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Original Paper

Gender Inequality and Environmental Well-Being: A Cross-National Investigation of Ecosystem Vitality and Environmental Health

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Abstract

Ecofeminist perspectives assert that issues of gender and the environment are intertwined, where increasing women's status will lead to more efficacious environmental policy and improved environmental conditions. We investigate the relationship between gender inequality and environmental well-being by employing a distinct set of indicators to better capture women's status in relation to men across a variety of contexts (e.g., health, economic, education, political), as well as a comprehensive environment index that includes a variety of ecological and environmental health measures. The results demonstrate that countries with higher levels of gender inequality are associated with poorer environmental well-being, net of other relevant factors. This lends support to the argument that addressing gender inequalities leads to better results for the environment and human health, and that women need to be included more prominently in environmental policy and planning.

Keywords

gender, environment, environmental health, ecofeminism, cross-national

1. Introduction

Many scholars emphasize the increase and significance of environmental crises across the globe, as well as how environmental degradation impacts human health and well-being (e.g., Steffen et al., 2015; Oglethorpe & Gelman, 2008; Mikkelson et al., 2007; Collins et al., 2016; Mohai & Saha, 2015; Denton, 2002; Austin & Mejia, 2017). While all countries are experiencing environmental changes and ecosystem alterations, a wide body of research documents that certain populations encumber a disproportionate share of environmental degradation and resulting impacts on health (e.g., Althor et al., 2016; Rice, 2007; Morello-Frosch et al., 2011). Indeed, poor nations are much more likely to experience high rates of ecosystem decline and environmental health issues in comparison to affluent nations (e.g., Althor et al., 2016; McKinney & Austin, 2015; Rice, 2007). More developed nations typically experience less environmental degradation within their borders, such as forest loss, despite higher levels of consumption due to their power and position in the global hierarchy which allows them to offshore environmental demands and wastes to poorer nations (e.g., Rice, 2007). However, some environmental outcomes, such as greenhouse gas emissions, are more difficult or impossible to offshore and remain highest in affluent nations with elevated energy demands (Roberts & Parks, 2007).

There is growing recognition that environmental issues are not only unevenly experienced across more- and less-developed nations, but also that certain groups within poorer nations are disproportionally affected by environmental problems and contaminant influences on health, including women (Mikkelson et al., 2007; Collins et al., 2016; Mohai & Saha, 2015; Denton, 2002; Austin & Mejia, 2017). The UN (2015) reports that women and girls are more deeply impacted than males by deforestation, climate change, water contamination, and other ecological concerns (UN Women, 2015). Not only are women differentially affected by various forms of ecological degradation, but numerous studies emphasize that women may also be most influential in mitigating environmental destruction and harm (e.g., Ergas & York, 2012; McKinney, 2014; McKinney & Fulkerson, 2015; Nugent & Shandra, 2009; Shandra et al., 2008).

Indeed, macro-comparative research examining inequalities in ecological and environmental health outcomes across more- and less-developed nations increasingly highlight the role of women's status in shaping trends in environmental well-being (e.g., Austin & Mejia, 2017; Ergas & York, 2012; McKinney, 2014). However, this research is relatively narrow in focus, often relying on unidimensional measures women's status, such as women's representation in government or access to schooling. This body of scholarship also focuses on singular ecological or environmental health issues, such as carbon emissions, deforestation, or indoor air pollution. It is arguable that this approach is insufficient to draw wide conclusions about the relationship between gender and the environment. Additionally, focusing on only one environmental outcome neglects that countries may perform well in one area, such forest preservation, but perform poorly in another area, such as greenhouse gas emissions. Such nuances are especially important as more- and less-developed nations tend to exhibit different and unequal environmental problems, largely due to the structure of the international economy which concentrates many environmental risks in poor nations despite that resource demands come from high-consuming affluent nations.

This study is unique in that we incorporate a comprehensive measure of gender inequality which is quantified by the relative gaps between women and men in four key areas, including health, education, economy, and politics. Additionally, we employ a broad measure of environmental performance that incorporates a myriad of ecological issues as well as key environmental health threats. By going beyond singular measures of women's status and environmental well-being, our study adds to the body of literature by potentially demonstrating that the relationship between gender inequality and the environment does not only apply to a certain set of issues but is widely applicable across a range of domains.

2. Gender Inequality and the Environment

Ecofeminist philosophy posits that women are more deeply connected to, concerned about, and affected by the environment due to their roles as caregivers and sustenance providers (Warren, 2000; Warren, 1990; Terry, 2009). Especially in less-developed countries characterized by traditional gender norms, gendered divisions of labor position women as reproducers of life (both in biological terms and in terms of reproductive labor), subsistence farmers, water and fuelwood collectors, and caregivers of children and the elderly (Aditya, 2016; Warren, 1990, 2000). These activities cause women to be more directly reliant on the environment in procuring and managing resources for themselves and their family (Denton, 2002).

There is an accumulating body of research showing the unique impacts that women face due to a wide range of environmental issues (Denton, 2002; Austin & McKinney, 2016; Austin & Mejia, 2017; Cannon, 2002; Downs et al., 2011; Horton, 2012; Stillwaggon, 2006). For example, in many regions in Sub-Saharan Africa, women are struggling to find water as climate change has led to major droughts and changes in rainfall patterns (Oglethorpe & Gelman, 2008). In India, large scale deforestation has expanded the distance between the forests and local villages, resulting in an increased burden to women who are traditionally responsible for fuel wood collection (Gill & Kewlani, 2010). For some, wood collection time has grown up to ten hours a day, which in turn drastically impacts women's ability to perform other vital tasks, such as sustenance farming, childcare, and income-related activities (Gill & Kewlani, 2010). In Tanzania, high rates of HIV are found in areas with contaminated water and as women more frequently encounter the contaminated water during their daily lives they are at a higher risk of urogenital inflammation which is a risk factor for infection (Downs et al., 2011).

While gender inequalities are common in both developed and less-developed nations, in poorer nations women's direct reliance on the environment is greatest. Indeed, women in developing nations often supply the bulk of food, water, and other basic necessities for the household (Mies & Shiva, 1993; Mies, 1998; Rocheleau et al., 1996). As resource scarcity or degradation makes these tasks more difficult or impossible to carry-out, the well-being of women and the family may be jeopardized (Barnett & Whiteside, 2002; Krishnan et al., 2008; Oglethorpe & Gelman, 2008; Stillwaggon, 2006). Thus, the division of labor and associated gender norms that situate women as collectors and providers of household resources cause them to be particularly affected by environmental degradation.

Relatedly, women are often more affected by environmental health issues, such as water contamination or indoor air pollution (e.g., Austin & Mejia, 2017; Downs et al., 2011) due to their involvements in traditional gender roles surrounding cooking and water collection. According to the WHO, vulnerable populations such as women and children face the highest risk of health impacts related to environmental conditions, including unsafe water, indoor air pollution, urban air pollution, toxic effluent and pesticide exposure, and climate change impacts, such as increased storm intensity, flooding and drought. Overall, environmental risks are estimated to cause about 25% of death and disease globally, and nearly 35% of deaths in poorer regions such as Sub-Saharan Africa (WHO, 2018).

Not only do ecofeminist perspectives argue that women are more affected by the environment and environmental degradation, but also that women are more likely to promote environmental stewardship and conservation (Mies, 1998; Norgaard & York, 2005; Roucheleau et al., 1996; Shandra et al., 2008; Villamor & van Noordwijk, 2016). Surveys conducted in developed and developing nations alike clearly convey that women are more likely to have higher levels of environmental concern than men (e.g., Hirsh, 2010; Givens & Jorgenson, 2011; Xiao & McCright, 2015). Heightened environmental concern among women undoubtedly connects to traditional gender roles that persist even in more affluent nations, as women still represent the primary caretakers of the household and children. Gender differences in environmental concern are especially significant in studies that examine perceived vulnerability to environmental risks and when perspectives on the environment are proposed in ways that trigger women's heightened sensitivity to ensuring the health and well-being of the family (e.g., Xiao & McCright, 2015).

In addition to expressing more concern for the environment, research demonstrates that women across developed- and less-developed nations are also more likely to support policies that are beneficial to ecosystem preservation and to vote for leaders who care about the environmental sustainability (Chattopadhyay & Duflo, 2004; Coleman & Mwangi, 2011; McCright 2010; UN Women Watch, 2012). Indeed, a growing body of cross-national research finds that when women are afforded positions of power in society, they tend to use their influence to protect natural resources, preserve the environment, and promote environmental health initiatives (Ergas & York, 2012; McKinney, 2014; McKinney & Fulkerson, 2015; Nugent & Shandra, 2009; Shandra et al., 2008; Villamor & van Noordwijk, 2016). There are numerous examples of this in the literature. A study in India found that areas with women-led councils are more likely to direct resources towards public goods, such as safe drinking water projects, in which investment in was 62 percent higher than in those with men-led councils (Chattopadhyay & Duflo, 2004). Evidence from across developed and developing countries indicates that countries with higher female parliamentary representation are more likely to set aside protected land areas (UN Women Watch, 2012). And women's involvement in promoting forestry and preventing deforestation has been recognized in numerous studies in Nepal, India, Bolivia, Kenya, Mexico, Uganda, and Senegal (e.g., Coleman & Mwangi, 2013; Roberts & Thanos, 2003; UN Dept. of Social and Economic Affairs, 2015), as well as cross-nationally (e.g., Shandra et al., 2008).

Based on these ideas, this study follows the general premise in asserting that increased representation and status of women should correlate to improved performance in the environment and reduced environmental health risks. In attempting to assess the relationship between female empowerment and the environment, previous studies often utilize data on the political dimensions of empowerment, such as women's voting rights, or representation of female politicians within countries (e.g., Colemen & Mwangi, 2013; Dhungel & Ram, 2012; Ergas & York, 2012; McKinney, 2014; McKinney & Fulkerson, 2015; Shandra et al., 2008; Nugent & Shandra, 2009). Other research, especially that which considers environmental health outcomes, emphasize the importance of gender inequality indicators related to women's access to health, education, and economic resources (e.g., Austin & Mejia, 2017; Austin et al., 2017; Shandra et al., 2011). Certainly, these dimensions of women's status overlap and interrelate with one another. Stand alone or unidimensional measures of empowerment are limited in scope and neglect the multifaceted and interactive nature of gender disparities. Improved access to education, economic resources, good health, and political spheres are likely to work together to promote improved capacity to protect the environment and mitigate against environmental health threats.

Similar to gender inequality, prior studies in this vein of research focus on singular environmental concerns or outcomes such deforestation, land preservation, carbon emissions, water pollution, or indoor air pollution (Colemen & Mwangi, 2013; Dhungel & Ram, 2012; Ergas & York, 2012; Shandra et al., 2008; Nugent & Shandra, 2009; Austin & Mejia, 2017). We contend that comparative research grounded in ecofeminism would be strengthened through approaches that incorporate multifaced data to more appropriately capture complex factors like gender inequality and environmental well-being. Finding evidence of a link between women's status and the environment across wide-ranging measures will enhance the robustness of broad claims regarding the role of gender inequality on environmental well-being.

3. Additional Cross-National Drivers of Environmental Well-Being

In addition to considering the role of gender inequality, a number of other factors are likely to contribute to environmental conditions across nations. Level of economic development, or Gross Domestic Product (GDP) per capita, is important to consider as patterns in environmental degradation closely mirror trends in international inequality. Undoubtedly, affluent nations have the highest levels of resource consumption and environmental waste (e.g., Jorgenson, 2003). However, as discussed previously, rich nations structure trade and investments to their own benefit, offshoring the bulk of dirty industries and resource extraction to poorer nations (e.g., Austin, 2010; Jorgenson, 2010; Roberts & Thanos, 2003; Rice, 2007). Largely as a result of these patterns, poor nations also face the greatest risks to environmental health, such as air pollution and water contamination (e.g., Roberts & Thanos, 2003). Nevertheless, not all environmental issues that result from consumption can be offshored easily, and affluent nations commonly suffer from high levels of greenhouse gas emissions and urban air pollution, for example (e.g., Kahuthu, 2006; Deutch, 2017).

Alongside to economic development, education represents another key determinant of environmental conditions across nations. Many studies find that education is negatively associated with environmental degradation, and that those with higher levels of education are more likely to express concern for the environment (Franzen & Meyer, 2010; Jorgenson & Burns, 2007). People with more education tend not only to be more concerned about the environment, but also to engage in actions that promote and support political decisions that protect the environment (Franzen & Meyer, 2010). Such pressure can be way of pushing governments towards the type of binding agreements and policy creation that are needed to promote better environmental performance.

Similarly, research often emphasizes the role of democracy in promoting environmental stewardship and responsibility. A number of studies find positive impacts of democracy, often measured through civil liberties and political freedoms, on the environment, including for outcomes such as preventing forest loss, reducing urban air pollution, and promoting land conservation (e.g., Winslow, 2005; Shandra et al., 2012). Countries with higher levels of democracy are likely to have better environmental well-being as representation and electoral accountability often promote leaders to develop platforms that include the environment and health as public concerns (e.g., Li & Reuveny, 2006).

Population growth represents a key driver of environmental degradation, as population pressures necessarily increase resource utilizations and the generation of waste products (Dovers & Butler, 2017; Ehrlich & Holdren, 1971; York et al., 2003). In poor nations, population pressures in rural areas can be especially salient in driving environmental degradation (e.g., Rudel, 2005). Indeed, it is important to decompose demographic factors in cross-national research and consider rural and urban dynamics carefully (e.g., York et al., 2003). Countries with large rural populations are often more dependent on subsistence and export agriculture in relation to more urbanized nations, placing key demands on the environment (e.g., Jorgenson & Burns, 2007). Conversely, urban populations consume more food, energy, and durable goods per capita, which also have substantial ecological impacts (e.g., Heinonen & Sepp, 2011).

In addition to the factors already discussed, a number of studies point to the role of the military in promoting environmental destruction. Coined “The Treadmill of Destruction”, this body of scholarship highlights the expansionary propensities and harmful environmental consequences of militarism (e.g., Hooks & Smith, 2004; Clark & Jorgenson, 2012). For example, military testing of weapons and technologies can lead to the destruction of ecosystems and produce major environmental health consequences (e.g., contamination, exposure). Thus, nations with larger investments in the military may experience worse environmental well-being.

4. Method

To assess the relationship between gender inequality and environmental well-being across nations, we conduct Ordinary Least Squares (OLS) regressions. This is an appropriate analysis technique to use as it allows us to examine the nature of the impact of gender inequality on environmental performance while considering other prominent macro-level factors known to impact ecosystem vitality and environmental health. Also, time series data on a variety of indicators used in the analysis are not available, preventing longitudinal or panel analysis. We utilize the program STATA 12 to conduct the regression analyses as well as the appropriate diagnostics.

4.1 Sample

We include in our sample all nations for which data are available for all measures used in the analysis. Our final sample includes 114 nations from across all income groups and all major world regions (Note 1). For a list of nations included in the sample, please see Table 1 below.

4.2 Key Dependent Variable

To provide a comprehensive measure of ecosystem vitality and environmental health, this study uses the 2016 Yale Environmental Performance Index (EPI), which ranks countries' performance across two broad areas of ecosystem vitality and environmental health. The scores for the EPI range from 0-100, with higher scores indicating better ecosystem performance and environmental health. The dimensions of the EPI for ecosystem performance include: Climate and Energy (trends in carbon intensity), Biodiversity and Habitat (species protection, terrestrial protection, marine protection), Fisheries (fish stocks), Forests (tree cover loss), Agriculture (nitrogen balance, nitrogen use efficiency), and Water Resources (wastewater treatment). The dimensions of the EPI for environmental health include: Water and Sanitation (drinking water quality, unsafe sanitation), Air Quality (air pollution, exposure to NO2, fine particulate matter exposure, household air quality), and Health Impacts (environmental risk exposure).

4.3 Key Independent Variable

To capture the multifaceted nature of gender inequality, we use a compressive measure of gender inequality rankings based on The Global Gender Gap Index. The Gender Gap Index ranks countries in gender equality based on economic, educational, health-based, and political indicators. The specific inequality indicators included in the index consist of: labor force participation; wage equality; income equality; percent legislators, senior officials and managers; percent professional and technical workers; literacy rate; primary, secondary, and tertiary school enrollments; sex ratio at birth; life expectancy; percent women in parliament; percent women in ministerial positions; years with female head of state (World Economic Forum, 2016).

The Global Gender Gap Index report ranks countries on a scale of 0 to 100, with higher scores signifying greater gender equality and lower scores indicating greater gaps in equality between men and women (World Economic Forum, 2016). In order to have the ranking truly reflect a gender gap, we reverse coded the data such that a higher score signifies greater gender inequality and a lower score signifies lower levels of gender inequality.

Table 1. Nations Included in the Analyses

Albania	Ecuador	Lesotho	Romania
Algeria	Egypt, Arab Rep.	Liberia	Russian Federation
Argentina	El Salvador	Lithuania	Rwanda
Armenia	Estonia	Luxembourg	Saudi Arabia

Australia	Finland	Macedonia, FYR	Senegal
Austria	France	Madagascar	Serbia
Bahrain	Georgia	Malawi	Slovak Republic
Belarus	Germany	Malaysia	Slovenia
Belgium	Ghana	Mali	South Africa
Belize	Greece	Malta	Spain
Benin	Guatemala	Mauritania	Sri Lanka
Bolivia	Guinea	Mauritius	Swaziland
Brazil	Honduras	Mexico	Sweden
Brunei Darussalam	Hungary	Mongolia	Switzerland
Bulgaria	India	Montenegro	Tajikistan
Burkina Faso	Indonesia	Morocco	Tanzania
Burundi	Iran, Islamic Rep.	Mozambique	Thailand
Cabo Verde	Ireland	Nepal	Tunisia
Cameroon	Israel	Netherlands	Turkey
Chad	Italy	New Zealand	Uganda
Chile	Jamaica	Nigeria	Ukraine
China	Japan	Norway	United Kingdom
Colombia	Jordan	Oman	United States
Cote d'Ivoire	Kazakhstan	Pakistan	Uruguay
Croatia	Korea, Rep.	Paraguay	Venezuela, RB
Cyprus	Kuwait	Peru	Yemen, Rep.
Czech Republic	Kyrgyz Republic	Philippines	Zimbabwe
Denmark	Latvia	Poland	
Dominican Republic	Lebanon	Portugal	

4.4 Control Variables

To capture level of economic development, we utilize a measure of Gross Domestic Product (GDP) per capita based on Purchasing Power Parity (PPP) for the year 2014 (Note 2). GDP capita PPP is the gross domestic product converted to international dollars using purchasing power parity rates. Data are reported in current international dollars (World Bank, 2017). To generate meaningful regression coefficients, we divided the GDP per capita estimates by 1,000 such that the GDP per capita score is reported in thousands.

We also take into account economic growth. We measure economic growth by the annual percent change in GDP per capita for the year 2014 (World Bank, 2017). This measure represents the annual percentage growth rate of GDP at market prices based on constant local currency. To take into account the general level of education, we include a measure of secondary school enrollments for the year 2014 (Note 3). The gross secondary school enrollment measure includes the total enrollment in secondary education regardless of age, expressed as a percentage of the population of official secondary education age (World Bank, 2017).

We also consider the impacts of agriculture and industry on environmental performance. We include a measure of percent GDP from agriculture, which represents the value added from agriculture as percent of GDP (World Bank, 2017). Agriculture includes forestry, hunting, and fishing, as well as cultivation of crops and livestock production. Value added is the net output of a sector after adding up all outputs and subtracting intermediate inputs. It is calculated without making deductions for depreciation of fabricated assets or depletion and degradation of natural resources. Percent GDP from industry represents the value added from industry as a percent of GDP (World Bank, 2017). Industry includes manufacturing and value added in construction, electricity, water, and gas. Value added is the net output of a sector after adding up all outputs and subtracting intermediate inputs.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
(1) Environmental Performance Index	1.00											
(2) Gender Gap Index	-.40	1.00										
(3) GDP per capita	.60	-.23	1.00									
(4) GDP Growth	-.39	.09	-.27	1.00								
(5) Secondary Schooling	.83	-.39	.65	-.40	1.00							
(6) % GDP from Agriculture	-.78	.20	-.67	.44	-.79	1.00						
(7) % GDP from Industry	-.30	.23	.24	-.12	.16	-.31	1.00					
(8) Military Spending	-.10	.30	.13	-.08	.03	-.12	.48	1.00				
(9) Democracy	.57	-.43	.38	-.20	.50	-.44	-.40	-.43	1.00			
(10) Population Growth	-.47	.29	-.11	.24	-.42	.29	.17	.33	-.40	1.00		
(11) Rural Population Growth	-.50	-.21	.26	.21	-.54	.41	.09	.32	-.47	.41	1.00	
(12) Percent Urban	.67	-.10	.67	-.38	.70	-.73	.21	.15	.40	-.27	-.46	1.00
Mean	71.3	.70	21.0	3.17	87.5	10.7	10.7	1.93	1.93	1.23	.27	61.8
SD	13.9	.07	19.3	2.64	28.6	10.6	10.6	1.77	1.76	1.19	1.79	21.5

Figure 1. Correlation Matrix and Univariate Statistics

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To control for the potential impacts of military activity on the environment, we include a measure of military expenditure as a percent of GDP. Military expenditures include all current and capital expenditures on the armed forces, including peacekeeping forces, defense ministries and other government agencies engaged in defense projects, paramilitary forces, military space activities (World Bank, 2017).

We include a measure of democracy, based on national measures of civil liberties and political rights from Freedom House (2017) for the year 2014. Freedom House produces annual measures of civil liberties and political rights for each country as part of its Freedom in the World Report. These two concepts are operationalized using a 7-point ordinal scale. We follow previous studies and use the mean of civil liberties and political rights as our measure of democracy. This results in a single measure of democracy with a range from 1 to 7, and we coded it such that higher scores represent higher levels democracy.

We also consider the influence of population dynamics on the environment and environmental health. We include the total population growth rate, which is an annual growth rate for the year 2014 (World Bank, 2017). Population is based on the de facto definition of population, which counts all residents regardless of legal status or citizenship. We also specifically consider rural population dynamics in including the rural population growth rate. The rural population refers to people living in rural areas as defined by national statistical offices (World Bank, 2017). Lastly, we control for the percent of the population than lives in urban versus rural areas by including a measure of percent urban. Percent urban represents the percentage of the total population that resides in urban areas as defined by national statistical offices (World Bank, 2017).

5. Results

Figure 1 displays the correlation matrix for all of the indicators used in the regression analyses. Of key importance to this study, the results presented in Figure 1 suggest that higher scores on the gender gap index have a moderate negative correlation to environmental well-being. Additionally, the results in Figure 1 demonstrate that many of the predictor variables are highly correlated to each other, indicating a need for careful attention to potentials of multicollinearity in the construction and organization of the regression models. To prevent issues of multicollinearity, a baseline model for the OLS regressions in Table 2 includes the gender gap index and GDP variables. Additional variables, such as secondary school enrollments, population growth, and democracy, are added in a step-wise fashion.

Table 2 presents the central results for the OLS regression analyses predicting environmental well-being or performance across nations. As stated previously, GDP per capita and GDP growth are included in all models as baseline predictors. Additional variables are added in a step-wise fashion in Models 2-5. Model 6 represents a saturated model, including all prior predictors. The VIFs which suggest issues of multicollinearity remain well within acceptable levels in Models 1-5 and only become elevated in the saturated model, Model 6. However, even here the VIFs for the gender gap index are modest and do not suggest any issues with our central findings.

Table 2. OLS Regression Results Predicting Environmental Well-Being

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Gender Gap Index	-.300***	-.140**	-.216***	-.197**	-.247***	-.130*
	(63.684)	(29.780)	(45.799)	(41.818)	(52.449)	(27.439)
	14.601	*11.912*	*11.562*	*15.092*	*12.737*	*11.719*
	[1.06]	[1.19]	[1.19]	[1.28]	[1.19]	[1.52]
GDP pc-(thousands)	.472***	.121+	.125+	.381***	.249**	.046
	(.340)	(.087)	(.090)	(.274)	(.176)	(.033)
	.051	*.049*	*.049*	*.054*	*.055*	*.050*
	[1.13]	[1.75]	[1.87]	[1.41]	[1.96]	[2.46]
GDP Growth	-.237**	-.082	-.057	-.208**	-.101+	-.014
	(-1.252)	(-.430)	(-.304)	(-1.099)	(-.531)	(-.075)
	.366	*.298*	*.294*	*.349*	*.318*	*.268*
	[1.08]	[1.20]	[1.25]	[1.11]	[1.20]	[1.29]
Secondary Schooling		.660***				.338***
		(.321)				(.164)
		.037				*.046*
		[2.16]				[4.43]
Percent GDP from Agriculture			-.691***			-.396***
			(-.908)			(-.520)
			.098			*.118*
			[2.22]			[4.03]
Percent GDP from Industry			-.202***			-.151*
			(-.280)			(-.210)
			.077			*.087*
			[1.24]			[1.99]
Military Spending				.025		-.041
				(.193)		(-.325)
				.599		*.484*
				[1.47]		*[1.89]*
Democracy				.319***		-.011
				(2.389)		(-.081)
				.639		*.087*

				[1.76]		*[2.71]*
Population Growth					-.204**	-.097*
					(-2.375)	(-1.130)
					.739	*.647*
					[1.33]	[1.55]
Rural Population Growth					-.127+	-.003
					(-.986)	(-.021)
					.514	*.475*
					[1.45]	*[1.88]*
Percent Urban					.332***	.111
					(.215)	(.072)
					.055	*.050*
					[2.36]	*[2.97]*
R^2	.5094	.7109	.7302	.5740	.6760	.7964

Notes. *** p< .001, ** p < .01, * p < .05, + p < .10 (two-tailed tests); standardized regression coefficients are flagged for statistical significance; the unstandardized regression coefficient are labeled in parentheses; and standard errors are reported in italics, and the VIFs are labeled in brackets.

Overall, the regression results depicted in Table 2 demonstrate the significance of gender inequality in contributing to lower environmental well-being across nations. Specifically, in all models (1-6) we find a statistically significant relationship between the gender gap index and environmental performance, net of other factors. In other words, even when taking into account other prominent macro-level factors that impact environmental performance, nations with higher levels of gender inequality tend to have lower environmental well-being.

In addition to the salience of gender inequality, we also find in Models 1-5 that GDP per capita and GDP growth are important in predicting environmental well-being across nations. Specifically, we find a positive association between GDP per capita and environmental performance. This means that nations higher on the developmental hierarchy tend to have better environmental conditions in relation to nations at low levels of economic development. However, nations experiencing high levels of annual GDP growth are more likely to have worse environmental performance.

Model 2 includes the predictor for total secondary education enrollments. We find that secondary school enrollments are a robust predictor of environmental performance across nations, where nations with higher levels of secondary school enrollments for both men and women tend to have better environmental well-being, net of the influence of the baseline predictors. In Model 3, we add indicators for specialization in agriculture and industry to the baseline model. Our results illustrate that both specializing in agriculture and industry are harmful to environmental performance, with the effects of agriculture being especially robust.

We consider the role of military spending and democracy on environmental well-being in Model 4. Our results suggest that military spending has no significant impact on the environment when taking into account democracy, GDP per capita, GDP growth, and gender inequality. However, the results presented in Model 4 do indicate that nations with higher levels of democracy tend to have better environmental performance, net of the other factors included.

Model 5 includes the demographic indicators for population growth, rural population growth, and percent urban. When considering these factors alongside the baseline predictors, we find that all three of these measures are important in predicting environmental well-being. Specially, we find that nations characterized by high rates of population growth and rural population growth tend to have lower environmental performance than nations with lower levels of population growth. Additionally, more heavily urbanized nations tend to have better environmental performance.

Model 6 represents the saturated model, including all predictors in the model. We emphasize that the gender gap index remains statistically significant in predicting environmental well-being with the inclusion of all control variables. Additionally, the VIF used to indicate multicollinearity is lowest for this measure, suggesting that this finding is not impacted by multicollinearity issues. The results in Model 6 also point to additional factors that are predictive of environmental performance, though the VIFs do become slightly elevated for some of these. The findings illustrate the significance of education, agriculture, industry, and population growth in contributing to cross-national patterns in environmental performance. Explicitly, nations with more educated populations tend to have better environmental well-being, and nations with strong specialization in agriculture or industry and high rates of population growth tend to have worse environmental well-being, net of all other factors. In this final model, GDP per capita and GDP growth are no longer statistically significant.

Taken together, the regression results demonstrate the significance of gender inequality in shaping cross-national trends in environmental well-being, even when considering prominent and important factors, such as economic development, general level of education, and population growth. Overall, the R-squared measure is robust across the models. In Model 6, which incorporates all predictors, the independent variables together explain nearly 80% of the cross-national variation in environmental performance.

6. Conclusion

We are now in the era of what many scientists are calling the "Anthropocene", which recognizes that human activities are the primary driver of ecological degradation and climate change (Crutzen & Soermer, 2000) Many recognize that the involvement of women in environmental decision-making at all levels is a key step to ensuring environmental well-being (e.g., UN Women, 2014; UN Dept. of Social and Economic Affairs, 2015; UN Framework on Climate Change, 2014). In spite of this knowledge, women remain insufficiently recognized and involved in environmental policy-making and environmental management (UN Women, 2014; UN Framework on Climate Change, 2014).

Globally, gender inequalities remain stark. Despite the importance of having women involved in political domains, currently only 20 women hold office as a head of state or government, which represents just 6.3% of total world leaders (UN Women, 2017). Globally, only 22 percent of all national parliamentarians are female and women currently occupy only 4.8 percent of CEO positions at S&P 500 companies (UN Women, 2017). In 2015, only 50% of the world's working-age women were in the labor force, compared to 77% working-age men. Two-thirds of all illiterate people in the world are women. While some progress has been achieved over the past few decades, women remain marginalized from political decision-making, education, healthcare, and employment and leadership in every region of the world (UN General Assembly, 2013).

Consistent with other studies utilizing gender inequality measures as a predictor of environmental outcomes, this study demonstrates that overall that there is a relationship between the gender gap index and environmental performance, where nations with increased levels of gender inequality tended to have lower levels of environmental well-being. This finding provides support for the ecofeminist premise that there is an crucial relationship between ecological issues and gender equality, and that improving women's empowerment will correspond with better environmental stewardship and health outcomes. The use of more comprehensive gender inequality and environmental well-being indicators represents a key contribution of this research. Using inclusive measures provides legitimacy to broad arguments that assert connections between women's empowerment and the environment. Our strategies directly build on theoretical conceptualizations of gender stratification that include components across political, economic, health, and education domains. Similarly, we add robustness to arguments about the influence of women's empowerment on the environment by demonstrating that such a connection applies to a wide range of ecosystem and environmental health conditions, not select environmental issues.

In addition to illuminating the relationship between gender inequality and environmental well-being, our analyses also explicate important cross-national relationships involving economic development and growth, education, population growth, and specialization in agriculture or industry. In general, our findings support political-economy interpretations drawing on the unequal economic and power relationships between developed and less-developed nations that shape environmental vulnerabilities (e.g., Rice, 2007). Specially, our findings involving GDP per capita and GDP growth reflect world-system processes, where economically powerful nations are able to off-shore the bulk of environmental demands and wastes to poorer nations (e.g., Rice, 2007). However, nations experiencing high rates of annual GDP growth tend to have worse environmental well-being than nations with stagnant growth or GDP declines. This suggests that economic growth is often achieved through environmental exploitation and degradation that impacts human health.

Building off these themes, we also find that specialization in agriculture and industry is especially harmful to environmental well-being. These findings call into question conservative and fundamental development approaches that focus on financial liberation and specialization in agriculture exports and rapid industrialization by demonstrating the impacts that such strategies have on ecosystem vitality and environmental health. Consistent with prior literatures, we also find that education and population growth are strong predictors of environmental performance across nations.

One of the limitations to this study is the availability of data. For some measures, data was only available for some nations, limiting the sample size. Restrictions on data availability also limited our study to a cross-sectional analysis. Based on the nature of the study, we are limited to data that is publicly available. It is therefore impossible to gather data on other measures that may have been relevant to this study, such as environmental attitudes for all nations. In addition, we would have liked to include a measure of environmental organizations or environmental NGOs. We did consider earlier models utilizing a measure of environmental NGOs, but the data was too thin and drastically reduced the sample size (to about 45 cases).

At current consumption levels, the global population is using 50% more resources in a day than the earth can provide (Global Footprint Network, 2017). As levels of environmental degradation and climate change continue to exacerbate, women are especially likely to bear the brunt of the impacts. Certainly, this study contributes to the body of knowledge that demonstrates that increasing the social, political and economic standing of women is inherently important in promoting sustainable and healthy environmental practices. Promoting women's access to education, health services employment, and politics represent crucial steps in addressing environmental degradation and environmental health threats globally.

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Notes

Note 1. We also tested models using a sample of only less-developed nations (nations in the lower three quartiles of the World Bank Income Classification). We achieved consistent results for the substantive findings reported here.

Note 2. Due to data availability limitations for 2014, GDP per capita estimates for Eritrea and Libya were taken from 2011, and Venezuela from 2013.

Note 3. Due to data availably limitations secondary education percentages were pulled from the following countries in years other than 2014: Algeria 2011, Angola 2011, Armenia 2015, Cameroon 2013, Central African Republic 2012, Chad 2012, Republic Congo 2012, Democratic Rep of Korea 2015, Dominica 2015, Gabon 2016, Mongolia 2015, Montenegro 2015, Morocco 2012, Nigeria 2013, Oman 2015, Papua New Guinea 2012, Paraguay 2012, Philippines 2013, San Marino 2012, Senegal 2015, Sierra Leone 2013, Solomon Islands 2012, South Sudan 2015, Sri Lanka 2013, Sudan 2013, Syrian Arab Republic 2013, Tajikistan 2013, Togo 2011, Uganda 2015, Tanzania 2013, Vanuatu 2015 and Yemen 2013.