Environmentalism as Long-Term Good Provision: Evidence from Forest Conservation

Sam Houskeeper

Columbia University

Abstract:
This article develops a novel institutional theory of long-term environmental good provision, particularly forest conservation. Long-term goods, or those for which payoffs are delayed or spread over time, are more likely to be provided by states with long-term institutions, or those with low discount rates and inter-temporal commitment mechanisms. Leveraging recent institutional theories, I argue that party institutionalization lengthens institutional time horizons while constraints on the executive allows inter-temporal commitment. Both features therefore predict long-term environmental good provision. Environmental goods are frequently long term because feedback from ecological systems creates tipping points or vicious cycles, meaning that current actions may be costless today but contribute to significant damage in future periods. Understanding the implications of the inter-temporal nature of many environmental goods is especially important because a large share of environmental goods, such as forest conservation, are not explained by traditional approaches which focus on public goods models for symmetric and non-excludable goods. I test my theory with cross-national time-series data on forest coverage, demonstrating that forest protection is not predicted by public goods theory but is well predicted by long-term institutions.

1 Introduction

Forests cover about one third of the Earth's land surface (FAO, 2020), are critical carbon sinks for the mitigation of climate change, and provide irreplaceable habitats for a large share of the world's biodiversity. But global forest coverage is receding by roughly 0.1% per year (FAO, 2020). In general, slow reforestation in the developed world is outpaced by rapid deforestation in the developing world, but this simplification obscures vital heterogeneity that does not fit traditional theories of environmental politics, which

focus on democracy and state capacity. While India, a democracy, and China, a strongly centralized government, each make slow progress in reforestation of close to 0.4% and 0.9% per year respectively (FAO, 2020), neighboring Bhutan, a monarchy beset by Maoist insurgents until 2008, nearly doubled its forest coverage between 1992 and 2016 through effective community-forestry policy (Fox et al., 2019).

I argue that a critical but under-studied factor in successful forest conservation, and many other kinds of environmental protection, is the state's ability to provide long-term goods. Deforestation, like many forms of environmental degradation, can yield large benefits in the present with delayed costs borne by future generations. This inter-generational distributive problem makes conservation more difficult. But political systems vary in their ability to manage such a tradeoff. I argue that different institutions have different institutional time horizons, the length of which is the crucial variable for explaining the provision of forest conservation and other long-term goods. Despite broad scholarly recognition of the problem of inter-temporal tradeoffs in environmental politics, little theory exists on the definition of long-term goods or the properties of long-term institutions.

I argue that long-term environmental goods are those for which benefits are delayed after the costs of provision, as is common to the management of ecosystems. This delay undercuts goods provision due to temporal discounting and time inconsistency problems. Thus, I argue that institutions with two qualities will be better able to provide long-term environmental goods. Institutions that lower discount rates, such as through the institutionalization of political parties, will place higher value on future benefits relative to current costs. And institutions that facilitate inter-temporal commitment, such as by constraining executive power, will ameliorate the potential for time inconsistency.

I test these predictions with a cross-national analysis of yearly change in forest coverage from 1985-2016 using landcover classification of satellite image data. After adjusting for noise in the dependent variable with robust regression and controlling for Forest Transition Theory predictions, I find moderate support for my theory. Although the effect of party institutionalization is insignificantly estimated due to lack of statistical power, constraints on executive power strongly predicts forest conservation.

This first-cut attempt to explain environmental protection with the time horizons of political institutions sets the stage for broadening the environmental politics research program and connecting it with growing literatures in comparative politics on the institutionalization and consolidation of autocracies and democracies. Explanations for environmental protection can leverage significant variation in varying structures of environmental problems and in varying forms of political institutions.

2 Environmental Protection and Institutional Time Horizons

Scholars have long recognized the challenges posed by intertemporal tradeoffs in environmental politics, especially in regards to climate change (Hovi, Sprinz and Underdal, 2009). But little theory exists to identify which environmental problems are long-term, and what kind of government institutions lead to domestic provision of long-term goods (Hale, 2024). I propose a simple conceptualization of long-term goods and a novel institutional theory of long-term good provision. Before developing this theory in Sections 2.1 and 2.2, I briefly compare this approach to the prevailing literature, especially in regards to forest conservation.

Conventional explanations of variation in domestic environmental protection can be divided into two major approaches: State Capacity Theory and Collective Goods Theory. Each approach is useful under the right conditions, and none are mutually exclusive. Recent focus on a third approach, Distributive Politics Theory, has so far not provided state-level institutional predictions that are substantially different from Collective Action Theory.

Table 1: Theories of Environmental Goods Provision:

Theory	What explains state environmental protection?	What kind of environmental protection?
State Capacity	high capacity/low corruption	all
Collective Goods	democracy	symmetric/non-excludable
Long-Term Goods	long-term institutions	long-term

According to state capacity theory, all states may want to provide some level of environmental protection, but ability to do so varies. Poverty, corruption, and low state capacity each subtract from this ability. Thus, states that have higher capacity and lower corruption are expected to provide more environmental goods, such as forest conservation. This argument is theoretically robust and empirically supported (Povitkina, 2018), but cannot explain observed variation among states with similar capabilities or between environmental issues that should be equally difficult to manage.

Hypothesis 1: Corruption will decrease forest conservation.

According to the collective goods and distributive politics approaches, on the other hand, environmental protection abates externalities from publicly polluting but privately rewarding activity. Collective goods theory focuses on symmetric externalities for which abatement is non-excludable, meaning that environmental protection is achieved through broad cooperation against a diffuse free-rider problem. Distributive politics theory focuses on externalities that are asymmetric or that can be abated in an excludable way, meaning that environmental protection occurs through effective bargaining between upstream polluters and downstream victims, or between those victims able to abate and those not. Despite this difference, the two theories have much in common.

Theoretically, both tend to define a protected environment as broadly beneficial and accessible. While the distributive politics literature identifies variation in vulnerabilities and capabilities, downstream environmental effects tend to be treated as broader than the private benefits of upstream polluters. Thus, the bargaining solution to the problems posed by much of the distributive politics literature is collective action of the many victims against the few polluters. This theoretical alignment drives empirical alignment. Empirically, both theories predict that broadly inclusive democracies will protect the domestic environment more effectively than governments more responsive to concentrated interests (Stokes, 2020; Mildenberger, 2020). Democracies are more likely to provide goods whose benefits are symmetric and non-excludable, as democratic governments are relatively more dependent on broad-based support (Deacon, 2009).

But not all environmental goods are symmetric and/or excludable. Forest conservation is one example. Benefits from forests are not equally distributed throughout society, as forests may be private property, may be geographically concentrated, or may be more important to particular industries. Moreover, some forests can be protected while others are not. This asymmetry and excludability means that forest conservation should not be classified as a public or collective good, and will not be predicted by democracy. Indeed, recent studies have found a null or even negative relationship between democracy and forest conservation (Marquart-Pyatt, 2004; Ehrhardt-Martinez, Crenshaw and Jenkins, 2002), especially during competitive election years (Sanford, 2023).

Hypothesis 2: Democracy will not affect forest conservation.

Another way in which the benefits of forest conservation are asymmetric is temporal. If allowed to remain healthy, forests pay dividends over the long run through self-sustainment and self-replenishment. But overzealous exploitation of forests in the short term forestalls these future benefits in favor of immediate benefits. Thus, forest conservation politics can be partially described as a distributional conflict between the present and the future. I lay out the conceptual and theoretical framework for this Long-Term Goods Theory in Section 2 below, where I also specify hypotheses to test against Hypotheses 1 and 2. I test these in Section 3.

2.1 Long-Term Environmental Goods

Long-term goods have benefits that are substantially realized after the realization of the provision cost. This could take the form of a single but delayed benefit, or of a gradual benefit that is spaced across future time periods. This payoff structure is particularly common in the realm of environmental protection and management because of feedback effects and non-linearities in environmental systems. Human interaction with the environment's growth and decay processes does not always result in linear and additive effects, but rather can lead to complex and even unpredictable system effects (Jervis, 1997). Outcomes of human degradation of the environment can be delayed, such as when

toxicity from accumulated chemicals builds up before crossing some threshold of safety, or can be multiplicative, such as when one season's catch leaves a fish population flourishing but several season's catches cause cascading fishery collapse. In short, environmental degradation can be costless in the short-term but costly in the long-term. Categories of environmental issues that are commonly long-term are those dealing with maintaining a particular ecosystem balance, such as managing toxicity, conserving self-replenishing natural resources, or species protection.

But not all environmental goods are long-term goods. Some forms of environmental protection are immediately beneficial, while others may even be paid for by a delayed cost (such as the cost of forgoing a long-term but environmentally damaging infrastructure project). While the climatic benefits of reduced GHG emissions are delayed, the local health effects of smog concentrations are felt almost immediately. Heavy particulate smog common near unregulated industrial plants or automobiles dissipates soon after it is released, meaning that measures to curb smog have immediate effects. This distinction suggests one reason why the success of smog eradication in developed economies (see the Clean Air Act of 1970 for the US case) has not been emulated with GHG emission reductions.

I illustrate the categorization of short-term versus long-term alongside that of collective (non-excludable and symmetric) versus not in Table 2. Although all long-term goods are asymmetric across time periods, they may be non-excludable and/or symmetric within time periods, so I let these categories overlap. For example, widespread chemical toxicity of groundwater, as scientists currently fear may result from buildup of "forever" chemicals over time, may be both a long-term problem, in which the costs are not born by several generations of polluters, and a non-excludable and symmetric threat in the period when the costs are realized.

Smog abatement is a short-term good, but whether it is collective depends on how diffuse the smog problem is. While power plants, for instance, may be concentrated in a few smog-choked towns or neighborhoods, smog from automobiles may be so diffuse as to be a symmetric externality. Thus, while abating concentrated power plant smog may be

an excludable environmental good specific to particular plants or communities, abating automobile smog may be a non-excludable collective environmental good that affects an entire society. While democracies may be more likely to address diffuse automobile smog, democracies and autocracies may be equally likely to treat localized smog as a serious problem, depending on the particular alignments of smog incidence and coalitions of support.[1] But neither type of smog suffers from the dilemmas of long-term goods provision.

Finally, natural resource conservation is often not a collective good, as resources often have private ownership or otherwise narrow beneficiaries. But resource conservation tends to be a long-term good, as natural resources that self-replenish must be managed through moderation in order to maximize long-term extraction. Forest conservation falls in this category, as it is generally not a collective good, but almost always has benefits that are delayed long after the costs paid for conservation.

Table 2: Domestic Environmental Goods

	Not Collective	Collective
Long-Term	resource conservation	forever chemical abatement
Short-Term	power plant smog abatement	automobile smog abatement

While previous literature has demonstrated that democracy predicts the provision of those goods in the right two quadrants of Table 2, a theoretical framework for long-term goods provision explains the unexplained environmental goods in the upper left quadrant. It also provides additional leverage to describe variation within collective environmental goods by differentiating between the bottom right and top right quadrants.

[1] See Alkon and Wang (2018) on smog and political support in contemporary China, and the authoritarian government's short-term abatement interventions.

2.2 Long-Term Institutions

Political institutions will be more likely to provide long-term environmental goods if their designs ameliorate four problems enhanced by or particular to long-term goods. First, long-term goods may mean greater uncertainty due to delayed realization of costs or benefits. The implications of uncertainty have been well studied in environmental politics (Barrett and Dannenberg, 2012, 2014). Second, dilemmas in organizational or bureaucratic politics or in human psychology may be exacerbated by long time horizons. In short, long-term planning is difficult for individuals and institutions alike. These first two problems will receive less treatment here but are a promising area for ongoing research.

Unlike uncertainty or planning difficulties, the next two problems weaken long-term goods provision even for hypothetical rational and unitary actors. First, discounting the future undercuts payoffs from long-term investments; state institutions that create lower discount rates will mean greater long-term environmental goods provision. Second, time inconsistency threatens the credibility of long-term payoff realization; state institutions that create intertemporal commitment mechanisms will mean more long-term environmental goods provision.

2.2.1 Discounting

Long-term payoffs complicate the politics of goods provision when the costs that payoffs are weighed against occur on a shorter time horizon. According to most theories of individual and institutional choice, costs and benefits in the present have higher relative valuations than those in the future. Similarly, future valuations are higher the closer they are to the present. Assumed discount functions and rates may vary by scholar or by topic, but intertemporal preferences are always negative in the first derivative.

Long-term environmental goods are paid for in the present but yield benefits in the future, either through a delayed benefit or through a steady stream of projected benefits. Forests, for example, offer small but consistent existence benefits (such as wildlife protection and hunting, tourism, air filtration, timber availability, flood and erosion protection,

etc.) but must be maintained by refraining from enjoying the high short-term benefits of over-exploitation (such as uncontrolled logging, slash and burn farming, etc.). Even if the summed future value of a forest's existence far outweighs the market value of its timber, the timber can be harvested and enjoyed today.

Political institutions with lower discount rates will be motivated to invest in more goods with payoffs in the long run. Institutionalized parties may be one vehicle through which a government's time horizons are extended from the lifespan or careerspan of a particular leader to the longer arc of an party's interests. A robust literature on the comparative politics of authoritarian regimes has found that those led by institutionalized parties are more stable (Magaloni, 2006). Similarly, institutionalized parties are seen as crucial to the consolidation of democracies and thus the stability of those political systems (Randall and Svåsand, 2002). Regime stability will likely increase the policy time horizons of leaders. But strong parties will also extend time horizons if decisions are at least partially be driven by the interests of the potentially permanent party rather than solely those of the mortal individual leader. Personalist political movements or weak political parties will be unlikely to value long-term policy goals over shorter-term ones. Thus, in democratic and authoritarian states alike, party institutionalization should increase forest conservation by lowering the discount rate inherent in policy decision-making.

Hypothesis 3: Party institutionalization will increase forest conservation.

2.2.2 Time Inconsistency

In addition to discounting, long-term goods provision can suffer from time inconsistency. This problem occurs when preferences are inconsistent across time periods, such as when actor A in period t prefers that A in $t+1$ would take action q, but knows that A (itself) will prefer to take action $q\neg$ when period $t+1$ actually occurs. Consider, for example, conservation of the Amazon rainforest. A particular Brazilian political party may value the numerous ecological benefits of conservation, which will continually pay off for Brazil forever unless the forest is logged and farmed past some irrecoverable level. But this party may figure that, through the natural rotation of power, another party

will likely come to office feeling differently and will destroy the forest for the short-term benefits of excessive extraction. Even without the rotation of actors, this party may know that its own prioritization between economic and ecological gain may change if the global economy slides into recession. Knowing that the forest is doomed sooner or later and thus that restraint today has lower future payoffs than would be preferred, even this party with green preferences may decide to cash in on resource extraction.

Political institutions with stronger intertemporal commitment mechanisms will be better able to invest in goods with payoffs across time. This argument is similar to the recognition that intratemporal commitment mechanisms that restrain political power are essential in fostering investment in short-term goods (North and Weingast, 1989; Wright, 2008). Intertemporal commitment is facilitated through constraints on executive power, either through judicial review or legislative oversight. These mechanisms bind executives to legal statutes, constitutional authority, or the commitments of parties, rather than allowing them free reign to change policy in favor of short-term incentives. In both democratic and authoritarian states, constraints on executive power should increase forest conservation by allowing the intertemporal commitment necessary for long-term goods investment.

Hypothesis 4: Constraints on executive power will increase forest conservation.

2.2.3 Comparing Institutions

These predictions correspond to a growing literature in comparative politics that distinguishes institutionalized from non-institutionalized autocracies as well as consolidated versus unconsolidated democracies. I argue that institutionalization and consolidation will allow long-term good provision by lowering discount rates and facilitating intertemporal commitment. Table 3 diagrams these categories by comparing level of democracy to short-term versus long-term institutions.

This table can be compared to the environmental problem classification in Table 2 by considering governments in the high democracy column or the long time horizons row to be more likely to provide goods within that row/column, but to be no more likely to pro-

Table 3: Institutions for Domestic Environmental Good Provision

		Democracy: Low	Democracy: High
Time Horizons	Long	institutionalized autocracy	consolidated democracy
	Short	non-institutionalized autocracy	unconsolidated democracy

vide goods elsewhere. Thus, consolidated democracies will be uniquely suited to providing long-term collective goods (forever chemical abatement), as likely as institutionalized autocracies to provide long-term non-collective goods (natural resource conservation), as likely as unconsolidated democracies to provide short-term collective goods (diffuse smog abatement), but no more likely than any other state to provide short-term non-collective goods (concentrated smog abatement).

Comparing states by regime type along an autocracy-democracy continuum is common practice in the study of international relations. The inclusion of an additional axis with orthogonal institutional variables, however, follows the comparative politics literature in allowing finer distinctions to be made within types and aberrant cases to be explained across types. A simple autocracy-democracy comparison cannot explain key cases in environmental protection, especially forest conservation. Examples include the high levels of conscientious reforestation in modern Bhutan, a hybrid constitutional monarchy, and continuing deforestation of the Amazon in Brazil, a still-consolidating democracy. I thus follow promising developments in recent scholarship that disaggregate the autocracy-democracy typology into more granular and useful subtypes (Mansfield and Snyder, 2002, 2005; Weeks, 2012, 2014).

3 Predicting Forest Conservation with Long-Term Institutions

In this section, I demonstrate that forest conservation is well predicted by long-term institutions but not by democracy. I focus on forestry because it is an environmental good that is both long-term and not collective. Thus, the predictive power of long-term institutions validates my proposed theory on environmental long-term goods, while the lack of predictive power of democracy invalidates previous literature's treatment of all environmental goods as collective goods.

Forests are also a useful dependent variable because they are inherently important for their crucial role in the broader environmental issues of species conservation and climate change mitigation. Understanding forest conservation thus improves our understanding of these important environmental problems.

Below, I first outline my data structure and sources, then discuss my strategy to adjust for exogenous variation in forest growth and decline. I adjust for mechanisms specified by Forest Transition Theory. I then add the key explanatory variables discussed in Section 2.2 in order to test my theory.

3.1 Data

I take values for forest coverage by country by year from a classification of NASA's Landsat earth image data (Song et al., 2018).[2] This estimate of national forest coverage provides a large sample with nearly continuous coverage (small temporal gaps are interpolated using averages of surrounding values).

For independent variables, I take population and economic data from the World Bank Development Indicators (World Bank, 2024) and institutional ratings from the Varieties of Democracy (V-Dem) institute at the University of Gothenburg, Sweden (Michael Coppedge et al., 2023; Pemstein et al., 2022).

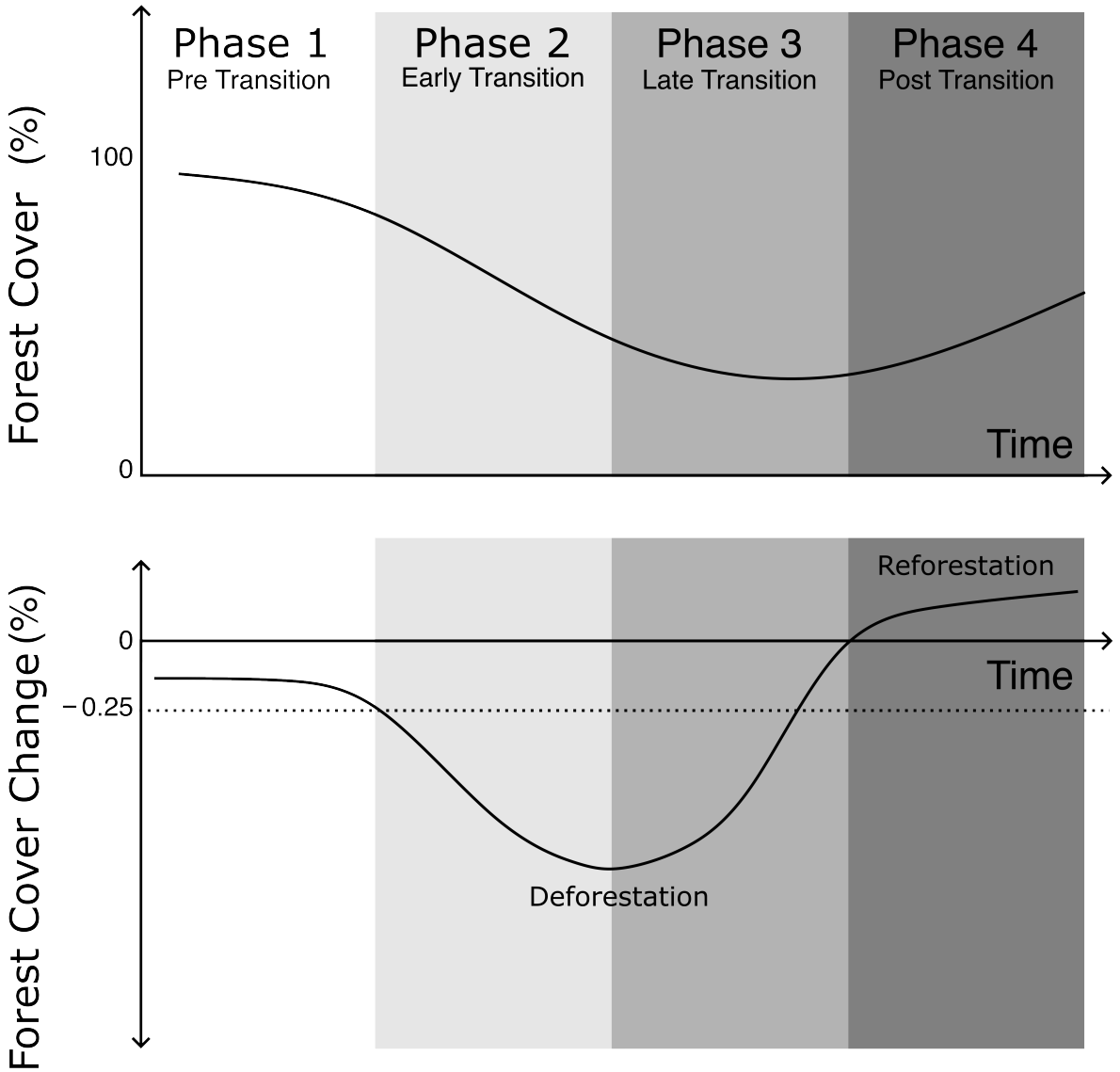
[2]Note that this is the same data source used by Sanford (2023) to estimate the deforestation effects of competitive elections, but my statistical approach differs notably.

3.2 Adjusting for the Forest Transition Curve

One problem with using institutions to predict change in forest coverage is the existence of other major drivers of deforestation and reforestation. If not adjusted for, other causes of forest change will lead to, at best, lack of statistical power due to noise in the dependent variable and, at worst, omitted variable bias if these drivers are also related to the explanatory variables. Fortunately, Forest Transition Theory offers a theoretically sound and empirically robust explanation for variation in forest coverage within and between countries (Mather, 1992; Kauppi et al., 2006). States tend to pass through sequential phases of a transition from high and stable forest coverage, to rapid deforestation, to slowing deforestation, to gradual reforestation at a lower level of forest coverage (Mather, 1992; Hosonuma et al., 2012).

At low levels of economic development, when economies are based on natural resource extraction and populations are largely rural, economic and population growth will each lead to rapid deforestation. Alternatively, at high levels of economic development, when economies have transitioned to industrial and post-industrial models and populations have largely urbanized, neither economic nor population growth will impact forest coverage to the same extent, and forests will be able to regrow (Mather and Needle, 1998; Barbier, Burgess and Grainger, 2010; Walker, 1993). At the same time, higher levels of societal wealth will lead to greater preference for environmental protection as a luxury good, while lower levels of national forest coverage due to previous deforestation will lead to increased motivation for conservation (Rudel et al., 2005). Thus, forest coverage plunges as societies develop and rebounds as they continue to develop. This prediction has been borne out by case studies and cross country comparisons (Hosonuma et al., 2012) but has not been tested in a large-n study (to my knowledge). I validate Forest Transition Theory and use that validation as a control for my estimation of the independent effects of institutions. If long-term institutions also lead to forest protection, they will predict states' deviations from the typical forest transition curves described by these variables. The predictions of Forest Transition Theory are specified below:

Figure 1: Stylized forest transition diagram, recreated from Hosonuma et al. (2012)



$$\Delta F_{i,t} \sim \beta_1 + \beta_2 F_{i,t-1} + \beta_3 W_{i,t-1} - \beta_4 \Delta W_{i,t} - \beta_5 \Delta P_{i,t}$$

$$\Delta F_{j,t} \sim \beta_1 + \beta_2 F_{j,t-1} + \beta_3 W_{j,t-1} + \beta_4 \Delta W_{j,t} + \beta_5 \Delta P_{j,t}$$

where i is a poor country, j is a rich country, Δ indicates a rate of change, F indicates forest coverage, W indicates wealth (i.e. GDP per capita), P indicates population size, and t denotes year. Based on this theoretical relationship, I fit the following regression model:

$$\begin{aligned} log(\frac{F_{i,t}}{F_{i,t-1}}) =& \beta_0 + \beta_1 log(\frac{F_{i,t-1}}{F_{i,t-2}}) + \beta_2 F_{i,t-1} \\ &+ \beta_3 W_{i,t-1} + \beta_4 W_{i,t-1}^2 + \beta_5 log(\frac{W_{i,t}}{W_{i,t-1}}) + \beta_6 log(\frac{P_{i,t}}{P_i, t-1}) \\ &+ \beta_7 W_{i,t-1} * log(\frac{W_{i,t}}{W_{i,t-1}}) + \beta_8 W_{i,t-1} * log(\frac{P_{i,t}}{P_{i,t-1}}) \\ &+ X_{i,t-1} + \tau_t + \gamma_i + \epsilon_{i,t} \end{aligned}$$

in which $X_{i,t-1}$ is a matrix of lagged values of the key explanatory variables specified in the hypotheses above (corruption, democracy, party institutionalization, and constraints on the executive). τ_t and γ_i are fixed effects for year and state respectively and I measure change as log difference (i.e. $log\frac{A1}{A2} = logA1 - logA2$), which approximates percentage change at low values but is more stable. I also include a lagged dependent variable as a predictor, making this model a first degree autoregression (AR(1)). Due to the panel setup of the data and the use of a lagged dependent variable, I cluster standard errors by state. I also test for serial correlation by plotting residuals from my fitted models in the appendix of this paper. I include state and year fixed effects in order to capture unobserved confounders that are shared across states by year, or that are shared across time by states. Finally, due to high levels of noise in the dependent variable, I fit a robust regression, modeling the error term with a Student t distribution rather than a normal distribution in order to reduce sensitivity to outliers.

3.3 Results

Table 4 displays the results from both models. Unsurprisingly, the coefficient for the lagged dependent variable is small, negative, and precisely estimated. This implies general stability of forestation and reforestation trends with some regression to the mean. The lagged percentage of national forest coverage also has a negative and statistically significant coefficient, validating arguments that countries with more forest coverage will see less need to conserve their forests. The coefficients for the logged and lagged value of GDP per capita and that value squared are also statistically significant. While the effect of GDP per capita is negative, indicating that more wealth leads to less conservation, the squared value is positive, indicating that this relationship is reversed for higher values of wealth. Specifically, the effect of GDP per capita will change from negative to positive before GDP per capita passes $1000 (see appendix for a detailed calculation).

These results correspond to Forest Transition Theory, but the remaining terms do not. Neither yearly change in GDP per capita nor its interaction with the level of GDP per capita can be precisely estimated, perhaps because of excessive noise in yearly GDP per capita growth. More worryingly, yearly change in population and its interaction with the level of GDP per capita are both precisely estimated but pointing in the wrong direction. I find that population growth corresponds to increased forest conservation, but that this is less true at higher levels of economic development.

Thus, Forest Transition Theory is only partially validated on this dataset, but nevertheless provides a useful control for my institutional analysis. Most Forest Transition variables are well estimated and their coefficients are stable when the institutional variables are added. Moreover, the regression has a good fit with a low residual standard error.

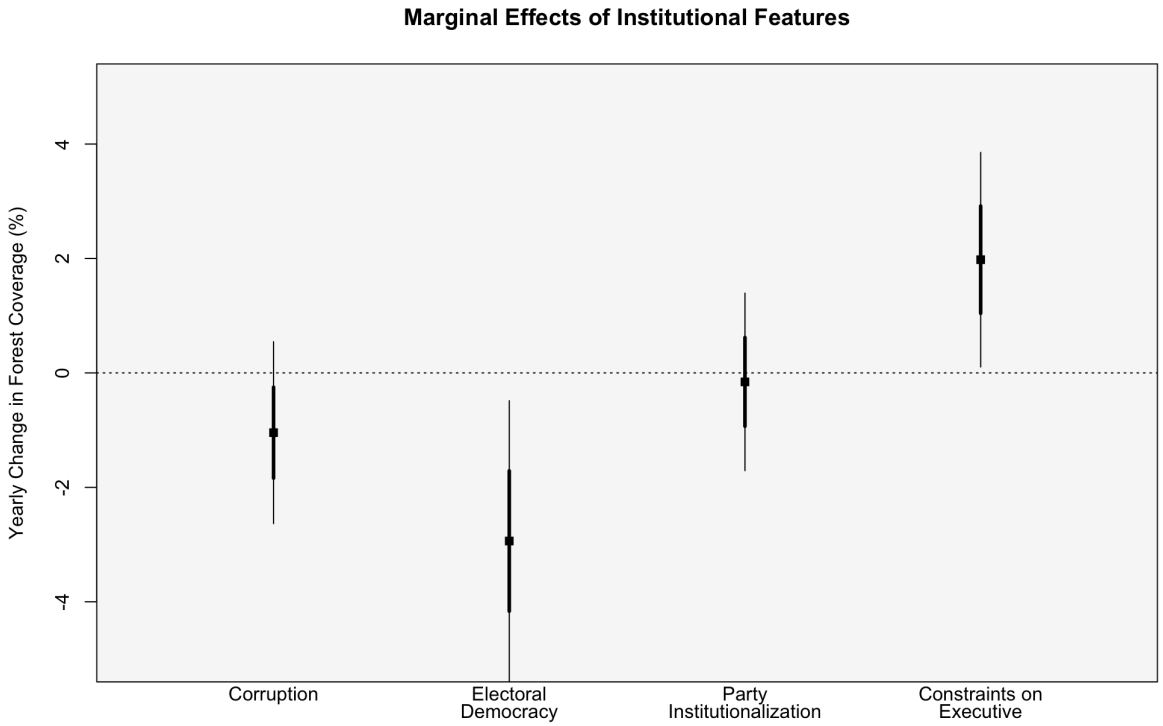
While all institutional variables are taken from V-Dem and therefore on the same scale, I also standardize each so that a difference of one unit corresponds to a difference of one standard deviation in the sample. Coefficients for the institutional variables provide a partial validation for the explanatory power of long-term goods theory and the limitations of other theories. I plot results for the institutional variables in Figure 2, which shows

Table 4: Main Results

	DV: Forest Change	
	(1)	(2)
Lag Forest Change	−0.184***	−0.183***
	(0.011)	(0.011)
Lag Forest Coverage	−1.391***	−1.403***
	(0.058)	(0.058)
log(Lag GDP per Capita)	−25.301***	−23.299***
	(4.763)	(4.845)
$(\log(\text{Lag GDP per Capita}))^2$	1.887***	1.736***
	(0.302)	(0.309)
GDP per Capita Change	−0.025	−0.043
	(0.232)	(0.233)
log(Lag GDP per Capita) × GDP per Capita Change	0.007	0.009
	(0.030)	(0.030)
Population Change	6.389***	6.312***
	(1.329)	(1.337)
log(Lag GDP per Capita) × Population Change	−0.845***	−0.832***
	(0.176)	(0.177)
Corruption		−1.040
		(0.792)
Electoral Democracy		−2.995**
		(1.250)
Party Institutionalization		−0.156
		(0.773)
Constraints on the Executive		2.031**
		(0.962)
Constant	107.363***	99.428***
	(20.001)	(20.396)
State and Year Fixed Effects	Yes	Yes
Observations	2,878	2,878
Residual Std. Error	7.863 (df = 2721)	7.725 (df = 2717)

Note: *p<0.1; **p<0.05; ***p<0.01

Figure 2: Main Results



estimated marginal effects as well as 1 and 2 standard deviation confidence intervals.

Hypothesis 1, testing State Capacity Theory, is weakly validated. A one standard deviation positive difference in corruption levels is associated with a one percent decrease in the growth of national forests per year. This negative coefficient is in line with the predictions of State Capacity Theory, but is insignificant, i.e. not statistically distinguishable from an effect of zero.

Hypothesis 2, testing the inapplicability of Collective Goods Theory, is partially validated. A one standard deviation difference in electoral democracy is associated with a nearly three percent decrease in national forest growth per year, and this result is statistically significant. Although this demonstrates that democracy is not predictive of positive forest conservation, these results indicate the stronger conclusion that democracy has a negative effect. Could democracy predict degradation of non-collective environmental goods like forestry? Without a strong theoretical framework for understanding why a negative effect may exist, I caution against overconfidence in this result. It may be that

electoral democracy is negatively correlated with types of long-term institutions not captured by party institutionalization or constraints on the executive. Further theoretical and empirical work is necessary to learn from this result.

Hypothesis 3, testing the effect of lower institutional discount rates, fails to be validated. The coefficient for party institutionalization is highly insignificant and sits near zero. It is possible that a longer time series, outcome data with less noise, or better methods for dealing with noisy outcomes could estimate the effect with precision. It is also possible that there exists a better proxy for lower institutional discount rates, as I discuss in the final section.

Hypothesis 4, testing the effect of stronger institutional intertemporal commitment, is strongly validated by a clear effect of executive constraints on forest conservation. A one standard deviation difference in executive constraints is associated with a positive two percent difference in yearly national forest growth. This effect is estimated at a 99% confidence level. It is also substantively large, supporting the theory that intertemporal constraints will allow the provision of long-term goods like forest conservation.

In sum, these results demonstrate the effectiveness of executive constraints, as a means for allowing intertemporal commitment, at allowing forest conservation. They also demonstrate, at a minimum, the insufficiency of state capacity and democracy, the prevailing theoretical explanations for environmental protection. The negative and significant estimate for electoral democracy and the insignificant effect for party institutionalization imply a need for further theorizing about long-term institutions, especially those correlated with democratic institutions.

4 Conclusion

This study has several limitations that suggest promising paths for future work. Technically, inference of cross-national patterns of forest change could be improved with longer time series, better landcover classifications for more stable outcome data, and improved statistical models. Theoretically, given the partial failure of the Forest Transition

model above, a refined theory on deforestation and reforestation patterns would be useful in isolating the independent effects of political institutions.

Further theoretical work on institutional time horizons will allow additional hypothesis testing of other institutional features that may correspond to lower discount rates or stronger intertemporal commitment mechanisms. This research should leverage the robust comparative politics literature on variation within autocratic and democratic institutions.

Despite these limitations, this paper has contributed in two major ways to explaining national variation in environmental protection. First, the theoretical discussion and empirical results above both amply demonstrate the insufficiency of State Capacity Theory and the inapplicability of Collective Goods Theory to non-collective environmental goods, such as forest conservation. Given the dominance of Collective Goods Theory especially to discussions of institutional determinants for environmental protection, these results demonstrate a clear need to complicate our theories of environmental goods and the institutions that provide them.

Second, this paper argues for the importance of institutional time horizons for explaining the provision of long-term goods. Environmental goods vary by their temporal payoff structures; some are short-term goods while others produce benefits gradually or after long delays. State institutions, meanwhile, vary in their ability to manage the intertemporal distribution problem posed by long-term goods. Institutions vary by their discount rate and by the strength of their intertemporal commitment devices. My effort to theorize this institutional variation has been partially validated with the finding that executive constraints are strongly predictive of forest conservation.

4.1 Implications for Climate Change

Climate change provides a particularly important example of a long-term environmental good. On one hand, greenhouse gas (GHG) emissions can be understood as an externality problem in the present. Abatement of this externality through emissions reduction is globally non-excludable. Scholars that consider the need for abatement to be mostly sym-

metric expect democracies to lead on climate change mitigation (Bättig and Bernauer, 2009), while those that see asymmetric effects predict bargaining between the geographically vulnerable and not (Schelling, 1992). But GHG emissions can also be understood as a time horizons problem in which externalities are asymmetric across time. The costs of GHG emissions are delayed by the non-linearity of the climate effect, in which only a large buildup of GHGs in the atmosphere will affect global temperatures enough to start disrupting climate systems. Emissions today ruin the climate tomorrow, but these costs are not realized directly or immediately. Moreover, the costs of cutting emissions are felt today.

The differential ability of domestic institutions to manage the intertemporal tradeoffs of climate change has only received recent attention (Hale, 2024). My theory would predict that states with institutionalized parties and constraints on the executive would be more proactive in addressing climate change, especially through mitigation.

But climate change mitigation is an international problem; absent radical improvements in carbon capture technology, no state can unilaterally maintain the proper GHG concentration in the globally shared atmosphere. It's therefore also critical to consider the time horizons of international institutions.[3] Although parties do not exist in international politics, could institutionalized subgroups of states, such as regional organizations, serve the same role? Do constraints on hegemonic power promised by the liberal international order (Ikenberry, 2001) approximate domestic executive constraints in such a way as to facilitate intertemporal commitment?

Further research on institutional time horizons is vital to understanding climate change, deforestation, and other crucial environmental problems. This paper attempts to lay the groundwork for further development of this question.

[3]It's also worth noting that international institutions could generally be described as low capacity and undemocratic.

References

Alkon, Meir and Erik H. Wang. 2018. "Pollution Lowers Support for China's Regime: Quasi-Experimental Evidence from Beijing." *The Journal of Politics* 80(1):327–331.
URL: *https://www.journals.uchicago.edu/doi/abs/10.1086/694577*

Barbier, Edward B., Joanne C. Burgess and Alan Grainger. 2010. "The forest transition: Towards a more comprehensive theoretical framework." *Land Use Policy* 27(2):98–107.
URL: *https://www.sciencedirect.com/science/article/pii/S0264837709000131*

Barrett, Scott and Astrid Dannenberg. 2012. "Climate negotiations under scientific uncertainty." *Proceedings of the National Academy of Sciences* 109(43):17372–17376.
URL: *https://www.pnas.org/doi/full/10.1073/pnas.1208417109*

Barrett, Scott and Astrid Dannenberg. 2014. "Sensitivity of collective action to uncertainty about climate tipping points." *Nature Climate Change* 4:36–39.
URL: *https://ui.adsabs.harvard.edu/abs/2014NatCC...4...36B*

Bättig, Michèle B. and Thomas Bernauer. 2009. "National Institutions and Global Public Goods: Are Democracies More Cooperative in Climate Change Policy?" *International Organization* 63(2):281–308.
URL: *https://www.cambridge.org/core/journals/international-organization/article/abs/national-institutions-and-global-public-goods-are-democracies-more-cooperative-in-climate-change-policy/3B04986C13488B291DF27F312DC23665*

Deacon, Robert T. 2009. "Public good provision under dictatorship and democracy." *Public Choice* 139(1):241–262.
URL: *https://doi.org/10.1007/s11127-008-9391-x*

Ehrhardt-Martinez, Karen, Edward M. Crenshaw and J. Craig Jenkins. 2002. "Deforestation and the Environmental Kuznets Curve: A Cross-National Investigation of Intervening Mechanisms." *Social Science Quarterly* 83(1):226–243.
URL: *https://onlinelibrary.wiley.com/doi/abs/10.1111/1540-6237.00080*

FAO. 2020. "Global Forest Resource Assessment 2020- Main Report.".
URL: *https://openknowledge.fao.org/items/d6f0df61-cb5d-4030-8814-0e466176d9a1*

Fox, Jefferson, Sumeet Sakseena, Kaspar Hurni, Jamon Van Den Hoek, Alexander Cuthbert Smith, Ram Chhetri and Sharma. 2019. "Mapping and Understanding Changes in Tree Cover in Nepal: 1992 to 2016." *Journal of Forest and Livelihood* 18(1):1–11.
URL: *https://www.nepjol.info/index.php/JFL/article/view/59607*

Hale, Thomas. 2024. *Long Problems: Climate Change and the Challenge of Governing Across Time*. Princeton, NJ: Princeton University Press.

Hosonuma, Noriko, Martin Herold, Veronique De Sy, Ruth S. De Fries, Maria Brockhaus, Louis Verchot, Arild Angelsen and Erika Romijn. 2012. "An assessment of deforestation and forest degradation drivers in developing countries." *Environmental Research Letters* 7(4):044009. Publisher: IOP Publishing.
URL: *https://dx.doi.org/10.1088/1748-9326/7/4/044009*

Hovi, Jon, Detlef F. Sprinz and Arild Underdal. 2009. "Implementing Long-Term Climate Policy: Time Inconsistency, Domestic Politics, International Anarchy." *Global Environmental Politics* 9(3):20–39.
URL: *https://econpapers.repec.org/article/tprglenvp/v3a9y3a2009i3a3p3a20 − 39.htm*

Ikenberry, G. John. 2001. *After Victory: Institutions, Strategic Restraint, and the Rebuilding of Order After Major Wars*. Princeton, NJ: Princeton University Press.

Jervis, Robert. 1997. *System Effects: Complexity in Political and Social Life*. Princeton, NJ: Princeton University Press.

Kauppi, Pekka E., Jesse H. Ausubel, Jingyun Fang, Alexander S. Mather, Roger A. Sedjo and Paul E. Waggoner. 2006. "Returning forests analyzed with the forest identity." *Proceedings of the National Academy of Sciences* 103(46):17574–17579. Publisher: Proceedings of the National Academy of Sciences.
URL: *https://www.pnas.org/doi/full/10.1073/pnas.0608343103*

Magaloni, Beatriz. 2006. *Voting for Autocracy: Hegemonic Party Survival and Its Demise in Mexico*. Cambridge, UK: Cambridge University Press.

Mansfield, Edward D. and Jack Snyder. 2002. "Democratic Transitions, Institutional Strength, and War." *International Organization* 56(2):297–337.
URL: *https://www.jstor.org/stable/3078607*

Mansfield, Edward D. and Jack Snyder. 2005. *Electing to Fight: Why Emerging Democracies Go to War*. The MIT Press.

Marquart-Pyatt, Sandra. 2004. "A Cross-National Investigation of Deforestation, Debt, State Fiscal Capacity, and the Environmental Kuznets Curve." *International Journal of Sociology* 34(1):33–51. Publisher: Taylor & Francis, Ltd.
URL: *https://www.jstor.org/stable/20628702*

Mather, A. S. 1992. "The Forest Transition." *Area* 24(4):367–379.
URL: *https://www.jstor.org/stable/20003181*

Mather, A. S. and C. L. Needle. 1998. "The Forest Transition: A Theoretical Basis." *Area* 30(2):117–124.
URL: *https://www.jstor.org/stable/20003865*

Michael Coppedge et al. 2023. "V-Dem Dataset v13.".
URL: *https://www.v-dem.net/data/dataset-archive/*

Mildenberger, Matto. 2020. *Carbon captured: how business and labor control climate politics*. American and comparative environmental policy Cambridge, Massachusetts London, England: The MIT Press.

North, Douglass C. and Barry R. Weingast. 1989. "Constitutions and Commitment: The Evolution of Institutions Governing Public Choice in Seventeenth-Century England." *The Journal of Economic History* 49(4):803–832.

URL: *https://www.cambridge.org/core/journals/journal-of-economic-history/article/abs/constitutions-and-commitment-the-evolution-of-institutions-governing-public-choice-in-seventeenthcentury-england/2E0D2B2D3490BE5C556D836ACB096362*

Pemstein, Daniel, Kyle L. Marquardt, Eitan Tzelgov, Yi-ting Wang, Juraj Medzihorsky, Joshua Krusell, Farhad Miri and Johannes von Römer. 2022. "The V-Dem Measurement Model: Latent Variable Analysis for Cross-National and Cross-Temporal Expert-Coded Data.".
URL: *https://papers.ssrn.com/abstract=3595962*

Povitkina, Marina. 2018. "The limits of democracy in tackling climate change." *Environmental Politics* 27(3):411–432.
URL: *https://doi.org/10.1080/09644016.2018.1444723*

Randall, Vicky and Lars Svåsand. 2002. "Party Institutionalization in New Democracies." *Party Politics* 8(1):5–29. Publisher: SAGE Publications Ltd.
URL: *https://doi.org/10.1177/1354068802008001001*

Rudel, Thomas K., Oliver T. Coomes, Emilio Moran, Frederic Achard, Arild Angelsen, Jianchu Xu and Eric Lambin. 2005. "Forest transitions: towards a global understanding of land use change." *Global Environmental Change* 15(1):23–31.
URL: *https://www.sciencedirect.com/science/article/pii/S0959378004000809*

Sanford, Luke. 2023. "Democratization, Elections, and Public Goods: The Evidence from Deforestation." *American Journal of Political Science* 67(3):748–763.
URL: *https://onlinelibrary.wiley.com/doi/abs/10.1111/ajps.12662*

Schelling, Thomas C. 1992. "Some Economics of Global Warming." *The American Economic Review* 82(1):1–14.
URL: *https://www.jstor.org/stable/2117599*

Song, Xiao-Peng, Matthew C. Hansen, Stephen V. Stehman, Peter V. Potapov, Alexandra Tyukavina, Eric F. Vermote and John R. Townshend. 2018. "Global land change from 1982 to 2016." *Nature* 560(7720):639–643. Publisher: Nature Publishing Group.
URL: *https://www.nature.com/articles/s41586-018-0411-9*

Stokes, Leah Cardamore. 2020. *Short Circuiting Policy: Interest Groups and the Battle Over Clean Energy and Climate Policy in the American States*. Oxford: Oxford University Press.

Walker, Robert. 1993. "Deforestation and Economic Development." *The Canadian Journal of Regional Science* 16(3):481–497.

Weeks, Jessica L. 2012. "Strongmen and Straw Men: Authoritarian Regimes and the Initiation of International Conflict." *The American Political Science Review* 106(2):326–347. Publisher: [American Political Science Association, Cambridge University Press].
URL: *https://www.jstor.org/stable/41495081*

Weeks, Jessica L. P. 2014. *Dictators at War and Peace*. Ithaca, NY: Cornell University Press.

World Bank, Data Catalog. 2024. "World Development Indicators.".
URL: *https://datacatalog.worldbank.org/search/dataset/0037712/World-Development-Indicators*

Wright, Joseph. 2008. "Do authoritarian institutions constrain? How legislatures affect economic growth and investment." *American Journal of Political Science* 52(2):322–343.
URL: *http://www.scopus.com/inward/record.url?scp=41649100087partnerID=8YFLogxK*