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Outcomes of Global Environmentalism: Longitudinal and Cross-National Trends in Chemical Fertilizer and Pesticide Use

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Previous research identifies changing world cultural norms as the impetus for a worldwide trend promoting environmentalism. However, the extent to which countries comply with the norms promoted and codified by environmental organizations and treaties has been less rigorously tested. Suspected noncompliance is generally explained as "decoupling" between policy and outcome. Here, I address the relationship between stated environmental objectives and practices and integrate world society and world-systems perspectives on the natural environment. Using random effects regression analyses of cross-national chemical fertilizer and pesticide use, I find that integration into world culture significantly predicts overall *decreased* use of these environmentally harmful products. However, the effect varies by zone of the world system, which supports an *integrated theory of global environmentalism*.

The protection and preservation of the natural environment constitutes a novel shift in cultural understandings of the relationship between societies and nature. Rather than a cornucopia of resources that can be extracted endlessly, the natural environment is increasingly seen as delicate, finite and warranting careful stewardship. With much of the shift occurring soon after World War II, this has manifested as the growth of both state and nonstate efforts toward environmentalism. Increasingly, citizens are joining international nongovernmental organizations (INGOs) with the direct aim of environmental protection. International environmental organizations such as the Audubon Society, Earth Rights International and Greenpeace continue to attract increasing numbers of citizen members worldwide. Likewise, states have taken steps to manage the effects of human populations and activities on the environment. The creation of national parks and environmental protection agencies represent state commitments to environmental protection. In addition, states are increasingly entering into inter-

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national agreements to reduce their negative effects on the environment. But how does this cultural transformation toward environmentalism affect actual environmental practices?

Sociological studies of global environmentalism are generally divided into neoinstitutional and political economy analyses. Rooted in neoinstitutionalism, the world society tradition emphasizes the positive effects of globalizing processes on the natural environment and focuses on changes in environmental policy. Previous research identifies changing world cultural norms as the impetus for a worldwide trend promoting environmentalism (Frank, Hironaka and Schofer 2000). Changing world cultural norms of rationalization, universalism and equality facilitate the widespread adoption of environmental policies. However, the extent to which countries comply with the norms promoted and codified by international organizations and treaties remains less rigorously tested as this line of research generally neglects environmental practices. Suspected and documented noncompliance is explained as "decoupling" between policy and outcome and remains peripheral to most studies in this tradition (Schofer and Hironaka 2005).

Political economy perspectives of the world-system, in contrast, tend to emphasize the harmful effects of globalization on the natural environment and pay particular attention to environmental practices. Researchers in this field have examined a wide range of environmental outcomes including greenhouse gas emissions (Grimes et al. 2003; Jorgenson 2003), mammal and bird biodiversity (Shandra et al. 2010), deforestation (Burns, Kick and Davis 2003; Shandra, Shircliff and London 2011), agrochemical use (Jorgenson and Kuykendall 2011) and the summary measure of "ecological footprints" (Dietz, Rosa and York 2007; Jorgensen 2003). Extending Wallerstein's (1974) research on the developmental exploitation of peripheral states by the core, political economists emphasize the significance of environmental exploitation that accompanies this process (Bunker 1984). World-systems research demonstrates the harmful effects of peripheral position, in the world economy on forests (Burns, Kick and Davis 2003) as well as the effects of foreign capital penetration on carbon dioxide (Grimes and Kentor 2003) and methane emissions (Jorgenson 2006).

In sum, for world society scholars, the role of organizations in institutionalizing environmentalism via isomorphic processes is key to understanding how globalizing processes affect the natural environment. In contrast, political economy scholars highlight the role of global capitalism in producing cross-national inequalities in extractive and degradation processes. Although their predictions are contrasting, I argue that these perspectives are not fundamentally contradictory. Rather, each highlights separate processes at the global level that affect environmental practices. Further, their integration can reveal new insights into the relationship between globalization and the natural environment. Recent research has taken the important steps of testing the effects of world culture on a variety of environmental outcomes (Schofer and Hironaka 2005) and integrating world society and political economy perspectives (Jorgenson Dick and Shandra 2011). Here, I extend this line of research by advancing a theory of world society outcomes and specifying the mechanisms by which cultural and political economic forces interact.

I proceed with a brief background on the role of agrochemical use in food production and its effects on the natural environment. I then review political economy and neoinstitutional perspectives on social change as it relates to the natural environment. I then argue for a closer dialogue between the two perspectives. In an integrated theory of global environmentalism, I argue that *differential decoupling* highlights the simultaneous forces of culture and political economy. Next, I test a series of hypotheses generated by world society and world-systems perspectives and an integrated perspective on global environmentalism using longitudinal panel multivariate regression analyses. Results indicate the relevance of world cultural integration on environmental practices and the significance of those effects depending on position in the world-system. I conclude with discussion of the implications of the findings.

Agrochemicals and the Natural Environment

A key component of the environmental preservation effort involves identifying the practices and products that contribute to its degradation and destruction. An extensive field of research identifies both chemical fertilizers and pesticides as harmful to the environment. For example, Zhu and Chen (2002) argue that synthetic nitrogen, a key component in chemical fertilizers, has become both less efficient in fertilizing crops and more environmentally harmful over time. Large-scale industrial agriculture, which depends heavily on agrochemicals, contributes to a wide range of ecological problems, especially in the global South (McMichael 2008). Increasing concentrations of nitrogen in ground and surface water damage local ecosystems (Zhu and Chen 2002) and create unbalanced mineral compositions in soil and the crops grown on that soil (Foster 1999). Further, a 2009 study conducted by the Earth Institute at Colombia University revealed that 58 percent of the "carbon footprint," a summary measure for effect on the natural environment, for *Tropicana* orange juice production, distribution and consumption came from application of nitrogen fertilizers during the growing process (compared with 37% on packaging *and* distribution combined).

Likewise, chemical pesticides directly and indirectly harm the natural environment and human health. They are linked to ground and surface water contamination, fishery losses and the reduced survival, growth and reproductive rates of wild birds (Pimentel et al. 1992) as well as a variety of cancers in humans (Magdoff, Foster and Buttel 2000). Reliance on agricultural chemicals in industrial agricultural production results in damage to natural ecosystems, which ultimately threatens the capacity to increase agricultural yields (Foster 1999). Additionally, Pimentel et al. (1992) highlight the importance of indirect effects of chemical pesticides on agricultural production such as the poisoning of bees, which reduces pollination and thereby crop yields and crop quality. Further, the United Nations recently advocated for "integrated pest management techniques" in order to reduce the use of agrochemicals and their damage to the natural environment and agricultural laborers (FAO 2011:57). With an abundance of scientific research concluding for the negative effects of agrochemical

use on human and animal populations as well as the natural environment, the stage is set for changing patterns of their usage.

In the context of growing concern for the health of the natural environment backed by scientific research and emphasized by international regulatory bodies such as the FAO, numerous environmental organizations and international treaties arose with the objective of curbing the usage of agrochemicals. Beginning in the twentieth century, international nongovernmental organizations (INGOs) specifically addressing global environmental concerns emerged and have since proliferated and nation-states worldwide have adopted environmentally friendly policies despite often competing interests between states and environmentalism (Frank et al. 1999; Schofer and Hironaka 2005). However, with agricultural production increasing over time, and given that the use of both chemical fertilizers and pesticides has contributed substantially to the recent increases in food production (Pimental et al. 1992; Zhu and Chen 2002), the economic incentive to use both remains high. As a result, a great deal of skepticism surrounds the effectiveness of environmental organizations and treaties (Gareau 2008; Park, Conca and Finger 2008). Many countries have been relatively quick to assert their commitment by joining environmental associations and participating in legal efforts to protect the environment. However, they seem to implement their newfound environmentalism at a much slower pace.

There is, therefore, simultaneously a great deal of pressure to use agrochemicals *and* substantial efforts to curb their usage. These contrasting pressures make the cases of chemical fertilizer and pesticide consumption particularly useful for comparing the effects of global cultural and global political economic forces on national environmental practices. Growing demand for agricultural products paired with the decreased effectiveness of chemical fertilizers and pesticides over time results in increasing political economic pressure to use both. At the same time, world cultural norms promoting environmentalism act as counter forces encouraging the reduction of agrochemical use. Here, I analyze how these forces interact at the global level and affect environmental practices cross-nationally over time. I use the cases of national-level chemical fertilizer and pesticide use to incorporate cultural and political economic theories of globalization and the natural environment and advance a theory of world society outcomes as well as an integrated theory of global environmentalism.

Environmental Social Change

While remaining largely separate within the sociological literature on the natural environment, political economy and neoinstitutional perspectives each emphasize global-level processes. Below I review their separate emphases and then argue for the utility of combining the two perspectives.

A Political Economy Theory of Change

Within the political economy tradition, world-systems perspectives of the natural environment posit that entrenched interests block improvement in environmental conditions. This perspective highlights the exploitative nature of global capitalism

that has historically favored some nation-states at the expense of others, which ultimately results in a very stable global stratification system (Wallerstein 1974). The global capitalist economy, formed as late as the 16th century, creates a rather rigid stratification system where mobility is largely determined by trade relationships and geopolitical power (Chase-Dunn 1989). National-level development and environmental outcomes derive from these global economic and political relationships. Research in this field highlights the negative environmental consequences of international political economic relationships for developing countries (Jorgenson and Kuykendall 2008). As a result, environmental degradation persists despite collective knowledge of its consequences because of the structure of global capitalism.

Political economy perspectives of agro-food production highlight the role of global capitalism in facilitating widespread environmental degradation (Goldfrank et al. 1999; Rice 2007) and the differential power relations in the world-system in the development of global agriculture (Friedmann 2000). From this perspective, current ecological and humanitarian crises trace their roots to the advancement of the modern world-system (Friedmann 2000; Magdoff, Foster and Buttel 2000), where a disproportionate amount of damage to the environment and human health affects peripheral areas of the world-system through a process of unequal ecological exchange (Rice 2007). Cross-national research within this field demonstrates the harmful environmental effects of international debt on deforestation (Shandra, Shircliff and London 2011) and biodiversity (Shandra et al. 2010) and of foreign investment dependence on agrochemical use (Jorgenson and Kuykendall 2008) among developing countries.

Therefore, for this perspective, international relationships are crucial to national-level outcomes generally. In the case of agrochemical use, agricultural production is both more profitable and environmentally harmful under industrialized cash crop systems compared with subsistence agricultural systems that use few or no harmful chemicals. National economies that depend more heavily on agriculture to promote development are more likely to engage in industrialized agriculture that uses chemical fertilizers and pesticides. Therefore, those countries that specialize in industrial agriculture for export will harm their local natural environments to improve their economic standing.

Hypothesis 1 (World-Systems): increased agricultural goods as a percentage of total exports will increase agrochemical use.

An Institutional Theory of Change

Like political economy theories, neoinstitutional theory in sociology has paid a great deal of attention to the role of globalization in environmentalism. This perspective argues that the world is constituted as a singular polity that is constituted by a world culture (Boli and Thomas 1999). The overarching world culture, which is the exogenous force that shapes the nation-state, creates structural homology cross-nationally (Meyer et al. 1997). The world culture becomes embedded in social organizations (Boli and Thomas 1999). Research in this field demonstrates that nation-states that are most integrated into the world

culture are more likely to take measures that align with world cultural norms, including environmentalism (Frank, Hironaka and Schofer 2000). However, this perspective has been criticized on the grounds that it fails to deal with real social change, or changes in behavior and practices rather than values only. World-systems theorists charge that states' participation in international environmental treaties is only relevant to the extent that states abide by those agreements.

Neoinstitutional theorists refer to this phenomenon as "decoupling," or the disjuncture between stated objectives and actual practices. Decoupling between intentions and results, they argue, is a central property of the culturally constituted nation-state and should be expected given the lack of institutional capacity, especially in weak states, to live up to world cultural models of rational actorhood (Meyer et al. 1997). Previous research addresses decoupling in a variety of areas including women's rights (Boyle, Songora and Foss 2001) environmental protection (Frank, Hironaka and Schofer 2000), human rights (Hafner-Burton and Tsutsui 2005) and health care (Inoue and Drori 2006). However, very little work scrutinizes the phenomenon directly. Rather, the majority of research focuses on policy change as the outcome analyzed (Frank, Hardinge and Wosick-Correa 2009, for example). In a notable exception, Schofer and Hironaka (2005) identify circumstances under which institutions will affect policy enactment, or in which decoupling will be minimal. A series of world-level analyses identifies highly structured institutions, the penetration of institutions to multiple levels and their persistence over time as the central conditions under which decoupling is diminished.

Here, I build on this work and argue that change in laws and discourse does result in change in practices. However, this is not a linear relationship between one law and the specific outcome it is meant to address. Rather, pressures in multiple directions promote change in outcomes. Where world-systems theory conceives of interests as primordial and understood by everyone, neoinstitutional theory sees interests as depending on institutional structure. The structure, in the case of environmentalism, includes institutions such as the United Nations Environmental Program, environmental laws, treaties, IGOs and ministries. Problems are defined within these institutions that disseminate a common set of standards for solutions, which increases monitoring and attention to those problems (Barnett and Finnemore 2004; Meyer 1997). These institutions change the calculation of interests. Further, I argue that the role that these institutions play is crucial to achieving the desired outcomes. Agenda setting by institutions is important outside of compliance because agents can press for change once laws and structures are in place.

Hypothesis 2 (World Society): participation in environmental IGOs, INGOs and treaties is associated with decreases in the use of environmentally damaging agrochemicals.

Integrating World-Systems and World Society Perspectives

While initial steps have been taken to examine the role of conflict within the world society (Beckfield 2003, 2010) and the role of culture within the world

economy (Gareau 2008), there remains a distinct gap between literature that focuses on political economic forces and that which highlights cultural forces. In a notable exception, Jorgenson Dick and Shandra (2011) engage both world economy and world society perspectives in their analyses of CO_2 emissions, water pollution and deforestation. Their results suggest the usefulness of engaging the two central perspectives in environmental sociology. I extend this research with the theoretical integration of power, conflict and culture at the macro-level of analysis and specify the mechanisms by which these forces interact below.

World-systems research identifies global capitalism as the driving force behind international development and environmental inequalities. With the focus on the material bases of production, this perspective highlights the role of states and relationships between states in creating cross-national inequalities in extractive and degradation practices (Frank 1998). Neoinstitutionalism in sociology focuses on the similarities in institutional structures at the state level *despite* the extent of development inequalities between states. This culturally oriented perspective highlights the role of institutions and nonstate actors and their structurally homogenizing effects on disparate nation-states through global processes. From this perspective, international nongovernmental organizations (INGOs) can act as counter-hegemonic forces, or counter to the interests of global capitalism focused on by political economy scholars, in that they have goals that are not determined by the state *and* contrary to state interests (Boli and Thomas 1999).

Further, from a world-systems perspective, the causes and consequences of environmental degradation vary primarily by zone of the world-system. As raw materials are extracted from the periphery for production, often elsewhere in the periphery or semiperiphery, consumption in the core and finally disposed of back in the periphery, developing nations disproportionately feel the effects of environmental degradation fueled by global capitalism (Bunker 1985; Gereffi 1995). Accordingly, much of the empirical research in this field test the effects of position in the global economic hierarchy. Although a wide range of dependent and independent variables have been scrutinized, the common theme is that effects vary by zone. For example, in predicting patterns of deforestation, Burns, Kick and Davis (2003) find that world-system position is a key factor. Likewise, Jorgensen (2004) finds that the effects of urbanization, domestic income inequality and literacy rates differently affect per capita ecological footprints depending on world-system position.

As neoinstitutionalists document the rise of environmental organizations and regulations (Frank et al. 1999; Frank, Hironaka and Schofer 2000), world-systems scholars emphasize differential patterns in treaty participation and domestic legislation enactment by zone, where newly industrializing countries tend to have fewer environmental regulations in general (Smith 1994). Within the semiperiphery, the potential for economic development paired with adequate resources to produce under environmentally detrimental conditions results in less environmental regulation (Burns, Kick and Murray 1994; Kick et al. 1996).

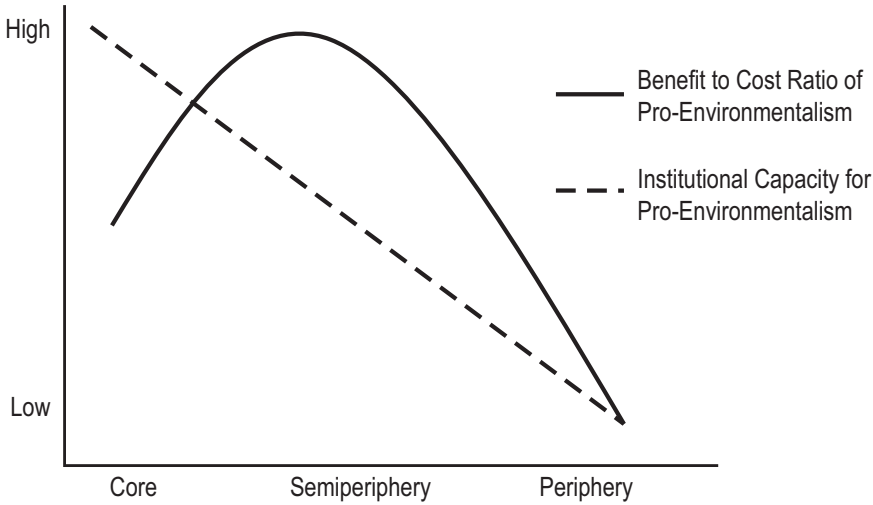
Although they focus on different processes, both political economy and neoinstitutional theories in sociology locate the impetus for world historical development outside of individual states. Neoinstitutionalism in sociology points to a world polity that encompasses all nation-states, which are then shaped by the larger cultural norms (Meyer et al. 1997). The political economy perspective highlights the role of relationships between nation-states in creating development and environmental inequalities (Chase-Dunn 1989; Jorgensen 2005). Together, these perspectives make a case that there are both striking dissimilarities and similarities in the world system. Although these perspectives predict contrasting outcomes of globalizing processes, they are not necessarily contradictory. Rather, both realist and phenomenological processes can and likely do work simultaneously (Meyer 2008). I argue that, given the importance of both cultural and political economic forces and multiple points of theoretical compatibility between neoinstitutional and political economy perspectives, it is useful to consider both types of processes to reveal a more complete picture of the effects of globalizing processes on environmental change.

To that end, I propose an integrated theoretical model of understanding global environmental change. In an extension of world society theory, I argue that integration into global culture, as evidence by memberships in environmental INGOs and participation in international environmental IGOs and treaties, does matter for actual environmental outcomes. Change in values is an essential prerequisite to change in practices. However, I do not expect cultural integration to affect environmental practices uniformly across all nations. Following world-systems theory, I argue that such effects will vary by zone of the world system. Variation in the material benefits of adopting and the ability to enforce pro-environmental practices at the national level will affect the impact of world cultural integration by zone. I conceptualize this as an interaction between power relationships in the global hierarchy and world cultural forces.

The key intersection between culture and political economy lies in the effect of nation-states' material interests and capabilities on the extent of decoupling between their official policies and actual practices on the use of agrochemicals. On the one hand, world-systems scholars emphasize the variation in the organization of production where the core specializes in capital-intensive production, the periphery in labor-intensive production and the semiperiphery in a combination of the two, which affects countries' development prospects and relationships to the world economy (Wallerstein 2004). On the other hand, world society scholars emphasize the broad adoption of new world cultural norms while acknowledging varying degrees of decoupling, or disjuncture between policy and practice (Meyer et al. 1997). Taken together, the result is *differential decoupling by zone of the world-system* where there is more economic incentive to violate environmental policies in more labor-intensive economies outside of the core. The relationship between sources of decoupling and the world-system hierarchy is illustrated in Figure 1.

Decoupling is largely explained in terms of willingness and ability to enforce policies and norms (Sauder and Espeland 2009). Given their economic costs, the primary incentive to adopt pro-environmental practices is the enhanced legiti-

Figure 1. The Roots of Differential Decoupling by World-System Zone



macy in the international system they provide. When the economic costs outweigh the benefits of legitimacy, states become less willing to enact environmental practices. This cost-benefit ratio, and therefore willingness to enforce policies, varies by zone curvilinearily, where the benefits of legitimacy via integration into world culture outweigh the cost of enforcement in the semiperiphery but not in the core or periphery. Semiperipheral countries are potentially upwardly mobile in the hierarchy of the world economy. Legitimacy in the international system gained by pro-environmental practices can facilitate much desired upward mobility. Core countries, in contrast, are less in need of legitimacy gained via participation in the international system because they are already located in a relatively advantaged position that is unlikely to be jeopardized by individual failures to integrate. However, the cost of implementing pro-environmental practices in the core is not terribly high relative to total resources making the cost-benefit ratio somewhat neutral. Finally, the extreme marginalized position of peripheral countries in the world economy renders this type of legitimacy ineffectual in catalyzing their upward mobility.[1] This zone of the world-system requires much more than cultural integration to facilitate economic growth.

In addition to willingness, ability is an essential component explaining the extent of decoupling generally. Lack of enforcement capabilities is frequently cited as the primary mechanism of decoupling (Hafner-Burton and Tsutsui 2005). Given the lack of enforcement agencies at the international level, the responsibility of policy and norm enforcement lies entirely with individual nation-states. However, domestic institutional capacity varies a great deal by world-system zone. The relationship between integration into the world economy and domestic institutional capacity is negative so that core position is highly correlated with greater institutional capacity and peripheral position, is highly correlated with weaker domestic institutional capacity. Therefore,

core countries that adopt pro-environmental policies experience relatively little decoupling between policy and practice. Semiperipheral countries are less able to enforce pro-environmental practices, and therefore should experience greater decoupling. Finally, peripheral countries lack the domestic institutional capacity to comply with any pro-environmental norms they have adopted, and therefore demonstrate the largest degree of decoupling.

The combination of curvilinear benefits of legitimacy and negative slope of capacity creates a diminishing but negative effect of environmental regime integration by zone. Although the cost-benefit ratio of practicing environmentalism is somewhat neutral in the core, when core countries do adopt pro-environmental norms they have the ability to enforce them via strong domestic infrastructures. The semiperiphery has much to gain materially by increasing their legitimacy in the international system. However, ability of semiperipheral countries to enforce such policies is lower than in the core that should result in weaker effects of integration into the environmental regime. Finally, peripheral countries do not have much to gain from or the capacity to enforce pro-environmental policies. The former point is consistent with the overall low rate of cultural integration for the periphery. But more importantly for this analysis, the latter point suggests that for those peripheral countries that do participate in the world environmental regime, decoupling between intention and practice will be the greatest.

Hypothesis 3 (Integrated Theory of Global Environmental Change): The effects of world cultural integration will vary by world-system position such that decoupling between norms and policies promoted by environmental IGOs, INGOs and treaties and environmental practices is lowest in the core and highest in the periphery.

Hypothesis 3a: decoupling between environmentalism and environmental practices is lowest in the core.

Hypothesis 3b: decoupling is moderate in the semiperiphery.

Hypothesis 3c: decoupling is greatest in the periphery.

Data

For these analyses I use an unbalanced panel of longitudinal cross-national data on national-level use of agrochemicals. I include all countries that have available data. Countries in the analysis include all major regions of the world and all development levels. However, like most cross-national data, data on agrochemical use is disproportionately limited in the least developed countries. The analyses focus on the post–World War II era in which both agricultural production (and therefore pressure to use agrochemicals) and world cultural norms promoting environmentalism (and therefore pressure to curb their usage) expanded greatly. Cross-national chemical fertilizer use is widely recorded during this time period, which allows analyses to run from 1961 to 2006. However, data on chemical pesticide use is more limited, restricting the analyses from 1983 to

2004.[2] Using indicators of world society theory, world systems theory and an integrated theory of global environmentalism as well as a series of controls, I test the effects on both chemical fertilizer and pesticide use over these time periods. Each of the indicators, with their definitions and sources are listed below. Descriptive statistics for all variables are shown in Table 1.

Dependent Variables[3]

Chemical Fertilizer Use

Fertilizer consumption is measured as the total quantity, in metric tons, of chemical fertilizer consumed in a country for each year. Data are from the International Fertilizer Industry Association's online database at www.fertilizer.org, which provides annual data from 1961 to 2006. They include the sum of nitrogen, phosphate and potash, except for select countries where only nitrogen data are available.[4]

Chemical Pesticide Use

Pesticide consumption is measured as the total quantity of products consumed with pesticidal active ingredients. In a formulated pesticide, active ingredients are often mixed with inert ingredients, which aid or dilute delivery of the active ingredients. Pesticide consumption data are from the United Nations Environmental Program (UNEP) Environmental Data Report (1987), which provides a 3-year average for 1983, and the UNEP Food and Agriculture Organization online database (www.fao.org), which provides yearly data for 1990–2005.

Independent Variables

Environmental Regime Index

Previous research within the neoinstitutionalist tradition has identified membership in IGOs and INGOs and participation in international treaties as indicators of integration into the world culture (Boli and Thomas 1999; Schofer and Hironaka 2005). Further, pro-environmental structures such as international organizations and treaties dedicated to environmentalism represent a key condition for institutions to affect environmental outcomes (Schofer and Hironaka 2005). Following Schofer and Hironaka (2005), I create an environmental regime index that includes state (intergovernmental organization [IGO] and treaty) and citizen (INGO) integration into the world environmental regime. I use the measure of IGO and international nongovernmental organization (INGO) memberships coded by Frank, Hironaka and Schofer (2000), also used by Schofer and Hironaka (2005). Likewise, I include a measure of treaty participation, which I collected. I include treaties for fertilizer and pesticide use separately, which most specifically relate to the outcomes under consideration. Each index includes data for environmental INGO memberships and participation in treaties that regulate the use of either chemical fertilizers or pesticides. To create the indices, I sum the z-scores of environmental INGOs and treaty participation for either fertilizer or pesticide use. Details on the component data are listed below.

Table 1: Descriptive Statistics

Variable	Mean	Standard Deviation	Minimum	Maximum
Fertilizer Analyses (N = 2987)				
Fertilizer[a] (metric tons)	1162.81	3755.20	.001	50,151.39
Population[a] (10,000s)	4120	13000	17.899	131,000
Agricultural land area[a] (hectares)	38425.83	92258.17	53.998	558,438.4
GDP, pc[a] (constant 2000 USD)	6092.94	8477.84	2.983	54,629.02
Environmental regime index	.017	1.910	-1.288	8.095
Agricultural exports[a] (% all exports)	1.163	2.977	.001	48.336
Core	.0523	.394	-.140	.860
Semiperiphery	.048	.463	-.281	.719
Periphery	.048	.494	-.374	.626
Environmental regime index × core	.032	1.374	-1.616	7.767
Environmental regime index × semiperiphery	-.013	.917	-1.290	6.722
Environmental regime index × periphery	-.008	.646	-.909	3.611
Pesticide Analyses (N = 829)				
Pesticide[a] (metric tons)	22970.42	53135.17	.001	535399.9
Population[a] (10,000s)	3940	12500	4.890	131,000
Agricultural land area[a] (ln)	38763.08	90532.94	51.000	558,438.4
GDP, pc[a] (constant 2000 USD)	5692.69	8084.71	2.983	54,629.02
Environmental regime index	.040	1.821	-1.715	9.410
Agricultural exports[a] (% all exports)	1.232	3.104	.001	48.336
Core	.019	.367	-.140	.860
Semiperiphery	.053	.472	-.281	.719
Periphery	.070	.497	-.374	.626
Environmental regime index × core	.020	1.185	-1.180	9.188
Environmental regime index × semiperiphery	.034	.997	-1.689	8.064
Environmental regime index × periphery	.002	.794	-1.444	4.467

[a] Log transformed in all analyses.

International Environmental Organizations

International environmental organization data are based on a sample of INGOs and IGOs from the *Yearbook of International Organizations* and range from 1965 to 2005. They report the total number of different environmental organizations that a country is linked to via citizen memberships in a given year, in which one citizen member is the threshold for membership. An organization is coded as dealing specifically with the natural environment if it expressly states so in its organization description. The measure includes only IGOs and INGOs that deal with environmental issues specifically to test the claim that international organization memberships affect environmental practices.

International Environmental Treaties on Fertilizer Use

International Environmental Treaty membership represents the total number of environmental treaties that deal with fertilizer regulation signed onto for each year from 1961 to 2006. Treaties must specifically mention fertilizer use to be included in the dataset. Data are from *EcoLex: Gateway to Environmental Law* online database at www.ecolex.org. There are a total of three international treaties dealing specifically with chemical fertilizer use. The treaties have 8, 40 and 93 members and year of adoption ranges from 1950 to 2010.

International Environmental Treaties on Pesticide Use

International Environmental Treaty membership represents the total number of environmental treaties that deal with pesticide regulation signed onto for each year from 1961 to 2006. Treaties must specifically mention pesticide use in order to be included in the dataset. Data are from *EcoLex: Gateway to Environmental Law* online database at www.ecolex.org. There are a total of six international treaties dealing specifically with chemical pesticide use. They range from 23 to 178 country signatories with a mean of 119. Pesticide treaty adoption ranges from 1953 to 2008.

Agricultural Raw Material Exports, (ln)

To test the effects of integration into the world economy on environmental outcomes, I measure per capita agricultural exports. In keeping with our world polity measures, I consider the type of exports that would directly relate to fertilizer and pesticide consumption. The agricultural exports indicator measures the exports of agricultural raw materials as a percent of all merchandise exported in each year, which captures the relative importance of agricultural production for a country as it relates to the world economy. These data are from the World Bank's *World Development Indicators (2010)*.

World-System Position

I classify all countries in the analysis into three discrete positions of the world-system: core, semiperiphery and periphery. Although complex indices including indicators such as military power and investment relationships are occasionally

included in calculating world-systems position (Kentor 2000), I use per capita gross domestic product (GDP), which is the most straightforward proxy for world-system position and also correlates very highly with other more complex measures (Van Rossem 1996). I base the classifications on average per capita GDP during the time period 1961-2006. With the exception of Saudi Arabia and Qatar, which most classification schemes place in the semiperiphery despite relatively large per capita incomes, I assign all countries with per capita GDPs exceeding $10,000 to the core; between $1,000 and $10,000 to the semiperiphery; and below $1,000 to the periphery. World-system position is first indicated by a dummy variable and then mean centered. Because of wider availability of data in richer countries, the number of observations is approximately equal for each zone despite a greater number of country memberships in the lower tiers of the hierarchy. See Appendix Table A for a complete list of position classification with mean GDP and number of contributing data points.

Interaction Effects

To test the integrated theory of environmental change, I interact the environmental regime index, for fertilizers and pesticides separately, with each of the positions in the world-system. All interaction terms use the data for environmental regime index and world-system position described above. Each interaction term will indicate the effect of integration into world culture for that specific zone of the world-system. Together, the interaction effects will indicate if the effects of world culture are consistent globally or if they vary by world-system position.

Control Variables

I control for agricultural land area, population and per capita gross domestic product. Agricultural land area is measured as the sum of arable land and permanent crops, plus permanent pastures.[5] Data are from UNEP's Food and Agricultural Organization online database (www.fao.org) and range from 1961 to 2006. Data for population and GDP are from The World Bank's *World Development Indicators (2010)* and range from 1961 to 2006.

Methods

I conduct cross-national time series regression analyses on chemical fertilizer and pesticide consumption using a random effects model. With cross-sectional data over time, such as these, observations are clustered by case and highly contingent on observations at previous points in time. It is common for time invariant unmeasured factors that differ across countries to be present in cross-national longitudinal data (Alderson and Nielsen 2002). Panel regression techniques correct for this by considering variables on two dimensions: cross-sectional units of observation and a temporal reference. I employ the Hausman test as postestimation diagnostic on all models, which indicates that random effects models (REMs) are most appropriate for these data. The diagnostic confirms that the unit effects and the explanatory variables are not correlated in these analyses,

which indicates preference to the more efficient REM over a more conservative fixed effects model (Halaby 2004).

REMs control for some unmeasured heterogeneity while allowing for the consideration of some cross-national differences. Estimating the random effects model is equivalent to using ordinary least squares regression analysis after removing a portion of the country-specific means. The random effects model includes a random error, v_i, that is constant over time and a random error, e_{it}, that is specific to each case. Because the theoretical objectives of this research center on between-country effects and postestimation diagnostics indicate that there is not a great deal of unmeasured country-specific heterogeneity in the models, I model the data using random effects, represented by the equation below.

$$Y_{it} = \alpha_i + \beta_1 X_{1it} + \ldots + \beta_n X_{nit} + e_{it} + v_i$$

In addition, outliers and influential cases are often a problem with longitudinal cross-national data (Alderson and Nielsen 2002). I employ the added-variable plot in order to identify outliers in the data. The added-variable plot graphs the relationship between independent and dependent variables, after controlling for the effects of the other independent variables (Frees 2004). I assessed the presence of outliers in the data for each dependent variable separately with all independent variables included in the model. I identified and removed five outliers for fertilizer consumption (Kuwait, Nigeria, Saudi Arabia, Qatar and Bosnia) and four outliers for pesticide consumption (Tanzania, Iceland, Kuwait and Burundi).

For each dependent variable, I begin with an analysis that includes controls only to assess the stability of the models. I then add the variables to test Hypotheses 1 and 2. Finally, I add the interaction terms, each in a separate model. To test Hypothesis 3, that the effects of integration into the world environmental regime varies by world-system zone, I sum the coefficients for environmental regime index with the interaction term. An *F*-test then determines whether the resulting coefficients are significantly different from zero.

Findings

Cross-national longitudinal random effects regression analyses for chemical fertilizer and pesticide use are reported in tables 2 and 3, respectively. For all main terms, negative coefficients indicate decreased agrochemical usage and, therefore, pro-environmental practices. First, consistently positive and significant coefficients for agricultural exports support Hypothesis 1. From a world-systems perspective, increased integration into the world economy is associated with increased use of both agricultural chemicals. This suggests that demands of economic growth and participation in the global economy via agricultural production play an important role in environmental practices. Consistent with world-systems expectations, I find that global capitalism as it relates to agriculture does result in increased use of environmentally harmful agrochemicals.

Table 2: Random Effects Model of Cross-National Chemical Fertilizer Use, 1961-2006

	Model 1	Model 2	Model 3	Model 4	Model 5
World Society					
Environmental regime index		-.142*** (.005)	-.115*** (.009)	-.150*** (.005)	-.144*** (.005)
World-Systems					
Agricultural exports, % all exports (ln)		.121*** (.020)	.124*** (.020)	.116*** (.020)	.126*** (.021)
Core		.389† (.231)	.406† (.232)	.405† (.230)	.197 (.191)
Semiperiphery		.214 (.228)	.190 (.229)	.206 (.228)	
Periphery					-.178 (.125)
Interactions					
Environmental regime index × core			-.041*** (.009)		
Environmental regime index × semiperiphery				.041*** (.010)	
Environmental regime index × periphery					.034 (.025)
Controls					
GDP, pc (ln)	.421*** (.050)	.541*** (.052)	.531*** (.052)	.543*** (.051)	.532*** (.053)
Agricultural Land Area (ln)	.091* (.062)	.099 (.061)	.094 (.061)	.084 (.061)	.120† (.063)
Population (ln)	1.204*** (.049)	1.313*** (.049)	1.286*** (.049)	1.309*** (.048)	1.290*** (.054)
Constant	-20.89*** (.659)	-21.42*** (.768)	-20.82*** (.792)	-21.23*** (.773)	-21.04*** (.835)
N_{total}/N_{group}	2987/86	2987/86	2987/86	2987/86	2987/86
Wald chi^2	2876***	2910***	3027***	2981***	2959***
R^2 within	.5242	.5593	.5609	.5609	.5593

R^2 between	.7250	.8014	.8045	.8037	.8081
R^2 overall	.7174	.8095	.8125	.8106	.8111

Note: *** $p < 0.001$ ** $p < 0.01$ * $p < 0.05$ †$p < 0.1$
All variables are mean-centered; Robust standard errors in parentheses.

However, the same models show consistently negative and significant coefficients for the environmental regime index. This supports Hypothesis 2, that integration into the world culture predicts decreased use of both chemical fertilizers and pesticides globally. This suggests that changes in values—in this case moves toward environmentalism—do affect practices in the same direction. Citizen-level and state-level adoption of environmental values translates to overall reduction in agrochemicals. As such, these models lend support for both world-systems and world society hypotheses and indicate that attention to both cultural and economic forces is important for understanding global environmental outcomes.

However, simultaneous support for political economic and cultural perspectives on globalization and the natural environment does not address how these forces interact to affect environmental practices. To address this issue, I propose an integrated theory of global environmentalism, which I test in Hypothesis 3. In the integrated theory, I argue that a pro-environmental culture matters for concrete outcomes, but that this effect varies by world-system position or level of integration into the world economy. Negative and significant interaction effects in the core, positive and significant interaction effects in the semiperiphery and insignificant interaction effects in the periphery indicate initial support for the integrated theory of global environmentalism. However, the interaction effects alone are insufficient to address Hypothesis 3. The effect of integration into the world culture promoting environmentalism is the sum of the coefficients for environmental regime index and its interaction with each position in the world-system. The effects are illustrated in Figure 2.

Models 3 and 8 test Hypothesis 3a, the effects of integration into the environmental regime on chemical fertilizer and pesticide use respectively, for core countries. In each model, a negative environmental regime index indicates an overall effect of reduced use of agrochemicals. The addition of a significantly negative interaction effect indicates that the effect of environmental culture is additionally strong, or that decoupling between environmentalism and environmental practice is lower than average, in the core. An *F*-test indicates that the sum of the main effects with their corresponding interaction terms is significantly different than zero. This is consistent with Hypothesis 3a, that decoupling between intention and practice is lowest in the core.

Next, Models 4 and 9 test the integrated theory of global environmentalism for the semiperiphery, Hypothesis 3b. Although the interaction terms for the semiperiphery are positive in both

Table 3: Random Effects Model of Cross-National Chemical Pesticide Use, 1983-2004

	Model 6	Model 7	Model 8	Model 9	Model 10
World Society					
Environmental regime index		-.075*** (.018)	-.0711*** (.027)	-.099*** (.018)	-.077*** (.019)
World-Systems					
Agricultural exports, % all exports (ln)		.241* (.095)	.2481* (.097)	.237* (.096)	.243* (.096)
Core		-.880* (.447)	-.746 (.455)	-.805† (.450)	-.851* (.338)
Semiperiphery		-.032 (.324)	-.060 (.324)	-.062 (.327)	
Periphery					.098 (.348)
Environmental regime index × core			-.080** (.028)		
Environmental regime index × semiperiphery				.071* (.031)	
Environmental regime index × periphery					.023 (.088)
Controls					
GDP, pc (ln)	.555*** (.075)	.508** (.167)	.492** (.170)	.512** (.169)	.522** (.177)
Agricultural land area (ln)	.206* (.094)	.182† (.096)	.185† (.096)	.174† (.096)	.184† (.096)
Population (ln)	.641*** (.130)	.763*** (.132)	.743*** (.132)	.771*** (.132)	.758*** (.127)
Constant	-8.205*** (1.835)	-9.658*** (2.249)	-9.256*** (2.268)	-9.752*** (2.263)	-9.720*** (2.279)
N_{total}/N_{group}	829/106	829/106	829/106	829/106	829/106
Wald chi^2	114***	132***	133***	142***	142***
R^2 within	.0319	.0554	.0632	.0609	.0553
R^2 between	.6102	.6195	.6193	.6204	.6198
R^2 overall	.6017	.6452	.6438	.6459	.6455

Note: *** $p < 0.001$ ** $p < 0.01$ * $p < 0.05$ †$p < 0.1$
All variables are mean-centered; Robust standard errors in parentheses.

models, when they are summed with the main terms the results are negative in both cases. The coefficients of -.150 and -.099 become less negative when summed with the interaction coefficients of .041 and .071, respectively (see Figure 1 for illustration). An *F*-test indicates that the resulting coefficients (-.109 and -.028) are significantly different from zero. This indicates that although there is greater decoupling in the semiperiphery compared with the core, the overall effect remains negative. Hypothesis 3b is therefore supported.

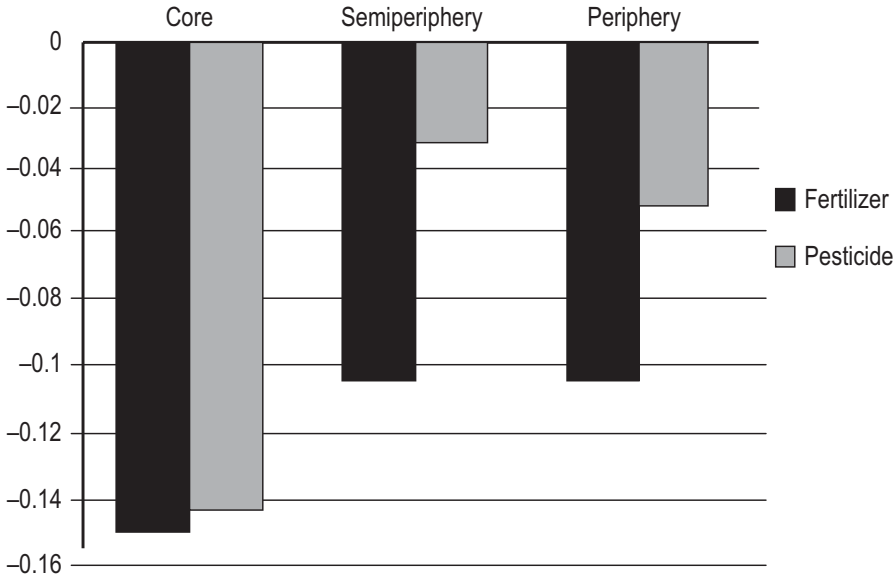
Finally, Models 5 and 10 test the integrated theory of global environmentalism in the periphery, Hypothesis 3c. Both models show positive but insignificant interaction effects. However, like the semiperiphery the net effects remain negative (-.11 for fertilizer use and -.054 for pesticide use). Although the net effects are comparable in size to the semiperiphery, an *F*-test indicates that they are not significantly different from zero. Therefore, decoupling between environmentalism and environmental practice is so great that integration into the world environmental regime has no significant effect on the use of agrochemicals. The largest extent of decoupling is in the periphery, which supports Hypothesis 3c.

In sum, these results show strong support for an integrated theory of global environmentalism. Participation in international environmental organizations and international treaties significantly reduces agrochemical use overall but the effect is strongest in the core, moderated in the semiperiphery and absent in the periphery. These findings highlight the phenomenon of *differential decoupling by world-system zone*, and suggest that a combination of material interests and domestic institutional capacity of nation-states results in the least amount of decoupling between culture and practice in the core and greatest in the periphery. Overall, I find strong support for world society and world-systems hypotheses separately as well as the integrated theory of global environmentalism that synthesizes the two.

Discussion and Conclusions

As the global economy shifts toward financial, technological and service industries, industrialized agriculture becomes increasingly necessary to feed the world's white-collar workers. Agrochemical use contributes substantially to increased agricultural yields (Zhu and Chen 2002; Pimental et al. 1992), which support growing human populations in general and the agriculturally nonproductive. However, chemical fertilizers and pesticides have proven to be detrimental to the natural environment and human health. They cause direct and indirect harm to local ecosystems and are currently recognized to potentially threaten the survival of human societies as well as numerous animal and plant species. Citizen organizations and state policies are on the rise in response. INGOs, IGOs and international treaties with the stated purpose of addressing the protection and restoration of the natural environment have risen dramatically over the latter portion of the 20th century. As such, the use of chemicals in agricultural production remains a contested issue. Political economic forces exert pressure for increased usage of agrochemical, while cultural forces simultaneously exert pressure for their reduction.

Figure 2. The Effects of World Society Integration on Agrochemical Use by World-System Zone



Source: Tables 2 and 3 ($\beta_{\text{Environmental Regime Index}} + \beta_{\text{Environmental Regime Index*World-System Position}}$)
Note: Values for core and semiperiphery analyses are statistically significant, but values for the periphery are not as indicated by *F*-tests of the summed coefficients.

World society researchers highlight the importance of changing world cultural norms (Meyer et al. 1997) and have documented the proliferation of environmental protection laws (Frank, Hironaka and Schofer 2000) in the post–World War II era. While a distinct rise of new world cultural norms is evident (Boli and Thomas 1999), the extent to which these changing cultural norms and the resulting environmental efforts are successful in altering practices is unclear. Skepticism over the effectiveness of environmental groups and legal agreements remains in the absence of empirical scrutiny. This research extends recent work connecting environmental values and norms with actual practices (Jorgenson Dick and Shandra 2011; Schofer and Hironaka 2005). In addition, I incorporate insights from the political economy tradition that highlight the structure of global capitalism in patterns of environmental degradation. From this perspective, position within the world-system is central in explaining a variety of environmental outcomes including deforestation (Burns, Kick and Davis 2003), carbon dioxide (Grimes and Kentor 2003) and methane emissions (Jorgenson 2006) and environmental degradation in general (Jorgensen 2003; York et al. 2003). Using the cases of national-level chemical fertilizer and pesticide use, I analyze how these contrasting forces interact at the global level to affect environmental practices cross-nationally and over time.

Though frequently presented as competing perspectives, I find that both neo-institutional and political economic expectations are supported in the case of

cross-national agrochemical use. These analyses show that not only have world cultural norms prompted the proliferation of international environmental organizations and international treaties, but those organizations and agreements significantly affect the achievement of their stated goals. I find that overall the environmental regime does affect national environmental practice in the intended direction. Citizen memberships in environmental INGOs, state membership in IGOs and national signatories to environmental treaties, measured together as an environmental regime index, are associated with more environmentally friendly practices. In contrast, political economy scholars highlight the role of global capitalism in producing cross-national inequalities in extractive and degradation processes where the core is able to extract natural resources from the periphery and return the waste materials (Jorgensen and Kick 2003). Consistent with these expectations, I find that national economies that depend more heavily on agricultural goods for exports consistently use larger quantities of chemical fertilizers and pesticides (Magdoff et al. 2000). As such, I find evidence of the significance of both global cultural and political economic forces on national-level environmental outcomes.

In addition, I argue for the utility of combing these perspectives into an integrated theory of global environmentalism. I argue that because the material benefits of adopting and the ability to enforce pro-environmental practices at the national level varies substantially by world-system zone, the effects of integration into the world environmental regime will likewise vary by world-systems zone. While integration into the pro-environmental culture consistently reduces agrochemical use, I find that these effects are not consistent throughout the world-system (see Figure 2 for illustration). I find that decoupling between stated objectives and practice is lowest in the core where incentives to adopt pro-environmental practices are relatively neutral but the infrastructure for enforcing them is quite high. In the semiperiphery, where the incentives for integration are highest but capabilities for enforcing pro-environmentalism are lower than in the core, integration reduces the use of environmentally harmful chemicals, but to a lesser extent than in the core. Finally, environmental culture has no significant effect in the periphery. Lack of both material incentives and institutional capacity to promote environmentalism results in extensive decoupling between objectives and practice in the periphery. In sum, I find evidence for differential decoupling by zone where decoupling is lowest in the core and highest in the periphery that supports the treatment of global environmentalism as it relates to both cultural and political economic forces.

Findings from this study contribute to world society theory and environmental sociology in two related ways. First, the treatment of environmental practices as the outcome of world cultural integration indicates the relevance of cultural changes for practical changes. Although previous literature shows the dramatic increase in international associations over the past 60 years, lack of analytical attention to associated practices supports a great deal of skepticism of the practical significance of this trend. In contrast, this research addresses the link between cultural associational trends and actual practices. The results suggest that changes in laws and discourse are important precursors for changes

in practices. Rather than a linear connection between policy and practice, this study highlights the relevance of considering a broader cultural context, or pressures in multiple directions. Citizen and intergovernmental associations provide cultural infrastructure for changes in practices.

Second, the integration of world society theory with the world-systems perspective adds context and power to a world cultural argument that typically neglects both. Rather than a blanket diffusion process, this study emphasizes national-level context and how it shapes the effect of world culture. The material conditions within each country along with their relative power position to the world stratification system affect both their incentives for integrating into world culture and their ability to enforce its norms. As such, the case of agrochemical use illustrates the significance of world-system position for the influence of world cultural integration. Support for differential decoupling by world-system zone, therefore, suggests that cultural and political economic forces both strongly shape global environmental practices.

In sum, these analyses demonstrate that a worldwide trend promoting environmentalism produces change in environmental practices at the national level. Although decoupling exists, this study suggests that changes in discourse, values and policy are important preconditions for change in practices. Further, evidence of *differential decoupling* by zone of the world-system points to the importance of considering both cultural and political economic forces on global processes such as environmentalism and environmental practice. Although this research represents an initial step toward integrating macrorealist and neoinstitutional perspectives, results suggest that world cultural norms favoring environmentalism have at least a tempering effect on the environmentally detrimental effects of economic globalization.

Notes

1. It is plausible that peripheral actors have more to gain from added legitimacy. However, even if the willingness of peripheral countries to enforce pro-environmental policies is high, lack of ability, or domestic institutional capacity, still yields high levels of decoupling.
2. Restricting the fertilizer analyses during 1983-2004 yields the same pattern as pesticide use. However, I present the longer time period because it is of interest theoretically. Models are available upon request.
3. All dependent and control variables are log transformed to more closely approximate normal distributions.
4. All three fertilizer components appear in consistent proportion to each other in countries in which data for all three components are available. Although using only nitrogen data for select countries underrepresents their total fertilizer consumption, we can reasonably assume that the patterns of consumption over time are reliably captured here.
5. Arable land is land under temporary crops (double-cropped areas are counted only once), temporary meadows for mowing or pasture, land under market and kitchen gardens and land temporarily fallow. The abandoned land resulting from shifting cultivation is not included in this category. Permanent crops are land cultivated with

crops that occupy the land for long periods and need not be replanted after each harvest, such as cocoa, coffee and rubber. Permanent pasture is land used permanently for herbaceous forage crops, either cultivated or growing wild.

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Appendix

Table A: Countries by World-System Position with Mean per capita Gross Domestic Product

Country	Mean pc GDP	N	Country	Mean pc GDP	N	Country	Mean pc GDP	N
Core			Estonia	5,276	7	Bulgaria	927	14
Australia	15,539	46	Greece	9,004	46	Cameroon	644	46
Austria	16,831	46	Hungary	3,592	46	Cote d'Ivoire	742	46
Belgium	16,192	46	Iran	1,550	42	Dominican	978	46
Canada	17,440	46	Jordan	1,792	32	Republic		
Denmark	21,808	46	Latvia	3,065	17	Ethiopia	129	26
Finland	16,458	45	Lebanon	4,254	19	Georgia	935	17
France	16,464	46	Libya	6,634	8	Guatemala	761	46
Germany	18,294	37	Lithuania	3,567	17	India	303	46
Iceland	22,461	46	Malaysia	2,370	46	Indonesia	507	46
Ireland	13,520	46	Mauritius	2,911	27	Iraq	928	3
Israel	13,604	46	Mexico	4,618	45	Kazakhstan	803	17
Italy	13,697	46	Nicaragua	1,142	46	Kenya	384	46
Japan	25,897	46	Peru	2,053	46	Kyrgyzstan	327	17
Netherlands	16,935	46	Poland	4,034	17	Macedonia	951	15
New Zealand	11,114	46	Portugal	6,996	46	Moldova	558	17

Norway	24,782	46	Qatar	28,989	6	Morocco	963	46
Sweden	20,857	46	Romania	1,900	27	Nepal	170	40
Switzerland	29,094	46	Russian Fed.	2,027	17	Nigeria	369	46
United Kingdom	17,787	46	Saudi Arabia	10,676	29	Pakistan	389	41
United States	25,020	46	Slovakia	3,711	17	Philippines	868	46
			Slovenia	9,414	15	Senegal	503	46
Semiperiphery			South Africa	3,087	46	Serbia	901	17
Albania	1,086	24	South Korea	5,764	36	Sri Lanka	541	46
Algeria	1,671	46	Spain	9,837	46	Sudan	296	46
Argentina	6,776	46	Trinidad and	5,590	46	Syria	934	46
Brazil	2,999	46	Tobago			Tajikistan	257	17
Chile	3,104	46	Turkey	3,124	39	Tanzania	271	19
China	1,434	36	Uruguay	5,066	46	Thailand	944	46
Colombia	1,902	46	Venezuela	5,453	46	Tunisia	994	46
Costa Rica	3,054	46				Turkmenistan	866	17
Croatia	4,783	15	*Periphery*			Ukraine	937	17
Cyprus	8,723	32	Armenia	687	17	Uzbekistan	599	17
Czech Republic	5,507	16	Azerbaijan	859	17	Vietnam	330	23
Ecuador	1,212	46	Bangladesh	272	45	Zambia	446	46
Egypt	1,151	46	Belarus	843	17	Zimbabwe	583	45
El Salvador	1,886	45	Bosnia and Herzegovina	863	13			

Note: Mean per capita GDP is reported only for country-years in which at least one of the dependent variables is present.