AN EXAMINATION OF CO_2 EMISSIONS, METHANE EMISSIONS, NATURAL RESOURCE DEPLETION, AND HUMAN WELL-BEING IN AFRICA

By

KUGBEME GAIUS ISUMONAH

Bachelor of Science in Economics

University of Ibadan

Ibadan, Oyo State, Nigeria

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Thesis Approved:

Dr. Michael Long

Thesis Adviser

Dr. Tammy Mix

Dr. Jared Fitzgerald

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Name: KUGBEME GAIUS ISUMONAH

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Abstract: Environmental degradation is an important issue at local, national, and global levels. This study investigates the drivers of air pollution, natural resource depletion, and human well-being in African countries. This research introduces the methane intensity of human well-being (MIWB) to complement the established carbon intensity of human well-being (CIWB). Together, these two measures capture pollution driven impacts on human well-being and by extension, sustainability. Specifically, the study uses Prais-Winsten regression models to test the neoliberalism, environmental Kuznets curve (EKC), ecological modernization, and political economy perspectives using panel data on 54 African countries between 1990 and 2020. The findings indicate that foreign direct investment (FDI) and debts are key drivers of environmental degradation in Africa. In addition, the results suggest that economic development and democracy reduce natural resource depletion in African countries. These outcomes lend support to the neoliberalism, EKC, and ecological modernization perspectives.

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CHAPTER I

INTRODUCTION

Environmental degradation remains an important issue across local, national, and global levels. Its manifestation in air pollution, natural resource extraction and depletion, land pollution, water pollution, forest cover loss, losses in animal species and impacts to human health outcomes suggest that there are numerous discourses surrounding its causes and potential mitigation strategies. Also numerous are the methods of evaluation employed by scholars and key stakeholders to measure and explain degradation levels. The examination of human well-being caused by pollution is an important element of this study. Human well-being refers to the overall quality of an individual's life and their capacity to live a healthy and fulfilling life. Human well-being encompasses physical health, mental health, social relationships, and access to basic needs such as food, shelter, clothing, and education (Dasgupta 2001; Plagerson 2021; Ryan and Deci 2001). As a result, the understanding of what human well-being means extends beyond individual incomes or GDP centered measurements. The focus of human well-being in this study is on physical health – specifically the effect of pollution resulting from carbon dioxide and methane emissions on human well-being. Within the context of causes of environmental degradation

lies neoliberalism and consequently its need for inclusion in the environmental degradation discourse.

Neoliberalism and neoliberal policies are central to contemporary capitalism. Within the neoliberal capitalist system lie competing explanations for environmental protection and degradation, including the environmental Kuznet's curve (EKC) hypothesis, ecological modernization, and perspectives based on political economy. These approaches offer differing perspectives on how the economy interacts with the environment. For instance, the neoliberalism perspective and the treadmill of production model (a political economic perspective) offer insights into the broadening of the capitalist space into areas previously shielded from capitalistic hold. In states with strong capitalist structures, neoliberalism has brought an increasing amount of the physical world under capitalist umbrella. The ever-expanding economic system described by the treadmill of production perspective highlights the continuously increasing consumption of natural resources and the generation of waste. Proponents of neoliberalism's advocacy for the privatization, financialization and commodification of an ever-increasing biophysical space extend capitalistic greed and profit making in ways that increase environmental degradation. Capitalism connects the environmental degradation caused by the expansive and exploitative processes of neoliberalism, the systems described by the political economy perspectives, and negative health outcomes (Gould, Pellow, and Schnaiberg 2015; Reed 2002; Springer, Birch, and MacLeavy 2016). Neoliberal policy measures that reduce the government's role in the provision of critical public services such as health and education have been found to negatively impact human well-being (Konadu-Agyemang 2000; Loewenson 1993; López 2006).

Proponents of neoliberalism view it as a solution rather than a cause of environmental problems (Beder 2001). They suggest that environmental problems arise from a failure to adequately value nature and advocate for the adoption of market mechanisms to address this valuation problem, thus, bringing the environment within the sphere of the market. *Green neoliberalism* is one way to conceptualize the dominant approach to solving environmental problems. This perspective suggests that the best way to improve socio-environmental relationships is to commodify the environment, which makes these policies important for understanding environmental degradation (Goldman 2005). Thus, since human well-being is impacted by the environment (and by extension environmental degradation), exploring how neoliberal policies affect environmental degradation can be extended to include how neoliberalism impacts human well-being and health.

Advocates of green neoliberalism attempt to convince environmentalists to accept a market-driven approach to environmental protection and sustainability (Beder 2001). However, neoliberal ideology – which involves a prioritization of economic objectives (i.e., growth, expansion, profits) over environmental concerns – appears to lie at the crux of environmental degradation. Further, the complexity of natural systems implies that effective valuation and incorporation of externalities into market models of the environment can be very difficult to do in a way that is beneficial to the natural environment. Consequently, market valuations of the environment are flawed, and exploitation strategies based on these flawed valuations are likely to create and exacerbate environmental degradation.

The environmental Kuznets curve and ecological modernization are approaches that are optimistic about the compatibility of economic growth and environmental protection. In contrast to the gloomy picture painted by proponents of the political economy perspectives, environmental Kuznets curve and ecological modernization approaches view economic development as a potential tool for addressing environmental concerns. However, the world's existing global order creates unequal access to resources and disproportionality in the vulnerability to negative environmental impacts. Hence, within the political economy perspective, ecologically unequal exchange is important in understanding the global nature of environmental degradation. In other words, capitalism driven expansions alter societies and change their interactions with the environment in ways that result in what Foster (1999, 2000) has referred to as a "metabolic rift." This study will use these different theoretical perspectives to investigate the drivers of environmental degradation in Africa. Further, this study will, to my knowledge, be the first cross-national study using the neoliberalism, the EKC hypothesis, ecological modernization, and political economy perspectives to understand the drivers of environmental degradation in Africa.

Research Questions

Carbon and methane emissions are measures of pollution. Natural resource extraction is measured in this study by natural resource depletion, which is the sum of net forest depletion, energy depletion, and mineral depletion. The carbon intensity of well-being (CIWB) and methane intensity of well-being (MIWB) capture the links between CO_2 emissions, methane emissions, and human health or well-being. CIWB and MIWB fall within the scope of research on the environmental intensity of well-being (EIWB) that examines how environmental outcomes are associated with human well-being. Thus, this

study will evaluate – using competing perspectives on environmental degradation – the drivers of human well-being measured by CIWB and MIWB. EIWB measures can be viewed as measures of sustainability. This study will test indicators of the neoliberalism, environmental Kuznet's curve hypothesis, ecological modernization, and political economy perspectives on indicators of environmental degradation. The study employs measures of CO_2 emissions, methane emissions, and natural resource extraction as measures of environmental degradation. Thus, this study addresses two broad questions:

- What are the drivers of air pollution and natural resource extraction in African countries?
- What are the links between the drivers of air pollution and human well-being in African countries?

Specifically, the study will test the following:

- What are the drivers of 1) CO_2 emissions, 2) methane emissions, and 3) natural resource depletion, in African countries?

There are indications that these emissions (CO_2 and methane emissions) are associated with human well-being since exposure to them occurs over people's entire life span and are a constant presence in the environment they reside and interact with (Givens, Clark, and Jorgenson 2016). Thus, this study will also evaluate these questions:

- What are the drivers of 1) the carbon intensity of human-well-being (CIWB), and 2) the methane intensity of human well-being (MIWB), in African countries?

In what follows, I provide a brief background of Africa including its colonial and post-colonial history. This is followed by the theoretical perspectives and literature section

which presents the theoretical foundations (i.e., neoliberalism, the environmental Kuznets curve (EKC) hypothesis, ecological modernization, and political economy perspectives) of the study. The section also summarizes the empirical evidence in the literature related to these theoretical perspectives. I draw a connection between human well-being – using the CIWB and MIWB – and neoliberalism by extending the neoliberalism-environmental degradation link. Next, the methods and data section explores the data and the analytic strategy for investigating the association between neoliberalism, environmental degradation, CIWB, and MIWB. This is followed by the results section which reports the bivariate relationships and regression models used in the study. This section covers the support for (or lack thereof) of the hypotheses arising from the review of theory and empirical literature. The discussion and conclusion section ties the results to the review of literature and offers insight on support for and the lack of support for some hypotheses. Further, it discusses the potential implications and policy recommendations arising from the analyses conducted in the study. In this section, I discuss limitations to this study. Finally, the study ends with a brief conclusion.

CHAPTER II

BACKGROUND

Overview of Africa

Africa is the second largest (covering 6% of the earth's surface and 20% of its land area) and second most populous (1.4 billion people in 2021) continent in the world. Its size in geography and demography is second only to Asia (Sayre 1999; United Nations 2022b). Currently, there are 54 sovereign nations in Africa, most of which have colonial history.

Beginning with European contact in the 15th century, Africa's colonial experience was one of unequal exchange that resulted in the exploitation of its (primarily natural) resources by Western actors while simultaneously suffering underdevelopment and environmental degradation (Aseka 1993). The colonial experience severed the independent developmental path African societies were on prior to European contact (Aseka 1993). The introduction of industrial scale mining, mechanized agriculture, lumbering, and urban transportation infrastructure by colonialists reshaped African geography and its physical environment (Aseka 1993). In southern Africa, imperial hunting and predatory colonial settler societies wreaked havoc on wildlife and caused the extinction of some species (Beinart 2000). The late 1800s recorded significant losses in cattle due to diseases.

Although, colonial authorities were involved in active environmental management as well as combating tropical diseases (Beinart 2000), the colonial experience introduced 'American crop domesticates that altered and reshaped the range of species, demography, farming systems and the environment' (Beinart 2000:286).

The unequal exchange relationship between Africa and the West (including its former colonial masters) persists in post-colonial Africa (Aseka 1993). The economic collapse of many African countries a few decades after their respective independence from colonial powers and the acceptance and implementation of Washington Consensus[1] style neoliberal solutions have only further entrenched the unequal exchange relationship. This era of neoliberal solutions was embodied by the structural adjustment programs (SAPs). SAPs were a Western led approach to the high levels of indebtedness and economic failures of many African nations. They represent some of the most prominent post-colonial processes across the African continent. A substantial body of literature links environmental impacts to the SAP experience in Africa (Cheru 1992; Konadu-Agyemang 2000; Loewenson 1993). Thus, SAPs are an important part in understanding environmental degradation in Africa.

Climate change has featured prominently in the discussion about environmental impacts in Africa with the continent regarded as one of the most vulnerable to climate change related environmental problems (Schneider 2007). Its vulnerability stems from high poverty, low technical capacity for adaptation, and a combination of colonial and post-colonial events (such as forced state formation, support for authoritarian governments,

[1] Washington Consensus is a term coined by British economist, John Williamson, and refers to a set of free-market economic policies driven by key Western institutions such as International Monetary Fund, the US Treasury, and the World Bank (Williamson 2004).

terrorism, SAPs) that have shaped the structure of African societies (Schneider 2007). I now turn to a discussion of the literature that is relevant to addressing my research questions.

SUSTAINABILITY, SUSTAINABLE DEVELOPMENT, AND HUMAN WELL-BEING

Sustainability and Sustainable Development

Sustainability refers to maintaining the Earth's carrying capacity through the use of technology and behavioral change at the individual and societal levels (Portney 2015:12). The goal of sustainability is to ensure that present and future generations are able to benefit from available resources without negative impacts on their well-being and survival (Brundtland 1987). Sustainability strives for a balance in economic, social, and environmental goals, as well as a balance in the activities driven towards the achievement of these goals which ensure the continued viability of human societies. Hence, the concept of "intergenerational equity" is important to sustainability since it emphasizes the need to incorporate the interests and needs of future generations in decisions on resource use and environmental management (Brundtland 1987). With sustainability, the distant future is just as important today because the ability of subsequent generations to flourish is determined by the actions of people in the present. While the concept of sustainability is not in opposition to economic growth, it implies the recognition of limits defined by existing level of technology (Brundtland 1987).

The United Nations sustainable development goals (SDGs) are a critical piece of the sustainability discourse and represent an important strategy for using sustainable

development to pursue the goal of sustainability. The SDGs of today were built on the concept of sustainability because they recognize that the strategies to tackle poverty and inequality, improve health and education, and drive economic growth must be compatible with conservation efforts focused on addressing climate change and protecting the environment (United Nations 2022a). In effect, sustainable development and by extension the SDGs are strategies for achieving the goal of sustainability. The emphasis of the SDGs on addressing environmental issues and improving human well-being provides a foundation for understanding the link between environmental problems and well-being captured by the body of research on environmental intensity of well-being (EIWB) (Givens, Kelly, and Jorgenson forthcoming). This also sets the stage for this study's investigation of the carbon and methane intensity of human well-being. The sustainable development thesis highlights the importance of human well-being in strategies for addressing environmental problems. Sustainable development is defined as development that meets the needs (economic growth and human well-being) of the present without compromising the capacity of future generations to meet their own needs (Brundtland 1987:24). Sustainable development emphasizes social inclusion which implies equity in access to the benefits of growth, development, and resource use. Policies that promote equal access to education, healthcare, housing, and other opportunities are essential to social inclusion and sustainable development (Brundtland 1987). Thus, environmental intensity of human well-being measures such as CIWB and MIWB can be used to evaluate the success of the drive for sustainability. Sustainable development advocates for modernization, technological progress, and overall improvements in efficiency. Thus, it aligns with environmental perspectives of ecological modernization and the EKC which

primarily see economic growth and development as viable solutions to environmental impacts (Givens et al. forthcoming).

The concepts of sustainable development and SDGs have been critiqued in previous literature. Jacob (1994) argues that sustainable development is ambiguous on what values (or definitions of growth) should take precedence in the pursuit of development that is considered sustainable. Redclift (2002) argues that sustainable development fails to account for the powerful political and economic structures driving action (or inaction) within the context of sustainable development policies. This extends to the SDGs because their implementation largely rests under the control of powerful political and economic actors whose support is necessary for success.

Degrowth is important to the discussion on sustainable development. Degrowth is the reduction of energy and material use of the economy in order to bring it back into a state of harmony with the physical and living world while ensuring equitable and fair development (Hickel 2020). The idea of degrowth is not necessarily in opposition to economic growth but an emphasis on more equitable distribution of resources rather than capital accumulation. Within the degrowth perspective is an emphasis on human well-being that focuses on liberating people from unnecessary labor and work, and investment in public goods and services that allow people to thrive and flourish (Hickel 2020). It is the restructuring of the economy to prioritize ecological goals and improvement in human well-being rather than the existing system that emphasizes continuous capital accumulation to the detriment of the environment and human well-being (Hickel 2020). As the amount of evidence from research linking economic growth to environmental damage (particularly emissions) continues to increase, proponents of degrowth view deemphasizing economic

growth and expansion as a way forward (Hickel 2020). They argue for abandoning the established capitalistic system of measuring progress by continuous economic growth because this is an unsustainable approach. Thus, degrowth measures must be pursued by nations at the top of the global hierarchy who use more than their fair share of resources and are responsible for disproportionately higher levels of environmental degradation. This view highlights the existing inequity (largely to the detriment of the Global South) in resource use and distribution and advocates for simultaneously pursuing growth (in the Global South) and degrowth (in more affluent areas of the globe) to achieve sustainability.

Sustainability is important within an African context because of the inequality in impact (in environmental and human well-being terms) brought on by global neoliberal capitalism and the resulting ecologically unequal exchange (Bunker 2005). Africa remains one of the world's poorest and underdeveloped regions. As a result, it needs development to elevate standards of living and improve human well-being. However, given the level of ecological damage throughout the world, Africa's development strategies should be focused on sustainability. Thus, the need for urgent development and improvement to human well-being across Africa highlights the importance of sustainable development in the region. Proponents of degrowth sustainability (which is a combination of sustainable development and degrowth strategies) measures point to inequalities in environmental damage and impacts as guidelines for determining what nations should actively pursue degrowth while allowing continued growth for others to achieve sustainable development on a global level.

Another related approach to achieving sustainability is in the reduction of working hours (Fitzgerald and Schor forthcoming; Hickel 2020). This approach is a degrowth

strategy. Fitzgerald, Schor and Jorgenson (2018) found that working hours were strongly and positively associated with CO_2 emissions using U.S. state level data, and that reducing working time represented a sustainable approach to development that could also improve human well-being. The working time and CO_2 emissions positive relationship has been further established by a study using data on U.S. households. The study showed that households that work longer hours generate more CO_2 emissions (Fremstad, Paul, and Underwood 2019). One of the ways capitalism traditionally seeks to maximize profits and increase output is by increasing labor productivity – extracting more from labor time (Hayden and Shandra 2009). However, from a sustainability perspective, the reduction in work time helps curb the limitless push for labor productivity. Beyond the reduction in energy use a reduction in working time can produce, it also offers a path to improved human well-being through relatively lower levels of labor exploitation (Hickel 2020).

Green neoliberalism represents a different approach to sustainable development. While emphasizing the supremacy of markets, a green neoliberal agenda sees potential for using market mechanisms to protect the environment. It is based on the premise that appropriate pricing of the environment can in fact produce sustainable outcomes (Stilwell 2011). For instance, the use of emissions trading is a market-based strategy that uses the free market principles of neoliberal ideology in an attempt to achieve green objectives – more efficient and sustainable production.

The Economy, Environment and Human Well-being

One of the main goals of economic growth and development is the improvement in quality of life and standard of living for humans. The improvement in quality of life includes improvements to human well-being. The environmental intensity of well-being

(EIWB) is a measure of how environmental degradation affects human well-being. Since human well-being falls under sustainability, the EIWB is essentially a measure of how environmental degradation affects sustainability. Since the activities that produce economic growth often generate pollution which in turn is harmful to sustainability (human health and well-being), the EIWB helps explain the relationship between environmental degradation, sustainability, and economic growth and development. The carbon and methane intensity of human well-being capture the impact of CO_2 and methane emissions on sustainability. Carbon intensity of human well-being has been used quite a bit in recent years, after being introduced into the literature (Ergas et al. 2021; Givens 2015; Jorgenson and Givens 2015; Wang et al. 2022) by Andrew K. Jorgenson (Jorgenson 2014) while the latter (methane intensity of human well-being) is a unique addition to the EWIB literature that this study will make.

CHAPTER III

LITERATURE & THEORETICAL PERSPECTIVES

Neoliberalism

Background on Neoliberalism

Neoliberalism can be referred to as a child of the Great Depression – given that the Keynesian perspective the Depression produced ultimately led to the emergence of neoliberal ideology decades later (Ganti 2014). The events – plummeting industrial production, soaring unemployment, high levels of poverty, and stock market crash – of the Great Depression led to the ideas of John Maynard Keynes, which became known as "Keynesianism," that argued for more direct government involvement in balancing and smoothening out the highs and lows of economies referred to as economic cycles (Mohan 2009). Keynesianism was implemented using a system known as the Gold Standard and a set of economic institutions known as the Bretton Woods Institutions. The Bretton Woods Institutions included the International Monetary Fund (IMF), The International Bank for Reconstruction and Development (World Bank), and the General Agreement on Tariffs and Trade (GATT) which later became the World Trade Organization (WTO). These economic institutions sought to manage international economic flows based on Keynesian

policy principles of active state involvement in regulating economic cycles. However, the abandonment of the Gold Standard and the rise of more flexible currency movements created pressures (such as rising inflation) and unrest in many developed nations (Mohan 2009). This created the conditions for the emergence of neoliberal ideology and its advocacy for market supremacy. Neoliberalism was a capitalist driven response to slowing growth rates and returns (Hickel 2020). Neoliberal policies allowed governments to open up areas of the economy previously off limits to profit-driven capitalist models (Hickel 2020). Neoliberalism can be viewed by some as a temporary solution – similar to the enclosure movement or European colonization of the new world – to address slowing capital returns because of the inability of neoliberal policies to bring continuously increasing returns to capital (Hickel 2020). This view assumes that the use of neoliberal policies cannot bring about continuous gains to capital. Thus, the reduction in the size of government and expansion of capitalism associated with neoliberal principles to achieve increasing returns is not sustainable. This is because there is a limit to how much smaller government can get as well as existing areas for capitalistic expansion. In its early days, neoliberal ideology targeted the state since it viewed the state as an obstacle to an efficiently functioning market (Mohan 2009). It also advocates for economic restructuring that opens economies to global (often Western/core) institutions and corporations in ways some consider to be global neocolonialism (Larner 2003; Venugopal 2015). In some ways neoliberalism has overtaken globalization as the defining process of contemporary economics and politics (Larner 2003). Neoliberalism argues for the liberation of individual entrepreneurial freedoms while simultaneously using state power to guarantee the protection of private property rights as well as the proper functioning of markets (Harvey

2007; Springer et al. 2016; Venugopal 2015). Under neoliberalism, the government is considered ill-equipped to provide economic growth through direct involvement in the market (Bockman 2013). Thus, state involvement in markets must be minimal. Minimalist state involvement is achieved through deregulation, privatization, reductions in government involvement in poverty reduction, and provision of social services (Noorbakhsh and Paloni 1999). Neoliberalism can operate under both autocratic and democratic governments since its advocacy focuses solely on providing the systems that ensure markets operate optimally rather than guaranteeing democracy and free exchange of political ideas (Thorsen and Lie 2006).

Neoliberalism and the Environment

One way neoliberalism influences the environment is through environmental policy. The use of terms such as "sustainability," "sustainable development," and "environmentally sustainable growth" in environmental policy are products of neoliberalism driven policy making regimes (Coffey and Marston 2013). Thus, neoliberalism influenced environmental public policy may allow for environmentally positive signaling without commensurate pro-environmental protection/anti-environmental degradation practices. It can also encourage the continued expansion of the capitalist system due to an expectation that continued economic growth – a centering of business interests – will eventually produce environmental sustainability (Coffey and Marston 2013). Also, neoliberalism's support for continued economic expansion within the current capitalist mold ultimately silences voices advocating for transformative (sometimes radical) steps to address environmental degradation in favor of the status quo (Coffey and Marston 2013). Individual responsibility for addressing environmental

degradation is a consequence of environmental policy under neoliberalism since it situates the cause of environmental degradation within individual choices (Coffey and Marston 2013; Felli and Castree 2012).

In response to the tragedy of the commons which suggests that resources held in common result in overutilization since externalities are excluded from considerations governing their use, proponents of neoliberalism argue for private ownership in order to mitigate against the overexploitation of resources and an incorporation of externalities that results in less destructive environmental uses of resources (Hardin 1968; Liverman and Vilas 2006). Those advocating for neoliberal policies argue that under neoliberal regimes private ownership of resources (including the environment) will limit environmental degradation by accounting for the costs involved in the extraction and exploitation of these resources. Private ownership implies that the management of the resource is undertaken in a way that ensures its long-term viability for exploitation. In other words, private ownership should result in more efficient use of resources which would slow down their exhaustion. However, the unequal exchange thesis suggests the assumption that private ownership of resources will result in resource exploitation and extraction because the more powerful actors in the exchange process often take advantage of the weaker ones to maximize their own benefits.

Neoliberalism involves the application of principles such as commodification, privatization, and marketization of the environment (Springer et al. 2016). Not even water – one of nature's most ubiquitous provisions – is exempt from the application of neoliberal principles. Through SAPs, an example of neoliberalism in practice, the use of water resources for industrial, mining, tourism, and irrigation purposes has intensified (Budds

2004; Gueorguieva and Bolt 2003; Springer et al. 2016). Neoliberalism actively extends markets and entrenches the commodification process in ways that increase pressure on the environment (Braedley and Luxton 2010). Further, privatization and commodification of nature (particularly key elements such as clean water or air) raise human rights concerns since the expectation is that critical resources should not be commodified and be freely available to everyone (Liverman and Vilas 2006).

The shift – made possible by neoliberal policies – in operations by resource extraction industries from the developed world to the Global South and the impacts of extraction on the environment merits consideration (Reed 2002). The asymmetry in technological expertise and financial power required by the resource extraction industry places developing countries in a disadvantaged position. Developing countries often require the assistance of multinational corporations, usually of Western origin, for the exploration (which becomes exploitation) of natural resources (Oshionebo 2010). The paucity of technological expertise and financial power within developing economies forces them to adopt neoliberal policies to attract foreign funding and expertise they desperately need. Unequal exchange relationships form and become entrenched which allows foreign multinational resource extraction firms to exploit the resources of developing countries while excessively degrading their environment with little or no consequences to their home country's environment.

The flow of money across national boundaries is aided by and is a crucial aspect of neoliberal policies. One of the most common forms of cross-national monetary flows is foreign direct investment (FDI). FDI describes the process that allows citizens or groups of one country to invest in and acquire ownership of firms in a foreign country (Moosa

2002). It is an investment that involves the acquisition of a lasting interest, stake, and control in a business domiciled in a foreign country (or an economy other than that of the investor). Specifically, the foreign acquisition process described by FDI allows the foreign investor to have a degree of control over policy and management decisions (Moosa 2002). FDI is associated with pollution in what has been called the "Pollution Haven Hypothesis" (Bao, Chen, and Song 2011:72), which describes conditions that make developing countries attractive to foreign capital. These conditions are rooted in the weak regulatory environments of developing countries that are incentives to foreign capital. The pollution haven hypothesis suggests that foreign capital flows into developing countries because of their weakened environmental regulatory structures due to neoliberal policies. Research has found that foreign direct investment increases CO_2 emissions in developing countries (Grimes and Kentor 2003). The level of foreign capital inflows into a country can be considered one reliable proxy for evaluating the extent of neoliberalism in the country. Neoliberal policies create conditions within countries that make them attractive to foreign capital. In some cases, the use of neoliberal policies weakens regulation through strong advocacy for minimalist government that encourages foreign capital through attractive returns and less stringent regulatory environments. This establishes a link between neoliberalism, foreign direct investment, and pollution (and other environmental impacts). Further, previous studies have linked increases in FDI to increases in natural resource extraction (Long, Stretesky, and Lynch 2017). On the effect of FDI on CIWB, Dang et al (2023) found that FDI inflows reduced CIWB, but the effect was low and unstable.

The resource extraction undertaken by Western multinational corporations (MNCs) in less developed countries has continued to give life to regimes that are authoritarian and

undemocratic (Reed 2002). The perpetuation of undemocratic and authoritarian governments by the activities of the resource extraction industry in the Global South produces a political landscape that makes it difficult, and in some cases dangerous, for environmental actors (individuals, groups, and communities) to confront their government and by extension the resource extraction firms about the environmental degradation produced by resource extraction (Reed 2002).

The neoliberal international capitalist economy also produces asymmetry in environmental regulations allowing resource extraction firms to engage in environmentally destructive extraction activities that would be illegal in their developed home countries (Reed 2002). In Nigeria, extensive environmental damage (of the scale impermissible in their Western home countries) caused by multinational resource extraction companies in the Niger Delta region often goes unpunished. The nature of governance across many African countries influences the outcomes on people and the environment caused by resource extraction activities (Gilberthorpe and Hilson 2016). Weak democratic political landscapes and ubiquitous autocratic leadership produce systems and societies that create laws and policies (including environmental regulations) that do not effectively incorporate the concerns and needs of local communities (Gilberthorpe and Hilson 2016). Thus, multinational resource extraction entities are afforded a landscape that allows them to operate in environmentally destructive ways (Jiang 2009). Resource extraction activities of Western MNCs can alter the social and cultural dynamics of the communities hosting the resource in ways that negatively impact health outcomes (Reed 2002). Here it is possible to link human health, quality of life, neoliberalization, and environmental degradation. Essentially, resource extraction in developing countries forces already

vulnerable populations to bear the risks as well as direct and indirect costs of resource exploitation. This vulnerability and lack of representation in the governance and regulatory processes guiding the resource extraction industry negatively impact health outcomes, the environment, and livelihoods (Jiang 2009; Veltmeyer 2013).

Cheru (1992) highlighted a key element of the neoliberal world order – its lack of fairness and the disadvantaged position Africa finds itself within the world. African countries often receive payments for their resources that are far below the costs (to the environment and human well-being) and potential value of their export commodities (particularly non-energy commodities). Thus, many countries resort to expanding production which brings in more aspects of the environment and ecosystem into neoliberal capitalism. As a result, environmental degradation increases, and human well-being suffers.

Green Neoliberalism

Green neoliberalism offers an alternative perspective on neoliberalism, arguing that neoliberal policies can in fact be beneficial for the environment. Green neoliberal policies (attempt to) internalize environmental and sustainability concerns. In other words, green neoliberalism can be described as neoliberalism that strives to be environmentally conscious and focuses on development that is sustainable (Goldman 2004; Obeng-Odoom 2014). Green neoliberalism is an ideology that drives "the scientization, governmentalization, and capitalization of strongly contested eco-zones (such as the Amazon)" (Goldman 2004:186). It arises from a growing acceptance that alternatives to the current developmental model are non-existent and that the focus should be on a sustainable form of neoliberal capitalism (Goldman 2005). Goldman (2004:168) notes that

'green neoliberalism is the common ground for what he calls neocolonial ideas of enclosure and preservation and neoliberal principles of market value and efficient resource allocation'. The World Bank – as a neoliberal institution – is moving toward a more green neoliberal perspective having been forced by external pressures (growing environmental concerns) to "green" or reform its activities (Goldman 2005). The World Bank's role in driving green neoliberalism is through the incorporation of social and environmental concerns to its standard neoliberal economic agenda through including green (environmentally conscious) regulatory conditions into lending terms for borrowing countries (Goldman 2004, 2005). Further, the World Bank's knowledge production machine is an important tool for the propagation and by extension enforcement of green neoliberal ideology (Goldman 2001). This is the process within the World Bank that guides its ability to set narratives and influence policy as well as its operations and the kinds of projects it finances. For instance, growing external pressure from environmental groups has led the World Bank to financing based primarily on sustainable development and green neoliberalism strategies. For example, the Bank argued for the application of neoliberal principles to environments (such as forests, water, and land) to reduce their unsustainable use (Goldman 2005). Thus, in countries of the Global South, green neoliberal policies have created institutional change, environment focused agencies, and in some cases, changes to laws and regulations geared towards what the World Bank argues is sustainable use (Goldman 2004, 2005).

Neoliberalism and Structural Adjustment Programs in Africa

Structural Adjustment Programs (SAPs) are well known instances of neoliberalization or the application of neoliberal theory and ideology into practice. They

are also helpful in understanding how neoliberal theory can differ from neoliberalization. The SAPs – following neoliberal logic – argued for adjustments to macroeconomic policy, liberalization in trade, deregulation, and privatization to engender growth and development in key economic sectors. The expectation is that these policy measures will increase competitiveness, efficiency in production, transfer of technology and capital, efficiency in public resource allocation, and the promotion of efficient activities, while disincentivizing the allocation of inputs into inefficient activities (Noorbakhsh and Paloni 1999). However, with the SAPs – particularly in Africa – inherent weaknesses such as low managerial and technical skills produced outcomes that differed from those outlined by the neoliberal theory upon which they were based (Noorbakhsh and Paloni 1999; Schneider 1999).

Neoliberalism in Africa is perhaps best understood when viewed through the lens of the SAPs era of the 1980s. SAPs are World Bank and International Monetary Fund (IMF) sponsored economic restructuring programs. The World Bank and the IMF, in response to the deterioration of economies in African countries in the years preceding 1980, began the process of economic restructuring on the African continent – country by country. The SAPs were geared toward addressing unsustainable national budgets, trade deficits, hyperinflation, and currency instability (Herbst 1990; Konadu-Agyemang 2000). External debt servicing obligations to neoliberal institutions have been particularly damaging to African countries. Thus, measures of debt servicing such as the World Bank's *total debt service* are good proxies for SAPs/neoliberal policies. The total debt service is the sum of principal repayments and interest actually paid in currency, goods, or services on long-term debt, interest paid on short-term debt, and repayments (repurchases and charges) to the IMF (World Bank 2022). It is a useful proxy for neoliberal policies because the level of a

country's debt burden likely affects its ability to repay its debts. A country's inability to repay its debt is likely to force it to accept IMF and World Bank structural policy adjustments (neoliberal policies) to address its debt problems. Debt servicing and the interests associated with it reduce the amount of funds available to governments and their citizens for growth and consumption necessary for development. The debt servicing process can lead to debt bondage that forces a country to consider environmentally destructive sources of income to replace income lost to debt servicing. Essentially, the World Bank and the IMF argue that the goal of the SAPs is to tackle issues of endogenous origins since they firmly believed that the developmental problems of developing countries were rooted in internal factors rather than external ones (Konadu-Agyemang 2000). SAPs as prominent examples of neoliberalism in action have had very few success stories and, in most cases, (particularly in poor countries, many of which are in Africa) negligible or negative results. As Mohan (2009) points out, in political terms, SAPs erode the sovereignty of poor countries as the programs forced their political and economic leadership to accept terms for which they had little or no say. Thus, within the environmental degradation and human well-being focus of this study, a loss of control over policy by leadership in African countries meant minimal say on policies involving the environment and human well-being.

The history of African countries post-independence is one of governments and regimes involved in patronage systems requiring state intervention. The undemocratic regimes that sprung up in the years after colonial independence across the continent employed patronage systems in attempts to institutionalize support for the regime (Herbst 1990). However, due to weak tax bases, state intervention directly rewarded groups and

actors considered to be critical for continued support and existence of the regime (Herbst 1990). State intervention was employed in import regimes enacted by African governments. These import regimes allowed governments to selectively allocate import licenses – often in inefficient ways – that created overvalued exchange rates (Herbst 1990). Here, the endogenous roots of economic collapse argued by the World Bank and the IMF are visible (Konadu-Agyemang 2000). Thus, the SAPs sought to reorganize African systems toward more efficient allocation of resources rather than the problematic post-independence patronage heavy systems (Herbst 1990; Konadu-Agyemang 2000).

In patronage heavy and state intervention ridden post-independence African countries, the introduction of SAPs was undesirable for the existing elites and their favored constituents and beneficiaries. The reason is that SAPs reduced the ability of governments and regimes to richly reward their elites and loyalists through patronage and state intervention mechanisms. The SAPs proposed cuts to certain welfare funding programs that were unpopular with the masses and created a volatile political landscape that threatened the grip on power held by African governments (Herbst 1990). The risks to continued leadership were the greatest for African leaders whose legitimacy was only propped up by patronage systems and coercion without some semblance of the legitimacy offered through democracy and votes (Herbst 1990).

Neoliberalism, Structural Adjustment Programs, the Environment, and Human Well-being

Gueorguieva and Bolt (2003) discussed the range of potential environmental outcomes (positive and negative) resulting from SAP driven policy measures. First, the removal of price distortions is expected to lead to cleaner energy use and the abandonment

of coal. This is because the presence of price distortions is favorable to the pricing of coal relative to energy alternatives, and price correction under SAP regimes makes it less appealing from a cost standpoint while encouraging a shift to other (now relatively cheaper) energy sources. However, the removal of price distortions under SAPs is associated with reductions to fertilizer subsidies that lead to a decrease in the use of fertilizers which may increase soil degradation. Both contradictory results of price distortion removals highlight the positive and negative outcomes that can result from the implementation of SAPs. Second, changes in the structure and scale of economic activity are expected to move economic activity away from environmentally destructive activities but may also lead to specialization in and incentivization toward erosive crops. Third, changes in income levels and income distribution can lead to a movement away from environmentally degrading activities to jobs in less destructive sectors. The reason for this is that environmentally degrading sectors are often low-income jobs whose scale decreases as income levels rise. Conversely, it may deepen poverty for certain parts of society (such as low skilled workers who may be unable to transition to the highly skilled and less environmentally destructive sectors), forcing them to engage in marginal agriculture that may be environmentally destructive. Finally, changes in environmental management measures could lead to the public sector moving away from inefficient ventures (such as the protection of some public commons deemed unnecessary or inefficient for public funds). This outcome would be viewed as a positive by advocates of SAPs. However, the categorization of some public commons as unnecessary or inefficient for protection using public funds may also lead to less effective management and protection of natural resources resulting in an increase in environmental degradation.

Castree (2010) describes how neoliberalism and the use of neoliberal policies impact the environment by highlighting neoliberalism's role in the expansion of capitalism to include spaces previously untouched by capitalism, including the increasing commodification of the biophysical world in ways that produce new sources of raw materials, energy, and waste disposal locations. However, Castree notes that neoliberalism driven capitalist expansion is not always an extraction only profit venture since it also incorporates protection, remediation, and conservation practices as profit generation strategies. In this vein, neoliberalism echoes the arguments of the EKC which argues that continued economic growth results in decreasing environmental impacts. Further, the market-centric approach of neoliberal ideology that increases the number of people whose livelihoods are dependent on the subjugation of nature is problematic. This is because it produces a system that prioritizes the needs of a growing majority – people whose livelihoods depend on the markets created by neoliberalism – over any attempts to address environmental degradation. Thus, the connection between neoliberalism and the environment is well-established (Castree 2010).

Liberalized trade regimes are products of neoliberal policy and are detrimental to the environment since they do not incorporate environmental costs (Reed 2013). Thus, competitive advantages in trade are made possible by a disregard for the environment in the production process. For instance, the provisions of the General Agreement on Tariffs and Trade (GATT) – the predecessor of the World Trade Organization (WTO) – did not create allowances for countries to differentiate between production processes that incorporated environmental costs and those that did not (Reed 2013). In fact, GATT considers environmental regulations as obstacles to liberalized trade (Reed 2013). The

prioritization of the protection of the economic interests of Western multinational firms, interests and investors as well as limits to the ability of host countries to drive economic, environmental and social policies results in environmental degradation (López 2006). Thus, neoliberal ideology's preference for international trading regimes often has negative consequences for the environment.

Redclift (2010)'s discussion of the environment as a social construct can aid our understanding of the link between neoliberalism and the environment. They argue that environmental degradation should be regarded as a social process which is tied to expansions and contractions in the global economic system (Mackenzie 1993; Redclift 2010). Thus, the increasing internationalization of the world brought on by neoliberal policies through trade, multinational corporations, relaxation of cross-country barriers to business, agricultural globalization and other processes subsequently leads to the internationalization of the environment into the global economy (Mackenzie 1993). For instance, global trade encourages the expansion of a given commodity which then results in the intensification of land use to support demand at the expense of land, forest, and soil nutrient rejuvenation as well as human well-being through the neglect of food crops for more export worthy crop production (i.e., non-staple foods and natural resources; Mackenzie 1993). Human well-being also suffers due to the exploitation of labor used to satisfy global demand for products at the lowest cost possible as neoliberal policy preferences for market driven economic growth and minimal government intervention in the economy are likely to result in exploitative behavior.

In Latin America, there has been little evidence that neoliberal policy has been positive for the environment (Liverman and Vilas 2006). Budds (2004) found that the

neoliberalization of water in Chile produced no benefits for peasant farmers and resulted in socio-environmental issues as well as increased vulnerability to drought. The study also reported that conflicts and illegal activities (such as illegal and unsanctioned water use by peasant farmers) have arisen from the adoption of a neoliberal agenda to water management. Ultimately, these neoliberal policies have negatively impacted human well-being in the region.

In Bolivia, SAPs favoring legal sawn wood exports through exchange rate devaluation, fiscal incentives, public road construction and other SAPs-based policies contributed to an increase in forest cover loss (Kaimowitz, Thiele, and Pacheco 1999). The results of a multi-country analysis on the association between the economy (and its neoliberal policies) and the environment found that for every 10% devaluation, round-wood production increases by 2%. Given that under SAPs, major currency devaluations are not uncommon, the environmental degradation of neoliberal policies from increased wood production may be quite significant (Pandey and Wheeler 2001).

Neoliberalism advocates for trade openness – increasing interconnectedness across nations. Mejia (2021) found that trade openness was positively related to greenhouse gas emissions, including methane emissions in the global South. Greenberg (2008) examined the impact of SAPs on the environment in the Dominican Republic and found that the focus on tobacco production pushed small scale farmers to exploit a biologically complex triple coral reef system as a way to supplement their tobacco heavy agricultural production after having been forced out of agriculturally rich lands and into marginal farm lands by large landholdings known as *latifundia*. The use of sheep and goat rearing by small scale farmers to supplement the little income earned from cultivating marginal and less productive

agricultural lands puts pressure on the land through overgrazing on pasture grounds and erosion of soil nutrients (Greenberg 2008). The increasing pressure from SAPs led some farmers to abandon farm cultivation, while some rejuvenation of their abandoned farmlands may be considered a victory for the environment, the overall environmental impact of neoliberalism here appears to have been negative (Greenberg 2008). The overexploitation of these fragile coral reefs was a consequence of neoliberal ideology-based SAPs that commodify certain products (such as tobacco) and forced peasant farmers into a more desperate and destructive relationship with the environment. In human well-being terms, the Dominican Republic SAPs resulted in a reduction in purchasing power and a rise in costs of purchased foods, consumer goods and agricultural inputs. These negative outcomes put pressures on human well-being from a standpoint of ability to purchase adequate nutrition and healthcare as well as increasing stress on individual citizens that produce negative health outcomes (Greenberg 2008).

Neoliberal institutions such as the World Bank and the International Monetary Fund are important actors in understanding neoliberalism's impact on the environment. Existing knowledge generation processes within these institutions have consequences for the environment in places where the capital they provide is utilized (Goldman 2005). This is the result of a widening of the distance between policy makers and the communities most affected by their decisions (Loewenson 1993). For instance, the protests in 1990 by villagers against the Sardar Sarovar Dam construction project in India and the subsequent independent review panel revealed that the World Bank's biased knowledge production process (which lacked effective representation) may have exacerbated environmental problems in that area (Goldman 2005). Also, power dynamics that place local communities

in subservient relationships with agents of neoliberal institutions result in capital financing that produces planning and production processes that may exacerbate environmental degradation (Goldman 2005). National governments can be affected by poor knowledge generation practices and in turn ill-informed neoliberal policy applications. For example, in Morocco, overgrazing was blamed for land degradation in Ouarzazate even though evidence supporting greater livestock productivity existed for mobile pastoralist systems relative to sedentary livestock production (Davis 2006). Klepeis and Vance (2003) showed that a neoliberal rural agricultural policy in Mexico contributed to deforestation while producing a modest increase in production. These cases highlight how neoliberal policies can be dismissive of local knowledge and nuances in ways that disrupt human and animal relationships with their environment, thus creating environmental degradation (Davis 2006; Foster 1999). The instances of poor knowledge generation at the neoliberal institutional and governmental levels emphasize the need for effective policy evaluation and feasibility processes that incorporate ecological and potential unintended consequences (Klepeis and Vance 2003).

The neoliberalism, environmental degradation, human well-being nexus is important in understanding how neoliberal policies harm humans and the environment. Cupples (2004) in a study of the El Hatillo rural community in Nicaragua explored the damage to farmers' livelihoods and increases in marginalization within economic, social and environmental contexts caused by structural adjustment policies. The loss of farmlands and livelihoods as a result of neoliberal policies in El Hatillo, contributed to a worsening of nutrition in the community (Cupples 2004). Neoliberalism can impact human well-being by favoring policies that cause the agricultural and food sectors to compete with other

sectors (Lawrence, Richards, and Lyons 2013). This can result in the agricultural sector suffering, which then can impact the environment, threaten food security, and contribute to an increase in deficient crop yields. All these processes negatively affect human well-being. The neoliberalism, environmental degradation, and human well-being connection is evident in the work of Wisner (2001) who argues that vulnerability to hurricanes and their significant impacts on human well-being are consequences of a neoliberal ideology driven Salvadorian government.

Within the context of corporations, Prechel (2021), using an analysis of the American electrical energy sector, shows that re-regulation brought on by neoliberal policies allowed for organizational restructuring within corporations that put them in a position to advance capital and wealth accumulation agendas that are environmentally destructive. However, Meier, Munasinghe, and Siyambalapitiya's (1995) study on how neoliberal (market-based) pricing of electricity impacts greenhouse gas (GHG) emissions in Sri Lanka found that pricing that incorporates long run marginal costs had positive environmental effects and thus provides a case for how economic efficiency can minimize the environmental degradation effects of economic development. Neoliberal energy reform policies also impact the composition of energy use. A study by Hughes and Lovei (1999) showed that for transitional economies, the consumption of solid fuels (such as wood and coal) decreased by more than the level of total energy consumption, with the largest decrease recorded by countries from the former Soviet Union. Also, the share of coal in total energy consumption dropped while the use of petroleum products also fell. On the human well-being effects of neoliberal energy policies, Lampietti et al. (2001) found that increases in electricity prices caused poor Armenian households to consume lower amounts

of electricity while the consumption of electricity substitutes (such as wood and gas) increased. Thus, while positive gains were seen from the electricity policy in lower electricity consumption, potential environmentally destructive behaviors, like wood consumption, increased.

In Ghana, as Konadu-Agyemang (2000) indicates, the effect of SAPs has been mixed with some macro level gains and debatable micro level benefits. For instance, while proponents of SAPs in Ghana cite GDP growth and reduction in the inflation rate due to SAP driven policies, the SAPs brought about job cuts, public spending cuts to social welfare facilities, currency devaluation resulting in costlier imported inputs for production, increases in Ghana's total debt by a factor of four within a 15-year period, and an overall decrease in access of the country's poor to critical health and education services (Konadu-Agyemang 2000). Further, the SAPs application within Ghana led to negative health outcomes with malnutrition, stunting and underweight issues increasing after the introduction of World Bank and IMF backed SAP policies (Konadu-Agyemang 2000). A study on the impact of SAPs in seven African nations showed that infant mortality rate – a key indicator of child health and overall community well-being – had risen by 4% due to the application of SAPs (Loewenson 1993). Many African governments, as part of the implementation of SAPs, cut back on healthcare expenditure. These cuts weakened already fragile social systems and health institutions resulting in poorer well-being outcomes for citizens (Loewenson 1993; Schneider 1999). Beyond the negative association between neoliberal driven SAPs in Ghana and human well-being, there was environmental degradation primarily in the form of deforestation, soil fertility decline, and water supply issues (Cheru 1992).

In Cameroon, SAPs led to changes in agricultural practices among local farmers. The practice of leaving land fallow to allow for natural rejuvenation and recovery was abandoned because more intensive cultivation was encouraged by liberalized agricultural markets. This put pressure on land use and intensified conflicts between farmers and grazers. Further, overgrazing led to increasing biodiversity loss and worsened soil erosion (Tchoungui et al. 1995). The Sudanese use of short-term SAPs designed to address its debt issues and improve its creditworthiness conflicted with long-term developmental priorities for its poor farmers. As a result, many were forced to continue to engage with degraded environments without government support in the form of inputs (such as improved seeds and fertilizers), credit, and adoption of new farming techniques. As a result, this lack of government support to farmers negatively impacted their productivity and well-being (Cheru 1992). Using primary data, Wekwete (1998) found that SAPs had worsened environmental degradation in Shamva District, Zimbabwe by intensifying the commodification of nature and incentivizing the aggressive exploitation of natural resources. The SAPs also led to an increase in gold panning resulting in increased siltation, water pollution and environmental degradation (Wekwete 1998). Increases in agricultural output prices due to economic liberalization in Tanzania incentivized an increase in agricultural production and the co-opting of a large area of the natural environment for exploitation. These processes led to an increase in environmental degradation (Angelsen, Shitindi, and Aarrestad 1999).

Richardson (1996) evaluated the role of SAPs on wildlife in Kenya. The study found that the reforms to exchange rates implemented on the back of the World Bank's neoliberal ideology driven SAPs increased the demand for wildlife services (such as

wildlife tourism) while simultaneously cutting the ability of authorities within that sector to effectively manage wildlife and undertake conservation efforts. This is a clear example of how SAPs intensify activity and demand within a sector while limiting the state and its agents' capacity to reasonably conduct oversight.

A couple of studies have used computable general equilibrium (CGE) models to evaluate how economic policies (including SAPs) are associated with the environment. A CGE model refers to a 'system of equations – based on economic theory – describing an economy as a whole as well as the interactions among its parts' (Burfisher 2021:12). Unemo (1996) used a CGE model to show that a fall in the price of diamonds resulted in an increase in land pressure by incentivizing investment in the agricultural sector in Botswana. The study also showed that government policies provided direct and indirect incentives for livestock production leading to overgrazing. Also using a CGE model, Wiig et al. (2001) evaluated the association between economic policy and the environment in Tanzania. The study found that a reduction in subsidies to fertilizers negatively impacts soil nitrogen. A study of Nicaragua found that reduction in public expenditures, due to SAPs led to forest conservation in the long run while intensifying deforestation in the short run through processes that initially make subsistence farming and land use relatively attractive to society's poor (Glomsrød, Monge, and Vennemo 1999).

Africa has a long history with neoliberalism and the use of neoliberal policies. The SAP era being a clear case of neoliberalism in Africa that drove significant institutional changes across Africa with positives and negatives for African people. Africa remains an understudied region of the world in terms of neoliberalism, environment, and human well-being. This study aims to contribute to scholarship on these key issues.

The globalization of the world driven by neoliberal ideology is an important phenomenon in modern times. The increasing interconnectedness of the world's nations has implications for the environment since it has transformed environmental concerns from primarily local concerns to global issues. Thus, it is necessary to examine how the interconnectedness and pursuit of small government brought on by neoliberalism have impacted environmental degradation, in this study measured by CO_2 emissions, methane emissions, natural resource depletion, carbon intensity of human well-being and methane intensity of human well-being. The importance of the latter measure is in its ability to incorporate human well-being and sustainability into the analysis. As shown earlier, Africa has been particularly impacted (often in negative ways) by neoliberal policies. It is therefore important to understand how the application of neoliberal policies and neoliberal agenda is associated with the environment in Africa as well as the well-being of African people. This study uses FDI and total debt service as proxies for neoliberalism. FDI is a useful proxy for neoliberalism because it captures the degree of foreign ownership of firms within a country. Foreign ownership of firms implies that these owners (such as foreign governments, entities, and groups) have a degree of control over policy (including the promotion of neoliberal policies) and management decisions. The total debt service captures a country's debt burden which is related to its ability to service its debts. In the case of African countries, the ability to pay is often low which forces them to accept IMF and World Bank interventions (SAPs). These understandings of FDI and total debt service allow them to serve as effective proxies for neoliberalism. Thus, the following hypotheses which will be tested in this study are suggested:

> ***H1a**: Increases in FDI are associated with increases in CO_2 emissions in African countries.*

***H1b**: Increases in FDI are associated with increases in methane emissions in African countries.*
***H1c**: Increases in FDI are associated with increases in natural resource depletion in African countries.*
***H1d**: Increases in FDI are associated with increases in CIWB in African countries.*
***H1e**: Increases in FDI are associated with increases in MIWB in African countries.*

***H2a**: Increases in Total debt service are associated with increases in CO_2 emissions in African countries.*
***H2b**: Increases in Total debt service are associated with increases in methane emissions in African countries.*
***H2c**: Increases in Total debt service are associated with increases in natural resource depletion in African countries.*
***H2d**: Increases in Total debt service are associated with increases in CIWB in African countries.*
***H2e**: Increases in Total debt service are associated with increases in MIWB in African countries.*

Environmental Kuznets Curve (EKC)

A related perspective to neoliberalism is the environmental Kuznets curve (EKC) hypothesis The EKC hypothesis suggests that, over time, economic output and environmental impact are related in an inverse U pattern. The EKC hypothesis argues that in the early stages of economic growth and development (that is the stage of low per capita income), environmental degradation is high. However, at some level of per capita income, environmental degradation begins to fall even as per capita income continues to rise (i.e., in other words, they decouple). Thus, the EKC relationship between environmental impacts and per capita income is an inverted U-shaped curve. It is named after Simon Kuznets whose original analysis was rooted in economic inequality and examined the relationship between income inequality and economic development (Stern 2018).

Previous research has found support for the EKC hypothesis (Apergis and Ozturk 2015; Sarkodie and Ozturk 2020; Shahbaz et al. 2015). Other studies failed to find support

for the EKC and find a positive GDP-pollution relationship in the short and long run (Al-Mulali, Saboori, and Ozturk 2015; Ozturk and Al-Mulali 2015).

The EKC perspective suggests that environmental degradation is expected to decline as technology and economic development progress. Thus, this study will test the following hypotheses:

> ***H3a**: The relationship between per capita income and CO_2 emissions is an inverted U-curve in African countries*
> ***H3b**: The relationship between per capita income and methane emissions is an inverted U-curve in African countries*
> ***H3c**: The relationship between per capita income and natural resource extraction is an inverted U-curve in African countries*
> ***H3d**: The relationship between per capita income and CIWB is an inverted U-curve in African countries*
> ***H3e**: The relationship between per capita income and MIWB is an inverted U-curve in African countries*

Ecological Modernization

Ecological modernization theory argues that the environmental impacts of production can be mitigated through a combination of strategies; specifically, regulation, science, and technology (Schlosberg and Rinfret 2008). As Jorgenson and Clark (2012) note, ecological modernization argues that as economic development progresses, the negative environmental impact arising from further development diminishes. Therefore, ecological modernization represents an optimistic or positive view of economic growth and development vis-à-vis environmental degradation (Jorgenson and Clark 2012). Ecological modernization highlights the roles modern science and technology play in ecological reform (Mol 1996). It also emphasizes the role of economic agents (such as entrepreneurs and innovators), state agencies, and social movements as social vessels of ecological

reform. Ecological modernization highlights the importance of a strong (usually democratic) state in the reallocation of production and consumption processes within the context of environmental reform. Here, the state's role in driving environmental policy is proactive rather than reactive in nature and environmental policy is employed as an innovative force that incentivizes changes in production (Mol 1996; Schlosberg and Rinfret 2008). Under the ecological modernization thesis, economic institutions (such as commodity and labor markets) still exist, however, their form takes a more ecologically conscious one – in contrast to their productivity and profit driven earlier forms (Mol 1996). The continuous transformation into a more ecologically oriented society through key institutions is a function of an ongoing flow of knowledge and education on sources and consequences of environmental impacts arising from existing social and institutional structures (Mol 1996). The idea of modernization in institutional and social structures is a function of ecological rationalization which is embodied by the transformation processes noted earlier (Mol, Spaargaren, and Sonnenfeld 2013). In summary, ecological modernization theory focuses on increased efficiency in production – driven through technological advancement – targeted at a proactive approach to addressing environmental degradation. It seeks to highlight the potential for profits in green goods and technologies and is driven towards encouraging economic institutions to adopt this perspective with an overall goal of reducing environmental impacts (Givens et al. 2016; Schlosberg and Rinfret 2008). The ecological modernization model also proposes a link between economic development and human well-being (Givens et al. 2016). It suggests a similar inverted U-shape relationship as the EKC hypothesis. Ecological modernization predicts that continued economic development is associated with a highly reflexive and post-materialist

citizenry who advocate for greener and safer environmental practices. This is a level usually attained after lower order or base needs have been met and evidence of improving well-being. Thus, the outcome ecological modernization predict requires improvement in human well-being (Givens et al. 2016).

Central to the ecological modernization perspective is the concept of *decoupling*. Ecological modernization suggests that decoupling begins first in developed countries as they are further along on the developmental path (Jorgenson and Clark 2012). The decoupling process occurs in two ways – relative and absolute decoupling. Relative decoupling occurs when the amount by which environmental impact rises is lower than the corresponding growth in the economy. Under the absolute decoupling process, the environmental impact measure remains unchanged or even decreases in response to economic growth (Jorgenson and Clark 2012). The ecological modernization perspective proposes a similar inverted U-curve between economic development and environmental degradation that has been earlier discussed under the EKC hypothesis. As with the EKC hypothesis, ecological modernization proposes that increasing economic development will eventually result in lower environmental impact. However, in addition to production becoming ecologically efficient, the ecological modernization perspective views government as important to the decoupling process. One way to capture this is through democracy (or measures of democracy) since democratic governments are seen to be more environmentally conscious due to the ability of environmental actors to influence policy. The notion of *green capitalism* is relevant to the ecological modernization perspective. Here, ecological concerns are not viewed as obstacles to economic objectives. Rather, ecology and its important themes, issues, and concerns are in fact seen as direct paths to

profit making (Foster 2012). Again, it is clear how the ecological modernization model strongly aligns with existing structures and represents an optimistic approach to studying environmental impact issues. In other words, environmental protection and economic growth are aligned.

Some proponents of the ecological modernization perspective have described it as dominant (at least outside academia) given its alignment with the world's leading political and corporate institutions (Foster 2012). The ecological modernization model is not at odds with the political establishment which implies that government plays an important role in society's ecological modernization path (Foster 2012). Extending this further leads to the conclusion that government and political institutions are critical actors in the decoupling process and by extension ecological modernization. The role of government in the ecological modernization perspective raises the question of what form of government – authoritarian or democratic – is better for the environment. Research has shown that more democratic societies produce better environmental outcomes (Baber and Bartlett 2018; Sjöstedt and Jagers 2014; Winslow 2005). Less democratic countries and authoritarian governments weaken institutions designed to protect the environment (Gilberthorpe and Hilson 2016; Jiang 2009). Given the role of government in the ecological modernization perspective, this study will test the following hypotheses:

> ***H4a**: Increases in democracy are associated with decreases in CO_2 emissions in African countries.*
> ***H4b**: Increases in democracy are associated with decreases in methane emissions in African countries.*
> ***H4c**: Increases in democracy are associated with decreases in natural resource depletion in African countries.*
> ***H4d**: Increases in democracy are associated with decreases in CIWB in African countries.*

***H4e**: Increases in democracy are associated with decreases in MIWB in African countries.*

Political Economy Perspectives

Treadmill of production

Initially, the treadmill of production perspective explained how changes in the American production system were responsible for significant changes in environmental impacts in the four decades between the 1940s and 1980 (Schnaiberg 1980). The perspective showed how a post-World War II view of surplus natural resources drove an increasingly capital-intensive system of production. This system also heavily featured the application of new technologies requiring higher energy consumption and chemical use in place of human labor. These new technologies were products of research and development in universities and large firms. A critical element of this new system of production was how new technologies were viewed. Unlike in earlier labor-intensive systems, new technologies were viewed as sunk cost or capital and necessitated increasingly aggressive profit seeking through ever increasing production levels and cuts to labor as the more efficient cost reduction strategy. Although, on the surface, the rapid technological changes appeared to be driven by the production system's quest for efficiency, there were in fact deliberate social control processes – such as investment in research and development by large firms and government and industry grants to universities for science and engineering focused research – driving the swiftly changing technologies. The treadmill's capital accumulation was an important driver of natural resource extraction. (Gould et al. 2015).

The treadmill model is comprised of three key actors: *capital* driven towards profits, the *state* seeking tax revenue, and *labor* desirous of wages. The treadmill of production defines how these key actors consume and are consumed by the existing production framework (Gould et al. 2015). It describes a self-reenforcing system for which increases in technology use displace workers who (through unions and collective bargaining tactics) then advocate for the treadmill's expansion as a solution to their reabsorption into the production system given their need for wages – actions which ultimately worsen environmental impact and climate change (Gould et al. 2015; Obach 2004). Thus, for investors and workers, the continuous expansion of the system was supported since for the former, it guaranteed increasing returns on investment and for the latter, a place in the system in the form of employment. The treadmill perspective shows how the dominant economic or production system increases degradation. In other words, even though workers may be desirous of environmentally safe and clean environments, their need for wages and employment forces them to participate in the system and therefore contribute to its expansion. The treadmill of production highlights the role of social inequality, power, and conflict in environmental degradation. The treadmill perspective is a production centric model because it argues that exploitation and allocation of resources are at the core of production decisions. Thus, within the treadmill model, focusing on more democratic ownership and control over production is a more effective strategy than altering consumption levels for mitigating environmental impacts (Gould et al. 2015).

As noted earlier, the treadmill's acceleration and expansion imply that even more natural resource extraction will occur to meet the demands of profit seeking and reabsorption (employment) of labor. Meeting the demands of investors and labor creates a

thirst for natural resources that continues to fuel conflicts, poverty, and environmental degradation. The globalization of the treadmill of production has meant that local political actors have limited capacity to protect their environment in the face of highly competitive private capital interests (Gould et al. 2015).

Resource extraction in Africa has been recently viewed within a somewhat imperialistic, "new scramble" for Africa lens that centers China as an important actor (Jiang 2009). For China, resource extraction activities on the African continent are simply a means to sustain its industrialization drive (Jiang 2009; Marsh 2015). Chinese extraction activities in Africa are unlikely to be environmentally sensitive but rather environmentally destructive since even within China, resource extraction is primarily done in environmentally damaging ways (Jiang 2009; Marsh 2015). Further, the lack of strict environmental regulations – or at the very least enforcement of existing regulations due to corruption and weak institutions – allows Chinese extractive activities to wreak havoc on African ecosystems (Jiang 2009). The Chinese development model employed in Africa for resource extraction is one built on low-wage labor (Jiang 2009). The application of this model in Africa has negative implications for health outcomes on the continent. Jiang (2009) also highlighted the issue of lack of expertise (particularly for Chinese oil companies operating in Africa) in environmental management and sustainability as a factor exacerbating the environmental degradation of African ecosystems perpetuated by the resource extraction industry. The very nature of resource extraction is one that exerts a heavy toll on the environment. On this topic, Marsh (2015) noted that exploratory activities employed by resource extraction companies in Africa have caused environmental degradation. For instance, in Gabon, a Chinese state-owned oil firm, Sinopec, undertook

exploration activities that resulted in water pollution, death of wildlife, and extensive disequilibrium in animal ecosystems within the Loango National Park. Again, these complex links between neoliberalism and environmental degradation, and human well-being are observable in resource extraction by Chinese actors. Like the West, China's role in African resource extraction is hypocritical. Pegg (2012) notes China's warm rapport with Africa's corrupt elite who control its resources and allows for environmentally destructive resource extraction while operating what is an efficient system (that is, relatively less environmentally degrading system) back home in China. A less duplicitous approach would be to aggressively advocate for more resource extraction that contributes to poverty alleviation in the region, rather than the current model which enriches a select few.

China's involvement in resource extraction in Africa goes beyond the negatives earlier discussed. Its foray into Africa's resource extraction industry creates competition and allows for a better positioning for resource rich African countries during negotiations with multinational resource extraction companies (Pegg 2012). The expectation is that better positioning should result in more favorable contractual terms and ultimately higher earnings for African countries from the extraction and sale of their natural resources (Pegg 2012).

Downey, Bonds and Clark (2010) noted that a key element of resource extraction in developing countries (including African countries) is armed violence. They argued that armed conflict creates environmental degradation. Although, violence is often perpetrated by military, police, rebel groups and mercenaries jostling for access to natural resources in developing countries, the activities of Western actors create the conditions and incentives

for these groups and institutions to engage in violent and armed conflict (Downey et al. 2010). On this issue of conflict laden resource extraction, the concept of the *treadmill of destruction* is useful. The treadmill of destruction scholars investigate the effect of militarism and by extension armed groups on environmental degradation (Clark and Jorgenson 2012; Jorgenson and Clark 2016). Militarism encourages the development and use of weapons that cause degradation to the physical environment and human well-being. For instance, displacements to local communities because of competition for resource extraction driven violence and conflict certainly impact human well-being. The sometimes violent nature of resource extraction in the developing world (particularly Africa) and the role of core and Western nation actors and institutions in this lend further support to how a neoliberal order contributes to environmental degradation and negative impacts on human well-being on the African continent.

Ecologically unequal exchange

Prior to research on ecologically unequal exchange is research on unequal exchange which arises from differences in organic composition (labor input) and wages. These instances lead to the transfer of value from one country to another (Emmanuel 1972). The *ecologically* unequal exchange model is largely influenced by the research of Stephen Bunker (Bunker 1984, 2005; Bunker and Ciccantell 2005) and argues that some countries enjoy disproportionately advantageous positions relative to other countries (Fitzgerald and Auerbach 2016; Rice 2007a). This advantage stems from supremacy in wealth, technology, political and military strength which is responsible for a stratified or hierarchical world order captured by world system theory (Jorgenson 2006; Rice 2007a). World systems theory (WST) argues that the world is hierarchical and is divided into what is referred to

as the core, periphery, and semi-periphery (Chase-Dunn and Rubinson 1977). These categorizations are relatively fixed with the semi-periphery providing some room for mobility. WST suggests that the global order is dominated by the core who by virtue of superior technology and structure dominates its relationship with the periphery and semi-periphery. This system involves an unequal exchange which supports the economic exploitation of the periphery. Within an environmental context, exploitation of the system by the core occurs through consumption and the core's export (and dumping) of hazardous materials in the periphery (Chase-Dunn and Rubinson 1977; Frey 2003; Prell et al. 2014). It explains the system that allows core countries relatively more favorable access to natural resources while externalizing environmental degradation to the periphery (Jorgenson 2006). It is an externalization process that occurs through the "vertical flow" of raw materials from the periphery to core (Jorgenson 2006:687). Essentially, developed or core countries support their higher incomes and consumption through the intensification of environmental exploitation in the less developed world while also reducing consumption in the periphery. This occurs because the periphery is used as a source of production and extraction while also leaving its people poor and without the resources to consume (Rice 2007a). The ecologically unequal exchange model can be extended to include impacts on human well-being. Due to pressures from the core and its institutions, countries in the periphery are forced to adopt export-oriented policies and the acceptance of any and all kinds of industrialization including hazardous and environmentally damaging industries (Frey 2003). These industries have detrimental effects on human well-being through pollution and unsafe working conditions – as was the case in the Mexican *maquiladoras* (Frey 2003). The externalization of extraction and production that the unequal world

system allows the core and developed countries to engage in implies that the effects on human health and well-being resulting from the environmental degradation caused by resource extraction are concentrated in the developing world. Bunker and Ciccantell (2005) noted how the world system and its unequal exchange processes severely degraded the environment in the Amazon. In more recent times, similar unequal exchanges have produced ecologically damaging results whose costs have been borne disproportionately by citizens of the Global South. The case of American transnational firms in Maquiladora centers in Mexico reveals an ecologically unequal exchange relationship that allowed the core (US firms) to externalize pollution to Mexico (Frey 2003). Using data from 137 countries, Rice (2007a) showed that low and lower middle income countries with higher proportions of exports to the core exhibit lower environmental resource consumption levels. The results show the unequal exchange arising from core-periphery exchange with the latter in the disadvantaged position (Rice 2007a). Research has established the role of the vertical flow of exports in pollution in less developed countries highlighting the disproportionate damage structurally unequal relationships can cause (Jorgenson 2006, 2012). Studies have shown how unequal exchange allows the core to grow at the expense of the periphery (Dorninger et al. 2021). Previous research has investigated the negative impact of ecologically unequal exchange on natural resource depletion. More specifically, the research has established links between ecologically unequal exchange and deforestation (or biodiversity loss). Shandra et al (2009) showed using a sample of 60 poor countries that export flows from poor to rich countries contribute to deforestation. Thus, the focus of this study on Africa is important since the continent is a victim of ecologically unequal exchange with all its countries firmly rooted in the periphery.

Metabolic rift

Humans are in a metabolic interaction with the earth and its ecosystems (Clark and Foster 2009). Karl Marx described labor as the process through which man regulates or controls the metabolic relationship he has with nature. Each of the systems preceding capitalism had a specific social metabolic order guiding the way humans (society) interacted with nature. The capitalist system however, introduced a completely different form of social metabolic order. Capitalism's focus on rapid profit generation reimagined the relationship between humans and the environment. The natural world with its own laws guiding its regenerative capacity was not respected under capitalist order. Capitalism's drive for unending growth and expansion is incompatible with the physical world's self-sufficient nature (Clark and Foster 2009).

The new form of social structure created by the capitalist model that stripped the countryside of its people, created crowded cities around their growing industries effectively illustrastes the change in the social metabolic order brought on by the capitalist system. Food and fiber that would ordinarily have returned to the soil in the societies prior to capitalism were now being transported to cities hundreds or thousands of miles away. Thus, a rift in the social metabolic order was created. It was a rift in the way humans interacted with the environment that disrupted the replenishing capacity of the soil (Clark and Foster 2009). The expansion of capitalism, resulting in greater food and fiber imports, widened the metabolic rift.

The growth in the importance of guano in the 19th century to meet the loss in soil nutrients due to capitalist agricultural practices and the transformation of landscapes, human population transfers, labor exploitation, exploitation of the peripheral and further

exploitation of the global economy it created was a consequence of the metabolic rift in the nutrient cycle. The guano trade was also a form of ecologically unequal exchange that allowed the core to continue to expand production and consumption at the expense of ecological damage in the periphery (Clark and Foster 2009). The treatment of the Chinese workers – whose working conditions were worse than slave labor – facilitated the guano trade and provides some evidence of how the form of interaction between humans and the environment (defined by a given social system) can produce environmental degradation and impact human well-being (Clark and Foster 2009). A recent study showed how an understanding of the metabolic rift perspective is driving composting and changing attitudes to waste in Rennes, France (Bahers and Giacchè 2019). Similarly, Ergas and Clement (2016) explored the role ecovillagers can play in addressing the metabolic rift problem. A previous study in Western Kenya investigated the impact of cellphones on the metabolic rift produced by rural-urban migration in the region (Ramisch 2016).

Synthesis of the political economy perspectives

The political economy perspectives are a much less hopeful approach to explaining environmental degradation. Unlike the optimism of the ecological modernization thesis, these perspectives argue for a significantly greater degree of alteration to social, economic, and political structures to meaningfully mitigate environmental damage. Although lacking optimism, the political economy perspectives highlight the reality that is an ever-increasing capitalist system driven by excessive desire for profit making, economic growth, and accumulation (on accumulation, see Foster 2005). These perspectives run contrary to the Human Exemptionalist Paradigm – which refers to human supremacy over the limits of the physical environment – since it highlights humans' limitations within an environmental

context and advocates for changes to the status quo to reduce or reverse environmental problems. They also note the existing inequalities in the current global system that allow a few powerful countries disproportionate access to resources while intensifying ecological harm in less developed nations. In sum, the political economy perspectives, while sometimes focused on different aspects of the economy – environment relationships, all suggest that economic development and growth are associated with increases in environmental degradation. GDP per capita income data is used as a proxy for the arguments of the treadmill of production theory while percent of exports to high-income countries (HICs) test for the ecologically unequal exchange and metabolic rift models since the percent of exports to HICs indicator captures movement of materials across international borders (Jorgenson 2012; Rice 2007b).

Based on the political economy perspectives of treadmill of production, ecologically unequal exchange, and metabolic rift, this study will test the following hypotheses:

> ***H5a**: Increases in per capita income are associated with increases in CO_2 emissions in African countries*
> ***H5b**: Increases in per capita income are associated with increases in methane emissions in African countries*
> ***H5c**: Increases in per capita income are associated with increases in natural resource extraction in African countries*
> ***H5d**: Increase in per capita income is associated with increases in CIWB in African countries*
> ***H5e**: Increase in per capita income is associated with increases in MIWB in African countries*
>
> ***H6a**: Increases in the percent of exports to high-income countries (HICs) are associated with increases in CO_2 emissions in African countries.*
> ***H6b**: Increases in the percent of exports to high-income countries (HICs) are associated with increases in methane emissions in African countries.*
> ***H6c**: Increases in the percent of exports to high-income countries (HICs) are associated with increases in natural resource extraction in African countries.*

***H6d**: Increases in the percent of exports to high-income countries (HICs) are associated with increases in CIWB in African countries.*
***H6e** Increases in the percent of exports to high-income countries (HICs) are associated with increases in MIWB in African countries.*

CHAPTER IV

METHODS AND DATA SOURCES

The study uses Prais-Winsten regression models with panel corrected standard error (pcse) to test the hypotheses. Prais-Winsten models with pcse allow for disturbances that are heteroscedastic and correlated across panels (Hossain, Long, and Stretesky 2020; Jorgenson 2009). The dataset is cross-national and covers the entire African continent (54 countries) from 1990-2020. All variables are changed into their natural log forms. The use of natural log transformations on both the independent variables and the dependent variable turns the regression coefficients into elasticity coefficients, which are effective for interpretation purposes. The elasticity coefficient is the percentage change in the dependent variable in response to a 1% change in the independent variable (Fitzgerald, Jorgenson, and Clark 2015).

Table 1. Outline of variables

Variable Name	Time Frame	Data Source
CO_2 emissions	1990-2020	World Bank
Methane emissions	1990-2020	US EPA
CIWB	1990-2020	Author's computation
Natural resource depletion	1990-2020	World Bank
MIWB	1990-2020	Author's computation
Foreign direct investment	1990-2020	World Bank
Total debt service	1990-2020	World Bank
Per Capita GDP	1990-2020	World Bank
Democracy	1990-2020	International IDEA
Percent of exports to high-income countries (HICs)	1990-2020	World Bank
Urban population	1990-2020	World Bank
Grants	1990-2020	World Bank
Current health expenditure	2000-2019	World Bank
Inequality	1990-2020*	World Bank

*Numerous missing years

Dependent Variables

The study investigates environmental outcomes via two perspectives. First, using data on carbon dioxide and methane emissions, and natural resource depletion, the study tests how indicators of the neoliberal, ecological modernization, and political economy perspectives are associated with environmental outcomes measured by CO_2 emissions, methane emissions, and natural resource extraction. The data for CO_2 emissions are those stemming from the burning of fossil fuels and the manufacture of cement and includes carbon dioxide produced during consumption of solid, liquid, and gas fuels and gas flaring. Data for CO_2 emissions are from the World Bank database and are measured in metric tons per capita (World Bank 2022). The data on methane emissions are obtained from the United States Environmental Protection Agency (EPA) (US EPA 2022). The methane emissions data from the US EPA cover methane emissions for individual countries across the following sectors: agriculture, waste, energy and industrial, measured in million metric tons of carbon dioxide equivalent ($MMTCO_2e$). The data are then further disaggregated by

sources within each of these sectors. For the study and ease of analysis, the data across different sectors and sources has been aggregated/summed up to determine total methane emissions for each year for the national units. Natural resource extraction is measured using the World Bank natural resources depletion indicator. Natural resources depletion is the sum of net forest depletion, energy depletion, and mineral depletion. Net forest depletion refers to unit resource rents times the excess of roundwood harvest over natural growth. Energy depletion is the ratio of the value of the stock of energy resources to the remaining reserve lifetime (capped at 25 years) and covers coal, crude oil, and natural gas. Mineral depletion refers to the ratio of the value of the stock of mineral resources to the remaining reserve lifetime (capped at 25 years) and covers tin, gold, lead, zinc, iron, copper, nickel, silver, bauxite, and phosphate. Data are from the World Bank database (World Bank 2022).

Second, using the carbon intensity of human well-being and the methane intensity of human well-being, the study explores the links between CO_2 emissions, methane emissions, neoliberalism, ecological modernization, political economy theory, and human well-being.

Carbon intensity of well-being (CIWB) is calculated using the following formula:

$$\frac{Carbon\ dioxide\ emissions/population}{Life\ expectancy}$$

Methane intensity of human well-being (MIWB) is calculated using the following formula:

$$\frac{Methane\ emissions/population}{Life\ expectancy}$$

In the mathematical relationships that capture the CIWB and MIWB, the numerators translate into CO_2 emissions per capita and methane emissions per capita. The denominators in both mathematical formulae adjust for life expectancy. Total population is the count of all residents within a geographical boundary regardless of legal status or citizenship. Life expectancy refers to the number of years a newborn would be expected to live if the existing mortality patterns at birth remained unchanged throughout the infant's life. Since carbon dioxide and methane emissions are contributors to greenhouse gas emissions which cause climate change (and by extension environmental degradation), CIWB and MIWB can be regarded as the ratios between the measures of climate change and human well-being (Wang et al. 2022). Thus, in this way, the CIWB and MIWB measure the links between environmental degradation and human well-being. The CIWB and MIWB variables were created using Stata (Thombs 2022). Beyond serving as measures of pollution driven human well-being, the CIWB and MIWB measure sustainability and should be interpreted as progress (or lack thereof) toward sustainability. Population and life expectancy data are gathered from the World Bank database. All data generally cover the period 1990 to 2020 with exceptions for cases of missing data.

Independent variables

Foreign direct investment

Foreign direct investment (FDI) is direct investment equity flows into an economy. It refers to investment capital flowing into a country. It is measured using net inflows as a percentage of GDP. It shows net inflows (new investment inflows less disinvestment) in the reporting economy from foreign investors and is divided by GDP. Data are from the World Bank database (World Bank 2022). Here, it can be considered a measure of

neoliberalism given that neoliberal policies commodify and privatize broader areas of the environment foster investment inflows that seek to take advantage of these newly accessible areas of nature.

Total debt service

This refers to the sum of principal repayments and interest actually paid in currency, goods, or services on long-term debt, interest paid on short-term debt, and repayments (repurchases and charges) to the IMF. Data are expressed as a percentage of gross national income (GNI) and are from the World Bank database (World Bank 2022). Given that the IMF is a neoliberal institution, total debt service can be taken to capture IMF influence within a country. The issue of debt servicing – involving indebtedness of African countries to Western institutions – is important within the context of African countries. The SAPs as noted earlier are neoliberal policies arising from debt repayment problems in African countries. Hence, total debt service can be employed to capture neoliberalism in African countries.

Per Capita Gross Domestic Product (GDP)

Real GDP per capita is one of the widely accepted measures of economic performance. It is particularly useful for understanding economic output relative to population and effective for comparisons across countries and regions. It is obtained by dividing GDP by midyear population. Specifically, the per capita GDP values employed in this study are the real per capita GDP figures since they have been adjusted for inflation. These data refer to the per capita GDP (constant 2015 US$) in the World Bank database (World Bank 2022). The per capita GDP squared is a squared version of the per capita

GDP obtained through the multiplication of the per capita GDP by itself. The per capita GDP squared has been included to test the EKC and ecological modernization hypotheses.

Democracy

This is a measure of how representative government is in the country. The index used in this study is the Global State of Democracy indices and is an aggregation of 116 individual indicators. It represents contested and inclusive popular elections for legislative and elective offices using an index that ranges from 0 (lowest) to 1 (highest). In effect, it measures democratic performance in different countries. In addition, the index can serve as a useful measure of monitoring the progress on the Sustainable Development Goals (SDGs) because it measures democratization and inclusivity which are included in the objectives of the SDGs (United Nations 2022a). These data are obtained from the Global State of Democracy Indices (International IDEA 2022).

Percent of exports to high-income countries (HICs)

This is the sum of merchandise exports from the reporting economy to high-income economies. The classification of countries as high-income is according to the World Bank classification of economies. The data are calculated as a percentage of total merchandise exports by the economy. Data are computed only if at least half of the economies in the partner country group had non-missing data. Data are from the World Bank database (World Bank 2022).

Control Variables

Urban population

The urban population captures people living in urban locations within a country. The inclusion of this variable is driven by the potential for neoliberalism's annexation of increasing areas of the nature for capitalist pursuit and the displacement to humans this may cause. Data for this will be obtained from the World Bank's urban population (% of total population) indicator (World Bank 2022).

Grants

These are legally binding commitments that require a specific value of funds be made available for disbursement. There is no repayment requirement. Neoliberal institutions such as the World Bank and the International Monetary Fund (IMF) as well as national governments routinely provide grants to other nation states. The use of grants controls for the receipt of funds from external sources (including neoliberal institutions and governments) that do not add to the debt burden of receiving countries. Data on grants are from the World Bank database (World Bank 2022). This study uses grants per capita (done by dividing grants by total population) since this allows for easier comparison across countries.

Current health expenditure

This refers to current health expenditure as a percentage of GDP and includes healthcare goods and services consumed during each year. It does not include capital health expenditures such as buildings and machinery. This controls for human well-being effects measured by CIWB and MIWB. Data for current health expenditure are gathered from the

World Bank (World Bank 2022). To address the problem of missing data and low sample, Stata was used to fill in missing values using the mean for each country. The use of country specific mean values rather than overall mean value was done to ensure that the generated values were more reliable.

Inequality

Inequality in this study is measured using the Gini index which captures the deviation in income distribution among individuals and households within an economy from a perfectly equal distribution. A Gini index of 0 represents perfect equality while an index of 100 represents perfect inequality in income distribution. Data are from the World Bank (World Bank 2022). Due to the issue of missing data in this variable, Stata was used to fill in missing values for each country using individual country mean values.

Analytic Strategy

Assumptions of Longitudinal models

The assumptions of longitudinal models are referred to as the "classical linear model assumptions of time-series regression (Long, Stretesky, and Barrett 2019:201). These assumptions ensure that statistical results produced using a given dataset are non-biased. These assumptions are: stationarity, exogeneity, no perfect collinearity, homoskedasticity, no serial correlation, and linearity in the parameters (Long et al. 2019).

Stationarity

The Fisher-type *xtunitroot* test was used to test for unit root (or stationarity) (Choi 2001). The null hypothesis is that all the panels contain a unit root which signifies

nonstationarity (Long et al. 2019). Thus, a rejection of the null hypothesis implies that the panels are stationary. Using the Fisher-type *xtunitroot* test, all variables except for GDP per capita and GDP per capita squared were found to be stationary. Performing the stationarity test at first difference revealed that GDP per capita and squared GDP per capita are stationary at first difference.

No perfect multicollinearity

Another assumption of time-series regression is the absence of perfect multicollinearity. This implies that no independent variables can be perfect linear combinations of each other. Collinearity can be tested for using the variance inflation factor (VIF) which is conducted after running an ordinary least squared (OLS) regression. In Stata, the command *estat vif* is used to determine the VIF – a collinearity diagnostic (Long et al. 2019). The VIF begins from 1 and has no upper limit. A value of 1 implies that there is no correlation between a given independent variable and other independent variables in the regression model. A value that lies between 1 and 5 implies the presence of moderate correlation, however, this level of severity of correlation does not require attention. VIF values above 5 indicate severe correlation implying that coefficient estimates and p-values in the regression model output are likely unreliable. The VIF values obtained from the five full models are all less than 5 (range; 1.09-2.34) which suggests multicollinearity was not a problem with these data.

Table 2. VIF values

	Dependent variables				
Independent variables	CO_2	Methane	Nat. Res. Depletion	CIWB	MIWB
Foreign direct investment	1.32	1.29	1.29	1.32	1.30
Total debt service	1.41	1.34	1.37	1.41	1.37
Per Capita GDP	2.34	2.31	2.33	2.34	2.32
Democracy	1.18	1.18	1.17	1.18	1.18
Percent of exports to HICs	1.17	1.17	1.17	1.17	1.17
Urban population	2.27	2.24	2.25	2.27	2.25
Grants	1.31	1.32	1.32	1.31	1.31
Current health expenditure	1.16	1.17	1.16	1.16	1.16
Inequality	1.09	1.09	1.09	1.09	1.09

Homoskedasticity

Homoskedasticity occurs when the standard deviation of the residuals are constant and do not depend on the values of the independent variables (Long et al. 2019). It is also referred to as homogeneity of variance. When residuals are not constant, there is likely the presence of heteroskedasticity which results in standard errors that are incorrect and cause misleading hypothesis tests (Long et al. 2019). The Breusch-Pagan/Cook-Weisberg test can be used to test for heteroskedasticity. The null hypothesis is constant variance or homoskedasticity implying that the desired outcome is a failure to reject the null hypothesis. Using the Breusch-Pagan/Cook-Weisberg test for the five full models shows that all five (CO_2 emissions, methane emissions, natural resource depletion, CIWB, and MIWB) of the models are heteroskedastic. When heteroskedasticity is present, robust standard errors can be employed in Stata using the *vce(robust)* option (Long et al. 2019).

No serial correlation

One of the assumptions of panel data is that there is no serial correlation (also known as autocorrelation). The presence of autocorrelation can introduce estimation issues

in longitudinal data and results in inefficient slopes and biased standard errors that distort statistical significance tests (Fitzgerald et al. 2015). The Wooldridge test can be used to test for autocorrelation. The null assumption with this test is that there is no serial correlation. Using the Wooldridge test via the *xtserial* command in Stata, all five full models with CO_2 emissions, methane emissions, natural resource depletion, CIWB, and MIWB as dependent variables showed evidence of autocorrelation. The use of Prais-Winsten regression is one way to address the issue of autocorrelation (Long et al. 2019).

Linearity

This assumption of longitudinal data series requires that the dependent variable is a linear combination of the independent variables and the residuals (Long et al. 2019). To check for this, fit plots were created in Stata to investigate the presence of linearity between the dependent variables and the independent variables.

Descriptive Statistics

The dataset comprises 54 African countries. Methane emissions and urban population variables accounted for the highest number of observations (1665) over the 30-year period examined. On the other hand, data on the total debt service accounted for the least number of observations at 1451 individual observations. Average CO_2 emissions over the period considered was 1.08 metric tons per capita. Average level of methane emissions over the same period was significantly lower at 0.00000138 $MMTCO_2e$ per capita. The mean value of natural resource depletion for all 54 countries was 8.49%. The mean value of CIWB was 22.47 while that of MIWB was found to be 0.000029 which suggests significantly higher levels of carbon intensity of human well-being relative to methane

intensity of human well-being in Africa over the period investigated. The level of FDI flows into African countries in the period covered by the study was low at 3.68%. This low level of FDI may be the result of weak foreign investor confidence in African economies. The mean ($2096.55) and median ($1121.58) values of GDP per capita over the period covered indicate that African economies fall within the World Bank's lower middle-income category (World Bank 2022). This is unsurprising since the Africa region is one of the world's poorest regions. The average percentage of exports to HICs was found to be 60.18%, with a median value of 62.97%, provides evidence that a significant proportion of the exports of African countries is to affluent economies. Previous studies have used the percent of exports to HICs to capture the environmental degradation in less affluent countries caused by ecologically unequal exchange dynamics arising from trading relationships with affluent countries (Jorgenson 2006; Rice 2007a). Based on the mean and median values for democracy, it appears that African countries were more likely to be less democratic during the period covered. Thus, since previous studies suggest that less democratic societies are more likely to be associated with poorer environmental outcomes, it is possible that the prevalence of less democratic governments on the African continent poses a threat to the African environment (Baber and Bartlett 2018; Winslow 2005).

CO_2 emissions increased over the period covered by the data while methane emissions decreased. Both CIWB and MIWB decreased between 1990 and 2020. While the levels of FDI, GDP per capita and democracy increased during the period analyzed, exports of African countries to HICs decreased. Urban population which is the percentage of the total population residing in urban locations increased due to growing urbanization

across the African continent within the period examined. To minimize skewness and aid in interpretation, the data are logged (ln) in the regression models (Jorgenson 2009).

Table 3. Descriptive statistics

Variable	*N*	Mean	Std. dev.	Min	Max	Skewness
CO_2 emissions	1565	1.075242	1.880706	0	11.67632	2.86956
Methane emissions	1665	0.00000138	0.00000242	0.000000116	0.0000231	5.16809
Natural resource depletion	1547	8.489319	10.95816	0	100.6133	2.736572
CIWB	1565	22.4661	3.678514	16.97072	44.50453	1.708839
MIWB	1612	0.0000294	0.00000587	0.0000203	0.0000702	1.932877
Foreign direct investment	1590	3.684498	8.462437	-18.91777	161.8237	8.646437
Total debt service	1451	3.552571	4.929061	0.0006069	73.28265	5.721977
Per Capita GDP	1564	2096.55	2568.039	204.0241	16438.64	2.581483
Democracy	1578	0.4178938	0.2091641	0.001	0.8486353	-0.2968186
Percent of exports to HICs	1602	60.17687	24.56781	0.0073598	99.82103	-0.5147329
Urban population	1665	40.05045	17.72826	5.416	90.092	0.4263582
Grants	1637	45.04327	55.26614	0.0135237	932.7288	5.804694
Current health expenditure	1643	5.310359	2.125627	1.263576	20.41341	1.267182
Inequality	1581	43.36897	7.413931	27.6	65.8	0.8141856

Note: All variables are in their unlogged forms

Results

Bivariate analyses

Here I discuss the bivariate relationships between the variables within the dataset. To create the correlation matrix, the *pwcorr* command is used in Stata and produces pairwise correlation values and significance levels for the independent and dependent variables used in the study.

Increase in FDI flows appears to be positively correlated with CO_2 emissions (r = 0.05), methane emissions, natural resource depletion, and MIWB (r = 0.01) in African countries. However, FDI is negatively correlated with CIWB (r = -0.01) in African countries. Although only the methane emissions (r = 0.07, p<0.05) and natural resource depletion relationships (r = 0.16, p<0.05) are statistically significant. The level of the total

debt service is positively correlated with CO_2 emissions ($r = 0.17$, $p<0.05$), natural resource depletion ($r = 0.12$, $p<0.05$), and CIWB ($r = 0.06$, $p<0.05$). GDP per capita is positively correlated with all measures of pollution (CO_2 emissions: $r = 0.83$, $p<0.05$; methane emissions: $r = 0.47$, $p<0.05$; natural resource depletion: $r = 0.12$, $p<0.05$) and pollution driven human well-being (CIWB: $r = 0.31$, $p<0.05$ and MIWB: $r = 0.01$) in the study. On the contrary, democracy is negatively correlated with pollution (CO_2 emissions: $r = -0.01$; methane emissions: $r = -0.21$, $p<0.05$; natural resource depletion: $r = 0.31$, $p<0.05$) and pollution driven human well-being (CIWB: $r = -0.16$, $p<0.05$ and MIWB: $r = -0.29$, $p<0.05$) implying that more democratic political settings across the African continent produce positive environmental outcomes. Proportion of African exports to HICs is generally positively correlated with pollution (CO_2 emissions: $r = 0.26$; methane emissions: $r = 0.13$, $p<0.05$; natural resource depletion: $r = 0.11$, $p<0.05$) and pollution induced human well-being (specifically, CIWB: $r = 0.06$, $p<0.05$). Increase in spending on healthcare goods and services in Africa appears to reduce pollution since the results of the correlation matrix show that current health expenditure (measured as expenditure on healthcare goods and services) is negatively correlated with CO_2 emissions ($r = -0.09$, $p<0.05$), methane emissions ($r = -0.16$, $p<0.05$), natural resource depletion ($r = -0.21$, $p<0.05$), and MIWB ($r = -0.03$). The level of inequality is positively correlated with CO_2 emissions ($r = 0.18$, $p<0.05$), methane emissions ($r = 0.27$, $p<0.05$), CIWB ($r = 0.39$, $p<0.05$) and MIWB ($r = 0.30$, $p<0.05$). The implication here is that African societies with higher levels of inequality are more likely to experience more environmental degradation. Except for CO_2 emissions ($r = 0.08$, $p<0.05$), year is negatively correlated with methane emissions ($r = -0.02$), natural

resource depletion (r = -0.05, p<0.05), CIWB (r = -0.30, p<0.05), and MIWB (r = -0.33, p<0.05) in African countries.

GDP per capita is positively correlated with FDI (r = 0.07, p<0.05) indicating that growth in GDP per capita is associated with increases to FDI inflows. On the other hand, decreases in GDP per capita will likely be associated with declines in FDI inflows. The percent of exports to HICs positively correlates with FDI inflows (r = 0.09, p<0.05) and GDP per capita (r = 0.27, p<0.05). The correlation matrix indicates positive and statistically significant relationships between year and FDI (r = 0.10, p<0.05), GDP per capita (r = 0.14, p<0.05), and the level of democracy (r = 0.23, p<0.05) in African countries. This implies that as one moves from 1990 to 2020, the levels of FDI, GDP per capita, and democracy generally increase across the African continent. Time is negative correlated with total debt service (r = -0.18, p<0.05) which suggests that the debt profiles of African countries improve as time progresses.

Table 4: Bivariate Pearson Correlations (r) for Variables in the Analysis

Variable	1	2	3	4	5	6	7	8	9	10	11	12	13	14
(1) CO_2 emissions														
(2) Methane emissions	0.61*													
(3) Natural resource depletion	0.16*	0.34*												
(4) CIWB	0.48*	0.43*	0.30*											
(5) MIWB	0.13*	0.63*	0.35*	0.78*										
(6) Foreign direct investment	0.05	0.07*	0.16*	-0.01	0.01									
(7) Total debt service	0.17*	-0.04	0.12*	0.06*	-0.05	0.004								
(8) Per Capita GDP	0.83*	0.47*	0.12*	0.31*	0.01	0.07*	0.30*							
(9) Democracy	-0.01	-0.21*	-0.31*	-0.16*	-0.29*	0.02	0.07*	0.09*						
(10) Percent of exports to HICs	0.26*	0.13*	0.11*	0.06*	-0.02	0.09*	0.16*	0.27*	-0.02					
(11) Urban population	0.56*	0.26*	0.11*	-0.01	-0.22*	0.10*	0.18*	0.58*	0.08*	0.12*				
(12) Grants	-0.06*	-0.09*	-0.06*	-0.19*	-0.17*	0.24*	-0.01	0.06*	0.16*	-0.01	0.11*			
(13) Current health expenditure	-0.09*	-0.16*	-0.21*	0.04	-0.03	0.06	-0.04	-0.17*	0.20*	-0.01	-0.27*	0.20*		
(14) Inequality	0.18*	0.27*	-0.18*	0.39*	0.30*	-0.07*	-0.03	0.08*	0.25*	-0.16*	-0.03	0.02	0.16*	
(15) Year	0.08*	-0.02	-0.05*	-0.30*	-0.33*	0.10*	-0.18*	0.14*	0.23*	-0.28*	0.22*	0.16*	0.08*	-0.03

Note: * indicates $p<0.05$

Multivariate Results

Table 5 shows eight Prais-Winsten regression equations modeling CO_2 emissions per capita, which is the first of five measures of environmental degradation investigated in this study. For interpretation purposes, I will focus mainly on the fully saturated model in each of the tables. Model 8a includes all independent variables and shows that increases in the total debt service are associated with increases in CO_2 emissions (b = 0.07, p<0.001). This implies that on average, a 1% increase in the total debt service results in a 0.07% increase in CO_2 emissions. This supports hypothesis H2a which tests the theoretical argument that neoliberalism produces negative outcomes (measured by CO_2 emissions) for the environment. The regression results show that more democracy is associated with more CO_2 emissions (b = 0.04, p<0.05), which contradicts the hypothesis (H4a) that democracy is negatively associated with CO_2 emissions in African countries. The regression results show that per capita GDP is positively associated with CO_2 emissions (b = 1.68, p<0.001). Specifically, a 1% increase in per capita GDP results in a 1.68% increase in CO_2 emissions. This lends support to hypothesis H5a and the theoretical arguments of the treadmill of production. In contrast, the regression results do not support hypothesis H6a since the findings show that the percent of exports to HICs is negatively associated with CO_2 emissions (b = -0.09, p<0.001). Regarding the control variables, the findings show that increases in the urban population (b = 0.40, p<0.001) and level of inequality (b = 0.11, p<0.01) are associated with increases in CO_2 emissions, which is consistent with previous research.

The Prais-Winsten regression results for methane emissions per capita are reported in Table 6. FDI is positively associated with methane emissions (b = 0.04, p<0.01), which

supports hypothesis H1b. More specifically, a 1% increase in FDI results in a 0.04% increase in methane emissions. In contrast, increases in the total debt service are associated with decreases in methane emissions (b = -0.11, p<0.001), which fails to support hypothesis H2b. The results of the Prais-Winsten regression equations for the control variables are consistent with previous literature. For instance, the urban population is positively related to methane emissions (b = 0.13, p<0.01). This urbanization effect implies that a 1% increase in the urban population results in a 0.13% increase in methane emissions. The findings in Table 6 suggest that the level of methane emissions decreases from year to year (b = -0.01, p<0.001).

The results presented in Table 7 show Prais-Winsten regression equations for natural resource depletion. The results indicate that increases in FDI are positively associated with natural resource depletion and support hypothesis H1c (b = 0.19, p<0.001). Specifically, a 1% increase in FDI results in a 0.19% increase in natural resource depletion. The study finds support for the EKC phenomenon (inverted U-curve) on natural resource depletion in African countries, which supports hypothesis H3c (b = -0.10, p<0.05). The results for the relationship between democracy and natural resource depletion show a negative association, which supports hypothesis H4c (b = -0.31, p<0.001). Increases in the urban population are positively associated with natural resource depletion, which is consistent with previous literature (b = 0.34, p<0.001). Again, the effect on urbanization on the environment is evident. On the contrary, the findings for the effect of inequality on natural resource depletion are not consistent with previous research. Specifically, they show that increases in inequality are associated with decreases in natural resource depletion (b = -1.42, p<0.001).

Tables 8 and 9 provide the Prais-Winsten regression equations for the measures of human well-being (CIWB and MIWB) and sustainability. Specifically, in Table 8, the results show that FDI is positively related to CIWB in African countries (b = 0.01, p<0.001). The results imply that a 1% increase in FDI results in a 0.01% increase in CIWB. This supports hypothesis H1d. The regression results contradict hypothesis H3d – that the relationship between per capita income and CIWB is an inverted U-curve in African countries (b = 0.04, p<0.001). The results suggest that per capita GDP is negatively related to CIWB, contradicting hypothesis H5d (b = -0.59, p<0.001). The regression equation results do not support hypothesis 6d since they show a negative relationship between the percent of exports to HICs and CIWB in African countries (b = -0.03, p<0.001). Further, the results show that increases in inequality worsen sustainability, measured by CIWB, which is consistent with previous research (b = 0.39, p<0.001). More specifically, a 1% increase in inequality results in a 0.39% increase in CIWB.

Table 9 shows relationships between the independent variables and MIWB that are identical to those presented in Table 8 for CIWB. Specifically, increases in FDI are associated with increases in MIWB and imply that a 1% increase in FDI results in a 0.01% increase in MIWB, which supports hypothesis H1e (b = 0.01, p<0.001); total debt service is negatively related to MIWB, contradicting hypothesis H2e (b = -0.01, p<0.01); the relationship between per capita income and MIWB is not an inverted U-curve, which contradicts hypothesis H3e (b = 0.01, p<0.05). Hypothesis H5e is contradicted because the regression equation results reveal that increases in per capita GDP are associated with decreases in MIWB (b = -0.15, p<0.001). Percent of exports to HICs is negatively associated with MIWB, contradicting hypothesis H6e (b = -0.02, p<0.001). Inequality is

positively related to MIWB (b = 0.35, p<0.001) and MIWB is negatively associated with time suggesting that as we move from year to year, the level of MIWB decreases (b = -0.01, p<0.001). More specifically, the results for inequality on MIWB imply that a 1% increase in inequality results in a 0.35% increase in MIWB.

Table 5. Prais-Winsten coefficients and panel-corrected standard errors for the prediction of CO_2 emissions per capita, 1990-2020.

	Model 1a *b* (SE)	Model 2a *b* (SE)	Model 3a *b* (SE)	Model 4a *b* (SE)	Model 5a *b* (SE)	Model 6a *b* (SE)	Model 7a *b* (SE)	Model 8a *b* (SE)
FDI		0.02**	0.02*					0.01
		(0.01)	(0.01)					(0.01)
Total debt service		0.07***	0.07***					0.07***
		(0.01)	(0.01)					(0.01)
Per Capita GDP		2.09***	1.89***	1.44***	1.26***	1.41***	1.24***	1.68***
		(0.19)	(0.23)	(0.02)	(0.02)	(0.01)	(0.02)	(0.23)
Per Capita GDP squared		-0.05***	-0.04**					-0.03
		(0.01)	(0.02)					(0.02)
Democracy				0.02*	0.05***			0.04*
				(0.01)	(0.01)			(0.02)
Percent of exports to HICs						-0.01	-0.02	-0.09***
						(0.02)	(0.02)	(0.02)
Urban population	2.00***		0.36***		0.40***		0.49***	0.40***
	(0.03)		(0.03)		(0.03)		(0.03)	(0.03)
Grants	-0.23***		-0.12***		-0.11***		-0.10***	-0.13***
	(0.03)		(0.01)		(0.01)		(0.01)	(0.01)
Current health expenditure	0.61***		0.46***		0.40***		0.38***	0.40***
	(0,05)		(0.05)		(0.04)		(0.04)	(0.05)
Inequality	0.99***		0.30***		0.12*		0.06	0.11**
	(0.07)		(0.04)		(0.05)		(0.04)	(0.04)
Year	0.003	-0.002	-0.001	-0.01***	-0.004***	-0.002**	-0.002	-0.001
	(0.002)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Constant	-18.00***	-9.17***	13.32***	-0.59	-3.18	-6.41***	-8.54***	-10.75***
	(3.38)	(2.48)	(2.74)	(1.67)	(1.86)	(1.76)	(1.88)	(2.79)
R^2	0.50	0.85	0.87	0.85	0.87	0.86	0.88	0.88
Wald χ^2	5329***	26350***	40391***	10436***	24328***	12632***	25953***	29083***
N	1423	1233	1212	1397	1320	1408	1337	1161

Note: ***$p < 0.001$, **$p < 0.01$, *$p < 0.05$.

Table 6. Prais-Winsten coefficients and panel-corrected standard errors for the prediction of Methane emissions per capita, 1990-2020.

	Model 1b *b* (SE)	Model 2b *b* (SE)	Model 3b *b* (SE)	Model 4b *b* (SE)	Model 5b *b* (SE)	Model 6b *b* (SE)	Model 7b *b* (SE)	Model 8b *b* (SE)
FDI		0.03**	0.03**					0.04**
		(0.01)	(0.01)					(0.01)
Total debt service		-0.12***	-0.11***					-0.11***
		(0.02)	(0.02)					(0.02)
Per Capita GDP		0.03	0.05	0.39***	0.20***	0.33***	0.19***	0.08
		(0.17)	(0.13)	(0.02)	(0.02)	(0.02)	(0.02)	(0.15)
Per Capita GDP squared		0.01	0.01					0.005
		(0.01)	(0.01)					(0.01)
Democracy				-0.05***	0.03			0.03
				(0.01)	(0.02)			(0.02)
Percent of exports to HICs						-0.01	-0.03	0.02
						(0.02)	(0.02)	(0.02)
Urban population	0.22***		0.01		0.07**		-0.001	0.13**
	(0.01)		-0.05		(0.03)		(0.04)	(0.05)
Grants	-0.06***		-0.05***		0.02		-0.03***	-0.01
	(0.01)		(0.01)		(0.01)		(0.01)	(0.02)
Current health expenditure	0.11***		-0.05		0.16***		0.04	0.04
	(0.03)		(0.04)		(0.03)		(0.04)	(0.04)
Inequality	0.85***		0.36***		0.39***		0.55***	0.04
	(0.03)		(0.06)		(0.05)		(0.06)	(0.05)
Year	-0.01***	-0.02***	-0.01***	-0.01***	-0.01***	-0.01***	-0.01***	-0.01***
	(0.001)	(0.002)	(0.002)	(0.001)	(0.001)	(0.001)	(0.001)	(0.002)
Constant	-6.39***	15.55***	9.12	-4.60**	4.61***	-3.18	-3.81*	12.24**
	(1.49)	(4.19)	(3.61)	(1.63)	(1.44)	(1.91)	(1.63)	(4.03)
R^2	0.07	0.08	0.09	0.19	0.12	0.15	0.09	0.09
Wald χ^2	1045***	1001***	1957***	347***	9309***	537***	515***	1061***
N	1523	1321	1298	1499	1416	1512	1433	1245

Note: ***$p < 0.001$, **$p < 0.01$, *$p < 0.05$.

Table 7. Prais-Winsten coefficients and panel-corrected standard errors for the prediction of Natural Resource Depletion, 1990-2020.

	Model 1b *b* (SE)	Model 2b *b* (SE)	Model 3b *b* (SE)	Model 4b *b* (SE)	Model 5b *b* (SE)	Model 6b *b* (SE)	Model 7b *b* (SE)	Model 8b *b* (SE)
FDI		0.14***	0.17***					0.19***
		(0.04)	(0.04)					(0.04)
Total debt service		-0.11	-0.08					-0.06
		(0.06)	(0.06)					(0.07)
Per Capita GDP		0.13	0.29	-0.11**	-0.38***	-0.32***	-0.62***	0.96
		(0.49)	(0.56)	(0.04)	(0.06)	(0.04)	(0.03)	(0.59)
Per Capita GDP squared		-0.03	-0.05					-0.10*
		(0.03)	(0.04)					(0.04)
Democracy				-0.30***	-0.32***			-0.31***
				(0.04)	(0.06)			(0.06)
Percent of exports to HICs						0.11	0.02	0.04
						(0.09)	(0.09)	(0.10)
Urban population	-0.37***		0.28***		0.42***		0.46***	0.34***
	(0.07)		(0.08)		(0.09)		(0.08)	(0.08)
Grants	-0.31***		-0.29***		-0.21***		-0.35***	-0.23***
	(0.05)		(0.05)		(0.05)		(0.05)	(0.05)
Current health expenditure	0.36***		0.67***		0.49***		0.44***	0.74***
	(0.10)		(0.09)		(0.10)		(0.10)	(0.11)
Inequality	-1.38***		-1.41***		-1.21***		-1.16***	-1.42***
	(0.17)		(0.20)		(0.21)		(0.14)	(0.24)
Year	0.03***	0.002	0.01	0.03***	0.03***	0.02***	0.03***	0.02
	(0.01)	(0.01)	(0.01)	(0.005)	(0.01)	(0.01)	(0.01)	(0.01)
Constant	-43.41***	-1.62	-5.97	-50.45***	-52.72***	-39.60***	-46.54***	-29.11
	(11.12)	(10.09)	(12.67)	(9.77)	(12.15)	(10.30)	(13.62)	(18.32)
R^2	0.04	0.04	0.07	0.05	0.08	0.02	0.07	0.09
Wald χ^2	234***	128***	433***	87***	282***	72***	1590***	635***
N	1465	1299	1276	1464	1387	1476	1403	1224

Note: ***$p < 0.001$, **$p < 0.01$, *$p < 0.05$.

Table 8. Prais-Winsten coefficients and panel-corrected standard errors for the prediction of CIWB, 1990-2020.

	Model 1b *b* (SE)	Model 2b *b* (SE)	Model 3b *b* (SE)	Model 4b *b* (SE)	Model 5b *b* (SE)	Model 6b *b* (SE)	Model 7b *b* (SE)	Model 8b *b* (SE)
FDI		0.00003	0.003					0.01***
		(0.002)	(0.002)					(0.002)
Total debt service		-0.01*	-0.003					-0.005
		(0.003)	(0.003)					(0.004)
Per Capita GDP		-0.75***	-0.61***	0.03***	0.001	0.03***	0.02***	-0.59***
		(0.04)	(0.05)	(0.01)	(0.004)	(0.01)	(0.003)	(0.04)
Per Capita GDP squared		0.05***	0.04***					0.04***
		(0.002)	(0.003)					(0.003)
Democracy				-0.01***	-0.01**			-0.01
				(0.002)	(0.003)			(0.003)
Percent of exports to HICs						-0.02***	-0.01**	-0.03***
						(0.005)	(0.003)	(0.004)
Urban population	-0.02*		-0.01		-0.02**		-0.05***	-0.03**
	(0.01)		(0.01)		(0.01)		(0.01)	(0.01)
Grants	-0.03***		-0.04***		-0.03***		-0.03***	-0.03***
	(0.03)		(0.004)		(0.004)		(0.003)	(0.004)
Current health expenditure	0.06***		0.07***		0.06***		0.07***	0.08***
	(0.01)		(0.01)		(0.01)		(0.01)	(0.01)
Inequality	0.33***		0.38***		0.35***		0.37***	0.39***
	(0.02)		(0.02)		(0.02)		(0.01)	(0.02)
Year	-0.01***	-0.01***	-0.01***	-0.01***	-0.005***	-0.01***	-0.01***	-0.01***
	(0.0005)	(0.001)	(0.0005)	(0.001)	(0.001)	(0.0005)	(0.0005)	(0.0005)
Constant	12.23***	20.03***	14.68***	15.15***	11.30***	17.26***	13.88***	17.60***
	(0.95)	(0.98)	(0.98)	(1.17)	(1.08)	(0.97)	(0.90)	(0.97)
R^2	0.36	0.24	0.46	0.14	0.37	0.14	0.41	0.48
Wald χ^2	747***	3301***	1664***	204***	757***	251***	1203***	2172***
N	1424	1233	1212	1398	1321	1408	1337	1161

Note: ***$p < 0.001$, **$p < 0.01$, *$p < 0.05$.

Table 9. Prais-Winsten coefficients and panel-corrected standard errors for the prediction of MIWB, 1990-2020.

	Model 1b *b* (SE)	Model 2b *b* (SE)	Model 3b *b* (SE)	Model 4b *b* (SE)	Model 5b *b* (SE)	Model 6b *b* (SE)	Model 7b *b* (SE)	Model 8b *b* (SE)
FDI		0.003	0.005*					0.01***
		(0.003)	(0.002)					(0.002)
Total debt service		-0.01***	-0.01**					-0.01**
		(0.003)	(0.004)					(0.004)
Per Capita GDP		-0.30***	-0.17***	-0.02**	-0.06***	-0.03***	-0.06***	-0.15***
		(0.04)	(0.05)	(0.01)	(0.01)	(0.01)	(0.004)	(0.04)
Per Capita GDP squared		0.02***	0.01*					0.01*
		(0.003)	(0.003)					(0.003)
Democracy				-0.01***	-0.01*			-0.01
				(0.002)	(0.003)			(0.004)
Percent of exports to HICs						-0.03***	-0.02***	-0.02***
						(0.01)	(0.005)	(0.01)
Urban population	0.12***		-0.04***		-0.03***		-0.05***	-0.05***
	(0.01)		(0.01)		(0.01)		(0.01)	(0.01)
Grants	-0.01***		-0.02***		-0.01***		-0.02***	-0.02***
	(0.003)		(0.003)		(0.003)		(0.003)	(0.003)
Current health expenditure	0.01		0.01		0.02*		0.02***	0.02**
	(0.01)		(0.01)		(0.01)		(0.01)	(0.008)
Inequality	0.33***		0.34***		0.37***		0.39***	0.35***
	(0.02)		(0.02)		(0.02)		(0.02)	(0.01)
Year	-0.01***	-0.01***	-0.01***	-0.01***	-0.01***	-0.01***	-0.01***	-0.01***
	(0.0004)	(0.0005)	(0.0004)	(0.001)	(0.0004)	(0.0005)	(0.0003)	(0.0004)
Constant	0.79	6.46***	2.23**	2.30	-0.07	4.71***	1.70**	4.43***
	(0.78)	(0.84)	(0.74)	(1.20)	(0.88)	(0.95)	(0.61)	(0.78)
R^2	0.41	0.36	0.49	0.15	0.46	0.16	0.52	0.51
Wald χ^2	1308***	1701***	2561***	374***	1485***	334***	2247***	3165***
N	1474	1278	1256	1449	1369	1460	1385	1204

Note: ***$p < 0.001$, **$p < 0.01$, *$p < 0.05$.

Table 10. Summary of support for hypotheses in full models (8a to 8e)

Perspective	Hypothesis	Supported/Not Supported/Not Sig.					
		CO_2	Methane	Nat. Res. Depl.	CIWB	MIWB	Total Supported
Neoliberalism	FDI	Not Sig.	Yes	Yes	Yes	Yes	4
	Total debt service	Yes	No	Not Sig.	Not Sig.	No	1
EKC	Per capita GDP squared	Not Sig.	Not Sig.	Yes	No	No	1
Ecological Modernization	Democracy	No	Not Sig.	Yes	Not Sig.	Not Sig.	1
Political Economy	Per capita GDP	Yes	Not Sig.	Not Sig.	No	No	1
	Percent of exports to HICs	No	Not Sig.	Not Sig.	No	No	0

Summary of results

Overall, the neoliberalism perspective measured by FDI is largely supported. Specifically, the findings support the neoliberalism perspective in four dependent variables. The exception to this is in the effect of neoliberalism on CO_2 emissions. In contrast, total debt service, which is the second measure of neoliberalism in this study is supported only once (CO_2 emissions). The EKC perspective which argues that the relationship between per capita income and environmental degradation is an inverted U-curve is supported only for natural resource depletion. Similarly, support for the ecological modernization perspective is found in one of dependent variables (natural resource depletion). Regarding the political economy perspectives, the treadmill of production model – measured by GDP per capita – is supported in only one of the five dependent variables (CO_2 emissions). On the contrary, support for the ecologically unequal exchange is not found in the five measures of pollution and human well-being evaluated.

Regarding the control variables, the results are mixed when compared to previous research. Specifically, the results generally show that increases in urban population and inequality are associated with increases in environmental degradation. The exception to this is in the relationship between inequality and natural resource depletion which shows a negative association. Overall, the results for urban population and inequality on environmental degradation are consistent with previous research. The Prais-Winsten regression equations also show that the level of grants received is negatively related the measures of environmental degradation. On the contrary, current health expenditure is positively related to the measures of environmental degradation, which is not consistent with previous research since the expectation is that increases in health funding and

expenditure would be associated with positive environmental outcomes – that is decreases in negative environmental impacts.

When it comes to the EKC and the expectation of an inverse U-curve, I only found support for this in CO_2 emissions. The lack of support for the EKC in methane emissions, natural resource depletion, CIWB, and MIWB may be due to the low levels of income (or GDP per capita) in African countries. Perhaps growth in income across the continent is required to empirically find evidence of the EKC perspective. From the findings, democracy appears to reduce natural resource depletion in Africa. This suggests that promoting democratic ideals and principles, and broadly elevating the level of democracy in African countries could potentially be positive for the environment in Africa.

CHAPTER V

DISCUSSION AND CONCLUSION

Discussion

This thesis contributes to the empirical literature examining hypotheses based on theoretical perspectives that attempt to explain environmental degradation. Specifically, this research investigates neoliberalism, EKC, ecological modernization, and political economy perspectives on pollution, natural resource depletion, and human well-being. On sustainability and human well-being, this research notably introduces the MIWB measure as an addition to previous research within the context of EIWB. The theoretical perspectives tested argue that there are links between society – through its economic and production activities –, environmental degradation, and sustainability. This study does this by using data on 54 African countries covering a period of 31 years and Prais-Winsten regression models to empirically test key environmental perspectives. The findings of this thesis suggest that neoliberalism (measured by FDI) is disadvantageous for African countries since FDI is positively related to pollution, natural resource withdrawals, and the worsening of sustainability (human well-being), lending support to hypotheses H1a to H1e (Long et al. 2017). FDI allows foreign citizens or groups to invest in and acquire ownership of firms in African countries. This is ownership that can confer some measure of control

over policy decisions. Therefore, it is evident how sufficiently motivated foreign groups and governments may use FDI as a strategy to promote adoption of neoliberal policies that negatively impact the environment and sustainability in Africa. Hence, African governments and policymakers should evaluate more critically the foreign investment flows into their economies to minimize the damaging effects of certain sources of FDI on environmental degradation. Further, African governments should drive policies that encourage their diaspora to invest more in their countries of origin. This can significantly replace FDI from foreign entities with no links to African countries and in a sense, a lack of interest in improving sustainability (protecting the well-being of Africans) and the environment in Africa. More specifically, governments and policymakers in Africa should prioritize FDI from entities that have proven themselves to be committed to protecting the environment and improving human well-being on the continent. Regarding total debt service, the findings indicate that debts to neoliberal institutions – a consequence of debt servicing issues – by African countries only increases CO_2 emissions in African countries. An interesting finding is that increases in the total debt service are associated with decreases in methane emissions which contradicts the hypothesis (H2b) that the total debt service is positively related to methane emissions. A reason for this contradiction may be due to the decrease in available funds for government spending and general consumption that results from a higher debt burden which limits human activities (such as industrial processes and agricultural activities) that cause methane emissions related pollution. A similar contradiction is found in the effect of total debt service on MIWB. The results from this study show that increases in total debt service are associated with decreases in MIWB. The hypothesis (H2e) suggests that the relationship is positive and not negative. Regarding

the lack of support for hypothesis H2e, it is possible that IMF loans which are included in computations of the total debt service are put to investment projects that foster sustainability outcomes by reducing the methane intensity of human well-being. This study found that democracy is negatively related to natural resource depletion in Africa which is supported by previous research on the links between democratic ideals and environmental degradation (Mol 1996; Winslow 2005). Thus, increasing the level of democracy could be effective in reducing natural resource depletion rates in African countries given that the findings from this study suggest that increases in democracy are associated with decreases in natural resource depletion.

This research study finds support for the treadmill of production in CO_2 emissions – a result that contributes to previous empirical research on the topic (Jorgenson and Givens 2015). This implies that economic expansion in Africa drives air pollution (measured by CO_2 emissions) on the continent. Interestingly, increases in GDP per capita reduce CIWB and MIWB. These findings deviate from the hypotheses that the relationships between economic expansion which is often measured by GDP per capita and sustainability (CIWB and MIWB) are positive. The study does not find evidence to support the ecologically unequal exchange perspective. For example, the results indicate that increases in the percent of exports to HICs are associated with decreases in CO_2 emissions which are inconsistent with previous empirical evidence on the topic (Jorgenson 2012). This contradictory evidence may be due to understated data on trade flows between low- and middle-income countries which in turn overestimates the level of exports to HICs (measured as a percentage of total exports).

Growing urbanization appears to be a driver of environmental degradation in African countries. In recent decades, urbanization has grown in Africa and appears to be increasing the level of CO_2 emissions, methane emissions, and natural resource depletion. Given the empirical evidence – in this study and in previous research on the issue (Givens 2015) – of the effect of urbanization on environmental degradation, this study suggests that policymakers pay close attention to growing urbanization in African countries to address the problem of environmental degradation more effectively. On the issue of human well-being, the findings suggest that increases in inequality negatively impact sustainability because they increase CIWB and MIWB. Perhaps this is because growing inequality increases the number of people who are vulnerable to CO_2 and methane emissions-based pollution that negatively impact their well-being and therefore, sustainability. Given the evidence linking inequality and sustainability, this study recommends that governments pursue policies narrowing income inequality to improve sustainability in Africa. The study finds that grants reduce CO_2 emissions, natural resource depletion, CIWB, and MIWB. These observed effects of grants may be because grants do not require repayment commitments and do not create the sorts of effects associated with debts by worsening a country's debt profile and potentially subjecting it to neoliberal policy interventions such as occurred with SAPs in African countries. Thus, the receipt of grants creates positive environmental effects by reducing environmental degradation. More affluent countries could consider prioritizing grants (or no repayment commitments funds transfers) to African countries to enable African countries tackle environmental degradation.

Limitations to this study were encountered. First, there was a lack of availability of robust data which prevented the inclusion of additional key control variables such as

corruption, regulatory mechanisms, and, environmental international non-governmental organizations (EINGOs) presence. Another limitation is that the data demonstrated levels of multicollinearity, heteroskedasticity, and autocorrelation. However, the use of Prais-Winsten regression models with panel-corrected standard errors was used to address some of these issues. Third, the use of proxies to model some of the perspectives may have affected the findings of the study.

Given the observed effects of grants on environmental degradation, this study suggests that future research investigate in detail the relationship between grants and environmental degradation. Similarly, democracy was found to produce some positive effects on natural resource depletion. Future studies may explore in detail the role of democracy in addressing the rate of natural resource depletion in African countries. Regarding urbanization, future researchers might examine in greater detail the links between urbanization and environmental degradation.

Conclusion

Overall, while some findings were mixed, this study provides evidence of links between neoliberalism, natural resource depletion, environmental degradation, and human well-being by empirically testing key perspectives in environmental sociology. More specifically, the findings suggest that neoliberalism (measured by FDI) is a significant driver of environmental degradation and sustainability (within the context of human well-being) in Africa. Additional findings support the arguments for effectively managing growing urbanization and reducing income inequality to address environmental degradation in Africa. The links that have been drawn by the findings of this study are significant particularly when considered within the context of the characteristics of African

countries. Given that Africa is poised to become one of the most populated regions of the world, the findings of this research are helpful for identifying potential drivers of environmental degradation as well as formulating policies geared towards addressing environmental problems in Africa.

REFERENCES

Al-Mulali, Usama, Behnaz Saboori, and Ilhan Ozturk. 2015. "Investigating the Environmental Kuznets Curve Hypothesis in Vietnam." *Energy Policy* 76:123–31. doi: 10.1016/j.enpol.2014.11.019.

Andrew Mejia, Steven. 2021. "The Climate Crisis and Export Intensity: A Comparative International Study of Greenhouse Gas Emissions in the Global South, 1990–2014." *International Journal of Sociology* 51(1):1–22.

Angelsen, Arild, Eric F. Katemansimba Shitindi, and Jostein Aarrestad. 1999. "Why Do Farmers Expand Their Land into Forests? Theories and Evidence from Tanzania." *Environment and Development Economics* 4(3):313–31.

Apergis, Nicholas, and Ilhan Ozturk. 2015. "Testing Environmental Kuznets Curve Hypothesis in Asian Countries." *Ecological Indicators* 52:16–22. doi: 10.1016/j.ecolind.2014.11.026.

Aseka, Eric Masinde. 1993. "Historical Roots of Underdevelopment and Environmental Degradation in Africa." *Transafrican Journal of History* 22:193–205.

Baber, Walter, and Robert Bartlett. 2018. “Deliberative Democracy and the Environment.” P. 0 in *The Oxford Handbook of Deliberative Democracy*, edited by A. Bächtiger, J. S. Dryzek, J. Mansbridge, and M. Warren. Oxford University Press.

Bahers, Jean-Baptiste, and Giulia Giacchè. 2019. “Towards a Metabolic Rift Analysis: The Case of Urban Agriculture and Organic Waste Management in Rennes (France).” *Geoforum* 98:97–107.

Bao, Qun, Yuanyuan Chen, and Ligang Song. 2011. “Foreign Direct Investment and Environmental Pollution in China: A Simultaneous Equations Estimation.” *Environment and Development Economics* 16(1):71–92.

Beder, Sharon. 2001. “Research Note-Neoliberal Think Tanks and Free Market Environmentalism.”

Beinart, William. 2000. “African History and Environmental History.” *African Affairs* 99(395):269–302.

Bockman, Johanna. 2013. “Neoliberalism.” *Contexts* 12(3):14–15.

Braedley, Susan, and Meg Luxton. 2010. *Neoliberalism and Everyday Life*. McGill-Queen’s Press - MQUP.

Brundtland, Gro Harlem. 1987. *Report of the World Commission on Environment and Development:" Our Common Future."*. UN.

Budds, Jessica. 2004. “Power, Nature and Neoliberalism: The Political Ecology of Water in Chile.” *Singapore Journal of Tropical Geography* 25(3):322–42.

Bunker, Stephen G. 1984. “Modes of Extraction, Unequal Exchange, and the Progressive Underdevelopment of an Extreme Periphery: The Brazilian Amazon, 1600-1980.” *American Journal of Sociology* 89(5):1017–64.

Bunker, Stephen G. 2005. “How Ecologically Uneven Developments Put the Spin on the Treadmill of Production.” *Organization & Environment* 18(1):38–54.

Bunker, Stephen G., and Paul S. Ciccantell. 2005. *Globalization and the Race for Resources*. JHU Press.

Burfisher, Mary E. 2021. *Introduction to Computable General Equilibrium Models*. Cambridge University Press.

Castree, Noel. 2010. “Neoliberalism and the Biophysical Environment 2: Theorising the Neoliberalisation of Nature.” *Geography Compass* 4(12):1734–46. doi: 10.1111/j.1749-8198.2010.00407.x.

Chase-Dunn, Christopher, and Richard Rubinson. 1977. “Toward a Structural Perspective on the World-System.” *Politics & Society* 7(4):453–76.

Cheru, Fantu. 1992. “Structural Adjustment, Primary Resource Trade and Sustainable Development in Sub-Saharan Africa.” *World Development* 20(4):497–512.

Choi, In. 2001. “Unit Root Tests for Panel Data.” *Journal of International Money and Finance* 20(2):249–72. doi: 10.1016/S0261-5606(00)00048-6.

Clark, Brett, and John Bellamy Foster. 2009. “Ecological Imperialism and the Global Metabolic Rift: Unequal Exchange and the Guano/Nitrates Trade.” *International Journal of Comparative Sociology* 50(3–4):311–34.

Clark, Brett, and Andrew K. Jorgenson. 2012. “The Treadmill of Destruction and the Environmental Impacts of Militaries 1.” *Sociology Compass* 6(7):557–69.

Coffey, Brian, and Greg Marston. 2013. “How Neoliberalism and Ecological Modernization Shaped Environmental Policy in Australia.” *Journal of Environmental Policy & Planning* 15(2):179–99. doi: 10.1080/1523908X.2012.746868.

Cupples, Julie. 2004. “Rural Development in El Hatillo, Nicaragua: Gender, Neoliberalism and Environmental Risk.” *Singapore Journal of Tropical Geography* 25(3):343–57. doi: 10.1111/j.0129-7619.2004.00190.x.

Dang, Hai Bac, Thuan Nguyen, Diem Nga Thi Tran, and Oanh Hoa Thi Su. 2023. “The Effect of Foreign Direct Investment on Human Well-Being: A Study of the Relationship Between the Carbon Intensity of Human Well-Being and Foreign Direct Investment in Nine Lower Middle-Income Countries.” Pp. 265–77 in *Contemporary Economic Issues in Asian Countries: Proceeding of CEIAC 2022, Volume 1*, edited by A. T. Nguyen, T. T. Pham, J. Song, Y.-L. Lin, and M. C. Dong. Singapore: Springer Nature.

Dasgupta, Partha. 2001. *Human Well-Being and the Natural Environment*. OUP Oxford.

Davis, Diana K. 2006. “Neoliberalism, Environmentalism, and Agricultural Restructuring in Morocco.” *The Geographical Journal* 172(2):88–105. doi: 10.1111/j.1475-4959.2006.00204.x.

Dorninger, Christian, Alf Hornborg, David J. Abson, Henrik von Wehrden, Anke Schaffartzik, Stefan Giljum, John-Oliver Engler, Robert L. Feller, Klaus Hubacek, and Hanspeter Wieland. 2021. “Global Patterns of Ecologically Unequal Exchange: Implications for Sustainability in the 21st Century.” *Ecological Economics* 179:106824. doi: 10.1016/j.ecolecon.2020.106824.

Downey, Liam, Eric Bonds, and Katherine Clark. 2010. “Natural Resource Extraction, Armed Violence, and Environmental Degradation.” *Organization & Environment* 23(4):417–45. doi: 10.1177/1086026610385903.

Emmanuel, Arghiri. 1972. *Unequal Exchange: A Study of the Imperialism of Trade*. Monthly Review Press.

Ergas, Christina, and Matthew Thomas Clement. 2016. “Ecovillages, Restitution, and the Political-Economic Opportunity Structure: An Urban Case Study in Mitigating the Metabolic Rift.” *Critical Sociology* 42(7–8):1195–1211.

Ergas, Christina, Patrick Trent Greiner, Julius Alexander McGee, and Matthew Thomas Clement. 2021. “Does Gender Climate Influence Climate Change? The Multidimensionality of Gender Equality and Its Countervailing Effects on the Carbon Intensity of Well-Being.” *Sustainability* 13(7):3956.

Felli, Romain, and Noel Castree. 2012. “Neoliberalising Adaptation to Environmental Change: Foresight or Foreclosure?” *Environment and Planning A* 44(1):1–4.

Fitzgerald, Jared B., and Daniel Auerbach. 2016. “The Political Economy of the Water Footprint: A Cross-National Analysis of Ecologically Unequal Exchange.” *Sustainability* 8(12):1263.

Fitzgerald, Jared B., Andrew K. Jorgenson, and Brett Clark. 2015. “Energy Consumption and Working Hours: A Longitudinal Study of Developed and Developing Nations, 1990–2008.” *Environmental Sociology* 1(3):213–23.

Fitzgerald, Jared B., and Juliet Schor. Forthcoming. “Working Time, Inequality, and Sustainability.” in *The Handbook of Inequality and the Environment,* edited by M. A. Long and P. B. Stretesky. Edward Elgar Publishing.

Fitzgerald, Jared B., Juliet B. Schor, and Andrew K. Jorgenson. 2018. “Working Hours and Carbon Dioxide Emissions in the United States, 2007–2013.” *Social Forces* 96(4):1851–74.

Foster, John Bellamy. 1999. “Marx’s Theory of Metabolic Rift: Classical Foundations for Environmental Sociology.” *American Journal of Sociology* 105(2):366–405.

Foster, John Bellamy. 2012. “The Planetary Rift and the New Human Exemptionalism: A Political-Economic Critique of Ecological Modernization Theory.” *Organization & Environment* 25(3):211–37.

Fremstad, Anders, Mark Paul, and Anthony Underwood. 2019. “Work Hours and CO2 Emissions: Evidence from US Households.” *Review of Political Economy* 31(1):42–59.

Frey, R. Scott. 2003. “The Transfer of Core-Based Hazardous Production Processes to the Export Processing Zones of the Periphery: The Maquiladora Centers of Northern Mexico.” *JWSR Editorial Policy* 9(2):318.

Ganti, Tejaswini. 2014. “Neoliberalism.” *Annual Review of Anthropology* 43:89–104.

Gilberthorpe, Emma, and Gavin Hilson. 2016. *Natural Resource Extraction and Indigenous Livelihoods: Development Challenges in an Era of Globalization*. Routledge.

Givens, Jennifer, Brett Clark, and Andrew K. Jorgenson. 2016. “Strengthening the Ties between Environmental Sociology and Sociology of Development.” Pp. 69–94 in *The sociology of development handbook*, edited by G. Hooks. University of California Press Oakland.

Givens, Jennifer E. 2015. “Urbanization, Slums, and the Carbon Intensity of Well-Being: Implications for Sustainable Development.” *Human Ecology Review* 22(1):107–28.

Givens, Jennifer E., Orla M. Kelly, and Andrew K. Jorgenson. Forthcoming. “Inequality, Emissions, and Human Well-Being.” in *The Handbook of Inequality and the Environment*, edited by M. A. Long and Paul B. Stretesky. Edward Elgar Publishing.

Glomsrød, Solveig, Maria Dolores Monge, and Haakon Vennemo. 1999. "Structural Adjustment and Deforestation in Nicaragua." *Environment and Development Economics* 4(1):19–43.

Goldman, Michael. 2001. "The Birth of a Discipline: Producing Authoritative Green Knowledge, World Bank-Style." *Ethnography* 2(2):191–217.

Goldman, Michael. 2004. "Eco-Governmentality and Other Transnational Practices of a 'Green' World Bank." Pp. 153–76 in *Liberation ecologies: Environment, Development, Social Movements*, edited by R. Peet and M. Watts. Routledge.

Goldman, Michael. 2005. *Imperial Nature: The World Bank and Struggles for Social Justice in the Age of Globalization*. Yale University Press.

Gould, Kenneth A., David N. Pellow, and Allan Schnaiberg. 2015. *Treadmill of Production: Injustice and Unsustainability in the Global Economy*. Routledge.

Greenberg, James. 2008. "A Political Ecology of Structural-Adjustment Policies: The Case of the Dominican Republic." *Culture & Agriculture* 19:85–93. doi: 10.1525/cag.1997.19.3.85.

Grimes, Peter, and Jeffrey Kentor. 2003. "Exporting the Greenhouse: Foreign Capital Penetration and CO? Emissions 1980 1996." *Journal of World-Systems Research* 261–75.

Gueorguieva, Anna, and Katherine Bolt. 2003. "A Critical Review of the Literature on Structural Adjustment and the Environment."

Hardin, Garrett. 1968. “The Tragedy of the Commons: The Population Problem Has No Technical Solution; It Requires a Fundamental Extension in Morality.” *Science* 162(3859):1243–48.

Harvey, David. 2007. *A Brief History of Neoliberalism*. Oxford University Press, USA.

Hayden, Anders, and John M. Shandra. 2009. “Hours of Work and the Ecological Footprint of Nations: An Exploratory Analysis.” *Local Environment* 14(6):575–600. doi: 10.1080/13549830902904185.

Herbst, Jeffrey. 1990. “The Structural Adjustment of Politics in Africa.” *World Development* 18(7):949–58. doi: 10.1016/0305-750X(90)90078-C.

Hickel, Jason. 2020. *Less Is More: How Degrowth Will Save the World*. Random House.

Hossain, Md Belal, Michael A. Long, and Paul B. Stretesky. 2020. “Welfare State Spending, Income Inequality and Food Insecurity in Affluent Nations: A Cross-National Examination of OECD Countries.” *Sustainability* 13(1):324.

Hughes, Gordon, and Magda Lovei. 1999. “Economic Reform and Environmental Performance in Transition Economies.”

International IDEA. 2022. “Global State of Democracy Indices.” Retrieved December 12, 2022 (https://www.idea.int/data-tools/tools/global-state-democracy-indices).

Jacob, Merle. 1994. “Toward a Methodological Critique of Sustainable Development.” *The Journal of Developing Areas* 28(2):237–52.

Jiang, Wenran. 2009. “Fuelling the Dragon: China’s Rise and Its Energy and Resources Extraction in Africa.” *The China Quarterly* 199:585–609.

Jorgenson, Andrew K. 2006. “Unequal Ecological Exchange and Environmental Degradation: A Theoretical Proposition and Cross-National Study of Deforestation, 1990–2000.” *Rural Sociology* 71(4):685–712.

Jorgenson, Andrew K. 2009. “Political-Economic Integration, Industrial Pollution and Human Health: A Panel Study of Less-Developed Countries, 1980—2000.” *International Sociology* 24(1):115–43.

Jorgenson, Andrew K. 2012. “The Sociology of Ecologically Unequal Exchange and Carbon Dioxide Emissions, 1960–2005.” *Social Science Research* 41(2):242–52.

Jorgenson, Andrew K. 2014. “Economic Development and the Carbon Intensity of Human Well-Being.” *Nature Climate Change* 4(3):186–89.

Jorgenson, Andrew K., and Brett Clark. 2012. “Are the Economy and the Environment Decoupling? A Comparative International Study, 1960–2005.” *American Journal of Sociology* 118(1):1–44.

Jorgenson, Andrew K., and Brett Clark. 2016. “The Temporal Stability and Developmental Differences in the Environmental Impacts of Militarism: The Treadmill of Destruction and Consumption-Based Carbon Emissions.” *Sustainability Science* 11(3):505–14.

Jorgenson, Andrew K., and Jennifer Givens. 2015. “The Changing Effect of Economic Development on the Consumption-Based Carbon Intensity of Well-Being, 1990–2008.” *PloS One* 10(5):e0123920.

Kaimowitz, David, Graham Thiele, and Pablo Pacheco. 1999. “The Effects of Structural Adjustment on Deforestation and Forest Degradation in Lowland Bolivia.” *World Development* 27(3):505–20. doi: 10.1016/S0305-750X(98)00146-6.

Klepeis, Peter, and Colin Vance. 2003. “Neoliberal Policy and Deforestation in Southeastern Mexico: An Assessment of the PROCAMPO Program.” *Economic Geography* 79(3):221–40. doi: 10.1111/j.1944-8287.2003.tb00210.x.

Konadu-Agyemang, Kwadwo. 2000. “The Best of Times and the Worst of Times: Structural Adjustment Programs and Uneven Development in Africa: The Case Of Ghana.” *The Professional Geographer* 52(3):469–83. doi: 10.1111/0033-0124.00239.

Lampietti, Julian A., Anthony A. Kolb, Sumila Gulyani, and Vahram Avenesyan. 2001. “Lessons from Armenia. Utility Princing and the Poor.”

Larner, Wendy. 2003. “Neoliberalism?” *Environment and Planning D: Society and Space* 21(5):509–12.

Lawrence, Geoffrey, Carol Richards, and Kristen Lyons. 2013. “Food Security in Australia in an Era of Neoliberalism, Productivism and Climate Change.” *Journal of Rural Studies* 29:30–39. doi: 10.1016/j.jrurstud.2011.12.005.

Liverman, Diana M., and Silvina Vilas. 2006. “Neoliberalism and the Environment in Latin America.” *Annual Review of Environment and Resources* 31(1):327–63. doi: 10.1146/annurev.energy.29.102403.140729.

Loewenson, Rene. 1993. “Structural Adjustment and Health Policy in Africa.” *International Journal of Health Services* 23(4):717–30. doi: 10.2190/WBQL-B4JP-K1PP-J7Y3.

Long, Michael A., Paul B. Stretesky, and Kimberly L. Barrett. 2019. “Longitudinal Methods for Analyzing Green Crime.” Pp. 198–217 in *Quantitative Studies in Green and Conservation Criminology*. Routledge.

Long, Michael A., Paul B. Stretesky, and Michael J. Lynch. 2017. “Foreign Direct Investment, Ecological Withdrawals, and Natural-Resource-Dependent Economies.” *Society & Natural Resources* 30(10):1261–76.

López, Ramón. 2006. “Structural Adjustment and Sustainable Development.” *Economic Development and Environmental Sustainability: New Policy Options* 154–77.

Mackenzie, Fiona. 1993. “Exploring the Connections: Structural Adjustment, Gender and the Environment.” *Geoforum* 24(1):71–87.

Marsh, Jessica. 2015. “Supplying the World’s Factory: Environmental Impacts of Chinese Resource Extraction in Africa.” *Tulane Environmental Law Journal* 28(2):393–407.

Meier, Peter, Mohan Munasinghe, and Tilak Siyambalapitiya. 1995. “Energy Sector Policy and the Environment: A Case Study of Sri Lanka.” *Environmental Impacts of Macroeconomic and Sectoral Policies*.

Mohan, G. 2009. “Structural Adjustment.” Pp. 1–9 in Vol. 11, edited by R. Kitchin and N. Thrift. Oxford, UK: Elsevier.

Mol, Arthur PJ. 1996. “Ecological Modernisation and Institutional Reflexivity: Environmental Reform in the Late Modern Age.” *Environmental Politics* 5(2):302–23.

Mol, Arthur PJ, Gert Spaargaren, and David A. Sonnenfeld. 2013. “Ecological Modernization Theory: Taking Stock, Moving Forward1.” Pp. 15–30 in *Routledge international handbook of social and environmental change*. Routledge.

Moosa, Imad. 2002. *Foreign Direct Investment: Theory, Evidence and Practice*. Springer.

Noorbakhsh, Farhad, and Alberto Paloni. 1999. “Structural Adjustment Programs and Industry in Sub-Saharan Africa: Restructuring or De-Industrialization?” *The Journal of Developing Areas* 33(4):549–80.

Obach, Brian K. 2004. “New Labor: Slowing the Treadmill of Production?” *Organization & Environment* 17(3):337–54.

Obeng-Odoom, Franklin. 2014. “Green Neoliberalism: Recycling and Sustainable Urban Development in Sekondi-Takoradi.” *Habitat International* 41:129–34. doi: 10.1016/j.habitatint.2013.07.009.

Oshionebo, Evaristus. 2010. “Stabilization Clauses in Natural Resource Extraction Contracts: Legal, Economic and Social Implications for Developing Countries.” *Asper Review of International Business and Trade Law* 10:1.

Ozturk, Ilhan, and Usama Al-Mulali. 2015. “Investigating the Validity of the Environmental Kuznets Curve Hypothesis in Cambodia.” *Ecological Indicators* 57:324–30.

Pandey, Kiran D., and David Wheeler. 2001. *Structural Adjustment and Forest Resources: The Impact of World Bank Operations*. Vol. 2584. World Bank Publications.

Pegg, Scott. 2012. “Social Responsibility and Resource Extraction: Are Chinese Oil Companies Different?” *Resources Policy* 37(2):160–67. doi: 10.1016/j.resourpol.2011.01.002.

Plagerson, Sophie. 2021. *Human Well-Being and Capabilities*. UNRISD.

Portney, Kent E. 2015. *Sustainability*. MIT Press.

Prechel, Harland. 2021. “Neoliberal Organizational and Political-Legal Arrangements and Greenhouse Gas Emissions in the US Electrical Energy Sector.” *The Sociological Quarterly* 62(2):209–33.

Prell, Christina, Kuishuang Feng, Laixiang Sun, Martha Geores, and Klaus Hubacek. 2014. “The Economic Gains and Environmental Losses of US Consumption: A World-Systems and Input-Output Approach.” *Social Forces* 93(1):405–28.

Ramisch, Joshua J. 2016. "'Never at Ease': Cellphones, Multilocational Households, and the Metabolic Rift in Western Kenya." *Agriculture and Human Values* 33(4):979–95.

Redclift, Michael. 2002. *Sustainable Development: Exploring the Contradictions*. Routledge.

Redclift, Michael. 2010. *Development and the Environmental Crisis: Red or Green Alternatives*. Routledge.

Reed, Darryl. 2002. "Resource Extraction Industries in Developing Countries." *Journal of Business Ethics* 39(3):199–226. doi: 10.1023/A:1016538006160.

Reed, David. 2013. *Structural Adjustment, the Environment and Sustainable Development*. London: Routledge.

Rice, James. 2007a. "Ecological Unequal Exchange: Consumption, Equity, and Unsustainable Structural Relationships within the Global Economy." *International Journal of Comparative Sociology* 48(1):43–72.

Rice, James. 2007b. "Ecological Unequal Exchange: International Trade and Uneven Utilization of Environmental Space in the World System." *Social Forces* 85(3):1369–92.

Richardson, Julie A. 1996. *Structural Adjustment and Environmental Linkages: A Case Study of Kenya.* Overseas Development Institute (ODI).

Ryan, Richard M., and Edward L. Deci. 2001. “On Happiness and Human Potentials: A Review of Research on Hedonic and Eudaimonic Well-Being.” *Annual Review of Psychology* 52:141.

Sarkodie, Samuel Asumadu, and Ilhan Ozturk. 2020. “Investigating the Environmental Kuznets Curve Hypothesis in Kenya: A Multivariate Analysis.” *Renewable and Sustainable Energy Reviews* 117:109481. doi: 10.1016/j.rser.2019.109481.

Sayre, April Pulley. 1999. *Africa*. Vol. 8. Twenty-First Century Books.

Schlosberg, David, and Sara Rinfret. 2008. “Ecological Modernisation, American Style.” *Environmental Politics* 17(2):254–75.

Schnaiberg, Allan. 1980. “The Environment: From Surplus to Scarcity.”

Schneider, Geoffrey E. 1999. “An Institutionalist Assessment of Structural Adjustment Programs in Africa.” *Journal of Economic Issues* 33(2):325–34. doi: 10.1080/00213624.1999.11506162.

Schneider, S. H. 2007. “Regional Vulnerabilities.” *Chapter 19: Assessing Key Vulnerabilities and the Risk from Climate Change. Climate Change 2007: Impacts, Adaptation and Vulnerability: Contribution of Working Group II to the 4th Assessment Report of the Intergovernmental Panel on Climate Change (IPCC)*.

Shahbaz, Muhammad, Smile Dube, Ilhan Ozturk, and Abdul Jalil. 2015. “Testing the Environmental Kuznets Curve Hypothesis in Portugal.” *International Journal of Energy Economics and Policy* 5(2):475–81.

Shandra, John M., Christopher Leckband, and Bruce London. 2009. “Ecologically Unequal Exchange and Deforestation: A Cross-National Analysis of Forestry Export Flows.” *Organization & Environment* 22(3):293–310.

Sjöstedt, Martin, and Sverker C. Jagers. 2014. “Democracy and the Environment Revisited: The Case of African Fisheries.” *Marine Policy* 43:143–48.

Springer, Simon, Kean Birch, and Julie MacLeavy. 2016. *The Handbook of Neoliberalism*. Vol. 2. Routledge New York.

Stern, David I. 2018. “The Environmental Kuznets Curve☆.” in *Reference Module in Earth Systems and Environmental Sciences*. Elsevier.

Stilwell, Frank. 2011. “Marketising the Environment.” *The Journal of Australian Political Economy* (68):108–27. doi: 10.3316/informit.991306631836981.

Tchoungui, R., S. Gartlan, J. a. M. Simo, F. Sikod, A. Youmbi, M. Ndjatsana, and J. Winpenny. 1995. “Structural Adjustment and Sustainable Development in Cameroon: A World Wide Fund for Nature Study.” *ODI Working Paper (United Kingdom)*.

Thombs, Ryan. 2022. “EIWB - Generate a Variable for the Ecological Intensity of Well-Being.”

Thorsen, Dag Einar, and Amund Lie. 2006. “What Is Neoliberalism.” *Oslo, University of Oslo, Department of Political Science, Manuscript* 1–21.

Unemo, Lena. 1996. “Environmental Impact of Governmental Policies and External Shocks in Botswana: ACGE Modeling Approach.” *Environmental Impacts of Macroeconomic and Sectoral Policies* 289.

United Nations. 2022a. “THE 17 GOALS | Sustainable Development.” Retrieved December 3, 2022 (https://sdgs.un.org/goals).

United Nations. 2022b. “World Population Prospects - Population Division - United Nations.” Retrieved September 11, 2022 (https://population.un.org/wpp/).

US EPA. 2022. “Inventory of U.S. Greenhouse Gas Emissions and Sinks.” *Inventory of U.S. Greenhouse Gas Emissions and Sinks*. Retrieved December 10, 2022 (https://www.epa.gov/ghgemissions/inventory-us-greenhouse-gas-emissions-and-sinks).

Veltmeyer, Henry. 2013. “The Political Economy of Natural Resource Extraction: A New Model or Extractive Imperialism?” *Canadian Journal of Development Studies / Revue Canadienne d’études Du Développement* 34(1):79–95. doi: 10.1080/02255189.2013.764850.

Venugopal, Rajesh. 2015. “Neoliberalism as Concept.” *Economy and Society* 44(2):165–87.

Wang, Shengyun, Huimin Ren, Longwu Liang, Jing Li, and Zhenbo Wang. 2022. “The Effect of Economic Development on Carbon Intensity of Human Well-Being: Evidence from Spatial Econometric Analyses.” *Journal of Cleaner Production* 364:132632.

Wekwete, Naomi N. 1998. “Implications of Economic Structural Adjustment Programme on Population and Environment: The Case of Shamva District.” Institute of Development Studies (IDS),(UZ).

Wiig, Henrik, Jens B. Aune, Solveig Glomsrød, and Vegard Iversen. 2001. “Structural Adjustment and Soil Degradation in Tanzania A CGE Model Approach with Endogenous Soil Productivity.” *Agricultural Economics* 24(3):263–87.

Williamson, John. 2004. “The Strange History of the Washington Consensus.” *Journal of Post Keynesian Economics* 27(2):195–206.

Winslow, Margrethe. 2005. “Is Democracy Good for the Environment?” *Journal of Environmental Planning and Management* 48(5):771–83. doi: 10.1080/09640560500183074.

Wisner, Ben. 2001. “Risk and the Neoliberal State: Why Post-Mitch Lessons Didn’t Reduce El Salvador’s Earthquake Losses.” *Disasters* 25(3):251–68. doi: 10.1111/1467-7717.00176.

World Bank. 2022. “World Development Indicators Database.” Retrieved May 3, 2022 (https://data.worldbank.org/).

VITA

Kugbeme Gaius Isumonah

Candidate for the Degree of

Master of Science

Thesis: AN EXAMINATION OF CO_2 EMISSIONS, METHANE EMISSIONS, NATURAL RESOURCE DEPLETION, AND HUMAN WELL-BEING IN AFRICA

Major Field: Sociology

Biographical:

Education:

Completed the requirements for the Master of Science in Sociology at Oklahoma State University, Stillwater, Oklahoma in May, 2023.

Completed the requirements for the Bachelor of Science in Economics at University of Ibadan, Ibadan, Oyo State, Nigeria in 2015.

Experience:

Graduate Teaching and Research Assistant, Oklahoma State University

Analyst, KPMG.

Professional Memberships:

American Sociological Association