

**DEBT, STRUCTURAL ADJUSTMENT, AND DEFORESTATION:  
A CROSS-NATIONAL STUDY**

By

**John M. Shandra\***

Department of Sociology  
State University of New York at Stony Brook

**Eran Shor**

Department of Sociology  
State University of New York at Stony Brook

**Gary Maynard**

Department of Sociology  
State University of New York at Stony Brook

**Bruce London**

Department of Sociology  
Clark University

\* Please direct correspondence to John M. Shandra, Department of Sociology, Social and Behavioral Sciences Building, State University of New York at Stony Brook, Stony Brook, New York, 11794 or via e-mail at [jshandra@notes.cc.sunysb.edu](mailto:jshandra@notes.cc.sunysb.edu).

## **DEBT, STRUCTURAL ADJUSTMENT, AND DEFORESTATION: A CROSS-NATIONAL STUDY**

### **Abstract**

We present cross-national models that examine the determinants of deforestation from 1990 to 2005. We test dependency theory hypotheses that both debt and structural adjustment affect forests. We find substantial support for this theoretical perspective. The results indicate that both factors increase deforestation. We also find support for world polity theory that international non-governmental organizations decrease deforestation and neo-Malthusian theory that rural population growth increases deforestation. We conclude with a brief discussion of the findings, policy implications, and possible directions for future research.

# **DEBT, STRUCTURAL ADJUSTMENT, AND DEFORESTATION: A CROSS-NATIONAL STUDY**

## **Introduction**

It is generally thought that debt should increase deforestation (e.g., Barbosa 2001; Rich 1994; George 1992). The logic behind this assumption is that poor nations are under constant pressure to service their foreign debts. Thus, governments attempt to increase export earnings in order to finance interest and principal payments. This, in turn, may increase deforestation because the sectors targeted for export include forestry, agriculture, cattle ranching, and mining. Nevertheless, cross-national research on this topic has yielded mixed results. For example, Kahn and McDonald (1994) find that debt service increases deforestation. Marquart-Pyatt (2004) finds no relationship between debt service and deforestation. Capistrano (1994) observes that debt service decreases deforestation by reducing capital available for investment.

These contradictory findings suggest a need for additional study. Therefore, we begin by reevaluating this relationship. However, we also expand upon previous research by considering the effect of structural adjustment lending on forests. We do so because structural adjustment requires indebted nations to adopt certain macro-economic policy reforms to receive the loans. These policy reforms include boosting exports, liberalizing trade, and cutting government spending, which all may increase deforestation. Thus, we now turn to a review of dependency theory and its prediction that structural adjustment should increase deforestation. We also elaborate upon the reasons for including other relevant predictors in our cross-national models. We conclude with a discussion of the findings, brief policy suggestions, and possible directions for future research.

## **Dependency Theory**

The debt crisis highlighted the inability of many poor nations to generate enough revenue to make payments on their foreign debt. The International Monetary Fund and World Bank responded to the debt crisis by providing structural adjustment loans designed to resolve the balance-of-payment issues by rescheduling payments, renegotiating loan terms, and providing new loans (George 1992). However, the new loans required indebted nations to institute a variety of economic policy reforms in return for the money (Rich 1994). These policy reforms include devaluing currency, reducing government spending, liberalizing trade, and privatizing government assets (Peet 2003). The underlying logic behind these reforms is an attempt to stimulate economic growth and generate hard currency for debt repayment by increasing exports and decreasing spending. While the "earn more" and "spend less" model may facilitate debt repayment, it also has the potential to increase deforestation (George 1992).

First, structural adjustment programs require that governments promote economic activity consonant with their "comparative advantage" (Peet 2003). Put differently, nations attempt to increase export earnings in order to finance interest and principal payments. (George 1992). The most common way to achieve this is currency devaluation, which creates a demand for a nation's exports on the world market (Mohan 2001). In most instances, poor nations meet increased demand by expanding production and extraction for export (Rich 1994). The sectors that may increase deforestation include logging, ranching, and agriculture (George 1992).

Second, structural adjustment loans usually require deep cuts in government spending to correct for budgetary imbalances (Barbosa 2001). The nature of the cuts has varied from nation to nation, but a common theme has been the reduction in the budgets

and staffs of environment and conservation departments (Tockman 2001). These cuts often hamper enforcement of environmental regulations, impede efforts to prevent illegal logging, and hinder demarcation of protected area (Rich 1994). In other words, structural adjustment reduces the regulatory capacity of governments to deal with causes of forest loss. It is also important to note that budgetary cuts reduce or eliminate government subsidies and credit for agricultural inputs. These subsidy cuts often force small-scale farmers to expand production into marginal land areas, especially forests, in order to maintain crop yields (Rudel 1993, 2005).

Third, structural adjustment loans require governments to liberalize trade by removing barriers to foreign investment. This involves a variety of regulatory concessions and financial incentives as well as privatizing government assets (Walton and Ragin 1990). Regulatory concessions may include exemptions on logging harvest quotas, exporting raw logs, logging protected species, and logging in protected areas (Hurst 1990). The most notable financial incentives are "tax holidays" that involve exemptions of export duties, import duties, and corporate income taxes (Leonard 1988). The purpose of the regulatory concessions and financial incentives is to stimulate investment within a nation to generate currency to meet debt obligations (Clapp 1998). However, regulatory concessions and economic incentives often result in deforestation. Tax cuts and environmental law exemptions make cattle ranching, logging, and export agriculture more profitable. Thus, investment in these areas tends to increase and, consequently, deforestation increases as well (Mohan 2001). In addition, tax breaks and selling off of public enterprises often yield additional reductions in spending by eroding the tax base because there is little new revenue being collected by the government

(George 1992). This hampers the regulatory capacity of governments to monitor forestry mandates and implement conservation projects, which are already limited by mandated cuts (Deacon 1994). Further, small-scale producers, who are thrown off the land when export agriculture is expanded by large corporations, may turn to logging for survival (Culas 2006).

Fourth, structural adjustment exacerbates poverty, which also may increase forest loss. In this regard, raw material exports prevent increases in value-added industry such as light manufacturing and services that may provide revenue for governments to invest in regulatory and conservation efforts (Mohan 2001). It also slows the creation of jobs in sectors other than agriculture, which would relieve pressure on forests (Ehrhardt-Martinez 1998). Finally, cuts on social service expenditures also increase incursions into forests as people extract resources to supplement their incomes (George and Sabelli 1994).

As noted previously, earlier cross-national research only examined how various indicators of foreign debt affect forests (e.g., Marquart-Pyatt 2004; Rudel and Roper 1997; Kahn and McDonald 1994; Capistrano 1994). This is somewhat surprising because dependency theory also predicts that structural adjustment should increase deforestation. Further, structural adjustment has been included as a predictor in cross-national research on a variety of other topics. For example, Walton and Ragin (1990) examined structural adjustment in models of political protest; Bradshaw and Schafer (2000) considered the impact of this variable on urbanization, economic growth, and access to safe drinking water; Schafer (1999) utilized this variable in cross-national models of education; and Buchman (1996) examined the relationship between structural adjustment and women's

education. It is important to note that these studies also examined considered debt service at the same time. Thus, we seek to test whether structural adjustment increases deforestation while also taking into account debt service.

### **World Polity Theory**

World polity theory holds that international non-governmental organizations play an important role in constituting and reinforcing world cultural norms (e.g., Boli and Thomas 1999). First, international non-governmental organizations intervene in global political processes and help shape the language of international treaties dealing with the environment, thereby influencing the normative content of global institutions (Risse et al. 1999; Smith 1995). In the absence of resources and formal mechanisms of enforcement, international non-governmental organizations monitor compliance by nations with environmental treaties (Frank 1999; Clapp 1994). Consequently, international non-governmental organizations are in a position of pointing out embarrassing failures and hypocrisies of nations, which puts pressure on governments to adapt their behaviors to international norms (Shor forthcoming; Hafner-Burton and Tsutsui 2005; Finnemore and Sikkink 1998).

Second, international non-governmental organizations also help mobilize support for problem-solving initiatives when national level avenues are either inadequate or blocked (Smith 1995). It has become increasingly common for these organizations to provide support for conservation efforts at sub-national levels (Schofer and Hironaka 2005). In doing so, international non-governmental organizations directly fund local environmental protection efforts. However, they often serve as intermediaries, bridging disparate community groups under the rubric of "grassroots" development (Schafer

1999). This involves facilitating conservation efforts by integrating financial, technical, and organizational resources from abroad with local knowledge and community participation (Bradshaw and Schafer 2000).

Third, international non-governmental organizations support social movement activity at the local level (Keck and Sikkink 1998). Frank, Hironaka, and Schofer (2000) found that nations strongly linked to world society (e.g., more international non-governmental organizations) experience a growth in domestic environmental social movements (e.g., more domestic non-governmental organizations). These ideas can be observed in practice when international non-governmental organizations (e.g., Greenpeace, Sierra Club, and Conservation International) employ frames and discourses that encourage domestic social movement activity and, in turn, environmentalism within a nation (Frank 1999). In such instances, governments are "squeezed" from above and below to attend to environmental problems like deforestation (Schofer and Hironaka 2005). Keck and Sikkink (1998) refer to this process as a "boomerang effect." Recently, Shandra (2007a), Shandra (2007b), and Schofer and Hironaka (2005) found support for world polity theory. As such, we seek to further evaluate that international non-governmental organization decrease deforestation while taking into account both debt service and structural adjustment.

### **Neo-Malthusian Theory**

Neo-Malthusian theory argues that demographic factors, especially population growth, are a prominent cause of environmental degradation. Such ideas, rooted in Malthus's (1798) well-known assertion that "geometric" growth in population would outstrip "arithmetic" growth in the means of subsistence, led to the pessimistic conclusion



that "carrying capacity" problems would be inevitable if population size outpaced finite environmental resources such as land and food. Ehrlich and Ehrlich (2004) among others have extended this line of reasoning recently. Their general argument holds that increases in population growth drive extraction, consumption, and production.

These processes have the potential to increase deforestation. For example, Rudel and Roper (1997) describe how deforestation comes about in their "immiserization" and "frontier" models of development. They see deforestation as the result of growing populations of peasants and shifting cultivators carving small farms out of forests. The economies of poor nations provide few livelihoods for poor peasants other than agriculture. Moreover, low levels of economic activity and the fiscal austerity associated with large foreign debts prevent the creation of jobs in sectors other than agriculture that otherwise might attract people to cities and relieve the human demand on forest resources (Burns, Kick, and Davis 2003). The absence of alternative economic opportunities and the increase in the number of people competing for these opportunities compel individuals to expand agricultural production by clearing forests (Burns, Kick, and Davis 2003). This often occurs when an "army of surplus laborers" moves to obtain property by clearing land when road building opens up a region for development (Rudel 1993). Jorgenson (2006), Ehrhardt-Martinez (1998), and Rudel (1989) among others find support for the hypothesis that population growth increases deforestation.

York, Rosa, and Dietz (2003) argue that it is important to "decompose" population in cross-national research. That is, researchers should examine not just overall growth rates per se, but also the impact of growth in different contexts. Accordingly, Jorgenson and Burns (2007) find that rural population growth should

contribute to deforestation while urban population growth reduces it. They argue that expanding urban centers often create economic opportunities other than agricultural ones, which attract people to cities. This process relieves the demand on forest resources and reduces deforestation. Thus, we examine the differential impact of rural and urban population growth on deforestation in the context of debt and structural adjustment.

We have provided the rationale for including debt service, structural adjustment, international non-governmental organizations, and population growth in our models. We also take several other factors into account. These variables include gross domestic product per capita, economic growth, domestic economy structure, democracy, government spending, forest stocks, and data quality. We provide a brief discussion for why these measures may also predict deforestation below.

### **Nations Included**

We include nations located in Asia, Africa, Latin America, and the Caribbean that are not classified as high income according to the World Bank's (2003) income quartile classification scheme.<sup>1</sup> We exclude high income nations because they do not receive structural adjustment loans. We also do not include nations formed following the collapse of the Soviet Union because there are no data for them in 1990. This yields a sample of sixty-three nations for which complete data are available. We follow the standard practice to report and remove any influential cases from the analysis (Jorgenson 2003).

### **Dependent Variable**

Deforestation:

The dependent variable for our analysis is the average annual percentage change in natural forest area from 1990 to 2005. Please note that deforestation is signified by a positive value for interpretation purposes. The data may be obtained from the Food and Agriculture Organization (2005). This measure includes land greater than half a hectare in size with trees higher than five meters and a canopy cover of more than ten percent. A natural forest consists only of native forest species with the possible exception of small areas of natural regeneration or assisted natural regeneration. This measure excludes forest plantations, which are areas established through planting or seeding (Food and Agricultural Organization 2005). Most cross-national research (e.g., Shandra 2007a, Jorgenson 2006; Burns, Kick, and Davis 2006) examines the average annual percentage change in total forest area, which includes natural forest areas as well as forest plantations. A forest plantation often involves relative homogeneity in the types of species grown for commercial purposes (World Resources Institute 2005). Thus, we use natural forest area data because we are interested in the potential effects of debt and structural adjustment on land that is not already being intensively managed for commercial production. We provide descriptive statistics and bivariate correlations in Table 1.

(Table 1 goes about here.)

### **Independent Variables**

#### Gross Domestic Product Per Capita:

As is standard in such analyses, it is incumbent on us to take into account a nation's level of development in order to make sure that any effects discovered are independent of a nation's level of wealth (London and Ross 1995). In this regard, we

employ a measure of gross domestic product per capita at parity purchasing power for 1990. These data may be obtained from the World Bank (2003). We log this variable to correct for its skewed distribution. Shandra (2007b) and Jorgenson (2006) find that economic development reduces deforestation. Burns, Kick, and Davis (2003, 2006) contribute this finding to wealthier nations externalizing their environmental costs by importing natural resources from poorer nations. Thus, we anticipate that gross domestic product per capita should decrease deforestation.

#### Economic Growth:

We also include the average annual economic growth rate from 1980 to 1990. These data may be obtained from the World Bank (2003). It is generally thought that economic growth should increase deforestation. This is because there are large amounts of capital available for investment in activities that accelerate forest loss during periods of economic growth (Rudel 1989).

#### Service-Based Economic Activity:

We also include the value added from service-based economic activity as a percentage of gross domestic product for 1990. The data may be obtained from the World Bank (2003). We include this variable because it has been suggested that the structure of the economy within a nation may be helpful in explaining deforestation (Ehrhardt-Martinez, Crenshaw, and Jenkins 2002). Jorgenson (2006) argues that poor nations largely rely on export markets to stimulate economic growth. In this regard, nations often export primary products and agricultural goods, which increase deforestation. However, forest loss may be mitigated to the extent that nations have something other than raw materials to export like services and manufacturing. Thus, we

hypothesize that nations with high levels of value added in services should have less deforestation.

Manufacturing-Based Economic Activity:

We also include value added from the manufacturing sector as a percentage of gross domestic product in 1990. These data may be obtained from the World Bank (2003). We include this variable to control for the structure of a domestic economy. As explained above, we hypothesize that nations with a larger amount of economic activity from manufacturing should have less deforestation.

Political Rights:

We use Freedom House's (1997) political rights scale as one measure of democracy. Political rights reflect the degree to which a nation is governed by democratically elected representatives and has fair, open, and inclusive elections. The variable is a seven-point scale with the following codes: free (1-2), partially free (3-5), and not free (6-7). We multiply our index by negative one so that high scores correspond with high democracy. We anticipate that democracy should decrease deforestation because of political activism and electoral accountability (Li and Reuveny 2006). In general, democratic nations have higher levels of political activism than repressive nations because democracies guarantee certain rights including freedoms of speech, press, and assembly (Ehrhardt-Martinez, Crenshaw, and Jenkins 2002). Leaders in a democracy must be responsive to such activism because of electoral accountability (Midlarsky 1998). Further, greater freedom of the press and assembly leads to wider diffusion of information, which, in turn, raises public awareness. Therefore,

environmental groups are often more successful at informing people and organizing them to act in democratic rather than in repressive nations (Li and Reuveny 2006).

Civil Liberties:

We also include Freedom House's (1997) civil liberties scale as an alternative indicator of democracy. Civil liberties reflect whether within a nation there is freedom of press, freedom of assembly, general personal freedom, freedom of private organizations, and freedom of private property (Freedom House 1997). The variable has the same seven-point coding scheme as political rights so we multiply it by negative one so that high scores indicate high democracy. Like political rights, civil liberties should decrease deforestation in the poor nations.

Government Expenditures:

We also include a variable to assess the effect of state strength on deforestation. This variable is the total amount of central government expenditures as a percentage of gross domestic product for 1990. This data may be obtained from the World Bank (2003). Deacon (1994) argues that when weak governments lack the ability to enforce how forests are used they tend to be treated as open access resources, which may lead to increased deforestation. Thus, we hypothesize that government spending should reduce deforestation. However, it may well be that governments are spending money on projects that increase deforestation such as infrastructure and rural resettlement programs (Rich 1994).

Population Growth:

The neo-Malthusian perspective suggests that demographic factors shape deforestation. Therefore, we include the population growth from 1980 to 1990 in the

analysis. The data may be obtained from the World Bank (2003). We hypothesize that population growth should increase deforestation.

#### Rural Population Growth:

We note above that Jorgenson and Burns (2007) find that it is important to "decompose" demographic factors. That is, researchers should examine not just overall growth rates per se, but also the impact of population growth in different contexts (York, Rosa, and Dietz 2003). Therefore, we include the rural population growth rate from 1980 to 1990. These data may be obtained from the World Bank (2003). We hypothesize that rural population growth should increase deforestation.

#### Urban Population Growth:

We also include the urban population growth rate from 1980 to 1990. These data may also be obtained from the World Bank (2003). The discussion of neo-Malthusian theory suggests that urban population growth should reduce deforestation by removing excess population from rural areas and relieving pressure on forests (Jorgenson and Burns 2007).

#### Natural Forest Stocks:

It is necessary to include a measure that controls for the potentially biasing effects of relative abundance or scarcity of forest resources (Rudel 1989). Therefore, we include natural forest area for 1990. We log this variable to control for its skewed distribution. The data may be obtained from the Food and Agricultural Organizations (2005).

#### Data Quality:

We also take into account data quality of the deforestation estimates. The data may be obtained from the Food and Agriculture Organization (2005). We classify

forestry statistics as being highly reliable if they are based upon remote sensing survey or current national field sampling estimates. We classify forestry statistics as having low reliability if they are based upon expert estimates, which often involves extrapolation from an outdated national inventory. As such, we include a dummy variable for reliability of deforestation, identifying those nations in which forest cover measures are based upon remote sensing surveys or current national field sampling estimates and should, therefore, be of higher quality (1 = high data quality). The reference category includes nations whose forestry estimates are based upon expert estimates or an outdated inventory (0 = low data quality). This coding has been used previously by Shandra (2007b).

#### Non-Governmental Organizations:

We also include the total number of international non-governmental organizations working on environmental issues in a nation per capita for 1990. The data were collected by Smith (2004) from the *Yearbook of International Associations*. The population data may be obtained from the World Bank (2003). It has been used recently by Shandra (2007a) and Smith and Wiest (2005). World polity theory hypothesizes that international non-governmental organizations should reduce deforestation.

#### Structural Adjustment:

To capture the effects of structural adjustment, pressure, and conditionality required by the International Monetary Fund and other multilateral lenders, Walton and Ragin (1990) developed a conditionality index. It has been used previously by Shandra, London, and Williamson (2003), Bradshaw and Schafer (2000), Schafer (1999), and Buchman (1996). This index is the sum of four variables which include (1) the number



of debt renegotiations between a country and an international financial body, (2) the number of debt restructurings experienced by an indebted nation, (3) the number of times a country utilized the International Monetary Fund Extended Fund Facility, and (4) the total International Monetary Fund loans received by a country as a percentage of its allocated quota. The variables are measured in 1990. The four components of the index are converted to z-scores and summed. The index effectively approximates structural adjustment because the International Monetary Fund imposes conditions in each of its negotiations and renegotiations with indebted nations (Walton and Ragin 1990). See Bradshaw and Wahl (1991) or Walton and Ragin (1990) for a more detailed discussion. Dependency theory hypothesizes that structural adjustment should increase deforestation.

Total Debt Service Ratio:

In addition to the pressure to adjust their economies under structural adjustment, indebted nations must continually service their foreign debts. Therefore, it is also important to control for debt service as well as structural adjustment. This approach has been used previously by Bradshaw and Schafer (2000), Schafer (1999), and Buchman (1996). Thus, we also include the average sum of principal and interest payments in foreign currency, goods, or services on long-term public and publicly guaranteed private debt with maturity of one year or longer as a percentage of goods and services exports in 1990. The data come from the World Bank (2003). We log this variable to deal with its skewed distribution. According to dependency theory, total debt service should also increase deforestation.

International Monetary Fund and World Bank Debt Service Ratio:

We also include the average debt service ratio that covers long-term public debt and repayments *only* to the International Monetary Fund and World Bank. The data are measured as a percentage of exports of goods and services for 1990. They may be obtained from the World Bank (2003). This variable is logged to control for its skewed distribution. Like total debt service, this variable should also be associated with more forest loss.

## **Findings**

In Table 2, we present the ordinary least squares estimates of deforestation. In every equation, we include the gross domestic product per capita, economic growth, service-based economic activity, manufacturing-based economic activity, government expenditures, forest stocks, data quality, international non-governmental organizations, and structural adjustment. We also include measures of population growth. In equations (2.1), (2.2), (2.5), and (2.6), we include the total population growth rate. We examine rural and urban population growth in equations (2.3), (2.4), (2.7), and (2.8). We examine the impact of political rights in odd-numbered equations and civil liberties in even-numbered equations. Finally, we examine total debt service in equations (2.1) through (2.4) and debt service to only the International Monetary Fund and World Bank in equations (2.5) through (2.8).

We organize our analysis in this way for several important reasons. First, we want to avoid potential problems with multicollinearity. When we include political rights and civil liberties in the analysis at the same time, variance inflation factor scores are greater than ten. This is likely due to the high bivariate correlation between these variable ( $r = .844$ ). However, the highest variance inflation factor score are less than four

in models where we examine the effects of these variables separately. Second, the sequential use of "cognate" but "distinct" indicators of more than one independent variable should shed considerable light on the complexity of dynamics involving the issue under investigation (London and Ross 1995). If both political rights and civil liberties maintain similar effects on deforestation, for example, then confidence in the findings is enhanced. Third, multiple indicators help guard against potential problems associated with measurement error, because one indicator may be imperfect but several measures are less likely to have the same error (Paxton 2002).

(Table 2 goes about here.)

Let us begin by focusing on the significant findings. First, we find substantial support for dependency theory that both debt and structural adjustment increase deforestation. The coefficients for structural adjustment are positive and significant in every equation. The coefficients for the two debt service ratios are also positive and significant in every equation. Second, we find support that international non-governmental organizations reduce deforestation. The coefficients for this variable are negative and significant in every equation. Third, we also find support for aspects of neo-Malthusian theory. The coefficients for the rural population growth rate are positive and significant in every equation in which it is included, indicating that rural population growth contributes to increased deforestation. Fourth, we find some support for the claim that nations with a greater share of manufacturing have less deforestation. The coefficients for this variable are negative and significant in four of the eight equations. Fifth, the coefficients for both data quality and forest stocks are negative and significant in every equation.<sup>2</sup>

There are some other non-significant findings that also should be mentioned. First, we find no support for ideas that democracy affects deforestation. The coefficients for both political rights and civil liberties do not reach a level of statistical significance.<sup>3</sup> Second, we do not find that economic development decreases deforestation. The coefficients for gross domestic product per capita are not statistically significant.<sup>4</sup> Third, we do not find support for the hypothesis that economic growth increases deforestation. The coefficients for this variable are positive but do not reach a level of statistical significance. Fourth, no support was found for certain aspects of the neo-Malthusian theory. We do not observe that urban population growth reduces deforestation by luring people to cities and lessening demands on forest resources. The coefficients for this variable are negative but not statistically significant. Likewise, the coefficients for total population growth are not significant. Fifth, we do not find that nations with a large service sector have less forest loss. The coefficients for service-based economic activity are not significant.<sup>5</sup> Sixth, we find no support for hypotheses that government spending affects forests.<sup>6</sup>

## **Discussion and Conclusion**

This study extends cross-national research on deforestation in a novel way. Previous work only considered how various debt indicators impact deforestation. However, it did not consider the effect of structural adjustment on forest loss. We addressed this gap in the literature by examining the impact of both factors on deforestation. As such, we found substantial support for dependency theory. The results indicate that debt service and structural adjustment increase forest loss. The reliability of these findings is demonstrated by their significance across alternative model

specifications and techniques for handling missing data. Thus, it is clearly important to consider debt service and structural adjustment when testing dependency theory hypotheses in a cross-national research regarding the natural environment.

We also found that it is still important to consider insights from other theories. First, we found that rural population growth increases deforestation while total population growth did not. This finding highlights Jorgenson and Burns' (2007) contention about the need to "decompose" demographic factors in cross-national research. It is clearly important to consider not just overall growth per se but also growth in different contexts—see also York, Rosa, and Dietz (2003). Second, our analysis supports world polity hypotheses that international non-governmental organizations decrease deforestation. This finding corresponds with recent research by Shandra (2007a) and Schofer and Hironaka (2005).

Some important policy implications originate from the main findings. First, it may serve non-governmental organizations well to focus their efforts on projects that decrease debt and deforestation. A "debt-for-nature" swap is a very good example. The procedure usually entails an international non-governmental organization paying off a portion of a nation's debt in return for that nation setting aside a certain amount of land for permanent protection (Cartwright 1989). Nevertheless, debt-for-nature swaps can be criticized for being "reformist" in that the swaps do not address the causes of increasing debt among poor nations (Newell 2001). Bryant and Bailey (1997) write, "If the argument is that fundamental change is the only way in which to solve the environmental crisis," then international non-governmental organizations "may be part of the problem and not part of the solution" (143). Accordingly, international non-governmental

organizations should also focus their efforts of lobbying leaders of lending institutions for greater debt forgiveness and elimination of structural adjustment loans. This process could also involve lobbying leaders in rich nations to withhold funding to multilateral institutions until such changes occur (Rich 1994).

These policy suggestions also point to some promising avenues for future research. The International Monetary Fund and World Bank's Enhanced Highly Indebted Poor Countries (HIPC) Initiative offers debt forgiveness and low interest loans to reduce debt repayments to "sustainable" levels. However, governments must meet a range of economic management and performance targets to qualify for the aid (Peet 2003). The HIPC Initiative targets usually involve liberalization of trade and fiscal policy (e.g., tax holidays, firing workers at will, and weakening of government regulations), which are quite similar to structural adjustment loan conditions. Thus, future research should consider if debt relief provided under the HIPC Initiative decreases pressure on forests or if the economic targets that must be met to qualify for the program promote it.

## Endnotes

1. The following nations are included in the analysis: Albania, Algeria, Angola, Argentina, Bangladesh, Benin, Bolivia, Brazil, Bulgaria, Burkina Faso, Central African Republic, Chad, Chile, China, Columbia, Congo, El Salvador, Ethiopia, Gabon, Gambia, Ghana, Guatemala, Guinea, Guinea-Bissau, Honduras, Hungary, India, Jamaica, Kenya, Lesotho, Madagascar, Malawi, Malaysia, Mauritius, Mexico, Mongolia, Mozambique, Nepal, Nicaragua, Nigeria, Pakistan, Panama, Papua New Guinea, Paraguay, Peru, Philippines, Poland, Romania, Rwanda, Senegal, Sierra Leone, South Africa, Sri Lanka, Swaziland, Tanzania, Thailand, Togo, Trinidad, Uganda, Uruguay, Zambia, and Zimbabwe.
2. A problem that commonly arises in cross-national research is that of missing data. Statistical procedures such as multivariate regression analysis generally assume that each country has complete data. However, for numerous reasons, countries may be missing values on one or more of the variables under investigation. When this is the case, questions may emerge about the extent to which inferences about the parameters and tests of statistics are influenced by the presence of incomplete data. When using listwise deletion, for example, the effective sample size only includes those nations with complete records, and, consequently, this number can be substantially smaller than the original sample size if missing observations are scattered across many nations. Further, nations that are excluded will often be the poorer countries that have fewer resources to allocate toward record keeping. Thus, the final sample may not be representative of the poorest nations. We attempt to determine if our estimates are biased by listwise deletion by using Arbuckle's (1996) full information maximum

likelihood estimation routine to handle incomplete data. This approach has been used by Jorgenson (2003), Paxton (2002), and Kentor (2001). The size and significance of the full information maximum likelihood estimates are remarkably similar to the listwise deletion estimates, providing little evidence that the listwise deletion results are biased.

3. Bollen and Paxton (2000) argue that non-random measurement error arising from the subjective perceptions of judges affect all cross-national measures of democracy to some degree. This bias may distort comparisons across nations, undermining the empirical results that ignore it. Therefore, we also estimate our models using the level of democracy or autocracy in a nation using data from the Polity IV Project (2005). This measure ranges from – 10 (autocracy) to 10 (democracy). The results using this measure are very similar to the results reported for the measurements of democracy in Table 1. We do not present these results for sake of space.
4. Ehrhardt-Martinez, Crenshaw, and Jenkins (2002) found that an environmental Kuznets curve exists between gross domestic product per capita and deforestation. We test this hypothesis using a quadratic polynomial equation in which the gross domestic product per capita and its square are entered into the same model. If this relationship exists, the sign of the coefficient for the level of development should be positive and the sign of the coefficient for the squared term should be negative with this term being statistically significant. To reduce problems of multicollinearity, we begin by centering the linear term around its mean. We then square the centered term. Finally, we include the centered linear term and squared term in our models



(York, Rosa, and Dietz 2003). The coefficients for the squared term are negative but fail to achieve statistical significance.

5. Ehrhardt-Martinez (1998) tests for the presence of an inverted u-shaped curve between urbanization and deforestation. We use the same procedure in the previous endnote to test this hypothesis. The squared urbanization term is negative but fails to predict any significant variation in deforestation, indicating no support for an environmental Kuznets curve between urbanization and deforestation.
6. Bradshaw and Schafer (2000) argue that it is not only important to examine overall government spending but also how governments allocate their resources. Therefore, we replaced total government spending with total government expenditures for health and total government expenditures for education. These variables are measured as a percentage of gross domestic product for 1990. The data may be obtained from the World Bank (2003). The coefficients for both variables are negative but not statistically significant.

## Works Cited

- Arbuckle, J. L. 1997. *Amos Users' Guide*. Chicago: Small Waters Corporation.
- Barbosa, L. C. 2001. *The Brazilian Amazon Rainforest: Global Ecopolitics, Development, and Democracy*. New York: University of American Press.
- Boli, J. and G. M. Thomas. 1999. *Constructing World Culture: International Nongovernmental Organizations Since 1875*. Stanford: Stanford University Press.
- Bollen, K. and P. Paxton. 2000. "Subjective Measures of Liberal Democracy." *Comparative Political Studies* 33: 58-87.
- Bradshaw, Y. and M. Schafer. 2000. "Urbanization and Development: The Emergence of International Non-Governmental Organizations among Declining States." *Sociological Perspectives* 43: 97-116.
- Bradshaw, Y. and A. Wahl. 1991. "Foreign Debt Expansion, the International Monetary Fund, and Regional Variation in Third World Poverty." *International Studies Quarterly* 35: 251-272.
- Bryant, R. L. and S. Bailey. 1997. *Third World Political Ecology*. London: Routledge.
- Buchman, C. 1996. "The Debt Crisis, Structural Adjustment, and Women's Education: Implications for Status and Development." *International Journal of Comparative Sociology* 37: 5-30.
- Burns, T. J., E. L. Kick, and B. L. Davis. 2006. "A Quantitative, Cross-National Study of Deforestation in the Late 20th Century: A Case of Recursive Exploitation." Pp. 37-60 in *Globalization and the Environment*, edited by A. K. Jorgenson and E. Kick. Leiden: Brill Press.
- Burns, T. J., E. L. Kick, and B. L. Davis. 2003. "Theorizing and Rethinking Linkages Between the Natural Environment and the Modern World System: Deforestation in the Late 20<sup>th</sup> Century." *Journal of World-Systems Research* 9: 357-390.
- Capistrano, A. D. 1994. "Tropical Forest Depletion and the Changing Macroeconomy, 1967-85." in *The Causes of Tropical Deforestation*, edited by Katrina Brown and David Pearce. University of California Press.
- Cartwright, J. 1989. "Conserving Nature and Decreasing Debt." *Third World Quarterly* 11: 114-27.
- Clapp, J. 1998. "Foreign Direct Investment in Hazardous Industries in Developing Countries: Rethinking the Debate." *Environmental Politics* 7: 92-113.

Clapp, J. 1994. "The Toxic Waste Trade with Less-Industrialized Countries: Economic Linkages and Political Alliances." *Third World Quarterly* 15: 505-518.

Culas, J. R. 2006. "Debt and Deforestation: A Review of Causes and Empirical Evidence." *Journal of Developing Societies* 22: 347-360.

Deacon, R. T. 1994. "Deforestation and the Rule of Law in a Cross-Section of Countries." *Land Economics* 70: 414-30.

Ehrhardt-Martinez, K., E. M. Crenshaw, and J. C. Jenkins. 2002. "Deforestation and the Environmental Kuznets Curve: A Cross-National Investigation of Intervening Mechanisms." *Social Science Quarterly* 83: 226-43.

Ehrhardt-Martinez, K. 1998. "Social Determinants of Deforestation in Developing Countries." *Social Forces* 77: 567-86.

Ehrlich, P. and A. Ehrlich. 2004. *One With Nineveh: Politics, Consumption, and the Human Future*. Island Press: New York.

Finnemore, M. and K. Sikkink. 1998. "International Norm Dynamics and Political Change." *International Organization* 52: 887-917.

Food and Agriculture Organization of the United Nations. 2005. *Global Forest Resources Assessment 2005: Progress Towards Sustainable Forest Management*. Food and Agriculture Organization Forestry Paper 147. Rome: United Nations.

Frank, D. J., A. Hironaka, and E. Schofer. 2000. "The Nation-State and the Natural Environment over the Twentieth Century." *American Sociological Review* 65: 96-116.

Frank, D. J. 1999. "The Social Bases of Environmental Treaty Ratification." *Sociological Inquiry* 69: 523-550.

Freedom House. 1997. *Freedom in the World: 1996-1997*. New York: Freedom House.

George, S., and F. Sabelli. 1994. *Faith and Credit: The World Bank's Secular Empire*. Boulder: Westview Press.

George, S.. 1992. *The Debt Boomerang*. Boulder: Pluto Press.

Hafner-Burton, E. M. and K. Tsutsui. 2005. "Human Rights in a Globalizing World: The Paradox of Empty Promises." *American Journal of Sociology* 110: 1373-1411.

Hurst, P. 1990. *Rainforest Politics*. London: Zed Books.

Jorgenson, A.K., and T. J. Burns. 2007. "Effects of Rural and Urban Populations and National Development on Deforestation in Less Developed Countries, 1990-2000." *Sociological Inquiry* 77: 460-482.

Jorgenson, A. K. 2006. "Unequal Exchange and Environmental Degradation: A Theoretical Proposition and Cross-National Study of Deforestation." *Rural Sociology* 71: 685-712.

Jorgenson, A. K. 2003. "Consumption and Environmental Degradation: A Cross-National Analysis of the Ecological Footprint." *Social Problems* 41: 279-288.

Kahn, J. R. and J. A. MacDonald. 1994. "International Debt and Deforestation." Pp. 57-67 in *The Causes of Tropical Deforestation*, edited by K. Brown and D. Pearce. Vancouver: UCB.

Keck, M. and K. Sikkink. 1998. *Activists Beyond Borders*. Ithaca: Cornell University Press.

Kentor, J. 2001. "The Long Term Effects of Globalization on Income Inequality, Population Growth, and Economic Development." *Social Problems* 48: 435-455.

Leonard, H. J. 1988. *Pollution and the Struggle for World Product: Multinational Corporations, the Environment, and International Comparative Advantage*. Cambridge: Harvard University Press.

Li, Q. and R. Reuveny. 2006. "Democracy and Environmental Degradation." *International Studies Quarterly* 50: 935-956.

London, B. and R. J. S. Ross. 1995. "The Political Sociology of Foreign Direct Investment: Global Capitalism and Capital Mobility, 1965-1980." *International Journal of Comparative Sociology* 36: 198-219.

Malthus, T. 1983. *An Essay on the Principle of Population*. New York: Penguin Books.

Marquart-Pyatt, S. 2004. "A Cross-National Analysis of Deforestation, Debt, State Fiscal Capacity, and the Environmental Kuznets Curve." *International Journal of Sociology* 34: 33-51.

Midlarsky, M. I. 1998. "Democracy and the Environment: An Empirical Assessment." *Journal of Peace Research* 35: 341-361.

Mohan, G. 2001. "The Environmental Impacts of Adjustment." Pp.95-117 in *Structural Adjustment: Theory, Practice, and Impacts* edited by Giles Mohan, Ed Brown, Bob Milward, and Aldred B. Zack-Williams. New York: Routledge.

- Paxton, P. 2002. "Social Capital and Democracy: An Interdependent Relationship." *American Sociological Review* 67: 254-77.
- Peet, R. 2003. *The Unholy Trinity: The International Monetary Fund, World Bank, and World Trade Organization*. London: Zed Books.
- Polity IV Project. 2005. *Polity IV Project: Political Regime Characteristics and Transitions*. College Park: University of Maryland.
- Rich, B. A. 1994. *Mortgaging the Earth: The World Bank, Environmental Impoverishment, and the Crisis of Development*. Boston: Beacon Press.
- Risse, T., S. C. Ropp, and K. Sikkink, ed(s). 1999. *The Power of Human Rights: International Norms and Domestic Change*. New York: Cambridge University Press.
- Rudel, T. and J. Roper. 1997. "The Paths to Rain Forest Destruction: Cross-National Patterns of Tropical Deforestation, 1975-1990." *World Development* 25: 53-65.
- Rudel, T. 2005. *Tropical Forests: Regional Paths of Destruction and Regeneration in the Late Twentieth Century*. New York: Columbia University Press.
- Rudel, T. 1993. *Tropical Deforestation: Small Farmers and Land Clearing in the Ecuadorian Amazon*. New York: Columbia University Press.
- Rudel, T. 1989. "Population, Development, and Tropical Deforestation: A Cross-National Study." *Rural Sociology* 54: 327-38.
- Schafer, M. J. 1999. "International Non-Governmental Organizations and Third World Education in 1990: A Cross-National Study." *Sociology of Education* 72: 69-88.
- Schofer, E. and A. Hironaka. 2005. "The Effects of World Society on Environmental Outcomes." *Social Forces* 84: 25-47.
- Shandra, J. M., B. London and J. B. Williamson. 2003. "Environmental Degradation, Environmental Sustainability, and Overurbanization in the Developing World: A Quantitative Cross-National Analysis." *Sociological Perspectives* 46: 309-29.
- Shandra, J. M. 2007a. "The World Polity and Deforestation: A Cross-National Analysis." *International Journal of Comparative Sociology* 48: 5-28.
- Shandra, J. M. 2007b. "Non-Governmental Organizations and Deforestation: Good, Bad, or Irrelevant?" *Social Science Quarterly* 88: 665-689.
- Shor, E. Forthcoming. "The Power of Human Rights in Times of Conflict: The Spiral Model for Norms Socialization Revisited." *Social Problems*.

Smith, J. 2004. "Exploring Connections between Globalization and Political Mobilization." *Journal of World System Research* 1: 255-285.

Smith, J. 1995. "Transnational Political Processes and the Human Rights Movement." In L. Kriesberg, M. Dobkowski, and I. Walliman (eds.), *Research in Social Movements, Conflict, and Change*, 185-220. Greenwood: JAI.

Tockman, J. 2001. *The International Monetary Fund—Funding Deforestation*. Washington D. C.: American Lands Alliance.

Walton, J. and C. Ragin. 1990. "Global and National Sources of Political Protest: Third World Responses to the Debt Crisis." *American Sociological Review* 55: 875-90.

World Bank. 2003. *World Development Indicators*. Washington: Compact Disk.

World Resources Institute. 2005. *World Resources 2005: The Wealth of the Poor*. Washington D.C.: World Resources Institute.

York, R., E. A. Rosa, and T. Dietz. 2003. "Footprints on the Earth: The Environmental Consequences of Modernity." *American Sociological Review* 68: 279-300.