Environmentalism in the Periphery:

Institutional Embeddedness and Deforestation among Fifteen Palm Oil Producers, 1990 – 2012

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Abstract

Environmental sociologists highlight the exploitative nature of the global capitalist economy where resource extraction from nations in the periphery tends to disproportionately benefit those of the core. From the Brazilian Amazon to mineral-rich Sub-Saharan Africa, the practice of "unequal ecological exchange" persists. Simultaneously, a "global environmental regime" has coalesced as a prominent feature of the contemporary world system. In the post-World War II era, legitimate nation-states must take steps to protect the natural environment and prevent its degradation even at their own economic expense. Stronger national ties to global institutions, particularly international nongovernmental organizations (INGOs) consistently yield more positive environmental outcomes. However, previous work suggests that normative expectations for improved environmental practices will be weak or nonexistent in the periphery. We use the case of palm oil production and its relationship to deforestation to provide a more nuanced analysis of the relationship between material and institutional forces in the periphery. Using unbalanced panels of fifteen palm oil producing countries from 1990 to 2012, we find that stronger national ties to world society via citizen memberships in INGOs result in greater primary forest area among palm oil producers. However, this effect is strongest where production is lowest and weakens as production increases. Even in the cases of Indonesia and Malaysia, where palm oil production is substantially higher than any other producer, ties to global institutions are significantly related to reduced forest loss. These results indicate the variable importance of national embeddedness into global institutions within the periphery of the world system.

Keywords: Environment; Unequal Ecological Exchange; Institutionalism; Palm Oil

Peripheral states occupy a subordinate position within the world economy generally (Emmanuel 1972; Wallerstein 1974) and in regard to environmental practices specifically (Austin 2012; Rice 2007). [1][2] Unequal exchange, or the disproportionate extraction of resources from poor nations to benefit the rich, is a key mechanism in maintaining global stratification (Chase-Dunn 1989; Raffer 1987). Rich core countries tend to externalize their environmental damages to the periphery in the process that environmental sociologists term "ecological unequal exchange" (Bunker 1985). Natural resource-intensive modes of production in the periphery of the world system result in levels of environmental degradation, including deforestation, that is disproportionate to their levels of consumption (Jorgenson 2006).

Peripheral exploitation and environmental degradation occur alongside the global expectation that all nations protect the natural environment (Frank Hironaka and Schofer 2000). The establishment of the United Nations' Environment Program, subsequent multi- and bilateral treaties addressing environmental concerns, and a myriad of international nongovernmental organizations focused on protection of the natural environment all constitute a world cultural context of environmentalism in which nation-states are embedded (Hironaka 2014). Stronger national ties to global institutions consistently correspond with more environmentally friendly policies (Frank et al. 2000), practices (Schofer and Hironaka 2005), and opinions (Jorgenson and Givens 2014).

We argue that the separate theoretical and empirical treatment of these well-established phenomena—ecological unequal exchange and global environmental norms—limits our understanding of environmental practices across the world system. Resource extraction contributes to the continued subordination of peripheral states. At the same time, national ties to global institutions contribute to improved environmental practices. We advance political economic and institutional perspectives of environmental sociology with the examination of the mediating effects of ecological unequal exchange on national ties to global institutions across a sub-set of theoretically significant peripheral countries. How does subordination in the global political economy affect the relationship between national ties to global institutions and environmental practices?

In order to answer this question, we focus on the production of palm oil and its relationship to deforestation. We move away from the large-N studies typical of cross-national environmental research. Instead, we focus specifically on key palm oil producers, the extraction of those natural resources, and their relationship to global institutions with a specific focus on international

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[2] This paper is a collaborative endeavor. Authors are listed alphabetically.

nongovernmental organizations (INGOs) and the pro-environmental scripts they diffuse to nation-states (Frank et al. 2000; Hironaka 2014). The cultivation of palm oil, derived from the oil palm tree (*Elaies guineenisis*), requires tropical conditions and the carbon emission-intensive conversion of primary forest area into plantations.[3] This ecologically harmful extractive production in the periphery paired with the widespread use of palm oil in food and industrial products globally, but especially in the core of the world system, makes palm oil production the prototypical example of ecological unequal exchange. Because of its direct relationship to the production of palm oil, we analyze the practice of deforestation across our targeted sample.

We proceed with a brief elaboration of the palm oil production process and it relationship to deforestation. We then review previous work in the field of global sociology and the natural environment from the perspectives of ecological unequal exchange and sociological institutionalism. We then elaborate on the advantage of integrating these perspectives in order to better understand global environmental practices and their determinants. We conduct cross-national regression analyses on an unbalanced panel of primary forest loss rates across fifteen palm oil producers from 1990 - 2012. Results indicate the variable importance of global institutions in explaining deforestation across the periphery. Overall, palm oil producers with stronger ties to INGOs have lower rates of primary forest loss. However, this relationship varies substantially across palm oil producers where higher levels of production reduce the size of this relationship. However, even where production is highest, ties to global institutions are significantly predictive of lower levels of forest loss. We conclude with a discussion of the theoretical and policy implications of these findings.

Palm Oil Production and Deforestation

The primary contributors to global climate change are the burning of fossil fuels and clearing of forests (Rosa et al. 2015). Palm oil production contributes to both phenomena. Production originated as part of mixed farming practices in West Africa. It has now expanded to industrial-scale monocropping with considerable environmental risk and impacts on local societies (Colchester and Chao 2011). Contemporary production requires the intensive use of synthetic fertilizers and pesticides and massive land-use transfers. The conversion of forest area to palm oil plantations is associated with substantial greenhouse gas emissions (Hansen et al. 2014; Reijnders and Huijbregts 2008). The subsequent reduction in forest area creates a "carbon sink," or a reduced ability to absorb carbon dioxide from the atmosphere (Hansen et al. 2014).

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[3] The Food and Agricultural Organization classifies primary forest as forest of native species where there are no signs of human disturbance

In addition to the global effects of carbon sinks, disruptions in the carbon cycle due to deforestation contribute directly to the loss of livelihoods as well as biodiversity. An estimated three hundred million people annually earn part or all of their livelihoods and food from forests (Pimentel et al. 1997). Deforestation is included as one of seven indicators in Diener's (1995) quality of life index.[4] Additionally, large-scale palm oil production generally involves the exploitation of workers. The International Labour Organization identifies numerous safety and health hazards associated with palm oil production. Hazards include injuries from cutting tools, poisoning and long term health effects from pesticide exposure, high levels of sun exposure, and snake and insect bites (ILO 2004). Additionally, orangutan populations, native to Indonesia and Malaysia, are "seriously endangered" in part to due to the expansion of palm oil plantations.

Figure 1. Palm Oil Production in Indonesia and Malaysia, 1990 – 2012

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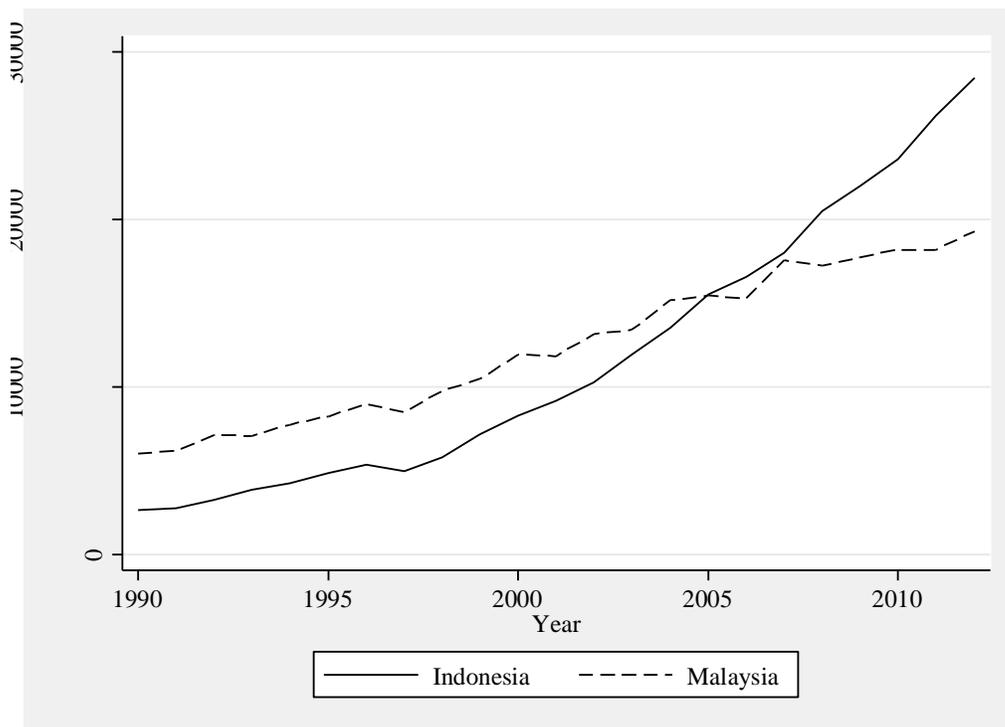
[4] The other six indicators are purchasing power, homicide rate, fulfillment of basic physical needs, suicide rate, literacy rate, and gross human rights violations.

Figure 2. Palm Oil Production in Thirteen Peripheral Countries, 1990 – 2012
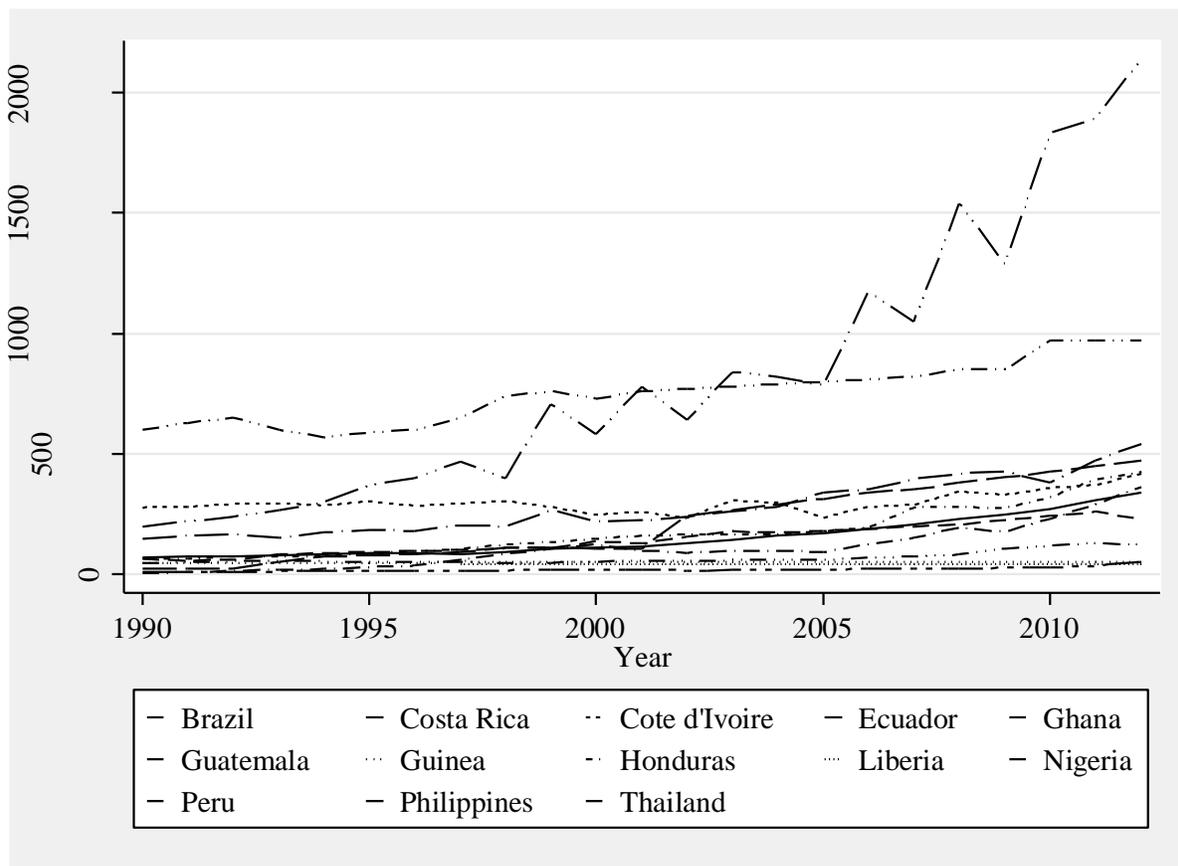
Palm oil is used in foodstuffs such as cooking oil, margarine, and pastries as well as in industrial products including cosmetics, soaps, and candles (UNEP 2011). Its uses continue to increase, thus increasing demand for its production. For example, palm methyl ester is a direct derivative of palm oil and increasingly used as a biodiesel (FAO 2010; Hansen et al. 2014). Palm oil is also popular with food manufacturers and is increasingly used as an alternative to industrially produced "trans fats" (Nellemann et al. 2007). Driven primarily by India, China, and the European Union, global demand for palm oil is projected to double from 2010 to 2020 (UNEP 2011). Figures 1 and 2 illustrate recent trends in palm oil production across the periphery.

Malaysia and Indonesia are consistently the world's largest palm oil producers. In fact, we illustrate their production trends separately from all other producers because of the drastic differences in scale. They each begin the time period under examination with around five million metric tons and reach twenty and thirty million metric tons respectively. In comparison, the thirteen other producers included in our sample produce between one thousand and two hundred thousand metric tons each yearly over the same time period.

Global Sociology and the Natural Environment

Cross-national research on the natural environment generally takes either a political economic or institutional approach. These traditions are largely separate, though recent work suggests the utility of their synthesis (Shorette 2012). Political economic work, specifically related to unequal exchange, highlights the importance of qualitative differences between processes of production and effects of international economic relationships based on a country's relative location within the world-system. The creation and maintenance of a global economic hierarchy keeps the periphery in a perpetually subordinate position (Chase-Dunn 1989; Mahutga 2006). In contrast, sociological institutionalism highlights the global institutional context in which nations are embedded. The level of policy isomorphism despite vast differences in levels of development and capacity to implement environmental policy is striking (Hironaka 2014). Below we review each of these perspectives on the natural environment and argue for the utility of examining the role of global environmental institutions specifically in the periphery of the world system.

Ecological Unequal Exchange

Political economic approaches to macro-historical change posit that the less developed nations are often relegated to the most labor-intensive and extractive economic activities with little chance of upward mobility (Smith and White 1992; Mahutga 2006). From this perspective, inequalities between countries are a result of global capitalism; and less developed "peripheral" nations, are exploited by richer "core" countries (Chase-Dunn 1989; Wallerstein 1974). The relative mobility of investment capital and relative immobility of labor creates unequal exchanges between highly developed and underdeveloped countries where surplus value is extracted from the periphery and relocated in the core (Emmanual 1972). These unequal exchanges lead to negative developmental outcomes both economically and ecologically (Bunker 1985; Chase-Dunn 1989).

Unequal exchange allows foreign capitalists to maintain low wage, labor and capital intensive production processes in the periphery while retaining the most profitable production processes for the core (Emmanual 1972). This mode of production also relegates the most resource intensive industries to the periphery, leading to high levels of extraction of natural resources from those nations (Bunker 1985). Taken together, unequal exchange research shows that peripheral nations have few options aside from engagement in low-wage, labor-intensive and extractive industries.

Building on this work, environmental sociologists conceptualize the effects of states' relative positions within the world system in an ecological framework with the articulation of a theory of ecological unequal exchange (Austin 2012; Bunker 1985; Rice 2007). Unequal economic exchanges between core and periphery countries entail a component of uneven natural resource exchange that leads to environmental degradation in peripheral nations (Bunker 1985; Hornborg

1998 2001; Rice 2007; Austin 2012). Oulu (2016) argues that ecological unequal exchange operates on a 'treadmill logic' where endless extraction (of capital and resources) from the periphery drives capital accumulation in wealthy nations. Economic growth, under these conditions, is prioritized over qualitative national development that could include better management of natural resources (Oulu 2016).

Numerous cross-national studies confirm that unequal exchange leads to negative environmental outcomes for the developing world. Austin (2012) and Jorgenson (2006) find that unequal exchange increases deforestation; Shandra et al. (2009) find that biodiversity is reduced under the conditions of unequal exchange; and Jorgenson (2012) finds that vertical trade flows associated with unequal exchange are correlated with higher national CO_2 emissions. More recent research builds on this logic and argues that importing nations owe an 'ecological debt' (a debt that cannot be reduced to a monetary value) to nations that have been historically exploited through colonialism or those who export their natural resources for the benefit of wealthy nations (Mayer and Haas 2016; Warlenius 2016).

Unequal exchange is only one of several mechanisms world systems theorists use to explain environmental inequalities. Reliance on extractive industries, industrialized agriculture, and fossil fuels are integral parts of the global capitalist system and result in massive damage to the natural environment (Clark and York 2005; Magdoff, Foster and Buttel 2000). Alongside studies examining unequal exchange, world systems research shows the negative environmental outcomes of dynamics like foreign direct investment and international finance (Jorgenson 2007; Shandra et al. 2010). Another explanation offered is that ecological damage in peripheral countries is a result of externalizing the costs of production to developing nations by moving more hazardous production to countries with less strict environmental regulations (Frey 2003). Empirical studies in these areas have linked these various dynamics of the world system to greenhouse gas emissions, deforestation, water pollution, and biodiversity loss among other negative outcomes (Burns Kick and Davis 2003; Jorgenson 2007; Shandra et al. 2009).

Deforestation has been a particularly important subject in the world systems literature in recent years. Researchers have highlighted several ways that the world economic system contributes to disproportionate forest loss in developing countries. Peripheral nations experience deforestation as a result of core countries exploiting their forests through directly consuming forest products like paper and wood (Burns et al. 2003; Jorgenson 2008). Like the case of palm oil, forests are also cleared to make room for a number of agricultural goods. Austin (2010, 2012) links cattle and coffee production in the developing world to forest loss in coffee and cattle producing nations. This system of production has made it possible for core countries to retain some of their remaining forests by outsourcing their consumption patterns to other economic zones (Burns et al. 2003). Similarly, as primary sector production in the periphery becomes consolidated under the control

of foreign direct investors, it becomes more integrated into the system of global trade, production expands, and more forest is cleared to meet demands (Gellert 2015; Jorgenson 2008).

International financial institutions contribute to both of these processes with terms of their structural adjustment loans which encourage specialization in forestry export products and selling public land to foreign investors (Shandra et al. 2009; Shandra, Shircliff and London 2011a). Austin (2012) highlights how primary sector exports of non-forestry products can exacerbate forest loss within a global system of production. She examines negative externalities of coffee production, a product grown exclusively in developing nations and consumed mainly by core countries, finding that coffee production is linked to deforestation as well as malnutrition and decreased school enrollment. Palm oil production, as it is done in the periphery of the world system, follows these broad patterns of unequal exchange, typifying the environmentally destructive processes highlighted in unequal ecological exchange.

Hypothesis 1: *higher levels of palm oil production promote higher rates of forest loss.*

Global Environmental Institutions

Another line of inquiry within environmental sociology focuses on the institutional context in which nations are embedded.[5] Like the world-system perspective, sociological institutionalism, or world society theory, places the impetus for world historical change outside the individual nation-state. However, these approaches to explaining social change diverge in key assumptions and focus. Whereas political economic perspectives on social change emphasize unequal power relations and material interests, world society theory emphasizes the institutional character of global processes (Schofer et al. 2012). Global institutions including intergovernmental organizations, treaties, and especially international nongovernmental organizations embody scripts that define the nation-state and what it can and should do (Boli and Thomas 1997; Meyer et al. 1997) and legitimate particular formations of domestic activity (Schofer and Longhofer 2011). Rather than actors pursuing *a-priori* interests, sociological institutionalists conceptualize states as enactors of these global scripts.

An increasingly global political culture comprises legitimate societal goals, such as equality, human rights, and environmentalism (Boli and Thomas 1999; Frank et al. 2000). State responsibility for the protection and preservation of the natural environment is a particularly salient script in the post-World War II world society (Frank et al. 2000; Hironaka 2014). Harm to the natural environment is now institutionalized as a social problem as evidenced by widespread

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[5] See Shorette et al.(forthcoming) for a detailed review of the world society approach to explaining macro-social change including the rise of the global environmental regime and how this compares to other theoretical perspectives.

participation in the United Nations' Kyoto Protocol and Paris Agreement. Both are multinational voluntary agreements that commit states to reducing carbon dioxide emissions. Environmental norms, i.e. expectations that legitimate nation states must take measures to protect the natural environment even at their immediate economic cost, are embodied in global institutions, especially international nongovernmental organizations (INGOs) (Boli and Thomas 1997, 1999). INGOs, a substantial proportion of which focus specifically on the natural environment, proliferate over this time period (Frank 1997; Hironaka 2014). Empirical work in this tradition points to the rise of global institutions and their subsequent effects on national-level policies and practices.

Early work focuses on the trend itself. Global institutions proliferated following the Second World War and the world cultural norm of environmentalism grew increasingly salient (Boli and Thomas 1997; Frank et al. 2000). This period marks a shift in our understanding of the natural environment from a collection of resources to be exploited to a global ecosystem in need of our stewardship (Frank 1997). International environmental treaties, for example, were nearly nonexistent prior to 1945 but their establishment is increasingly frequent thereafter (Frank et al. 2000). Frank (1997) illustrates that the dramatic increase in global level discourse and activity regarding environmental problems, including deforestation, is not a consequence of the problems themselves. Rather, it represents a "conceptual reconstitution of the entity 'nature'… that spurred world-level discourse and activity" (Frank 1997: 411).

In turn, the reconceptualization of nature represents the coalescence of a "global environmental regime" which results in a striking trend of worldwide policy isomorphism.[6] In the next stage of empirical work researchers demonstrate the relationship between national embeddedness into global institutions and national policy outcomes. Global institutions, especially INGOs, provide blueprints for legitimate nation-state behavior which includes environmental protection (Boli and Thomas 1997, 1999). Despite vast differences in economic development, systems of governance, and the capacity of state institutions to implement political commitments, nation-states across the world adopted remarkably similar internal structures intended for the protection of the natural environment (Frank et al. 2000). Frank et al. (2000) demonstrate that the growing number of national parks, chapters of international environmental associations, memberships in intergovernmental environmental organization, environmental impact assessment laws, and environmental ministries are all better explained by environmental scripts institutionalized at the global level than by dynamics internal to states.

Those states which are more connected to these world society scripts tend to enact the proscribed policies even when they are contrary to states' material interests (Finnemore 1996;

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[6] Hironaka (2014) provides a detailed explanation of the formation and expansion of the "global environmental regime."

Meyer 2004). National embeddedness into global institutions shapes domestic policy in a wide range of fields including the criminal regulation of sex (Frank et al. 2010) and neoliberal (Fourcade-Gourinchas and Babb 2002; Henisz Zellner and Guillén 2005), environmental (Frank et al. 2000), and human rights (Hafner-Burton and Tsutsui 2005) policies.[7] Longhofer and Schofer (2010) demonstrate that state ties to global cultural models, net of domestic economic, political and institutional dynamics, explain the rise of domestic voluntary associations devoted to environmental protection, across the global South. Work on policy isomorphism led to speculation on the potential non-effect on actual environmental outcomes (Buttel 2000).

This criticism spurred the next stage of empirical work in the tradition of sociological institutionalism focusing on practical outcomes. A growing body of work finds national embeddedness into networks of global institutions to be consequential for practical environmental outcomes including greenhouse gas emissions (Schofer and Hironaka 2005), agrochemical use (Shorette 2012), biodiversity loss (Shandra et al. 2009), and concern for environmental issues (Jorgenson and Givens 2014), for example. In the first of these studies, Schofer and Hironaka (2005) demonstrate that fewer emissions of carbon dioxide and chlorofluorocarbons are related to the extent to which states are tied to the global environmental regime, state participation in organizations constituting the regime, and the length of time since its emergence. Subsequent research generally supports the relationship between ties to global environmental institutions and positive environmental outcomes cross-nationally. These findings demonstrate the link between changing understandings of legitimate societal goals, state policies and the concrete outcomes addressed by these policies. Accordingly, they point to the importance of cultural change for practical social change. Consistent with this work, we focus specifically on INGOs.

Hypothesis 2: stronger ties to global institutions, specifically international nongovernmental organizations, are associated with lower levels of forest loss.

Environmentalism in the Periphery
Drawing on insights from world-systems theory and sociological institutionalism, we argue that processes of ecological unequal exchange mediate normative pressures to protect the natural environment in the periphery. We suggest that the phenomenon of global environmentalism – or the tendency of national ties to global institutions to associate with more environmentally friendly practices – is not uniform across the world system. Rather, environmentalism in the periphery is uniquely shaped by peripheral states' qualitatively distinct relationship to global production. The

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[7] National ties to global institutions are traditionally measured as citizen memberships in INGOs in general, but also as ties to INGOs with specific focuses, and also sometimes state participation in international treaties and membership in intergovernmental organizations (IGOs).

reliance on labor-intensive natural resource extraction for economic development creates a unique tension between material and normative forces in the periphery that is the focus of our study.

Sociological institutionalism takes a global focus with the assumption that institutional context is less salient in the periphery. Overall, as global institutions expand and national ties to them increase, environmentally friendly policies are increasingly widespread. Perfect and immediate compliance with such policies is unlikely. The observed disconnect, or decoupling, between policy and practice varies considerably cross-nationally. Coupling between environmental norms and practices tends to be strongest in the core and weakest in "poor countries that lack the resources for effective policy implementation" (Hironaka 2014: p. 150). Weak states in the periphery lack the capacity to enforce environmental policies. Accordingly, environmentalism is often assumed to serve as mere "window-dressing" in the periphery.

Qualitative differences between the zones of the world-system are central to the theory of ecological unequal exchange. However, empirical work on global institutions tends to analyze their role across a large set of countries – either globally or across the entire Global South. Sampling such a wide array of nations is problematic because it implies that the effect of a given variable, such as the effect of world society ties, is relatively uniform across all countries. As a result of this approach, many of these studies find an effect of global institutions, while others do not. For example, Jorgenson Dick and Shandra (2011) find that global institutions have no direct effect on carbon emissions or water pollution (although they do find an indirect effect where ties mediate pollution from foreign direct investment), and find mixed results supporting a direct effect of world society ties on deforestation. Their sample includes the bottom three quarters of the World Bank's income quartile classification. This results in samples of forty to eighty countries analyzed together. The inclusion of all countries across the global South where data are available is very common in cross-national environmental research.

We suggest that an over-reliance on large-N cross-national analyses is problematic. On the one hand, massive amounts of worldwide variation obscure important difference across the periphery. For example, average income in members of the Organization of the Petroleum Exporting Countries (OPEC) is forty times greater than average income in the "low income" countries as classified by the United Nations. However, average income varies by a nontrivial factor of five within the periphery itself (World Bank 2016). There also exists a great deal of variation in the extent to which nations are integrated into global environmental institutions in the periphery. The number of organizational ties ranges from 205 to 2,350 even within our small sample.

Our approach to this problem is to limit our sample size to nations that produce a common crop, resulting in a smaller sample where the effects of global institutions is likely to be more uniform This approach is similar to Austin's (2012) study of unequal exchange in the coffee

producing nations of the world. Limiting our sample in this way allows us to focus on the effect of world society ties in a small part of the globe and within the context of a single industry. This is desirable because the effect may be more uniform and thus possible to detect in statistical models that assume uniformity across observed effects.

Drawing further on the theory of ecological unequal exchange and the importance of qualitative differences between zones of the world system, we argue for the examination of specific rather than general processes. Instead of testing for an institutional effect across the entirety of the periphery, we suggest that a more theoretically targeted sample will yield more informative results. Peripheral states are affected specifically by environmentally harmful natural resource extraction. Palm oil production results in the carbon-intensive process of clearing natural forests and the carbon sinks left in their place. For these reasons palm oil producers and their rates of deforestation are the subject of this study.

Following previous work within the world society tradition, we expect variation in the extent to which states are tied to global institutions to be consequential for environmental outcomes. However, we expect global institutional factors to be mediated by the resource-extractive production processes that are unique to this zone. We hypothesize that forest loss will be lowest among palm oil producers with the strongest ties global institutions, specifically international nongovernmental organizations (INGOs). We further hypothesize that relationship to be mediated by the production of palm oil. National ties to INGOs will be less important for forest loss in the highest producing states and will be most important for forest loss where palm oil is produced the least.

Hypothesis 3: the intensity of palm oil extraction mediates the relationship between national ties to INGOs and forest loss. More intensive palm oil production mitigates the effects of INGO ties on forest loss across palm oil producers.

Data

The data for these analyses come from four sources. Primary forest area and palm oil exports by dollar amount are from the United Nation's Food and Agricultural Organization. Data on palm oil production by volume is from the United States Department of Agriculture's Foreign Agricultural Services. Data on international organizations is from the Union of International Associations' Yearbook of International Organizations. All other variables are from the World Bank's Open Data Catalogue. Data used in the analysis are available for all years across all countries except for Liberia. Data are missing for one variable, Liberia's total exports, from 1990 to 1996. Because we use casewise deletion, this results in Liberia being included in the analysis from 1997 to 2012. Table One presents descriptive statistics for each variable that we describe below and includes data

from 1990-2012 across all countries unless otherwise noted. The distribution of most variables is skewed. We natural log transform variables to reduce skew for all continuous variables except for protected land area, which is normally distributed throughout our sample.

Primary Forest Area

The Food and Agricultural Organization classifies primary forest as forest of native species where there are no signs of human disturbance. In these areas, the last significant human intervention was long enough ago to allow natural species and processes to re-establish themselves and they exhibit the occurrence of dead wood and natural age structure. These forests may be naturally regenerated but not managed. Biologists assert that primary forest areas are particularly important for species richness and biodiversity because they contain more complex ecosystems and significantly more species than agroforests or other managed forest areas (Thiollay 1995). Data are from the FAO's most recent Forest Resource Assessment and measurements are standardized by total land area. Primary forest area is measured in square kilometers and standardized as a percent of the total amount of land in a country.[8]

Palm Oil Production

Data are gathered from the United States Department of Agriculture's Foreign Agricultural Services. The FAS database contains information on palm oil production, exports, imports and domestic consumption for all countries in this analysis from 1987 to 2016. Production values are measured in 1000 metric tons.

Global Institutions

Consistent with work in sociological institutionalism, we measure national embeddedness in global institutions as the total number of international nongovernmental organizations (INGOs) in

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[8] In some years, FAO measurements of primary forest area are done manually with remote sensing surveys, while in others experts provide estimates. One of the difficulties with large scale forest data lies in collecting measurements of forest area. The cost of measuring large areas of forest is high and, in developing countries, regular field surveys are sometimes not possible. When field survey data are not available, the FAO may rely on experts in a particular field to estimate the amount of primary forest area in a nation. We control for variability that may arise due to the measurement technique utilized in a given year comparable to Shandra et al. (2011a). The highest quality estimates are measured manually with remote sensing surveys or field samples (1=higher quality) while in other years measures are estimated by experts in a given country often with extrapolation methods from previous year's estimates (0=lower quality). Data are available from the FAO.

which a country's citizens have membership.[9] Data are from the Union of International Association's *Yearbook of International Organizations*.

Gross Domestic Product per capita

This variable is included as a control for the level of a country's development. Studies have found mixed results when examining the effects of per capita GDP on deforestation. Shandra et al. (2011a) find that countries with higher levels of development have lower rates of deforestation. Burns, Kick and Davis (2003) suggest that this is partly due to unequal exchanges in the world system. In comparable studies, models have shown the effect of per capita GDP to be insignificant (Jorgenson 2007; Shandra Shircliff and London 2011b). Data are downloaded from the World Bank (2016) and are measured in constant 2000 U.S. dollars.

Exports

We measure this variable as total dollar amount of exports less the amount of palm oil exports in constant 2000 dollars. The final dollar amount is standardized by a country's gross domestic product. Research in political economy has shown that a country's level of total exports is associated with a number of negative environmental outcomes including reduced biodiversity and increased greenhouse gas emissions (Shandra et al. 2010, Jorgenson 2007). Data for this variable are missing for Liberia from 1990-1996, but otherwise available across all years used in this study for all countries. Because we use casewise deletion, this results in Liberia being included in the analysis from 1997 to 2012.

Population

As populations grow, they consume more resources leading to more stress on the environment and subsequent deforestation (York Rosa and Deitz 2003). This makes population an important variable to control for when assessing factors that determine rates of forest loss. Estimates are taken at mid-year and published by the World Bank (2016).

Urban Population

It is also important to consider population dynamics when examining changes in forest areas. Jorgenson and Burns (2007) find that urban population growth is negatively related to deforestation. They suggest that this occurs because rural workers migrate to cities as nations

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[9] Some studies index INGOs with international treaties and intergovernmental organizations. We focus on INGOs for ease of coefficient interpretation. We also note the very high correlation between the three.

industrialize, thus reducing dependence on rural agriculture and associated forest loss. Estimates are also from the World Bank (2016) and are measured as a percent of the total population.

Table 1. Descriptive Statistics

	Mean	Median	St. Dev.	Min.	Max.
Key Variables					
Primary Forest (sq. km)	2,432	131	5,390	4.04	21,824
Primary Forest (% of Total Land Area)	.0163	.0131	.0172	.00004	.0556
Total Primary Forest Loss (% of Total Primary Forest)	-7.18	-.685	7.09	-28.46	4.04
Palm Oil Production (1,000 tonnes)	1,851	180.5	4,705	6.00	4,705
Ties to INGOs	846.5	825.0	426.7	205.0	2,350.0
Economy					
GDP in millions	126,376.8	33,101.47	259,643.4	316.55	2,001,994
GDP per capita	2,045.53	1,554.17	1,771.38	122.55	9,984.13
Exports (% GDP)*	37.50	32.12	22.03	6.71	121.37
Imports (% GDP)*	40.71	36.20	22.64	7.00	144.73
Population					
Total population (millions)	54.12	20.17	66.56	2.37	248.04
Urban population (% total)	50.53	47.27	14.45	28.02	84.90
Biophysical					
Forested area (100,000 sq. km)	5.62	1,02	13.47	23.76	57.48
Forested area (% land area)	43.75	46.03	15.60	9.03	72.71
Protected land (% land area)	16.35	15.78	7.11	1.63	30.93
Political					
Democracy (freedom house index, 1-7)	3.17	3.5	1.11	1	5

Note: *Data are missing for Liberia from 1990-1996

Forest Area

We also control for the total square kilometers of forested area in a country. This variable is important because countries with relatively more or less forest resources experience deforestation in different ways. Previous work has shown that that net of relevant controls, countries with larger forest tend to experience lower rates of deforestation (Shandra et al 2011a; Burns, Kick and Davis 2003).

Protected Land Area

We control for the amount of land that is protected in each country, which is vital to national forest protection efforts. Laurance et al. (2012) suggests that protected areas are quickly becoming the last refuge of biodiverse areas in many countries around the world. As such, losses in a nation's protected land area may result in a loss of primary forest. This variable, measured as a percent of total land area, and is not log transformed in our analysis.

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Methods

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For these analyses, we use an unbalanced panel of 15 palm oil producing countries from 1990 to 2012. In order to focus on variance within palm oil producing nations, we limit our sample countries that produce and export palm oil. This approach is comparable to Austin (2012) which examines unequal ecological exchange in coffee production. Table 2 summarizes the key indicators for all included and excluded countries. Countries are included based on two criteria: whether they (a) face economic pressure to produce palm oil for exports and whether they (b) have any primary forest area. To meet the first criteria, a country must produce at least as much palm oil as it exports and export more palm oil than it imports (production $\geq$ exports $>$ imports). If a country meets this criterion for at least one year, it is included in the analysis.

The first criterion excludes six countries that produce very small amounts of palm oil primarily for domestic consumption. Six countries are further excluded based the second criterion because they already have no primary forest left at the beginning of the period analyzed.[10] Since the vast majority of palm oil is produced for export by heavily forested nations, 91.14% of global palm oil production that took place during the time period of our analysis is included in our sample.

We use Prais-Winston regression analyses with panel corrected standard errors and corrections for first order autoregressive correlation. This is a more efficient variation of the Cochrane-Orcutt model in that it does not omit the first observation for each panel. In addition, we

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[10] Results are robust to the inclusion of countries with no primary forest area, non-net exporters, and all palm oil producers. Results are also robust to the exclusion of Indonesia and Malaysia.

Table 2. Summary of Key Indicators for All Palm Oil Producers

	N	Mean GDP per capita	Palm Oil Production	INGO Ties	Primary Forest 1990 % Land Area	Δ Primary Forest Area
Brazil	23	5,016.49	151.00	1901.52	.0261	-.0018
Costa Rice	23	4,346.22	146.61	789.39	.0257	.0039
Cote d'Ivoire	23	874.61	299.17	544.87	.0020	0
Ecuador	23	2,568.62	278.04	762.09	.0527	-.0016
Ghana	23	592.31	209.61	604.26	.0020	0
Guatemala	23	1,748.99	110.00	604.26	.0275	-.013
Guinea	23	410.31	48.70	246.96	.0003	0
Honduras	23	1,137.97	176.22	451.00	.0041	0
Indonesia	23	1,274.23	11,709.78	1,065.96	.0273	-.0015
Liberia	16	186.33	42.00	226.44	.0018	0
Malaysia	23	4,867.90	12,389.65	1,101.22	.0116	.0034
Nigeria	23	677.36	750.48	939.00	.0017	-.0016
Peru	23	2,555.51	20.35	1,049.35	.0544	-.0027
Philippines	23	1,200.92	67.87	1,115.74	.0029	0
Thailand	23	2,660.21	822.70	1,073.57	.0132	0

Palm Oil Producers Excluded from Analyses

	N	Mean GDP per capita	Palm Oil Production	INGO Ties	Primary Forest 1990 % Land Area	Δ Primary Forest Area
Angola	23	1,430.89	48.52	231.26	0	0
Benin	23	451.54	36.43	371.78	0	0
Cameroon	23	849.25	175.57	560.91	0	0
Congo, D.R.	20	207.31	153.08	479	.0463	-.0009
Colombia	23	2,997.42	543.70	1,151.10	0	0
Dominican Rep.	23	2,859.16	22.09	559.48	0	0
India	23	607.21	40.78	1,787.44	.0052	0
Mexico	23	6,167.30	31.09	1,629.35	.0203	-.0033
Papua New Guinea	23	957.72	338.30	384.22	.0691	-.0267
Sierra Leone	23	275.60	38.30	325.82	.0031	-.0017
Venezuela	23	5,188.77	55.22	1,151.09	.0528	-.0003
Togo	23	369.25	11	354.48	0	0

correct for autoregressive correlation in the first order AR(1), or the tendency of observations to be correlated strongly with observations from previous time points within the same case (Becketti 2013; Prais and Winston 1954; Woolridge 2010). A Woolridge F statistic indicates the strong first order autoregressive correlation correlation in all of our models and thus the need for the Prais-

Winston model with AR(1) correlation. The regression model is represented by the equation below.

$$Y_{it} = \beta_n X_{nit} + \alpha_p + e_{it}$$

Y is the dependent variable for country i at time t. It is the equivalent to the sum of all coefficients (β_n) multiplied by their respective independent variables (X_n) for country i at time t plus the unobserved time period-invariant country effect (α_p) and the error (e_{it}).

Results

In Table 3 we present findings for Prais-Winston regression estimates of primary forest from 1990 to 2012. All models estimate coefficients for palm oil production, ties to INGOs, population, urban population, GDP per capita, exports, forest and protected land areas, and control for measurement technique. The linear effects of palm oil production and ties to INGOs are shown in model one and their interaction is shown in models two and three. All coefficients are small because of the scaling of all variables. Readers should keep in mind that although these coefficients are small, they explain more than half of the variance in our dependent variable.

The results of model one support the hypothesis that palm oil production is associated with decreased primary forest area. The coefficient for palm oil production is negative and statistically significant (-.0008 p<.001). This demonstrates that, net of other factors, as a country produces more palm oil its percentage of primary forest area decreases. Model one also demonstrates support for our second hypothesis, that greater embeddedness into global institutions is associated with having more primary forest. The coefficient for INGO ties is positive and statistically significant (.0101, p<.001) indicating that as nations are more strongly tied to world normative expectations for environmental protection, they retain more primary forest over time. This finding supports previous research that indicates that NGOs are overall effective at reducing deforestation (Shandra 2007). Our next models examine the interaction between our political economy and institutional variables.

Models two and three support our hypothesis that the relationship between national ties to global institutions and environmental practices is mediated by palm oil production. Our second and third models include a term for the interaction of palm oil production and INGOs as well as the constitutive terms (those that make up the interaction effect). Model two includes the uncentered palm oil and INGO variables while model three shows the coefficient for those variables centered with a mean of zero. We interpret the results of both interaction models following Brambor, Clark and Golder (2006).

The uncentered coefficients in model two show the conditional effect of INGO ties and palm oil production when the other constitutive variable is equal to zero (Brambor et al. 2006). In

other words, the coefficient for INGO ties (.012, p<.01) is the coefficient when palm oil production is equal to zero. Likewise, the coefficient for palm oil production (.002, p>.05) is the coefficient conditional upon a country having zero INGO ties.

Table 3. Unstandardized Coefficients for Prais-Winston Regression Models of Primary Forest Area with AR[1] Corrections

	Model 1	Model 2	Model 3
Palm Oil Production 1000 MT (ln)	-0.0008*** (.0002)	0.0019 (.0014)	--
INGO Ties (ln)	0.0101*** (.0015)	0.0120*** (.0017)	--
Palm Oil Production 1000 MT (ln) Mean Centered	--	--	-0.0008*** (.0002)
INGO Ties (ln) Mean Centered	--	--	0.0097*** (.0015)
INGO*Palm Oil	--	-0.0004* (.0002)	-0.0004* (.0002)
Population (ln)	-0.0063*** (.0006)	-0.0063*** (.0006)	-0.0063*** (.0006)
% Urban Population (ln)	0.0132*** (.0017)	0.0130*** (.0016)	0.0130*** (.0016)
Exports %GDP (ln)	-0.0004 (.0004)	-0.0004 (.0004)	-0.0004 (.0004)
GDP per capita (ln)	0.0012** (.0004)	0.0012** (.0004)	0.0012** (.0004)
Forest Area Sq. KM (ln)	0.0056*** (.0003)	0.0057*** (.0003)	0.0057*** (.0003)
Protected Land	0.0001** (.0000)	0.0001** (.0000)	0.0001** (.0000)
Measurement Technique	-0.0002 (.0002)	-0.0002 (.0004)	-0.0002 (.0004)
Constant	-.0634***	-.0755***	-.00006
N	338	338	338
R^2	.57	.57	.57

Notes: * p<.05 **p<.01 ***p<.001; Standard Errors are in Parentheses.

Since we have no actual observances of countries with zero palm oil production or zero INGO ties, this coefficient is not substantively meaningful and readers should instead interpret the constitutive effects displayed in model three, which recalculates the regression equation after centering the mean at zero. The results for the constitutive terms in model three show the conditional effects of INGOs and palm oil production on primary forest area and demonstrate that higher INGO ties is associated with larger primary forest areas (.0097, p<.001) and higher palm oil production is associated with smaller areas of primary forest (-.0008, p<.001).

The interaction term in models two and three is negative and significant (-.0004, p<.05). This supports our hypothesis that the relationship between environmentalism and protecting primary forests is diminished as palm oil production increases. We also calculate and plot unconditional marginal effects of our interaction terms. Figure 3 illustrates the unconditional marginal effects of ties to INGOs across various levels of palm oil production (represented by the solid line in figure 3) and the 95% confidence interval for these estimates (the dashed lines in figure 3). The negative slope of the unconditional marginal effects further supports our hypothesis that the intensity of natural resource extraction mediates the relationship between national ties to global institutions and environmental practices.

Figure 3. Marginal Effects of Environmentalism by Palm Oil Production
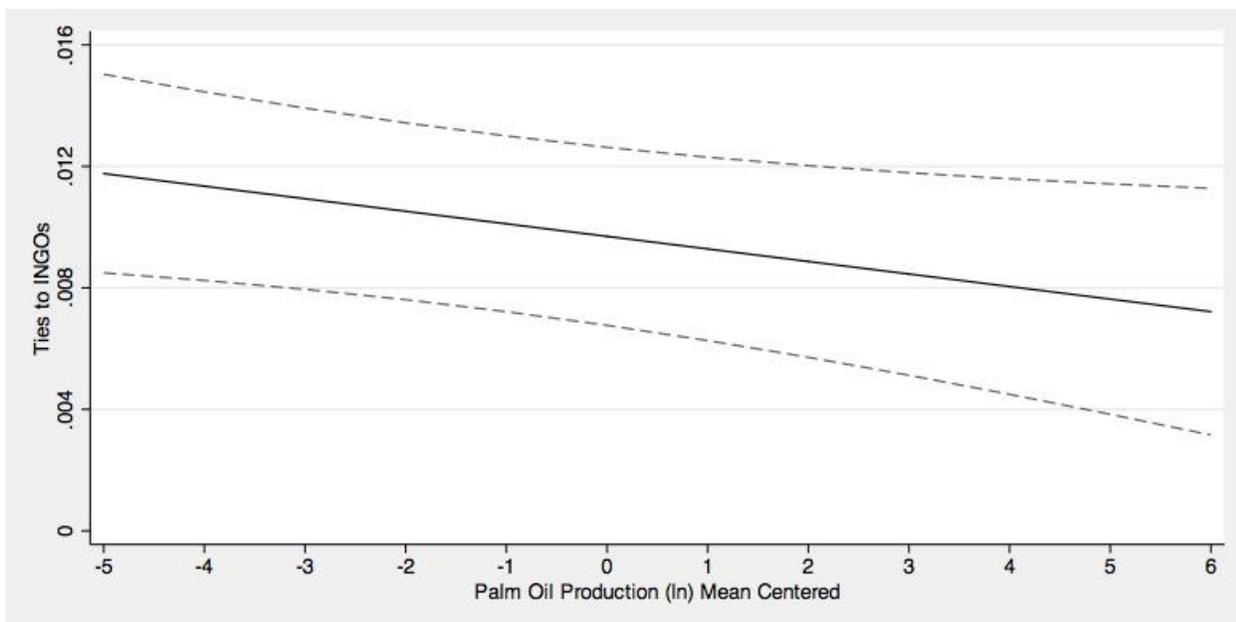
All of our control variables are consistent across both models and results are similar to previous research. Population increase is associated with less primary forest area, whereas total forest area, protected land, GDP per capita and percent urban population are associated with more

primary forest. The only variable that did not reach statistical significance is total exports. In sum, our analyses indicate the importance of national ties to INGOs in mediating rates of forest loss among palm oil producers. Theoretically, results of our study suggest that national exposure to environmental norms institutionalized at the global level temper the environmentally harmful effects of ecological unequal exchange.

Discussion

Results of our study indicate that while the process of palm oil production in the periphery of the world system has significant damaging effects on the natural environment, that damage is mitigatable. Projected increases in the demand for palm oil products for both industrial and foodstuffs suggest the urgency for developing solutions to its negative impact on the natural environment. We consider several policy and practical implications of our findings that complement the theoretical perspectives we engage. We suggest that states, international nongovernmental organizations (INGOs), and international financial institutions (IFIs) can all meaningfully contribute to mitigating palm oil-related deforestation.

World society theory is focused on the overall context in which nation states are embedded and how that context shapes state structures and activities. However, within this context we can conceptualize of INGOs as actors with specific objectives. Several large INGOs, Friends of the Earth and Greenpeace, for example, are dedicated to a wide range of environmental issues. Notably, both highlight the specific environmental problem of palm oil production and its effects on species endangerment and climate change respectively (Friends of the Earth 2005; Greenpeace 2007). Nongovernmental efforts for sustainable production have the potential to contribute to improved environmental practices in palm oil producing countries. The Roundtable on Sustainable Palm Oil, for example, has seen improvement in forest loss and other environmental consequences of palm oil production among its voluntary participants (Garrett et al. 2016). However, it has a very low adoption rate.

Inequalities within the world system as they relate to global capitalism and unequal exchange are central to the problem of palm oil-driven deforestation. Expectations for economic development persist alongside environmental norms. Given the tension inherent in "sustainable development" and that peripheral countries develop economically while minimizing environmental damage, material resources are crucial for success. The international community, and perhaps IFIs in particular, should provide support for sustainable cultivation of palm oil. The projected increase in the use of palm oil as a biodiesel base and the likely investments coming from international financial institutions suggests the importance of governmental support for mitigating its harmful effects in the periphery. However, thus far, IFIs have contributed mostly to destructive palm oil production practices. Political and economic incentives from the Association

of Southeast Asian Nations (ASEAN), for example, reinforce environmentally destructive production in these areas (Stampe and McCarron 2015).

Additionally, individual states have potential to reduce forest loss through policy implementation and enforcements. However, current efforts are largely ineffective. For example, a compromise between the desire for constant expansion and the need for environmental protection has led to schemes where palm oil plantations are permitted to expand if they protect smaller patches of natural areas known as "forest fragments." In addition to being ineffective at protecting biodiversity (Edwards et al. 2009), forest fragment schemes do not address the underlying unequal exchange conditions that push for endless accumulation and expansion of land use for the cultivation of crops. A key insight of the ecological unequal exchange approach to development lies in considering the whole of the global capitalist system. Successful reduction of forest loss and reforestation requires changes in palm oil consumption trends worldwide.

In the meantime, peripheral states should focus on increasing outputs of staple crops grown for national consumption while limiting the areas that are used for export cultivation instead of promoting "sustainable" expansion programs like forest fragment protections. This might be achieved via government subsidies for staple crop production and penalties for land-clearing for the production of palm oil and other commodities. Research has shown that increasing staple crop yield is linked to less per capita agricultural land use and more forest area; however, this effect is strongest in nations with an adequate food supply that do not expand other forms of agricultural land use (Ewers et al. 2009). A sound policy to use less land, therefore, could lie also in a solution to increasing steady food supplies in developing countries which may reduce pressure to expand export commodities such as palm oil. In all, we suggest that a combination of state and non-state support for sustainable palm oil production has the potential to generate closer coupling between environmental norms and forest loss trends across the periphery.

Conclusions

We conclude with the specification of three distinct but related contributions of this study followed by suggestions for future research to extend this line of work. Results of this study contribute to development and environmental sociology with 1) the integration of two largely siloed perspectives on macro social change; 2) a challenge to previous assumptions that global institutions are inconsequential in the periphery; and 3) a specific focus on theoretically relevant cases. We situate the longstanding exploitation of the periphery and its natural resources in the global context of changing environmental norms. Drawing on insights from the theories of ecological unequal exchange and sociological institutionalism enables us to examine the interaction between material and normative processes that relate to environmental outcomes. With a focus on the world's palm oil producers, we take a targeted approach to examining how

subordination in the global economy mediates the extent to which environmental norms and practices are coupled.

Our study provides evidence for the relevance of institutional ties in the periphery and examines how the processes of ecological unequal exchange mediate the relationship between the strength of institutional ties and environmental practices. Among the top palm oil-producing countries, stronger ties to global institutions predict lower levels of forest loss. However, this effect is not uniform across this population. Rather, the relationship between norms and practices is heavily mediated by the extent of production. We find that environmental norms are more strongly coupled with environmentally friendly practices where extractive production is lowest. Increases in production decrease the degree of coupling between norms and practices. However, even in the cases of Indonesia and Malaysia, where palm oil production is substantially higher than any other producer, ties to world society are significantly related to reduced forest loss.

We conclude that while subordination in the global stratification system is generally negative for the natural environment, changes in environmental norms can reduce this consequence. Likewise, we conclude that while the material needs of economic development can outweigh normative commitments to environmental protection, reduced extractive production can enable the tighter coupling between norms and practices. Historically, continued economic development has not affected forest loss in a strictly linear manner. On the contrary, trends toward "reforestation" can follow an initial phase of deforestation (Rudel 1998). Our results suggest that national ties to world society may enable peripheral states' transition toward reversing previous trends in forest loss.

Theoretically, these findings suggest the importance of integrating political economic and institutional perspectives on the natural environment. Processes of unequal ecological exchange have a meaningful effect on the relationship between environmental norms and environmental practices. The extent to which norms and practices are coupled, even within palm oil producer in the periphery, are not uniform. The extent to which these countries are embedded in a global context is consequential for environmental practices. Therefore, the strength of national ties to global institutions in the periphery should be incorporated into institutional analyses. However, these ties should not be considered without context. The qualitative distinctiveness of the periphery as it relates to the global economy should also be accounted for.

This leads us to research implications for scholars of development focusing on environmental outcomes. We see several promising avenues for expanding upon this study. Future work might examine the relationships between global institutions and processes of ecological unequal exchange in the extraction of other natural resources and commodities; how these dynamics operate specifically in semiperipheral states; how normative and political economic pressures vary along global commodity chains spanning all world-system positions.

Additionally, more work should interrogate the complex dynamics of decoupling between cultural norms and practical outcomes related to the natural environment. This might include the elaboration on the tensions between normative expectations for continued economic development and increased environmental protections, for example. Future work might also expand on the scope of global environmental institutions and examine specific relevant intergovernmental organizations such as the United Nations Environment Programme and lending and aid practices of the World Bank and International Monetary Fund. Ultimately, the significant mediating effect of ties to global institutions on ecological unequal exchange suggest the importance of integrating these theoretical traditions in future empirical work.

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Disclosure Statement

Any conflicts of interest are reported in the acknowledge section of the article's text. Otherwise, authors have indicated that they have no conflict of interests upon submission of the article to the journal.

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