Distribution Agreement

Helena Zhao April 9, 2019

REDD+ program implementation, economic growth, and quality of government in 141 countries

by

Helena Zhao

Blake Allison
Adviser

Economics

Blake Allison

Adviser

Christina DePasquale

Committee Member

Eri Saikawa

Committee Member

2019

REDD+ program implementation, economic growth, and quality of government in 141 countries

By

Helena Zhao

Blake Allison

Adviser

An abstract of
a thesis submitted to the Faculty of Emory College of Arts and Sciences
of Emory University in partial fulfillment
of the requirements of the degree of
Bachelor of Arts with Honors

Economics

2019

Abstract

REDD+ program implementation, economic growth, and quality of government in 141 countries
By Helena Zhao

REDD+ is a United Nations program designed to incentivize a reduction in carbon emissions via deforestation in developing countries with results-based payments. Success of REDD+ has proven to be a function of contextual variables such as economic growth, level of democracy, and population growth. This study determines the effect of economic, political, and demographic variables on likeliness of REDD+ implementation in 141 countries utilizing probit analysis. Results indicated that countries with greater terrestrial protected areas and forested lands, transitioning economies, greater democracy, political corruption, and human rights violations, and protection of property rights were more likely to implement REDD+. Alternatively, trade openness and rural population growth predicted for lower likelihood of REDD+ implementation. These results speak to past criticisms and shortcomings of REDD+ as well as how the implementation of REDD+ is affected by issues such as globalization and environmental attitudes worldwide. Taken together, the results of this study can inform how REDD+ policy can be adjusted and improved in order to appeal to more countries and see higher rates of success.

REDD+ program implementation, economic growth, and quality of government in 141 countries

By

Helena Zhao

Blake Allison

Adviser

A thesis submitted to the Faculty of Emory College of Arts and Sciences
of Emory University in partial fulfillment
of the requirements of the degree of
Bachelor of Arts with Honors

Economics

2019

Acknowledgements

My thanks to Blake Allison, my advisor, who continually offered interesting insight and new ways for me to change and improve my thesis, and my committee members, Christina DePasquale and Eri Saikawa, for taking the time to read and offer critique of my thesis.

Table of Contents

Tables

Introduction

Climate change and environmental degradation are two of the most pressing issues facing humanity today. Extreme weather events, mass die-offs, and the eradication of diverse and sprawling ecosystems around the world have intensified both in scale and degree as society continues to pollute without signs of halting. With climate change threatening the safety and livelihood of future generations, international organizations such as the United Nations have begun to design and implement programs to mitigate the impacts of climate change on our environment (Edenhofer et al. 2014). There has been a particular focus on reducing greenhouse gas emissions that come from a variety of human activities in both developing and developed countries.

Deforestation, in particular, is responsible for 15-20% of carbon emissions globally, surpassing those of the global transportation sector (Kissinger et al. 2012). In addition to releasing greenhouse gas emissions, deforestation threatens biodiversity and species habitats while increasing the risk of soil erosion, landslides, eutrophication, and increased water temperatures (Edenhofer et al. 2014). Many of the environmental services supplied by nature are externalities and therefore global society has failed to create institutions that internalize the public goods of intact ecosystems (Pattanayak et al. 2010). In order to save the world's remaining forests while simultaneously working to reduce greenhouse gas emissions, the United Nations Framework for the Convention on Climate Change (UNFCCC) has introduced the REDD+ initiative, a voluntary program which focuses on reducing emissions from deforestation and forest degradation, with sustainable management of forests, conservation of forest carbon stocks and enhancement of forest carbon stocks (REDD+) (Duchelle et al. 2018).

REDD+ incentivizes a divergence from historic trends of increasing deforestation rates and greenhouse gas emissions. The program provides a framework through which developing countries—where the majority of the world's remaining forests are found—are rewarded financially for any emissions reductions associated with a decrease in deforestation rates (Boyd et al. 2018). Funding for REDD+ comes from international donors such as national governments and corporations. By assigning economic valuation to forest ecosystem services, REDD+ allows pristine tropical forests, in theory, to compete with lucrative alternative land uses, which have historically resulted in forest clearing and environmental degradation (Boyd et al. 2018). The program, furthermore, hopes to build the foundation for a global cap-and-trade market, where developing countries can sell the carbon credits generated from reduced deforestation rates to interested governments and corporations (Visseren-Hamakers et al. 2012). The ability to participate in this market should theoretically increase the incentives for adhering to REDD+.

The REDD+ program has been re-negotiated and forced to evolve from its inception in 1997 to its formalization in 2013, and continues to adjust in order to address the interdisciplinary and multifaceted issues associated with deforestation and forest degradation, which inevitably vary from country to country (Pistorius 2012, United Nations 2011). While the formalized REDD+ program attempts to holistically address the causes and consequences of deforestation, the ambiguity of the framework results in success depending almost entirely on how different nations choose to implement the program (Pistorius 2012). Moreover, although more than 60 countries have implemented the REDD+ program in some shape or form, more than 100 of the world's remaining countries have not, despite the fact that all countries contribute to greenhouse gas emissions and environmental degradation. This study attempts to address the economic, political and demographic indicators that characterize countries which choose to participate in the REDD+ program compared to those that do not. Few studies exist that examine the relationship between contextual country characteristics and the likeliness of implementation of international environmental policy, which is surprising given the broad and interdisciplinary nature of environmental degradation. Understanding the historical, political, economic, and cultural context in which programs such as REDD+ is applied, however, is crucial in understanding the successes and failures of the program within the country, and furthermore can inform research regarding the "readiness" of a country to implement an international program such as REDD+ in terms of issues such as infrastructure and monitoring capabilities (Minang et al. 2014, Sheng et al. 2016). Studies examining and critiquing REDD+ programs across the world have affirmed that six functions of readiness are crucial in preparing a country to implement a program such as REDD+: planning and coordination in terms of policy, laws, and institutions; measurement, reporting verification, and audits; benefit sharing; financing; and demonstrations and pilots (Minang et al. 2014, Simmons 2002, Visseren-Hamakers et al. 2011).

REDD+ implementation

Given the vague guidelines which define REDD+, economic and political factors can heavily influence if not entirely control how REDD+ is implemented in a country and therefore whether or not the program will see success. Broadly, it has been argued that REDD+ is not fulfilling its potential to play a transformative role in catalyzing action on drivers of deforestation, whether those be local, regional, national, or international (Weatherly-Singh & Gupta 2015). By effectively characterizing countries that have implemented REDD+ by factors such as economic growth and quality of government, this study can not only determine areas in which REDD+ can expand its scope and jurisdiction, but also examine relationships between the incentives REDD+

offers and how these can appeal to countries in various states of economic and political development.

Both international diplomacy and environmental degradation are complex and multifaceted issues, with involvement varying highly from country to country based on a plethora of contextual and political factors. While no study to date has been found in existing literature characterizing the countries which choose to participate in the REDD+ program on such a broad scale, a multitude of studies have been published examining the relationship between economic, political, and demographic factors and deforestation rates. Combes-Motel et al. (2008), among others, have indicated that high deforestation rates are strongly and positively correlated with REDD+ implementation, indicating that countries are aware of the gravity of deforestation as an issue and are responsive in the policy arena towards this issue (Arima et al. 2014, Pattanayak et al. 2010). Therefore, high deforestation rates were utilized as a proxy variable when conducting the literature review for this study.

REDD+ and political, economic, and demographic factors

A plethora of studies have stressed the interdisciplinary nature of both the causes and consequences of deforestation, and thus have called for appropriate policy responses which account for this complex and entangled nature (Gupta et al. 2012, Umunay et al. 2018, Visseren-Hamakers et al. 2012). Political, economic, social, and demographic factors are all inextricably intertwined with natural resource use, and as such these characteristics have been found to influence deforestation rates throughout countless studies (Obydenkova et al. 2016, Shandra et al. 2011, Ferreira 2012, Leblois et al. 2017, Robinson et al. 2014, Chang & Hao 2017, Buizer et al. 2014, Panfil & Harvey 2016). In general, studies on the effect of political factors on deforestation rates have focused on level of corruption, democracy, property rights, and the presence of protected areas (Aguilar-Støen 2017, Buitenzorgy & Mol 2011, Güney 2017, Schroeder 2010, Shandra et al. 2011). In terms of economy, a plethora of studies covering the effects of economic growth and development, agriculture and mining, and trade openness on deforestation have been published (Gullison & Losos 1993, Ferreira 2012, Tsurumi & Managi 2014). Sociodemographic indicators found to be correlated with deforestation rates in previous studies include national poverty level, income inequality, population growth and density—both total and rural— and initial country forest area (Combes-Motel et al. 2008, Kissinger et al. 2012, Todaro & Smith 2015). To date, however, no studies have been conducted holistically examining the effects of these country characteristics on REDD+ program implementation.

In this study, I attempt to comprehensively characterize countries which have implemented REDD+ programs. Currently 65 developing countries across the world are REDD+ partner countries. Probit analysis is utilized to analyze cross-sectional data from the year 2014 on 141 countries. In general, it is expected that countries with greater political stability (i.e. lower levels of corruption, higher levels of democracy) and effective governance will be more likely to implement some form of REDD+ program. On the other hand, primary export-focused economies that depend on agriculture and cash crops for a large sector of their economy are expected to see lower probability of program implementation, while countries with higher forested area and greater population growth and density are expected to be associated with program implementation. Taken together, the results of this study could inform how countries could adjust their economic and political advancement agendas in order to promote better protection of the environment via international agreements and policies such as REDD+, as well as how REDD+ programs can be revised to encourage more prevalent adoption.

The rest of the paper is outlined as follows: first, there is a literature review of previous studies that have been conducted regarding country characteristics and deforestation rates. Following this, data sources and methodology are stated, results of the study, discussion of the results, and conclusion and further recommendations. Additional regression tables for region-specific models are located in the appendices.

Literature Review

As previously stated, no studies to date have been conducted examining the effect of contextual country characteristics on REDD+ program implementation on a global scale. The scope and popularity of REDD+ is rather unprecedented and as such studies examining the widespread implementation of other singular environmental programs across a large number of countries have not been conducted either. However, factors that contribute to deforestation rates are also likely to affect the adoption of related policies such as REDD+, due to the strong positive correlation observed between high rates of deforestation and adoption of REDD+ programs (Arima et al. 2014, Combes-Motel et al. 2008, Pattanayak et al. 2010). Therefore, in order to glean an understanding of which variables may affect the probability of REDD+ program implementation, studies examining the relationship between deforestation rates and contextual country characteristics are included in this literature review. Relevant political, demographic, and economic factors are examined and the directionality of correlation between these factors and REDD+ implementation is hypothesized based on previous findings.

Political factors & deforestation

Political factors found to be correlated with deforestation rates include level of democracy, corruption, property rights and tenure security, presence of protected areas, and demarcated indigenous territories. In current literature these have been examined both individually and in conjunction with intersecting variables such as economic growth (Chang & Hao 2012, Enrici & Hubacek 2018, Güney 2017, Sekrafi & Sghaier 2018). In this way political indicators have been found to have both direct and indirect effects on deforestation, in particular via their interactions with other sociodemographic and economic variables, which will also be discussed shortly.

Corruption has been found in multiple studies to have a positive, statistically significant relationship with deforestation rates (Arima et al. 2014, Börner et al. 2014, Chang & Hao 2017, Güney 2017, Obydenkova et al. 2016, Pietras 2012, Sekrafi & Sghaier 2018). Historically, corrupt or instable governments have tended to favor rich and powerful interests at the expense of the rural poor (Simmons 2002). While evidence of these biases may be more nuanced in modern society, weak government policy continues to vacillate between human rights and environmental issues on one hand, and commercial and economic interests on the other (Simmons 2002). Oftentimes structural inequality and residual racism from postcolonial policies are exacerbated by corruption and lead to ignorance regarding not only human rights but also environmental degradation (Chomba et al. 2016, Fishbein & Lee 2015, Sandker et al. 2009, Sekrafi & Sghaier 2018). The effect of corruption on deforestation rates depends largely on the effectiveness of government institutions and the extent of environmental regulations in the country of interest (Chang & Hao 2017). In general, however, it has been found that corruption reduces the efficiency of environmental regulation and policy stringency (Arima et al. 2014, Obydenkova et al. 2016). Therefore, as corruption levels increase, air and water pollution increase and environmental quality deteriorates (Börner et al. 2014). For example, Pietras (2012) found that in Papua New Guinea, the exorbitantly high deforestation rates were due to illegal logging made more possible by poorly regulated forest laws and corruption in the decentralized government. In this country the logging sector has become synonymous with corruption, environmental degradation and human rights violations (Pietras 2012). Political corruption is expected to be negatively correlated with likeliness of REDD+ implementation. Although corruption has been found to be correlated with higher environmental deterioration, it has more importantly been found to reduce environmental policy stringency and effectiveness and furthermore is negatively correlated with an ignorance of environmental degradation.

The effect of democracy on deforestation rates has been less clear. While studies have found that democracy has a positive impact in reducing environmental disruption, other literature claims that democracy tends to accelerate environmental degradation. In a study of 177 countries, Buitenzorgy & Mol (2011) actually find evidence of an inverted U-shaped relationship between deforestation and democracy not unlike the Kuznets Curve[1], suggesting that both sides may be correct. According to the authors, countries in democratic transition experience the highest deforestation rates compared to non-democracies and mature democracies (Buitenzorgy & Mol 2011). Empirical evidence from Buitenzorgy & Mol (2011) suggests that deforestation rates would be relatively low under autocracy or mature democracy and deforestation rates are higher under semi-democracies or transitional countries due to their weakened state and still immature civil society. Studies with more a limited number of observations have found a positive relationship between democratization and deforestation (Chang & Hao 2017), and cite factors such as budget constraints, competing voter concerns, the absolute power of autocracies in supporting their results. Alternatively, others observe a negative relationship between deforestation and democratization, and attribute this to several different factors (Obydenkova et al. 2016, Shandra et al. 2011). Shandra et al. (2011) hypothesizes that democracy enhances the

[1] Discussed in-depth in the *Economic factors and deforesetation* section of this review

ability of NGOs, both domestic and international, to deal with the causes of forest loss, and therefore decreases deforestation rates. Obydenkova et al. (2016), alternatively, argue that democratization, through the instrument of political and civil liberties, works to protect the nation's environmental resources. The results from previous literature suggest that an inverted U-shaped relationship should be observed between likeliness of REDD+ implementation and level of democracy, with rates of implementation higher in developing countries with moderate to high levels of democracy.

The effect of property rights and security on deforestation rates is uncontestable in existing studies. Current literature finds that improvements in tenure security are associated with reduced deforestation rates (Blackman & Veit 2018, Robinson et al. 2014, Schroeder 2010, Simmons 2002, Martinez 2017). The theoretical framework behind this link focuses on the idea that communities with less secure rights over their lands harvest forests at a greater rate because future risks diminish the discounted future value of forests (BenYishay et al. 2017, Blackman & Veit 2018, Irawan et al. 2013). Moreover, if encroachment on community land by outsiders is motivated by resource extraction, greater tenure security could reduce the likelihood of expropriation by encroachers (Blackman & Veit 2018). Property rights over forests directly determine who is eligible to receive REDD+ program incentives and who is responsible for meeting the program's contractual obligations. As such, clear and secure land tenure is crucial for an efficient REDD+ program and equitable distribution of benefits (Pietras 2012, Aguilar-Støen 2017). Based on previous literature, it is expected that greater property rights security is associated with lower likelihood of REDD+ implementation due to the effectiveness of property rights in reducing deforestation rates.

In general, it has been recommended that protected areas act in synergy with property rights to effectively reduce environmental degradation while maintaining local wellbeing (Aguilar-Støen 2017, Blackman & Veit 2018, Börner et al. 2009). A plethora of studies across the world have been conducted that attest to the effectiveness of protected areas (PAs) in reducing deforestation rates (Arima et al. 2014, Cabral et al. 2018, Soares-Filho et al. 2010, Panlasigui et al. 2018, Nzunda & Midtgaard 2017). For example, Soares-Filho et al. (2010) has shown that in Brazil, indigenous territories, strictly protected areas, and sustainable use areas have all been shown to increase effectiveness in inhibiting deforestation without provoking leakage into adjacent, non-protected forest areas. Although protected areas in Brazil are more often in critical conditions than not, all have been found to actively contribute to improved conservation of native ecosystems and positive forest outcomes (Cabral et al. 2018, Robinson et al. 2014). In other South American countries such as Ecuador, Van Der Hoek (2017) has found that protected areas experienced lower deforestation rates than unprotected areas. Not only in South America but in various countries throughout the world it has been ubiquitously proven that PAs are not only effective at reducing deforestation rates, but also have the additional benefits of sustaining traditional livelihoods, preventing forest fires, and maintaining climate-vegetation balance and hydrological regimes (Andam et al. 2008, Cabral et al. 2018, Nelson & Chomitz 2011, Nolte et al. 2013, Nzunda & Midtgaard 2017, Panlasigui et al. 2018, Pfaff et al. 2013). However, it is important to note that in several of these studies the PAs represented a significant cost to the national economy (Andam et al. 2008, Panlasigui et al. 2018). It is recommended that costs are compensated by any conservation policy to be implemented so as to not hinder economic development in the country struggling with the often dichotomous goals of environmental conservation and economic wellbeing (Adams et al. 2004, BenYishay et al. 2017, Kakembo

2001, Nelson et al. 2009). It is expected that greater presence of protected areas are negatively correlated with likelihood of REDD+ implementation due to their effectiveness in reducing deforestation rates. However, it is important to note that protected areas pose an opportunity cost to developing countries and REDD+ could potentially serve as a means of payment for this cost.

Population: density, growth & urbanization

An analysis of the underlying drivers of deforestation, drawing largely on 31 national REDD+ project proposals, revealed that countries identified population growth as 1 of the top 5 underlying drivers of deforestation (Kissinger et al. 2012). Globally, both population growth and population density have been found to be positively associated with deforestation (Bhattarai & Hammig 2001, Van Khuc et al. 2018, Nzunda & Midtgaard 2017). The majority of the world's poor continue to experience high fertility rates and typically rely on natural resource extraction or subsistence agriculture for their livelihoods (Todaro & Smith 2015). Forest encroachment, fuelwood depletion, soil erosion, declining fish and animal stocks, inadequate and unsafe water, air pollution, and urban congestion are all environmental issues which arise in developing countries in relation to the relatively low living level of an expanding population base (Todaro & Smith 2015).

The more nuanced effects of rural population growth on deforestation appear to depend on the region of interest. Multiple studies have found that while rural population density is positively associated with deforestation in Latin America and Africa, the opposite is true for countries in Asia (Bhattarai & Hammig 2001, Cropper & Griffiths 1994, Shandra et al. 2011). Both Bhattarai & Hammig (2001) and Cropper & Griffiths (1994) argue that this is due to land scarcity, which is an issue of greater significance in Asia than in Latin America and Africa. By increasing the need for arable land, both population growth and increased population density in rural areas encourage the conversion of forest land to other uses, driving basic extraction, production, and consumption activities (Shandra 2007). Furthermore, because population growth places increasing pressure on the assimilative capacity of the environment, it is also viewed as a major cause of air, water, and solid waste pollution (Leblois et al. 2017). To some, the logical conclusion of these arguments is that rural population control is an important means of improving environmental quality (Sathler et al. 2018, Leblois et al. 2017, Shandra et al. 2011). Indirectly, deforestation is driven by population growth via low levels of economic activity and the fiscal austerity associated with the large foreign debts of these countries (Shandra 2007). Poverty and population growth participate in a positive feedback loop, with population growth enforcing the cycle of poverty and vice versa, leading to an increasing dependence on the clearing of natural resources to meet basic livelihood needs (Scanlan 2001, Shandra et al. 2011). Due to the positive correlation between population growth, population density, and environmental degradation, it is expected that these demographic variables are positively associated with REDD+ implementation.

Economic factors & deforestation

There is no doubt that a country's economy is related to environmental degradation. Economic factors found to have an influence on deforestation rates include economic growth and development, reliance on primary exports (e.g. agriculture and precious metals), and openness to trade (Culas 2006, Gullison & Losos 1993, Kissinger et al. 2012, Tsurumi & Managi 2014).

The most commonly utilized model to illustrate the relationship between economic development and environmental degradation is the Environmental Kuznets Curve (EKC) (Kuznets 1955). The

Environmental Kuznets Theory postulates that environmental deterioration rises in the early stages of economic development and eventually begins to decrease as the economy develops beyond a certain point, thus forming a U-shaped curve (Baloch et al. 2018, Bhattarai & Hammig 2001, Kuznets 1955). Very poor nations initially have restrictive production functions based on rudimentary technology and low levels of human capital (Nzunda & Midtgaard 2017, Sekrafi & Sghaier 2018). This typically places a ceiling on productivity and primarily limits underdeveloped economies to subsistence agriculture. However, as countries begin to industrialize, extraction of resources increases exponentially (Kuznets 1955). Eventually, countries reach a state of advanced capitalism, where they typically experience improvements in energy efficiency and a growing service and science-based production system (Cropper & Griffiths 1994, Du et al. 2018, Faith 2010). Given this theory, an EKC relationship is expected to be observed between REDD+ implementation and GDP per capita.

A plethora of studies have indicated that two of the principal direct drivers of deforestation are agriculture and the extraction of natural resources (Carrasco et al. 2017, Kissinger et al. 2012, Richards 2015, Rodrigue & Soumonni 2014, Sobhee 2004, Nhem et al. 2017). Commercial agriculture in tropical forest countries drives 40% of global deforestation (Umunay et al. 2018). This is largely due to increasing international consumer demand for agricultural cash crops such as soy, beef, and palm oil (Butler et al. 2009, Combes-Motel et al. 2008). Livestock and cattle ranching, in particular, is expected to increase in upcoming years due to population growth and increased meat consumption (Combes-Motel et al. 2008). Furthermore, extraction of precious metals and other natural resources via mining has served as another driver of deforestation and forest degradation (Rodriguez-Faria & Nunes-Almedia 2016, Richards 2015, Rodrigue & Soumonni 2014). Primary goods industries tend to be centralized in developing countries due to the lack of resources or financing to develop other more advanced industries, and furthermore the increasingly globalized nature of international society results in the redistribution of primary export industries to countries with the greatest availability of cheap resources, typically all of which are found in developing countries (Shandra 2007, Lavelle et al. 2016). Given the economic dependency of developing countries on natural resource extraction, it is expected that greater agricultural activity in a country is associated with lower likelihood of REDD+ implementation.

Openness to trade influences the disposition of national economies and as such can influence deforestation rates as well, as much of existing literature indicates. Generally, economic principles from early trade theory suggest that trade openness can have a positive effect on deforestation, as countries with substantial amounts of natural resources may develop a system that uses those resources intensely (Culas 2006, DeFries et al. 2010, Ferreira 2012, Leblois et al. 2017, Rodrigues-Faria & Nunes-Almedia 2016, Tsurumi & Managi 2014). Similar to the relationship between agriculture and REDD+ implementation, it is expected that greater trade openness will be associated with lower likelihood of REDD+ implementation due to the economic dependency of developing countries on trade and primary exports for a significant portion of their national income.

In general, the economic viability of environmental conservation depends on the profitability of alternative land uses, as oil palm, cattle, and soybean production have become major drivers of tropical deforestation over the last few decades (Butler et al. 2009, Irawan et al. 2013). Existing literature presents contrasting results regarding the economic sustainability of conservation programs such as protected areas. For example, Butler et al. (2009) indicate that converting a hectare of forest into palm oil production would be more profitable to land owners that preservation of forest for carbon credits, which are currently restricted to voluntary carbon markets. Similarly, Irawan et al. (2013) performed a cost-benefit analysis to determine the opportunity cost of REDD+ land use activities in Indonesia and find that the opportunity cost of palm oil plantations on mineral soils preceded by logging of degraded forest is prohibitively high, and therefore there would be a substantial loss of public revenue at various government levels. Contrary to these studies, Börner et al.'s (2009) macro-scale spatial analysis and economic-quantitative analysis suggested that under current carbon prices, the economic preconditions in order to pay were in place to pay for deforestation in over half of threatened forests over the next decade. In other words, current global carbon prices were high enough to offset the opportunity cost of preserving land over converting forest for agricultural uses or timber harvesting. Regardless, in order to combat the issue of deforestation global climate policies would need to legitimize the trading of carbon credits from avoided deforestation (Butler et al. 2009, Chhatre & Agrawal 2009, Phelps et al. 2011).

Data and Methodology

Data

Data for this study was obtained from the Quality of Government Institute (QoG), an independent research institute within the Department of Political Science at the University of Gothenburg, Sweden. The primary purpose of this dataset is to promote research on the causes, consequences, and nature of government institutions around the world, and how the quality of such institutions influences public policy and socioeconomic conditions in a broader sense (Teorell et al. 2019). The QoG dataset has compiled datasets from every freely available data source, including aggregated individual-level data. The original dataset contains more than 2,000 variables that fall into 19 thematic categories. Since 2008 the Quality of Government Institute has published annual updates of the dataset, adding or removing variables or entire data sources in order to evolve an optimal holistic understanding of the quality of government and standard of living in 194 countries. The QoG standard cross-sectional dataset was utilized for this study. All data reported was for the year 2014.

Table 1 – Variable Descriptions

Classification	Variable Name	Description
Deforestation and forest area	Forest land (% of land area)	Forested land as a percentage of total land area. Includes primary forest, planted forest, and naturally regenerated forest
	Terrestrial protected areas (national biome weights)	Percentage of the terrestrial biome area that is protected, weighted by domestic biome area
Economic	GDP per capita, PPP (current international dollar)	PPP GDP is gross domestic product converted to international dollars using purchasing power parity rates. Data are in current international dollars based on the 2011 ICP round.
	Agriculture, forestry, and fishing, value added (% of GDP)	Agriculture corresponds to ISIC divisions 1-5 and includes forestry, hunting, and fishing, as well as cultivation of crops and livestock production. Value added is the net output of a sector after up all outputs and subtracting intermediate inputs.
	Trade freedom	The trade freedom score is based on two inputs: the trade-weighted average tariff rate, and non-tariff barriers (NTBs). The country's trade freedom ranges between 0 and 100, where 100 represents the maximum degree of trade freedom.
Quality of government	Level of democracy	Scale ranges from 0-10 where 0 is least democratic and 10 is most democratic. Taken from open data sources on Freedom House and Polity. The imputed version has imputed values for countries where data on Polity is missing by regressing Polity on the average Freedom House measure.
	Political corruption index	The directionality of this index runs from less corrupt to more corrupt. It includes measures of six distinct types of corruption that cover both different areas and levels of the polity realm, distinguishing between executive, legislative and judicial corruption. The index is arrived at by taking the average of the public sector corruption index, the executive corruption index, the indicator for legislative corruption, and the indicator for judicial corruption. These four different government spheres are weighted equally in this index.

	Human rights and rule of law	Measures when human rights are violated or unevenly protected. Includes pressures and measures related to press freedom, civil liberties, political freedoms, human trafficking, political prisoners, incarceration, religious persecution, torture, executions. The index ranges from 0-10, with 10 representing the maximum violation of human rights
Territory and property	Property rights and security	This factor scores the degree to which a country's laws protect private property rights and the degree to which its government enforces those laws. It also accounts for the possibility that private property will be expropriated. The less certain the legal protection of property is and the greater the chances of government expropriation of property are, the lower a country's score is. The index ranges from 0 to 100.
Demographic	Population density (people per sq. km. of land area)	Midyear population divided by land area in square kilometers. Population is based on the de facto definition of population, which counts all residents regardless of legal status or citizenship--except for refugees not permanently settled in the country of asylum, who are generally considered part of the population of their country of origin. Land area is a country's total area, excluding area under inland water bodies, national claims to continental shelf, and exclusive economic zones.
	Population growth (annual %)	The exponential rate of growth of midyear population from year t-1 to 1, expressed as a percentage. Population is based on the de facto definition of population, which counts all residents regardless of legal status or citizenship
	Rural population growth (annual %)	Rural population refers to people living in rural areas as defined by national statistical offices. It is calculated as the difference between total population and urban population. This is intended to represent the rate of urbanization of a country, as the exact variable was not included in the QoG dataset.

Variables were sourced from the QoG online open database, and are for cross-sectional data for 141 countries for the year 2014.

This study analysis was conducted on a subset of the original QoG dataset consisting of 14 variables and 141 observations. 14 variables were extracted from the QoG dataset which were found to be relevant for the present study and represent the following dimensions: deforestation and forest area, quality of government, territory and property, economic, and demographic (see Table 1). These indicators were chosen to measure the economic, political, and demographic state of 141 countries, 54 of which are REDD+ partner countries. REDD+ partner countries are defined as countries not only participating in REDD+ activities and programs but also receiving assistance from the UN-REDD Programme in developing the capacities needed in order to meet the UNFCCC's REDD+ requirements, in order to receive results-based payments under the Convention (United Nations 2011). Theoretically, REDD+ partner countries are supported in their nationally-led REDD+ processes with a particular emphasis on the informed and meaningful involvement of all stakeholders, including indigenous peoples and other forest-dependent communities.

51 countries, 11 of which are REDD+ partner countries, were removed from the dataset for their excessive numbers of missing values. These included countries such as Cuba and North Korea, for which data collection would be particularly difficult. Because deforestation is primarily an issue of focus in developing countries, separate versions of the models were estimated for Asia, Africa, and Latin America & the Caribbean (hereupon referred to as simply Latin America), in addition to an all-countries model.

Table 2 - Descriptive Statistics

Statistic	N	Mean	St. Dev.	Min	Pctl(25)	Pctl(75)	Max
Forest land (% of land area)	141	30.47	22.44	0.01	10.98	43.39	98.28
Terrestrial protected areas (national biome weights)	141	79.33	22.04	7.34	68.15	99.67	100.00
GDP per capita, PPP (current international dollar)	141	17,910	17,970	660	3,835	26,150	102,520
Agriculture, forestry, and fishing, value added (% of GDP)	141	11.84	11.62	0.23	3.39	17.15	58.65
Trade freedom	141	75.83	10.66	41	68.8	86.2	90
Level of democracy	141	6.74	2.95	0.00	4.50	9.33	10.00
Political corruption index	141	0.51	0.31	0.01	0.18	0.78	0.98
Human rights and rule of law	141	5.65	2.56	0.70	3.50	7.70	10.00
Property rights and security	141	41.97	25.05	5.00	25.00	55.00	95.00
Population density (people per sq. km. of land area)	141	131.36	195.32	1.92	31.03	132.24	1,394.68
Population growth (annual %)	141	1.44	1.21	-0.94	0.53	2.36	5.86
Rural population growth (annual %)	141	0.44	1.40	-4.35	-0.46	1.59	3.80

Descriptive statistics for the variables included in this study, including number of observations (N), mean, standard deviation (St. Dev.), minimum (Min), 25th percentile (Pctl 25), 75th percentile (Pctl 75), and maximum (Max).

Multicollinearity Tests

Many international studies similar in nature to the present study have high degrees of multicollinearity due not only to the redundancy of measurements, but also to the interdependency of macro-level economic and political factors. Therefore, appropriate estimation methods and identification were two critical concerns for this empirical analysis. The raw data were first checked before coding, and possible correlations among variables were examined and combined via the Pearson correlation method. Collinearity among variables were then formally tested using variance inflation factors (VIF). After running all models two variables were found to have excessively high VIFs and as such were eliminated from the models, resulting in a final variable count of 12. VIFs are obtained via the following equation:

$$VIF_j = \frac{1}{1 - R_j^2}$$

Which is precisely the term in $Var(\beta_j) = \frac{\sigma^2}{SST_j} \times VIF_j$ that is determined by the correlation between x_j and other explanatory variables. The value of 10 was chosen as the cutoff value for which it was concluded that the VIF was a problem of significance. Reliable representatives of economic, political, and demographic indicators were selected for this study and a VIF analysis of the final 12 variables do not suggest that multicollinearity is a problem of significance.

Probit Model

Probit regression analysis is utilized in order to determine the effect of the explanatory variables on the response probability of the dependent variable *y,* or the existence of REDD+ partnership in the country (Green 2000). Probit modeling falls under a class of binary response models of the form:

$$P(y = 1|\boldsymbol{x}) = G(\beta_0 + \beta_1 x_1 + \cdots + \beta_k x_k) = G(\beta_0 + \boldsymbol{\beta x})$$

where G is a function taking on values strictly between zero and one: $0 < G(z) < 1$, for all real numbers z (Wooldridge 2013). This ensures that the estimated response probabilities are strictly between zero and one. In the probit model, G is the standard normal cumulative distribution function (cdf), which is expressed as an integral:

$$G(z) = \phi(z) = \int_{-\infty}^{z} \phi(v)dv$$

where $\phi(v)$ is the standard normal density

$$\phi(v) = (2\pi)^{-1/2} e^{-z^2/2}$$

This choice ensures that G is a function taking on values strictly between zero and one. The G function is an increasing function. It increases the most quickly at $z = 0, G(z) \rightarrow 0\ as\ z \rightarrow -\infty$, and $G(z) \rightarrow 1\ as\ z \rightarrow \infty$. As for most applications of binary response models, the primary goal of utilizing probit model in this study is to explain the effects of the covariate x_j on the response probability $P(y = 1|\boldsymbol{x})$. The conventional formulation of a binary dependent variable model assumes that an unobserved, or latent, dependent variable $Y_i^*$is generated by a classifical linear regression model of the form

$$Y_i^* = \mathbb{X}_i^T \beta + u_i = \beta_0 + \beta_1 x_{i1} + \beta_2 x_{i2} + \cdots + \beta_k x_{ik} + u_i$$

Where Y_i^*= a continuous real-valued index variable for observation i that is unobservable, or latent; $\mathbb{X}_i^T$= (1 x_{i1} x_{i2}…x_{ik}), a 1 xK row vector of regressor values for observation i, $\beta =$

$(\beta_0 \;\; \beta_1 \, \beta_2 \, ... \, \beta_k)^T$, a $K \times 1$ column vector of regression coefficients, $x_i^T \beta =$ a 1×1 scalar called the index function for observation i, and $u_i =$ an independent and identically distributed $N(0, \sigma^2)$ random error term for observation i.

The empirical model utilized for this study is as follows:

$$Y_i^* = \mathbb{X}_i^1 \beta_1 + \mathbb{X}_i^2 \beta_2 + \mathbb{X}_i^3 \beta_3 + \mathbb{X}_i^4 \beta_4 + u_i$$

Where $\mathbb{X}_i^1 =$ environmental factors, $\mathbb{X}_i^2 =$ political factors, $\mathbb{X}_i^3 =$ economic factors, $\mathbb{X}_i^4 =$ demographic factors, and u_i serves as the error term. Environmental factors include terrestrial protected areas and forested land, while political factors include level of democracy, political corruption, property rights and security. Economic factors include GDP per capita, trade openness, and agriculture, forestry, and fishing, as a percentage of GDP. Finally, demographic variables include population growth, population density, and rural population growth.

The observable outcomes of the binary choice problem are represented by a binary indicator variable Y_i that is related to the unobserved dependent variable Y_i^* as follows:

$$Y_i = 1 \; if \; Y_i^* > 0$$

$$Y_i = 0 \; if \; Y_i^* \leq 0$$

The random indicator variable Y_i represents the observed realizations of a binomial process with the following probabilities:

$$\Pr(Y_i = 1) = \Pr(Y_i^* > 0) = \Pr(x_i^T \beta + u_i > 0)$$

$$\Pr(Y_i = 0) = \Pr(Y_i^* \leq 0) = \Pr(x_i^T \beta + u_i \leq 0)$$

Therefore, probit models analytically represent the binomial probabilities in the above equations in terms of the standard normal cumulative distribution function $\Phi(z)$ as follows:

$$\Pr(Y_i = 1) = \Pr(Y_i^* > 0) = \Phi(x_i^T \beta)$$

$$\Pr(Y_i = 0) = \Pr(Y_i^* \leq 0) = 1 - \Phi(x_i^T \beta)$$

In order to determine the partial effect of roughly continuous variables on the response probability y, or, in this case, the existence of REDD+ partnership, calculus must be utilized. If x_j is a roughly continuous variable, its partial effect on $p(\boldsymbol{x}) = P(y = 1|\boldsymbol{x})$ is obtained from the partial derivative:

$$\frac{dp(x)}{dx_j} = g(\beta_0 + \boldsymbol{x\beta})\beta_j, \text{ where } g(z) \equiv \frac{dG}{dz}(z).$$

Because G is the cumulative distribution function of a continuous random variable, g is a probability density function. The above equation illustrates that the relative effects of any two continuous explanatory variables do not depend on $\boldsymbol{x}$: the ratio of the partial effects for variables x_j and x_h is $\frac{\beta_j}{\beta_h}$. In the typical case that g is a symmetric density about zero, with a unique mode at zero, the largest effect occurs when $\beta_0 + \boldsymbol{x\beta} = 0$. In order to determine the partial effect of a discrete variable x_k on response probability, the effect on the probability of x_k going from c_k to $c_k + 1$ is simply

$$G[\beta_0 + \beta_1 x_1 + \beta_2 x_2 + \cdots + \beta_k(c_k + 1)] - G[\beta_0 + \beta_1 x_1 + \beta_2 x_2 + \cdots + \beta_k c_k].$$

Therefore, in order to determine the partial effects of each covariate of interest in this study on the response probability of REDD+ implementation, the above equations were utilized with probit modeling. All analyses were performed utilizing RStudio version 1.1.456 software for Mac OS X.

Results

Table 3 - All Countries

	Likeliness of Implementation					
	REDD+					
	(1)	(2)	(3)	(4)	(5)	(6)
Forest land (% of land area)	0.021***	0.029***	0.025***	0.024***	0.033***	0.034***
	(0.007)	(0.008)	(0.007)	(0.007)	(0.009)	(0.009)
Terrestrial protected areas (national biome weights)	0.025***	0.027***	0.022***	0.022***	0.032***	0.035***
	(0.008)	(0.008)	(0.008)	(0.007)	(0.010)	(0.011)
GDP per capita, PPP (current international dollar)	-0.562**	9.536***			11.322***	11.103***
	(0.236)	(2.624)			(3.340)	(3.436)
GDP per capita, PPP (current international dollar) squared		-0.572***			-0.674***	-0.660***
		(0.150)			(0.193)	(0.198)
Agriculture, forestry, and fishing, value added (% of GDP)	-0.015	0.009			0.015	0.021
	(0.022)	(0.023)			(0.026)	(0.027)
Trade freedom	-0.062***	-0.054***			-0.066***	-0.065***
	(0.016)	(0.016)			(0.023)	(0.025)
Level of democracy			0.409***	0.642**	0.292	0.336
			(0.099)	(0.260)	(0.334)	(0.371)
Level of democracy squared				-0.026	0.004	0.005
				(0.027)	(0.034)	(0.036)
Political corruption index			1.399	1.200	2.121*	2.524**
			(0.920)	(0.940)	(1.213)	(1.272)
Human rights and rule of law			0.715***	0.651***	0.439**	0.484**
			(0.157)	(0.170)	(0.201)	(0.213)
Property rights and security			0.011	0.014	0.043***	0.044***
			(0.012)	(0.012)	(0.015)	(0.016)
Population density (people per sq. km. of land area)						0.0004

						(0.001)
Population growth (annual %)						0.406
						(0.280)
Rural population growth (annual %)						-0.419*
						(0.223)
Constant	7.034***	-38.246***	-10.943***	-10.751***	-53.230***	-54.071***
	(2.408)	(11.680)	(1.994)	(2.010)	(14.961)	(15.710)
Observations	141	141	141	141	141	141
Log Likelihood	-57.780	-49.034	-55.625	-55.156	-40.031	-38.162
Akaike Inf. Crit.	127.560	112.068	125.250	126.313	104.062	106.325
Note:						*p**p***p<0.01

All countries

Table 3 contains estimates on the effects of environmental, economic, political, and demographic indicators on likeliness of REDD+ implementation. Model 1 includes economic indicators as linear covariates. Model 2 regresses economic variables on likeliness of REDD+ implementation while testing for the existence of an EKC relationship between REDD+ implementation and GDP per capita. Model 3 examines the relationship between political factors and likeliness of REDD+ implementation. Model 4 includes identical political variables but tests for an EKC relationship between REDD+ implementation and level of democracy. Model 5 includes both economic and political indicators and tests for the existence of EKC relationships for both GDP and level of democracy simultaneously. Finally, model 6 controls for demographic variables while testing for the effect of political and economic variables on REDD+ implementation likeliness.

Forested land was found to have a positive and significant marginal effect and correlation with likeliness of REDD+ implementation. Similarly, terrestrial protected areas were found to have a positive and statistically significant relationship with likeliness of REDD+ implementation. For both of these variables, the magnitude of the coefficient observed increased as a greater number of variables were added to the models.

When tested as a linear covariate, GDP per capita was found to have a negative and statistically significant effect on the likelihood of REDD+ implementation. When testing for a quadratic relationship between GDP and likelihood of REDD+ implementation, evidence supporting an EKC relationship was observed for all models in which it was included. Alternatively, GDP growth was found to have an insignificant and positive effect on likeliness of REDD+ implementation in all models, regardless of the economic, political, or demographic controls which were included. Similarly, the agricultural sector was not found to have statistically significant coefficients in any of the models in which it was included. When GDP per capita was included only as a linear covariate, a negative effect was observed for the relationship between the agricultural sector and likeliness of REDD+ implementation, while in models where GDP was included as a quadratic variable, a positive coefficient was observed. Trade freedom was found to have a negative and statistically significant marginal effect on likeliness of REDD+ implementation for all models.

When tested as a linear covariate, level of democracy was found to have a positive and statistically significant effect on the likeliness of REDD+ implementation. When testing for the existence of an EKC, a nonmonotonic relationship was observed; however, results were insignificant, contrary to what was observed for GDP. Political corruption was found to have a positive effect on likeliness of REDD+ implementation but significance varied from model to model, with statistical significance observed only when controlling for economic and demographic variables. Human rights and rule of law were found to have a positive and statistically significant marginal effect on likeliness of REDD+ implementation regardless of economic, political, and demographic controls. Property rights and security were also found to have a positive effect on likeliness of REDD+ implementation, but similar to political corruption, significance was only observed when controlling for economic and demographic variables.

Both population growth and population density were found to have positive but insignificant effects on likeliness of REDD+ implementation while rural population growth was found to have a negative and statistically significant marginal effect on likeliness of REDD+ implementation.

Region-specific models: Asia, Africa, Latin America & the Caribbean

Region-specific models did not vary significantly from the all-countries models, exhibiting the same directionality and similar magnitudes in models specific to countries in Asia, Africa, and Latin America & the Caribbean. The only significant differences observed were for two covariates in Africa and one covariate in Latin America & the Caribbean. For Africa-specific models, the coefficient for political corruption was only found to be statistically significant when controlling for all economic, political, and demographic variables, and the coefficient for population growth was found to be positive and statistically significant. For Latin America & the Caribbean, political corruption was found to be statistically significant only when level of democracy was included as a linear variable, and when economic and demographic variables were controlled for. Region-specific tables can be found in the appendices of this paper.

Discussion

In general, the results of this study suggest that countries are more likely to implement REDD+ if they are experiencing economic transition (i.e. industrialization) and are less open to trade, and are experiencing rural population decline. These correlations must be contextualized in the global state of the economy in order to understand both the potential causality and consequences of the observed results. Countries which have a high proportion of forested area and a significant presence of terrestrial protected areas are also more likely to implement REDD+. The significance of the effect of these environmental observations on likeliness of REDD+ implementation, regardless of the addition of other contextual variables, could be explained by the environmental attitudes of both the citizens and governments of countries which implement REDD+. Finally, countries with higher levels of democracy, higher instances of violation of human rights and political corruption, and greater protection of property rights, were found to be more likely to implement REDD+. The results of these political correlations can be added to a growing body of literature criticizing REDD+ for its lack of human livelihood safeguards as well as the discrepancy between REDD+ in theory and REDD+ in practice. The interactions of these variables amongst one another was most notable in the effect of economic and demographic variables on determining statistical significance for the political variables of political corruption, and property rights and security.

Trade, rural population growth, and globalization

As linear covariates, trade openness and rural population growth were found to have statistically significant and negative marginal effects on likeliness of REDD+ implementation. In all models, trade freedom was found to have an approximate negative marginal effect of -0.02 on likeliness of REDD+ implementation, indicating that a 1-point increase (on the 100-point scale of this indicator) in trade openness would decrease likelihood of REDD+ implementation by approximately 2 percentage points. Rural population growth, alternatively, was found to have an approximate negative marginal effect of -0.14 on likeness of REDD+ implementation, indicating that a 1% increase in rural population growth would decrease likelihood of REDD+ implementation by 14 percentage points.

The negative relationship observed between REDD+ implementation likeliness, trade openness, and rural population growth, can be explained via the globalizing forces which are an ever-increasing pressure in our interconnected world. Globalization has allowed the pervasive, and at times brutal, nature of capitalism to shift the global economy to account for economies of scale, maximization of profit, and minimization of costs on an international scale. This has resulted in a ubiquitous availability of novel sources of cheap human capital and raw natural resources. Developing countries have been goaded by the international community via conditional loans, well-intended aid programs, and a neo-colonial complex into liberalizing their trade policies. At the same time, efforts to industrialize and advance their economies have served as an additional motivator for trade openness in many developing countries. Primary exports—such as cash crops—comprise the majority of trade exports for developing countries, which typically lack the technology, human capital, or industrial infrastructure required to refine and develop raw materials domestically. With developing nations facing issues such as restricted industrial capacity, low levels of research and technology, and inadequate investment in human capital, primary exports can serve as a valuable percentage of national income and a means of foreign exchange. Trade openness, furthermore, allows for the importation of consumer goods that are both required and demanded by domestic society. National income from exports, furthermore, can be allocated towards human development and infrastructure. REDD+, due to its focus on the reduction of carbon emissions, can severely restrict the harvesting of natural resources and the cultivation of primary exports such as cash crops. This could explain the negative marginal effect of trade openness on likeliness of REDD+ implementation.

As the extraction and harvesting of natural resources tends to occur in rural areas, the negative correlation observed between rural population growth and REDD+ implementation can be explained by a reliance on primary exports as well. In fact, many countries, in their development strategies, have actually encouraged in-migration into rural or densely forested areas in order to promote agricultural development and extraction of primary resources as a crucial means for generating foreign exchange (Rodrigues-Faria & Nunes-Almedia 2016, Simmons 2002, Tsurumi & Managi 2014). The connections documented between rural population growth, resource extraction, and trade openness can explain the negative directionality observed between these variables of interest and likelihood of REDD+ implementation.

GDP per capita, the Environmental Kuznets Curve, and the goals of REDD+

In model 1, where GDP per capita was included as a linear covariate of REDD+ implementation likeliness, the marginal effect of GDP per capita on likeliness of REDD+ implementation was calculated to be 0.16, indicating that a 1 unit increase in GDP per capita predicts a 16-percentage point increase in likeliness of REDD+ implementation. Evidence supporting an EKC relationship was observed for the relationship between GDP and likeliness of REDD+ in the remaining models, indicating that likeliness of REDD+ implementation is low at both extremely low and extremely high GDPs, with highest likeliness of implementation observed at a GDP between $4,479 and $5,095 (depending on the model of interest). These GDPs serve as optimization points where theoretically, the highest probability of REDD+ implementation is predicted. For context, countries such as Myanmar, Honduras, Nicaragua, and Samoa have GDPs within this range and theoretically would be the most likely to implement a REDD+ program.

Economic development and environmental conservation often come into conflict according to EKC, and this conflict is especially evident in developing countries. As impoverished countries continue to develop and undergo economic transition, however, stabilization can allow for governments to focus on other issues such as environmental degradation (Cropper & Griffiths 1994, Du et al. 2018, Kisswani et al. 2019, Destek & Sarkodie 2019). Therefore, as low-income countries develop, likeliness of REDD+ implementation increases exponentially until the point of optimization, or so is implied by the EKC relationship observed. After this point likeliness of REDD+ implementation decreases exponentially, indicating that past a certain point of development, REDD+ does not appeal to countries. According to EKC, low-income countries would necessarily experience high rates of environmental degradation and deforestation, arguably to fuel industrialization and economic development. Historically this has been the case, as economic development necessarily relies on the utilization of resources at society's disposal (Adams et al. 2004, Boyd et al. 2018, Faith 2010). Therefore, low-GDP countries would be less likely to implement an international environmental mitigation program such as REDD+ before they reach a certain point in development, as it could heavily interfere with the resource extraction, and therefore economic development, that the country relies on (Kisswani et al. 2019, Torras & Boyce 1998).

Likeliness of REDD+ implementation begins to decrease past the identified GDP optimization points and diminishes to very low likelihoods as GDP increases to substantial levels. This can be explained by the nature and targets of REDD+. The very inception of REDD+ was based on the tenet of "providing financial incentives *to developing countries* for reducing greenhouse gas emissions from deforestation and forest degradation" (Clements 2010, Holloway & Glanomenico 2009). Therefore, REDD+ was, and continues to be, an international effort pinpointing the issue of environmental degradation specifically in developing countries. REDD+ is not focused on environmental issues prevalent in developed countries and so due to its very nature no developed countries have implemented REDD+. This explains why likelihood of REDD+ implementation decreases past a certain GDP.

Forested area, terrestrial protected areas, and environmental attitudes

Both forested area and terrestrial protected areas were found to have positive and statistically significant marginal effects on the likelihood of REDD+ implementation. The marginal effect of forested land ranged from 0.008 to 0.010. This indicates that a 1 percentage point increase in forested area suggests a consequential 0.8-1.0 percentage point increase in likelihood of REDD+ implementation. Similarly, the marginal effect of terrestrial protected areas on likelihood of REDD+ implementation ranged from 0.008 to 0.009. These marginal effects indicate that a 1-percentage point increase in national biome weight of terrestrial protected areas corresponds to a 0.8-0.9 percentage point increase in likelihood of REDD+ implementation.

The positive effect of forested land and terrestrial protected areas could be explained via underlying environmental attitudes and awareness. Dasgupta et al. (2006) has shown that greater forested area is correlated with the implementation of environmental protectionist policies and theorize that this is due to growing awareness of the external benefits that forests and other ecosystems can provide for society, such as clean drinking water, air purification, nutrient cycling, and mitigation of natural disasters. The interaction between ecocentric attitudes and environmental awareness can positively influence environmental behavior (Kalburan & Hasiloglu 2018). Ficko & Bončina (2018) suggest that human values play a prominent role in conservation behavior, as general attitudes towards forest cover, agricultural stock, harvesting intensities, and biodiversity loss predicted participation in environmentally-conscious consumer behavior by 33%. Personal environmental attitudes have the potential to translate to environmental policy as well as an environmentally conscious economy; however, in order for the former to establish a relationship with environmental attitudes, variables such as level of democracy, as well as government progressiveness, priorities, and responsiveness to citizen desires, must be considered. Nevertheless, environmental attitudes have been shown to ubiquitously predict for environmental behavior and as such could explain how countries which have already implemented terrestrial protected areas and have high forested area are also interested in implementing the additional environmental mitigation program of REDD+.

Political corruption, human rights, and property security: criticisms of REDD+

Political corruption, human rights and rule of law, and property rights and security were all found to have positive marginal effects on likelihood of REDD+ implementation, although significance varied considerably from model to model. While the coefficient for human rights and rule of law was found to be positive and statistically significant in all models, both political corruption and property rights and security were only found to be statistically significant when economic and demographic variables were controlled for.

The marginal effect of human rights violations on likelihood of REDD+ implementation was found to be between 0.14-0.25, depending on which variables were controlled for. These marginal effects indicate that if human rights violations increase by 1 point on the 10-point scale of this indicator, likelihood of REDD+ implementation increases by 14-25 percentage points. The marginal effect of human rights violations on likelihood of REDD+ implementation decreased as economic and demographic variables are controlled for. For context, on the human rights violation scale, the Democratic Republic of Congo is ranked 10, while Nigeria is ranked 9, Uganda 8, South Korea 3, Spain 2, and Iceland 1.

The positive relationships observed between corruption levels, human rights violations, and REDD+ implementation were unexpected, but could be attributed to previous critiques and shortcomings of REDD+. Historically REDD+ projects have been criticized for not only their lack of specific goals but also the lack of logical links between its ambiguous goals, project interventions, and monitoring techniques. Due to the disjointed nature of the program, projects experience difficulty in both achieving and measuring biodiversity impacts (Panfil & Harvey 2016). More relevant to this discussion, REDD+ has been widely criticized for its failure to acknowledge the deeply rooted relationship between humans and the environment (Enrici & Hubacek 2018, Pistorius 2012, Saeed et al. 2018, Umunay et al. 2018). Primary issues from past debates include the participation and rights of local people and REDD+'s relationship with the problematic legacies of colonial structures (Buizer et al. 2013, Chomba et al. 2016, Saeed et al. 2018). Historically, payment for environmental services (PES) projects and integrated conservation and development projects (ICDPs)—to which REDD+ closely identifies—have seen plagues of cases where initial flow of benefits has been concentrated in the hands of a few wealthy elite (Fletcher & Büscher 2017, Lansing 2017, Lund et al. 2017, Martin et al. 2014). Indeed, oftentimes equity concerns arise in the distribution of benefits amongst all REDD+ stakeholders (Chomba et al. 2016, Simmons 2002, Vergara-Asenjo et al. 2017). The centralized, top-down, government-led process in which REDD+ has operated ignores the political economy of weak states and can offer new incentives for corruption and fraud by government officials and project sponsors, particularly in weakened political states (Duchelle et al. 2018, Karsenty & Ongolo 2012). For REDD+, this was found to be the case in both Kenya and Ghana, although on paper both countries programs have attempted to ensure that all stakeholders are "subjects of equity" (Chomba et al. 2016, Saeed et al. 2018). The ease in which it is possible to take advantage of the rewards-based payments REDD+ offers may be well known in the international community, and as such politically corrupt governments may implement the program for the sake of exploiting payments for personal gain.

The failure of REDD+ to address the rights and needs of local stakeholders and marginalized populations—such as indigenous communities—can explain the link between human rights violations and likelihood of REDD+ implementation. Countries are fiscally incentivized to implement the REDD+ program but are not necessarily held accountable in implementing livelihood safeguards or involving local stakeholders, serving as an example of the disparity between REDD+ in theory versus REDD+ in practice (Duchelle et al. 2018). Although the new paradigm of conservation has focused on the inclusion and agency of indigenous peoples and local stakeholders in environmental programs such as REDD+, old paradigm assumptions—which prioritize Western science and environmental conservation above all—continue to be held by many international conservationists, government officials and bureaucrats, and donors (Stevens 2016). For example, a significant issue of contention that has arisen time and time again has been the right to free, prior, and informed consent of local and indigenous peoples (FPIC) when implementing environmental policies such as protected areas or renewable energy projects (Finley-Brook & Thomas 2011). The historical lack of consideration of local and indigenous rights by many developing countries is easily perpetrated by programs such as REDD+. In other words, governments which have historically ignored basic human rights for its citizens may be more likely to implement REDD+ because they are primarily motivated by fiscal incentives and are unconcerned regarding the effect of REDD+ on rural livelihoods. Alternatively, these governments could also be motivated to implement REDD+ because although on paper REDD+

stipulates the importance of considerations of all stakeholders, officials are aware that they are not necessarily required to follow through due to the disparities between paper and practice.

Contrary to the results for political corruption and human rights violations, an increase by 1 point (on a 100-point scale) in protection of property rights predicts for greater likelihood of REDD+ implementation with a marginal effect of between 0.03 and 1.34 percentage points. The positive relationship between protection of property rights and REDD+ implementation is unexpected, given the close correlation typically observed among political corruption, human rights violations, and tenure insecurity. This correlation can also be explained via the discrepancies between REDD+ *de jure* and REDD+ *de facto.* Oftentimes, countries can have equitable property rights laws on paper that fail to be implemented in practice (Alchian & Demsetz 1973, Frontiers et al. 2009). Property rights granted by governmental policies are often not identical to the perceived rights citizens base their actions on. A high discrepancy between these variables signifies ineffective policy implementation and bears the risk of unsustainable decision-making (Klumper et al. 2018). While nearly every country in the world maintains some form of legislation regarding property rights and compensation for expropriation, the implementation of these laws in practice can vary highly, and furthermore this discrepancy can be difficult to measure unless qualitative research in the country of interest is undertaken (Alchian & Demsetz 1973). Indeed, formal or legal recognition does not alone guarantee tenure security (Smith et al. 2017). Countries with property rights *de jure* may experience inequitable distribution and expropriation *de facto*. Motivated by the fiscal incentives of REDD+, countries may be aware that REDD+ includes guidelines for tenure security but that governments are not necessarily accountable in following through with this aspect of the program.

REDD+ has been attempting to respond to its critiques and historical failures, at least on paper (United Nations 2011). REDD+ has shifted its emphasis to focus on processes that can incorporate implicit or explicit social objectives into its goals of forest conservation and sustainable forest management. These include, for example, the creation of provisions that focus on issues such as women's participation in forest stewardship, and economic opportunity for indigenous and local communities (Bee & Sijapati-Basnett 2017, Godoy 2014, McShane et al. 2011). It could be argued that countries with high records of human rights violations would be more interested in implementing REDD+ programs because of a desire to mitigate and correct human rights violations and instill tenure security measures. Given the fact that countries with transitioning economies and higher levels of democracy are also associated with greater likelihood of REDD+ implementation, a focus on addressing human rights violations could be an issue of interest to these countries. Thus, this could serve as another explanation for the positive correlation between human rights violations, property rights, and REDD+ implementation.

Level of democracy and political modernization perspective

As a linear covariate, level of democracy was found to have a positive and statistically significant relationship with likelihood of REDD+ implementation. Evidence supporting the existence of a Kuznets Curve in the relationship between level of democracy and likeliness of REDD+ implementation was not observed. Level of democracy as a linear covariate was determined to have a positive marginal effect of 0.15 on likeliness of REDD+ implementation, indicating that a 1-point increase towards greater democracy on the 10-point polity scale predicts a 15-percentage point increase in likeliness of REDD+ implementation.

The positive relationship observed between level of democracy and probability of REDD+ implementation can be explained via political modernization theory. Political modernization perspective suggests that democracy can mitigate environmental degradation by regulating consumption and making the government more responsive to the environmental demands of civic society (Shandra 2007). Governments must be more responsive to civil society due to electoral competition. This fact, combined with the greater freedom of speech and press that accompanies democracy, tends to result in greater accountability and transparency in both governments and corporations (Tipps 1973). Therefore, policy-makers in democratic countries whose citizens are concerned about environmental problems will be, in theory, required to demonstrate a strong commitment to environmental conservation. A wealth of research has been conducted examining the relationship between political systems and environmental degradation, with the majority advancing a negative correlation between the two variables, attributable to greater accountability and enforcement of environmentally conscious policies (Buitenzorgy & Mol 2011, Culas 2006, Obydenkova et al. 2016, Poore 1975, Ribot & Larson 2006). It should be noted, however, that this theory relies heavily on the assumption that citizens in democratic countries are concerned with deforestation and environmental degradation, which may or may not be the case.

The agricultural sector, population density, and population growth

Population density, population growth, and the agricultural sector as a percentage of GDP were found to be statistically insignificant in their effect on REDD+ likeliness. Given existing literature, population density and population growth were expected to have a positive effect on likeliness of REDD+ implementation, given their positive influence on high rates of deforestation. The agricultural sector, furthermore, was expected to have a negative effect on probability of REDD+ implementation due to its importance place in the economy of many developing countries. However, results were insignificant, indicating that the marginal effects of these variables in likelihood of REDD+ implementation could be minimal, or captured in large part by another variable with already included in the regression with which they were already highly correlated.

The agricultural sector variable included hunting, forestry, and fishing in addition to agriculture in its calculation of value added to GDP. Agriculture and forestry could actually have opposite effects on likeliness of REDD+ implementation and as such could directly cancel out one another's effects, thereby resulting in insignificant results. Alternatively, the effect of the agricultural sector on likeliness of REDD+ implementation could be conditional on trade openness, given that the majority of trade in developing countries revolves around the cultivation and exportation of primary resources (Leblois et al. 2017, Tsurumi & Managi 2014). While hunting, fishing, and agriculture fundamentally extract resources from the environment, the effect of these industries on environmental conservation policies could be marginal compared to other variables such as trade openness, economic development, and quality of government.

Potential sources of error

Potential sources of error that could have biased the results of this study include high correlations among covariates, which could lead to instances of statistical insignificance or the overrepresentation of the significance of other covariates. As previously mentioned, latent or underlying variables which were not accounted for in this study, such as environmental attitudes, historical context, and social factors such as gender equality and religion could also influence international diplomacy and therefore REDD+ implementation in these countries. The effects of these variables could not be captured given the availability of data and therefore could skew the results obtained for the covariates which were included in this study. Finally, data sources, in their measurement and creation of scales to grade certain economic and political factors, have ultimately arbitrarily graded these countries and could have failed to capture true variance or nuances in country characteristics in their standardization of these measurements. It is quite possible that these studies do not translate to what is actually practiced on the ground in these countries; however, this was unable to be examined in the present study due to funding, travel, and time constraints.

Conclusion and Further Recommendations

In a study of 141 countries, it was observed that countries with greater terrestrial protected areas and forested lands, transitioning economies, greater democracy, political corruption, human rights violations, and protection of property rights were more likely to implement REDD+. Alternatively, trade openness and rural population growth predicted for lower likelihood of REDD+ implementation. The correlations and marginal effects obtained in this study are likely the result of an interaction of the global economic environment with evolving environmental and political attitudes. Ultimately the results were unexpected but can be utilized in order to inform how REDD+ policy can be affected by contextual country variables and how this policy can evolve to see higher rates of success. The observed positive correlation between political corruption and likeliness of REDD+ implementation, for example, suggests that the funding mechanism for REDD+ should be reviewed and additional accountability measures should be set in place in order to reduce the potential for REDD+ funding to be exploited. Additionally, based on the negative relationship between trade openness and REDD+ implementation, the mechanism of payment should be re-evaluated and restructured in order to accurately account for the opportunity cost of protecting forest as opposed to harvesting the raw materials for resource use and foreign exchange. To protect against human rights violations, REDD+ should be structured as a decentralized program, with indigenous and rural stakeholders playing a key role in the formulation, implementation, and maintenance of REDD+ strategies, rather than utilizing the top-down approach currently in place for REDD+. Further studies dedicated to understanding the correlation between environmental attitudes and environmental policy should be conducted in order to supplement the results of this study and contribute to greater understanding of the relationship between environmental policy and contextual country variables. Moreover, it would serve as a point of interest to conduct further studies on how these country contextual variables are related to REDD+ program success.

References

Adams, W. M., Aveling, R., Brockington, D., Dickson, B., Elliott, J., Hutton, J., … Wolmer, W. (2004). *Biodiversity Conservation and the Eradication of Poverty*. New York, New York: Pearson. Retrieved from http://science.sciencemag.org/

Aguilar-Støen, M. (2017). Better Safe than Sorry? Indigenous Peoples, Carbon Cowboys and the Governance of REDD in the Amazon. *Forum for Development Studies*, *44*(1), 91–108. https://doi.org/10.1080/08039410.2016.1276098

Alchian, A. A., & Demsetz, H. (1973). Economic History Association: The Property Right Paradigm. *The Journal of Economic History, 33*(3), 107-122. Retrieved from https://www-jstororg.proxy.library.emory.edu/stable/pdf/2117138.pdf?refreqid=excelsior%3Ac0512f2cf3f15fc7a2cc9963996f315f

Andam, K. S., Ferraro, P. J., Pfaff, A., Arturo Sanchez-Azofeifa, G., & Robalino, J. A. (2008). *Measuring the effectiveness of protected area networks in reducing deforestation*. Retrieved from www.pnas.orgcgidoi10.1073pnas.0800437105

Arima, E. Y., Barreto, P., Araújo, E., & Soares-Filho, B. (2014). Public policies can reduce tropical deforestation: Lessons and challenges from Brazil. *Land Use Policy*, *41*, 465–473. https://doi.org/10.1016/j.landusepol.2014.06.026

Asner, G. P., Clark, J. K., Mascaro, J., Galindo García, G. A., Chadwick, K. D., Navarrete Encinales, D. A., … Ordóñez, O. (2012). High-resolution mapping of forest carbon stocks in the Colombian Amazon. *Biogeosciences*, *9*, 2683–2696. https://doi.org/10.5194/bg-9-2683-2012

Baccini, A., Goetz, S. J., Walker, W. S., Laporte, N. T., Sun, M., Sulla-Menashe, D., … Houghton, R. A. (2012). Estimated carbon dioxide emissions from tropical deforestation improved by carbon-density maps. *Nature and Climate Change*, *2*, 181–185. https://doi.org/10.1038/NCLIMATE1354

Baloch, S., Zamin, S., Zaleha, M., Noor, H., & Bakhsh Magsi, A. (2018). The nexus between income inequality, economic growth and environmental degradation in Pakistan. *GeoJournal*, *83*. https://doi.org/10.1007/s10708-016-9766-3

Bee, B. A., & Sijapati-Basnett, B. (2017). Engendering social and environmental safeguards in REDD+: lessons from feminist and development research. *Third World Quarterly*, *38*(4), 787–804. https://doi.org/10.1080/01436597.2016.1191342

Bell, A. R., Caviglia-Harris, J. L., & Cak, A. D. (2015). Characterizing land-use change over space and time: applying principal components analysis in the Brazilian Legal Amazon. *Journal of Land Use Science*, *10*(1), 19–37. https://doi.org/10.1080/1747423X.2013.832427

BenYishay, A., Heuser, S., Runfola, D., & Trichler, R. (2017). Indigenous land rights and deforestation: Evidence from the Brazilian Amazon. *Journal of Environmental Economics and Management*, *86*, 29–47. https://doi.org/10.1016/j.jeem.2017.07.008

Bhattarai, M., & Hammig, M. (2001). Institutions and the Environmental Kuznets Curve for Deforestation: A Crosscountry Analysis for Latin America, Africa and Asia. *World Development*, *29*(6), 995–1010. Retrieved from www.elsevier.com/locate/worlddev

Blackman, A., & Veit, P. (2018). Titled Amazon Indigenous Communities Cut Forest Carbon Emissions. *Ecological Economics*, *153*, 56–67.

https://doi.org/10.1016/j.ecolecon.2018.06.016

Börner, J., Wunder, S., Wertz-Kanounnikoff, S., Hyman, G., & Nascimento, N. (2014). Forest law enforcement in the Brazilian Amazon: Costs and income effects. *Global Environmental Change*, *29*, 294–305. https://doi.org/10.1016/j.gloenvcha.2014.04.021

Börner, J., Wunder, S., Wertz-Kanounnikoff, S., Rügnitz Tito, M., Pereira, L., & Nascimento, N. (2009). Direct conservation payments in the Brazilian Amazon: Scope and equity implications. *Ecological Economics*, *69*, 1272–1282. https://doi.org/10.1016/j.ecolecon.2009.11.003

Boyd, W., Stickler, C., Duchelle, A. E., Seymour, F., Nepstad, D., Bahar, N. H. A., & Rodriguez-Ward, D. (2018). *JURISDICTIONAL APPROACHES TO REDD+ AND LOW EMISSIONS DEVELOPMENT: PROGRESS AND PROSPECTS ENDING TROPICAL DEFORESTATION: A STOCK-TAKE OF PROGRESS AND CHALLENGES*. Retrieved from http://wriorg.s3.amazonaws.com/s3fs-public/ending-tropical-deforestation-jurisdictional-approaches-redd.pdf

Buitenzorgy, M., & Mol, A. P. J. (2011). Does Democracy Lead to a Better Environment? Deforestation and the Democratic Transition Peak. *Environmental and Resource Economics*, *48*(1), 59–70. https://doi.org/10.1007/s10640-010-9397-y

Buizer, M., Humphreys, D., & De Jong, W. (2014). Climate change and deforestation: The evolution of an intersecting policy domain. *Environmental Science & Policy*, *35*, 1–11. https://doi.org/10.1016/j.envsci.2013.06.001

Butler, R. A., Koh, L. P., & Ghazoul, J. (2009). REDD in the red: palm oil could undermine carbon payment schemes. *Conservation Letters*, *2*(2), 67–73. https://doi.org/10.1111/j.1755-263X.2009.00047.x

Cabral, A. I. R., Saito, C., Pereira, H., & Laques, A. E. (2018). Deforestation pattern dynamics in protected areas of the Brazilian Legal Amazon using remote sensing data. *Applied Geography*, *10*(1), 101–115. https://doi.org/10.1016/j.apgeog.2018.10.003

Cabrera, E., Vargas, D. M., Galindo, G., García, M. C., Ordóñez, M. F., Vergara, L. K., … Giraldo, P. (2011). *Memoria técnica de la cuantificación de la deforestación histórica nacional - Escalas gruesa y fina*. *Memoria técnica de la cuantifi cación de la deforestación histórica nacional – escalas gruesa y fina*.

Caplow, S., Jagger, P., Lawlor, K., & Sills, E. (2010). Evaluating land use and livelihood impacts of early forest carbon projects: Lessons for learning about REDD+. *Environmental Science and Policy*, *14*, 152–167. https://doi.org/10.1016/j.envsci.2010.10.003

Carrasco, L. R., Webb, E. L., Symes, W. S., Koh, L. P., & Sodhi, N. S. (2017). Global economic trade-offs between wild nature and tropical agriculture. *PLoS Biology*, *15*(7), 1–23. https://doi.org/10.1371/journal.pbio.2001657

Chang, C. P., & Hao, Y. (2017). Environmental performance, corruption and economic growth: global evidence using a new data set. *Applied Economics*, *49*(5), 498–514. https://doi.org/10.1080/00036846.2016.1200186

Chhatre, A., & Agrawal, A. (2009). *Trade-offs and synergies between carbon storage and livelihood benefits from forest commons*. Retrieved from www.pnas.org/cgi/content/full/

Chen, B. xia, & Qiu, Z. mian. (2017). Community attitudes toward ecotourism development and environmental conservation in nature reserve: a case of Fujian Wuyishan National Nature Reserve, China. *Journal of Mountain Science*, *14*(7), 1405–1418. https://doi.org/10.1007/s11629-016-3983-6

Chomba, S., Kariuki, J., Lund, J. F., & Sinclair, F. (2016). Roots of inequity: How the implementation of REDD+ reinforces past injustices-NC-ND license (http://creativecommons.org/licenses/by-nc-nd/4.0/). *Land Use Policy*, *50*, 202–213. https://doi.org/10.1016/j.landusepol.2015.09.021

Clements, T. (2010). Reduced Expectations: the political and institutional challenges of REDD+. *Oryx*, *44*(03), 309–310. https://doi.org/10.1017/s0030605310000712

Combes-Motel, P., Pirard ⁎, R., & Combes, J.-L. (2008). A methodology to estimate impacts of domestic policies on deforestation: Compensated Successful Efforts for "avoided deforestation" (REDD). *Ecological Economics*, *68*, 680–691. https://doi.org/10.1016/j.ecolecon.2008.06.001

Cropper, M., & Griffiths, C. (1994). American Economic Association: The Interaction of Population Growth and Environmental Quality. *Source: The American Economic Review*, *84*(2), 250–254. Retrieved from https://www.jstor.org/stable/pdf/2117838.pdf?refreqid=excelsior%3A09af2b07b5a30106c472e273c24d39c0

Culas, R. J. (2006). Debt and Deforestation: A Review of Causes and Empirical Evidence. *Journal of Developing Societies*, *22*(4), 347–358. https://doi.org/10.1177/0169796X06071524

Dasgupta, S., Hamilton, K., Kiran Pandey, U. D., & Wheeler, D. (2006). Environment During

Growth: Accounting for Governance and Vulnerability. https://doi.org/10.1016/j.worlddev.2005.12.008

Destek, M. A., & Sarkodie, S. A. (2018). Investigation of environmental Kuznets curve for ecological footprint: The role of energy and financial development. *Science of the Total Environment*, *650*, 2483–2489. https://doi.org/10.1016/j.scitotenv.2018.10.017

Du, G., Liu, S., Lei, N., & Huang, Y. (2018). A test of environmental Kuznets curve for haze pollution in China: Evidence from the penal data of 27 capital cities. *Journal of Cleaner Production*, *205*, 821–827. https://doi.org/10.1016/j.jclepro.2018.08.330

Duchelle, A. E., Simonet, G., Sunderlin, W. D., Wunder, S., Agrawal, A., Liao, C., … Hajjar, R. (2018). What is REDD+ achieving on the ground? *Current Opinion in Environmental Sustainability*, *32*, 134–140. https://doi.org/10.1016/j.cosust.2018.07.001

Edenhofer, O., Sokona, Y., Minx, J. C., Farahani, E., Kadner, S., Seyboth, K., … Zwickel Senior Scientist, T. (2014). *Climate Change 2014:Mitigation of Climate Change. Working Group III Contribution to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change Edited by*. Retrieved from www.cambridge.org

Enrici, A. M., & Hubacek, K. (2018). Challenges for REDD+ in Indonesia: A case study of three project sites. *Ecology and Society*, *23*(2). https://doi.org/10.5751/ES-09805-230207

Everitt, B., & Hothorn, T. (2011). *An introduction to applied multiviate analysis with R*. *Use R!* https://doi.org/10.1007/978-0-387-78171-6

Faith, D. P. (2010). The role of trade-offs in biodiversity conservation planning: linking local management, regional planning and global conservation efforts. *Journal of Biosciences*, *27*(4 (suppl. 2)), 393–407.

Farzin, Y. H., & Bond, C. A. (2006). Democracy and environmental quality. *Journal of Development Economics, 81*(1), 213-235. https://doi.org/10.1016/j.jdeveco.2005.04.003

Ferreira, S. (2012). Deforestation, Property Rights, and International Trade. *Land Economics, 80* (2), 174-193. https://doi.org/10.1111/j.1475-3588.2012.00663.x

Ficko, A., & Benčina, A. (2018). Public attitudes toward environmental protection: The Environmental Concern Kuznets Curve theory. *Journal of Environmental Management, 231* (2), 968-981. https://doi.org/10.1016/j.jenvman.2018.10.087

Finley-Brook, M., & Thomas, C. (2011). Renewable energy and human rights violations: Illustrative cases from indigenous territories in panama. *Annals of the Association of American Geographers*, *101*(4), 863–872. https://doi.org/10.1080/00045608.2011.568873

Fishbein, G., & Lee, D. (2015). *Early Lessons from Jurisdictional REDD+ and Low Emissions Development Programs*. Retrieved from https://www.forestcarbonpartnership.org/sites/fcp/files/2015/January/REDD%2B_LED_web_high_res.pdf

Fletcher, R., & Büscher, B. (2017). The PES Conceit: Revisiting the Relationship between Payments for Environmental Services and Neoliberal Conservation. *Ecological Economics*, *132*, 224–231. https://doi.org/10.1016/j.ecolecon.2016.11.002

Frontiers, U. S., Alston, L. J., Harris, E., & Mueller, B. (2009). *De Facto and De Jure Property Rights: Land Settlement and Land Conflict on the Australian*. Retrieved from https://www.nber.org/papers/w15264.pdf

Green, W.H., 2000. Econometric analysis. Prentice Hall International, Hempstead, UK.

Godoy, L. F. (2014). Complexities in REDD + Safeguard Development and Implementation. *New Zealand Journal of Environmental Law*, 135–166.

Guadalupe, V., Doff Sotta, E., Ferreira Santos, V., José Gonçalves Aguiar, L., Vieira, M., Pereira de Oliveira, C., … Juscelino Kubitschek, R. (2018). REDD+ implementation in a high forest low deforestation area: Constraints on monitoring forest carbon emissions. *Land Use Policy*, *76*, 414–421. https://doi.org/10.1016/j.landusepol.2018.02.015

Gullison, R. E., & Losos, E. C. (1993). *The Role of Foreign Debt in Deforestation in Latin America*. *Conservation Biology, 7* (1), 140-147. Retrieved from https://www-jstor-org.proxy.library.emory.edu/stable/pdf/2386650.pdf?refreqid=excelsior%3A68a01eed2eda420a1970d12b5a9174e3

Güney, T. (2017). Governance and sustainable development: How effective is governance? *The Journal of International Trade & Economic Development*, *26*(3), 316–335. https://doi.org/10.1080/08039410.2016.1276098

Gupta, A., Lö Vbrand, E., Turnhout, E., Vijge, M. J., Visseren-Hamakers, I. J., Herold, M., & Peñ A-Claros, M. (2012). In pursuit of carbon accountability: the politics of REDD+ measuring, reporting and verification systems. *Current Opinion in Environmental Sustainability*, *4*, 726–731. https://doi.org/10.1016/j.cosust.2012.10.004

Gupta, A., Pistorius, T., & Vijge, M. J. (2016). Managing fragmentation in global environmental governance: the REDD+ Partnership as bridge organization. *International Environmental*

Agreements: Politics, Law and Economics, *16*(3), 355–374. https://doi.org/10.1007/s10784-015-9274-9

Holloway, V., & Glanomenico, E. (2009). *The History of REDD Policy*. Retrieved from https://redd.unfccc.int/uploads/2_164_redd_20091216_carbon_planet_the_history_of_redd_carbon_planet.pdf

Irawan, S., Tacconi, L., & Ring, I. (2013). Stakeholders' incentives for land-use change and REDD +: The case of Indonesia. *Ecological Economics*, *87*, 75–83. https://doi.org/10.1016/J.ECOLECON.2012.12.018

Kakembo, V. (2001). Trends in vegetation degradation in relation to land tenure, rainfall, and population changes in Peddle district, Eastern Cape, South Africa. *Environmental Management*, *28*(1), 39–46. https://doi.org/10.1007/s002672001

Kalburan, C., & Hasiloglu, S. B. (2018). The Importance of Environmental Attitudes Towards Products for Sustainability and Business Strategies. *Present Environment and Sustainable Development*, *12*(2), 233–245. https://doi.org/10.2478/pesd-2018-0043

Karsenty, A., & Ongolo, S. (2012). Can "fragile states" decide to reduce their deforestation? The inappropriate use of the theory of incentives with respect to the REDD mechanism. *Forest Policy and Economics*, *18*, 38–45. https://doi.org/10.1016/j.forpol.2011.05.006

Key decisions relevant for reducing emissions from deforestation and forest degradation in developing countries (REDD+). (2016). Retrieved from https://unfccc.int/files/land_use_and_climate_change/redd/application/pdf/compilation_redd_decision_booklet_v1.2.pdf

Kissinger, G., Herold, M., & De Sy, V. (2012). *A Synthesis Report for REDD+ Policymakers Drivers of Deforestation anD forest DegraDation Drivers of Deforestation and Forest Degradation: A Synthesis Report for REDD+ Policymakers [1]*. Retrieved from https://www.forestcarbonpartnership.org/sites/fcp/files/DriversOfDeforestation.pdf_N_S.pdf

Kisswani, K. M., Harraf, A., & Kisswani, A. M. (2019). Revisiting the environmental kuznets curve hypothesis: evidence from the ASEAN-5 countries with structural breaks. https://doi.org/10.1080/00036846.2018.1529399

Klümper, F., Theesfeld, I., & Herzfeld, T. (2018). Discrepancies between paper and practice in policy implementation: Tajikistan's property rights and customary claims to land and water. *Land Use Policy*, *75*, 327–339. https://doi.org/10.1016/j.landusepol.2018.03.030

Kuznets, S. (1955). Economic Growth and Income Inequality. *The American Economic Review, 45*(1), 1-28. Retrieved from https://about.jstor.org/terms

Lansing, D. M. (2017). Understanding Smallholder Participation in Payments for Ecosystem Services: the Case of Costa Rica. *Human Ecology*, *45*(1), 77–87. https://doi.org/10.1007/s10745-016-9886-x

Lavelle, P., Dolédec, S., Arnauld De Sartre, X., Decaëns, T., Gond, V., Grimaldi, M., … Velasquez, J. (2016). Unsustainable landscapes of deforested Amazonia: An analysis of the relationships among landscapes and the social, economic and environmental profiles of farms at different ages following deforestation. *Global Environmental Change*, *40*, 137–155. https://doi.org/10.1016/j.gloenvcha.2016.04.009

LeBlois, A., Damette, O., & Wolfersberger, J. (2017). What has Driven Deforestation in

Developing Countries Since the 2000s? Evidence from New Remote-Sensing Data. *World Development*, *92*, 82–102. https://doi.org/10.1016/j.worlddev.2016.11.012

Lund, J. F., Sungusia, E., Mabele, M. B., & Scheba, A. (2017). Promising Change, Delivering Continuity: REDD+ as Conservation Fad. *World Development*, *89*, 124–139. https://doi.org/10.1016/j.worlddev.2016.08.005

Maginnis, S., & Espinosa, C. (2009). *REDD-plus and Benefit sharing Experiences in forest conservation and other resource management sectors FOREST CONSERVATION PROGRAMME*. Retrieved from http://cmsdata.iucn.org/downloads/

Martin, A., Gross-Camp, N., Kebede, B., & McGuire, S. (2014). Measuring effectiveness, efficiency and equity in an experimental Payments for Ecosystem Services trial. *Global Environmental Change*, *28*(1), 216–226. https://doi.org/10.1016/j.gloenvcha.2014.07.003

Martínez, H. de A. (2017). Deforestation in the Kayabi Indigenous TErritory: Simulating and Predicting Land Use and Land Cover Change in the Brazilian Amazon. *Revista Cartográfica*, *94*, 149–163.

McShane, T. O., Hirsch, P. D., Trung, T. C., Songorwa, A. N., Kinzig, A., Monteferri, B., … O’connor, S. (2011). Hard choices: Making trade-offs between biodiversity conservation and human well-being. *BIOLOGICAL CONSERVATION*, *144*, 966–972. https://doi.org/10.1016/j.biocon.2010.04.038

Mummolo, J., & Peterson, E. (2017). *Improving the Interpretation of Fixed Effects Regression Results*. Retrieved from https://scholar.princeton.edu/sites/default/files/jmummolo/files/fe_paper_psrm_rr2.pdf

Nelson, A., & Chomitz, K. M. (2011). Effectiveness of Strict vs. Multiple Use Protected Areas in Reducing Tropical Forest Fires: A Global Analysis Using Matching Methods. *PLoS ONE*, *6*(8), 22722. https://doi.org/10.1371/journal.pone.0022722

Nelson, E., Mendoza, G., Regetz, J., Polasky, S., Tallis, H., Cameron, D. R., … Shaw, M. R. (2009). Modeling multiple ecosystem services, biodiversity conservation, commodity production, and tradeoffs at landscape scales. *Frontiers in Ecology and the Environment*, *7*(1), 4–11. https://doi.org/10.1890/080023

Nolte, C., Agrawal, A., Silvius, K. M., & Soares-Filho, B. S. (2013). Governance regime and location influence avoided deforestation success of protected areas in the Brazilian Amazon. https://doi.org/10.1073/pnas.1214786110

Nzunda, E. F., & Midtgaard, F. (2017). Spatial relationship between deforestation and protected areas, accessibility, population density, GDP and other factors in mainland Tanzania. *Forest, Trees and Livelihoods*, *26*(4), 245–255. https://doi.org/10.1080/14728028.2017.1322921

Obydenkova, A., Nazarov, Z., & Salahodjaev, R. (2016). The process of deforestation in weak democracies and the role of Intelligence. *Environmental Research*, *14*(8), 484–490. https://doi.org/10.1016/j.envres.2016.03.039

Panfil, S. N., & Harvey, C. A. (2016). REDD+ and Biodiversity Conservation: A Review of the Biodiversity Goals, Monitoring Methods, and Impacts of 80 REDD+ Projects. *Conservation Letters*, *9*(2), 143–150. https://doi.org/10.1111/conl.12188

Panlasigui, S., Rico-Straffon, J., Pfaff, A., Swenson, J., & Loucks, C. (2018). Impacts of certification, uncertified concessions, and protected areas on forest loss in Cameroon, 2000 to 2013. *BIOLOGICAL CONSERVATION*, *22*(7), 160–166. https://doi.org/10.1016/j.biocon.2018.09.013

Pattanayak, S. K., Wunder, S., & Ferraro, P. J. (2010). Show Me the Money: Do Payments Supply Environmental Services in Developing Countries? Why Do We Need Another PES Review? *Review of Environmental Economics and Policy*, *4*(2), 254–274. https://doi.org/10.1093/reep/req006

Pettenella, D., & Brotto, L. (2012). Governance features for successful REDD+ projects organization. *Forest Policy and Economics*, *18*, 46–52. https://doi.org/10.1016/j.forpol.2011.09.006

Pfaff, A., Robalino Catie, J., Rica, C., Sandoval Catie, C., & Diego Herrera, L. (2014). Governance, Location and Avoided Deforestation from Protected Areas: Greater Restrictions Can Have Lower Impact, Due to Differences in Location. https://doi.org/10.1016/j.worlddev.2013.01.011

Phelps, J., Friess, D. A., & Webb, E. L. (2011). Win–win REDD+ approaches belie carbon–biodiversity trade-offs. *BIOLOGICAL CONSERVATION*. https://doi.org/10.1016/j.biocon.2011.12.031

Pietras, J. (2012). An (Indigenous) Rights-Based Approach to Deforestation in Papua New Guinea. *Waikato Law Review*, *22*, 137–164.

Pistorius, T. (2012). From RED to REDD+: the evolution of a forest-based mitigation approach for developing countries. *Current Opinion in Environmental Sustainability*, *4*, 638–645. https://doi.org/10.1016/j.cosust.2012.07.002

Poore, D. (1975). Conservation and Development. *Environmental Conservation*, *2*(4), 243–246. https://doi.org/10.1017/S0376892900001685

Ribot, J. C., & Larson, A. M. (2006). Recentralizing While Decentralizing: How National Governments Reappropriate Forest Resources. *World Development, 34* (11), 1864-1866. https://doi.org/10.1016/j.worlddev.2005.11.020

Rich, B. (2013). REDD+, Markets, and Corruption. *The Development World, 18*(3), 1-14.

Richards, P. (2015). What Drives Indirect Land Use Change? How Brazil's Agriculture Sector Influences Frontier Deforestation. *Annals of the Association of American Geographers*, *105*(5), 1026–1040. https://doi.org/10.1080/00045608.2015.1060924

Robinson, B. E., Holland, M. B., & Naughton-Treves, L. (2014). Does secure land tenure save forests? A meta-analysis of the relationship between land tenure and tropical deforestation. *Global Environmental Change*, *29*, 281–293. https://doi.org/10.1016/j.gloenvcha.2013.05.012

Rodrigue *, J., & Soumonni, O. (2014). Deforestation, foreign demand and export dynamics in Indonesia. *Journal of International Economics*, *93*, 316–338. https://doi.org/10.1016/j.jinteco.2014.03.004

Rodrigues-Faria, W., & Nunes-Almeida, A. (2016). Relationship between openness to trade and deforestation: Empirical evidence from the Brazilian Amazon. *Ecological Economics*, *121*, 85–97. https://doi.org/10.1016/j.ecolecon.2015.11.014

Rudel, T. K., Coomes, O. T., Moran, E., Achard, F., Angelsen, A., Xu, J., & Lambin, E. (2005). Forest transitions: Towards a global understanding of land use change. *Global*

Environmental Change, *15*(1), 23–31. https://doi.org/10.1016/j.gloenvcha.2004.11.001

Saeed, A.-R., Mcdermott, C., & Boyd, E. (2018). Examining equity in Ghana's national REDD+ process. *Forest Policy and Economics*, *90*, 48–58. https://doi.org/10.1016/j.forpol.2018.01.006

Salvati, L., & Zitti, M. (2009). The Environmental "'Risky'" Region: Identifying Land Degradation Processes Through Integration of Socio-Economic and Ecological Indicators in a Multivariate Regionalization Model. *Environmental Management*, *44*, 888–898. https://doi.org/10.1007/s00267-009-9378-5

Sandker, M., Bruce, A. E., Campbell, M., Zacharie, A. E., Ae, N., Sunderland, T., … Sayer, J. (2009). Exploring the effectiveness of integrated conservation and development interventions in a Central African forest landscape. *Biodivers Conserv*, *18*, 2875–2892. https://doi.org/10.1007/s10531-009-9613-7

Sathler, D., Adamo, S. B., & Lima, E. E. C. (2018). Deforestation and local sustainable development in Brazilian Legal Amazonia: An exploratory analysis. *Ecology and Society*, *23*(2). https://doi.org/10.5751/ES-10062-230230

Scanlan, S. J. (2001). Food Availability and Access in Lesser-Industrialized Societies: A Test and Interpretation of Neo-Malthusian and Technoecological Theories. *Sociological Forum*, *16*(2), 231–262. Retrieved from https://www.jstor.org/stable/pdf/685064.pdf?casa_token=Al6K8ztBOD0AAAAA:wkAaKNHIuiHTKYyRPep29yjPWLtBo_QEuQ5e77vAIJ6FEDbaNdqv1MZyoNPgGSAbt44FSgl2h6H-ZHBpxThw9xSuWom--IN_8XIbKJOcv6FtHNpiBwk

Schroeder, H. (2010). Agency in international climate negotiations: The case of indigenous peoples and avoided deforestation. *International Environmental Agreements: Politics, Law and Economics*, *10*(4), 317–332. https://doi.org/10.1007/s10784-010-9138-2

Sekrafi, H., & Sghaier, A. (2018). Examining the Relationship Between Corruption, Economic Growth, Environmental Degradation, and Energy Consumption: a Panel Analysis in MENA Region. *Journal of Knowledge Economy*, *9*(963–979). https://doi.org/10.1007/s13132-016-0384-6

Shandra, J. M. (2007). The World Polity and Deforestation A Quantitative, Cross-National Analysis. *International Journal of Comparative Sociology Www.Sagepublications.Com London, Thousand Oaks and New Delhi*, *48*(1), 5–27. https://doi.org/10.1177/0020715207072157

Shandra, J. M., Esparza, L. E., & London, B. (2011). Nongovernmental Organizations, Democracy, and Deforestation: A Cross-National Analysis. *Society & Natural Resources*, *25*, 251–269. https://doi.org/10.1080/08941920.2011.573841

Sheng, J., Han, X., Zhou, H., & Miao, Z. (2016). Effects of corruption on performance: Evidence from the UN-REDD Programme. *Land Use Policy*, *59*, 344–350. https://doi.org/10.1016/j.landusepol.2016.09.014

Simmons, C. S. (2002). The Local Articulation of Policy Conflict: Land Use, Environment, and Amerindian Rights in Eastern Amazonia. *The Professional Geographer*, *54*(2), 241–258. https://doi.org/10.1111/0033-0124.00343

Soares-Filho, B., Moutinho, P., Nepstad, D., Anderson, A., Rodrigues, H., Garcia, R., … Maretti, C. (2010). Role of Brazilian Amazon protected areas in climate change mitigation. *PNAS*, *107*(24), 10821–10826. https://doi.org/10.1073/pnas.0913048107

Sobhee, S. K. (2004). Economic development, income inequality and environmental degradation of fisheries resources in Mauritius. *Environmental Management*, *34*(1), 150–157. https://doi.org/10.1007/s00267-004-0133-7

Stevens, S. (2016). A New Protected Area Paradigm. In *Indigenous Peoples, National Parks, and Protected Areas : A New Paradigm Linking Conservation, Culture, and Rights.* (2nd ed., pp. 47–83). Tucson: University of Arizona Press.

Sunderlin, W. D., de Sassi, C., Ekaputri, A. D., Light, M., & Pratama, C. D. (2017). REDD+ contribution towell-being and income is marginal: The perspective of local stakeholders. *Forests*, *8*(4), 100–125. https://doi.org/10.3390/f8040125

Teorell, Jan, Stefan Dahlberg, Sören Holmberg, Bo Rothstein, Natalia Alvarado Pachon & Richard Svensson. (2019). The Quality of Government Standard Dataset, version Jan19. University of Gothenburg: The Quality of Government Institute, http://www.qog.pol.gu.se doi:10.18157/qogstdjan19

Tipps, D. C. (1973). Modernization Theory and the Comparative Study of Societies: A Critical Perspective. *Comparative Studies in Society and History*, *15*(2), 199–226. Retrieved from https://www.jstor.org/stable/pdf/178351.pdf?casa_token=Zc5CmRT1yzUAAAAA:urCyjx1t l01MR0q13LRPcT6fMHoeK6S2ylwrQIYbSFLe1aKi0Lup7-CdVn3wyaJBAaZI7jCh1OmWCtTGgezSHz_l0GCwgZk3KYESDdNqirrIsUjAqoE

Todaro, M.P., & Smith, S. C. (2015). *Economic Development*. Washington D.C.: Pearson.

Torras, M., & Boyce, J. K. (1998). *Income, inequality, and pollution: a reassessment of the* *environmental Kuznets Curve*. *Ecological Economics* (Vol. 25). Retrieved from https://ac-els-cdn-com.proxy.library.emory.edu/S0921800997001778/1-s2.0-S0921800997001778-main.pdf?_tid=cc3c4945-6814-43a5-8f00-458ecb5b84de&acdnat=1550964344_8442bcca1a252b51d47d673013177590

Tsurumi, T., & Managi, S. (2014). The effect of trade openness on deforestation: empirical analysis for 142 countries. *Environmental Economics and Policy Studies*, *16*(4), 305–324. https://doi.org/10.1007/s10018-012-0051-5

Umunay, P., Lujan, B., Meyer, C., & Cobián, J. (2018). Trifecta of Success for Reducing Commodity-Driven Deforestation: Assessing the Intersection of REDD+ Programs, Jurisdictional Approaches, and Private Sector Commitments. *Forests*, *9*(10), 609. https://doi.org/10.3390/f9100609

United Nations. (2011). *Report of the Conference of the Parties on its sixteenth session*. Cancun.

Van Der Hoek, Y. (2017). The potential of protected areas to halt deforestation in Ecuador. *Environmental Conservation*, *44*(2). https://doi.org/10.1017/S037689291700011X

Van Khuc, Q., Tran, B. Q., Meyfroidt, P., & Paschke, M. W. (2018). Drivers of deforestation and forest degradation in Vietnam: An exploratory analysis at the national level. *Forest Policy and Economics*, *90*, 128–141. https://doi.org/10.1016/j.forpol.2018.02.004

Vergara-Asenjo, G., Mateo-Vega, J., Alvarado, A., & Potvin, C. (2017). A participatory approach to elucidate the consequences of land invasions on REDD+ initiatives: A case study with Indigenous communities in Panama. *PLoS ONE*, *12*(12), 1–20. https://doi.org/10.1371/journal.pone.0189463

Visseren-Hamakers, I. J., Gupta, A., Herold, M., Peñ A-Claros, M., & Vijge, M. J. (2012). Will REDD+ work? The need for interdisciplinary research to address key challenges This review comes from a themed issue on Climate systems. *Current Opinion in Environmental Sustainability*, *4*, 590–596. https://doi.org/10.1016/j.cosust.2012.10.006

Weatherley-Singh, J., & Gupta, A. (2015). Drivers of deforestation and REDD+ benefit-sharing: A meta-analysis of the (missing) link. *Environmental Science & Policy*, *54*, 97–105. https://doi.org/10.1016/j.envsci.2015.06.017

Willem Den Besten, J., Arts, B., & Verkooijen, P. (2014). The evolution of REDD+: An analysis of discursive-institutional dynamics. *Environmental Science & Policy*, *35*, 40–48. https://doi.org/10.1016/j.envsci.2013.03.009

Wooldridge, J. M. (2013). *Introductory Econometrics: A Modern Approach* (5th ed., pp. 584-603). Mason, OH: South-Western.

Appendix A

Table 4 - Asian Countries

	Likeliness of Implementation					
	REDD					
	(1)	(2)	(3)	(4)	(5)	(6)
Forest land (% of land area)	0.021***	0.029***	0.025***	0.024***	0.033***	0.034***
	(0.007)	(0.008)	(0.007)	(0.007)	(0.009)	(0.009)
Terrestrial protected areas (national biome weights)	0.026***	0.028***	0.021***	0.021***	0.032***	0.035***
	(0.008)	(0.009)	(0.008)	(0.008)	(0.010)	(0.011)
GDP per capita, PPP (current international dollar)	-0.594**	9.416***			11.322***	11.103***
	(0.238)	(2.627)			(3.345)	(3.433)
GDP per capita, PPP (current international dollar) squared		-0.566***			-0.674***	-0.660***
		(0.150)			(0.193)	(0.198)
Agriculture, forestry, and fishing, value added (% of GDP)	-0.015	0.009			0.015	0.021
	(0.021)	(0.023)			(0.026)	(0.027)
Trade freedom	-0.058***	-0.052***			-0.066***	-0.065***
	(0.017)	(0.017)			(0.023)	(0.025)
Level of democracy			0.410***	0.634**	0.292	0.336
			(0.100)	(0.261)	(0.339)	(0.370)
Level of democracy squared				-0.025	0.004	0.005
				(0.027)	(0.034)	(0.036)
Political corruption index			1.401	1.212	2.121*	2.527**
			(0.919)	(0.939)	(1.215)	(1.273)
Human rights and rule of law			0.732***	0.669***	0.439**	0.485**
			(0.160)	(0.174)	(0.203)	(0.216)
Property rights and security			0.012	0.015	0.043***	0.044***
			(0.012)	(0.012)	(0.015)	(0.016)
Population density (people per sq. km. of land area)						0.0004
						(0.001)
Population growth (annual %)						0.406
						(0.280)
Rural population growth (annual %)						-0.418*
						(0.223)
Asia dummy	0.280	0.171	-0.195	-0.168	0.001	-0.021
	(0.334)	(0.363)	(0.347)	(0.351)	(0.432)	(0.472)

Observations	141	141	141	141	141	141
Log Likelihood	-57.438	-48.927	-55.468	-55.042	-40.031	-38.161
Akaike Inf. Crit.	128.876	113.853	126.937	128.083	106.062	108.323
Note:						*p**p***p<0.01

Appendix B

Table 5 - African Countries

	Likeliness of Implementation					
	REDD					
	(1)	(2)	(3)	(4)	(5)	(6)
Forest land (% of land area)	0.020***	0.028***	0.026***	0.026***	0.033***	0.034***
	(0.007)	(0.008)	(0.007)	(0.007)	(0.009)	(0.010)
Terrestrial protected areas (national biome weights)	0.028***	0.028***	0.020***	0.021***	0.034***	0.036***
	(0.008)	(0.009)	(0.008)	(0.008)	(0.010)	(0.011)
GDP per capita, PPP (current international dollar)	-0.736***	8.950***			11.089***	10.725***
	(0.251)	(2.685)			(3.387)	(3.525)
GDP per capita, PPP (current international dollar) squared		-0.544***			-0.669***	-0.648***
		(0.152)			(0.195)	(0.202)
Agriculture, forestry, and fishing, value added (% of GDP)	-0.014	0.009			0.018	0.026
	(0.022)	(0.023)			(0.026)	(0.027)
Trade freedom	-0.071***	-0.059***			-0.074***	-0.076***
	(0.017)	(0.017)			(0.024)	(0.027)
Level of democracy			0.413***	0.596**	0.271	0.361
			(0.101)	(0.269)	(0.331)	(0.379)
Level of democracy squared				-0.020	0.005	0.002
				(0.028)	(0.033)	(0.037)
Political corruption index			1.408	1.267	1.816	2.163*
			(0.920)	(0.938)	(1.254)	(1.310)
Human rights and rule of law			0.683***	0.637***	0.458**	0.502**
			(0.158)	(0.170)	(0.207)	(0.223)
Property rights and security			0.010	0.013	0.047***	0.049***
			(0.012)	(0.012)	(0.016)	(0.017)
Population density (people per sq. km. of land area)						0.00005
						(0.001)
Population growth (annual %)						0.556*
						(0.301)
Rural population growth (annual %)						-0.471**
						(0.234)
Africa dummy	-0.770*	-0.411	0.440	0.403	-0.572	-0.848

	(0.412)	(0.415)	(0.309)	(0.315)	(0.514)	(0.607)
Observations	141	141	141	141	141	141
Log Likelihood	-55.928	-48.551	-54.601	-54.337	-39.409	-37.153
Akaike Inf. Crit.	125.857	113.101	125.202	126.675	104.819	106.305
Note:						*p**p***p<0.01

Appendix C

Table 6 - Latin America and the Caribbean

	Likeliness of Implementation					
	REDD					
	(1)	(2)	(3)	(4)	(5)	(6)
Forest land (% of land area)	0.017**	0.024***	0.020***	0.019***	0.027***	0.027***
	(0.007)	(0.009)	(0.007)	(0.007)	(0.010)	(0.010)
Terrestrial protected areas (national biome weights)	0.027***	0.026***	0.023***	0.024***	0.032***	0.035***
	(0.008)	(0.008)	(0.008)	(0.008)	(0.010)	(0.011)
GDP per capita, PPP (current international dollar)	-0.467*	7.883***			9.480***	9.389***
	(0.239)	(2.779)			(3.406)	(3.477)
GDP per capita, PPP (current international dollar) squared		-0.476***			-0.569***	-0.565***
		(0.159)			(0.196)	(0.201)
Agriculture, forestry, and fishing, value added (% of GDP)	0.0002	0.016			0.024	0.028
	(0.022)	(0.024)			(0.026)	(0.027)
Trade freedom	-0.071***	-0.062***			-0.072***	-0.070***
	(0.017)	(0.017)			(0.024)	(0.026)
Level of democracy			0.366***	0.626**	0.270	0.269
			(0.100)	(0.259)	(0.348)	(0.383)
Level of democracy squared				-0.030	-0.001	0.006
				(0.027)	(0.036)	(0.038)
Political corruption index			1.674*	1.445	2.054	2.463*
			(0.978)	(0.999)	(1.322)	(1.385)
Human rights and rule of law			0.743***	0.668***	0.458**	0.517**
			(0.159)	(0.173)	(0.207)	(0.224)
Property rights and security			0.022*	0.025*	0.054***	0.054***
			(0.013)	(0.013)	(0.017)	(0.018)
Population density (people per sq. km. of land area)						0.001
						(0.001)
Population growth (annual %)						0.393
						(0.305)
Rural population growth (annual %)						-0.403*
						(0.243)
Latin America and the Caribbean	1.507***	1.265***	1.249***	1.264***	1.537***	1.528***
	(0.393)	(0.436)	(0.456)	(0.456)	(0.526)	(0.541)

Observations	141	141	141	141	141	141
Log Likelihood	-49.312	-44.287	-51.189	-50.601	-35.184	-33.669
Akaike Inf. Crit.	112.624	104.574	118.379	119.202	96.368	99.337
Note:						*p**p***p<0.01