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Does Freedom of Domestic Movement Impact Forest Loss? A Cross-National Analysis

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Abstract

On the one hand, previous research argues that growth in rural populations leads to forest loss from clearing trees to make room for the growing population and their farming needs. On the other hand, research is also concerned with how deforestation drives people out of rural areas, leading to overurbanization. From this work, it is clear that the movement of people has an important relationship to forest loss, but it is less clear what the autonomy of people is in this process. Put differently, more focus has been put on state-level economic and environmental factors than political factors when considering the impact of domestic migration on forest loss. Although there has been substantial work on how political factors, like democracy, impact forest loss, there is less research on how political rights, like freedom of domestic movement, may impact forest loss. To build on this research, we test the impact of freedom of domestic movement and democracy on forest loss from 2001 to 2014 for a sample of 107 low- and middle-income nations. We find support for the idea that having more freedom of movement decreases forest loss in more democratic nations compared to less democratic nations. We also find that both rural and urban population growth, among others, is associated with higher levels of forest loss. Together, our findings suggest that the freedom of domestic movement should be taken into consideration in addition to population growth from actual domestic movement when researching forest loss.

Keywords

freedom of domestic movement, internal migration, forest loss, crossnational

Introduction

On the one hand, previous research argues that growth in rural populations leads to forest loss from clearing trees to make room for the growing population and their farming needs. Based on a combination of Malthusian arguments, many argue that rural population increases lead to forest clearing (Allen and Barnes 1985; Cropper and Griffiths 1994; Jorgenson and Burns 2007; Rudel and Roper 1997). Generally, the argument is that when a nation focuses on more agricultural activities, like farming, there tend to be rapid increases in forest loss because of people moving to rural areas, followed by reductions in forest loss when the economic activities in the nation move toward industry and finance, which would require migration to urban areas, taking the pressure off of forests (Allen and Barnes 1985; Ehrhardt-Martinez 1998; Rudel 1989; Tole 1998). More recent formulations of this line of reasoning put less of the blame for forest loss on domestic migrants and instead emphasize how agricultural activities themselves (especially unequal ecological exchanges) increase forest loss (Jorgenson 2006).

On the other hand, research is also concerned with how deforestation drives people out of rural areas, leading to overurbanization. Other research, often in demography conversations, focuses more on theories of overurbanization, specifically the rural-push and urban-pull perspectives (Harper 2009; Hawley 1971; Weeks 2020). According to these perspectives, demographic transitions, like population growth, can result in fewer jobs and less income, driving increasingly

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impoverished rural populations into urban areas (Bradshaw 1987; Kasarda and Crenshaw 1991; London 1987; Shandra, London, and Williamson 2003). These arguments have also been used to better understand environmental scarcity, where supply-induced scarcity is when resources are degraded or reduced faster than they are replenished, demand-induced scarcity is when there is increased consumption of resources per capita, and structural scarcity is when resources are concentrated in a few people and the remaining population has resource shortages (Homer-Dixon 1994). Environmental scarcity can lead to rural-to-urban migration due to fewer current and future earnings from slowing agricultural production and increased health issues (Broad and Cavanagh 1993; Homer-Dixon 1994).

From this work, it is clear that the movement of people has an important relationship to forest loss, but it is less clear what the autonomy of people is in this process. Put differently, more focus has been put on state-level economic and environmental factors than political factors when considering the impact of domestic migration on forest loss. Although there is substantial work on how political factors, like democracy, impact forest loss, there is less research on how political rights, like freedom of domestic movement, may impact forest loss. Moreover, there still appears to be an implicit assumption in Malthusian arguments that the onus of responsibility for forest loss from rural population growth is on individual people rather than the result of global and domestic political and economic factors beyond any ordinary individual's control.

Thus, in this article, we aim to build on this previous research by refocusing the discussion of forest loss resulting from an assumption of domestic migration to rural areas to the possible impacts of the right to freedom of domestic movement on forest loss. Repositioning this argument in conjunction with human rights arguments may help further reveal the complexities of the domestic movement of populations on forest loss. Moreover, we also test an interaction effect between a nation's democracy composition and freedom of domestic movement on forest loss to further assess how the larger political characteristics of a nation can influence these processes. In doing so, we test the impact of freedom of domestic movement (Coppedge et al. 2021) and democracy composition (Vanhanen and Lundell 2014) on the World Resources Institute's (2016) measure of forest loss from 2001 to 2014 for a sample of 107 low- and middle-income nations.

Our article is organized in the following way. Next, we describe previous research on domestic migration, democracy, and human rights measures concerning forest loss. Then, we present our argument and reasoning for why a nation's democracy composition and freedom of domestic movement may interact to impact forest loss. Finally, we explain our analysis, data, and findings and conclude with a discussion of how our results build on previous research, what policy actions they may suggest, and directions for future research.

Previous Research

On the one hand, previous research in Malthusian traditions suggests that the more a nation is focused on agricultural activities, like farming, the more likely it is to experience a rapid increase in forest loss because of people moving to rural areas (Carr 2009a; Perz 2001). For example, Wright and Muller-Landau (2006) assert that depopulating rural areas may reduce pressure on forests. Other scholars also point out that lowering demand for agricultural lands in rural areas along with increasing yields is likely to lead to land-sparing (Green et al. 2005). In line with this argument, Aide and Grau (2004) also find that decreasing local population density in rural areas could promote reforestation through natural regeneration. Similarly, Jorgenson and Burns (2007) find that increase in rural population is positively associated with deforestation, especially in less developed countries with weak forest protection policies and heavy agricultural and industrial intervention. Juniwaty et al. (2019) present another angle by arguing that in cases where more men migrate away from rural areas, forest use will change because women pursue different productive activities. Juniwaty et al. (2019) argue that when family members migrate to urban areas to pursue education, it will lead to increased household costs, followed by the intensification of agriculture and, thus, deforestation.

Similarly, Carr (2009b) finds that rural areas with low population density have experienced deforestation because government safeguarding tools to protect the forest are very few. In other cases, governments feel pressure to create settlements and develop frontiers. This leads to migration, bringing more available labor supply and low wages in frontier areas. The result is lowering the transaction costs of finding and employing laborers, improving the profitability of crop production, and promoting land clearing and deforestation (Amacher, Koskela, and Ollikainen 2009). Similarly, Rudel, Schneider, and Uriarte (2010) argue that forest cover returns on abandoned small farms in the domestic movement of people seeking job opportunities in urban and international destinations. More recent research, notably Rudel et al.'s (2020) findings, hint at the possibility of a "forest transition" where industrialization and urbanization will over time lead to increased tree cover.

On the other hand, researchers point out that a declining rural population does not necessarily mean that forest loss will stop or naturally rejuvenate. Areas that lose population can still experience deforestation as modern mechanized agriculture replaces traditional farming (Morton et al. 2006; Sloan 2008. For instance, Ehrhardt-Martinez's (1998) study shows that urbanization has a curvilinear effect on deforestation rates whereby as a nation transitions from rural agricultural activities to urban manufacturing labor, populations will congregate in urban areas, reducing the pressure on forests in rural areas. Building on this claim, Ehrhardt-Martinez, Crenshaw, and Jenkins (2002) find that rural-to-urban

migration reduces the detrimental impact of rural populations on forest loss.

Another widely cited explanation for deforestation is linked to urban migration. Hawley (1971) argues that population increase in rural areas may outstrip job opportunities and decrease agricultural productivity. These dynamics will likely result in a labor surplus in rural areas that produces poverty and leads to population migration to urban centers in search of jobs (Shandra et al. 2003). Shandra et al. (2003) also support the rural-push and urban-pull theory that high levels of deforestation lead to high levels of urbanization as people are pushed from rural to urban areas. Similarly, DeFries et al. (2010) find that rural population growth is not associated with forest loss and connect urban and international demands for agricultural products as the culprits of deforestation.

Freedom of Domestic Movement and Forest Loss

The wide range of cross-national research on urban and rural migration has inspired scholars to focus more directly on how migration impacts forest loss. Overall, researchers find that the interactions between migration and deforestation are diverse and that migration can be both the cause and consequence of deforestation. For example, Rudel (2021), among others, recommends that more research is needed to understand possible measures that decrease the adverse effects of migration on the one hand and reduce migration flows caused by deforestation on the other (Schelhas, Brandeis, and Rudel 2021). Rudel et al. (2010) also point out that reforestation declines in areas with large industrial farms. In a similar line of reasoning, Jorgenson (2006) emphasizes how agricultural activities themselves (especially unequal ecological exchanges) increase forest loss. Generally, previous research concerning migration or movement directly is more focused on how migration itself impacts forests rather than focusing on the conditions and contexts in which people may migrate. In fact, many scholars encourage researchers to pay more attention to the link between global commodity demands and deforestation. For example, Zak et al. (2008) show how global commodity demands drive deforestation in areas of high export agriculture growth, such as the southern cone of South America and Argentina. Similarly, Aide et al. (2013) encourage us to consider the global demands for food when analyzing deforestation. Their work finds that deforestation occurred in moist forests and lowland areas with low population density where cover change was unrelated to municipality-scale population change (Aide et al. 2013). In line with the spirit of this previous research, we argue that perhaps shifting the discussion to the conditions in which people migrate domestically and their freedoms and rights to do so may provide a deeper understanding of migration and forest loss.

Although there is no research to our knowledge that focuses on how rights to freedom of domestic movement may impact forest loss, there has been substantial work on how political factors, like democracy, impact forest loss. For example, Li and Reuveny (2006) find that democracy reduces the average annual deforestation rates in the 1980s and the 1990s for 134 countries. Moreover, Mather and Needle (1999) find that democratic countries tend to have stable or expanding forests compared to the rapid forest loss in less democratic countries. Others also find that democracy tends to decrease forest loss (Cary and Bekun 2021; Dietz and Adger 2003). In contrast, Midlarsky (1998a) finds that democracy increases the percentage of annual deforestation between 1981 and 1990 in a sample of 77 countries. This finding is supported by other researchers as well (Ehrhardt-Martinez et al. 2002; Shandra, Shircliff, and London 2011). Conversely, cross-national research finds no relationship between democracy and forest loss (Shandra, Esparza, and London 2021; Shandra, Restivo, and London 2008; Shandra, Shandra and London 2008). More recent research concerning human rights and environmental outcomes also find that women's property rights are associated with lower levels of forest loss (Sommer, Burroway, and Shandra 2022). With these findings in mind, how may rights to freedom of domestic movement impact forest loss? Given the contradictory findings concerning rights and democracy on forest loss, there may be a more complicated relationship that needs further evaluation concerning domestic movement and the right to do so.

Possible Interaction Effects

Drawing on dependency theory traditions, the right to freedom of domestic movement may not have any impact on forest loss or even increase forest loss if there is a lack of opportunities for jobs and livelihoods that do not involve resource-intensive or resource-extractive activities. For example, scholars argue that democratic states are much better positioned to enact policies and allocate resources directed at reducing forest loss (Cozma et al. 2021; Deacon 1994). Hence, several researchers have examined how varying levels of national democracy impact forest loss (Biswas et al. 2021; Cary and Bekun 2021; Didia 1997; Li and Reuveny 2006; Shandra 2007). Generally, more democratic nations have higher levels of activism because public demonstrations and dialogue are not repressed and are instead encouraged as an integral part of the political process (Crenshaw and Jenkins 1996; Paxton 2002; Shandra 2007). These freedoms help dedicate public space to facilitate discussion of environmental rights and issues, while freedoms of press and speech allow for the greater dissemination of environmental demands and information (Barbier and Burgess 2001; Bhattarai and Hammig 2001; Kotov and Nikitina 1995; Murphy 2000; Rydning Gaarder and Vadlamannati 2017; Shandra 2007; Torras and Boyce 1998). Combined with the freedom of domestic movement, people will have the opportunity to relocate to areas that have more opportunities that may not contribute to forest loss.

Moreover, democratic electoral systems help hold politicians and leaders responsible for the demands of the people, potentially yielding political interest in environmental policies and reform (Ehrhardt-Martinez et al. 2002; Rydén et al. 2020). In short, if leaders want to be continually elected, they are incentivized to be accountable to their voters, even if environmental legislation goes against corporate interests (Gleditsch and Sverdrup 2002; Li and Reuveny 2006; Shandra 2007). Thus, because nations with higher levels of democracy tend to be more environmental, largely due to civilians holding their political leaders accountable, there may be more opportunities to move into jobs and areas that are more sustainable (Congleton 1992; Payne 1995; Schultz and Crockett 1990; Shandra et al. 2021).

In contrast, less representative democracies can exacerbate environmental issues. In such cases, the "commons" may be exploited due to a combination of corporate self-interest and poorly defined laws on shared resources like water and air (Hardin 1968 as articulated by Li and Reuveny 2006) because democracies are often market economies favoring corporate interests, which would reduce both the autonomy and opportunities of people to move into more sustainable livelihoods and areas (Dryzek 1987). Furthermore, less representative democracies may suffer from inaction or hypocrisy by failing to address either corporate exploitation or citizens' environmental concerns, again limiting the opportunity for people to benefit from freedom of domestic movement (Chileshe and Moonga 2019; Heilbroner 1974; Jorgenson and Burns 2007; Midlarsky 1998a; Paehlke 1996; Riedel 2021).

Thus, we argue that a combination of high levels of democracy and freedom of domestic movement together should reduce forest loss. What informs this argument? Overall, democratic nations possess the institutional tools to keep environmental concerns and their consequences in the public realm, even if they are not realized due to other external or internal factors (e.g., corporate interests). Specifically, freedom of the press keeps citizens informed about environmental concerns and ensures governments and corporate interests consider the public interest (Farzin and Bond 2006; Obydenkova 2008, 2011). Moreover, the power of civil society groups in reducing deforestation is evident in Shandra et al.'s (2012) study, which finds that the more nongovernmental organization groups are present, the more likely it is to observe lower rates of deforestation. Thus, it appears that when people can choose or have the power to facilitate or demand environmental protection and when other factors are not impinging on their survival necessitating that other actions take precedence, there are measurable positive environmental outcomes.

The freedom to move domestically may, in the same line of reasoning, be vital in reducing forest loss. In contrast to authoritarian regimes, democratic societies permit social mobility, which includes seeking various job opportunities, higher educational attainment, and gender equality (Shandra 2007). The increasing presence of higher educational attainment also means that many will relocate to urban areas and participate in occupations that do not contribute directly to forest loss (Rudel 2017). Additionally, living in these environments will likely increase their sense of activism and demand for environmental concerns to be taken seriously by government and corporations alike (Opoku and Sommer 2023).

Hypotheses

Based on the previous discussions, we expect the following hypotheses.

Hypothesis 1: Higher levels of freedom of domestic movement are associated with lower levels of forest loss.

Hypothesis 2: Higher levels of democracy are associated with lower levels of forest loss.

Hypothesis 3: There is a statistically significant interaction effect between democracy and freedom of domestic movement. Freedom of domestic movement should decrease forest loss more at higher levels of democracy rather than lower levels of democracy.

Methods and Data

Dependent Variable

Forest loss. Until recently, cross-national research on forest loss was largely based on data made available in the United Nation's Food and Agriculture Organization's (FAO) Global Forest Resources Assessment 2010 (e.g., Shandra, Rademacher, and Coburn 2016). These data are used to estimate forest loss over time. They are particularly valuable in discerning between forest loss from deforestation and forest loss from forestry plantations that were created to be cut down. This is an important distinction when measuring forest loss because the dynamics that impact forestry plantations can differ from the dynamics that concern old growth or preexisting forests (Shandra 2007). However, the comparability of the data has been called into question because they are gathered utilizing collection methods that vary from nation to nation (Grainger 2008). In some nations, forest loss estimates may be of low reliability because they are based on expert opinions or extrapolated from an outdated forest inventory rather than remote-sensing data (Grainger 2008). For example, Grainger (2008) empirically analyzed the FAO data and found major inconsistences between three main trends in the data. She found that these conflicting trends are due to errors, changes in statistical design, and new data use. Thus, although these data are often used in analyses over time, much cross-national work uses them cross-sectionally to try to reduce this error or use different data entirely (Shandra 2007; Shandra et al. 2016).

Table 1. Descriptive Statistics and Bivariate Correlation Matrix for Deforestation Analysis ($N = 107$).

	Mean	Standard deviation	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
(1) Forest loss, 2001–2014	.102	.144	1.000										
(2) Freedom of domestic movement, 2000	1.414	.803	−.174	1.000									
(3) Democracy composition, 2000	15.037	12.426	−.161	.402	1.000								
(4) Environmental nongovernmental organizations, 2000	13.508	31.627	−.109	.248	.122	1.000							
(5) Agricultural land area, 2000 (ln)	3.341	.970	.182	−.290	−.120	−.301	1.000						
(6) Population density, 2000 (ln)	4.203	1.478	−.213	.081	.027	.066	.376	1.000					
(7) Gross domestic product (per capita), 2000 (ln)	7.768	1.661	−.261	.485	.315	.359	−.196	−.016	1.000				
(8) Forestry exports, 2000	758270	2818253	−.016	−.026	.107	−.086	−.026	.033	.139	1.000			
(9) Total population growth rate, 1990–2000	.182	.153	.387	−.225	−.353	−.075	−.144	−.173	−.310	−.050	1.000		
(11) Urban population growth rate, 1990–2000	.284	.263	.224	−.236	−.387	−.117	.008	.055	−.347	.077	.564	1.000	
(10) Rural population growth rate, 1990–2000	.087	.193	.337	−.267	−.294	.003	−.126	−.098	−.525	−.246	.729	.210	1.000

Following the work of recent scholars (Rudel 2017; Rudel et al. 2016), we use newly available data on forest loss derived from high-resolution satellite imagery (30×30 m). These data are obtained from the World Resources Institute's (2016) Global Forest Watch site. The major benefit of this measurement is that it more accurately captures forest loss from 2001 to 2014 compared to the forest loss estimates from the FAO because they use high-resolution satellite images for data rather than expert opinions or forest inventories that can be outdated or extrapolated from smaller samples (Grainger 2008; Hansen, Stehman, and Potapov 2010). Although this major improvement in measurement is the key reason these data are used in this study, these data are still flawed.

The measures used to standardize the forest loss data are only available for the year 2000 in the relevant time period for this analysis. Thus, we can only cross-sectionally capture the change in forest loss standardized in the year 2000 from 2001 to 2014 due to how recently high-resolution satellite imagery became available. Although this is a major limitation, it is important to note that this type of measurement is consistent with previous cross-national research (see Shandra et al. 2016). Another limitation of these data is that they do not directly eliminate forest loss from forest plantations. However, these data aim to overcome that by measuring tree cover canopy density to eliminate certain types of forests, like forest plantations. Thus, the researcher can choose the tree cover canopy density level to sort out different types of forests from the data. Therefore, we include only forest loss data equal to 75 percent or greater tree cover canopy density (Hansen et al. 2010; Rudel et al. 2016). Although not perfect, these data have far fewer inconsistencies and internal conflicts than the FAO data (Rudel 2017). See Hansen et al. (2010) for an in-depth discussion of the methodology used to arrive at the estimates. We calculate forest loss in the following way. First, we follow Rudel (2017) and set the minimum tree cover canopy density equal to 75 percent or greater to represent the loss of forests. The tree cover density for a nation represents the estimated percentage of a pixel taken from satellite imagery that is covered by tree canopy (World Resources Institute 2016). In total, 75 percent tree canopy is the accepted limit for forest cover. Second, we obtain the amount of each nation's land area in hectares with the corresponding minimum tree cover canopy density (i.e., 75 percent). These base satellite tree cover data are only available for the year 2000; therefore, the data are analyzed cross-sectionally. Subsequent data are calculated in reference to the 2000 base data. Third, we gather the number of hectares cleared from 2001 to 2014 in the preceding area. Fourth, we divide the total amount of hectares cleared by the total forest size in 2000 to compute the rate of forest loss (Rudel 2017). The resulting variable represents forest loss between 2001 and 2014. Based on the limitations of the data described previously, we use the following sample and statistical model. In Table 1, we provide a bivariate correlation matrix for all the variables used in the analysis. Data may be obtained from the World Bank (2019) unless specified in the following.

Table 2. Ordinary Least Squares Regression Estimates of Forest Loss, 2001 to 2014.

	Model 2.1	Model 2.2
Independent variables		
Freedom of domestic movement, 2000	.020 (.020)	.021 (−.002)
Democracy composition, 2000	.001 (.001)	.001 (−.001)
Environmental nongovernmental organizations, 2000	.001 (.001)	.001 (−.001)
Agricultural land area, 2000	.077*** (.023)	.082*** (−.022)
Population density, 2000	−.042** (.139)	−.048*** (.014)
Gross domestic product, 2000	−.027* (.147)	−.003 (.015)
Forestry exports, 2000	.001 (.001)	.001* (.001)
Total population growth rate, 1990–2000	.489*** (.123)	
Rural population growth rate, 1990–2000		.403** (.132)
Urban population growth rate, 1990–2000		.115* (.067)
Constant	.060	−.090
R^2	.293	.289
Number of countries	107	107
Highest variance inflation factor score	1.61	2.10
Mean variance inflation factor score	1.38	1.49

Note: Standardized coefficients are presented, with the robust standard error in parentheses.
*$p < .05$. **$p < .01$. ***$p < .001$. (one-tailed test).

Sample and Statistical Model

From the aforementioned considerations, the sample consists of 107 low- and middle-income nations. Following recent previous research on forest loss, we focus on low- and middle-income nations only because this grouping of nations experiences more forest loss than high-income nations, which is both theoretically meaningful and practical for our hypotheses and interpretation of findings (see Hargrove and Sommer 2022; Sommer, Restivo, and Shandra 2022; Tasmim, Sommer, and Shandra 2022). We use ordinary least squares regression using robust standard errors to analyze the data. This is the most common methodology employed to analyze the determinants of forest loss with current data availability, reviewed previously (e.g., Shandra et al. 2016; Sommer 2017).

We test for multicollinearity, linearity, outliers, influential cases, and heteroscedasticity. There does not appear to be any potential problems with multicollinearity because mean and highest variance inflation factor scores do not exceed a value of 3 (see Table 2; York, Rosa, and Dietz 2003). We also transform variables and note them in Table 1 (Tabachnick and Sanford 2013). Extreme values did not bias the results. However, the Breush-Pagan statistics indicate the presence of heteroscedasticity, so we report robust standard errors.

Main Independent Variables

Freedom of domestic movement. This variable is available from the Varieties of Democracy Database (Coppedge et al. 2021). According to Coppedge et al. (2021:309), "this indicator specifies the extent to which citizens are able to move freely, in daytime and nighttime, in public thoroughfares, across regions within a country, and to establish permanent residency where they wish." This variable is calculated by averaging the two indicators of freedom of domestic movement for men and freedom of domestic movement for women. They use the following coding system:

> 0: Virtually no [people] enjoy full freedom of movement (e.g., North Korea or Afghanistan under the Taliban). 1: Some [people] enjoy full freedom of movement, but most do not (e.g., Apartheid South Africa). 2: Most [people] enjoy some freedom of movement but a sizeable minority does not. Alternatively, all [people] enjoy partial freedom of movement. 3: Most [people] enjoy full freedom of movement but a small minority does not. 4: Virtually all [people] enjoy full freedom of movement. (Coppedge et al. (2021:183)

Democracy. To measure democracy, we use Vanhanen and Lundell's (2014) democracy composition index, which measures the percentage of votes gained by smaller parties in elections for presidents and parliamentarians in smaller parties and the percentage of the population that voted. This variable ranges from 0 to 45, with higher levels associated with more democracy. We present results using this measure rather than others (such as Freedom House's [2005] civil and political liberty scales and Polity V's measure of democracy) for three reasons. First, a major advantage of these data compared to other measures of democracy (Munck 2009; Munck and Verkuilen 2002) is that it is measured using only two indicators, competition and participation, which are based on election and population data, rather than using multiple indicators often based on expert and opinion data. Second,

although obviously using expert and opinion-based data is fully legitimate, we do test for interaction effects between the freedom of domestic movement measure and democracy and thus aim to simplify the interpretation of the findings as much as possible. Third, democratic competition and participation are more theoretically relevant to our analysis because it encompasses the voting power of minority parties and actual voter participation in elections, which may better encompass environmental and freedom of movement interests even if these issues have less popular support (Shandra et al. 2003). Moreover, this measure is better able to capture variation within democracies compared to other measures that focus more on the variation between democracies and nondemocracies (Vanhanen 2000, 2003). However, it is important to note that the findings we present are substantively similar when using different measures of democracy, including Freedom House's (2005) civil and political liberty scales and Polity V's measure of democracy.

Although some argue democracy should reduce forest loss because the state can be more accountable to the interests of its citizens (assuming the citizens are concerned with reducing environmental issues like forest loss; Li and Reuveny 2006; Marquart-Pyatt 2004; Obydenkova, Nazarov, and Salahodjaev 2016; Ross 2001), others argue that democracies may be more partial to companies than environmentalists and focus more on economic concerns of its citizenry than environmental ones (Kashwan 2017; Midlarsky 1998b).

Control Variable Selection and Measurement

We use recent previous cross-national research on forest loss in low- and middle-income nations to inform our control variable selection (see Hargrove and Sommer 2022; Sommer, Restivo, and Shandra 2022; Tasmim et al. 2022). We control for several factors consistent with previous research on forest loss: gross domestic product (GDP; per capita), environmental nongovernmental organizations (Smith and Wiest 2005), agricultural land area, forestry exports, population density, and population growth. GDP (per capita), environmental nongovernmental organizations, forestry exports, and agricultural land area are measured for the year 2000 to avoid simultaneity bias. Total, rural, and urban population growth represent the change in growth from 1990 to 2000.

Findings

In Tables 2 and 3, we present the ordinary least squares regression estimates of forest loss. The first number presented is the unstandardized coefficient, and the second number in parentheses is the robust standard error. In Table 2, we present the impacts of freedom of domestic movement and democracy (as separate, main effects) and various control variables on forest loss. In Table 3, we present the impact of the interaction between freedom of domestic movement and democracy and control variables on forest loss. Put differently, in Table 3, we include freedom of domestic movement and democracy both separately as main effects and the interaction term (which is Freedom of Domestic Movement × Democracy; Jaccard and Turrisi 2003).

Beginning with the results in Table 2, we find that the coefficients that represent both freedom of domestic movement and democracy fail to reach levels of statistical significance. Even though a significant number of studies indicate that more democratic nations have greater freedom of movement and much higher levels of environmental activism and demands (Crenshaw and Jenkins 1996; Paxton 2002; Shandra 2007), that does not necessarily mean decreases in forest loss will follow. Previous research speculates that in less representative democracies, lands are prone to be exploited by corporate interests and that governments lack the safeguarding tools and willingness to protect forests from corporate exploitation and deforestation (Chileshe and Moonga 2019; Li and Reuveny 2006; Riedel 2021). Nations with lower levels of democracy often are less likely to address civil society's environmental concerns, which may limit the chances for people to benefit from freedom of domestic movement (Midlarsky 1998a; Riedel 2021). The results from Table 2 support arguments stemming from dependency theory whereby the right to freedom of domestic movement may not have any impact on forest loss if there is a lack of opportunities for jobs and livelihoods that do not involve resource-intensive or resource-extractive activities (Bryant and Bailey 1997; Deacon 1994; Sommer 2022; Sommer, Burroway, and Shandra 2022). Moreover, many find contradictory relationships between democracy and forest loss, which can often be explained by interactive relationships (Opoku and Sommer 2023). We further delve into the meaning and interpretation of these findings when we describe Table 3 in the following.

We also find the coefficients representing the control variables for environmental nongovernmental organizations do not consistently reach levels of statistical significance. Our findings correspond with some previous research in this area (Chileshe and Moonga 2019; Li and Reuveny 2006; Riedel 2021). However, we do find that several control variables are related to forest loss. Across Table 2, we find that the coefficients that represent agricultural land area are associated with higher levels of forest loss and that the coefficients that represent population density are associated with lower levels of forest loss. Also, in line with previous research, in Model 2.1, we find that total population growth is associated with higher levels of forest loss, and when we decompose total population growth into rural and urban population growth in Model 2.2, this finding is consistent (Allen and Barnes 1985; Cropper and Griffiths 1994; Morton et al. 2006; Rudel and Roper 1997; Sloan 2008). Although previous studies (Aide and Grau 2004; Green et al. 2005; Wright and Muller-Landau 2006) find that many countries experience a rural-to-urban demographic shift, where people tend to move to urban areas when the economy is not closely linked to natural resource extraction,

Table 3. Ordinary Least Squares Regression Estimates of Forest Loss with Interaction Terms, 2001 to 2014.

	Model 3.1	Model 3.2
Independent variables		
Freedom of domestic movement, 2000 (main effect)	.057* (.315)	.064* (.031)
Democracy composition, 2000 (main effect)	.006* (.003)	.007* (.003)
Freedom of Domestic Movement × Democracy Composition (interaction effect)	−.004* (.002)	−.004* (−.002)
Environmental nongovernmental organizations, 2000	.001* (.001)	.001 (.001)
Agricultural land area, 2000	.076*** (.023)	.082*** (.022)
Population density, 2000	−.043** (.014)	−.049*** (.022)
Gross domestic product, 2000	−.028* (.015)	−.003 (.016)
Forestry exports, 2000	.001* (.001)	.001* (.001)
Total population growth rate, 1990–2000	.489*** (.124)	
Rural population growth rate, 1990–2000		.405*** (.128)
Urban population growth rate, 1990–2000		.126* (.061)
Constant	.031	−0.135
R^2	.314	.316
Number of countries	107	107

Note: Standardized coefficients are presented, with the robust standard error in parentheses.
*$p < .05$. **$p < .01$. ***$p < .001$. (one-tailed test).

which should result in less forest loss, we find both rural population growth and urban population growth are associated with higher levels of forest loss (DeFries et al. 2010; Morton et al. 2006; Rudel and Roper 1997). Moreover, we do find that higher levels of population density are associated with lower levels of forest loss, which both supports previous arguments and helps further clarify the relationship between forest loss and various demographic factors. We also find that forestry exports are associated with higher levels of forest loss in Model 2.2 and that GDP per capita is associated with lower levels of forest loss in Model 2.1, which corresponds with previous research and theory (Jorgenson and Burns 2007).

We now return to the findings concerning freedom of domestic movement and democracy. Moving on to Table 3, we find support for our hypothesis that there is an interactive relationship between freedom of domestic movement and democracy. The coefficients that represent the interaction between freedom of domestic movement and democracy are negative and statistically significant, suggesting that the freedom to move domestically reduces forest loss more at higher rather than lower levels of democracy.

The predicted effects (see Figures 1 and 2) illustrate that freedom of domestic movement in nations with low levels of democracy is actually resulting in increased forest loss. On the other hand, from Figures 1 and 2, we see that in nations with high levels of democracy, freedom of domestic movement has the intended and expected result of decreasing forest loss. The *x*-axis of Figures 1 and 2 represents the interactions between freedom of domestic movement and democracy. The *y*-axis represents the linear prediction of the interaction effect on forest loss. Because the mean of the democracy indicator is about 15, the plotted interactions pass through the horizontal line at this point. We graph the predicted change in freedom of domestic movement as democracy simultaneously increases, holding all continuous covariates at their mean. Looking at the general trend of Figures 1 and 2, the downward sloping lines suggest that freedom of domestic movement reduces forest loss more at higher levels rather than lower levels of democracy. Therefore, nations with the lowest levels of democracy are expected to benefit the least from freedom of domestic movement. According to the marginal effects, at the lowest levels of democracy, there is a positive effect of freedom of domestic movement on forest loss. At slightly higher levels of democracy, freedom of domestic movement has a negative effect on forest loss. At medium levels of democracy, freedom of domestic movement has no effect on forest loss. In contrast, it is clear that higher levels of democracy and freedom of domestic movement have a strong negative effect on forest loss. As a result, nations with the highest levels of democracy are expected to benefit the most from freedom of domestic movement. Overall, the general trend suggests that as freedom of domestic movement and democracy increase, forest loss steadily declines (as indicated by the downward sloping line). The most important takeaway from Figures 1 and 2 is that freedom of domestic movement decreases forest loss more at higher rather than lower levels of democracy. The figures illustrate the need for improvements in democracy and increases in freedom of domestic movement to reduce forest loss.

Together, the findings and predicted effects graphs support the idea that having the freedom to move domestically can reduce forest loss and may be better supported in democracies, allowing for true social mobility, including seeking various job opportunities, higher educational attainment, and gender equality, which are all ultimately beneficial for forest

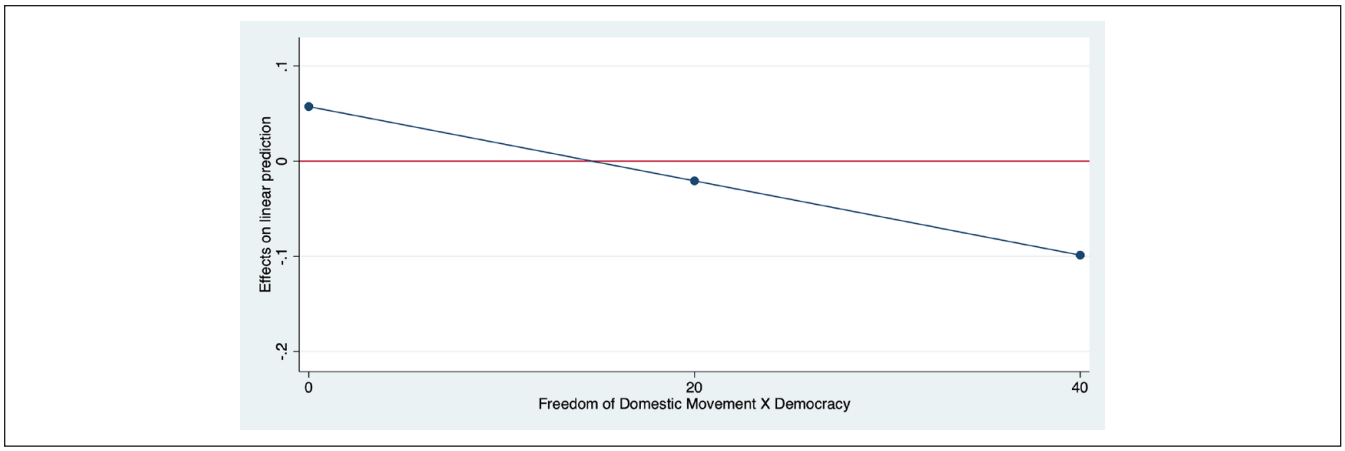

Figure 1. Predicted effects.

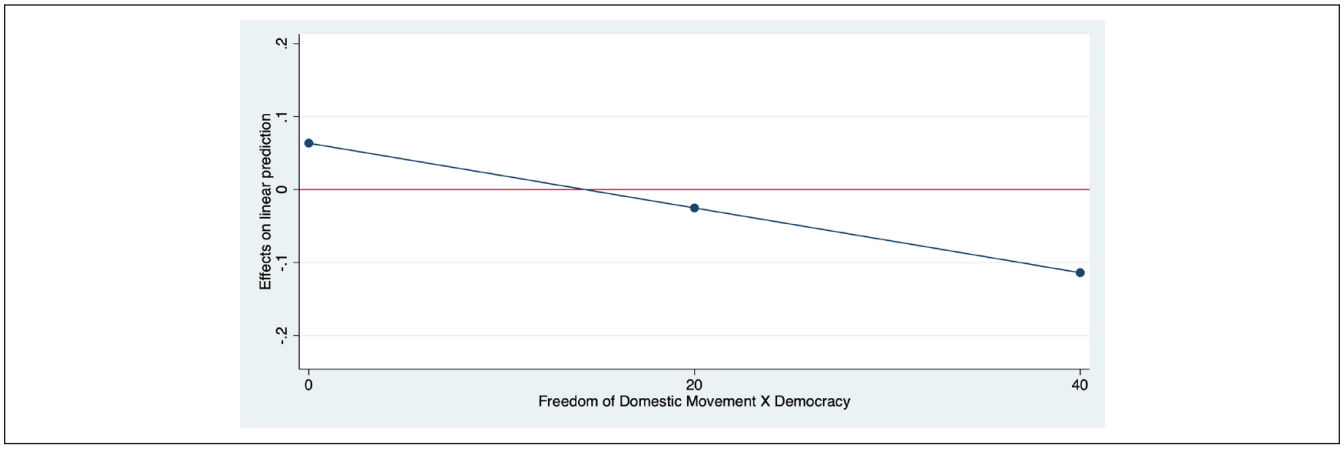

Figure 2. Predicted effects.

preservation and living and working conditions that indirectly contribute to forest loss (Rudel 2023; Shandra 2007). Moreover, living in such environments may increase a sense of activism and demand for environmental concerns to be taken seriously by the government and corporations alike (Opoku and Sommer 2023). Overall, these findings provide support for the idea that having more freedom of movement decreases forest loss in more democratic nations compared to less democratic nations. Together, our findings suggest that the freedom of domestic movement should be taken into consideration in addition to population growth from actual domestic movement when researching forest loss. The remainder of our findings in Table 3 are substantively similar to Table 2 with the exception of environmental nongovernmental organizations in Model 3.1.

Discussion and Conclusion

This study was motivated by previous research that examined the relationship between migration, democracy, and forest loss. Previous studies suggested that rural population growth could lead to deforestation as people cleared forests for agriculture and that deforestation could also drive migration from rural to urban areas (Allen and Barnes 1985; Cropper and Griffiths 1994; Rudel and Roper 1997). The role of political factors, particularly democracy, in influencing forest loss was also explored (Shandra 2007). We aimed to expand on this previous research with respect to the impact of freedom of domestic movement on forest loss and the potential interaction effects between freedom of movement and democracy. Our study builds on previous research by exploring the relationship between freedom of domestic movement, democracy, and forest loss in low- and middle-income nations.

At first, our findings revealed that the coefficients representing freedom of domestic movement and democracy did not reach levels of statistical significance. This indicates that the right to freedom of domestic movement may not independently impact forest loss and taking dependency theory arguments into mind, suggests its effects may be contingent

on the availability of opportunities for movement, such as job opportunities (Bradshaw 1987; Firebaugh 1979; Kasarda and Crenshaw 1991; London 1987; Shandra et al. 2003). Also, the relationship between democracy and forest loss was not statistically significant, which aligns with the existing contradictory findings in the literature.

However, we find that the interaction effect between freedom of domestic movement and democracy is statistically significant. The negative coefficients representing this interaction suggest that the freedom to move domestically is effective in reducing forest loss in more democratic nations. This finding highlights the importance of democratic contexts in enabling social mobility, access to sustainable livelihoods, and the preservation of forests. Thus, our research seems to support the idea that living in environments that promote activism and a demand for environmental concerns can further contribute to reducing forest loss (Opoku and Sommer 2023; Shandra 2007).

Considering the implications of our findings in relation to previous research, it becomes clear that the complexity of the relationship between migration, democracy, and forest loss extends beyond individual factors. The interplay between freedom of movement, democracy, job opportunities, and sustainable livelihoods is crucial for understanding the impact on forest loss (Amacher et al. 2009; Balmford, Green, and Scharlemann 2005; Carr 2009a; Juniwaty et al. 2019). This emphasizes the need to take a complete and context-specific approach when formulating policies to address deforestation and promote sustainable development.

Drawing insights from our findings, policymakers may consider the following strategies. First, promoting democratic institutions and processes can create an environment conducive to addressing environmental concerns and promoting sustainable practices. Providing that citizens are free to move domestically can enhance social mobility and access to sustainable opportunities, reducing the pressure on forests. Second, policymakers should focus on making job opportunities that do not involve resource-intensive or resource-extractive activities, providing alternatives for livelihoods contributing to forest loss. This can involve investments in sectors such as renewable energy, ecotourism, and sustainable agriculture.

Although our study provides valuable insights, there are a few limitations that should be acknowledged. First, the analysis was conducted using cross-sectional data, limiting the ability to establish causal relationships. Future research could employ longitudinal data to explore the temporal dynamics of the relationship between freedom of domestic movement, democracy, and forest loss when data are available. Also, our study focused on low- and middle-income nations, and the findings may not directly apply to high-income nations or specific local contexts. Future research can expand the analysis to include a broader range of countries and conduct case studies to understand the relationship's intricacies better. Additionally, the study did not delve into the tools through which freedom of movement and democracy affect forest loss. Thus, ongoing research is needed to specify the various aspects of democracies that may contribute a more nuanced understanding of the underlying processes of democracy, freedom of movement, and forest loss.

In conclusion, our study contributes to the existing literature by exploring the interaction between freedom of domestic movement, democracy, and forest loss. The results highlight the importance of democratic contexts and the availability of sustainable livelihoods in reducing forest loss. Policymakers can use these findings to inform strategies that promote democratic institutions, create sustainable job opportunities, and protect forests. However, further research is needed to deepen our understanding of the complex relationship between migration, democracy, and forest loss and to explore the mechanisms driving these relationships in different contexts.

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