grand Calumet River and the Indiana Harbor and Shipping Canal have been described as the most polluted waterways in the country.[5] Another function was that the flattening of dunes and dredging of lakes and rivers provided useful landfill that industry could use to expand their operations, both on land or into Lake Michigan (Figure 3). For this reason, by the 1890s, "sand had become to Northwest Indiana what coal was to West Virginia" (Schoon 2016: 27). Slag, which is solid material produced when separating iron or steel from impurities, was another massive source of aggregate for landfill. Combined with ashes and rubble from the Great Fire of 1871, sand and slag from Calumet were used to create Grant Park in downtown Chicago as well as Indiana Harbor in Calumet, which extends more than a mile into Lake Michigan (Schoon 2016). Thanks to these processes, where oil workers at Standard Oil once used small boats to travel between oil tanks in 1890,

[5] Indiana Departmental of Environmental Management, https://www.in.gov/idem

within a few short years the entire acreage was dry and navigable by land (Figure 4). All told, sixty square miles (155km^2) of lakefront and wetlands in Calumet have been filled in since the 1840s, which amounts to 21 billion cubic feet (595m meters^3) of landfill, sand, and slag in the region (Kay *et al.* 1997; cited in Wallaert 2016).

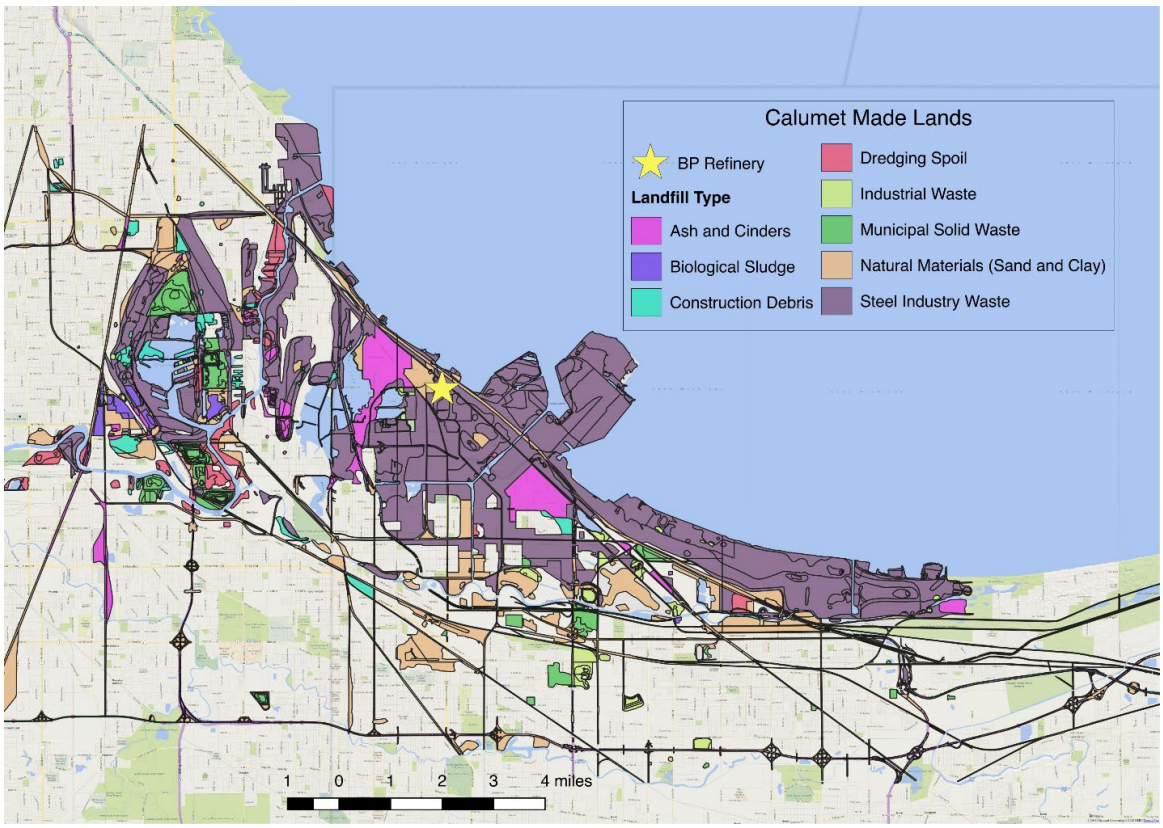

Figure 3: Calumet Made Lands. Landfill data set produced by Marc Lambruschi at The Field Museum of Natural History. Used with permission.

In sum, Standard Oil's development outside Chicago was tied to the movement of the western frontier, to processes of 'productivity and plunder' whereby cheap natures were brought into capitalist orbit (Moore 2015a). In the 19th century, western Ohio sour crude was an 'unconventional' oil, not unlike the tar sands of today, unlocked through the transformation of dunes and wetlands into industrial spaces in Calumet as well as via technological breakthroughs that eventually allowed Standard Oil engineers to reduce the sulfur content of the oil. This early work set the stage for the Whiting refinery to emerge as the center of the auto-age, when in 1910 engineers at the facility developed the Burton process for 'cracking' hydrocarbons, which doubled the output of gasoline from a barrel of oil and thus lowered the costs of automobility. Patents on the cracking process provided windfall profits to Standard Oil as refineries rushed to service the automobile industry, ushering in a transition away from railroads and towards highways that went on to impact every aspect of social, economic, and political life in the country. In many ways, the auto-age was born in Whiting, and I have argued that an underappreciated moment in this development is the unpaid work done by nature in various forms.

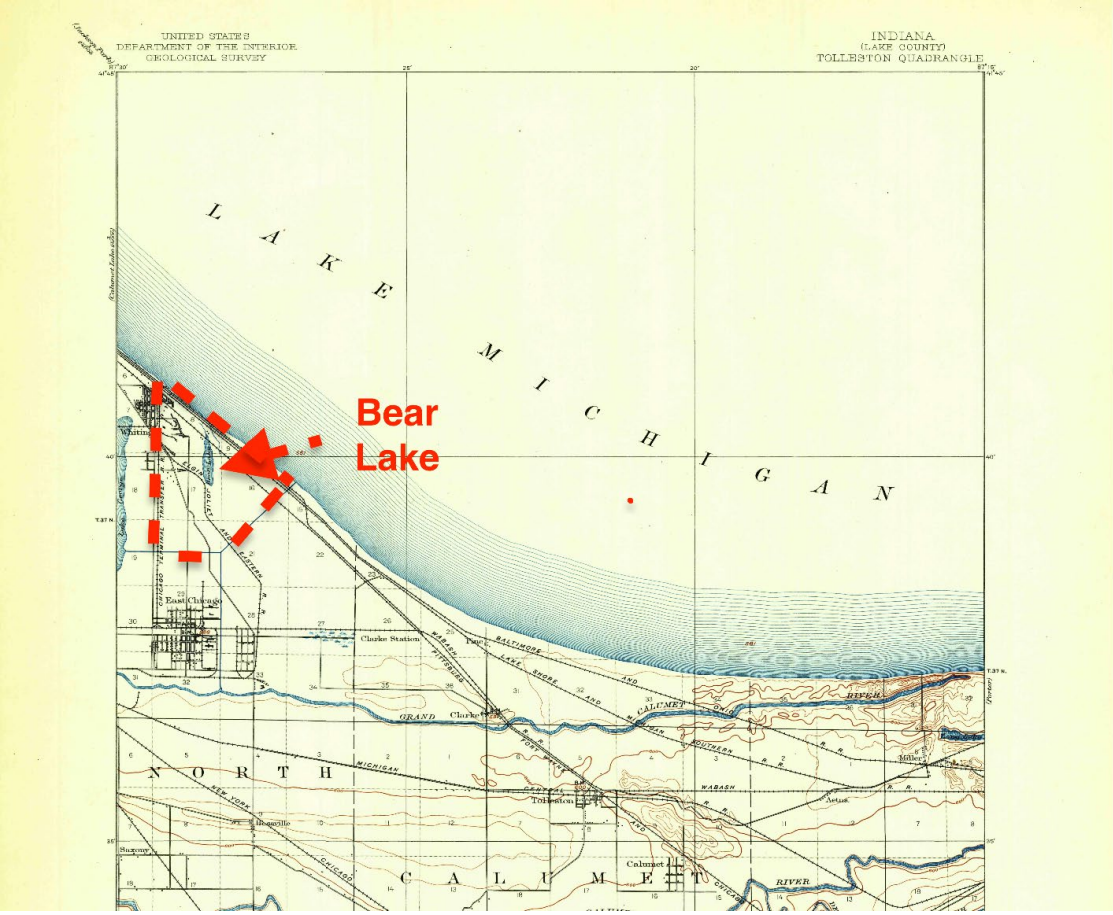

Figure 4: Bear Lake appears on this map of the Standard Oil Refinery site in 1900 but does not exist today. Image from the USGS Historical Topographic Map Explorer.

In the current moment, the same processes of productivity and plunder continue for BP in the region, culminating in the recent US$4.3 billion tar sands upgrade completed in 2013. The air, land, water, and of course, people, around the refinery continue to bear the unpaid costs of BP's activities as it has moved heavily into the unconventional oil refining sector. In the next section, I explore the tar sands investment activities of BP and demonstrate the ways in which the threat of rising production costs and a falling ecological surplus have been successfully navigated by the company. I argue that the colonial dominance of BP and other industries creates conditions akin to a positive feedback loop in which ongoing and historical ecological degradation suppresses land values and the possibilities of non-industrial developments, which works to subsidize BP's further expansion both geographically in the region and economically into the petcoke market. In short, the dominance of industry in the region has spoiled the landscape to the degree that the only possible future of the area is as a continuation of industrial colonialism. This form of accumulation by degradation, where externalities create the conditions for further accumulation (Johnson 2010), is the dominant logic at the local and regional scale, despite the fact that negative value and rising costs loom at the planetary scale and over longer temporal durations.

4. Sacrifice zones, internally displaced persons, and accumulation by degradation

Since 1889, the communities near the refinery have faced constant exposure from air, water, and land-based emissions not just from refining, but steel and auto-related industries. In short, these are the sacrifice zones of fossil fuel capitalism, the negative exposure that is absent in the hype around jobs, growth, and 'freedom' from Middle Eastern geopolitics that surrounds contemporary discourses of American 'energy independence.' As bipartisan coalitions of policymakers celebrate the American energy boom, the costs are born unequally in communities that have long been the sacrificial lambs of the growth machine. Whiting and the wider Calumet region are what one local activist described to me as an "industrial colony" (interview 4/6/18). And indeed, the celebration of energy independence rests upon a colonial logic in which the maintenance of empire and elite rule relies upon the occupation and death of others. This perspective comes most clearly into view when examining energy independence not at the level of GDP or trade balances, but at the local and regional scale, where the privatization of profits and socialization of risk is most readily visible.

BP's investment in tar sands saw the company expand from Whiting into the nearby city of East Chicago, a move facilitated by the granting of a seven-year tax abatement to the company (Zabroski 2006). The expansion has been extremely profitable for BP, which logged a five-year high US$3.8 billion profit in the third quarter of 2018 (Pete 2018). With Canadian producers dependent on selling crude to American refineries, and supply exceeding demand, barrels of tar sands oil are being sold for US$50 less than the lighter West Texas crude (Mikulka 2018). On top of these windfall conditions, BP's pivot towards Canadian tar sands has led to a tripling of petcoke production, which is a hydrocarbon 'residue' produced by refining tar sands that can be sold to power plants as a fuel source (Figure 5). In the Chicago area from 2013-2015, an estimated 2 million tons of petcoke was being stored in uncovered piles directly next to residential areas, generating protest around threats to health as petcoke dust covered homes, cars, and windows (Geertsma 2015; Hawthorne 2013). Protests from residents forced action from the City of Chicago, which halted the storage of uncovered petcoke in Calumet in 2015. But the Whiting refinery inevitably continues to produce petcoke, as the multi-billion dollar upgrade was designed to do, and railroad cars of uncovered petcoke can be seen in the area as they transit to sites in Wisconsin, Kentucky, and Virginia (Beaver 2016).

Figure 5: One of the main fixtures of BP's tar sands renovation is the coking tower, pictured on the left.

Petcoke is an additional burden on the bodies of Calumet residents, but it is a profitable side business for the Whiting refinery. BP Whiting produced 30,000 barrels of petcoke per day in 2018, up from just 10,000 per day in 2013 (prior to the new coker becoming operational) (EIA Refinery Capacity reports). As Oil Change International has reported, the production of petcoke as a byproduct of tar sands refining props up the longevity of coal-fired power plants that can co-fire coal with petcoke, essentially providing a cheap substitute that cuts costs for the coal industry (OCI 2013). For this reason, petcoke has been called the hidden coal in the tar sands (ibid), a 'free gift' that continues to prop up fossil fuel profits.

Even as the piles of petcoke have been forced to move elsewhere, the Calumet region continues to suffer the consequences of growing domestic fossil fuel production. For example, using the U.S. EPA's Environmental Justice Screening and Mapping Tool (EJSCREEN) to map the relationship between environmental indicators and population characteristics, Figure 6 shows that communities within a 5 mile radius of the BP refinery in Whiting face are disproportionately minority and low-income and also face disproportionate exposure/risk/proximity to facilities than the state, regional, and national averages. These are neighborhoods that are not prospering, despite being located near some of the most important petroleum, steel, and auto-industries in the Great Lakes. Indeed, the nine census tracts within five miles (8km) of the BP refinery had mean incomes of US$47,195 in 2016 – 44% lower than the US$84,669 mean income found in the Chicago Core Based Statistical Area (Figure 7).

Selected Variables	Value	State Average	Percentile in State	EPA Region Average	Percentile in EPA Region	USA Average	Percentile in USA
Environmental Indicators							
Particulate Matter (PM 2.5 in $\mu g/m^3$)	11.6	10.9	95	10.1	95	9.14	95
Ozone (ppb)	35.9	38.2	1	37.6	22	38.4	23
NATA* Diesel PM ($\mu g/m^3$)	1.28	0.835	86	0.932	70-80th	0.938	70-80th
NATA* Air Toxics Cancer Risk (risk per MM)	34	34	58	34	50-60th	40	<50th
NATA* Respiratory Hazard Index	1.7	1.4	77	1.7	60-70th	1.8	50-60th
Traffic Proximity and Volume (daily traffic count/distance to road)	430	250	84	370	79	590	75
Lead Paint Indicator (% pre-1960s housing)	0.73	0.35	87	0.39	82	0.29	88
Superfund Proximity (site count/km distance)	0.6	0.16	94	0.13	96	0.13	96
RMP Proximity (facility count/km distance)	3.8	0.81	97	0.81	97	0.73	97
Hazardous Waste Proximity (facility count/km distance)	0.33	0.078	96	0.091	96	0.093	95
Wastewater Discharge Indicator (toxicity-weighted concentration/m distance)	4.2	0.29	98	4.2	98	30	97
Demographic Indicators							
Demographic Index	66%	27%	93	29%	90	36%	85
Minority Population	78%	19%	95	25%	91	38%	83
Low Income Population	54%	35%	80	33%	82	34%	80
Linguistically Isolated Population	7%	2%	92	2%	89	5%	78
Population with Less Than High School Education	24%	12%	88	11%	90	13%	82
Population under Age 5	8%	6%	68	6%	72	6%	69
Population over Age 64	11%	14%	34	14%	33	14%	38

*The National-Scale Air Toxics Assessment (NATA) is EPA's ongoing, comprehensive evaluation of air toxics in the United States. EPA developed the NATA to prioritize air toxics, emission sources, and locations of interest for further study. It is important to remember that NATA provides broad estimates of health risks over geographic areas of the country, not definitive risks to specific individuals or locations. More information on the NATA analysis can be found at: https://www.epa.gov/national-air-toxics-assessment.

Figure 6: The EPA's EJSCREEN data for an area within a 5-mile radius of the BP refinery in Whiting. The table displays state, regional, and national percentiles for 11 different environmental indicators and 7 demographic characteristics.[6]

[6] A full glossary of the environmental indicators is available here: https://www.epa.gov/ejscreen/glossary-ejscreen-terms.

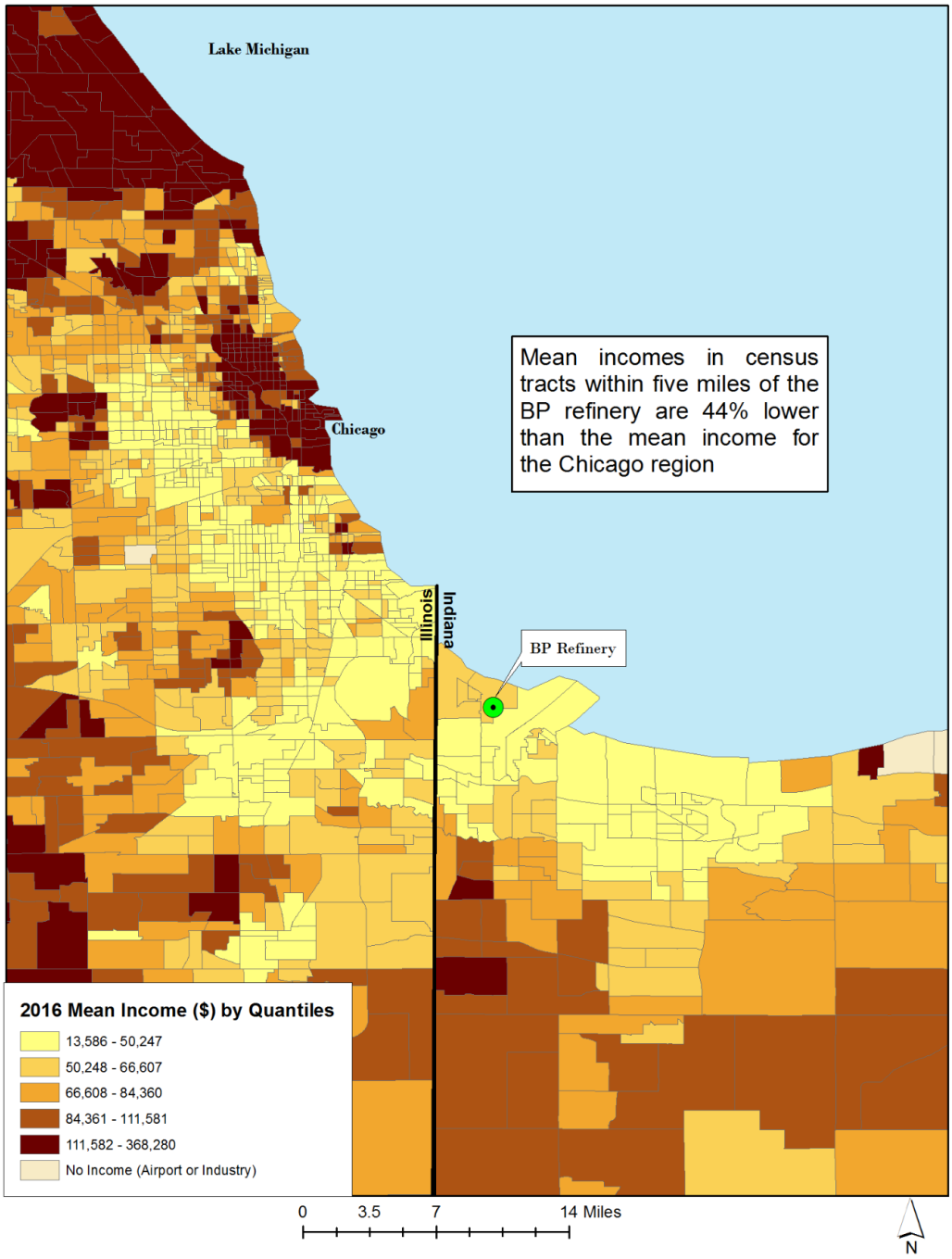

Figure 7. 2016 Mean Income of Census Tracts within proximity to BP Refinery.

In terms of employment, Census data shows that 26% of workers making more than US$3,333 per month in the Whiting refinery's census block lived within 10 miles (16km) of the refinery (U.S. Census Bureau On the Map tool). But looking at workers making only US$1,250 per month or less, nearly double that number – 44% - live within 10 miles (16km). The fact that the lowest income earners at the BP refinery are the most

likely to live in an area that has higher than average environmental hazards shows that even when BP is creating jobs in the Calumet region, the poorest workers suffer geographically from risks of health hazards.

The retrenchment of the Calumet region as a sacrifice zone for fossil fuel and industrial interests speaks to Johnson's concept of accumulation by degradation. In Johnson's analysis of the ways in which melting Arctic ice produced new accumulation opportunities by opening up territory for oil exploration, she recognizes that these accumulation opportunities are different from other forms of commodifying externalities such as carbon trading or wetland banking credit systems:

> The external costs of radiative forcing on the Earth's temperature are not themselves commodified (as they are in carbon trading or sequestration); rather, the radiative forcing from excess GHGs sets in motion a natural thermodynamic feedback mechanism that *grants access to new factors of production.* Within this iterative cycle of accumulation by degradation, fossil energy and its waste may both operate as subsidies for capital." (2010: 835, emphasis mine)

This dynamic, whereby externalities work to 'grant access', is on full display in the Calumet region, as BP has begun buying property and demolishing homes in the refinery-adjacent Marktown community of Northwest Indiana (Figure 8). As many as 52 properties were purchased and razed by the company between 2012 and 2017 (Anderson 2017). Despite the historical character and architectural significance of the neighborhood, 2018 median home values in Marktown are only US$17,100 according to the Lake County Tax Assessor compared to US$224,600 for the Chicago region (U.S. Census Bureau, 2011-2015 American Community Survey), primarily because the neighborhood has become completely surrounded by heavy industry and refining.[7] Residents are faced with a set of bad choices: either take a meager payment for their home from BP, who is likely the only buyer, or continue to be inundated with hazardous emissions. The rationale claimed for buying out Marktown has been for BP to create more parking and 'green space' near the refinery, but in driving through the refinery with a local activist, there was no shortage of parking on the sprawling 1,700 acre (688 ha) refinery property. Instead of creating parking or green space, BP seems interested in demolishing Marktown as a way to reduce their liability from future lawsuits related to environmental exposure. Rather than acting as a barrier to accumulation, pollution 'does work' for BP by driving out other land users.

Indeed, if Marktown were to disappear it would be following in the footsteps of two other Calumet communities completely displaced by the forces of institutional racism, environmental exposure, and corporate power: the Brickyard in the 1990s, an African-American community uprooted by a chemical company (Campbell 1994); and the West Calumet Housing Complex, a public housing project with 1,100 residents currently being demolished because of widespread lead contamination stemming from prior industrial land uses on site (Lyons 2018). While the production of the Calumet region as a sacrifice zone is not exclusively driven by energy interests, it is possible that continued growth of domestic energy production will lead to further conflicts over not just public health, environmental quality, and climate change, but over land rights and tenure. As Auch notes, debate over the existence of climate refugees and internally displaced persons (IDPs) arising from rising sea levels, droughts, and floods has drawn significant attention from journalists in recent years. But, as he states,

> The issues associated with oil and gas infrastructure expansion and IDPs are only going to grow in the coming years as the Shale Revolution results in a greater need for pipelines, compressor stations, cracker facilities, etc. We would propose there is the potential for IDP resulting from the rapid, ubiquitous, and intense expansion of the Hydrocarbon Industrial Complex here in the United States. (Auch 2016)

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[7] Data for Marktown was gather using the Lake County GIS Online portal https://portico.mygisonline.com/portals/lakein/ to gather parcel numbers. Parcel numbers were then manually entered into the Lake County Tax Assessment parcel search tool to extract values: http://counties.xsoftin.com/lake/default.aspx

Figure 8. Historic homes in Marktown, designed in the 'English village' style by architect Howard van Doren Shaw.

Accumulation by degradation shows that frontiers not only remain available in despoiled places, but become available *precisely because of* the degradation of the landscape. The rising costs associated with the toxification of the Calumet are not being paid, except by the local environment and by the bodies and futures of residents. Moreover, accumulation by degradation works not just to keep land prices low, but also

undermines contemporary efforts to reimagine the future of Calumet in other ways, as a coalition of residents, policymakers, business leaders, scientists, and activists have expressed interest in developing a 'green industrial corridor', restoring habitat for native species, installing solar systems on brownfields, and/or remaking the region as a hub for recreational tourism (see the City of Chicago Calumet Land Use Plan adopted in 2002; Calumet Heritage Partnership 2016 and Environmental Law and Policy Center nd). But one of the stumbling blocks to any 'accumulation by conservation' (Büscher and Fletcher 2014; see also Fairhead *et al*. 2012 and Kay 2017) is that the historical and ongoing land, air, and water pollution from BP (and many others) make large-scale commercial redevelopment (like solar arrays on brownfields) and ecological restoration (for wetland banking, offsets, ecotourism, etc.) prohibitively expensive due to the remediation requirements. To date, negative value blocks the reimagining of Calumet by 'greener' circuits of capital, but accumulation by degradation[8] maintains the hegemony of heavy industry in the region by keeping other types of development at bay.

5. Conclusions

William Cronon's seminal work on Chicago, *Nature's metropolis* (1991) described the ways in which capital, wheat, timber, livestock, and railroads intersected in Chicago to redefine the relationship between city and country, and nature and society. This article, while not nearly as ambitious as Cronon's account, is part of a larger project that focuses on the ways in which pipelines, oil and gas storage facilities, and refineries connect the Chicago region to global energy metabolisms that are unsustainable from a climate justice perspective. And yet, as I have attempted to show here, these infrastructures are not only resilient, but expanding and entrenching petro-capitalist relations now and into the future. The fossil fuel industry is threatened with falling fuel prices, a weakening social license to operate, the accelerating growth of renewable energy capacity, and the scarcity of the atmosphere's capacity to absorb carbon emissions. Crises in Calumet emerging from the supply-side, however, are more a latent threat than placing firm limits on the energy sector. Calumet embodies the U.S.' turn towards 'energy independence' and short-term extractivism. These colonial relations were subsidized in the late 19th and early 20th centuries by the appropriation of ecological surpluses, and the free gifts of the landscape. Today, the continued industrial dominance of the region is subsidized, in a perverse way, by the very externalities that, in a more just world, would be cause for direct political intervention by the state.

While the long-term shift towards a renewable energy regime may be inevitable, the ways in which fossil fuel capital wields power in places like the Calumet – privatizing profits, socializing risk – suggests that if these same interests come to dominate the renewable energy future, the carbon content of our fuels will change but power relations will not. As such, one of the broader lessons of this case is that demands for the democratization of energy infrastructure and production *ownership* remain as crucial as demands for increased renewable energy output.

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[8] This interpretation of accumulation by degradation differs somewhat from other scholars' uses of the concept. In Johnson's original case and in the Calumet, accumulation by degradation serves to create accumulation opportunities for the same sectors that are generating the externalities. But for example, Cantor and Knuth's study of plans to redevelop the Salton Sea in California into a hub for renewable energy development and ecological restoration focuses on the ways in which sectors other than the ones creating the pollution might seize upon the devaluation of land in the region (2018). In the case of the Salton Sea, the long-term degradation of the area was largely caused by pollution from agricultural runoff. Proposals for restoration and renewable energy development have since emerged from the tech and real estate sectors seeking to capitalize on cheap land to develop land uses like solar and geothermal energy that are seen as less desirable when situated in more 'pristine' landscapes.

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