Analyzing the Environmental Injustices of Carbon Offsetting: The Limits of the California-REDD+ Linkage

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Abstract

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Emissions from greenhouses gases (GHGs), especially carbon dioxide (CO2), have driven anthropogenic climate change. In response, global policymakers have promoted carbon trading and its subset, carbon offsetting, as approaches to lower these emissions by commodifying GHG reductions for market exchange. Recently, the US state of California has sought to incorporate carbon offsets from a "Reducing Emissions from Deforestation and Forest Degradation" (REDD+) program in the state of Acre, Brazil, into its own carbon trading scheme. Using a theoretical framework drawn from Marxist Political Economy, I argue that the "California-REDD+ linkage" is an ineffective and unjust method of climate change mitigation, because it prioritizes economic growth over substantial and equitable emissions reductions. By interrogating the environmental and social credibility of REDD+ offsetting, this thesis exposes the limits of market-based environmental strategies to mitigate climate change in a fossil fuel-powered capitalist society.

March 8, 2017

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List of Acronyms & Abbreviations

AB	Assembly Bill
AB 32	Global Warming Solutions Act of 2006
AR	Afforestation and Reforestation
ATF	anti-deforestation Task Force
BAU	Business-As-Usual
BNDES	Brazilian National Development Bank
BRL	Brazilian Real
CAR	Rural Environmental Registry
CARB	California Air Resources Board
CCBS	Climate, Community, & Biodiversity Standards
CCI	California Climate Investments
CDM	Clean Development Mechanism
CER	Certified Emission Reduction
CfRN	Coalition of Rainforest Nations
COSATU	Congress of South African Trade Unions
COP	Conference of the Parties
CO_2	Carbon Dioxide
EDF	Environmental Defense Fund
EJAC	Environmental Justice Advisory Committee
ERU	Emissions Reduction Unit
EU	European Union

EUR	European Union Currency
FCPF	World Bank Forest Carbon Partnership Facility
GCF	Governors' Climate and Forests Task Force
GHG	Greenhouse Gas
IEA	International Energy Agency
IMC	Institute of Climate Change and Regulation of Environmental Services
INCRA	Institute of Colonization and Agrarian Reform
INDC	Intended Nationally Determined Contribution
IPCC	Intergovernmental Panel on Climate Change
JI	Joint Implementation
KM^2	Square Kilometers
MOU	Memorandum of Understanding
MPE	Marxist Political Economy
MRV	Monitoring, Reporting, and Verification
Mt	Million Tonnes
$MtCO_2$	Million Tonnes of Carbon Dioxide
$MtCO_2e$	Million Tonnes of Carbon Dioxide Equivalent
NGO	Non-Governmental Organization
NUMSA	National Union of Metalworkers of South Africa
OECD	Organization for Economic Cooperation and Development
PPM	Parts Per Million
REDD	Reducing Emissions from Deforestation and Forest Degradation

REDD+	Reducing Emissions from Deforestation and Forest Degradation, plus conservation, sustainable management of forests, and enhancement of forest carbon stocks
ROW	REDD Offset Working Group
SB	Senate Bill
SISA	State System of Incentives for Environmental Services
SPVS	Society for Wildlife Research and Environmental Education
tCO_2	Tonne of Carbon Dioxide
tCO_2e	Tonne of Carbon Dioxide Equivalent
tCO_2/capita	Tonne of Carbon Dioxide Emitted per Person
UN	United Nations
UNEP	United Nations Environment Programme
UNFCCC	United Nations Framework Convention on Climate Change
USD	United States Dollars
VCM	Voluntary Carbon Market
VCS	Verified Carbon Standard
WCI	Western Climate Initiative
WMO	World Meteorological Organization

Chapter 1: Introduction

The emission reductions associated with REDD programs are not only cost-effective compared to other options for abating emissions because of the low opportunity costs, but also because of the flexibility it would give covered entities in the REDD+ Program…more options mean that covered entities have more emissions reductions opportunities allowing them to determine the least-cost compliance methods.

> –An excerpt from the California Air Resources Board (CARB) White Paper on the use of international, sector-based offset credits in the state's carbon market (CARB, 2015 p. 12)[i]

For years our organizations, most of which are based in California, have been working toward the protection of forests, preventing catastrophic climate change, and promoting ecological justice and social equity. In this context we applaud the State of California for considering new ways to curb its emissions and protect the last remaining tropical forests. However, ROW's [the REDD Offset Working Group] proposal to use rainforests as an offset to replace industrial emissions would achieve none of these objectives.

> -A letter from 27 environmental and social justice organizations to California Governor Jerry Brown and CARB Chairwoman Mary Nichols, opposing the use of REDD+ offsets in the California Cap-and-Trade Program (qtd. in Lang, 2013a)[ii]

They want us to stay in here all huddled up in a corner, without being able to do anything, so that a few days from now, we won't even have fields to plant our crops in. I want someone to explain to me what carbon is, because all I know is that this carbon

isn't any good to us. It's no use to us. They're removing it from here to take to the U.S.… They will sell it there and walk all over us? And us? What are we going to do?

-A rubber tapper expressing his concern about the Purus REDD+ project in the state of Acre, Brazil (qtd. in Faustino & Furtado, 2014, pp. 16-17)[iii]

1.1 Carbon Trading: Climate Policy at The Dawn of Climate Catastrophe

In December 2015, nations from around the globe convened at the 21st Conference of the Parties (COP 21) to the United Nations Framework Convention on Climate Change (UNFCCC) in Paris, France. The goal of the two-week summit was to forge a new international climate treaty to succeed the Kyoto Protocol, the previous climate treaty signed at COP 3 in Kyoto, Japan, in 1997. The outcome of the discussions at COP 21 was the Paris Agreement, which was widely praised for its goal to limit global temperature rise to 2°C above pre-industrial levels, and ideally, 1.5°C (UNFCCC, 2015, p. 2). To date, 194 countries have signed the treaty, which took effect on November 4, 2016.

Indeed, the time for swift and robust action to mitigate climate change has never been more urgent, given the worrying trend in global temperatures and extreme weather events. 2016 was the warmest year since record-keeping began, and the third year in a row to set a record. At present, global temperatures have risen by 1.1°C since 1880, and 16 of the 17 warmest years on record have all occurred since 2001 (NASA, 2017). Perhaps the starkest indicator of what unchecked temperature rise will look like comes from the projection that global temperatures could warm by 4°C above pre-industrial levels by the end of the 21st century (World Bank, 2012, pp. xii-xvi). Albeit in the

opposite direction, 4°C is nearly the same distance as the 4.5°-7°C difference that separates the present climate from that during the last ice age, when several regions in the Northern Hemisphere were covered with ice (p. xvi).

The adverse effects of climate change are becoming pronounced in multiple ways. The August 12-14, 2016, floods in the US state of Louisiana, responsible for the deaths of 13 people and an estimated USD 10-15 billion in damage, were linked to climate change in a recent study. Van der Wiel et al. (2016) found that the odds of a similar-magnitude storm occurring had increased by at least 40% since 1900 due to climate change (p. 2). This type of heavy precipitation and flooding should be expected as the Earth warms, since the atmosphere can hold 7% more water vapour for every 1°C increase in temperature (Trenberth, 2011, p. 124). At the current rate of global warming, areas of the globe located at high latitudes are slated to receive more average precipitation each year through the end of the 21st century (IPCC, 2013, p. 23).

On the other side of the precipitation spectrum, the state of California has experienced a severe, multi-year drought. A persistent, blocking ridge in the jet stream over the northern Pacific Ocean guided winter storms away from California throughout the early 2010s. Researchers concluded that the presence of the massive blocking ridge was three times as likely to occur due to climate change (Swain et al., 2014, p. S6). The consequences of the drought in California's agriculture sector alone were estimated to have cost a total of USD 2.7 billion and contributed to a loss of 21,000 jobs (Howit, MacEwan, Medellín-Azuara, Lund, & Sumner, 2015, ES-1). Dry regions of the globe

located in the mid-latitudes – like California – and the subtropics are also expected to see a decline in precipitation by the end of this century (IPCC, 2013, p. 23).

An outlook for more extreme weather events and long-standing shifts in climate patterns could also jeopardize the livelihoods of millions of people worldwide. 36% of the planet's workforce primarily relies on agriculture for their livelihoods, particularly residents of Asia and the Pacific (40-50%) and Sub-Saharan Africa (66%) (FAO, 2008, p. 1). Due to changes in rainfall patterns and rising temperatures under climate change, global food production may decline by about 10% in 2030 and by more than 20% in 2050, which would seriously endanger these groups' survival (von Braun, 2016). Even for those not fully dependent on agriculture for their existence, elevated food prices from decreased production could still seriously affect many low-income and vulnerable populations. One report predicts that the average price of maize, wheat, and rice in 2050 will increase between 18.4% and 34.1% above what they would otherwise in the absence of climate change (Nelsen et al., 2010, p. 21).

Additionally, when the earth heats up, sea levels rise as polar ice caps melt and water grows in volume by the property of thermal expansion (IPCC, 2013, p. 25). At the current rate of warming, coastal populations will be vulnerable to sea level rise between 0.26 and 0.82 metres, if not higher, by 2100 (p. 25). This threat is already causing the populations of small island states in the Pacific to consider relocating entirely, as residents of the island nation of Kiribati will do beginning in 2020 (Pashley, 2016). Already, the nation of Tuvalu has witnessed 15% of its residents emigrate between 2006 and 2015, while another small island state in the Pacific, Nauru, has seen 10% of its

population leave over the same period (Bawden, 2015). It is not just island nations being affected, though, as a 0.9 metre rise in sea levels by 2100 would also inundate the homes of a projected 4.2 million people in the US alone (Hauer, Evans, & Mishra, 2016, p. 691). Climate change-induced migration is not confined to low-lying coastal regions either. According to the International Displacement Monitoring Centre (2015), 17.5 million people were displaced by weather-related disasters in 2014, and climate change is expected to amplify this trend in the coming years (p. 8).

Together, these statistics reinforce why the wide-ranging and dire ramifications of climate change should be a top priority for international mitigation efforts, including those outlined in the Paris Agreement. One way that signatories to the treaty are to mitigate climate change is by aligning their country's greenhouse gas (GHG) emissions – the principal drivers of anthropogenic climate change – with the 1.5°C and 2.0°C temperature goals, and the treaty expresses a desire for countries to peak their GHG emissions as soon as possible (UNFCCC, 2015, pp. 2, 22). However, of the twenty-four times GHGs are mentioned in the Paris Agreement, not once does the text connect GHGs to the main source behind them, global fossil fuel usage. Emissions from carbon dioxide (CO_2) – the most prevalent and longest-lasting GHG – and other GHGs result primarily from the widespread combustion of fossil fuels (IPCC, 2013, p. 17).[1] In fact, between 2006 and 2015, CO_2 emissions from fossil fuels and industrial processes accounted for 91% of all CO_2 emissions worldwide (Le Quéré et al., 2016, p. 625).

[1] Although CO_2 is the greenhouse gas that causes climate change, the term "carbon" is often used in environmental policy discourse to refer to CO_2, despite the molecular differences between carbon and carbon dioxide. In this piece, any mention of carbon (i.e. carbon trading, carbon offsetting) also refers to CO_2.

Fossil fuels, which include coal, oil, and natural gas, supply 81.1% of the world's total energy, and their production has risen anywhere between 50% (oil) and 193% (natural gas) from 1973 to 2015 (IEA, 2016, p. 6). This trend has also correlated with increased CO_2 levels and temperatures. CO_2 emissions from fossil fuel combustion rose from 15,458 million tonnes of CO_2 ($MtCO_2$) in 1973 to 32,381 $MtCO_2$ in 2014, while the average global temperature climbed by an average of 0.18°C each decade over roughly the same period (Ciais, 2013, p. 467; Milman, 2016). Due to the embeddedness of fossil fuels in global production, cutting down on CO_2 and other GHG emissions to mitigate climate change remains a daunting task.

Over the past several decades, though, a collection of economists, environmentalists, politicians, and business leaders have proposed a strategy to reduce these fossil fuel-based GHG emissions, known as carbon pricing. Supporters of carbon pricing argue that climate change has come about because firms and industries have not factored in the environmental cost of emitting GHGs into their daily business operations (Sandor, Bettelheim, & Swingland, 2002, p. 1608). However, if GHG emissions were assigned a price, or "internalized", as part of an industry's expenses, activities that involved fossil fuels would become more expensive, incentivizing cutbacks in emissions-intensive production methods and consumption patterns (Ervine, 2016, p. 10). Over the past two decades, this strategy has caught on, as 40 national and 20 municipal and subnational governments have put a price on 13% of global GHG emissions (World Bank, 2016, p. 11).

Usually, carbon pricing takes place either through a carbon tax, where a government sets the price to emit a certain quantity of GHGs (usually measured as one tonne of carbon dioxide equivalent, or tCO_2e), or emissions trading, where a government puts a limit on the total amount of GHG emissions allowed in a certain timeframe (Farley, Filho, Burke, & Farr, 2015, p. 244). In the latter method, industries that find it physically difficult or expensive (or both) to reduce their emissions at the source may buy surplus "permits" or "allowances" to cover their emissions from more efficient industries in the scheme, all while staying below the total emissions "cap". This constitutes the "trading" portion of the program (Reyes & Gilbertson, 2010, pp. 90-91).

Emissions trading, also known as "cap-and-trade", has especially caught on. By the end of 2017, 19 cap-and-trade schemes are expected to operate across the globe, which would cover more than 15% of the world's GHG emissions (ICAP, 2017, pp. 20, 22). Proponents assert that cap-and-trade lets industries seek out the cheapest sources of emissions reductions across an entire market, allowing them to lower the cost of mitigating climate change (Sandor et al., 2002, p. 1608; World Bank, 2016, pp. 16, 83). Instead, opponents contend that cap-and-trade is a political project, designed to protect the economic models of fossil fuel-dependent businesses and governments from policies that would require more substantial cuts in GHGs. (Böhm, Misoczky, & Moog, 2012, p. 1624; Ervine, 2012, p. 6). Rather than reducing emissions at the source, entities in a cap-and-trade scheme can purchase surplus allowances in the market to continue business-as-usual (BAU) production that drives climate change.

Another trading option for participants in a cap-and-trade program is a subset known as carbon offsetting. In this arrangement, industries purchase credits (i.e. offsets) from projects that reduce emissions – which are not covered by the cap-and-trade scheme – to compensate for their own continued emissions (Reyes & Gilbertson, 2010, pp. 93-94). However, the environmental and social legitimacy of carbon offsetting as a means of climate change mitigation has been called into question. This is especially true for a type of offsetting known as Reducing Emissions from Deforestation and Forest Degradation, or REDD+. Moving forward, I examine the proposed "linkage" between the California Cap-and-Trade Program and a REDD+ scheme in the state of Acre, Brazil. Drawing on a Marxist Political Economy (MPE) framework, the thesis analyzes the environmental and social components of carbon trading and REDD+ to understand the possible impacts of the so-called "California-REDD+ linkage" in each state. In so doing, it seeks to answer the following related questions: can the California-REDD+ linkage be used to effectively and equitably mitigate climate change; and, how might this linkage affect populations in both California and Acre from an environmental and socio-economic standpoint? Before answering, it is useful to provide some context that underlines the basic arguments for and against REDD+.

1.2 REDD+ Offsetting: A Place for Forest Preservation in Carbon Markets?

As mentioned above, when an entity offsets its emissions, it buys emissions reduction credits to use as its own from a project that is not subject to the requirements of the cap-and-trade scheme (Lovell, Bulkeley, & Liverman, 2009, p. 2361). Emitters are thus given added flexibility in reducing their emissions, which may benefit fossil fuel-

dependent entities that find it cheaper to pay others to mitigate climate change than cut their own GHGs at the source. In the past several decades, numerous offset projects have popped up in low-income, developing countries (the Global South, hereafter referred to as simply "the South") and have attracted investment from heavy emitters in high-income, industrialized states (the Global North, hereafter referred to as simply "the North"). According to proponents, lower costs of land and labour in the South give offset projects there a competitive advantage at producing emissions reductions, compared to the higher costs of these components in the North (Böhm & Dabhi, 2009, p. 11).

Many countries in the South also possess large expanses of tropical forests, a critical source for storing CO_2 emissions. Tropical forests absorb nearly 20% of fossil fuel-based CO_2 emissions globally, but this rate is shrinking with widespread deforestation. Between 2000 and 2010, 13 million hectares of forests were lost to human or natural causes every year (Hall, 2012, p. 4). Additionally, CO_2 emissions from land use change, which includes deforestation for agriculture and logging, were estimated to comprise 9% of global CO_2 emissions from 2006 to 2015 (Le Quéré et al., 2016, p. 625). Therefore, implementing strategies that prevent deforestation and forest degradation-related emissions from occurring – the basis of REDD+ – is an important part of combatting climate change and preserving the role of rainforests as the "lungs of the earth", taking in CO_2 to regulate the climate and releasing oxygen to sustain life.

Noting the integral climatic function that trees provide, many businesses, government policymakers, non-governmental organizations (NGOs), and financial institutions have sought to invest in REDD+ projects as a source of carbon offsets

(CARB, 2015; Code REDD, 2013; ROW, 2013). Supporters claim that REDD+ offsets represent a "win-win" solution, a cost-effective method for Northern emitters to combat climate change while channelling funding for development and conservation initiatives to populations in the South (Angelsen & McNeil, 2012, p. 35). REDD+ offsets, advocates contend, give industries a cost-effective means to mitigate climate change, and generate economic growth opportunities for businesses that develop offset projects and technologies to measure and monitor emissions reductions (Code REDD, 2013). As former Norwegian Prime Minister Jens Stoltenberg bluntly put it, REDD+ makes sense as a quick and easy solution to climate change because "everybody knows how not to cut down a tree" (qtd. in Angelsen & McNeil, 2012, p. 35). Article 5 of the Paris Agreement also identifies REDD+ as a mechanism for mitigating climate change, possibly as part of a post-2020, UN-administered international carbon market (UNFCCC, 2015, p. 23).

On the other hand, critics of REDD+ offsetting reject the notion that emissions reduction credits from avoided deforestation projects contribute to a "win" of any sort. Environmentally speaking, an industry purchases a tCO_2e offset credit to compensate for an actual tCO_2e it emits from fossil fuel combustion, meaning that overall, emissions do not decline (Lang, 2009, p. 216). Carbon forestry projects like REDD+ also face significant obstacles to ensuring that reductions in deforestation would not have occurred without industry payments ("additionality"), are not lost to human or natural causes ("non-permanence"), and are not cancelled out if forest clearing activities simply relocate outside the project boundaries ("leakage") (McAfee, 2015, p. 340).

Opponents also argue that REDD+ offsetting, like all carbon trading strategies, favours cuts where emissions reductions are cheapest, not where they are most necessary. This is evident as heavy emitters in the North outsource the responsibility to reduce emissions to cheap offset project sites in the South, including REDD+ schemes (Bachram, 2004; Bond, 2011). However, given that countries in the South have contributed far less to climate change over the last 200 years than wealthy, industrialized countries in the North, offsetting is not an equitable emissions reduction strategy. Poor, disadvantaged groups in both the North and South also bear a disproportionate risk to the effects of continued GHG emissions through higher costs for food and energy and vulnerability to the extreme weather events described earlier. Thereby, programs that merely compensate for emissions, rather than reduce them, will continue to expose the poor far more than the wealthy to the costs of climate change (Storm, 2009, p. 1021).

Furthermore, studies of past and current carbon forestry projects have revealed some troubling effects. Some forest dwelling communities have been evicted from areas slated for offset credit generation (Beymer-Farris & Bassett, 2012; Cavanagh & Benjaminsen, 2014). Others have experienced negative alterations in their traditional and customary rights to hunt, cut trees, and engage in other subsistence and income-generating activities in forested areas when offset projects commence (Asiyanbi, 2016; Faustino & Furtado, 2014; Kill, 2014). Drops in the market price for offsets have also deprived rural communities of carbon revenues that were expected to follow from the sale of REDD+ credits (Chomba, Kariuki, Lund, & Sinclair, 2016).

1.3 Thesis Statement

By utilizing a MPE framework, which locates capitalist production as the cause of the climate crisis, I argue that the California-REDD+ linkage, like carbon trading in general, cannot be used as an effective or equitable solution to mitigate climate change. I posit this because sufficient evidence exists to demonstrate that REDD+ offsetting favours capitalist, economic growth over significant and credible reductions in GHG emissions, while also negatively impacting the livelihoods of communities incorporated into these trading networks. To illustrate this point, I build off the vast literature on carbon trading and carbon forestry offset projects and examine the likely, detrimental effects of the California-REDD+ linkage in both California and Acre. The selection of these case studies exemplifies how carbon trading and REDD+ programs can yield negative environmental impacts (false emissions reductions) and socio-economic consequences (restricting or altering access to land and resources). These ramifications affect populations in both the Global North and South, a testament to the wide-ranging effects of future carbon market development. Above all, I plan to demonstrate that market-based forms of climate change mitigation, like REDD+ offsetting, are incompatible with the tremendous cuts in GHGs required to avoid climate catastrophe. This last point brings me to a clearer description of the theoretical framework I have used to develop my argument.

1.4 Theoretical Framework

In this thesis, I use MPE to explain the environmental and social implications of carbon trading as a response to the climate crisis, and to analyze the potential California-

REDD+ linkage. Broadly speaking, MPE stems from the extensive writings of Karl Marx on how capitalism as a socio-economic system contains numerous contradictions that threaten its very existence. Capitalist development is driven by a growth imperative, which compels industries to lower their costs in order to gain ever-larger profits. These profits are then used to expand production, which industries must do to avoid going out of business in competitive marketplaces (Luxemburg, 1951). Applied to the environment, a Marxist perspective points to the ways in which capitalist industries deplete natural resources (like fossil fuels) to continue growing and profiting, but simultaneously neglect to account for the cost of this degradation (like releasing GHG emissions from fossil fuel combustion) (Malm, 2013, pp. 52-53; O'Connor, 1988, 1991). Consequently, as fossil fuels become rooted in the circuit of capitalist production as a central means of obtaining greater profits, so do GHG emissions (Malm, 2013, p. 53). Therefore, understanding the growth imperative of capitalism is key to explaining the present climate crisis (Foster, 2011).

MPE is a useful framework for this thesis because it helps unravel why carbon trading has emerged as the dominant method of global climate change mitigation. In the past, capitalist firms and governments in the North have responded to their growth imperative through imperialism, seizing resources and assets from populations in the South (Harvey, 2004, p. 74). More recently, carbon markets have accommodated this growth imperative by allowing industries to purchase allowances or offsets to continue BAU growth, while leaving emissions at the source untouched (Ervine, 2013, p. 656). By enclosing, pricing, and marketizing (in all, "commodifying") GHG emissions for

exchange, carbon markets also provide a boon to traders, consultants, project developers, and others that can turn a profit off the new trade in GHG commodities (Ervine, 2013, p. 656; Lohmann, 2005, p. 205).

Additionally, MPE provides insight on why REDD+ offsets have become a desired source of emissions reductions for capped industries. In a carbon trading program, all GHG emissions are deemed to have the same impact on the planet, no matter where or how they were produced. Because of this, low-cost emissions reductions are prioritized over more effective and expensive strategies that could permanently lead away from fossil fuel usage (Lohmann, 2012, p. 91). One may view REDD+ offsets as a recent extension of this practice, as wealthy, industrialized emitters in the North seek out cheaper offset commodities in the South to alleviate the costs of complying with environmental policies (Bachram, 2004; Bumpus & Liverman, 2008).

This thesis also uses MPE to address the socioeconomic effects of REDD+ offset projects, specifically related to how forest dwellers, indigenous communities, and others in the North and South are affected by this new phase of capitalist expansion. Carbon forestry project developers have taken often harmful measures to guarantee the environmental integrity of offset commodities, such as evicting communities from forested spaces or restricting their interactions with forests (Beymer-Farris & Bassett, 2012, Cavanagh & Benjaminsen, 2014; Kill, 2014). An MPE perspective sees these acts as enabled by a distinct power asymmetry, where wealthier project developers and offset buyers demand enclosed spaces to generate offsets and assist growth, negatively affecting the human-environment interactions, income-generating opportunities, and use and

access rights of poorer communities (Böhm et al., 2012, p. 1624; Fairhead, Leach, & Scoones, 2012, pp. 238-239).

In contrast, other approaches do not challenge global capitalism and market-based environmental strategies nearly to this extent. For example, a neoclassical economic approach, promoted in the works of Sandor et al. (2002) and Stern (2009), takes the commodification of GHGs for market trade as a prerequisite for climate change mitigation. These economists are primarily concerned with how to provide firms, industries, and other market actors with a clear price signal through which to cost-effectively reduce their emissions. (Sandor et al., 2002, pp. 1608-1609; Stern, 2009, pp. 99-100, 107). This includes giving industries the flexibility to invest in cheaper projects that preserve or plant trees in tropical forested countries (Sandor et al., 2002, p. 1614; Stern, 2009, p. 166).

However, the neoclassical approach falters because it assumes that market trade in GHGs is a politically neutral strategy. Conversely, a strict focus on price signal disguises the power relations that reveal to whom a given solution to climate change is most cost effective for (McAfee, 2015, p. 343). For instance, an oil refinery may find it cheaper to offset its emissions via a REDD+ project than to cut them at the source. Yet, populations in the REDD+ project location, who may not have contributed to climate change at even a fraction of the refinery's rate, are now tasked with a new cost of withholding from deforestation activities in the project area, which offset payments may not fully compensate for. Furthermore, the potential for a clear carbon price to correct the "market failure" of climate change is slim when carbon trading does not confront the root cause of

climate change in the first place, the capitalist growth imperative (Storm, 2009, p. 1016-1017).

An MPE framework also goes deeper its analysis of carbon trading than many existing critiques on the subject do. This observation is inspired by Böhm et al. (2012), who highlight the wide spectrum that critiques of carbon markets fall on (p. 1624). What these critiques do have in common is that they reject a strictly neoclassical approach to carbon market design, and acknowledge the many environmental and social problems of carbon trading schemes so far. However, as Böhm et al. (2012, p. 1624) note, even some critical political economists (see Bailey, Gouldson, & Newell, 2011; Newell & Paterson, 2010) believe that the structure in which carbon markets operate can be improved through stronger regulation and better integration across economies.[2] Other authors are even more critical (see Bachram, 2004; Bond, 2012; Lohmann 2005, 2012, 2015), and dismiss the idea that carbon markets can seriously or equitably mitigate climate change even through comprehensive reform. In their view, carbon markets are designed first and foremost to protect the business models of fossil fuel-dependent entities, and additionally to spur new growth opportunities through the commodification of GHG emissions (Böhm et al., 2012, p. 1624; Ervine, 2013, p. 656).

MPE pushes even the most rigorous critiques of carbon trading further by firmly positioning global capitalism as the cause of the climate crisis. Moreover, an MPE framework vitally situates carbon markets within the historical development of

[2] Newell & Paterson (2010), for example, advocate for "Climate Keynesianism", where "markets are not abandoned, merely better governed to direct them more closely towards the goal of decarbonisation and to ensure the 'environmental integrity' of offsets both in the CDM [Clean Development Mechanism] and the voluntary markets" (p. 173).

capitalism, creating new accumulation opportunities for some and protecting fossil fuel-dependent growth for others (Böhm et al., 2012; Ervine, 2013). While criticisms of carbon markets from a variety of perspectives are welcome and essential, an MPE framework is best at sufficiently explaining the environmental and social consequences of carbon market development thus far. Otherwise, any efforts to reform carbon trading schemes will be forever constrained by the limitations of the capitalist system that they both operate in and accommodate.

1.5 Methodological Overview

This thesis was developed through an extensive, qualitative literature review. This was undertaken to situate the case study at hand within the greater debates on carbon trading and REDD+ as responses to the climate crisis. The types of works consulted include scientific papers, peer-reviewed journal articles and books, and reports and statements from NGOs, policy institutes, international institutions, and environmental and social organizations, which are readily available online. The results of this search helped to establish MPE as the best framework through which to analyze the rise of carbon trading and assess the theoretical and empirical implications of carbon trading schemes.

For the case study, a content analysis of written material was utilized to connect the theoretical framework and earlier literature review to the environmental and social consequences of a California-REDD+ linkage. The material reviewed includes: reports, data, and documents from CARB and outside research bodies on the design, current statistics, and possible changes to the California Cap-and-Trade Program; reports, statements, and letters from environmental and social groups, international institutions,

NGOs, consultants, and media sources advocating for or against REDD+ offsets; and peer-reviewed journal articles and NGO reports presenting case studies of carbon forestry projects in Brazil and elsewhere. These documents are also available online, and furthermore provide a wealth of information regarding the diverging opinions on the California-REDD+ linkage and the rationales for these viewpoints.

Additional ethnographic observation was conducted at the Carbon Expo conference, May 25-27, 2016, in Cologne, Germany. Hosted by the World Bank and the International Emissions Trading Association, the 2016 Carbon Expo attracted one of the largest collection of players and proponents of global carbon markets internationally. Among the 2,000 attendees were representatives from large international organizations (the UN, World Bank), national governments (Germany, Spain), banks, private companies, NGOs, and others involved in market-based climate policy. Providing over 20 hours of participant observation, the conference served as a valuable tool in connecting the literature on carbon markets, offsetting, and REDD+ to current events and discussions on the trajectory of carbon trading programs. Research Ethics Board approval was attained from Saint Mary's University prior to the conference.

1.6 Chapter Outline

This thesis is presented in five chapters. Chapter 2 serves as the literature review and explains why fossil fuel-led capitalist development is responsible for the climate crisis, and how carbon trading has become the dominant global strategy to mitigate climate change. The chapter situates the development of carbon trading within the rise of neoliberal capitalism, in which free markets are believed to be capable of both

stimulating economic growth and protecting the environment. It also examines the environmentally and socially-based critiques of carbon trading that are rooted in MPE, with special attention paid to research and case studies on carbon forestry offsetting. These carbon forestry projects have emerged from the compliance-based carbon market of the UN's Clean Development Mechanism, as well as projects that have originated outside of this channel in the voluntary carbon market (VCM).

Chapter 3 focuses on the California-REDD+ linkage in relation to California, and examines the political-economic history of the state's Cap-and-Trade Program in the lead-up to the possible linkage. This history illuminates why private industries and the state government have promoted cap-and-trade and offsetting, and why the environmental justice community and its allies have opposed market-based climate policies. Additionally, the chapter documents how REDD+ offsets may figure into the future of the Cap-and-Trade Program, and outlines the main arguments and concerns regarding the California-REDD+ linkage from the perspective of supporters and critics.

Chapter 4 examines the development of REDD+ in Acre, located within the context and history of environmental policy and land tenure in Brazil more broadly. This information provides the basis for describing how Acre came to adopt its State System of Incentives for Environmental Services (SISA) program, which observers have dubbed the world's first jurisdictional REDD+ program. Furthermore, this section utilizes case studies from past and present carbon forestry projects in Brazil and Nigeria to analyze how the linkage may negatively impact forest dwelling communities in Acre. I utilize Fairhead et al.'s (2012) concept of "green grabbing", where rich, powerful entities

appropriate resources from poorer populations for environmental ends, to explain the theoretical backing behind the detrimental effects of carbon forestry projects.

Chapter 5 analyzes whether or not the California-REDD+ linkage would contribute to effective and equitable climate change mitigation. Specifically, I frame my closing argument under the concepts of environmental integrity, environmental injustice, "carbon colonialism", and green grabbing, gained from the information laid out in Chapters 2 through 4. The chapter also summarizes the overall themes and lessons to take away from this thesis, which centre on identifying the dominance of global capitalism as the key obstacle in forging effective climate policy. A final section considers the tremendous struggle of overcoming the twin hurdles of fossil fuel dependency and capitalist development to combat climate change. As a result, the push for effective and just alternatives to the present market-led model of climate policy will require widespread mobilization and coordination on an unforeseen scale.

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[i] The full title of the paper is, *Scoping Next Steps for Evaluating the Potential of Sector-Based Offset Credits under the California Cap-and-Trade Program, including from Jurisdictional "Reducing Emissions from Deforestation and Forest Degradation" Programs*

[ii] The letter from these organizations came in response to the REDD Offset Working Group's final recommendations on how CARB should utilize REDD+ offsets in its Cap-and-Trade Program. CARB organized the REDD Offset Working Group in 2011 to formulate how California might "link" its carbon market to jurisdictional REDD+ schemes

[iii] The state of Acre could supply the California Cap-and-Trade Program with REDD+ offsets as early as 2018.

Chapter 2: Literature Review

2.1 Introduction

Climate change – brought on primarily by fossil fuel-based GHG emissions – is an immediate and dangerous threat to the planet, capable of unleashing extreme weather events, jeopardizing food security, and provoking mass population displacement. Global policymakers have touted carbon pricing as a logical response to lower these emissions, and carbon trading has emerged as the most popular method of doing so. While some form of carbon pricing covered 13% of global GHG emissions in 2016, cap-and-trade schemes made up most of this, at 9% of global GHG emissions (ICAP, 2016, p. 26; World Bank, 2016, p. 11). Yet, carbon trading is not by any means the only choice of climate policy. Government policies that phase out or restrict the usage of fossil fuels, like coal, have in recent years demonstrated how strict regulations can drive significant emissions reductions (Littlecott & Schwartzkopff, 2015, pp. 11-12). Why then, has carbon trading become a more popular method to mitigate climate change globally?

Drawing from the MPE framework outlined in Chapter 1, this chapter argues that carbon trading is a distinctly capitalist response to the climate crisis, and protects the business models of heavy emitters over more substantial, credible, and equitable mitigation strategies. Section 2.2 begins by detailing the role of global capitalism in giving way to the present climate crisis. Under the growth imperative of capitalism, fossil fuels have become entrenched in the circuit of capitalist production to lower costs and increase profits. However, fossil fuel combustion, largely in the Global North and in

rapidly industrializing countries like China and India, releases vast quantities of planet-warming GHGs like CO_2, causing the climate crisis.

Section 2.3 explains how carbon trading has aligned with the market-centred, growth-oriented theory of neoliberalism from the 1970s onward. Proponents of neoliberal environmentalism argue that by commodifying GHG emissions from all sources and locations, free markets will reveal the most cost-effective places for an entity to achieve emissions reductions and sustain BAU growth at home. A subsequent analysis of the United Nations' Kyoto Protocol shows how carbon trading developed on the international stage, especially through the Clean Development Mechanism (CDM) for carbon offsetting. This discussion provides essential background on the development of carbon forestry offsetting, including afforestation and reforestation (AR) projects (part of the CDM) and REDD+ (excluded from the CDM). Above all, this section concludes that the main goal of all offsetting strategies is to provide "flexible", "least-cost" strategies for heavy emitters in the North to comply with the GHG reduction targets mandated under the Kyoto Protocol.

Section 2.4 problematizes carbon trading and carbon forestry as strategies that foster or accommodate fossil fuel-intensive capitalist growth, do not ensure substantial or credible emissions reductions, and yield negative social ramifications. An analysis of the logic behind carbon offsetting reveals that, in fact, offsetting merely cancels out fossil fuel emissions instead of reducing GHG emissions overall. Measuring and monitoring emissions reductions from forestry projects is also an incredibly difficult task, and undermines the environmental integrity of offset credits. Additionally, this section

provides examples from past and current carbon forestry projects, including REDD+ schemes, to show how carbon trading can further social injustices. This can lead to carbon colonialism and green grabs, which reinforce the economic and environmental dominance of the North over the South and worsen the socioeconomic situations and livelihoods of forest dwelling communities.

2.2 Fossil Capitalism and the Climate Crisis

Skyrocketing CO_2 levels and anthropogenic climate change have only arisen since the mid-1800s as fossil fuel-powered capitalist production has spread globally. A discussion of capitalism as a socioeconomic system is warranted, as such, to fully grasp why the climate crisis has come about. In a capitalist system, the owners of firms and industries engage in the production of commodities, which are objects produced for sale in markets (Polanyi, 1944, p. 72). The owner of capital must sell the finished commodities for a price that will cover the costs of both human labour and the means of production, like raw materials and machinery, used to make that commodity. The money left over, or profit, is a central driving force behind this capitalist form of commodity production in the first place. Without the reasonable expectation of profit, an owner of capital will not want to risk losing a return on her investment in labour and the means of production (Luxemburg, 1951; Harman, 1979). To ensure profit in a competitive marketplace, then, a capitalist must sell an increasingly greater number of commodities for as cheaply as possible, reinvesting the profits to expand production (Luxemburg, 1951).

In contrast to other economic systems like feudalism or Soviet-style communism, production in a capitalist system is determined purely by the number of people willing to pay for a commodity (effective demand), not a consideration of which commodities fulfill societal needs. Without enough effective demand, the capitalist will fail to both yield a profit and pay off her production costs, thereafter going out of business. Meanwhile, competing industries will expand their own operations by increasing market share for their finished commodities (Luxemburg, 1951). The Marxist theorist Rosa Luxemburg (1951) concisely summarizes this growth imperative of capitalism, in that "expansion becomes in truth a coercive law, an economic condition of existence for the individual capitalist."

Additionally, an important quality of the capitalist mode of production is that it effectively divides society into two groups. The first are capitalists, who own the means of production and employ the labour force required to generate a profit from commodity production. The second are workers, who lack this ownership and are compelled to sell their labour to capitalists in exchange for a wage to sustain themselves. This arrangement creates a division between the capitalist class and the working class, with the former seeking to lower their production costs and increase profits, and the latter fighting for higher pay and better working conditions (Harman, 1979).

Capitalists have found they can both expedite growth and control their labour force by using fossil fuels as the primary energy source in production. To start, fossil fuels present an easily transportable and storable input for industries to expand with (Altvater, 2006, p. 41). Andreas Malm (2013) illustrates this point through his account of

the British cotton industry's shift from water-powered mills to coal-powered steam engines in the mid-19th century. Before the advent of coal power, cotton mills were located directly next to their power source, waterfalls in the countryside. This was disadvantageous for the cotton industry since the location was far from markets to sell the finished product in and from an abundant labour supply to staff the mills with. The introduction of coal allowed for the construction of factories in burgeoning urban centres where this workforce resided (Malm, 2013, pp. 32-33). Cotton factory owners were no longer dependent on rural waterfalls to power production, as coal could be easily shipped and stored in multiple locations where access to labour that was "substitutable, expendable, and adapted to machinery" was greatest (pp. 33, 39). The consolidation of cotton mills in cities also allowed owners to exert greater control over their workforces. In the sparsely-populated countryside, workers possessed stronger bargaining power, since there were not many options to replace them. However, workers in urban factories were forced to compete with a growing number of other labourers, giving employers greater power in structuring production and disciplining their staff (pp. 53-54).

Fossil energy could also function with the same intensity year-round, removed from the variations and natural cycles of non-fossil energy types (Altvater, 2006, p. 41). Again, Malm (2013) cites the drawbacks of water-powered versus steam-powered cotton plants to document this point. When the water flow at a cotton mill was low, the owner of the plant had no choice but to send workers home and make up for the lost time on another date (Malm, 2013, p. 41). In contrast, the energy potential of coal is separate from that of its underground origin, which eliminated the contingent nature of water

power. Steam power supplied consistent energy intensity that greatly accelerated worker productivity, enabling a labourer to produce more in a shorter period (p. 41). Together, the two distinct advantages of fossil fuel-based energy – lack of geographical fixity and independent energy flows – provided a boon for capitalist industries to produce more commodities, attain higher profit margins, and control their labour forces.

In addition to coal, oil became another fossil fuel used to accelerate capitalist production. In fact, oil is a more efficient form of fossil energy than coal. Oil is forced toward the surface from underground pressure, and as a liquid, it can be transported through pumping stations and pipelines rather than by railroad or carts, both of which minimize the labour costs needed to extract and distribute it (Mitchell, 2011, p. 36). Overall, the extraction and transportation process for oil does not require as much labour and capital as other forms of energy, which gives it a very high "Energy Returned on Energy Invested" (EROEI) (Altvater, 2006, p. 39; Mitchell, 2011, p. 36). Oil thus presents capitalist industries with a marked efficiency and profit-making advantage over coal. Together, though, all fossil fuels – coal, oil, natural gas – have helped lower the costs of capitalist production at a greater rate than non-fossil energy forms, facilitating the growth imperative of capitalism and stimulating industry profits.

To demonstrate how ubiquitous fossil energy has become in the world economy, one only needs to observe the historic rise in global fossil fuel use rates. The world's "total primary energy supply", defined by the International Energy Agency (IEA) as the total amount of energy production by fuel type, increased for all fossil fuels from 1973 to 2014. Coal consumption rose from 3,074 million tonnes (Mt) in 1973 to 7,709 Mt in 2015

(IEA, 2016, p. 14). Oil consumption followed suit, increasing from 2,869 Mt to 4,331 Mt over the same period (p. 10). When adding in natural gas consumption, in 2014 fossil fuels were responsible for 81.1% of all energy production globally (p. 6). Reflecting on the dominant role of fossil fuels in global production, Malm (2013) has developed a model of fossil capitalism:

> Money – Commodities (Labour Power + Means of Production (Fossil Fuels)) … Production ^ (CO_2) … Commodity Increment – Money Increment (Malm, 2013, p. 52).

This model illustrates the circuit of fossil capitalist production, a process that leads to a continuously increasing usage of fossil fuels and production of CO_2. The capitalist invests money into paying workers' wages, purchasing machinery and tools, and acquiring fossil fuels for use in production. When fossil fuels burn and combust, they release CO_2 (and other GHGs) into the atmosphere. A greater number (i.e. increment) of finished commodities will ideally yield a greater profit for the owner of capital to expand production with in the future, a symptom of the growth imperative. In so doing, fossil fuel extraction and CO_2 emissions become intertwined with commodity production when the circuit starts anew (Malm, 2013, pp. 52-53).

One can ascertain the serious climatic impact of CO_2 by understanding its scientific properties. CO_2 does not immediately break down after being emitted, but rather circulates between the different "reservoirs" that take it in from the atmosphere,

including vegetation, soils, and the ocean (Ciais et al., 2013, p. 544). Each reservoir takes a long time to sequester atmospheric CO_2: vegetation sequestration takes up to 100 years; soils up to 500 years; the deep ocean up to 2000 years (p. 544). As fossil fuel emissions continue and intensify, each reservoir experiences a diminished capacity to absorb CO_2, and more of it remains in the atmosphere (p. 544). Although these reservoirs have stored roughly half of the CO_2 emitted since the dawn of the Industrial Revolution in the mid-18th century, this sequestration is not permanent because these reservoirs will also release CO_2 in addition to taking it in – for example, when trees and other forms of vegetation are lost to fires or impacted by disease (p. 546).[3]

Once emitted, CO_2 and other GHGs like methane (CO_4), halocarbons (including HFC-23), and nitrous oxide (N_2O) directly influence climate change through the greenhouse effect. Here, incoming ultraviolet solar waves pass through GHGs in the atmosphere and are absorbed by various surfaces on Earth. About 30% of these waves are reflected into space in the form of infrared energy. GHGs get their name because although they originally let the ultraviolet waves in, they trap many of the outgoing infrared waves, like a greenhouse. The infrared radiation remaining in the atmosphere is then released in the form of heat energy and warms the planet (Lallanila, 2016). Of these GHGs, CO_2 is the most prevalent and will linger in the atmosphere for the longest amount of time, making it the focal point of climate change mitigation efforts (Ciais, 2013 pp. 470, 473). Indeed, Ciais et al. (2013) predict that between 15 to 40% of the CO_2 emitted until 2100 will stay in the atmosphere for over 1000 years (p. 472).

[3] Ciais et al. (2013) define permanence as a period of time longer than ten of thousands of years (p. 546).

Recent data shows the connection between the CO_2 content in the atmosphere, fossil fuel-based CO_2 emissions, and global temperature rise quite clearly. From 1750 to 2016, the atmospheric CO_2 concentration rose from 278 parts per million (ppm) to 400ppm, an unprecedented statistic when considering that in the previous 7,000 years leading up to 1750, the atmospheric CO_2 concentration only increased by about 20 ppm (Ciais et al., 2013, pp. 467-468; NOAA, 2016). Tellingly, the last time the atmospheric CO_2 content reached 400ppm was between 3 and 4 million years ago (NOAA, 2016). During this era, sea levels were 65 feet (20 metres) higher than today and the planet was so warm that trees grew near the North Pole (Milman, 2016). In 2014, 32,381 $MtCO_2$ were emitted from fossil fuel combustion, up from 15,458 $MtCO_2$ in 1973 (IEA, 2016, p. 44). Simultaneously, the global average temperature has risen 1.1°C above pre-industrial levels, the hottest the planet has been in 115,000 years, and continuing the alarming trend of global temperatures warming by 0.18°C each decade over the past 45 years (Milman, 2016; NASA, 2017).

This evidence has led the Intergovernmental Panel on Climate Change (IPCC) to state that it is *extremely likely* that anthropogenic CO_2 and GHG emissions from economic growth are the cause of unprecedented global warming since the mid-20th century (IPCC, 2014, p. 4, emphasis original). Importantly, the IPCC (2014) states that the phrase "extremely likely" means there is a 95-100% assessed likelihood of a certain outcome or result, based on the IPCC contributors' confidence in their statistical analyses of observations, model results, or expert judgment (p. 2). Based on this explanation,

"extremely likely" is as close as the IPCC can come to saying that human activity is indisputably responsible for rising temperatures.

Critically, though, not all regions of the globe are responsible for the current state of the climate crisis. The wealthy, advanced capitalist countries in the North were the first to industrialize, and consequently, the first to release vast quantities of CO_2 into the atmosphere. In 1850, the UK was the world's largest emitter, generating over 60% of the planet's fossil fuel-based CO_2 emissions, (Friedrich & Damassa, 2014). The United States, France, Germany, and Belgium rounded out the remainder of the top five emitters in 1850, together making up 94% of all fossil fuel-based CO_2 released worldwide that year (World Resources Institute, 2016). Over the next century and a half, GHG emissions continued to rise in these countries and others – mostly in North America and Europe – that had extensively incorporated fossil fuel use into daily production processes and consumption patterns. CO_2 emissions really escalated in the United States, which overtook the UK as the world's largest fossil fuel-based CO_2 emitter in 1888, and held onto this title for over a century (Friedrich & Damassa, 2014). From 1900 to 2010, fossil-based CO_2 emissions from the seven wealthy countries making up the informal "G7" bloc vastly exceeded those from the entire regions of Africa, Latin America, and the Caribbean combined by 1,567 $MtCO_2$ in 1900 and 6,443 $MtCO_2$ in 2010 (World Resources Institute, 2016).[4]

In recent years, a few countries outside of the European-settled, early industrialized states have closed the CO_2 emissions gap between North and South. The

[4] The G7 includes Canada, France, Germany, Italy, Japan, the UK, and the US

overwhelming contributor is China, whose emissions surged in the late 20th century as it rapidly industrialized, culminating when it passed the US as the world's largest CO_2 emitter in 2005 (Friedrich & Damassa, 2014). China alone was responsible for 9,087 $MtCO_2$ emissions from fossil fuel-based sources in 2014, 28% of the world's total (IEA, 2016, pp. 45, 50). India is another country that is quickly industrializing, with a corresponding boom in GHG emissions to prove it. In 2014, India generated 2,020 $MtCO_2$ emissions from fossil fuels, over 6% of the world's total (p. 52).

Tropical forested countries have also experienced a surge in CO_2 emissions over the past several decades, but mainly from non-fossil fuel sources. Instead, deforestation-related activities are largely to blame for these emissions, which stem from large-scale agriculture, livestock, mining, and timber operations that clear forests and release sequestered CO_2 (De Shazo, Pandey, & Smith, 2016, pp. 53-54). Climate change-related effects, such as more frequent droughts and fires, also lead to trees dying and releasing CO_2 (Lang, 2016b). Brazil is the largest emitter of CO_2 from tropical deforestation, averaging 722 $MtCO_2$ worth of deforestation emissions per year from 2001 to 2014 (Global Forest Watch, 2016a). Indonesia follows in second place, having released an average of 447 $MtCO_2$ from activities related to deforestation over the same period (Global Forest Watch, 2016b).

Despite the increase in CO_2 emissions from rapidly industrializing countries and from activities related to deforestation, countries in the North still bear the greatest responsibility for contributing to climate change from their historic and present CO_2 emissions. Between 2006 and 2015, fossil fuel combustion and industrial production are

estimated to have generated 91% of all anthropogenic CO_2 emissions, while activities related to land use change caused the other 9% (Le Quéré et al., 2016, p. 625). CO_2 emissions from land use change have also remained constant from 1960 to 2015, while fossil fuel and industrial-based emissions have risen over this same stretch (pp. 625-626). Furthermore, countries in the mid-Northern latitudes (largely corresponding to states in the Global North) were responsible for most emissions from large-scale deforestation and land use change prior to the 1980s. Only from the 1980s onward did tropical deforestation in the South, including Latin America, Africa, and Asia, take over as a bigger contributor to emissions from land use change (Ciais et al., 2013, p. 491).

Even so, export-oriented, commercial agriculture is the largest factor in deforestation across the South. Large-scale agriculture contributes to 40% of deforestation in Latin America, Africa, and Asia, while subsistence-based agriculture only makes up 33% (FAO, 2016, p. 88).[5] In Latin America specifically, commercial agriculture for soybean, beef, and oil palm (biofuels) drives an even larger 70% of deforestation (p. 88). As such, deforestation has not occurred in the South in isolation, but rather as part and parcel of the growth of global commodity markets. Brazil, for example, was the world's third largest exporter of agricultural products in 2014, worth USD 88 billion and falling only behind the European Union (EU) bloc and US (WTO, 2015, p. 77). These numbers are consistent across South America as well. Member states of the Andean Community customs union exported USD 67 billion more in fuels, agricultural products, and mining products than they imported in 2014, while countries in the

[5] Mining, urban expansion, and infrastructure rounds out the other 27% of deforestation

Mercosur trading bloc exported USD 180 billion more than they imported of these same products (pp. 55-56).[6]

A comparison of different regions' per-capita emissions rates also puts the North's overwhelming contribution to climate change into perspective. Member states of the Organization for Economic Cooperation and Development (OECD), a collection of 35 high to middle income countries mostly located in the North, averaged a per-capita emissions rate of 9.36 tonnes of CO_2 per person (tCO_2/capita) in 2014. OECD countries with even higher rates were the US (16.22 tCO_2/capita), Australia (15.81 tCO_2/capita), and Canada (15.61 tCO_2/capita) (IEA, 2016, pp. 49, 51, 57). China, the world's largest emitter, had a smaller per-capita emissions rate of 6.66 tCO_2/capita (p. 49). Even more revealing, non-OECD countries in Asia and Africa had minuscule per-capita emissions rates of 1.58 and 0.96 tCO_2/capita respectively (p. 49). Although CO_2 emissions may be increasing across many regions, clearly the wealthy, industrialized countries in the North have disproportionately contributed more to climate change than those in the South, and continue to do so today.

To summarize, fossil fuel combustion by itself emits CO_2, causing climate change by trapping solar radiation and inducing global warming. Combined with the efficiency advantages fossil fuels present to growth-driven capitalist industries, fossil fuel usage has exploded, accompanied by a dramatic rise in the global concentration of atmospheric CO_2. Armed with an understanding of the fact that the North has brought on the climate crisis by its overwhelming historic and present use of fossil fuels (even as emissions in

[6] The Andean Community comprises Bolivia, Colombia, Ecuador, and Peru, while Mercosur includes Argentina, Brazil, Paraguay, and Uruguay

the South increase through industrialization and deforestation), the next section turns to showing how representatives from businesses, governments, and international institutions, influenced by a neoliberal, market-led approach to environmental policy, have formulated carbon trading as the least disruptive response to BAU, fossil fuel-led capitalist growth.

2.3 The Origins of and Arguments for Carbon Trading

In the years immediately following World War II, and decades before policymakers had started debating how to lower GHG emissions, governments in heavy-emitting, advanced capitalist states were taking on a more active role in regulating their economies for a different reason. Drawn from the work of the British economist John Maynard Keynes, the ideology of "embedded liberalism", or "Keynesianism", emphasized that governments should regulate different business sectors with the goal of promoting full employment and limiting inflation (Harvey, 2005, pp. 10-11). Keynesian policies were designed to prevent shocks like the Great Depression – in which a decade of free market policy triggered a widespread economic crisis in these same advanced capitalist states – from occurring in the future (p. 21). Additionally, a so-called "class compromise" would provide workers with social welfare benefits, like healthcare and education support, from the state's increased economic output (Harvey, 2005, p. 10; Moore, 2011, p. 135). Under Keynesianism, an active regulatory state was viewed as an integral part of ensuring stable, economic growth, while also extending welfare support to its citizens.

The regulatory apparatus of the Keynesian state also extended to the environment, seeking to curtail environmentally-harmful forms of economic growth (McCarthy & Prudham, 2004, p. 278). For example, the US government passed the Clean Air Act, Endangered Species Act, Marine Mammal Protection Act, and created the Environmental Protection Agency throughout the 1960s and early 1970s, an era when US Republican President Richard Nixon even declared "we are all Keynesians now" (qtd. in Harvey, 2005, p. 13). Furthermore, international organizations and environmental movements were beginning to sound the alarm on the environmental consequences of unchecked economic growth. The Club of Rome's 1972 publication, *The Limits to Growth*, projected that excessive industrial production and resource usage would, over several centuries, surpass Earth's ecological limits to sustain this growth (Foster, 2012, p. 215; Turner, 2008, p. 397). "Sustainability" discourses in the 1970s also built upon the findings of *The Limits to Growth* by recognizing that the planet could accommodate only so much economic growth without environmental collapse (Agyeman, Bullard, & Evans, 2002, p. 80; McManus, 1996, p. 50).

The antagonism between capitalist economic growth and environmental sustainability is given a thorough analysis by the ecological Marxist theorist James O'Connor (1988, 1991) through his work on the second contradiction of capitalism. Essentially, the second contradiction describes how capitalism's growth imperative destroys the very means of production it depends on for further growth. Inputs in production, like natural resources, are treated as "free gifts to capital" to lower costs, and the capitalist neglects to account for the deterioration of these inputs over time (Marx qtd.

in Foster, 2002; O'Connor, 1988, 1991). This not only raises the costs of acquiring these increasingly-scarce inputs in the future, but also "externalizes" them, leaving the rest of society to bear the economic and environmental costs and consequences of using them up (O'Connor, 1988, p. 26).

For instance, fossil fuel-based industries have historically not incorporated the costs of releasing CO_2 into their daily operations. Society then faces the ramifications of these industries' unvalued and uncontrolled CO_2 emissions, like lower agricultural yields from more frequent heat waves and droughts, or relocation due to sea level rise (Foster, 2002; O'Connor, 1988, p. 25). Large-scale deforestation also has a similar effect. Not only do trees play a vital role in sequestering CO_2 and regulating the climate, but as forest cover shrinks, it becomes more difficult to replenish timber stocks and their capacity to sequester CO_2 in the future, since replanting trees takes years until they will reach maturity (Hall, 2012, p. 3; Prudham, 2003, p. 641). Therefore, the environmental costs of deforestation may be revealed through increased temperatures from newly-released CO_2 in the atmosphere. In his environmentally-based critique of capitalism, O'Connor believed that the state must lead efforts to curtail capitalist growth, from the subnational to the supranational level (Castree, 2008, pp. 144-145).

However, the state-led regulations that the Keynesian Welfare State had applied towards the environment would fall out of favour beginning in the 1970s. Amidst a slow-down in growth rates in the advanced capitalist countries and a rise in unemployment and inflation, critics of Keynesianism claimed that active, interventionist states had interfered with the free functioning of global markets and stifled capitalist growth (Harvey, 2005,

pp. 20-21). In response, the political-economic theory known as "neoliberalism" swept across both the North and South to replace Keynesianism. Under neoliberalism, proponents argue, unhindered private property rights, free trade, and free markets are supposed to best guarantee human welfare (p. 2). Neoliberal theory borrows heavily from neoclassical economics, which states that a rational individual acting in her own self-interest guides economic behaviour (Arnsperger & Varoufakis, 2006, p. 8). Free markets are viewed as best equipped to distribute an individual's unlimited wants and desires in accordance with the finite amount of goods and services available to the rest of society (McAfee, 2015, p. 342).

To ensure that markets will properly distribute these goods and services, the neoliberal state must guarantee individual, private property rights. Proponents argue that doing so not is only necessary to ensure social order, but also to generate profit from economic activities taking place within these well-defined, enclosed spaces (McCarthy & Prudham, 2004, p. 277; Wood, 2002, p. 111). Individuals will then govern their property in the same way that they seek to maximize their self-interest elsewhere. Additionally, the neoliberal state is only to intervene in the economy insofar as it creates or protects the proper functioning of markets. Advocates of neoliberalism believe that state intervention will distort price signals that are determined through voluntary forms of market exchange, and should thereby remain at a minimum to stimulate economic growth (Harvey, 2005, p. 2).

Around the same time that neoliberalism was spreading globally, scientists were starting to connect elevated CO_2 levels with climate change. Organizations like the

United Nations World Meteorological Organization (WMO) and United Nations Environmental Programme (UNEP) began developing what are known as "general circulation models" to demonstrate how elevated GHG emissions would affect the climate (Newell & Paterson, 2010, p. 16). These efforts culminated in the creation of the IPCC by both the WMO and UNEP in 1988 (p. 18). Since then, successive IPCC reports have publicized the link between human activity and climate change, most recently in the IPCC's (2013) *Fifth Assessment Report*. Bolstered by additional scientific studies and increased media coverage of extreme weather phenomena linked to climate change, heavy emitters in the public and private sectors have faced added pressure to address their environmental impact.

In contrast to the more state-led, "command and control" approach to environmental regulation under Keynesianism, environmental policies under the neoliberal state would take on a very different shape. Instead of government laws and policies, neoliberal environmentalism would consist of market-led policies aimed at making capitalist growth environmentally sustainable. Key to this strategy of "free market environmentalism" would be to "internalize externalities", or bring the environmental cost of depleting natural resources and ecosystem functions more fully into capitalist markets (Castree, 2008, pp. 146-147).

This model builds off the work of environmental economists, perhaps most notably Robert Costanza and his colleagues. Costanza et al. (1997) argued that the planet faces an environmental crisis because society has not accounted for the environmental cost of using up ecosystem services, the natural resources and ecosystem functions that

humans benefit from (p. 253). These ecosystem services range from animal habitat protection to water filtration to climate regulation, including carbon sequestration in vegetation-based reservoirs (McAfee, 2012, p. 105). If natural resources and ecosystem services were properly valued, so Costanza et al.'s (1997) argument goes, the real environmental cost of depleting them could be incorporated into business practices and government policies (Costanza et al., 1997, pp. 254-257). Effectively, assigning a price to natural resources and ecosystem services would make exploiting them more expensive, prompting those who rely on these goods and services to become more sustainable.

The arguments presented by Costanza et al. (1997) aligned perfectly with the growth-centric, market-led approach to economic policy in the neoliberal era. Command-and-control regulations enacted by the state were viewed by proponents of neoliberalism as costly and obstructive to the free functioning of markets (Harvey, 2005, p. 2). However, if ecosystem services – like CO_2 sequestration – were given a price, these proponents believed that the newly-valued services could be treated as commodities and traded in markets. For example, a forest-based landowner could sell her ability to efficiently sequester CO_2 through planting trees. In return, she could earn payments from other market actors that also want to mitigate climate change, but did not have the competitive advantage of doing so themselves. And since advocates of neoliberalism viewed free markets as the preferred means of distributing goods and services, trade in environmental commodities became the common-sense response to climate policy under neoliberalism as well (Kallis, Gómez-Baggethun, & Zografos, 2013, p. 99).

By the end of the 20th century, as the ideals of neoliberalism had spread worldwide, a growing number of policymakers and economists began promoting market trade as a solution to lower GHG levels. Hereafter, the design of cap-and-trade began to take shape. In a cap-and-trade scheme, a government sets an economy-wide limit (the "cap") on the quantity of emissions allowed in each trading period. The total quantity of allowable emissions under the cap are treated as property rights to emit and divided between individual firms participating in the market. Firms must then ensure they have enough property rights, commonly known as permits or allowances (and measured as a tCO_2e), to cover their emissions within the scheme's designated trading period (Reyes & Gilbertson, 2010, p. 90). In other words, a cement factory must have allowances equivalent to its emissions for one trading period to surrender to the scheme administrator, typically the state in the jurisdiction where it exists.

Depending on the economic sector or cap-and-trade scheme itself, allowances may be allocated to firms free of charge or sold to them in a method known as auctioning. If an industry's emissions exceed its share of allowances, it must cover them through auction purchases or various forms of market exchange. The latter forms include several different strategies, the exact rules of which depend on the cap-and-trade scheme itself. First, firms may buy surplus allowances from other firms in the market who are more successful at reducing their emissions (Sandor et al., 2002, p. 1609). Second, firms can purchase allowances from speculators, entities without any emissions reduction commitments, that seek to buy and sell allowances at a profit (Ervine, 2016, p. 32; McAfee, 2015, p. 337). Third, firms might offset their emissions, purchasing credits from

projects that reduce GHGs outside the jurisdiction of the scheme administrator (Lovell et al., 2009, p. 2361).

Carbon offsetting, as an important subset of cap-and-trade, warrants its own explanation as well. An oil refinery, for example, might find it physically difficult or expensive to reduce its emissions below a certain level in a cap-and-trade scheme. Instead, the company could purchase cheaper emissions reduction credits (i.e. offsets) from projects that reduce GHG emissions outside the scheme (Reyes & Gilbertson, 2010, pp. 93-94). One example of offsetting is a project that installs technology to destroy HFC-23, a GHG calculated to be 11,700 times more potent than CO_2. The oil company might find it is cheaper to pay this project developer to destroy 11,700 tonnes of HFC-23 than it is to reduce only one tonne of CO_2 at the source, which makes the project a more financially viable alternative to comply with the cap-and-trade scheme (MacKenzie, 2009, pp. 444-445). Another offset type is methane capture from livestock, particularly swine and cattle. In this model, technology is deployed to capture and burn methane – a GHG that is 21 to 25 times more potent than CO_2 – by actually turning it into CO_2 (Alarcón, 2009, pp. 74-76). Like destroying HFC-23, an emitter could more cost-effectively mitigate climate change by destroying 21 to 25 tonnes of methane instead of reducing one tonne of CO_2.

Critically, in both projects, the offset credits are considered equal to allowances traded in the cap-and-trade scheme, and may be used to meet a firm's emissions reduction target. Therefore, an actual tCO_2e reduction that the firm foregoes under the cap equals a payment for an "avoided" tCO_2e outside the scheme; which in other words,

is a tCO_2e that does not exist because of the firm's offset payment (Lohmann, 2012, p. 96). Overall, the idea behind all market transactions in a cap-and-trade scheme is that as the emissions cap shrinks over time, firms will seek to reduce their emissions by whatever method is cheapest.

This neoliberal logic behind carbon trading is perhaps best summed up by Richard Sandor, Eric Bettelheim, and Ian Swingland (2002) in their piece, "An overview of a free-market approach to climate change and conservation". According to Sandor et al. (2002), saving the environment and mitigating climate change involves pricing CO_2 emissions (and other GHGs), which previously contained "zero" value (p. 1608). By assigning this price and treating these emissions like tradable property rights, carbon pricing could make one's ability to freely release CO_2 increasingly difficult. In this context, industries responsible for large quantities of CO_2 emissions would now find it expensive to continue emitting at a BAU rate (pp. 1608-1609).

According to Sandor et al. (2002), a market-led system would be the most efficient strategy to mitigate climate change. State-led regulatory policies, in their view, were not only a prohibitive restriction on economic growth, but also prevented various industries and firms from exercising their competitive advantage at cutting CO_2 emissions (p. 1609). Instead, if all entities were given property rights over their CO_2 emissions, and public policies did not interfere with market price signals, market transactions would efficiently reduce emissions where the cost of doing so was cheapest (Sandor et al., 2002, pp. 1608-1609; Stern, 2009, p. 99). This new trade in CO_2 commodities would present growth opportunities for efficient industries, who could sell

their unused emissions allowances on the market (Lohmann, 2005, p. 205). Additionally, carbon markets would create an opportunity for offset project developers, consultants, brokers, traders, and others who hoped to profit off the trade in carbon commodities (Ervine, 2013, p. 656).

Driven in part by this logic, the idea of carbon trading entered centre stage on the international environmental policy realm by the end of the 20th century. The UNFCCC held its 3rd annual Conference of the Parties (COP 3) meeting in 1997 to construct a global agreement in combatting the threat of worsening climate change. The treaty reached at the meeting, known as the Kyoto Protocol (hereafter referred to simply as "the Protocol"), contained binding legislation that wealthy, industrialized, "Annex I" countries were to reduce their greenhouse gas emissions by 5.2% below 1990 levels between 2008 and 2012, while non-industrialized, lower-income "non-Annex I" countries were not assigned emissions targets (Cabello, 2009, p. 192).

At COP 3, the US delegation was steadfast in its assertion that any strategy to reduce emissions must include a market mechanism. Prior to the conference, US Democratic President Bill Clinton stated that to "harness the power of the free market" would be to protect the environment and "yield not costs, but profits" (qtd. in Meckling, 2011, p. 34). Financial traders and heavy-emitting corporations like BP and DuPont also supported a market-based policy, hoping to either profit off the new trade in GHGs or prevent more regulation-intensive policies from arising that interfered with their fossil fuel-led business models (Lohmann, 2005, p. 205; Meckling, 2011, p. 33). Acquiescing to US pressure, the Protocol included three "flexible mechanisms" for market-based

emissions reductions; cap-and-trade, and two carbon offsetting platforms, Joint Implementation (JI), and the CDM.

The first cap-and-trade scheme to regulate GHG emissions after the Protocol was the European Union Emissions Trading Scheme (EU ETS). Originating in 2005, the EU began the scheme as a way for its (now) 28 member states to meet their emissions reduction targets under the Protocol. Today, it is the world's longest-running and largest cap-and-tap trade scheme. At the end of 2016, 17 cap-and-trade schemes operated across supranational (the EU), national (New Zealand, Switzerland) and subnational (California, Québec) levels worldwide, putting a price on 9% of the planet's GHG emissions (ICAP, 2016, p. 26). The province of Ontario also started its own Cap-and-Trade Program in 2017, and China's network of eight regional and municipal programs may be scaled up into a nationwide cap-and-trade scheme sometime during 2017 as well (ICAP, 2017, p. 22).

For the offset programs under the Protocol, JI allows Annex I countries to offset their emissions by investing in emissions reduction projects located in other Annex I countries – usually those in the former Soviet Union – while the CDM permits Annex I countries to invest in offset projects in non-Annex I countries in the South. The investor then receives emissions reduction credits, called Emissions Reduction Units (ERUs) in JI and Certified Emissions Reductions (CERs) in the CDM (and standardized as one tCO_2e), that correspond with the size of the payment (Newell & Paterson, 2010, pp. 79-80, 86). Among the dozens of approved offset project types that are eligible to issue

offsets under the Protocol are HFC-23 destruction, methane capture, renewable energy (wind, solar, hydroelectricity), and tree planting.

Particularly, the CDM has received the bulk of offset investment to date. Cheaper land and labour costs and less stringent regulatory frameworks for offset projects in Southern countries were promoted as a more cost-effective way for Annex I countries to comply with the Protocol, instead of altering their dependence on fossil fuels (Böhm & Dabhi, 2009, p. 12). In fact, Article 12 of the Protocol states outright that the CDM is designed to make it less costly for Annex I countries to meet their emissions targets (McAfee, 2012, p. 111). Additionally, non-Annex I countries that hosted CDM projects were also supposed to benefit through income from project development and offset credit generation, knowledge transfers of low-carbon technologies, and community involvement in CDM projects (Böhm & Dabhi, 2009, pp. 13, 16). Subsequently, a vast network of carbon offset projects has developed across the Global South. Between the Protocol's ratification in 2005 and January 2017, 7,749 offset projects were registered with the CDM (UNFCCC, 2017). 3,027 of these projects have generated over 1.75 billion CERs, or two-thirds of all offsets issued under the Protocol (UNEP-DTU Centre, 2017b; UNFCCC, 2017). On the other hand, JI projects have issued just over 871 million ERUs (UNFCCC, 2016).

Importantly, creating a carbon offset is an incredibly complex undertaking. Adam Bumpus (2011) has coined the phrase "hemming in" to describe the process of transforming a tCO_2e reduction into tradeable commodity (p. 619). At the outset, trade in offsets depends on a tCO_2e reduced from one offset project equalling a tCO_2e reduced

from a different project (commensuration), so it may then be bought and sold on the market (fungibility) (MacKenzie, 2009, p. 443; Newell & Paterson, 2010, p. 86). However, offset project types vary in their capacity to fully hem in a tCO_2e reduction, and thereafter generate reliable emissions reduction credits. For example, HFC-23 destruction projects contain a clear methodology for reducing GHG emissions, and do so at an easily accessible, central location, making for efficient credit issuance. On the other hand, offset initiatives to replace emissions-intensive, wood-burning stoves in rural households with stoves that burn less biomass are more difficult. Not only is emissions data from these stoves often sourced from estimates, but the process of issuing offset credits can mean conducting lengthy follow-up studies to verify that the new stoves are being used (Bumpus, 2011, pp. 616, 627; Ervine, 2015, p. 252). It should come as no surprise, then, that HFC-23 destruction projects have issued 30% of all CERs to date, while projects that improve household energy efficiency, including clean cookstoves, have generated less than 1% (UNEP-DTU Centre, 2017b). As this statistic shows, the capacity for a project to hem in a tCO_2e is directly linked to its potential for future capital accumulation (Bumpus, 2011, p. 621).

The concept of hemming in also relates to an essential quality of any offset project in JI or the CDM, proving "additionality". That is, emissions reductions through an offset project must exceed what would otherwise occur in a BAU scenario (Ervine, 2013, p. 657). If reductions were going to happen without the project – through a government regulation, for example – then the project should not issue ERUs or CERs, as the Annex I emitter would not have contributed to those reductions via its offset

payments. To achieve additionality, a reference level or baseline is calculated to forecast what BAU emissions would look like in the absence of a project (Lohmann, 2012, p. 99; Seyller et al., 2016, p. 232). If the project then reduces emissions below the baseline rate, ERUs and CERs may be generated.

However, there are several problems related to additionality. As Bumpus (2011) notes, proving additionality is a key part of marketing an offset project, as initiatives that reduce many emissions are more financially attractive to investors (p. 621). This, in turn, creates a perverse incentive for project developers to inflate a reference level or actual emissions and generate more offsets (Lohmann, 2005, p. 218). For example, in JI, several Russian industries intentionally increased their production of HFC-23 and other industrial gases past BAU levels. Once the plant operators received JI investment, they scaled back this artificially high production and issued ERUs that were not caused by the original payments, which in other words, were non-additional (Schneider & Kollmuss, 2015, p. 1062). Similarly, in 2010, firms in China, India, and Central America were found to have artificially increased their HFC-23 production to earn CERs as well (Ervine, 2013, p. 662). Although such projects have come under scrutiny in the time since (the EU ETS phased out HFC-23 destruction projects in 2013), the goal of maximizing additionality to sell offsets remains a key driver across all project types, since offset project developers depend on carbon commodity revenue to make a profit.

2.3.1 Carbon Forestry: The Beginnings of REDD+

One important type of offset project that has arisen through the development of the CDM is carbon forestry, which builds off the numerous ecosystem functions and

services that trees provide. Trees cover 30% of Earth's surface and play a critical role in sequestering CO_2 for long periods of time (De Shazo et al., 2016, p. 9). [7] Tropical forests, mainly located in countries in the Global South, also hold up to 50% more carbon per hectare than those in other regions (Hall, 2012, p. 3). Adding to their importance, 15 million hectares of forests are lost every year, which contributes to roughly 9% of global CO_2 emissions (De Shazo et al., 2016, p. 9; Le Quéré, 2016, p. 625). Around 1.6 billion people worldwide are either fully or partially dependent on forests for their livelihoods or shelter as well, making forest preservation an immense environmental, economic, and social priority (Hall, 2012, p. 7).

Initially, two distinct categories of forestry-based offset projects were proposed for use under the CDM. The first of these are the related methodologies of afforestation and reforestation (AR). Under the terms of the Kyoto Protocol, afforestation involves planting trees on land not forested for the past fifty years, while reforestation involves planting trees on areas deforested prior to 1990 (Neef, von Luepke, & Schoene, 2006, p. 3). As new forest stocks grow and mature, they can, in theory, store CO_2 emissions in addition to what would happen in a BAU scenario, allowing them to generate CERs for purchase by Annex I countries.

The second category is comprised of "avoided deforestation" initiatives. Rather than a project developer planting new trees to sequester CO_2, avoided deforestation projects would generate emissions reduction credits by merely slowing an area's deforestation rate from its BAU, historical rate. A baseline deforestation rate, or reference

[7] Although as Ciais et al. (2013) caution, this sequestration is not permanent, as trees will continue to release CO_2 through seasonal cycles or after dying.

level, would be calculated using a mix of historical deforestation data from the project area or country at hand, remote sensing satellite imagery, and on-the-ground measurements. These methods are designed to determine additionality, which in this case is the projected rate of deforestation expected to occur without project financing versus deforestation that takes place after the addition of the project (Estrada & Joseph, 2012, pp. 253-256; Lohmann, 2015, p. 4). Once a decline in deforestation below the baseline rate is monitored, reported, and verified (MRV) via remote sensing, field data measurements, and local knowledge of the project area, the project developer can issue and sell emissions reductions credits (Korhonen-Kurki, Brockhaus, Duchelle, Atmadja, & Thu Thuy, 2012, pp. 97-98).

Carbon forestry projects have attracted a variety of critiques though, especially in relation to the problem of hemming in forest-based offsets. Unlike emissions from fossil fuel-based sources, which are mostly constant over time, forest-based GHG emissions range in intensity based on both weather conditions and shifts in economic activities that cause deforestation (Ervine, 2015, p. 252). Thereby, the process of setting a credible reference level to measure additional emissions reductions is incredibly difficult. Trees can also be lost to human-related or natural causes – like fires or shifts in climate patterns – once the project begins, which threaten to invalidate offset credits (Gutiérrez, 2011, p. 650). Furthermore, if deforestation activity simply relocates from the project area to another location, an occurrence known as leakage, emissions are only displaced rather than reduced (p. 652).

Debates between scientists, policymakers, and others about the feasibility and integrity of carbon forestry projects ultimately ended in a compromise: only AR projects in the CDM were ruled to be credible enough to produce offsets under the legally-binding Protocol, while avoided deforestation projects were banned due to the technical difficulties in the measurement and MRV process for emissions reductions (Pistorius, 2012, p. 639). Even then, though, apprehensions about carbon forestry remained. The EU ETS barred its member industries from utilizing AR credits to offset their emissions, and Annex I countries under the Protocol were only permitted to offset 1% of their 1990 emissions totals through AR initiatives (Hall, 2012, p. 31; Haupt & Von Lüpke, 2007, p. 5).

Subsequently, AR projects have failed to stimulate much development in the CDM. In addition to problem of hemming in forest-based emissions, another reason for this is that newly planted trees take years to mature and realize their full sequestration and credit generating capacity, which is a financial constraint on project developers (Thomas, Dargusch, Harrison & Herbohn, 2010, p. 881). Other kinds of offset methodologies, like methane capture and HFC-23 destruction, can generate emissions reductions and a subsequent return on investment much quicker (Bumpus, 2011, p. 621). A CDM project backer would, therefore, likely find these types of projects to be more reliable and profitable investments than AR projects. Combined with the problem of hemming in forest-based emissions, AR has barely made a dent in CDM offset projects. Only 0.8% of registered CDM projects were AR in January 2017, of which a mere 3

projects had issued 751,000 CERs, far less than 1% of all CERs issued to date (UNEP-DTU Centre, 2017a; UNEP-DTU Centre, 2017b).

Although omitted from the CDM, avoided deforestation projects would resurface in climate policy discussions in the mid-2000s. A group of countries called the Coalition of Rainforest Nations (CfRN) put avoided deforestation back on the table at COP 11 in Montreal in 2005. The CfRN believed that selling emissions reductions from forest preservation on international carbon markets could provide an important source of foreign investment for tropical forested countries (Coalition of Rainforest Nations, 2016; McAfee, 2012, p. 123). By the time that COP 13 in Bali, Indonesia took place in 2007, the CfRN's initial blueprint for avoided deforestation offsetting had evolved into the modern framework for REDD. The Bali Action Plan, adopted at COP 13, also called for REDD to incorporate the goals of conservation, sustainable management of forests, and enhancement of forest carbon stocks into this model, now denoted as "REDD+" (Lang, 2009, pp. 214-215).

Because REDD+ projects are not permitted under the Protocol, current efforts to scale up avoided deforestation initiatives are occurring outside the CDM. The UN REDD Programme and World Bank's Forest Carbon Partnership Facility (FCPF) are providing technical and financial support to countries in the South in getting nationally-administered REDD+ schemes off the ground (McAfee, 2015, p. 2015, p. 338). So far, the UN REDD Programme has partnered with 64 countries and raised USD 269.7 million in funds, and the FCPF has partnered with 47 countries and received over USD 1.1

billion in funds for REDD+ program development and implementation (FCPF, 2016, pp. 11, 59; UN-REDD Programme, 2016, pp. 1, 4).

For now, REDD+ project financing in both the UN REDD Programme and FCPF is only taking place through grants. Ultimately, the goal is that recipient countries will transition to a model where payments are received only when forest-based emissions reductions are proven, in route to a market-based system (FCPF, 2016, p. 7). Donor nations have begun working with tropical forested countries as well to develop the frameworks for nationally-administered, market-based REDD+ programmes, including Germany's REDD Early Movers Programme and Norway's International Forest and Climate Initiative (De Shazo et al., 2016, p. 32). Article 5 of the Paris Agreement also identifies REDD+ as a mechanism for mitigating climate change in the UN's post-2020 climate policy, possibly through a global carbon market (UNFCCC, 2015, p 23).

Alternatively, one option for market-based REDD+ schemes put forth by governments, private companies, and NGOs has materialized in the voluntary carbon market, or VCM (McAfee, 2015, p. 338). Instead of going through the CDM cycle of design, registration and MRV that AR projects must follow – which involves numerous private, governmental and UN bodies and can take up to three years before approval – VCM projects take place outside of existing environmental and climate change regulations and agreements (Newell & Paterson, 2010, pp. 84-85, 110). In most cases, they are initiated by companies looking to promote corporate social responsibility and brand themselves as both environmentally and socially progressive (Forest Trends, 2016, p. 37; Lovell et al., 2009, p. 2364). VCM projects typically use third party standards and

companies to develop, manage, and verify carbon offset projects and the emissions reduction credits they produce (Forest Trends, 2016, p. 37). In 2015, offset credits produced by REDD+ projects in the VCM retailed for an average price of USD 3.30/tCO_2e and were worth an estimated USD 37.5 million. This amounts to 11.1 $MtCO_2e$ transacted, or 22% of the VCM's overall quantity of offset credits from all project types (pp. 3, 15, 46).

Above all, carbon forestry offset programs, like carbon trading in general, appeal to heavy emitters in a fossil fuel-dependent society. One estimate predicts that climate change mitigation efforts in the forest sector alone would save 3.5 billion tCO_2 emissions by 2030, and could halve the cost of lowering these emissions to 1990 levels by 2030 (Lederer, 2011, p. 1902). To proponents, carbon forestry projects like REDD+ represent a "win-win" solution to climate change, reducing deforestation rates through market-based payments, while also providing funding for conservation and development to populations in the South (Angelsen & McNeil, 2012, p. 35; Code REDD, 2013; Sandor et al., 2002, p. 1614). As the next section will demonstrate, though, many important environmental and social concerns have plagued the design and implementation of carbon trading and carbon forestry mechanisms.

2.4 Analyzing the Critiques of Carbon Trading and Carbon Forestry

Carbon trading programs have taken hold globally as a neoliberal approach to climate change mitigation, promising cost-effective emissions reductions facilitated by market trade. However, critics have challenged the ability of carbon trading strategies to contribute to rapid, significant, and equitable cuts in GHG emissions that are necessary to

avert catastrophic climate change. Apprehensions about the lasting environmental effectiveness and social impacts of cap-and-trade and offsetting, including REDD+, also relate to the distinctly capitalist design of carbon trading.

As this thesis has already suggested, carbon trading is not an ideologically neutral climate policy. Instead, when viewed through an MPE framework, carbon trading has become the dominant climate change mitigation strategy over the past two decades because it best aligns with the growth imperative of fossil capitalism (Böhm et al., 2012 p. 1624). By leaving market price signals to determine the cheapest sources of emissions reductions, heavy-emitting firms and governments can protect their dependence on fossil fuels so long as they purchase additional allowances within their cap-and-trade scheme, or offset their emissions elsewhere. Here, fossil-fuel intensive entities can use carbon trading's dual promises of economic growth and market-based emissions reductions to dilute the "fatal connection" (Newell, 2008, p. 516) that links capitalist development with the climate crisis (see also Lohmann 2012, p. 91).

However, existing research has problematized the notion that carbon trading can rectify the environmental degradation caused by capitalist development. In particular, carbon forestry offsetting has been a focal point to hone in on the environmental concerns that surround all forms of carbon trading. A common theme among opponents is that carbon forestry offsetting lacks environmental integrity, a by-product of commodifying CO_2 emissions for market trade regardless of how or where they were produced. In the case of REDD+ offsetting, for example, an actual reduction of a fossil fuel-based tCO_2e (not taken by the entity purchasing the offset) is made equal to that of an avoided,

"biotic-based" tCO_2e (made possible by the entity's offset payment), found in trees, grasslands, soils, and other forms of organic matter in the planet's biosphere (Lohmann, 2012, p. 96; Lohmann, 2015, p. 4).

Indeed, those who question the environmental promise of carbon trading raise some critical points. Although fossil-based and biotic-based CO_2 emissions are treated as chemically equal in carbon markets, from a climatic standpoint the two are very different. When fossil fuel combustion occurs, CO_2 that has not interacted with the atmosphere for millions of years is suddenly released and adds to the above-ground "carbon pool" (Dooley, 2014, p. 6). In non-geologic time, these emissions are basically irreversible, since different carbon reservoirs, like oceans and forests, can sequester only so much CO_2 over the course of hundreds or thousands of years (Ciais et al., 2013, p. 544; Dooley, 2014, p. 6). In fact, a recent study suggests the Northern Hemisphere biosphere reached peak carbon storage capacity in 2006, and has taken in less CO_2 every year since (Curran & Curran, 2016). This is a troubling development, especially when considering another recent study that projects global temperatures to rise between 6.4° and 9.5°C if known fossil fuel resources are burned (Tokarska, Gillett, Weaver, Aurora, & Eby, 2016). In contrast, biotic CO_2 emissions will fluctuate between the atmosphere and vegetation based on seasonal growth patterns, and trees will only store CO_2 for centuries at most before dying and returning it to the atmosphere as part of a natural cycle (Dooley, 2014, p. 6).

The climatic difference between these two types of emissions is incredibly significant. For one, carbon forestry offsetting, like offsetting in general, does not

actually mitigate climate change. A tree-planting or avoided deforestation offset project merely compensates for continued fossil fuel-based CO_2 emissions, and does not reduce global CO_2 emissions overall (Cabello, 2009, p. 196). Additionally, commensurating fossil and biotic CO_2 reductions as equal for market trade neglects whether or not these emissions reductions come from strategies that phase out fossil fuel combustion, the biggest and longest-running contributor to anthropogenic climate change (Lohmann, 2012, p. 91).

Putting aside this fundamental distinction between fossil and biotic-based CO_2 emissions for the time being, the process of accurately hemming in emissions reductions through carbon forestry offset schemes is an arduous task. Several uncertainties and challenges abound in estimating carbon stock transfers between trees and the atmosphere, accessing sufficient historical data to calculate a project's baseline deforestation rate, and protecting tree stocks from loss due to fire, droughts, and other weather or climate-related events (Bumpus, 2011, p. 616; Dooley, 2014, pp. 11-12, 17-18). Companies, governments, and organizations involved in developing forest-based offset projects have formulated various technologies and calculations to aid the process of hemming in biotic CO_2, but these methods have also run into their own set of issues.

Remote sensing, a computer-based system that uses satellite imagery to measure changes in forest cover and subsequent carbon fluctuations in AR and REDD+ projects, is one technology that shows the difficulty of hemming in biotic CO_2 emissions. A 2012 study produced for the Center for International Forestry Research assessed the quality of remote sensing technology used by 17 pilot REDD+ projects implemented in 6 countries.

Of these projects, only 7 were using high resolution (<10 metre) remote sensing imagery to model the deforestation rate, a requirement established by the largest VCM project developer and verifier, the Verified Carbon Standard (VCS) (Estrada & Joseph, 2012, p. 258).

Although only 10 of these 17 projects were seeking verification through the VCS, the quality of remote sensing imagery can be critical in determining the environmental integrity of a carbon forestry project, as reported by Betsy Beymer-Farris and Thomas Bassett (2012). The two analyzed a pilot REDD+ project in coastal Tanzania that was developed to combat an alleged decline in mangrove forest cover. However, the authors found that the project's medium resolution remote sensing imagery was not detailed enough to account for the naturally patchy and geographically varied distribution of mangrove forests. Without confirmation that deforestation is occurring and is capable of being measured, the rational for the entire project could be debunked (Beymer-Farris & Basset, 2012, p. 339).

Yet, even if a project developer were to obtain high-resolution imagery, it would not overcome a fundamental problem with remote sensing itself. In their discussion on the use of geospatial data to stimulate biofuel production, Rachel Nalepa and Dana Marie Bauer (2012) identify several important drawbacks of remote sensing technology. Namely, remote sensing categorizes forested spaces in line with the perspective of who is deploying the technology. In this case, the technology suits developers that are focused strictly on increasing biofuel production, and classifies forests based on their potential contribution to the growth of international commodities markets for bioenergy (Nalepa &

Bauer, 2012, pp. 405, 418). Through this narrow view, remote sensing technology does not account for the complex socio-economic factors that lead to an area's classification, or may stimulate a need for re-classification in the future (pp. 415, 418). Applied to REDD+, remote sensing is undertaken first and foremost to serve the interests of developers engaged in carbon commodity exchange, identifying which locations can yield the most offset credits.

Next, establishing credible baseline emissions rates to judge the additionality of a REDD+ project is a monumental task. In fact, a lack of consensus on how to prove that offset payments would directly lead to a decline in deforestation was one reason why UN policymakers did not include avoided deforestation projects in the CDM in the first place (Pistorius, 2012, p. 639). Nevertheless, the issue has persisted among REDD+ projects in the VCM, which Seyller et al. (2016) document in a recent study. The authors look at two REDD+ projects developed by private companies and conservation NGOs in the Democratic Republic of the Congo (DRC) and Madagascar. Both initiatives used reference areas – an outside land unit believed to reflect the biophysical makeup of the project area, as well as land use activity in it – to determine the baseline deforestation rate. Consequently, the baseline is used to assess how much deforestation the REDD+ project will prevent, and how many offset credits it can generate (pp. 234-235).

The reference areas used, though, drastically varied in size, forest density, and deforestation trends from the actual project sites. Both reference areas contained a deforestation rate that was twice that of the project area, which in the Madagascan project was mistakenly attributed to be the actual rate of the project area (Seyller et al., 2016, p.

240). In what is known as the "hot air phenomena", the deforestation rate could stay the same, or even increase, yet earn bogus, non-additional offset credits because the rate would still be lower than that of the reference area. (pp. 235, 240). In other words, a company could say that it had reduced emissions by purchasing offset credits from the REDD+ project, even though the deforestation rate in the project area did not improve. Additionally, the reference area in the DRC project featured a patchy, mosaic forest instead of the project area's dense, tropical forest (p. 237). Forest cover in the project area could decline but still not count as deforestation, because the forest type assumed from the reference area was naturally sparser. Seyller et al. (2016) conclude from their analysis that REDD+ project developers prioritize maximizing offset credit generation and revenue over environmental integrity in designing reference areas for the projects (pp. 243-244). This is also reminiscent of the perverse incentive exercised by HFC-23 project developers, who overestimated or intentionally increased their emissions to produce more offset credits and gain higher profits (Ervine, 2013, p. 662; Lohmann, 2005, p. 218).

Any emissions reductions from a carbon forestry project that were deemed additional would not be immune from environmental integrity concerns at a later point. One problem relates to non-permanence, where trees that are either planted or protected from deforestation are later destroyed or degraded from human or natural causes (Gutiérrez, 2011, 650). If the trees responsible for the offset credit are lost due to fires, droughts, or the resumption of land-clearing activity, that credit no longer represents a tCO_2e reduction for the entity offsetting its emissions. A Dutch NGO called Face the Future learned this lesson firsthand while developing an offset-based reforestation project

in Uganda's Mount Elgon National Park. Initially, the project was forecasted to produce 3.73 $MtCO_2e$ worth of offset credits, with 44% of these put in a risk buffer to issue in the case of forest loss in the future (Cavanagh & Benjaminsen, 2014, p. 61). To make room for the project, the Ugandan state forcibly evicted as many as 150,000 forest dwellers living throughout the parts of the national park destined for reforestation and additional conservation measures to be carried out by the state and NGOs (p. 59).

Many of these people, however, were poor and subsistence-based farmers who depended on the land and resources in the park to survive. Firewood and medicinal plant collection, small-scale agriculture, and animal grazing were just some of the integral livelihood functions performed by local people in this area (Nakakaawa, Moll, Vedeld, Sjaastad, & Cavanagh, 2015, p. 2). In fact, restrictions on economic activity and forest access in the wake of these measures contributed to a USD 108.00 drop in average household income (Vedeld, Cavanagh, Petursson, Nakakaawa, Moll, & Sjaastad, 2016, p. 190). With few other options for income generation, these groups continued to engage in small-scale deforestation and resource collection from the areas they had been evicted or banned from. After several years of project activity, Face the Future found that up to 44% of the reforestation area was affected by villagers' prolonged use of the forest, which was the upper limit of the risk buffer (Cavanagh & Benjaminsen, 2014, p. 62). This threatened the environmental integrity of the offset credits so much that Face the Future eventually halted its reforestation activities altogether.

Another problem that undermines the environmental integrity of carbon forestry is leakage, where deforestation-related activities move outside of the project area (McAfee,

2015, p. 340). Any instance where deforestation emissions are simply displaced from inside the project area to outside of it means that no net emissions reductions occur, invalidating the tCO_2e reduction credit issued. Many companies and organizations that advocate for carbon forestry projects also possess a short-sighted view of leakage, and believe that deforestation pressure can be contained just outside of a project's boundaries (Seyller et al. 2016, p. 241). However, this view neglects the fact that governments that host REDD+ projects can encourage avoided deforestation initiatives in remote areas, while still channelling investments in agriculture, logging, or other forest-clearing activities to more accessible locations (pp. 241, 243).

Connor Cavanagh, Pål Vedeld, and Leif Trædal (2015) take this possibility even further, exposing how leakage may go beyond the national borders of the host country. Looking at the development of national REDD+ schemes in Tanzania, Kenya, and Uganda, the authors theorize that increased environmental monitoring in preparation for REDD+, including heightened military patrols to clamp down on encroachment, might lead to an accompanying rise in deforestation in the region's less-regulated neighbouring countries (pp. 76-77). A nearby country like the Democratic Republic of the Congo (DRC), for example, contains a much larger forested area (68% of total area) than Kenya (6%) or even Tanzania (38%), and could very well fill the demand for timber and charcoal in the region that is restricted by certain countries' national REDD+ schemes (p. 77).

The above examples demonstrate the immense contradiction between commodifying CO_2 emissions for market trade and achieving verifiable and lasting

emissions reductions. As Polanyi (1944) described through the concept of a "fictitious commodity", nature (in the case of carbon trading, CO_2) can never be fully captured in capitalist markets, because it was never produced for sale as a commodity in the first place (McCarthy & Prudham, 2004, p. 281; Robertson, 2012, pp. 389-390). By assigning property rights to nature, market actors unsuccessfully attempt to overcome its biophysical properties and socio-cultural values that exist independent of the demands of capital accumulation (Castree, 2008, p. 281; Wanner, 2015, p. 25).

Thus, the complications and uncertainties that characterize carbon forestry projects – equating fossil and biotic-based CO_2, hemming in emissions, proving additionality, preventing against non-permanence and leakage – should foreclose any reason to promote carbon forestry in mitigating the worsening effects of climate change. However, the possible use of REDD+ for a post-2020 global carbon market in the UN Paris Agreement, the development of national REDD+ schemes, and the operation of many REDD+ projects on the VCM suggest that policymakers will not exercise this caution. Simply put, carbon forestry programs offer the least path of resistance for heavy emitters to sustain BAU growth under fossil capitalism. The economic arguments in favour of carbon forestry – low-cost emissions reductions for heavy emitters, profit opportunities for project developers, consultants, and others – have neatly aligned with the preference for market-led, growth-accommodating solutions to environmental management in the era of neoliberalism. Capitalist entities require new sources of commodities to satiate their growth imperative, so the potential for forest-based offsets to satisfy this demand has undermined the valid environmental critiques of AR and REDD+.

The implications of relying on questionable, market-led climate change strategies go beyond that of environmental integrity as well. Carbon forestry, and offsetting more broadly, has become a method to protect the North's capacity to emit GHGs. Bachram (2004) has formulated the term carbon colonialism to describe how the North has displaced the responsibility to mitigate climate change to cheaper project sites in the South. The same set of measurement technologies that equates GHG emissions anywhere and from any source also allows Northern countries to offset their emissions in far off locations, rather than reduce emissions at home (Böhm & Dabhi, 2009, p. 13). In this view, carbon trading may be seen as a historical development of capitalism, where powerful countries exert their superior economic and political status for financial gain and heighten global inequalities in the process (Böhm et al., 2012, p. 1624). Now, these same powerful countries in the North are similarly attempting to maintain their dominance by convincing nations in the South to reduce emissions on their behalf (Bumpus & Liverman, 2008, p. 142; Lohmann, 2005, p. 209).

Several interrelated criticisms highlight the multiple ways in which the spread of carbon trading and REDD+ negatively impacts marginalized groups. The first of these criticisms comes from environmental justice and climate justice advocates, who condemn carbon trading for permitting GHG emissions to continue at Northern industries so long as offsets are purchased elsewhere. Environmental justice groups note that fossil-fuel industries in the North are typically located next to low-income, communities of colour, rather than more upwardly mobile, wealthy, typically white communities (Agyeman et al., 2002, p. 82). This is particularly problematic because fossil fuel combustion also

releases other airborne pollutants, which can cause serious cardiovascular and respiratory problems, and even death (EPA, 2014). A study by the American Cancer Society revealed that among 500,000 adults in 151 US cities, the mortality rate of residents in the most polluted cities exceeded residents of the least polluted cities by 17% (Bell & Samet, 2016, p. 327). Furthermore, these damaging "co-pollutants" will continue if an industry can simply trade for emissions reductions credits elsewhere instead of reducing its pollution locally (Bachram, 2004, p. 17). In response, environmental justice advocates demand greater political representation to have a say in where polluting industries are located, and furthermore, to phase out harmful pollutants at the source (Agyeman et al., 2002, p. 82).

Similarly, climate justice proponents follow the model of environmental justice groups, noting that the responsibility to drastically cut fossil fuel consumption should fall on the industrialized countries in the North, who have already contributed to 80% of historic global CO_2 emissions (Okereke, 2011, pp. 121-122). Indeed, fossil fuel-based CO_2 emissions outnumber CO_2 emissions from land use change by over 9 to 1, and per-capita emissions rates are substantially larger for countries in the Global North (IEA, 2016; Le Quéré, 2016, p. 625). With these statistics in mind, the fact that Northern industries and countries are using carbon forestry projects to avoid tackling their own, larger contribution to climate change makes Bachram's (2004) term carbon colonialism even more appropriate.

Several groups have embraced the arguments against carbon trading and REDD+ put forth by the environmental and climate justice movements over the years. The 2010

'First Peoples' World Conference on Climate Change and the Rights of Mother Earth in Cochabamba, Bolivia was organized by climate justice advocates, who hoped to include environmentally just principles in United Nations treaties and legislation on climate change. Among these principles was a recognition of the North's historic contribution to climate change through fossil fuel consumption, and a rejection of the commodification of nature through carbon markets, including REDD+ (Bond, 2011, p. 8). The Durban Group for Climate Justice issued a statement at COP 16 in Cancún, Mexico that rejected REDD+ on the same basis as carbon offsetting more broadly. The statement argued that REDD+ offsetting delays urgent action on large-scale emissions cuts by giving industries and countries flexible investment opportunities in forest conservation (Bond, 2012, p. 696).

The environmental and climate justice perspectives offer an important critique of carbon trading and carbon forestry that problematizes market-based environmental policies in general. The growth imperative of capitalism has historically produced negative climatic effects, while policymakers have responded with schemes like carbon trading and carbon forestry that protect the North's capacity to emit. In the process, Southern nations are tasked with fixing a problem to which they have contributed very little, if at anything at all.

Moreover, it is not just the discrepancy between the North and South's contribution to GHG emissions that is worthy of being termed an environmental injustice. Past and existing AR and REDD+ projects have threatened the economic opportunities and livelihoods for forest dwelling communities. Indeed, as the case of the Mount Elgon

reforestation project shows, many rural and indigenous communities in tropical forested countries depend on forest-based resources for their survival (Cavanagh & Benjaminsen, 2014; Nakakaawa et al., 2015; Vedeld et al., 2016). Furthermore, the process of enclosing and privatizing a tCO_2e reduction for market trade can affect existing land tenure arrangements, which are defined as the right to hold and use land and other resources for a given period and under specific conditions (Corbera, Estrada, May, Navarro, & Pacheco, 2011, p. 304). As Corbera et al. (2011) explain, land tenure includes both formal rights to property that are upheld by legal institutions and informal rights relating to access and use. Informal rights can not only exist alongside formal rights, but may also be governed by relations and forms of authority that are entirely separate from those that guarantee the formal rights to property (p. 303).

One concept that is especially useful to pinpoint some of the ways that carbon forestry can negatively impact livelihoods and land tenure is James Fairhead, Melissa Leach, & Ian Scoones' (2012) term green grabbing. These authors define green grabbing as "the appropriation of land and resources for environmental ends", a phenomenon that evolves out of market-based environmental policies (Fairhead et al., 2012, p. 238). As these policies spread, previously uncommodified goods and services, like the ability of forests to store CO_2, are commodified and privatized for incorporation into capitalist markets. However, when this occurs, CO_2 and other objects are effectively "enclosed" or privatized, controlled by capitalist entities for the purpose of growth and profit, often regardless of how and by whom these goods and services were governed previously (De Angelis, 2004, p. 64). In this arrangement, a tCO_2 reduction can be bought and sold by a

singular, private entity, and no longer exists as a part of the global commons (Bachram, 2004, p. 13) Fairhead et al. (2012) also note that green grabbing can lead to outright enclosures of land and resources for control by private or state capital, or alternatively foster the reorientation of laws and customs regarding access and resource use that still produces the same alienating effects (p. 239). Either way, green grabs can promote new inequalities between communities and outsiders, or exacerbate existing inequalities.

MacDonald's (2005) account of a market-based wildlife conservation strategy in northern Pakistan serves as an example of the implications of commodifying nature, and thus helps to shed light on how we must theorize the consequences of carbon forestry as green grabbing. In 1996, the World Conservation Union signed an agreement with village leaders in the town of Hushe; villagers would stop hunting ibex, and in return, would receive revenue from the sale of permits to international hunters (MacDonald, 2005, pp. 262-263). In effect, ibex became a commodity, whose preservation depended on enclosing them for exclusive hunting privileges by wealthy Westerners. The project moved forward despite no evidence to suggest that Hushe villagers had unsustainably hunted ibex in the past, or should be banned from hunting them in the future (pp. 273, 282).

Furthermore, the process of enclosing the ibex negatively impacted Hushe villagers by individualizing their role in the community. Formerly, village members had been able to freely hunt ibex in the region, a right that held significant cultural value in addition to its dietary necessity (MacDonald, 2005, p. 280). However, after the implementation of the World Conservation Union's plan, any Hushe villager that killed

an ibex was not only reinforcing the organization's false narrative of subsistence hunters as environmentally destructive, but was also committing a crime against the community by threatening village income from sale of the hunting permits (p. 281). The international hunter, on the other hand, was deemed to be protecting the ibex as a global commodity when she purchased a hunting permit (p. 282). An important implication of this for carbon forestry is that in a market-based environmental scheme, local modes of regulation and custom are usurped by the demands of the new regime doing the governing. Thereby, communities that hope to receive financial compensation as part of a conservation or carbon forestry project must abide by these enclosures.

Already, existing carbon forestry projects have advanced green grabs through the commodification of forest-based CO_2. As discussed earlier, Cavanagh & Benjaminsen's (2014) analysis of the Mount Elgon reforestation project in Uganda revealed that the initiative eventually halted reforestation activity after local people continued to use the project land they were evicted from. However, the evicted residents did not view themselves as illegal invaders, as they held customary tenure rights to their land based on their local traditions. Still, they were evicted for the creation of the reforestation project in 1993, a period when the Ugandan government claimed state ownership of all land. The state reversed this position in 1995 and recognized customary tenure rights again, but by this time the evictions had already started (Carmody & Taylor, 2016, p. 108; Cavanagh & Benjaminsen, 2014, p. 59). Despite the evicted peoples' numerous claims to customary land ownership following the constitutional change, the project developer Face the Future made no mention of this contested history and forced removal when they published

brochures and annual reports about the trajectory of the project (Cavanagh & Benjaminsen, 2014, pp. 59-60). Together, the Ugandan state's willingness to enforce Face the Future's request for carbon offset commodities – free from human influence – advanced a green grab by adversely impacting the people who depended on the project area for their livelihoods.

The pilot REDD+ project in coastal Tanzania described by Beymer-Farris and Bassett (2012) also shows a preference for excludable spaces free from perceived human interference. The Tanzanian state planned to evict 18,000 residents from the Rufiji Delta to make way for the initiative, even though the residents had sustainably harvested mangrove forests for centuries (pp. 336-37). Again, a confusing land history complicates the situation. All Tanzanian mangrove forests are under state protection, and subsequent laws in the 1990s consolidated their control under the state and limited their use to scientific and protective purposes only (p. 335). Yet, the 2002 Forest Act permitted two different types of participatory forest management, giving local community associations some autonomy over their mangrove-covered jurisdictions (p. 335). In fact, some data even showed an increase in the area's mangrove forest cover between 1993 and 2010 (pp. 338-339). Nevertheless, forestry officials – backed by armed police – still attempted to evict villagers over their alleged forest destruction in the delta in 2011, reportedly burning down villagers' huts and cutting down trees in the process (Lang, 2012; Beymer-Farris & Bassett, 2013 p. 1355). Since then, the project has been halted due to reports of embezzlement, but the case still serves as a sobering example of the detrimental effects of green grabs (Hance, 2012).

The case of the Kasigou Corridor REDD+ project in Kenya also exemplifies how offset projects can produce new inequalities or widen existing ones between local groups. The US corporation Wildlife Works started planning the project in 2008, and laid out a plan to compensate land owners and landless community members alike for refraining from cutting trees in the project area. Landowners in the area would receive 33% of the revenue from the sale of offsets, and after project costs were deducted, non-landowning community members would receive the remainder of the funds. However, the market price of carbon offsets on the VCM dropped significantly when credits were issued in 2010, and non-landowning community members only received 14% of total revenue distribution. This was far less than the one-third ratio split expected between project costs, landowners, and communities at the outset of the project (Chomba et al., 2016, pp. 206-207). These communities already faced restrictions on hunting, charcoal gathering, cultivation, and other extractive activities in the REDD+ project area to ensure that offsets were credible (p. 210). Consequently, a further decrease in revenue from the sale of carbon credits damaged their possible income opportunities even more.

Additionally, private and public entities alike could take advantage of small land owners (smallholders) with marginal or unclear tenure rights, worsening income disparity through REDD+ payments. In Vietnam, for example, the state owns the highest quality forests, whereas local people typically receive access to poorer-quality, degraded forests. The possibility of a national REDD+ scheme in Vietnam means that most payments could be held at the government level, with very little trickling down to those who manage the forests on the ground (Larson et al., 2013, p. 683). Thus, even if communities

are not relocated or restricted from their homes, they could still be subjected to a different kind of green grab, where REDD+ payments remain in private or state hands, rather than flowing down to forest dwelling populations. Moreover, as the above examples have demonstrated, REDD+ entails a marked shift in how communities may use and interact with forests. As the carbon stored in trees becomes the property of the offset user, local groups are barred from subsistence-based, small-scale activities that may undercut the value of the offset credit. In turn, community livelihoods may be negatively impacted not only at the outset of a REDD+ scheme, but at a later point as well if these groups are not adequately compensated for their involvement in the project.

2.5 Conclusion

Carbon trading has become the dominant policy response to climate change, albeit one that accommodates the main cause of the climate crisis itself, fossil capitalism. In the neoliberal era – where the power of free markets triumphs over state-led regulation of the economy – carbon trading, according to its proponents, promises flexible, low-cost emissions reductions designed to protect economic growth for fossil fuel-dependent entities. Carbon forestry offsetting is also an embodiment of market-based environmentalism. Firms receive emissions reduction credits for planting or protecting trees in the Global South, which is a more cost-effective method than reducing their emissions at the source. Moreover, it is a strategy that does not require the firm to shut down or drastically scale back production and CO_2 emissions.

In all, this chapter argues that carbon trading is a problematic solution to climate change both environmentally and socially, and carbon forestry as a subset raises several

important questions. Why should the global community put its faith in a climate change strategy that not only has difficulty measuring and monitoring CO_2 reductions, but in its design, allows for fossil-based CO_2 emissions to continue? Why should populations in the Global South and marginalized groups in the Global North favour offset provisions that allow high-emitting countries and industries to ignore their disproportionate historic and present contribution to fossil-based CO_2 emissions by offsetting their emissions instead? Why should carbon forestry policies that have the potential to undermine and harm peoples' livelihoods by restricting access to land and resources be a central component to climate change policy?

The above concerns are becoming increasingly pronounced as more governments implement cap-and-trade schemes with offset provisions, and as the possibility of a post-2020 international carbon market with REDD+ grows. The next two chapters show that in the immediate future, all eyes will be focused on California to establish an important precedent for the future of carbon trading worldwide. If the government of California allows capped industries to use REDD+ offsets in its Cap-and-Trade Program, the aspiration to achieve environmentally effective and socially just climate change mitigation in the future could take a serious hit.

Chapter 3: Market Environmentalism or Environmental Justice? Debates on Carbon Trading and Offsetting in California

3.1 Introduction

As the world's 15th largest emitter—if taken as a country on its own – California has a significant impact on the state of climate change globally (Union of Concerned Scientists, 2014). In recent years, governments in the state have passed measures to limit California's contribution to fossil fuel-based GHG emissions, one of which is the California Cap-and-Trade Program. Industries participating in the scheme may take several steps to cover their emissions under the cap, including trading allowances and offsetting from domestic sources. At present, international offsets are not permitted, but this may change if offsets from a REDD+ program in Acre, Brazil are allowed as early as 2018. If completed, the "California-REDD linkage" would be the first time REDD+ offsets are used in a compliance-based emissions trading scheme anywhere in the world. Yet, many of the same environmental and social concerns about REDD+ offsetting discussed in Chapter 2 have surfaced in the debates over this proposed REDD+ linkage too.

This chapter provides the background information on how proposals and plans for the California-REDD+ linkage have come about, with a specific focus on California. Section 3.2 presents a history of the California Cap-and-Trade Program, including how it was developed, the arguments for its implementation, and information on its design and current statistics. It also highlights the environmental justice community's original opposition to the scheme. This is rooted in the connection between heavy-emitting

facilities and local pollution, which makes people sick while also worsening their resiliency to the effects of climate change. The environmental justice community argued that cap-and-trade would lead to or perpetuate pollution "hot spots", where industries trade or offset their emissions rather than reduce them at the source. Subsequent movements have attempted to either block trading and offsetting altogether, so that industries would be forced to reduce their emissions and pollution at the source, or direct cap-and-trade funds to disadvantaged communities in the state, so that marginalized communities would receive tangible economic and environmental benefits from the trade in GHGs.

Section 3.3 details how the state of California's early efforts to protect tropical forests with other subnational jurisdictions worldwide has led to the proposed California-REDD+ linkage, bolstered by California's 2010 Memorandum of Understanding (MOU) with Acre. Advocates of the linkage claim that REDD+ offsets, which they assert are "proven" and "significant" sources of emissions reductions, would help Californian industries achieve "flexible" and "cost-effective" climate change mitigation. On the other hand, critics have raised concerns that allowing REDD+ offsets in the scheme would constitute an environmental injustice, where industries pay for international offsets of questionable environmental integrity, all while protecting their fossil fuel-dependent business models at home.

3.2 A History of Carbon Trading in California

California has been somewhat of a unique case in the US, as it has consistently pioneered more stringent pollution regulations, emissions standards, and environmental

policies than most other states or the federal government. California's environmental ambition can be traced back to the 1940s, when the city of Los Angeles was experiencing a massive problem with smog and haze brought on by rapid industrialization and automobile emissions in the region (Hanemann, 2007, p. 3). In 1945, the city passed an ordinance that placed limits on industrial smoke emissions and established an air pollution control unit in the city's industrial health department. Two years later, the Los Angeles County Air Pollution Control District was created, the first of its kind in the country (p. 4). The city's regulatory work to improve its environment spread state-wide throughout the 20th century, and even the federal government looked to California as "a kind of laboratory for innovation" in regulating pollution and developing clean technology (qtd. in Hanemann, 2007, p 5).

California's attention to environmental protection extended to tackling climate change in 1988, when the state's energy policy and planning agency, the California Energy Commission, was tasked with taking inventory of California's GHG sources (Hanemann, 2007, p. 8). Subsequent automobile fuel standards and renewable electricity mandates in the late 20th and early 21st centuries were passed by the state Legislature to both tackle the environmental cost of GHG emissions in the state and stave off potential fuel and energy shortages (p. 10). Given the state's reliance on oil imports (70% of California's petroleum consumption is sourced from out of state) and shale gas (the production of which only constitutes 1% of GDP), fossil fuel industries possessed a relatively marginal economic standing in the state, and thereby, less influence in obstructing these environmental policies (Harrison, 2013, p. S105; Houle, Lachapelle, &

Purdon, 2015, pp. 61-62). Coupled with high public belief in anthropogenic climate change and support for environmental policies in the mid-2000s, the stage was set for California to undertake its most robust environmental plan yet.

In 2006, the California state Legislature passed Assembly Bill (AB) 32, also known as the Global Warming Solutions Act. Hailed at the time as a ground-breaking climate change policy, the act required California to cut its GHG emissions to 1990 levels by the year 2020, 40% below 1990 levels by 2040, and 80% below 1990 levels by 2050 (Cullenward, 2014, p. 41; ICAP, 2016, p. 41). The state's clean air agency, the California Air Resources Board (CARB), was tasked with developing programs to achieve this target under an initiative known as the Scoping Plan (London, Karner, Sze, Rowan, Gambirazzio, & Niemeier, 2013, p. 791). Twelve of the fourteen members of CARB are appointed by the Governor and approved by the Senate, while the other two are appointed by the state Legislature. Six of these members are selected from the boards of the state's local Air Quality Management Districts, and the other eight come from a pool of experts on engineering, science and law, health, and social work with communities that are vulnerable to high levels of pollution (CARB, 2016a). Some of the programs CARB included under the Scoping Plan were the Renewables Portfolio Standard, which mandates that electricity retailers source 33% of their product from renewable energy by 2020, and the Low Carbon Fuel Standard, which requires a 10% drop in the carbon intensity of transportation fuels by 2020 (CARB, 2016b; Ramo, 2014, p. 113).

Additionally, CARB developed an emissions trading scheme, known as the California Cap-and-Trade Program. Cap-and-trade was not originally mandated when AB

32 was passed, but an Executive Order from California Republican Governor Arnold Schwarzenegger soon followed and prioritized it as a method to achieve the state's GHG reductions (London et al., 2013, p. 795). The Schwarzenegger Administration argued that cap-and-trade would allow the state of California to achieve the greatest amount of emissions reductions at the lowest cost, and thereafter, CARB submitted its first cap-and-trade plan in 2008 (Truong, 2014, pp. 502, 504).

The California Cap-and-Trade Program began operation in January 2012, and Californian industries were forced to comply with the program's restrictions on GHG emissions in January 2013. Californian businesses emitting over 25,000 tCO_2e per year in the electricity and industrial sectors were required to participate in the scheme when it began. Since 2015, when transportation fuels were added to the coverage, the scheme has capped roughly 85% of the state's emissions (Truong, 2014, p. 504). Emissions regulated by the cap are to decline by nearly 80 million tCO_2e from a BAU emissions scenario by the end of the third trading period in 2020, at a rate of 2-3% a year (Burtraw; McLaughlin, & Szambelan, 2012, p. 4; Purdon, Houle, & Lachapelle, 2014, p. 16). Of this number, 18 $MtCO_2e$ of reductions are expected to come exclusively through cap-and-trade activity, meaning regulated industries must cut their emissions by 15% below 2012 levels to meet this target (Ramo, 2014, p. 128).

Allowances to emit, measured as one tCO_2e, are distributed to participating Californian firms through a mixture of free allocation and auctioning. For free allocation, firms are ranked by their perceived carbon "leakage" risk, where a competitively disadvantaged or trade-exposed industry could relocate to a jurisdiction not subject to

carbon pricing rather than reducing its emissions (Ervine, 2016, p. 22). In the California Cap-and-Trade Program, oil and gas extraction companies, paper mills, chemical and cement manufacturers, and electricity retailers are given 100% of their allowances for free throughout the scheme's three trading periods (Purdon et al., 2014, pp. 21-22).

For the permits that are not freely allocated, quarterly joint permit auctions take place between California and the Canadian province of Québec. Québec linked its own "Cap-and-Trade System for Greenhouse Gas Emissions Allowances" to California's in 2014 as part of the environmental non-profit corporation Western Climate Initiative (WCI). The WCI was designed to provide technical and administrative support to North American state and provincial governments in developing carbon trading programs (WCI, 2014). The linkage and joint auctions between California and Québec are meant to allow industries in each jurisdiction to achieve their GHG targets more easily by providing them with additional options (Haya, 2016, p. 5). Proponents contend that this allows for even greater efficiency and cost-effectiveness by expanding the number of low-cost emissions reductions possible in the scheme (WCI, 2010, pp. 5-6).

For instance, a firm in Québec may have a difficult time reducing its emissions under the cap. Through the linkage to the California Cap-and-Trade Program, it may find it can purchase surplus allowances from an efficient Californian industry for cheaper than the cost of purchasing allowances at auction or from other Québécois industries. Similarly efficient industries in either jurisdiction, then, could also financially benefit from the sale of such allowances. Alternatively, critics of linking cap-and-trade markets argue that the arrangement allows market actors to send financial resources out of the

state or province, contributing to lost at-the-source emissions reductions and economic investment at home (Ranson & Stavins, 2016, pp. 5-6, 8).

Capped industries in California may also offset up to 8% of their compliance emissions from domestic sources approved by CARB. US Forest, Urban Forest, Livestock (Methane Management), Ozone Depleting Substances, Mine Methane Capture, and Rice Cultivation are the six different project types industries may offset their emissions from (ICAP, 2016, p. 42). The US Forest offset type is an especially relevant precursor to the REDD+ linkage. Reforestation, improved forest management, and avoided forest conversion projects within the US are all eligible to receive funds for offset credits to use in the California Cap-and-Trade Program (Lueders, Horowitz, Carlson, Hecht, & Parson, 2014, p. 10). As of February 2017, CARB has issued just over 30 million offset credits for compliance use from all the approved project types, except for Urban Forest and Rice Cultivation. About 70% of these credits have come from US Forestry projects as well (CARB, 2017b).

Similar to the reasons presented in favour of the CDM, California politicians, fossil fuel industry representatives, and some environmental NGOs argued that offsets would substantially lower the costs of complying with emissions reductions under the Cap-and-Trade Program. The Western States Petroleum Association, a trade group representing 28 companies in the fossil fuel industry, argued that a more generous allowance for offsetting than CARB's 8% limit would decrease program costs by 80% and keep 300,000 jobs in California that would otherwise be lost to leakage, as companies relocated to avoid the costs of the scheme (Reheis-Boyd, 2009). The non-

profit environmental organization Environmental Defense Fund (EDF) claimed that the agriculture, forestry, and other sectors whose emissions were not capped under AB 32 could benefit from technological innovation and emissions reductions made possible through offset payments (EDF, 2012). Additionally, proponents stated that climate change action could spur economic development in California, creating a centre for clean technology development in the state (Purdon et al., 2014, p. 40).

However, not everyone has been keen to support the California Cap-and-Trade Program. Environmental justice groups were quick to oppose carbon trading, as it builds upon their struggle against California's first experience with market-based environmental policy two decades ago. During the 1990s, the South Coast Air Quality Management District, covering metropolitan Los Angeles, implemented a pollution trading program to reduce the amount of particulate matter, a mix of solid and liquid pollutants, in the region (EPA, 2014). Particulate matter is emitted from power plants and some industrial and combustion processes, and can cause or seriously exacerbate respiratory or cardiovascular diseases like asthma, chronic bronchitis, coronary artery disease, and even cancer (Drury, Belliveau, Kuhn, & Bansal, 1999, p. 231; EPA, 2014). The pollution trading program, known as Rule 1610, allowed stationary facilities, like factories and refineries, to purchase credits from destroying old, high-polluting cars rather than installing more expensive technology to reduce pollution at the source (Drury et al., 1999, pp. 247-248).

When Rule 1610 went into effect, industries predictably started to purchase cheaper pollution reduction credits from destroying automobiles instead of reducing at-

the-source pollution. Four oil companies, Unocal, Chevron, Ultramar, and GATX, were the primary purchasers of these credits. Although air pollution declined slightly across the region, it became more concentrated near the facilities that chose to purchase the credits, creating "hot spots" of pollution (Drury et al., 1999, p. 253; Truong, 2014, p. 506). Communities located next to these facilities did not receive the health benefits of lowered pollution, even though under Rule 1610, pollution across the region technically declined when automobiles were taken off the road and destroyed (Drury et al., 1999, p. 253).

Additionally, the communities located next to high-polluting facilities in California are disproportionately comprised of low-income persons of colour. According to a 2012 study, 46% of Californian residents live within 6 miles of petroleum refineries, cement plants, and power plants. However, 62% of this group are persons of colour, whereas non-Hispanic whites only make up 38% (Pastor, Morello-Frosch, Add, and Scroggins, 2012, p. 82). For some groups, the disproportionate exposure to pollutants is even worse. The number of African Americans that live within ½ mile of one of the above facilities is double the number that live more than 6 miles from one (p. 82). Additionally, 70% of African Americans that make less than USD 10,000 a year live within 6 miles of a facility, while only 41% of whites do (p. 87).

Because of these inequalities, CARB's own Environmental Justice Advisory Committee (EJAC) and their allied organizations across the state contended that carbon trading would bring no improvement in reductions of GHG emissions or co-pollutants for low-income groups and persons of colour (Truong, 2014, pp. 507-508). Environmental

justice advocates came together in releasing *The California Environmental Justice Movement's Declaration on Use of Carbon Trading Schemes to Address Climate Change* in 2007, which was endorsed by dozens of organizations and individuals across the US. The declaration stated that carbon offsetting and trading schemes like the CDM and EU ETS do not contribute to substantial fossil fuel-based emissions reductions required to mitigate climate change, because the market-led design of carbon trading allows cost-efficiency, rather than environmental impact, to determine where emissions cuts occur (EJ Matters, 2007).

The EJAC acted on this argument in 2009 by filing a lawsuit against CARB. EJAC charged CARB with attempting to push through cap-and-trade in its Scoping Plan without thoroughly researching alternative, non-market-based emissions reduction policies (London et al., 2013, p. 796). The California Superior Court found that indeed, CARB had not carried out enough research into alternatives to cap-and-trade in the Scoping Plan, and furthermore did not wait to consider public feedback on cap-and-trade before approving the Plan (p. 797). Nevertheless, once CARB proved it had researched non-market alternatives and incorporated public feedback, it could proceed with its original cap-and-trade design as a part of AB 32.

Once cap-and-trade was imminent, a conglomeration of civil rights organizations, mainstream environmental groups, communities of color, and environmental justice groups banded together over a common cause. These groups engaged in several legislative and legal proceedings to try and improve the Cap-and-Trade Program from an environmental and socio-economic standpoint. On the one hand, more environmentally-

oriented groups were especially skeptical of the offsetting provision, and contended that it could not reliably reduce GHG emissions and mitigate climate change (Truong 2014, pp. 507-508). When firms offset their emissions, the state does not receive revenue from auctioning allowances that can go toward low-carbon and green energy projects (Ervine, 2016, p. 6). One the other hand, and building off the experience of Rule 1610, civil rights groups argued that market-based environmental policies, including cap-and-trade, subject communities of colour and disadvantaged groups to new or continued "hot spots" in pollution. In the process, these groups do not experience the environmental and health benefits that could be achieved if pollution was cut at the source. (London et al., 2013, p. 796).

A main point among both groups was that AB 32 did not stipulate how exactly disadvantaged communities, like those located near heavy-emitting facilities, would benefit from California's climate policy (Truong, 2014, p. 510). In addition to the health effects of co-pollutants, disadvantaged communities spend a large portion of their income on necessities like food and water, with costs likely to grow even more because of climate change (p. 498). One study also found that African Americans in Los Angeles were twice as likely than other Los Angeles residents to die in a heat wave, in part because they have less income to spend on water and electricity (p. 498). In response, the combination of environmental groups and civil rights organizations helped write and pass Senate Bill (SB) 535 in 2011 (p. 511).

SB 535 mandates that 25% of allowance auction revenue from the California Cap-and-Trade Program must benefit disadvantaged communities as defined by the California

Environmental Protection Agency's "CalEnviroScreen" metric. [8] Additionally, 10% of the revenue must be invested within the geographic boundaries of the disadvantaged communities themselves (Truong, 2014 p. 514). So far, the state has implemented USD 1.2 billion of auction revenue in low-carbon, green energy, and sustainable development programs that comprise the California Climate Investments (CCI) fund. SB 535 has contributed to 50% (USD 614 million) of this total benefiting disadvantaged communities, and 34% (USD 413 million) of the original amount has been invested within these communities' geographic boundaries (CCI, 2017, pp. v, vii).

For example, the Department of Community Services and Development has implemented its share of the state's auction proceeds in the CCI fund towards various subprograms of the Low-Income Weatherization Program. These subprograms are designed to help low-income families save money on energy costs while also providing job training and employment opportunities. Employees might install solar panels in poor, single-family households, or repair or replace windows, refrigerators, and heating/cooling systems in low-income, single-family households and small multi-family homes (CCI, 2017, pp. 72,75). Critically, 100% of the auction proceeds in these specific subprograms benefit and are located in disadvantaged communities (pp. 72, 75). Additionally, the California State Transportation Agency has designated 95% (USD 213.3 million) of its

[8] In 2010, the California Environmental Protection Agency and Office of Environmental Health Hazard Assessment developed the *California Communities Environmental Health Screening Tool*, known as "CalEnviroScreen". CalEnviroScreen quantitatively assesses pollution sources and stressors with a population's vulnerability to pollution based on socio-economic indicators, and ranks the sum of these indicators across California's 8,000 census tracks. Based on this methodology, roughly 25% of the state's population was categorized as "disadvantaged" (California Environmental Protection Agency, 2014).

allotted auction proceeds through its Transit and Intercity Rail Capital Program to benefit disadvantaged communities, with 81% (USD 182.4 million) located within these communities. The program is intended to make the state's transit and rail system more efficient and sustainable, which includes improving access to transit and rail systems and increasing service for disadvantaged communities (p. 58).

To bolster the effectiveness of legislation like SB 535, environmental justice advocates have also sought to either rein in or prevent outright the offsetting provision within the California Cap-and-Trade Program. In February 2013, SB 605, co-authored by Senate President Pro Tem Darrell Steinberg and Senator Ricardo Lara, was introduced to the California Legislature. This bill was designed to limit any offsets used within the California Cap-and-Trade Program to sources strictly originating in California (Lueders et al., 2014, p. 10). However, by the time the bill was passed a year and a half later, the California State Assembly had subjected it to major revisions, most importantly taking out the limitations on out-of-state offsetting (p. 11).

In 2015, the Court of Appeal of the State of California upheld a prior Superior Court decision that had challenged CARB's authority to include offsets in the Cap-and-Trade Program. The original case, *Citizens Climate Lobby and Our Children's Earth Foundation vs. California Air Resources Board*, was brought forth by two attorneys acting on behalf of the Citizens Climate Lobby (Monfreda, 2015, pp. 244-245). First, the attorneys argued against the use of "performance standards" to determine the validity of domestic offset projects. Performance standards were introduced as an alternative to the project-by-project standards used to register offset projects in the CDM, which critics

asserted made for a slow and expensive process of issuing offsets. In their view, performance standards would provide a universal measurement to quickly and cheaply determine additionality across an offset category if projects were simply beyond "common practice" (p. 245). However, the attorneys countered that the use of performance standards would allow for ongoing GHG reduction activities that were beyond common practice to generate non-additional offsets (p. 245).

Furthermore, the attorneys claimed a "profitability test" – used to separate offset projects likely to go ahead without offset finance from those that were not – involved too much guesswork to account for the total costs of the project and how much offset credits would sell for (Monfreda, 2015, pp. 246-248). As a result, the petitioners cautioned that corrupt project developers could include activities that were not additional to earn more offset revenue (p. 248). However, both the Appeals Court and Superior Court concluded that if the petitioners' critiques of determining additionality were accepted, these market-based approaches to climate change mitigation would be ineligible from the program entirely (p. 250).

The overall debate on carbon trading in California touches on many of the themes already raised in this thesis. Proponents have touted a cap-and-trade program as the means of providing cost-effective emissions reductions for Californian industries, with offsets adding an additional layer of flexibility for industries to reduce emissions outside of capped sectors. On the other hand, opponents have cited the major concerns with environmental effectiveness and equity in market-based emissions trading programs both in California and abroad to fight the roll-out of carbon trading. As the next section shows,

as REDD+ offsets may enter the Cap-and-Trade Program very soon, the debate between the two sides is far from over.

3.3 Room for REDD+? International, Sector-Based Offsets in California

In its final draft of the Cap-and-Trade Program legislation, CARB sanctioned the possible use of international, sector-based offset credits in the California carbon market. Instead of coming from individual projects, a national, regional, or subnational government body outside the US could generate offsets by reducing its jurisdictions' emissions across an entire economic sector, like in transportation, electricity, or land use, (Lueders et al., 2014, p. 5). If the governing body of this economic sector linked its climate policy or program providing the offsets to the California Cap-and-Trade Program, Californian industries could purchase these emissions reduction credits (CARB, 2015, pp. 28-29). CARB stipulated that sector-based offsets could count for up to 2% of a firm's emissions during the first two compliance trading periods, and up to 4% during the third, all within the existing 8% offsetting limit (Ramo, 2014, p. 128).

As outlined in its final cap-and-trade plan in 2011, CARB has specifically targeted REDD+ projects as the source of sector-based offsets (Lueders et al., 2014, p. 9). According to CARB, continued deforestation, especially in the Amazon, would have a tremendous impact on California's resistance to climate change. Forecast models predict that increased Amazonian deforestation could alter the path of the jet stream and lead storms away from California, which would reduce the shrinking snowpack in the state's Sierra Nevada mountain range. (CARB, 2015, p. 10). Already, a 2014 report ruled that the state's drought over most of the 2010s, caused by a persistent shift in the jet stream,

was three times as likely to occur under today's atmospheric GHG levels than at pre-industrial levels (Swain et al., 2014). Additionally, more studies predict that Amazonian deforestation could set off frequent El Niño-like events, where the eastern Pacific Ocean around the equator warms by several degrees, triggering intense climatic phenomena. In the past, El Niño has been linked to melting snowpacks in the Sierra Nevadas, and flooding and landslides at lower elevations in California (CARB, 2015, p. 10).

With these worrying studies in mind, the Schwarzenegger Administration and outside consultants like US Forestry Service employee Tony Brunello and attorney William Boyd began working on international partnerships to stop deforestation, including through REDD+ (Lueders et al., 2014, pp. 7-8). First, the Californian government fomented interest among regional governments in tropical countries to tackle their forestry-related GHG emissions. At the 2008 Governors' Climate Summit in Los Angeles, the government of California signed an MOU with many subnational governments at both domestic (Illinois, Wisconsin) and international (Brazil, Indonesia) levels to work on reducing deforestation and mitigating climate change (Lueders et al., 2014, p. 8). The following year marked the founding of the Governors' Climate and Forest Task Force (GCF), which built on the MOU signed at the Governors' Climate Summit. The GCF also incorporated more regional governments, including jurisdictions in Brazil, Indonesia, Spain, Nigeria, Mexico, and Peru, encompassing over $1/5^{th}$ of the world's tropical forest cover in total (ROW, 2013, p. 8).

Most importantly, in November 2010 California signed an additional MOU with fellow GCF states Acre, Brazil and Chiapas, Mexico. This MOU was distinct from the

previous version in its explicit desire to link jurisdictionally-administered REDD+ programs in both states to the California Cap-and-Trade Program. In contrast to project-based REDD+ programs operating in the VCM, or UN and World Bank-sponsored schemes being developed nationally, the jurisdictional REDD+ program agreed upon in the MOU between California, Acre, and Chiapas would operate at the subnational level of the latter two states.

Within a jurisdictional REDD+ scheme, a subnational government determines the baseline deforestation rate for its entire governing area. Proponents of this method – including researchers, government representatives, and others comprising the REDD Offset Working Group (ROW) commissioned by CARB in 2011 – argued that a jurisdictional program would allow a subnational government to coordinate deforestation-related policies, measurement and MRV techniques, social and environmental safeguards, and law enforcement approaches on a much larger scale than any project-based initiative (ROW, 2013, p. 24). In theory, the increased scope, coordination, monitoring, and planning in relation to avoided deforestation at the jurisdictional level would help prove the additionality of reduced forest-based emissions compared with a BAU scenario. Also, this increased scope might better account for and prevent non-permanence and leakage issues than a project-based REDD+ scheme (p. 24).

The REDD Offset Working Group also raised the possibility of incorporating existing or future project-based REDD+ initiatives into a "nested" approach. In a nested REDD+ framework, emissions reductions are tracked at the project level, but projects issue offset credits based on gains or losses in forest-based emissions across the entire

jurisdiction (ROW, 2013, p. 28). Karsenty, Vogel, & Castell (2014) state that a nested REDD+ strategy might appeal to private sector groups who are skeptical of putting subnational governments in charge of distributing all REDD+ revenues (p. 21). However, a nested REDD+ strategy would require a great deal of work to harmonize deforestation reference levels and divide emissions reduction credits between projects and the subnational government, to ensure that false emissions reductions are not credited (Karsenty et al., 2014, p. 22; ROW, 2013, p. 28).

Regardless of a purely jurisdictional or nested approach, REDD+ offsets remain attractive to Californian firms that desire cost-effective emissions reductions under the cap (CARB, 2015, p. 12; Dixon, Anger, Holden, & Livengood, 2008, p. 10). In a 2013 letter to California Governor Jerry Brown and CARB Chairwoman Mary Nichols, dozens of private companies and market-based environmental organizations in the for-profit and non-profit sectors expressed their support for the California-REDD+ linkage. Their letter asserts that REDD+ "makes good business sense for California companies", and is a "*proven, cost-effective tool*" in reducing deforestation-related GHG emissions (Code REDD, 2013, emphasis in original). One of these supporters, the natural gas and electricity utility Pacific Gas & Electric Company, stated that REDD+ offsets would help contain the costs of the Cap-and-Trade Program, while the EDF also wrote that a jurisdictional REDD+ program would lead to "significant emissions reductions" for Californian industries (Lueders et al., 2014, p. 19). [9]

[9] An extensive list of both supporters and critics of the California-REDD+ linkage may be found in the public comments for CARB's workshops on sector-based offsets, on CARB's website at https://www.arb.ca.gov/cc/capandtrade/meetings/meetings.htm.

On the other hand, opponents of the California-REDD+ linkage have contended that there are serious environmental and social pitfalls with REDD+ offsets. A main environmental concern is that it is one thing to assert that deforestation in a jurisdiction has declined, based on remote sensing satellite imagery and on-the-ground checks; however, it is much more difficult to prove that deforestation has not occurred precisely due to REDD+ payments, rather than from regulatory policies or changes in the activities that drive deforestation. This recalls the hot air phenomenon, where credits are issued for emissions reductions that offset payments did not cause, meaning the credits are "non-additional" (Haya, 2016, p. 2; Seyller et al., 2016, p. 535). Other groups have raised questions about how the credibility of REDD+ offsets would be affected if trees were lost to natural or human causes in the future (non-permanence) or if deforestation activity relocated outside of each jurisdiction (leakage) (Lang, 2013a).

There is also concern about the proposal from a social standpoint. A letter to CARB, signed by 21 representatives from groups like the California Environmental Justice Alliance, Friends of the Earth US, and the Asian Pacific Environmental Network, has argued that the agency has so far not identified how the California-REDD+ linkage would protect disadvantaged Californian communities from pollution hotspots (Vanderwarker, 2016). In this view, the linkage would be yet another barrier towards reducing co-pollutants and improving local health and the environment for disadvantaged groups. Organizations in both California and Acre have also labelled the California-REDD+ linkage as an example of carbon colonialism. Here, wealthy industries in California would seek out cheaper, forest-based offset commodities in Acre to preserve

their business models, rather than address their overwhelming historic and present contribution to fossil fuel-driven climate change (Lang, 2013b; Nussbaumer & Lupien, 2016).

Currently, CARB is still deliberating on whether or not it will pursue the linkage. Previously, the REDD Offset Working Group produced a set of final recommendations in July 2013 that advised CARB on how to best proceed with a jurisdictional REDD+ linkage (ROW, 2013). Two years later, CARB published a white paper that definitively advocated for the use of REDD+ offsets (CARB, 2015). In 2016, CARB also issued a draft plan on the future of the California Cap-and-Trade Program after 2020. In the paper, REDD+ credits were still floated as a potential offset source for industries at the start of the program's third compliance period in 2018, but nothing certain was laid out (Garside & Szabo, 2016).

3.4 Conclusion

Overall, the rationale for including REDD+ offsets in the California Cap-and-Trade program matches the growth imperative of firms under fossil capitalism. Cheap REDD+ offsets from Acre would provide a boon for California's heaviest emitters over costlier mitigation strategies, while also stimulating economic growth for California-based or other firms involved in offset project development, consulting, and research. However, critics caution that an economic argument behind the California-REDD+ linkage overlooks serious problems regarding the questionable environmental integrity of REDD+ offsets, the effect of offsetting on disadvantaged communities in the state, and how the proposal could further carbon colonialism. Before analyzing these issues in

depth, it is important to consider not only how REDD+ has become a policy proposal in California, but also in Acre. The next chapter examines the history of Acre's own foray into REDD+, while also demonstrating why its plan to supply Californian industries with offsets is problematic for a different set of reasons.

Chapter 4: Deforestation, Carbon Forestry, and Conflict in Brazil and Acre

4.1 Introduction

Acre is a heavily forested state in the western part of the Brazilian Amazon, and was one of two states identified in the 2010 MOU as a possible supplier of REDD+ offsets for the California Cap-and-Trade Program. Recently, CARB (2015) has stated that REDD+ offsets from Acre would not only help Californian industries cost-effectively mitigate climate change, but also benefit populations in Acre (Acrianos) by providing funds to protect their culture, create jobs, and preserve biodiversity (p. 14). These actions build upon the government of Acre's own efforts to reduce deforestation over the past two decades as well, most notably through its 2010 State Incentives for Environmental Services (SISA) program. In fact, because of the legal and institutional frameworks for statewide deforestation reductions contained in SISA, outside observers have called Acre the host of the world's first jurisdictional REDD+ program (CARB, 2015, p. 43; Duchelle, Greenleaf, Mello, Gebara, & Melo, 2014b, p. 33).

This chapter presents an overview of how Acre came to develop its own deforestation reduction policy to link to the California Cap-and-Trade Program, and what it might gain or lose should the linkage go ahead. Section 4.2 begins by documenting the federal history of land tenure and ownership, drivers of deforestation, and environmental policy in Brazil. Decades of the federal government giving land titles to extractive industries has caused deforestation nationwide to skyrocket, especially in the Amazon. Policy responses have included outright bans on commodity production linked to

deforestation, as well as distributing land titles to smallholders in exchange for forest protection, to varying degrees of success or failure. Section 4.3 shows how Acre has, like California, forged ahead of the federal government's environmental efforts in creating its own subnationally-administered environmental policies over the past two decades. Ultimately, this has culminated in SISA, the potential source of offset credits for the California-REDD+ linkage. This section discusses some of the key aspects of SISA, as well as highlighting some pros and cons of the initiative that could affect Acrianos if SISA takes on a market component and supplies offsets to California.

Section 4.4 inserts the concept of green grabs back into the discussion of carbon forestry offsetting. This time, the discussion functions as a warning based on the experience of other carbon forestry projects that have worsened the socio-economic circumstances and livelihoods of local populations, created rifts within communities, or exacerbated land tenure conflicts of forest dwelling groups living in these project areas. Fairhead et al. (2012) note that green grabbing can occur in a multitude of ways, but essentially, all forms of green grabbing contribute to alienating poorer communities from their land and resources for the benefit of more powerful entities (p. 239). In any case, the three Brazilian case studies that will be examined – the Guaraqueçaba Climate Action Project, the Suruí Forest Carbon Project, and the Purus Project – as well as a jurisdictional REDD+ program in Cross River State, Nigeria, illustrate the various ways green grabs can take effect. As such, they provide a powerful lesson for those that should influence the future of the California-REDD+ linkage.

4.2 Land Tenure, Deforestation, and Environmental Policy in Brazil

The state of Acre did not establish what CARB (2015) and the REDD Offset Working Group (2013) have called one of the most advanced REDD+ programs in the world in isolation. Rather, it has built off the Brazilian federal government's efforts to undertake a series of land reform and deforestation-related policies over the past several decades. The history of these measures provides useful context in the lead up to the government of Acre's own foray into subnational environmental policy and jurisdictional REDD+.

Up until the 1960s, large swaths of land in Brazil were held by either the government or in private holdings, a remnant from the Portuguese colonial era. During the colonial period, the Portuguese Crown would transfer its ownership of large landholdings in the Amazon to elites, who worked the land in exchange for tax exemption and a portion of the land's profits (Duchelle et al., 2014a, p. 55; Reydon, Fernandes, & Telles, 2015, pp. 510-511). Following independence, the Brazilian state passed several laws that attempted to consolidate unclaimed land in the hands of the federal government. These included the 1850 Land Law, which stated that only land acquisition through legal channels allowed for land access, and the 1916 Registration Law, which mandated that legal documentation was necessary to prove land ownership (Reydon et al., 2015, pp. 510-511). However, landless rural peasants vehemently challenged these measures, leading to numerous violent conflicts between these "camponeses" and large landholders in the late 19th and early 20th centuries (Simmons, Walker, Armia, Aldrich, & Caldus, 2007, p. 568). These laws were largely unsuccessful

at verifying landholdings, though, so by the-mid 20th century, the occupation of unclaimed land by forest dwellers was a common feature throughout rural Brazil (Reydon et al., 2015, p. 511).

Formally, the situation began to change in the 1970s for several reasons. On the one hand, several reform-minded peasant movements had grown frustrated with high levels of rural poverty and inequality among landless forest dwellers, which still exists today. For example, in 2006, 5% of the largest farms in Brazil encompassed almost 70% of the total farm area, while 50% of the smallest farms only covered 2.3% of this area (Reydon et al., 2015, p. 509). Furthermore, 47% of the country's forests are owned by individuals and private firms, whereas only 26% is owned by communities and indigenous people (Larson et al., 2013, p. 681). As a result, peasants sought to redistribute the large estates held over from the colonial period so that the land could be put to productive use and generate income (Reydon et al., 2015, p. 511). On the other hand, the federal government also wanted to bolster its national borders through increased rural settlement. The Institute of Colonization and Agrarian Reform (INCRA) initiated a program called Direct Action Land Reform to distribute large state-owned or privately-held landholdings to smallholders. Peasants organized into associations, drafted development plans for their land plots, and invested in productive activities on the land in exchange for access to federal credit and services like education and healthcare, provided by INCRA (Duchelle et al., 2014a, p. 55).

Several problems arose with Direct Action Land Reform though. Large landholders and investors in major extractive industries like livestock and logging were

given priority for government subsidies over smallholders, the latter of whom often found themselves without financial support after settling in rural areas (Hall, 2008, p. 1926). Excessively large 2,000 to 3,000 hectare plots sold by INCRA were also intended for purchase by large mining and cattle ranching operations, in close coordination with the state. Thus, Direct Action Land Reform not only failed to provide much needed long-term income to newly-settled peasants and forest dwellers, but also accelerated large-scale deforestation (Thomas, 2011, p. 1119). Indeed, large landholders are estimated to account for 80% of deforestation in the Brazilian Amazon (Osborne, Bellante, & VonHedemann, 2014, p. 31).

Additionally, some settlers chose not to obtain official titles for their new land under Direct Action Land Reform, because they would consequently lose the financial subsidies given to peasants while they applied for landholdings (Simmons, 2010, pp. 433, 439). This meant that the land the settlers resided on was still technically owned by the state or a private entity (Duchelle et al., 2014a, p. 55). INCRA also stipulated that redistributed land must be put to "productive" use to warrant receiving subsidies, services, and eventually a formal title. Settling the land in the first place often led to forest clearing, but the productive use requirement led smallholders to engage in deforestation-related activities like slash-and-burn, a practice where forested areas are set ablaze to make room for agriculture (p. 55). Ironically, the Brazilian state began to frame smallholders as agents of deforestation, even though the government had helped finance extractive industries through policies like Direct Action Land Reform, and required smallholders to deforest in order to secure landholdings (Hall, 2008, p. 1926).

Smallholders often had to move to new land plots when soil quality declined after several years of farming, and those without title also were forced off their plots by land grabbers and forced to start their activities over in new areas (Thomas, 2011, p. 1109).

Increasingly, forest dwelling communities started to resist not only how large, extractive industries disproportionately earned tax breaks and government subsidies compared to smallholders, but also how the state framed forest dwellers as agents of deforestation instead of the extractive industries it helped finance. In Acre, this conflict boiled over as poor rubber tappers, who usually worked for large company estates, began losing their jobs. The Brazilian government had subsidized credit and gave tax breaks to cattle ranchers to buy out the rubber companies and clear cut Amazonian forests (Centro de Memória das Lutas e Movimentos Sociais da Amazônia, 2013; Schwartzman, 2015, p. 3). Chico Mendes, an Acriano rubber tapper, labour activist, and environmentalist, started to organize fellow rubber tappers and forest dwelling communities to protest the loss of their livelihoods and shelter. National and international environmental organizations picked up on the plight of Mendes and activists in the Amazon, and widely popularized the communities' struggle against the proliferation of land-clearing, extractive industries in Brazil (Schwartzman, 2015, p. 3). After Mendes' 1988 murder – carried out by a disgruntled rancher – international public opinion coalesced around the contributions of Brazilian smallholders in preventing deforestation and sustaining their economic livelihoods (Hall, 2008, p. 1926; Schwartzman, 2015, p. 3).

In the following decades, the Brazilian federal government moved to address deforestation that was rapidly accelerating in its territory, particularly in the Amazon. The

government's official position recognized that climate change, brought on in part by forest-based GHG emissions, is a serious threat to the environmental health of the country, and hits low-income groups particularly hard (Government of Brazil, 2008, p. 7). It also recognized that forests provide numerous ecosystem services, including CO_2 sequestration, so reducing deforestation would be essential in protecting these functions (p. 17). Economic practices that lead to deforestation, like agriculture and cattle ranching, would have to become more sustainable to foster low-emissions economic growth (pp. 7, 9-10).

One measure the government took was amending the Brazilian Forest Code, which stipulates that a certain percentage of each private landholding – which varies by region – must be protected as a forest reserve (Nepstad et al., 2014, p. 1118). In 1996, the government increased the forest reserve requirement for Amazonian landholdings from 50 to 80% (p. 1119). Notably, the federal government was skeptical of carbon trading programs as an incentive for landowners to meet this requirement. At COP 3, Brazil opposed the inclusion of avoided deforestation projects in the Kyoto Protocol, framing them as a free pass for Annex I countries to forego emissions cuts at home, while also undermining national sovereignty (Corbera et al., 2011, p. 318).

A decade later, the government imposed moratoriums on soy and beef production that took place on recently cleared lands as part of its "Plan for Preventing and Controlling Deforestation in the Amazon" (Richards, Arima, VanWey, Cohn, & Bhattari, 2017, p. 1). Farmers who grew soy on land cleared after July 26, 2006, and cattle ranchers who deforested after 2009 would not be allowed to sell their products to

wholesalers (Nepstad et al., 2014, pp. 1118-1120). The Brazilian government also passed its National Policy on Climate Change in 2008. One of the deforestation-related goals of this measure was a proposal to eliminate net forest cover loss by 2015. The government aimed to accomplish this by planting 11 million hectares of forest and reducing Amazonian deforestation by 80% – compared to the average deforestation rate from 1996 to 2005 – by 2020 (Government of Brazil, 2008, p. 14; Nepstad et al., 2014, p. 1119). Other measures included expanding protected areas and indigenous territories to encompass 68% of the Brazilian Amazon, as well as incorporating satellite imagery data through the national PRODES mapping system to monitor changes in forest cover (Nepstad et al., 2014, p. 1118; Richards et al., 2017, p. 2).

Another way the Brazilian government sought to eliminate net forest cover loss was by addressing the ongoing, land reform-minded peasant movements. By giving land titles to forest dwellers, the government believed it could hold these new landowners liable for deforestation in violation of the Forest Code (Thomas, 2011, p. 1134). In 2009, the Brazilian Ministry of Agriculture launched the *Terra Legal* (Legal Land) program. Over the course of three years, *Terra Legal* was supposed to give formal land titles to 300,000 smallholders who occupied and claimed rights to non-designated public land (Duchelle et al., 2014a, p. 55). To qualify for the program, forest dwellers needed to submit proof that they had peacefully occupied the land and cultivated a portion of it since 2004, were Brazilian citizens, and did not own rural property elsewhere in the country (p. 55). They also had to maintain 80% forest cover within their property as mandated by the Forest Code, and register their plot in a Rural Environmental Registry

(CAR) with the Ministry of Agriculture (Duchelle et al., 2014a, p. 55; Nepstad et al., 2014, p. 1119).

However, when *Terra Legal* began, large landholders began to acquire the rights to these lands at a far greater rate than smallholders, widening the already sizeable gap between the number of large and smallholder properties (Lang, 2013b; Osborne et al., 2014, p. 64). Indeed, 8% of the individuals who requested land titles for parcels between 400 and 1,500 hectares accounted for 49% of the total land area up for titling under *Terra Legal* (de L.T. Oliveira, 2013, p. 271). Additionally, the 80% land cover requirement under the Forest Code – which the government found difficult to enforce as deforestation rates rose in the early 2000s – was amended in 2012, thanks to heavy lobbying by the agribusiness industry. Under the new revision, Amazonian landholdings under 440 hectares that were deforested prior to 2008 were not required to maintain the 80% threshold. Combined with separate alterations on preservation requirements in small properties and those located in protected areas, the new Forest Code lowered the amount of land to be restored by an estimated 29 million hectares (Soares-Filho et al., 2014, p. 363).

One state where the consolidation of public lands in the hands of large, private owners escalated was Acre. In 2003, 444 landowners in the state possessed 2.8 million hectares of land, but by 2010, 583 landowners possessed 6.2 million hectares (Lang, 2013b). This means that as the number of landowners increased by 31%, the total area they controlled increased by 121%, amounting to nearly 79% of all registered land in the state. Given that *Terra Legal* allowed an individual to obtain up to 1,500 hectares of land

when the average Amazonian settlement is 50 hectares, representatives for large landowners and companies could theoretically apply for multiple land titles without penalty (Thomas, 2011, p. 1139). The difficulties of implementing *Terra Legal* add to the complex and often uncertain nature of land tenure regimes in the Amazon. 24% of the Brazilian Amazon is still comprised of unclassified public land, which features competing claims to land and unclear tenure rights between different groups (Larson et al., 2013, p. 682).

More recently, Brazil's Intended Nationally Determined Contribution (INDC), a country's individual emissions reduction strategy under the Paris Agreement, calls for the state to restore and reforest 12 million hectares of forests by 2030 (Federative Republic of Brazil, 2015). Brazil has also softened its stance on carbon trading somewhat in its INDC, which acknowledges that any emissions reductions produced in the country "will be subject to prior and formal consent by the Federal Government" before allowing another state to purchase these reductions as credits (Federative Republic of Brazil, 2015). Still, the INDC prohibits other signatories to the Paris Agreement from using emissions reductions produced on Brazilian territory for use outside the UNFCCC channels (Federative Republic of Brazil, 2015). Critically, this makes the legality and feasibility of the California-REDD+ linkage uncertain, given that offset credits from Acre would count as emissions reductions in California.

To recap, it is important to understand the context in which deforestation and subsequent environmental policies in Brazil have occurred. Deforestation in the second half of the 20th century has resulted from favourable sales of unclaimed land to extractive

industries, and to a much lesser extent, from smallholders fulfilling productive use requirements under land redistribution and titling programs. The land tenure history in Brazil is important to consider for the introduction of REDD+ schemes as well. If carbon forestry programs were to restrict or alter access to the many forested areas with unclaimed or unclear tenure rights, rural communities could be subjected to more land grabs or conflicts. Furthermore, while some might claim that REDD+ programs may be an opportunity for marginalized groups to gain legal title, evidence from the rollout of *Terra Legal* shows how these efforts may backfire (de L.T. Oliveira, 2013; Larson et al., 2013; Thomas, 2011). Already, this section has revealed some of the effects of deforestation and land tenure reform in Acre, from mobilizing rubber tappers threatened by the entrance of cattle ranching, to the consolidation of landholdings under *Terra Legal*. Moreover, as the federal government tried to implement these environmental and land tenure policies to curb deforestation, the government of Acre was carving out its own subnational climate change plan.

4.3 SISA: Jurisdictional REDD+ in Acre

Acre's SISA program, the model for jurisdictional REDD+ and the potential source of market-based offsets for the California Cap-and-Trade Program, can trace its start to the turn of the 21st century. From 1999 to 2010, the "Forest Government" administration of Acre governor Jorge Viana built upon the legacy of Chico Mendes by carrying out a forest-based development model for the state, which would protect the environment and provide socio-economic benefits for forest dwellers (Duchelle et al., 2014b, p. 37; Schwartzman, 2015, pp. 4-5).

In 2001, the government implemented the Acre Forestry Law, which created a legal framework in sustainable forest management for both forest dwelling communities and private sector groups that operated on public land (Faustino & Furtado, 2014, pp. 10-11). The Acre Ecological-Economic Zoning Plan followed in 2007, which called for the development of economic and environmental strategies for reforestation and forest restoration in cleared areas, and payments to landowners and forest users in exchange for sustainable management practices in heavily forested areas (Duchelle et al., 2014b, p. 33; Schwartzman, 2015, p. 7). A year later, the Acriano government implemented the Policy for Valuing Forest Environmental Assets, which emphasized assigning a monetary value to ecosystem service provision (Faustino & Furtado, 2014, p. 14). One program under this measure, the Certification of Sustainable Production Units, provided certification and technical assistance to 3,000 family farms for cutting out slash-and-burn agriculture (Schwartzman, 2015, p. 7).

The culmination of these policies was unveiled in Acre's SISA program in 2010, which included many "principles, guidelines, institutions, and instruments" to guide ecosystem service provision (qtd. in Centro de Memória, 2013, p. 1). To receive SISA funding, ecosystem service providers must submit the boundaries of their landholding to a CAR (Schwartzman, 2015, p. 8). The state then uses satellite imagery to assess the holding's compliance with the 80% forest cover threshold mandated under the Forest Code (Duchelle et al., 2014a, p. 55). Acriano citizens are eligible for payments under the law when they engage in sustainable forestry and agricultural practices and programs defined in SISA (Schwartzman, 2015, p. 12). In large part, these programs under SISA

incorporate Acre's earlier efforts to avoid deforestation, like the Certification of Sustainable Production Units and Acre Ecological-Economic Zoning Plan. These programs also intend to increase funding for measures like subsidizing wild rubber production, in order to discourage clear cutting forests for monoculture plantations (Bastos Lima, Visseren-Hamakers, Braña-Varela, & Gupta, 2017, p. 12; Duchelle et al., 2014a, p. 59).

Notably, as McAfee (2015, p. 338) comments, since there is no standardized criterion, model, or enforcement mechanism to deem an avoided deforestation project "REDD+", observers have branded SISA as the world's first jurisdictional REDD+ initiative (CARB, 2015, p. 43; Duchelle et al., 2014b, p. 33). Indeed, Acre has developed its own remote sensing technology and deforestation reference level, separate from the federal government's, to use in measuring deforestation and distributing payments for forest conservation (Schwartzman, 2015, pp. 9-10).[10] The government has also created several agencies to oversee the various components of SISA. These include the Institute of Climate Change and Regulation of Environmental Services (IMC), which regulates SISA and monitors private REDD+ projects, the Commission for Validation and Accompaniment, which monitors SISA and approves program regulations and implementation approaches, and the Company for Development of Environmental Services, which implements SISA and attracts and administers private funding (Duchelle et al., 2014b, pp. 36-37).

[10] To achieve comparability with other states, Acre is still using the federal government's PRODES remote sensing satellite imagery for its official rate (Schwartzman, 2015, p. 9).

One funding source for SISA was reached in 2012, when the government of Acre signed an agreement with the German Development Bank KfW. KfW agreed to transfer EUR 16 million (USD 17 million) through its REDD Early Movers Programme to SISA in exchange for Acre's commitment to pursue measures that limit deforestation (Duchelle et al., 2014b, p. 37). Though KfW cannot offset its own emissions through the REDD Early Movers Programme, the payments are still conditional on the state of Acre reducing its emissions below an agreed-upon level (Kill, 2014, p. 15). The federal government's Amazon Fund, overseen by the Brazilian National Development Bank (BNDES), also has contributed to Acre's deforestation reduction efforts, transferring BRL 60 million (USD 19 million) to the state to help roll out the implementation of SISA (Kill, 2014, p. 14). The government of Acre also put forth a carbon reduction proposal, in which the state pledged to recover 50% of degraded or altered rural property holdings that are registered in a CAR, and to eliminate illegal deforestation in conservation units, settlement projects, and private rural holdings in the state by 2030 (Governado do Estado do Acre, 2015).

The government of California learned about Acre's plans to implement SISA even earlier, through each government's membership in the GCF. CARB viewed the "payments-for-forest conservation" model under SISA as a potential source of international, sector-based REDD+ offsets for industry use in the California Cap-and-Trade Program. Joint policy efforts have consequently produced the 2010 MOU between the two states, the basis for the proposed California-REDD+ linkage (CARB, 2015, p. 43). Supporters have argued that market-based payments for REDD+ offsets in Acre would provide a critical resource to build upon SISA's framework and reduce GHG

emissions, create jobs, and preserve cultural identity for forest dwelling Acrianos, particularly when considering that deforestation in Brazil is increasing again after a lull from 2005-2012 (CARB, 2015, p. 14; Nepstad, Swette, & Horowitz, 2014, p. 7).

Within Acre though, questions have arisen as to how a California-REDD+ linkage under SISA might worsen economic inequality in the state. One area identified to receive early attention under SISA is called the Priority Assistance Zone, a collection of several rural Acre municipalities that share unclear property rights to their land (Duchelle et al. 2014a, p. 57). Although the Priority Assistance Zone is only 4% deforested, recent road paving is opening the area to increased settlement. The activity is further obfuscating the land rights of forest dwellers who claim the right to the land through usucaption, where one gains ownership of land after working it for a certain period of time (Duchelle et al., 2014, p. 58; Pacheco, 2009, p. 1339). Indeed, of the four communities surveyed within the Priority Assistance Zone, Duchelle et al. (2014a) found that two of them did not possess the right to exclude others from their property, while all felt that their land tenure was insecure (p. 58).

The SISA program has identified the process of giving land titles based on customary ownership and payments for sustainable agriculture as two ways to improve the twin problems of land insecurity and deforestation. However, these actions still may not guarantee a better socio-economic situation or livelihood for Acriano communities. Under SISA, there is no formal process to address conflicts between land users that may arise during titling, and no detail on how the rights to carbon emissions will be distributed by the state (Duchelle et al., 2014a, p. 60). Increased demand for carbon sequestration in

a California-REDD+ linkage could amplify both issues if numerous groups claim to sustainably manage their forests in exchange for REDD+ payments. As Chomba et al.'s (2016) study of the Kasigou Corridor REDD+ Project in Kenya cautions, even an agreed-upon breakdown of offset payment distribution can be meaningless if market payment totals do not reach expectations. In this sense, Acre forest dwellers could see their relationship to their land and resources deteriorate if they are not adequately compensated for withholding from other activities to sequester CO_2.

4.4 Carbon Forestry and Green Grabs: Cases from Brazil and Nigeria

One of the main concerns about a California-REDD+ linkage is that it could worsen the lives of Acrianos in the form of a green grab. To recall Fairhead et al. (2012), green grabs do not only take place through outright enclosures, but can also occur when an environmental project negatively alters use rights, access to land and resources, labour relations, and human-environment interactions (p. 239). In past carbon forestry projects, forest dwelling communities have been removed from project areas, or have had their access and use rights in these spaces restricted to generate offset credits (Beymer-Farris & Bassett, 2012; Cavanagh & Benjaminsen, 2014; Chomba et al., 2016). This may occur in forested landscapes where various forms of land tenure and forest access overlap or conflict with one another. REDD+ schemes can thereby worsen the socio-economic standing of forest dwellers and indigenous groups that are newly affected by the addition of a carbon forestry project (Larson et al., 2013, p. 680). Evidence from three carbon forestry programs in Brazil and one in Nigeria demonstrate the various ways that green grabs can take shape.

The first example of green grabbing in a Brazilian carbon forestry initiative is the Guaraqueçaba Climate Action Project, located in the southern state of Paraná. The multinational companies American Electric Power, Texaco/Chevron, and General Motors began funding the project in 1999 to generate "2 million tons of carbon benefits" in the form of emissions reductions credits (qtd. in Kill, 2014, p. 24). The companies would then use the credits for corporate marketing or offsetting purposes (p. 24). Soon after project implementation though, the Caiçara mixed Indigenous-European community found themselves barred from the natural reserves that were utilized to generate the carbon credits. Historically, the Caiçara used the forests in the project area for small-scale agriculture and the collection of palm hearts for food, even doing so after the government created the Guaraqueçaba Environmental Protection Area throughout their lands (pp. 22-23).

Despite the Caiçara's claim to the land, three private nature reserves were created within these forests for carbon credit generation, and the Caiçara could no longer access them. The Brazilian NGO Society for Wildlife Research and Environmental Education (SPVS) that ran the project worked closely with the environmental police in Paraná, Força Verde (Green Force), to restrict Caiçara subsistence and livelihood activities on the now-privatized lands (Kill, 2014, pp. 28-29). In fact, some villagers who continued to access the nature reserves were thrown in jail by Força Verde for activities as simple as cutting down a tree to build a canoe or repair a house (p. 29). Additionally, the 47 jobs provided by SPVS to Caiçara villagers had largely vanished roughly 10 years after the project began, despite the fact they were promised to last for the entire 40 years of the

project duration (p. 27). Many of the jobs that were created were forest rangers for Força Verde, putting employees in an incredibly difficult position of having to report on fellow Caiçara community members for forest incursions (p. 27). This example also clearly showcases Bachram's (2004) concept of carbon colonialism. Here, three large fossil fuel-dependent companies in the North enclosed Caiçara lands in the South to offset their emissions instead of reducing them at the source. In the process, the demand for carbon offset commodities by the companies criminalized Caiçara villagers for their long-standing subsistence practices.

Second, the case of the Suruí Forest Carbon Project is a current example of how REDD+ initiatives can heighten tension within communities. The project began in 2009 to stop illegal deforestation from occurring on the Paiter Suruí indigenous territory in the Brazilian states of Mato Grosso and Rondônia. By 2013, the project had been verified by both the VCS and Climate, Community, and Biodiversity Standards (CCBS) for achieving social and environmental sustainability in international offsetting (West, 2016, p. 7). It had also generated 251,530 tCO_2e worth of offset credits, 120,000 of which were purchased by the Brazilian company Natura at a price of USD 4.30/tCO_2e (p. 7). Supporters of the Suruí Forest Carbon Project have previously hailed it as an example of a successful indigenous-led REDD+ project (Lang, 2015a). Shortly after the CCBS had verified the project, many members of the Paiter Suruí indigenous community were also engaged with the goals and strategies of the project (West, 2016, p. 8).

Recently though, a rift has formed within the Suruí community regarding whether or not the REDD+ project should continue. The anti-REDD+ camp, led by Henrique

Suruí and the Indigenous Missionary Council, has called for the project to cease operation. They contend that many Suruí villagers have not received promised payments for forest preservation, and that in turn, some villagers have resorted to illegal logging in the protected territory to generate income and compensate for this payment gap (Lang, 2015a). Indeed, Suruí chief Almir Narayamoga Suruí noted in an October 2016 appeal that due to a lack of alternatives, some community members have engaged in illegal logging, which the chief claims has contributed to an estimated 600 hectares of deforestation a day since the beginning of 2016 (Lang, 2016a). Henrique Suruí and several other members of the Paiter Suruí even travelled to the state capital of Brasília in early 2015, where they unsuccessfully petitioned the Federal Public Ministry and National Indian Foundation to help suspend the project (Lang, 2015c).

Indeed, the concerns among this group regarding carbon market payments are well-founded when considering the state of carbon prices globally. Over the past several years, the price of carbon on both the VCM and CDM had dropped precipitously as buyers of carbon credits have declined. On the VCM, REDD+ offsets dropped from an average price of USD 12.00/tCO_2e in 2011 to only USD 3.30/tCO_2e in 2015 (Forest Trends, 2012, p. 22; Forest Trends, 2016, p. 3). On the CDM, the price of CERs also dropped from EUR 7/tCO_2e (USD 7.40) in 2011 to only EUR 0.28/tCO_2e (USD 0.30) in February 2017 (Ervine, 2013, p. 663; ICE, 2017). Yet, the Suruí Forest Carbon Project needs revenue of around USD 3 million to implement all aspects of its land management plan for sustainable food production, forest protection, and furthering education and employment in the community (Metareilá, Kanindé, & ACT-Brasil, 2009, p. 13; West,

2016, p. 6). Although NGOs involved with the project hope to bring in revenue from outside of carbon markets –through private investments and national and international aid, for example – the drop in offset buyers and prices adds a new level of precarious to the project. Imposing market relations on the Paiter Suruí despite the depressed and volatile state of offset prices can thereby produce new inequalities through market-dictated enclosures.

On the other hand, the pro-REDD+ camp, led by the Suruí chief Almir Narayamoga Suruí and the Metareilá Association responsible for the project's management, have defended the Suruí Forest Carbon Project. A statement from the Metareilá Association insisted that monthly BRL 2500 (USD 804) payments were distributed in early 2014 to the seven Suruí clan associations. However, the Metareilá association then withheld the payments 5 months later when it claimed the clans had become too dependent on the payments, while not developing sustainable initiatives they had agreed to for the Forest Carbon Project (Lang, 2015b). Although the Metareilá Association insists payments and training have been and will be implemented over the 30-year length of the scheme, one is justified in questioning this possibility. Fisher (2012) documents how villagers in a Ugandan reforestation and CO_2 sequestration project were primarily motivated by monetary incentives to conserve their forests. Payments in the scheme were dispersed at the beginning, and despite the 25-year project span, approximately half of community respondents reported that they harvested the trees early to plant crops and generate steady income (Fisher, 2012, p. 51). For the Suruí Forest

Carbon Project, this case exemplifies how individual monetary needs, especially for poorer groups, can take precedent over community land management.

The third example of green grabbing in Brazilian carbon forestry projects comes from the Purus Project in Acre, which was the first private REDD+ project to be registered with the IMC under SISA in 2012. Originally, 18 smallholder families lived on the site that would host the Purus Project, and they asserted their right to the land through usucaption, as they did not hold formal title to it (CarbonCo, TerraCarbon, Carbon Securities, and Moura & Rosa, 2012, p. 24; Centro de Memória, 2013, p. 6). Many of these families were originally rubber tappers, but starting in the second half of the 20th century, the Brazilian government began to undermine the rubber industry. Cattle ranchers were given tax breaks and subsidies to purchase old rubber plantations, which were in turn cleared for large livestock holdings (Centro de Memória, 2013, pp. 5-6; Schwartzman, 2015, p. 3). Subsequently, families in the eventual Purus Project area, like others throughout the Amazon region, took up small-scale livestock ranching and subsistence farming to make ends meet when they could no longer find work in rubber tapping (Centro de Memória, 2013, p. 5).

A pair of landowners, Normando Sales and Wanderley Rosa, came to acquire the property. The two planned a large cattle ranching operation that would deforest 20% of the project area, while a logging operation would commence on the other 80%. If carried out, the 18 families that that lived on the land, some who had resided there for several decades, would be forced off it (CarbonCo et al., 2012, p. 24; Centro de Memória, 2013, pp. 4, 6). However, once the new owners acquired the land, they discovered its potential

to store CO_2 emissions. They could then sell carbon offsets on the VCM to protect the forest instead of chopping it down, which in their view would not only generate revenue from ecosystem preservation, but also provide sustainable development to the existing families and allow them to stay put (CarbonCo et al., 2012, p. 24). Essentially, the Purus Project was to function as a public relations move for the landowners, in which they could avoid the political backlash for displacing the community while generating carbon credit-based income for themselves and the forest dwellers.

Together, Sales and Rosa started the company Moura & Rosa to manage the daily operations of this new carbon sequestration project (Faustino & Furtado, 2014, p. 16). At the end of the fifth year of credit generation, communities in the project area could start to receive offset credit revenue based on how much forest they preserved, and in addition, Moura & Rosa would finance new socio-economic initiatives like a health centre and primary school (CarbonCo et al., 2012, pp. 41-42). Moura & Rosa also guaranteed the families living in the Purus Project area 100 hectare parcels of land, provided they obtained titles to their land in court (Centro de Memória, 2013, p. 6). The international soccer organization FIFA also used the Purus Project to offset its emissions from the 2014 World Cup in Brazil (FIFA, 2014).

There are several concerns though with how the Purus Project may change smallholders' relationship with their land and resources. For one, positioning these families as "deforestation agents" is disingenuous, as even the Project Design Document written by CarbonCo et al. (2012) acknowledges that most deforestation by smallholders is done for subsistence purposes (p. 28). The thought of comparing the large-scale cattle

ranching and logging activities that the landowners Moura & Rosa could undertake on their property to the mostly subsistence-based deforestation of smallholders contains the overtones of green grabbing, an appropriation of land from the lower to the upper classes.

Additionally, Moura & Rosa's consent to give families 100 hectare parcels, provided the land is titled in court, is not a simple task. Forest dwellers face an uphill battle in receiving formal title when considering the few financial and legal resources these groups possess vis-à-vis large landholders, the potential for manipulation and corruption in the legal process, and the lack of education to read and interpret legal documents (Centro de Memória, 2013, p. 6). Furthermore, some families had occupied well over 100 hectare plots in the past, which would constitute a more visible type of green grab if they were to lose part of their lands to the REDD+ project (pp. 6-7). Because of these concerns, community support for the project declined. Residents became fearful that the project would infringe on their access to land in the project area and to their small-scale subsistence and income-generating activities that involved deforestation (Centro de Memória, 2013, p. 9; Faustino & Furtado, 2014, pp. 17-18). In the end, the case shows how sustainable development endeavors can create serious rifts between marginal forest dwellers and more powerful project developers, even if Moura & Rosa really believed the carbon offset project would easily lead to land titling and benefit the community.

REDD+ projects outside of Brazil are also leading to green grabs as well. Especially relevant to Acre's jurisdiction-wide SISA program is the REDD+ project ongoing in Nigeria's Cross River State. To start the development of a REDD+ scheme

across Nigeria, the UN REDD- Programme transferred a USD 4 million readiness fund to the federal government in 2011, with an additional USD 3.6 million coming from the FCPF in 2013 (Asiyanbi, 2016, p. 148) Currently, 3 REDD+ pilot projects in the Cross River State are serving as trials for the future nationally-administered REDD+ scheme, but the government of Cross River has changed several of its policies to coordinate deforestation-reduction efforts across the entire jurisdiction. Governor Liyel Imoke removed the state's revenue target from the forest sector, declared a logging ban throughout Cross River, and implemented a militarized organization, the anti-deforestation Task Force (ATF), to enforce the moratorium (p. 147).

The government of Cross River and ATF's application of what Asiyanbi (2016) calls "carbonized exclusion" is also undoubtedly a green grab, as access and use rights and human-environment interactions are negatively altered to facilitate environmentally-based capital accumulation. Perhaps most obviously, the moratorium on timber harvesting has deprived local communities of a critical source of income. Before the ban, communities in Cross River were to receive 70% of the royalties from the state's timber harvest. Yet, after the moratorium was enacted, the government put forth a replacement carbon credit sharing formula that only sought to distribute 10% of carbon benefits to communities (Asiyanbi, 2016, p. 151). This economic injustice is even worsened by the fact that the ATF generates much of its income by selling confiscated timber and issuing fines on violators – revenue from timber sales and fines amounted to 64% of the ATF's total income in the Fiscal Year 2012-2013 (p. 153). Thereby, a perverse incentive exists to allow communities to illegally harvest trees and non-timber forest products (which

were also given a ban after the initial logging moratorium) so that elites in the military and government, closely associated with the ATF, can financially benefit from their sale (p. 153). As Asiyanbi (2016) observes, the contradiction between how elites receive money from carbon credits and confiscated timber, while forest dwellers lose essential income streams and forest access, is part and parcel of the dynamic that REDD+ drives and is shaped by (p. 147).

4.5 Conclusion

To summarize, like California, Acre has forged ahead in crafting environmental policy in a more rapid and robust manner than the federal government. The California-REDD+ linkage proposal builds off nearly two decades of work within Acre to lower deforestation and encourage socio-economic development, and would add a market-based offset component to Acre's jurisdictional REDD+ program in SISA. While clamping down on deforestation is an important step in the fight to mitigate climate change, questions remain about how amending SISA to provide offsets for Californian industries could worsen the lives of Acrianos. REDD+ offsetting necessarily entails the preservation of forested spaces for the benefit of wealthy market actors, among them high-emitting companies in the North. In this arrangement, the activities of forest dwelling populations must align with the requirements necessary to commodify CO_2 reductions for market trade. This commodification process has unfolded as offset project developers have banned or negatively altered communities' subsistence-based activities and land tenure arrangements, framed poor forest users as major deforestation agents, or created rifts within communities that concern the unclear or volatile nature of offset project payments.

Above all, REDD+ offsetting is a green grab, and the above case studies demonstrate why it is plausible to predict that the negative environmental, socio-economic, and cultural effects of the above carbon forestry projects may follow a California-REDD+ linkage. Yet, the detrimental outcomes of green grabbing are not the only reasons that this international offset proposal is troubling. The next section combines the background information provided on California, Brazil, and Acre in the past two chapters to analyze why the linkage would represent both an ineffective climate change mitigation strategy and an environmental injustice.

Chapter 5: Analyzing the Environmental Injustices of the California-REDD+ Linkage

5.1 Introduction

The previous chapters have laid out the histories of carbon trading and REDD+ in both California and Acre, examining the context in which the California Cap-and-Trade Program and SISA developed, how they are structured, and what the arguments for and against each of them are. Although Californian industries cannot use REDD+ offsets from Acre at the present to meet their emissions reduction commitments, by building upon the existing knowledge of carbon forestry offsetting laid out in this thesis, one can make a strong case for why the linkage cannot be used to effectively or equitably mitigate climate change. Environmentally, REDD+ offsets in Acre cannot guarantee credible or lasting emissions reductions under the California Cap-and-Trade Program. Furthermore, the linkage outsources the responsibility to cut emissions from wealthy industries in California to poorer, rural populations in Acre, while also furthering social injustices.

Section 5.2 argues that REDD+ offsets do not contain environmental integrity, because even from a jurisdictionally-administered program like SISA, they would not yield the "real, measurable, and long-term emissions reductions" that CARB requires in mitigating climate change. Section 5.3 focuses on the socio-economic ramifications of the linkage and argues that like domestic offsets, REDD+ credits would benefit the heaviest emitters in California, while directing cap-and-trade revenue out of state and imposing carbon colonialism on populations in Acre. The section also summarizes how green grabs may unfold through the linkage using the case studies described in Chapter 4.

Section 5.4 concludes the thesis by emphasizing that capitalist development drives ineffective responses to the climate crisis – like carbon trading – to protect or foster economic growth for heavy emitters and other entities. Lastly, Section 5.5 considers the daunting task that simultaneously combatting climate change and resisting global capitalism will entail, and touches on what just alternatives to current climate policy and REDD+ might look like.

5.2 Environmental Integrity

Contrary to the claims of CARB, Californian businesses, offset project developers, and some environmental NGOs, there is ample reason to believe that the California-REDD+ linkage will produce neither "proven" nor "substantial" emissions reductions to mitigate climate change. Certainly, the "cost-effective" and "flexible" monikers given to the linkage by its supporters make sense. REDD+ offsets on the VCM only averaged a price of USD 3.30/tCO_2e in 2015, nearly four times cheaper than the current price of allowances in the California Cap-and-Trade Program at USD 13.57/tCO_2e (CARB, 2017a; Forest Trends, 2016, p. 3). Under the growth imperative of capitalist development, REDD+ offsets represent a cheap compliance strategy for Californian industries, one that allows them to sustain their profits while also attesting to mitigate climate change.

Instead, the assertion that REDD+ projects yield "proven" and "substantial" emissions reductions runs counter to the established scientific knowledge on biotic CO_2 emissions and the difficulties of commodifying them. Larry Lohmann (2015) points out in his critique of the 2015 CARB White Paper that fossil carbon emitted by Californian

industries permanently adds to the carbon cycle, whereas vegetation and soil-based carbon does not (pp. 4-5). Nevertheless, in arguing for a REDD+ linkage, Californian politicians and cap-and-trade supporters have pointed to the serious climatic impacts that the state will face if worldwide deforestation, especially in the tropics, does not stop (CARB, 2015, pp. 9-11).

Yet, what these groups either neglect or forget to realize is that in a REDD+ offsetting scheme, standing forests are protected from expected deforestation, while fossil fuel emissions may continue at the firm that purchases the offsets, negating a total reduction in emissions. The forests that are saved from destruction or degradation can also still easily release CO_2 in the future as well (Dooley, 2014, p. 6). For example, if trees were to die, the permanent emissions reductions promised by the REDD+ project would not exist. In all, carbon forestry does not challenge the growth imperative of fossil capitalist industries in California, and moreover, it allows REDD+ proponents to falsely assert that emissions would be reduced through forest-based offsetting, rather than just cancelled out (Lohmann, 2015, p. 5).

In short, the climatic impossibility of equating fossil emissions with biotic emissions should be enough to dissuade any entity dedicated to achieving actual emissions reductions from pursuing forest-based offsets. Putting aside this critical distinction for the time being, CARB and its supporters have called for guidelines to bolster the environmental integrity of REDD+ credits, under the assumption that REDD+ can indeed mitigate climate change. These guidelines include measures to prove additionality and set a credible deforestation reference level. As stated previously, offsets

are deemed to be additional when emissions reductions occur that were not expected in the absence of project finance (which in turn made the offset project itself possible) (Ervine, 2013, p. 657).

To prove additionality, the REDD Offsets Working Group recommended setting a reference level equal to or below the 10-year average of deforestation in the jurisdiction (ROW, 2013, pp. 4-5). Deforestation that falls below this reference level is assumed to have come from Californian industry payments, and the jurisdiction can then generate offset credits for use in the Cap-and-Trade Program. On this note, CARB has stated its additionality requirement for international, sector-based offsets outright. The jurisdiction implementing the REDD+ initiative "must show that real, measurable, and long-term emissions reductions would occur *in addition* to what would be BAU reductions from existing environmental laws and regulations" (qtd. in CARB, 2015, p. 24, emphasis in original).

However, it is challenging, to say the least, to prove that an emitter in California would have explicitly caused emissions reductions (i.e. "additional" offsets) in Acre through its REDD+ payments, especially when there are other environmental policies in play that also intend to reduce deforestation (Haya, 2016, p. 4). For instance, Brazil has passed the 2008 National Climate Change Plan, its INDC to the UN Paris Agreement, soy and beef moratoriums, and *Terra Legal* to clamp down on both large and small-scale deforestation nationwide (Duchelle et al., 2014a, p. 55; Federative Republic of Brazil, 2015; Nepstad et al., 2014, pp. 1118-1120). In Acre specifically, the REDD Early Movers

Programme has provided the government with a USD 17 million financial incentive to reduce emissions across its jurisdiction as well (Schwartzman, 2015, p. 17).

Additionally, a drop in commodity prices for soy, beef, and other agricultural products could also influence deforestation rates. Decreased revenue from producing these goods could eliminate the financial incentive for landowners in Acre to clear their lands for agriculture or cattle ranching, without REDD+ payments from Californian industries factoring in at all. As Nepstad et al. (2014) document, a crash in the price of soy was one of the reasons for a decline in Amazonian deforestation in the mid-2000s (p. 1118). Therefore, it would be an immense challenge to isolate how deforestation in Acre had declined when factoring in each funding source, change in commodity prices and global product demand, and national policies and regulations.

Despite these external influences, supporters of the California-REDD+ linkage have claimed that setting a credible reference level can help to accurately establish the BAU deforestation rate from which to produce additional offset credits. Consistent with the REDD Offset Working Group's (2013) recommendation, the government of Acre has developed a baseline deforestation rate of 496 square kilometers (km^2) per year based on the state's ten-year average deforestation rate from 2001 to 2010 (Schwartzman, 2015, p. 10). Barbara Haya (2016), a researcher from the Berkeley Climate and Energy Institute, has projected that using this baseline rate to generate REDD+ offsets is not low enough to avoid "non-additional" crediting though. Non-additional crediting occurs when an offset project generates emissions reduction credits without sufficient evidence that project finance was responsible for those reductions. The 496 km^2 rate is substantially above the

2006-2015 average deforestation rate of 266 km^2, meaning that offset credits could be generated without any changes occurring on the ground, an example of the "hot air" phenomenon (Haya, 2016 p. 2; Seyller et al., 2016, p. 235). Combined with the funding from REDD Early Movers and the BNDES to limit deforestation, it would be extremely difficult to identify what portion of emissions reductions were explicitly caused by Californian industry payments.

The REDD Offset Working Group (2013) is quick to point out that reference levels can be updated over time and set lower than the average deforestation rate. This is supposed to stimulate so-called "jurisdictional own effort", where a government must take additional steps to reduce deforestation that are not provided by market payments (ROW, 2013, p. 25). Yet, even jurisdictional own effort does not answer an integral question that even CARB (2015, p. 35) has posed: can it be proven that "a forest was or is actually destined for deforestation"? Based on all the other factors that can influence deforestation outside of market payments, the knowledge of how many emissions will be avoided through a REDD+ project requires information that is impossible to predict (Lohmann, 2012, p. 99; Lohmann, 2015, p. 4). Therefore, if one cannot calculate the jurisdiction's future deforestation rate with complete certainty, then setting a credible BAU reference level to generate additional REDD+ offsets is perhaps an impossible task, and negates the basis for offsetting entirely (Lohmann cited in Lang, 2016c).

The environmental integrity of a REDD+ program also depends on emissions reductions lasting well into the future. A guideline adopted by the CDM and VCS suggests that carbon forestry projects should operate for at least 30 years, be monitored

and reported on for 20 years, and factor in risks for 100 years in order to prevent reversals in deforestation, and therefore increases in emissions (Leach & Scoones, 2013, p. 959). The REDD Offset Working Group (2013) has asserted that jurisdictional REDD+ programs would be better able to account for reversals than project-based schemes, since the governing body of the program would monitor changes in forest stocks across an entire region rather than in one specific location. In addition, it has also suggested using a "buffer" to set aside a certain number of offset credits from being issued in case of reversals (ROW, 2013, pp. 24, 38).

A buffer would only do so much good, though, as the factors that accelerate unplanned deforestation and degradation are becoming more frequent. REDD+ offsetting allows for permanent, fossil fuel-based CO_2 emissions to continue, which in turn, contribute to rising global temperatures and shifting climate patterns. One effect of climate change so far has been less frequent rainfall in the tropics, exposing the Amazon rainforest to more catastrophic fires. As this occurs, the Amazon turns from a carbon sink into a carbon source. For example, a 2005 drought caused the Amazon to release between 1.2 and 1.6 billion tCO_2 into the atmosphere (Lang, 2016b). The Amazon has also taken in one-third less carbon than usual from the 1990s onwards because of losses in tree stocks (Brienen et al., 2015). Even trees not ravaged by fire or drought are losing their ability to store CO_2 as well, as Curran and Curran's (2016) study shows that the Northern Hemisphere biosphere has sequestered less CO_2 every year since 2006. Although the reason why is unknown, this evidence only adds to the urgency in cutting down on fossil fuel-based emissions that power climate change (Curran & Curran, 2016, p. 227).

There would also be difficulties to ensure that offsets from Acre would be permanent, because its government continues to subsidize BAU, non-sustainable forms of agriculture. Between 2011 and 2014, the state of Acre received the equivalent of USD 56 million in public agricultural credit for BAU livestock farming, over twice the amount that KfW gave the Acriano government though REDD Early Movers (Bastos Lima et al., 2017, p. 12). Furthermore, SISA programs that promote sustainably harvested non-timber forest products, like wild rubber and fruits, do not receive steady demand or specialized market access (p. 13). Coupled with the fact that cattle meat is a produce in high-demand in Brazil and internationally, and one that serves as a "savings account" for farmers to sell in times of hardship, there are significant barriers to achieving sustainable practices that could prevent deforestation and thus generate REDD+ offsets (p. 13). Unless these agricultural subsidies are addressed alongside SISA, forest dwellers may find that BAU agricultural activities will generate more revenue than sustainable options in the long run.

Additional claims that a jurisdictional REDD+ program is designed to better prevent against leakage do not quite hold up under scrutiny either. The REDD Offset Working Group has suggested that the Partner Jurisdiction hosting the REDD+ program (in the event of a California-REDD+ linkage, Acre or Chiapas) should address the drivers of deforestation within its boundaries to clamp down on leakage (ROW, 2013, p. 6). In addition to the above example of cutting BAU agricultural subsidies – which requires government action to properly address – one suggested strategy to avoid leakage is intensifying livestock, agriculture, and timber production on already-cleared land, rather than expanding outward into intact forests (p. 6)

However, in their analysis of the growth of the soy industry in Brazil and neighbouring South American countries, Gustavo Oliveira and Susanna Hecht (2016) have found the opposite to have occurred. Agribusiness owners and soy farmers have chosen to reinvest their profits into new areas, like Brazil's less regulated Cerrado region south of the Amazon, rather than intensifying production on already-existing land (p. 270). Consequently, deforestation in the dry, woodland Cerrado region has dramatically increased, leaving 70% of the region affected by human incursion (Hecht, 2005, pp. 397-398). The government of Acre has also given cattle ranchers an 80% value-added tax exemption to slaughter their herds in neighbouring states, effectively relocating a driver of deforestation out of its jurisdiction (Bastos Lima et al., 2017, p. 12). While the REDD Offsets Working Group (2013) has called for strategies to track shifts in deforestation out of the Partner Jurisdiction, the fact that leakage is a constant, viable threat to producing credible REDD+ offsets is incredibly problematic, because a jurisdictional REDD+ program cannot control global prices for commodities like soy and beef. Additionally, if landowners, labourers, and others can attract more revenue from expanding production elsewhere than they will receive from market-based REDD+ payments to intensify production on their existing plots, the leakage potential will not disappear.

The above problems with equating fossil-based and biotic-based CO_2, demonstrating additionality, setting credible reference levels, and preventing against reversals and leakage all demonstrate why the notion that REDD+ has generated "proven" and "significant" emissions reductions is misleading. Despite these concerns, understanding the capitalist growth imperative of fossil fuel-dependent Californian

industries explains why “flexible” and “cost effective” market trade in forest-based offsets, however questionable, takes precedence over the environmentally suspect nature of REDD+ in complying with the cap. In addition, there are also numerous social consequences of a California-REDD+ linkage for communities in both California and Acre that deserve a critical analysis.

5.3 Environmental Injustice, Carbon Colonialism, and Green Grabs

Previously, Chapter 3 revealed how past market-based pollution trading programs in California led to the creation of pollution “hot spots”. Pollution became more concentrated in areas where industries chose to offset their pollutants rather than reduce them at the source at an increased cost (Drury et al., 1999, p. 253; Truong, 2014, p. 506). Based on statistics from the first compliance trading period (2013-2014) of the California Cap-and-Trade Program, there is reason to believe that offsetting would become even more attractive to fossil fuel-intensive industries in California with REDD+ credits permitted in the scheme, lessening the gains that environmental justice communities could make in the absence of the linkage.

Indeed, a study by researchers from four California universities found that the top 10 offset users during the first compliance period of the Cap-and-Trade Program were not only responsible for 36% of covered emissions under the cap, but also used a whopping 65% of all available offsets (Cushing, Wander, Morello-Frosch, Pastor, Zhu, & Sadd, 2016, p. 9). The firms in possession of this massive number of offsets were either fuel and gas suppliers like Chevron, Shell, and Southern California Edison, or gas power plants like Calpine Energy. This suggests that these industries used cheaper domestic

offsets, which currently retail for an average of 20-25% below the price of CARB-issued allowances, to protect their fossil fuel-led business models instead of purchasing additional allowances at auction, on the market, or cutting emissions at the source (California Carbon, 2017). In fact, 9 of these top 10 companies offset the full 8% limit of their emissions allowed by CARB (Vanderwarker, 2016). Over the duration of the first compliance period, Californian industries in total offset more than 12 $MtCO_2e$. Remarkably, this accounts for more than four times the amount of reductions expected to occur under the cap during the first compliance period (Cushing et al., 2016, p. 9).

With 76% of these offsets also sourced from out-of-state projects, it is certainly feasible that a California-REDD+ linkage will further delay emissions reductions at the source (Cushing et al., 2016, p. 8). Indeed, Cushing et al.'s (2016) same study reported that 61% of high-emitting facilities in California saw an increase in their localized GHG emissions during the first compliance period of the Cap-and-Trade Program (p. 4). The use of offsets also diverts funds away from auction revenue, which through SB 535, could be channelled toward green energy projects and other initiatives that benefit these disadvantaged communities. Thus, disadvantaged communities in California face another struggle to both improve their resilience to climate change and cut down on the health effects from co-pollutants that accompany GHG emissions.

The California-REDD+ linkage does not only represent an injustice to communities in California, however. As the NGO Food and Water Watch has stated, the proposal is "ill fated and racist", a neocolonial method that restricts the development of nations in the Global South while letting fossil fuel-based emissions in California persist

(Nussbaumer & Lupien, 2016). Additionally, in April 2013, over 25 Brazilian indigenous, environmental, and social justice organizations and 40 individuals penned a letter to Governor Brown in which they rejected the linkage. The letter criticizes it as another instance of wealthy populations in the Global North appropriating commodities, in this case CO_2 reduction credits, from the South as a mechanism to cheaply sustain their overly-consumptive and emissions-intensive habits (Lang, 2013b).

Perhaps the simplest way to show the inherently colonial nature of a California-REDD+ linkage is by comparing the GHG emission totals from each state. In 2010, GHG emissions in the state of California totaled 456.1 $MtCO_2e$, of which over 75% came from the industrial, electricity generation, and transportation sectors (CARB, 2012). By contrast, GHG emissions in Acre were far less at under 23 $MtCO_2e$ in 2010, and nearly all this amount (97%) came from deforestation and land use change (Schwartzman, 2015, p. 10). The implication from these statistics is that fossil-fuel intensive production and consumption patterns have caused the majority of California's contribution to climate change. As a largely forested, rural state, Acre has not emitted anywhere close to California's industrial and transportation-based emissions totals. Therefore, the fact that forest users in Acre would need to stop deforestation in part so that oil and gas companies in California can avoid more stringent cuts in emissions is an unmistakably colonialist issue that exposes the inequalities between the two subnational bodies.

The Brazilian and Nigerian carbon forestry projects also show how green grabs can unfold through offset initiatives. By altering access and use rights to land, forest products, and human-environment interactions, these projects have worsened the socio-

economic situations of forest dwelling communities or created conflicts within these communities over the future of the projects. In the Guaraqueçaba Climate Action Project, villagers were barred from collecting food and practicing agriculture in the project area, and even thrown in jail by a police force created from these same community members (Kill, 2014). The Suruí Forest Carbon Project has engendered resistance among some members of the Paiter Suruí who claimed that promised payments were not being received, consequently leading some community members to engage in illegal logging to generate income (Lang, 2015a; Lang, 2016a).

In the Purus REDD+ Project, subsistence-based forest dwellers were somewhat ironically portrayed as "deforestation agents" by the project developer, who originally wanted to start a cattle ranching and logging operation on this group's land. Furthermore, these forest dwellers face an uphill battle in obtaining legal title to the land they have occupied for decades, a requirement stipulated by the project developer (Centro de Memória, 2013; Faustino & Furtado, 2014). Finally, the Cross River State REDD+ project has forwarded "carbonized exclusion" by banning poor, rural communities from harvesting timber, while militarized, anti-deforestation patrols and connected elites profit off the confiscation of illegal lumber (Asiyanbi, 2016).

Therefore, the above examples demonstrate the numerous social injustices that could follow a California-REDD+ linkage. Combined with the inability of forest-based offset credits to ensure "proven" or "substantial" emissions reductions, REDD+ offsetting constitutes an environmental injustice, failing to mitigate climate change and negatively impacting the lives of vulnerable populations in both the North and South. To reiterate

the theoretical implications behind this argument, the next section recaps the main themes from this thesis.

5.4 Conclusion: Capitalism Drives Ineffective Climate Policy

The California-REDD+ linkage is another example of an ineffective and unjust carbon trading proposal, which functions primarily to accommodate the insatiable growth imperative of capitalist development. To summarize, capitalist firms must continuously grow or else they will go out of business in competitive marketplaces. This, in turn, leads these firms to undertake strategies that maximize profits and expand commodity production. Fossil fuels have provided these entities with an incredibly efficient energy source that has revolutionized the rate and scope at which they can grow and profit. In the process, GHG emissions have also become embedded within the circuit of capitalist production, ushering in the climate crisis through the heavy use of fossil fuels in the advanced capitalist countries of the Global North and recently industrialized countries of the Global South. Thus, anyone who desires a complete solution to climate change must recognize that GHG emissions are intertwined with the dominant socio-economic form of organization globally, capitalism.

In the era of neoliberalism, public and private sector interests alike have touted free markets as the most efficient way to distribute societal goods and services and stimulate economic growth. When the climate crisis became too difficult to ignore, proponents of neoliberal economic thinking applied their ideology to environmental protection: markets could reduce GHG emissions in the most cost-effective fashion, and consequently, in the way least-harmful to BAU, fossil fuel-dependent growth. Some

market actors could profit off the new trade in GHGs by developing, facilitating, or selling carbon market allowances and offsets; others could minimize their costs of environmental compliance by purchasing allowances and offsets. In either case, the effect is the same: through the commodification of GHGs for market trade, powerful, influential, carbon market proponents (corporations, governments, international institutions) have normalized the capitalist mode of production as a solution to the very same environmental crisis it caused in the first place (Ervine, 2012, p. 6). Furthermore, carbon trading and carbon offsetting schemes uphold the economic and political dominance of market actors – often wealthy, heavy emitters in the Global North – who respond to their growth imperative by either profiting off the new trade in GHGs, or using this trade to continue BAU development.

Moreover, the capitalist, market-led logic of carbon trading, where cost-effectiveness guides emissions cuts rather than climatic necessity, will not effectively or justly mitigate climate change in California or Acre for several reasons. First, environmentally suspect REDD+ schemes gain legitimacy by equating reductions in fossil fuel usage to the preservation of standing forests, which is neither an actual nor permanent means of cutting GHG emissions. In reality, this is a strategy to give emitters "flexibility" in meeting their emissions targets as cheaply as possible. Second, the commodification of CO_2 for market trade goes against the principles of environmental and climate justice. REDD+ offsets allow Californian industries to avoid cuts at the source of emissions, which would not only benefit disadvantaged communities in the state environmentally and economically, but also tasks poorer Acrianos to withhold from

deforestation to preserve these industries' capacity to emit. Third, the commodification process also necessarily brings CO_2 into the ownership of wealthy, powerful actors, leading to green grabs as forest dwellers experience negative changes in their land tenure arrangements, socio-economic activities, and livelihoods. In all, carbon trading, including REDD+ offsetting, is characteristic of the environmentally destructive and highly unequal development of capitalist production. While the obvious solution to this might be enacting more effective and just climate policies outside of carbon trading and REDD+, the final section reflects on just how difficult this task will be.

5.5 Beyond Carbon Trading: Towards Effective and Just Climate Change Mitigation

As this thesis has shown, capitalist growth and the proliferation of fossil fuel-based GHG emissions are two sides of the same coin. Emissions from fossil fuel sources have grown from an average rate of 11 billion tCO_2 per year in the 1960s to over 34 billion tCO_2 per year from 2006 to 2015, as global gross domestic product (GDP) has risen from USD 1.3 trillion to USD 74.2 trillion over the same period (Le Quéré, 2016, p. 625; World Bank, 2017).[11] Therefore, any climate policy intent on averting climate catastrophe must immediately phase out and ultimately abolish fossil fuel-based forms of energy. One report by Climate Analytics (2016) states that the EU and OECD countries will need to phase out coal power by 2030, China by 2040, and all other countries by 2050 to limit global temperature rise to 2°C above pre-industrial levels (p. 2). Another

[11] Note: Le Quéré et al.'s (2016) original figures were quoted in gigatonnes of carbon (GtC). My figures were attained by multiplying these figures by 3.67, as the atomic weight of CO_2 is 3.67 times larger than that of carbon.

study suggests that to keep global temperatures below 2°C, 80% of known fossil fuel reserves must stay in the ground, which would represent roughly USD 10 trillion in stranded assets for fossil fuel companies (Hayes, 2014).

However, one cannot ignore the monumental struggle that uprooting the political-economic power of high-emitting industries and fossil fuel-dependent governments will entail. Fossil fuels are not only entrenched in capitalist production, but countless numbers of the poor and middle classes also depend on fossil energy and production for their livelihoods. With the dominance of free market economic thinking and the rollback of the welfare state in the neoliberal era, unemployment and higher energy prices will also hit the working class especially hard. Therefore, it is crucial to think through the many barriers to overcoming the dominance of capitalist development and fossil fuel dependence before putting forth strategies of how to attain effective and just climate policy.

Take, for instance, the recent developments in coal and oil production in Canada and the US. In November 2016, Prime Minister Justin Trudeau announced a plan to phase out coal-fired electricity federally by 2030. The undertaking follows the success of the province of Ontario fully doing so in 2014, which helped contribute to a 20% drop in GHG emissions in the province since 2005 (Littlecott & Schwartzkopff, 2015, pp. 11-12). Yet, the province of Nova Scotia was granted an extension that will allow it to continue coal production past the 2030 end date, a measure the provincial government claims will keep electricity prices from skyrocketing (Harris, 2016). While eliminating coal – the most emissions-intensive of all fossil fuels – is an integral part of combatting climate

change, the threat of higher energy prices without accompanying compensation understandably will not appeal to poorer communities.

Another development that problematizes capitalist society's commitment to clean energy – and shows how central of a role fossil fuels play in labour-capital relations – is the TransCanada Keystone XL pipeline. The project was originally intended to transport oil extracted from the Albertan tar sands, which emit 14-20% more GHGs than regular crude oil, to refineries in the US (Tollefson, 2013). In 2015, former President Barack Obama vetoed the construction of the pipeline; however, in January 2017 new president Donald Trump issued a memorandum that encouraged the TransCanada corporation to reapply for a construction permit and complete the project. Prime Minister Trudeau welcomed the change as a potential boost to the struggling Albertan economy, even though his administration has proposed to cut Canada's GHG emissions to 30% below 2005 levels by 2030, as part of its INDC under the Paris Agreement (Canada, 2015; Tasker, 2017). In these cases, the juxtaposition between effective climate policy and the economic interests of fossil capital, government allies, and labour is a key obstacle in both substantially and equitably reducing emissions. What, then, might some possibilities be for forging effective and just climate policies and movements that can occur outside the coalition of private and public fossil capital?

One concept that has gained traction in recent years is the "just transition", which highlights the necessity of securing or creating well-paying jobs for the working classes who are affected by climate policy, while simultaneously decarbonizing the economy (Cock, 2014, p. 31; Newell & Mulvaney, 2013). Cock (2014) documents how the

Congress of South African Trade Unions (COSATU) has incorporated the notion of a just transition into its "Climate Change Framework of 15 Principles". Not only does the COSATU identify capital accumulation as the driver of climate change (and oppose market mechanisms to solve the climate crisis), it also calls for its vision of a "fundamentally transformed society" to incorporate the connection between environmental protection and socio-economic benefit as a part of a just transition (Cock, 2014, pp. 31-32). One member of COSATU, the National Union of Metalworkers of South Africa (NUMSA), has taken the concept even further, stating that:

> A just transition must be based in worker controlled, democratic social ownership of key means of production and means of subsistence…without this…the just transition will become a capitalist concept, building up a capitalist "green economy" (qtd. in Cock, 2014, p. 32).

In a recent piece for *Jacobin,* the geographer Matt Huber also summarizes the danger of relying on capitalist markets to yield serious climate action as expressed by NUMSA.

> Climate change is not an exceptional market failure that can be corrected by getting the prices right. Capitalist markets are simply not wired to meet social and ecological needs — they will always "fail" in this regard. We cannot cede our future to a game of market competition by simply hoping renewables will overtake fossil fuels in the market. Collective action and public-oriented solutions are our only hope for survival. (Huber, 2016).

Though one should applaud the results of organized labour in obtaining the environmental and political commitment that COSATU and NUMSA have, the clear majority of workers the world over do not have the bargaining power or means to put forth this vision, much less achieve it. While Malm (2015), for example, advocates for the working classes to overhaul the means of production through a "planned economic recession" or "war against capital" to usher in a sustainable economy, he also acknowledges the immense power of capital to prevent these changes (p. 114). Historically, when labour has obtained too much power, the owners of capital have undertaken what Harvey (2001) termed the "spatial fix", transferring the means of production to cheaper, more docile locations amenable to accumulation (Malm, 2015, p. 112). Therefore, in an era where fossil fuels and free market economics have given the owners of capital tremendous spatial mobility, the alignment of climate policy with material benefits for workers remains a great challenge.

Fortunately, some groups have started to push for more effective and just climate change policies, specifically by rejecting or amending REDD+. In September 2016, the El Salvadoran Roundtable on Climate Change (SLV-RCC), comprised of 25 environmental and indigenous organizations, released a statement that asked the Salvadoran government to drop its REDD+ plans in coordination with the FCPF. The SLV-RCC listed many of the same environmental and social reasons for opposing REDD+ as those laid out in this paper – that REDD+ carbon offsetting is not additional nor permanent, that it cannot ensure the environmental integrity of uncertain and technically complex emissions reductions, and that it restricts or alters food sovereignty

and land use rights in a negative fashion (Lang, 2016d). Instead, the SLV-RCC is demanding that the government eliminate REDD+ as a mechanism to reduce CO_2 emissions in its INDC to the UN Paris Agreement, and better inform the public of the controversies and drawbacks of becoming involved in a REDD+ project (Lang, 2016d).

Other groups are seeking to rid REDD+ of its market-driven orientation, and instead use it to recognize forest dwelling communities' longstanding contributions to forest preservation and foster economic development. In 2010, the Inter-Ethnic Association for the Development of the Peruvian Amazon introduced the concept of REDD+ Indígena Amazónico, or Indigenous REDD+. The Coordinator of Indigenous Organizations of the Amazon River Basin started to formally support Indigenous REDD+ a year later (Climate Alliance & ATSM, 2015, p. 16). Indigenous REDD+ is designed as an alternative to the market-led, results-based avoided deforestation model. Funds for forest conservation would come not from industries offsetting their fossil-based emissions (under Indigenous REDD+, heavy-emitting industries should not be allowed to offset industrial emissions) but from bilateral and multilateral development agencies and governments (COICA, 2013, p. 9).

Unfortunately, it is difficult to envision significant funding flowing towards Indigenous REDD+ projects anytime soon. International organizations already face a shortfall in funds for climate change mitigation and adaptation projects, including the UN REDD Programme. The UN REDD Programme has so far only received USD 15 million out of its requested USD 200 to 300 million for the 2016 to 2020 period to deliver payments and technical assistance to its partner countries (Lang, 2016e). As evident by

the low prices of REDD+ credits on the VCM and CERs on the CDM, if private finance is not demanding forest emissions reductions, the public sector is not likely to have the funds to invest in them either.

Instead, making a serious contribution to reducing deforestation emissions will involve addressing the drivers of deforestation globally. Many of these drivers are linked to capitalist production and consumption patterns in the North and newly industrialized countries like China, so tasking the South with reducing their emissions through REDD+ schemes and offset programs underscores the colonial nature of carbon trading itself. For example, a recent study has found that US demand for imported oil, processed partly in Californian refineries, is a large contributor to deforestation in the Amazon (Amazon Watch, 2016). Additionally, the Foreign Agriculture Service to the US Department of Agriculture reports that Brazil is now tied with India as the world's largest exporter of beef and veal (Foreign Agriculture Service/USDA, 2016). Perhaps it is no coincidence, then, that Brazilian deforestation in 2016 reached its highest level since 2008 (Butler, 2016). These examples are what REDD+ project developers and policymakers miss in their quest to halt deforestation: market-based payments for forest preservation can only accomplish so much if global demand still finances activities that contribute to deforestation.

In sum, avoiding climate catastrophe will be a monumental struggle, one that directly confronts both society's faith in capitalism and markets to bring about environmental protection, and the dominance of public and private entities that depend on or profit off the production and consumption of fossil fuels. Yet, as the case of the

California-REDD+ linkage demonstrates, carbon markets will struggle to bring about credible, significant, and equitable reductions in GHGs. While the logical solution to this problem might be to suggest that state governments and the working classes unite to push for a “just transition” or “war against capital”, doing so is far easier said than done, requiring an extraordinary, coordinated effort of an unforeseen magnitude to accomplish. Although this may be a bleak outlook, ongoing movements from within organized labour, environmental justice groups, indigenous communities, and others show what actions and trends can be built upon to effectively and equitably avert climate catastrophe. The thought of doing so has never been more daunting, but the consequences of not acting have never been greater.

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