Consumption and Environmental Degradation: A Cross-National Analysis of the Ecological Footprint

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Consumption and concomitant environmental degradation are among the most pressing global issues confronting us today. This research argues that these problems are embedded within the context of hierarchical inter-state relationships and intra-national characteristics in the modern world-system. Using cross-national comparisons among 208 countries, I construct a recursive indirect effects model to estimate the direct, indirect, and total effects of world-system position, domestic inequality, urbanization, and literacy rates on a comprehensive indicator of per capita consumption of natural resources: the ecological footprint. I find that world-system position has the strongest positive total effect on per capita consumption, followed by urbanization and literacy rates. Domestic inequality, by contrast, has a strong negative total effect on per capita consumption. In a second analysis, I examine the extent to which cross-national variation of consumption levels occurs within different zones of the world-system. I find and discuss two outliers in the core and one in the periphery, and a relatively high level of variation in the semiperiphery.

Previous studies identify several macro-level causes of a serious problem affecting all human and non-human populations: environmental and ecological degradation. However, a critical empirical component is missing in this research: the overall level of bioproductive land and other natural resources required to produce material commodities consumed by humans. Conceptually, this is a common topic in analytical essays and studies of anthropogenically caused environmental destruction, but empirically it is relatively ignored (Burns et al. 2001; Hornborg 2001; Jorgenson and Burns 2003; Princen 2002; Princen, Maniates, and Conca 2002). Up until recently this lack of attention resulted from a dearth of adequate empirical indicators of overall consumption levels.

A comprehensive national-level measurement is now available that quantifies how much land and water are required to produce the commodities consumed and assimilate the wastes generated by them: the *ecological footprint* (Wackernagel et al. 2000). The advantage of the ecological footprint as a measure of consumption is that its use does not require researchers to know what specific region of the world the resources come from. Furthermore, it provides a common unit of measurement that allows for comparisons of various types of impacts (Wackernagel et al. 2000; York, Rosa, and Dietz 2001).

In this article, I analyze the structural causes of national-level per capita ecological footprints. Drawing from world-systems and ecostructuralist theoretical perspectives, I argue that national consumption levels, measured as per capita ecological footprints, are a function of a

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country's position in the world-system. Beyond the direct effect of world-system position, I integrate mediating factors into the analysis. These include domestic inequality, urbanization, and literacy rates. Following the causal analysis, I examine cross-national variation of per capita footprints within and between different "zones" of the world-economy, and identify specific outliers in the core, semiperiphery, high periphery, and low periphery. I conclude with a brief discussion of the next steps for this research agenda.

Results of this study provide empirical evidence suggesting that per capita consumption levels are largely a function of a country's position in the core/periphery hierarchy of the world-system. More powerful, "core" countries possess per capita consumption levels substantially higher than those of "semiperipheral" and "peripheral" countries. Moreover, urbanization, domestic income inequality, and literacy rates all prove to be significant predictors of per capita ecological footprints.

Most countries consume biospheric resources at levels above the global bio-capacity per capita,[1] which could lead to potentially catastrophic outcomes for all societies. Taking a world-systemic, global approach provides insights important and necessary for dealing with the most difficult social problems we will face in the coming century (Smith 2001). By identifying the global and interconnected domestic factors that explain varying levels of consumption, I take an initial step in addressing a critical problem for human societies and the global ecological system in which we all live.

World-Systems Analysis, Ecostructuralism, and the Environment

Immanuel Wallerstein, the first to address the idea of unequal global linkages and a world-systems perspective (1974), argued that the modern capitalist world-economy,[2] which originated in the 16th century, reflected a tripartite global division of labor that generated and maintained relative structural inequalities across core, semiperipheral, and peripheral "zones" of the world-economy. Since Wallerstein's seminal writings, other macrosociologists further developed this perspective which now generally identifies the modern world-system as a complex, continuous, multidimensional system of global inequalities and exploitation (Arrighi 1994; Boswell and Chase-Dunn 2000; Chase-Dunn 1998, 2002; Chase-Dunn and Hall 1997; Kentor 2000).

World-systems analysis provides a useful framework for analyzing and explaining various types of environmental outcomes (Bergesen and Bartley 2000; Bergesen and Parisi 1997; Chew 1997; Hornborg 1998, 2001; Roberts and Grimes 1999, 2002; Smith 1994). The political-economy of the world-system indicates that modern capitalism is in crisis because it cannot find solutions to key dilemmas, including the inability to contain ecological destruction[3] (Broswimmer 2002; Bunker 1985; Foster 1999, 2002; Jorgenson forthcoming; Jorgenson and Burns 2003; Wallerstein 1999). One can easily and rather convincingly link global modes of production and accumulation with environmental degradation (e.g., extraction of natural resources and multiple forms of pollution). Furthermore, the core-periphery model of exploitation provides useful explanations of different environmental and ecological outcomes (Bergesen and Parisi 1997), and degradation can be seen as both a cause and consequence of underdevelopment in non-core regions (Boswell

1. Wackernagel and associates (2000) calculate national bio-capacity per capita by dividing all the biologically productive land and sea on earth by the total world population. The result is an average of 2.1 hectares per person. The majority of national per capita ecological footprints are higher than the earth's bio-capacity per capita (Wackernagel et al. 2000).

2. Like others, I use world-system and world-economy interchangeably when referring to the modern capitalist world-system.

3. Earlier, Schnaiberg (1980) and Schnaiberg and Gould's work (1994) was pivotal in stimulating discourse and research on the political-economy of the environment, particularly their notion of the "treadmill of production" (see also Buttel 1987).

and Chase-Dunn 2000:143–4; Bunker 1985; Evans 1979). Thus, structural features of the world-economy affect our environment, which in turn has an impact on human societies.

A growing community of social scientists labels this body of literature and research "eco-structuralism." They argue that it provides a needed counterbalance to conventional explanations of environmental degradation that stress more cultural and micro-oriented factors such as lifestyle and individual consumption habits (Grant, Jones, and Bergesen 2002). Ecostructuralism represents a recent attempt to give the environment a more prominent positioning in sociological research, particularly studies that address environmental outcomes as being a function of social structural factors (Grant et al. 2002). In sum, incorporating the environment into ecostructural world-systems research—especially in the modern world-system—allows us to identify structural factors, relational characteristics, and global processes that are both political-economic and ecological, and to consider the environment as an independent and/or dependent variable, especially in quantitative, cross-national research (Bergesen 2001; Grant et al. 2002; Hornborg 2001).[4]

The Ecological Footprint: A Missing Piece of the Puzzle

Having the ability to identify national-level differences in the amount of land and water required to produce commodities consumed would allow researchers to more adequately address questions regarding macrostructural causes of environmental and ecological degradation. Consumption is a critical factor affecting degradation, and unequal relationships between countries in the world-system enable more powerful countries to externalize the environmental and ecological costs associated with their domestic consumption of raw materials and produced commodities.

> While it is very difficult to track, consumption in the core is likely a significant cause of environmental degradation in other zones of the world-system. This becomes even more pronounced over time as non-core countries produce manufactured goods and agricultural products, and extract natural resources for consumption in other parts of the world, particularly the core. (Burns et al. 2001:12)

Many writers and researchers use the term "ecological footprint" when referring to the biologically productive land and water required to produce the resources consumed and to assimilate the wastes generated by a given population (Wackernagel et al. 2000; Wackernagel and Rees 1996). Recently, Mathis Wackernagel and associates (2000) developed a comprehensive, sophisticated measurement of national-level ecological footprints for approximately 150 nations that traces all the resources a nation consumes and the waste it emits. More simply, ecological footprints are an estimate of human pressure via consumption on global ecosystems (York et al. 2001).

The ecological footprint is the sum of six components: the area of cropland required to produce the crops consumed, the area of grazing land required to produce the animal products, the area of forest required to produce the wood and paper, the area of sea required to produce the marine fish and seafood, the area of land required to accommodate housing and infrastructure, and the area of forest required to absorb the carbon dioxide emissions resulting from the unit's energy consumption (Wackernagel et al. 2000). It is measured in area where one unit is the equivalent of approximately 2.47 acres.[5] The advantage of the footprint

4. For a review of most recent empirical research done in this area, see Bergesen and Bartley (2000), or Burns et al. (2003).

5. A nation's consumption level is calculated by adding imports to, and subtracting exports from, domestic production. In mathematical terms: consumption = (production + imports) − exports. This balance is calculated in approximately sixty categories including both primary resources (e.g., raw timber, wheat, or milk) and manufactured products that are derived from them (e.g., paper or yogurt). Each category is screened for double counting to increase the consistency and robustness of the measures. To avoid exaggerations in measurement, secondary ecological functions that are accommodated on the same space as primary functions are not added to the footprints (Wackernagel et al. 2000).

method is that, because it does not require researchers to know specifically what each consumed resource is used for, it can capture indirect effects of consumption that are difficult to measure (Wackernagel et al. 2000). This measure is further advantageous in that it does not require researchers to know what area of the world the resources came from.

Researchers can compare the footprint measures to the ecological capacity that exists on the planet. National-level per capita footprints range from .35 hectares to more than 16 hectares; the majority of national per capita measures are higher than the earth's bio-capacity per capita (2.1 hectares), illustrating the severity of overuse of resources. Furthermore, people should not use all the 2.1 hectares per capita since humans are not the sole animals on earth (Wackernagel et al. 2000).

With the development of this national-level measure, an interesting discussion occurred in the ecological economics literature (*Ecological Economics*, 32 [2000]) regarding the utility of the ecological footprint and what it identifies. The power of the ecological footprint is that it aggregates and converts typically complex resource use patterns into a single use number (Costanza 2000). This makes it accessible for empirical use while providing a clear, unambiguous message in an easily digested form (Moffatt 2000). It is an excellent tool for communicating human dependence on life-support ecosystems, and can be applied to a variety of issues to help identify the fundamental complimentarity between natural capital and economic development, and to foster a worldview of humans as part of nature (Deutsch et al. 2000). The footprint builds on the critical importance of natural capital to economic development and suggests a comparative natural capital accounting framework (Rees 2000; Wackernagel, Onisto, and Bello 1999). With its emphasis on the ecological deficit, the footprint method points towards externalities as a means by which such deficits can be explained (Templet 2000).

Mathis Wackernagel and Judith Silverstein (2000) are among those scholars who took part in this dialogue. They argued that the purpose of the ecological footprint is to (1) illustrate the possibility of overshoot,[6] and (2) offer a robust ecological economics tool for demonstrating its actual occurrence. Footprints identify the extent to which national societies contribute to loss of bioproductive capital, and illustrate the variation in national-level consumption effects (Wackernagel and Silverstein 2000).

Recently, researchers modeled and tested the effects of population, affluence, and other factors on *total national-level ecological footprints* (York et al. 2001, 2003). Their results indicate that population and affluence by themselves account for 95 percent of the variance of total national footprints (population standardized coefficient = .97; affluence standardized coefficient = .66). York and associates' analysis illustrates the utility of the footprints in cross-national quantitative research. However, the results themselves do not address the significant variation in *per capita footprints* with the exception of a relatively brief discussion of the relationship between per capita GDP and per capita footprints (York et al. 2001). Identifying the ecostructural and world-systemic factors leading to per capita differences would provide additional evidence of the extent to which more powerful, domestically "green" societies externalize the environmental "costs" associated with material consumption, a process known as the "Netherlands Fallacy" (e.g., Ehrlich and Ehrlich 1990; Ehrlich and Holdren 1971; Rosa and York 2002). A survey of major commodities by Thomas Princen and associates (2002:4–8) reveals that per capita growth in consumption of certain goods (e.g., fiberboard, printing and writing paper) is expanding eight to twelve times faster than population growth and total consumption.

Although the correlation between per capita GDP and per capita footprints is relatively high, the former is an inadequate measure of world-system position. Rather, it is a more appropriate indicator of domestic affluence or internal economic development (e.g. Burns,

6. Overshoot generally refers to a condition in which a given population outgrows or out-consumes its ecological carrying capacity (Harper 2001:20).

Kentor, and Jorgenson 2003; Dietz and Rosa 1994; Jorgenson forthcoming; Jorgenson and Burns 2003; Rosa and York 2002). By itself, the per capita GDP method does not capture the political-military attributes or international relational characteristics of a country's position in the core-periphery hierarchy of the modern world-system (Chase-Dunn 1998, 2002; Kentor 2000). Simply suggesting that per capita consumption is primarily a function of economic development or affluence discounts potential impacts of the structurally complex non-economic characteristics associated with relative position in the modern world-system. Moreover, this disallows for the analysis of intervening factors, which is critical to adequately identifying the interrelated causal mechanisms that influence levels of per capita consumption.

Major Theoretical and Empirical Arguments

A key factor is relatively ignored in cross-national studies of environmental depletion and degradation: varied consumption levels and the associated natural resources required to produce the commodities in question (Burns et al. 2001; Princen 2002; Princen et al. 2002). The capitalist world-economy produces commodities through labor and natural resource exploitation that usually end up in core markets (Bunker 1985; Hornborg 2001). Although difficult to empirically identify, many social scientists argue that material goods consumed in the core have disastrous effects on the environment in other regions of the world (Burns et al. 2001; Clapp 2002; Conca 2002; Hornborg 2001; Tucker 2002). With the recent development of the national-level ecological footprint measure, consumption can now be adequately specified in cross-national research as both a dependent and independent variable for explaining various forms of anthropogenically caused environmental and ecological degradation, regardless of where it may occur. This measure identifies the amount of land and water required to produce commodities without needing to know the actual source of the resources.

Before we incorporate consumption (i.e., per capita ecological footprints) into other models of degradation, it is first necessary to identify and explain variation in national-level per capita consumption levels. Drawing from world-systems theory, ecostructuralism, and previous empirical research, I model and test the structural causes of ecological footprints per capita. For present purposes, I test a recursive indirect effects model. I model domestic inequality, urbanization, and literacy rates as variables that partially mediate the effect of world-system position. Full specification of the model is shown in Figure 1.[7]

World-System Position

I hypothesize that world-system position has a positive effect on per capita ecological footprints (hypothesis 1). On average, core regions contain more productive economies and articulated markets, while peripheral and semiperipheral regions generally contain more extractive oriented economies and disarticulated markets[8] (Boswell and Chase-Dunn 2000; Bunker 1985). Unprocessed, natural resources are exported from more extractive peripheral economies to productive core economies where they are either consumed in their natural form or transformed through industrial material production into commodities. These commodities generally remain in the same regions that contain articulated markets, or are transported to

7. An important and relevant concern in cross-sectional/cross-national models of this type is reciprocal causality. Since time-series data are not available for the indicators specified in the analysis (most importantly, per capita ecological footprint and world-system position), reciprocal effects cannot be tested. Hence, I argue that the direct effect of world-system position on per capita ecological footprints reported in this study might be slightly higher than it actually is because the effect of consumption on world-system position is not specified and tested (due to data limitations). This effect warrants future research when these measures are available in time-series form.

8. Disarticulated economies depend on external markets, while articulated economies are able to focus on internal, domestic markets (Bunker 1985).

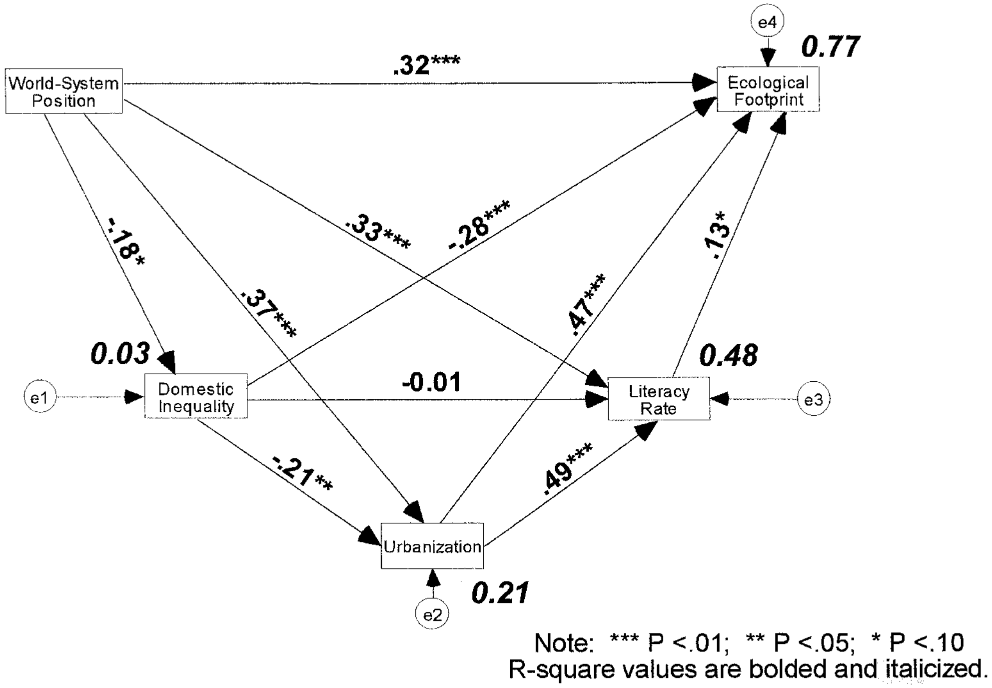

Figure 1 • ***Structural Causes of Ecological Footprints***

other core regions where—due to domestic levels of development and relative position in the world-system—consumption levels are relatively high as well. On average, non-core countries with extractive economies are highly dependent on a small number of primary exports, most notably agricultural products and other natural resources (e.g., Burns et al. 2003; Jorgenson forthcoming; Jorgenson and Burns 2003; Tucker 2002). This type of dependency, known as export commodity concentration, is one of the relational characteristics affecting the relative position of countries in the core-periphery hierarchy of the modern world-system (Kentor 2000).

In addition to possessing extractive characteristics, non-core regions are more susceptible to forms of dependent industrialization and underdevelopment because of foreign capital penetration by transnational corporations; these corporations are primarily headquartered in core regions of the world-economy (Bornschier and Chase-Dunn 1985; Boswell and Chase-Dunn 2000; Kentor 1998). Higher levels of foreign capital penetration create an industrial structure in which monopoly is predominant, labor is insufficiently absorbed, and there is underutilization of the potentially productive forces. Non-core countries that experience this path of uneven development characterized by income inequality and foreign capital imports experience economic stagnation, underemployment, and increasing marginalization of the population relative to countries that are less penetrated by and dependent on transnational corporations (Bornschier and Chase-Dunn 1985; Kentor 1998). Furthermore, a large proportion of the commodities produced are exported to core countries for consumption, and profits derived from foreign capital penetration are repatriated to more powerful countries where the foreign direct investment originated (Bornschier and Chase-Dunn 1985; Conca 2002; Kentor 1998, 2001). This repatriation of profits retards domestic development and increases domestic inequality, which lowers per capita consumption (Bornschier and Chase-Dunn 1985; Chase-Dunn 1975; Kentor 2001). Hence, the complicated processes of underdevelopment, emerging dependent industrialization, and economic stagnation, coupled with the classically dependent, extractive characteristics of non-core countries, limits the structural conditions in which the populations of non-core, foreign capital dependent countries consume both unprocessed bio-productive resources and industrially produced commodities.

On average, more powerful countries in the world-economy contain relatively higher levels of per capita income and economic development (Arrighi and Drangel 1986; Boswell and Chase-Dunn 2000; Chase-Dunn 1998; Chase-Dunn and Hall 1997; Kentor 2000; Snyder and Kick 1979). Populations in core regions have relative economic advantages compared to non-core countries, which enable them to acquire and consume natural and produced commodities at higher levels (Burns et al. 2001; Hornborg 2001). Moreover, core countries possess relatively greater military size, strength, and international political dominance, which increase their abilities to maintain and reproduce unequal trade relations with less-powerful countries. Further, overall military size as well as continual research and development elevate both total and per capita consumption levels (Broswimmer 2002; Bunker 1985; Chase-Dunn 1998; Chase-Dunn and Hall 1997; Kentor 2000).

In sum, I argue that consumption, measured as per capita ecological footprints, is largely a function of a country's position in the core/periphery hierarchy of the world-system. Both the relational characteristics and domestic attributes of a country's position in the modern inter-state system need to be accounted for when addressing the effect of world-system position on environmental outcomes. Furthermore, I argue that the effect of world-system position on per capita ecological footprints is both direct and indirect, mediated by its effects on domestic income inequality, urbanization, and literacy rates.

Domestic Income Inequality

Inequality both within and between countries is a common topic in quantitative, cross-national research (e.g., Beer 1999; Beer and Boswell 2002; Bergesen and Bata 2002; Bornschier 2002; Bornschier and Chase-Dunn 1985; Chase-Dunn 1975; Kentor 1998, 2001). A general argument in this literature is that average income potential and the domestic distribution of income are partly a function of a country's position in the core/periphery hierarchy, their level of foreign capital penetration, and their level of foreign capital dependence. On average, non-core countries with relatively higher levels of foreign capital penetration and dependence experience greater income inequality and higher levels of social marginality (Beer 1999; Beer and Boswell 2002; Bornschier 2002; Bornschier and Chase-Dunn 1985; Kentor 2001). Net of other factors, foreign investment benefits the elite segments of the domestic income-earning population, and increases the polarization between this group and the rest of the population (Beer and Boswell 2002).

Analytical explanations for these outcomes are as follows. Foreign capital dependence distorts the class structure of host countries by creating a small, highly paid group of elites to manage foreign investments and the concomitant emerging informal sectors of the economy (Kentor 1981, 2001; Timberlake and Kentor 1983). The majority of jobs generated by foreign investment pay relatively low wages. The profits made from these investments are usually repatriated instead of reinvested in the host economy, which hinders domestic capital formation and economic development (Kentor 2001). Foreign capital penetration tends to concentrate land ownership, and host economies are more likely to create economic and political conditions favorable to foreign investors, which hamper domestic labor's ability to obtain more favorable wages (Kentor 2001; London and Robinson 1989).

Building on these previous studies, I argue that domestic income inequality has a negative effect on per capita consumption levels (hypothesis 2). Within countries possessing higher levels of income inequality, a higher proportion of a nation's annual income is generally accounted for by the top 10 or 20 percent of the domestic population (Beer 1999; Beer and Boswell 2002). Non-core countries with higher levels of intra-inequality also tend to possess characteristics of disarticulated extractive economies (Bunker 1985). Thus, these regions possess relatively lower per capita consumption levels, since on average (1) the majority of the population has substantially lower income levels, and (2) the domestic market focuses on the exportation of raw materials and commodities produced by means of dependent industrialization.

Urbanization

A rather extensive body of literature addresses world-systemic factors and urbanization, which justifies the inclusion of urbanization as an intervening variable that is partly a function of world-system position[9] (Kentor 1981; Smith 1996, 2000, 2003; Smith and Timberlake 1997; Taylor 2003; Timberlake 1985). Building on this literature and recent studies of the global city-system (e.g., Chase-Dunn and Jorgenson 2003; Smith and Timberlake 2001), I hypothesize that urbanization has a positive effect on per capita ecological footprints (hypothesis 3). Regions with higher levels of urbanization contain productive economies of scale that favor large and integrated economic enterprises and a spatial concentration of economic and industrial activities (Bornschier and Chase-Dunn 1985; Bunker 1985).

Biospheric resources are consumed at higher levels in urban regions through (1) industrial processes of commodity production, and (2) the corresponding domestic articulated consumer markets. These areas, many of which fit the criteria of global cities, are the key markets for material goods that require bio-productive elements in their production (Chase-Dunn and Jorgenson 2003; Sassen 1991). Furthermore, urban areas possess relatively higher literacy rates than agrarian regions. On average, educational institutions are more developed and accessible in urban areas, and higher literacy rates are a characteristic of the managerial sectors and specialized labor populations nested within urban regions of core countries in the world-economy (Bornschier and Chase-Dunn 1985).

Human Capital and Literacy

Numerous social scientists argue that human capital attributes, such as literacy rates or education, need to be taken into account in studies of cross-national processes and social problems (Alderson and Nielsen 1999; Burns et al. 2003; Jorgenson forthcoming; Kentor 2001). The inclusion of human capital indicators controls for domestic factors that affect various outcomes (Kentor 2001). However, I hypothesize that in addition to this empirical utility, a country's literacy rate has a positive effect on material consumption levels for specific analytical reasons (hypothesis 4). On average, higher levels of literacy correspond with higher incomes, which allow for greater material consumption. More literate populations are also subjected to increased consumerist ideologies and contextual images of "the good life" (Princen et al. 2002) through mass media, primarily advertising, which corresponds with what Leslie Sklair (2001) and Jennifer Clapp (2002:161) label the "cultural ideology of consumerism / consumption." Previous research, particularly the work of Sheila Pelizzon and John Casparis (1998), explicitly addresses the effects of world-system position on literacy rates and other indicators of domestic human capital. Not surprisingly, a country's position in the world-economy has a significant positive effect on its domestic literacy rate (Pelizzon and Casparis 1998; see also Burns et al. 2003; Jorgenson forthcoming; Jorgenson and Burns 2003).

9. The relationship between world-system and urbanization is extremely complex and varies substantially in different "zones" of the world-economy (e.g., peripheral urbanization). However, for purposes of this analysis, I expect the effect of world-system position on urbanization to be positive.

Summary of Hypotheses

Below, I develop a causal model to examine the complex interrelationships among world-system position, domestic inequality, urbanization, literacy rates, and per capita ecological footprints. Drawing from relevant empirical research and theoretical traditions, I test the following set of hypotheses.

1. World-system position has a positive effect on per capita ecological footprints.
2. Domestic income inequality has a negative effect on per capita ecological footprints.
3. Urbanization has a positive effect on per capita ecological footprints.
4. Literacy rate has a positive effect on per capita ecological footprints.

Measures and Research Design

The dependent variable of consumption is measured as the ecological footprint per capita for 1996. These data are taken from the work of Wackernagel and associates (2000). The exogenous variable is world-system position for 1990. Numerous studies attempt to empirically chart the core/periphery hierarchy of the world-economy (Arrighi and Drangel 1986; Kentor 2000; Kick 1987; Nemeth and Smith 1985; Snyder and Kick 1979; Terlouw 1993). For these analyses, Jeffrey Kentor's measure of *world-system position* (2000) is used due to its theoretical significance and level of sophistication. Success and position in the capitalist world-system is based on a combination of relative military power, economic power, and global dependence (Chase-Dunn 1998, 2002; Kentor 2000). Kentor's index combines ten relevant attributes and relational characteristics of world-system position as one standardized, continuous measure.[10] Use of this indicator allows for the theoretically and empirically multidimensional characteristics of relative position in the core/periphery hierarchy to be accounted for in one variable. This permits the construction and testing of an analytically sophisticated yet empirically parsimonious model.

The first mediating variable is the gini index, which measures *domestic income inequality*[11] (World Bank 1999). The second mediating variable is level of *urbanization* for 1992, which represents the mid-year percent of a nation's total population residing in urban regions (World Bank 2000). The third mediating variable is *literacy rates*, referring to the percent of a nation's population over the age of fifteen that can read and write a short, simple statement about their everyday life (World Bank 2000). These data are for the year 1994, and have been transformed from illiteracy into literacy rates by subtracting the initial values from one hundred.

The sample used includes countries for which data were available on all or some of the independent and dependent variables. For the variables of interest I found at least partial

10. Kentor's (2000) multidimensional measure of world-system position combines level of capital intensiveness, production size, trade size, global capital control, military expenditures, military exports, global military control, export commodity concentration, foreign capital dependence, and military dependence. Using these data, he creates national-level index scores that measure relative position in the modern world-system. Because of problems with availability for some of these measures for non-core regions, Kentor creates a surrogate measure of position in the world-economy to increase the sample size for cross-national comparisons and use in other analyses. Total GDP, GDP per capita, and military expenditures are included in the new measure, which correlates with the original index at .98, while substantially increasing the sample size for this indicator. Hence, the surrogate measure is used in this series of analyses. The correlation between per capita GDP and Kentor's measure of world-system position (both for 1990) is approximately .58. For a more in-depth discussion of the methodology involved in the construction of this indicator, see chapter four in Kentor (2000).

11. Gini coefficient measures vary in years (1985–1995) on a case-by-case basis. However, levels of domestic inequality remain relatively stable over time (Bergesen and Bata 2002). Thus, issues of temporality need not be of concern for this variable in relation to the other variables. A gini index score of zero equals perfect equality, while an index score of one hundred suggests perfect inequality (World Bank 1999).

Table 1 • *Correlation Matrix and Descriptive Statistics*

		1	*2*	*3*	*4*
Ecological footprint per capita 1996	1				
World-system position 1990	2	.67			
Domestic inequality	3	− .46	−.24		
Urbanization 1992	4	.75	.42	−.26	
Literacy rate 1994	5	.58	.40	−.06	.58
	N	*Mean*	*S.D.*	*Skewness*	*Kurtosis*
Ecological footprint per capita 1996	147	2.96	2.45	1.33	1.34
World-system position 1990	95	−.005	2.50	4.19	23.77
Domestic inequality	96	39.76	10.47	0.35	−0.87
Urbanization 1992	201	51.73	23.92	0.14	−0.94
Literacy rate 1994	131	72.69	22.82	−0.65	−0.78

data for 208 countries. The precise numbers of valid cases for each variable are given in Table 1.

In order to examine the direct and indirect effects of world-system position and other factors on ecological footprints per capita, I employ a structural equation modeling approach (Joreskog 1970; Kaplan 2000) using AMOS software (Arbuckle and Wothke 1999; Byrne 2001) and maximum likelihood estimation (Eliason 1993; Kaplan 2000).[12] No information is excluded from the analyses because of missing data.

Table 1 presents correlations and descriptive statistics for all variables included in the analysis. The descriptive statistics indicate relatively normal distributions for all variables.[13]

Findings and Discussion

I test the hypotheses discussed above, as presented in Figure 1. Maximum likelihood estimates are presented in standardized form. Unstandardized estimates, standard errors, critical ratios, and probability values are given in Appendix A. As indicated by Figure 1, a major proportion of the variation in per capita footprints is explained ($R^2 = .77$). Overall, my findings support all four hypotheses: world-system position has a positive effect on per capita footprints, domestic inequality has a negative effect on per capita footprints, urbanization has a positive effect on per capita footprints, and literacy rates have a positive effect on per capita footprints.

The direct effect of world-system position on per capita ecological footprints is significant and positive (.32), which confirms the first hypothesis and supports other arguments regarding core/periphery differences in consumption (Bunker 1985; Burns et al. 2001; Hornborg

12. This type of modeling is advantageous over standard regression models because it clearly specifies the hypothesized direct and indirect relationships among the variables in question, and permits the estimation of these effects (Kentor 2001). This methodology employs maximum likelihood estimation (MLE) of parameters (Byrne 2001; Kaplan 2000). This is particularly useful in dealing with missing data, an endemic problem in cross-national, quantitative research. A maximum likelihood estimation of missing data is preferable to the other, more common methods of addressing the missing value problem (most notably, pairwise and listwise deletion), because MLE provides more consistent and less biased results than other methods (Eliason 1993).

13. The high level of kurtosis associated with the world-system position indicator is attributed to the fact that the variable is in standardized form (Z scores).

2001). On average, core countries consume at higher levels because they contain more productive economies and articulated markets, while non-core regions possess more extractive economies, disarticulated markets, and higher levels of dependent industrialization and underdevelopment (Bornschier and Chase-Dunn 1985; Boswell and Chase-Dunn 2000; Bunker 1985; Kentor 1998). Furthermore, more powerful countries contain relatively higher levels of per capita income, higher total economic development, lower levels of global economic dependency, and higher levels of international political/military dominance, which enable them to maintain and reproduce the core/periphery hierarchy and imbalanced cross-national levels of per capita consumption (Chase-Dunn 1998; Jorgenson forthcoming; Jorgenson and Burns 2003; Kentor 2000).

Causal relationships are complex and not necessarily captured in simple direct effects models (Kaplan 2000). World-system position has a significant negative effect on domestic inequality (−.18), which in turn has a significant negative effect on per capita footprints (−.28). The former generally supports the findings of Volker Bornschier and Christopher Chase-Dunn (1985), Linda Beer (1999), Jeffrey Kentor (2001), Linda Beer and Terry Boswell (2002), and many others, while the latter confirms the second hypothesis: domestic income inequality has a negative effect on per capita ecological footprints. On average, countries with higher levels of income inequality—partly a function of position in the world-system—consume at lower per capita levels because (1) the majority of the population has substantially lower income levels, and (2) the domestic market focuses on the exportation of raw materials and commodities produced by means of dependent industrialization.

As a process, urbanization takes various forms in different zones of the world-system (Kentor 1981; Sassen 1991; Smith 1996, 2000, 2003; Timberlake and Kentor 1983). World-system position has a significant positive effect on urbanization (.37), which in turn has a significant positive effect on per capita footprints (.47). The former finding indicates that on average, in more powerful countries a relatively higher proportion of the total population resides in urban areas. The latter finding confirms the third hypothesis: that urbanization has a positive effect on per capita ecological footprints. Biospheric resources are consumed at higher levels in more urban areas by (1) industrial commodity production, and (2) the domestic articulated consumer markets that have greater and more convenient access to commodities. Many urban regions, particularly in core countries, are the most powerful cities in the global city-system and contain key markets for material goods that require natural resources in their production (Chase-Dunn and Jorgenson 2003; Sassen 1991; Smith and Timberlake 2001).

World-system position has a significant positive effect on literacy rates (.33), which in turn has a significant positive effect on per capita footprints (.13). The former supports the findings of Pelizzon and Casparis (1998), Burns and associates (2003), Jorgenson (forthcoming), and Jorgenson and Burns (2003). The latter finding confirms the fourth hypothesis: on average, a country's literacy rate has a positive effect on its level of per capita consumption. Relatively higher levels of literacy correspond with elevated levels of income, which increase the economic opportunities for greater material consumption. This finding also empirically supports Sklair (2001) and Clapp's (2002) conception of the "cultural ideology of consumerism/consumption," which I argue is partly a function of a population's literacy rate. Literate individuals are more susceptible to consumerist ideologies through mass media sources, many of which have written formats.

To increase the reliability of the analysis, I compare the reported findings with those of a standard ordinary least squared regression analysis (OLS) using listwise deletion. For direct comparison, Table 2 presents direct effects for both standardized regression coefficients using listwise deletion and maximum likelihood estimates. The use of the former method results in a sample size of 49 cases. All regression coefficients vary slightly from the maximum likelihood estimates and remain statistically significant with the exception of literacy rate, which increases from an MLE of .13 to a standardized regression coefficient of .31. I suggest that this change is primarily a statistical artifact resulting from a large decrease in sample size, which introduces a sampling bias favoring relatively powerful and wealthy core countries (Burns et

Table 2 • *Maximum Likelihood Estimates and Standardized Regression Coefficients for Direct Effects*

	MLE	*Beta*
World-system position	.32 (p = .000)	.30 (p = .003)
Domestic inequality	−.28 (p = .000)	−.22 (p = .018)
Urbanization	.47 (p = .000)	.40 (p = .001)
Literacy rate	.13 (p = .061)	.31 (p = .006)

al. 2003; Jorgenson forthcoming a, b; Kentor 2001). Overall, results from the OLS analysis using listwise deletion confirm the reported findings that employ maximum likelihood estimation.

In the same OLS analysis, I (1) use Cook's distance to identify possible influential cases, and (2) check variance inflation factors (VIF) and associated tolerance levels to test for multicollinearity. The country with the largest Cook's distance value is Russia (Cook's d = .20), with all other cases falling into a clear acceptable range of scores. Upon removing Russia from the OLS analysis, values and significance levels for standardized regression coefficients remain the same with one minor exception: the effect of world-system position decreases from .29 to .25. Thus, I include Russia in all reported findings. I find that all VIFs fall well below 2.50 and all tolerance levels fall well above .40; urbanization is the closest to these standard benchmarks, with a VIF of 1.57 and tolerance level of .64 (Allison 1999). Reported analyses and findings are not influenced by multicollinearity.

I test a second model in which the non-significant path is eliminated, to permit the estimation of direct, indirect, and total effects of the variables. This reduced model has a reasonable fit to the data, with a chi-square of .03 and 1 degree of freedom [p = .87] (Bollen 1989; Kaplan 2000). The maximum likelihood estimates are identical to those of the previous model, with 77 percent of the total variance in per capita footprints explained. Table 3 provides standardized total effects of all exogenous and endogenous variables.

World-system position is the overall best predictor of per capita footprints, followed closely by urbanization, domestic inequality, and literacy rates, which adds additional support for my first hypothesis: per capita consumption, measured as per capita ecological footprints, is largely a function of a country's position in the core/periphery hierarchy on the world-economy. Furthermore, this analysis illustrates the importance and utility in identifying mediating factors and testing for indirect and total effects (Burns et al. 2003; Kaplan 2000).

Some social scientists might still be concerned about the use of Kentor's (2000) multidimensional indicator of world-system position rather than simply modeling and testing the effects of per capita GNP (GNP pc) on per capita footprints. The latter approach would certainly be more parsimonious. To address this concern, I incorporate GNP pc for 1990 (1995 constant US dollars) into the original model as an additional predictor of per capita footprints

Table 3 • *Total Effects*

	W-S Position	*Domestic Inequality*	*Urbanization*	*Literacy*
Domestic inequality	−.18			
Urbanization	.40	−.21		
Literacy rate	.53	−.10	.49	
Ecological footprint	.63	−.39	.53	.13

(World Bank 2000). Other quantitative cross-national studies take a similar approach for analogous reasons (e.g., Smith 1996). Results are provided in Appendix B and undoubtedly indicate that a sizable amount of variation in per capita ecological footprints is explained by the nine other world-system position components of Kentor's indicator. Incorporating GNP pc in the analysis assumes that GNP pc is completely independent of world-system position, which is certainly an erroneous assumption (Smith 1996). Thus, GNP pc tempers the effects of world-system position, making the test of the effects of the latter rather conservative and the results even more compelling. Maximum likelihood estimates for all predictor variables remain statistically significant, estimates change slightly, and the coefficient of determination increases by merely 3 percent from .77 to .80. Moreover, correlation coefficients, variance inflation factors, and tolerance levels all indicate that the model is not influenced by multicollinearity. World-system position clearly has a significant impact on per capita consumption, net of GNP pc.

Results of the analyses above lead to a further question. Is there cross-national variation in per capita consumption levels within different zones of the world-system? To address this question, I perform a descriptive analysis of central tendency and variation for countries in the core, semiperiphery, high periphery, and low periphery.[14] Appendix C lists all countries, per capita footprints (Wackernagel et al. 2000), and world-system position (Kentor 2000) in each zone of the world-economy that are included in this analysis. The results are presented in Figure 2.

The series of boxplots provide clear visual evidence of the bivariate relationship between a country's position in the modern world-system and per capita consumption. Three outliers emerge in the analysis: two in the core and one in the high periphery. Not surprisingly, the high outlier in the core is the United States, while the low outlier is China. I suggest that this is in large part a function of the different dimensions and levels of political, economic, and military power between the two countries, as well as differences between their respective levels of human capital and economic development (e.g., education, literacy, per capita GDP). The overall size of China's population, military, and economy are three of the stronger elements of the country's world-system position, while its per capita GDP is substantially lower than that of the United States and most other countries in the core. I argue that this substantial difference in per capita GDP greatly accounts for the variation in per capita consumption between the high and low outliers of the core. Furthermore, because of China's relatively low per capita GDP, many would suggest that it is a semiperipheral country, and not in the core.

The United States' higher level of per capita consumption is indicative of the country's dominant position in the world-economy (Boswell and Chase-Dunn 2000; Chase-Dunn et al. 2002). In regards to world-system position, especially when one considers cross-national differences in per capita GDP, overall size of the economy (total GDP), global capital dependence, and military strength and size, the United States' relative power is substantially higher than that of the other core countries (Chase-Dunn et al. 2002; Kentor 2000). Consistent with my preceding theorization, I argue that this relative strength and high level of domestic development allows the United States to consume at a per capita level much higher than the rest of the world.

The carbon dioxide portion accounts for approximately 50 percent of the United States' total per capita footprint (Wackernagel et al. 2000). This supports the previous findings of Tom Burns, Byron Davis, and Ed Kick (1997), which identify per capita carbon dioxide emissions to be largely a function of a country's position in the world-economy. Moreover, the ratio of the United States' 1998 actual carbon emissions rate to its 1990 targeted emissions rate, as

14. Due to the substantially larger number of peripheral countries relative to the semiperiphery and core, I divide the periphery into two categories of equal sample size. This allows for a closer analysis of variation between (1) more peripheral ("low periphery") countries, and (2) less peripheral ("high periphery") countries. I use Kentor's measure (2000) of world-system position and create "boundaries" between each zone that are relatively consistent with previous studies (Kick 1987; Nemeth and Smith 1985; Snyder and Kick 1979). See Appendix C for the list of countries in each "zone" of the world-economy.

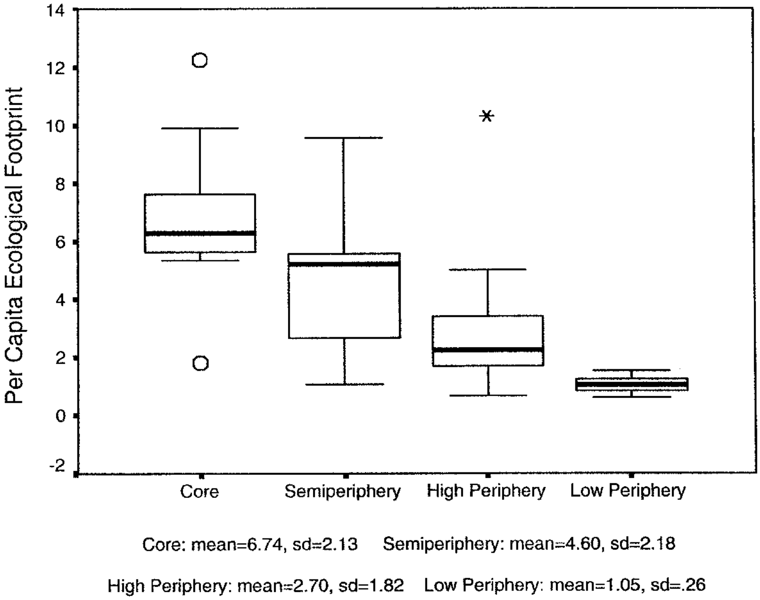

Figure 2 • *Boxplots for Per Capita Ecological Footprints within Different Zones of the World-System*

determined by the United Nations Framework Convention on Climate Change (UNFCCC), is 5.38. This illustrates the actual disparity in the nation's per capita carbon emissions and the associated biospheric degradation (Podobnik 2002).

The outlier in the high periphery is Kuwait. As was the case for the United States, this position is largely a function of the carbon dioxide portion of Kuwait's total national level per capita footprint (Wackernagel et al. 2000), which I attribute to Kuwait's overall level of oil production and refineries coupled with its relatively small population and greater per capita use of fossil fuels. The carbon dioxide portion accounts for approximately 80 percent of Kuwait's total per capita footprint (Wackernagel et al. 2000). Moreover, the ratio of Kuwait's 1998 actual carbon emissions rate to its 1990 targeted emissions rate determined by the UNFCCC is 5.09. This illustrates the actual disparity in Kuwait's per capita carbon emissions and the catastrophic environmental impact of fossil fuel extraction and refinement (Podobnik 2002). Paradoxically, although the carbon dioxide portion of Kuwait's footprint largely attributed to the extraction and refinement of fossil fuels elevates its overall per capita footprint, the majority of the refined fuels are exported to other regions of the world for consumption (Podobnik 2002).

The relatively high level of variation in the semiperiphery supports the theoretical characterization of the multidimensional structural and cultural heterogeneity of semiperipheral countries (Boswell and Chase-Dunn 2000; Chase-Dunn 1998, 2002; Chase-Dunn and Hall 1997). Historically, semiperipheral regions are hot beds for social change, and likely to "generate new institutional forms that transform system structures and modes of accumulation" (Chase-Dunn and Hall 1997:79). Thus, many semiperipheral countries are potentially upwardly mobile in the world-system, and capable of increasing both total and per capita levels of consumption (Arrighi and Drangel 1986; Boswell and Chase-Dunn 2000; Burns et al. 2001; Chase-Dunn 1998; Chase-Dunn and Hall 1997). Some follow a developmentalist approach—

commonly referred to as embedded autonomy—characterized by a combination of state-sponsored corporate coherence and a triple alliance between the state, domestic entrepreneurs, and transnational capitalists (Evans 1995). This form of highly bureaucratized, institutionally planned development stimulates local economies, reduces foreign capital dependence, and increases the average per capita consumption of domestic consumers. However, many other semiperipheral countries contain extractive-oriented markets which export a disproportionate share of agricultural products and other natural resources such as wood to core markets for commodity production and consumption (Boswell and Chase-Dunn 2000: 143–4; Bunker 1985; Burns et al. 2001; Jorgenson forthcoming; Jorgenson and Burns 2003; Kick et al. 1996). These societies contain higher levels of domestic inequality, lower levels of urbanization, and lower literacy rates, all of which inhibit domestic consumption of biospheric resources. Clearly, the relatively high level of variation in per capita consumption within the semiperiphery warrants additional research beyond the scope of this study.

Conclusion

The goal of this research was to examine the impact of world-system position both directly and indirectly via mediating factors on national per capita consumption levels measured as ecological footprints. It is clear from the results of these analyses that consumption levels, measured as per capita ecological footprints, are largely a function of a country's position in the core/periphery hierarchy of the world-system. On average, more powerful countries consume biospheric resources at higher per capita levels than less-powerful, non-core countries. As indicated by the model in Figure 1, variation in consumption levels involves a relatively complex set of factors; these include intervening factors that are intra-national conditions affected by outside influences, primarily the core/periphery hierarchy of the world-economy. Beyond its direct effect, world-system position affects per capita consumption indirectly by its effects on domestic income inequality, urbanization, and literacy rates, which in turn all significantly affect per capita consumption. Overall, world-system position has the largest total effect on per capita ecological footprints, followed by level of urbanization, domestic inequality, and literacy rates.

Following the causal analysis of per capita ecological footprints, I performed a descriptive analysis of central tendency and variation of per capita consumption levels within the different zones of the world-system. This analysis identified three outliers and a relatively high level of variation in semiperipheral countries. In the core, I found the United States to be a high outlier and China to be a low outlier. In the high periphery, I found Kuwait to be a high outlier.

Per capita ecological footprints are negatively correlated with various environmental outcomes, including deforestation (−.43), and organic water pollution (−.49).[15] These correlates, combined with the findings reported above and by previous research (Bergesen and Bartley 2000; Bunker 1985; Burns et al. 2001; Clapp 2002; Hornborg 2001; Jorgenson forthcoming; Jorgenson and Burns 2003; Tucker 2002) provide indirect evidence of core countries' externalization of the environmental and ecological costs associated with their higher levels of per capita consumption. The next crucial steps in this area of research involve: 1) incorporating the ecological footprint as an independent or mediating variable in quantitative cross-national studies that directly test the effects of consumption on degradation displacement across national borders; or 2) developing similar indicators that quantify specifically what regions of the

15. Deforestation is calculated by dividing the difference between total forest in 1990 and 2000 by total forest in 1990. More simply, deforestation = total forest 1990 − total forest 2000/total forest 1990. Total forest data are taken from the Food and Agriculture Organization's *Forest Resource Assessment* (2001) online version. Total forest is defined as the sum of natural forest and plantations. Organic water pollution is measured as emissions of organic water pollutants in kilograms per day per worker in 1995. These data are taken from the World Bank (1999).

world the biospheric resources come from. The former would probably require cross-national ecological footprints in time series form. The latter would require the analyses of dyadic trade relations between more powerful countries with higher per capita footprints and less-powerful countries with lower per capita footprints and higher levels of environmental degradation.

The identification of the three outliers and the relatively high level of variation between countries within the semiperiphery offers opportunities for in-depth comparative analyses of individual cases, and the long overdue application of hierarchical linear modeling (HLM) to analyses of global social problems (Byrk and Raudenbush 1992; Chase-Dunn and Jorgenson forthcoming). With the application of this methodology, researchers could study causal interactions and per capita consumption levels among nested levels of interaction networks, such as cross-national variation nested within the different zones of the world-system, which is nested within the global system as a whole.

Long-term damage and destruction of the natural environment is a significant problem and poses a serious threat to human and non-human survival on this planet. This research is critical to improve our understanding of anthropogenically caused environmental destruction. Before we can make noteworthy global changes to alter the impact humans have on the biosphere, we must have a better conception of how complex structural factors and processes in the modern world-system create these potentially disastrous outcomes. The findings reported here heighten our awareness of how more powerful societies consume at relatively higher levels, which leads to environmental and ecological degradation in other regions of the world.

Appendices

Appendix A • *Unstandardized Maximum Likelihood Estimates, Standard Errors, Critical Ratios, and Probability Levels*

	Estimate	*S.E.*	*C.R.*	*P*
Domestic inequality ← World-system position	−0.801	0.480	−1.670	0.095
Urbanization ← Domestic inequality	−0.479	0.203	−2.361	0.018
Urbanization ← World-system position	3.672	0.853	4.303	0.000
Literacy rate ← World-system position	3.406	0.887	3.839	0.000
Literacy rate ← Urbanization	0.503	0.079	6.332	0.000
Literacy rate ← Domestic inequality	−0.033	0.204	−0.163	0.870
Ecological footprint ← Domestic inequality	−0.064	0.012	−5.373	0.000
Ecological footprint ← World-system position	0.329	0.061	5.384	0.000
Ecological footprint ← Literacy rate	0.013	0.007	1.870	0.061
Ecological footprint ← Urbanization	0.048	0.006	7.612	0.000

Appendix B • *Standardized Maximum Likelihood Estimates for Direct Effects, Variance Inflation Factors, Tolerance Levels, and Correlations*

	MLE	*VIF*	*Tolerance*	*Correlation GNP pc*
GNP per capita	.34 (p = .000)	1.76	.566	1.00
World-system position	.23 (p = .001)	1.26	.795	.57
Domestic inequality	−.20 (p = .000)	1.15	.873	−.43
Urbanization	.35 (p = .000)	1.92	.519	.58
Literacy rate	.13 (p = .034)	1.64	.608	.41

Appendix C • ***World-System Zones, Per Capita Footprints, and World-System Positions***

	E.F. pc	*W-S Pos.*
CORE		
United States	12.22	16.96
Russia	5.36	9.29
Japan	5.94	5.44
China	1.84	4.28
Germany	6.31	3.98
France	7.27	3.62
United Kingdom	6.29	3.15
Italy	5.51	2.68
Canada	7.66	2.5
Switzerland	6.63	2.17
Netherlands	5.75	1.54
Sweden	7.53	1.54
Australia	8.49	1.53
Denmark	9.88	1.44
Belgium	5.88	1.41
Austria	5.45	1.29
Norway	6.13	1.25
Finland	8.45	1.18
Spain	5.5	1.17
HIGH PERIPHERY		
Kuwait	10.31	−0.4
Oman	3.39	−0.43
Hungary	5.01	−0.44
Chile	3.39	−0.49
Yugoslavia	3.85	−0.49
Turkey	2.73	−0.52
Indonesia	1.48	−0.58
Malaysia	3.68	−0.58
Thailand	2.7	−0.61
Colombia	1.9	−0.62
Syrian Arab Rep.	2.56	−0.69
Uruguay	4.91	−0.8
Romania	3.49	−0.82
South Africa	4.04	−0.86
Botswana	1.68	−0.97
Iraq	1.73	−1.04
Philippines	1.42	−1.07
Peru	1.33	−1.07
Panama	2.35	−1.09
Algeria	1.79	−1.09
Tunisia	2.27	−1.1
Ecuador	2.26	−1.12
Jordan	1.71	−1.13
Sri Lanka	0.95	−1.14
Egypt	1.7	−1.15
Pakistan	1.09	−1.16
Morocco	1.56	−1.16
Gabon	2.06	−1.19
Paraguay	2.84	−1.21
Dem. Rep. of Congo	0.69	−1.23
SEMIPERIPHERY		
Saudi Arabia	6.15	0.76
New Zealand	9.54	0.69
Korea, Rep.	5.6	0.59
Brazil	2.6	0.33
India	1.06	0.27
Portugal	4.99	0.27
Greece	5.58	0.2
Israel	5.4	0.2
Czech Republic	6.3	0.1
Venezuela	2.88	−0.09
Trinidad and Tobago	2.43	−0.13
Poland	5.4	−0.19
Argentina	3.79	−0.21
Mexico	2.69	−0.22
LOW PERIPHERY		
Guatemala	1.4	−1.23
Dominican Rep.	1.37	−1.26
El Salvador	1.55	−1.33
Nigeria	1.31	−1.34
Bolivia	1.29	−1.36
Zimbabwe	1.45	−1.38
Cameroon	0.89	−1.4
Honduras	1.43	−1.41
Nicaragua	1.26	−1.41
Sudan	1.14	−1.44
Bangladesh	0.6	−1.44
Cote d'Ivoire	0.95	−1.44
Senegal	1.06	−1.44
Kenya	1.15	−1.45
Myanmar	1.07	−1.47
Uganda	0.88	−1.49
Haiti	0.78	−1.49
Lesotho	0.7	−1.49
Mozambique	0.76	−1.5
Liberia	1.16	−1.52
Zambia	1.21	−1.52
Angola	0.82	−1.53
Togo	0.82	−1.54
Tanzania	1.02	−1.55
Burkina Faso	0.9	−1.56
Rep. of Congo	1.15	−1.56
Ethiopia	0.85	−1.57
Mali	0.86	−1.57
Chad	0.75	−1.59

E.F. pc = Ecological Footprint per capita, W-S Pos. = World-System Position.

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