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

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Abstract:
This article develops a novel institutional theory of long-term environmental good provision, particularly forest conservation. Long goods, or those for which payoffs are delayed over time, are more likely to be provided by states with long 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 environmental good provision. Environmental protection is frequently a long problem 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 institutions.

1 Introduction

Forests provide critical carbon sinks for the mitigation of climate change, irreplaceable habitats for a large share of the world's biodiversity, vital resources for much of the global economy, and essential sources of recreation and aesthetic value. Although forests currently cover about one third of the Earth's land surface (FAO, 2020), they are 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, like many other kinds of environmental protection, is the state's institutional time horizons. Deforestation 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. Despite broad scholarly recognition of such inter-temporal tradeoffs in environmental politics, little theory exists on the definition of so-called "long problems" or what I call the "long institutions" that are able to resolve them.

I argue that long problems or, alternatively, difficulties in providing long goods occur when benefits are delayed after the costs of good provision. 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 goods such as forest conservation or many other kinds of environmental protection. 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 Explaining Forest Conservation as a Long Problem

Conventional explanations for national variation in domestic environmental protection focus on state capacity, collective action, and distributive politics. These explanations are limited; each theory applies only to a particular type of environmental problem. They are also empirically insufficient; their broad predictions that high capacity democracies will protect the environment often fail to fit reality, especially in the case of forest conservation. I propose a new theoretical framework that explains forest conservation as, in Hale's (2024) terms, a long problem. Forest conservation should be easier for governments with long time horizons, i.e. with long institutions, as I refer to them below. This framework should generalize to help explain variation in some other types of environmental protection because many other (but not all) environmental problems are also long problems.

Scholars have long recognized the challenges posed by inter-temporal tradeoffs in environmental politics, especially in regards to climate change (Hovi, Sprinz and Underdal, 2009; Finnegan, 2022; Hale, 2024). But little systematic theory exists to identify which environmental problems are long problems and what kind of governments have long institutions. Before proposing some simple schemas for each question in Sections 2.2 and 2.3, I briefly emphasize the need for grappling with time for the explanation of environmental protection, especially forest conservation, in Section 2.1.

2.1 Explaining Environmental Protection

Scholars explain levels of domestic environmental protection with 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.

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.

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 potential asymmetry and excludability means that forest conservation is not always collective good, and thus will not necessarily be predicted by democracy. Indeed, research has 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).

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; while forest conservation does not always follow a clear logic from collective action theory or static distributive politics research, it will always reflect the dilemmas posed by goods with upfront costs and delayed benefits. I explain below that this makes forest conservation, like many other environmental efforts, a long problem. I call institutions that are more effective in providing such problems long institutions.

Table 1: Theories of Environmental Problems

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

2.2 Long Problems

I argue for a simple definition of long goods as those for which benefits accrue after costs. 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 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.

Long goods may be excludable or non-excludable and may be symmetric or asymmetric. Thus, private goods, club goods, public goods, and commons goods could all be either long goods or short goods. Long problems therefore are distinct from collective

action problems or distributive politics problems, but could interact with these dilemmas in interesting and complex ways. Smog abatement, for example, 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 goods provision.

Much of the budding literature on long politics defines long problems by the political dilemmas that they pose. Finnegan (2022) and Hale (2024) define long goods as those whose provision suffers from inter-temporal discounting, Hovi, Sprinz and Underdal (2009) define long goods as those whose provision suffers from uncertainty and time inconsistency, while Jacobs (2016) argues that a good that suffers from the former will necessarily suffer from the latter.

I argue instead that the political dilemmas arising from long problems will depend on both the structure of the long problem and the bundle of assumptions used in its analysis. Long problems can be divided into two sub-types: long payoff problems and long action problems. In a long payoff problem, the necessary action to provide a good can be taken immediately, but at least part of the good's payoff is delayed after provision. In a long action problem, on the other hand, not only are payoffs delayed but these future payoffs also require additional future action. In other words, in a long payoff problem, today's action is not worthwhile without considering tomorrow's payoffs, while in a long action problem, today's action is not worthwhile without additional action tomorrow. Any long action problem also suffers from long payoff problems–payoffs must reside in the future

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

or else securing them would not depend on future action–but long payoff problems are not necessarily also long action problems–sometimes all necessary action can be taken immediately even if the payoffs are delayed.

Meanwhile, either of these types of problems can be analyzed under more or fewer simplifying assumptions. A parsimonious analysis of long problems could assume rational unitary actors. If so, then the problem faced by actors trying to provide long payoff goods is discounting. 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 inter-temporal preferences are always negative in the first derivative. Long 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.

Under this same rational actor assumption, an actor trying to provide a long action good suffers not only from discounting but also from time inconsistency. Also known as dynamic inconsistency, this dilemma occurs when preferences may change over time in such a way as to undermine commitment to future action. For example, actor A in period t may prefer that A (itself) in $t+1$ would take action q, but knows that it 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 in the present.

Table 2: Why are long problems difficult?

		Problem structure:	
		Long Payoff	Long Action
Assume rational unitary actors?	Yes	discounting	time inconsistency discounting
	No	uncertainty discounting	planning time inconsistency uncertainty discounting

Next, consider loosening the rational actor assumption. If scholars consider non-rational and non-unitary states, then the provision of long payoff goods will face not only discounting dilemmas but also problems of uncertainty. Long goods are more prone to uncertainty than goods with immediate feedback because of the delayed realization of results, hindering experimentation and ongoing reactions. The implications of uncertainty have been well studied in environmental politics (Barrett and Dannenberg, 2012, 2014), but significantly more work is needed on the connection between uncertainty and time.

Under the same loosened assumptions, the provision of long action goods will face not only discounting, uncertainty, and time inconsistency dilemmas but also planning dilemmas. In addition to the appreciation of delayed payoffs, the planning of delayed action presents complications in organizational and bureaucratic politics that are mitigated for short-term actions.

In the analysis below I will maintain the relatively strict assumption of rational and unitary actors in order to limit the breadth of my analysis to discounting and time inconsistency. But future research would benefit from the incorporation of the broader set of dilemmas resulting from long payoff and long action problems.

2.3 Long Institutions

Many solutions proposed by the literature on long problems take some form of democracy reduction, although the authors generally do not frame their solutions in that way. Jacobs (2016) and Finnegan (2022) each propose electoral reforms that reduce the responsiveness of the government to popular will (i.e., reducing seat-vote elasticity) and reduce the clarity of government accountability. Aside from the obvious normative dilemmas posed by these prescriptions, they also suffer from theoretical and empirical problems. Theoretically, these suggestions rely on the very strong assumptions that legislators are intrinsically motivated to maximize public welfare and are correct in their views on how to do so. Legislators balance intrinsic goals against the short-term necessity of winning re-election; if they are less vulnerable to electoral backlash from short-term costs of their actions, then they are more likely to pursue long-term welfare maximization. In much of the comparative politics literature, scholars rely on significantly weaker assumptions about legislator preferences. Legislators may be assumed only to care about re-election, or to balance a preference for re-election with some intrinsic preferences that are orthogonal to public welfare. Moreover, legislators are typically not assumed to be necessarily wiser or more competent than the public. Elections and other methods of legislator accountability are thus both preference and competence discovery processes. Empirically, these proposals also suffer from the lack of a clear relationship between democracy and suboptimal long good provision. If these arguments were correct, then democracies would be worst at providing long goods. Jacobs (2016) may be acknowledging these theoretical and empirical problems when he writes that long good provision will be increased by decreasing the vote-seat elasticity only up to a point, although he gives no indication of where this point is.

The democratic deficit in long problem theorizing is especially problemmatic because these authors have tended to focus on long goods that are also collective goods (Hovi, Sprinz and Underdal, 2009; Finnegan, 2022; Hale, 2024), which democratic legislators should be more inclined to provide. As I pointed out above, long goods need not necessarily be collective goods. Thus, I explore determinants of long institutions that are

at least partially independent of the determinants of collective institutions, i.e., partially independent of the democracy-autocracy distinction.

Political institutions will be more likely to provide long environmental goods if their designs ameliorate the four problems outlined in Table 2. Under the simplifying rational actor assumption used to maintain a manageable scope for this article, long institutions will mitigate two dilemmas: discounting and time inconsistency.

2.3.1 Discounting

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. 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.

2.3.2 Time Inconsistency

Second, time inconsistency threatens the credibility of long-term payoff realization; state institutions that create inter-temporal commitment mechanisms will mean more long environmental goods provision. Political institutions with stronger inter-temporal commitment mechanisms will be better able to invest in goods with payoffs across time.

This argument is similar to the recognition that intra-temporal commitment mechanisms that restrain political power are essential in fostering investment in many types of short-term goods (North and Weingast, 1989; Wright, 2008). Inter-temporal 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 inter-temporal commitment necessary for long goods investment.

2.4 Hypotheses

Based on previous research on environmental politics and on my own intervention with regards to long institutions, I will test the following four hypotheses:

Hypothesis 1: Corruption will decrease forest conservation.

Hypothesis 2: Democracy will not affect forest conservation.

Hypothesis 3: Party institutionalization will increase forest conservation.

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

3 Predicting Forest Conservation with Long Institutions

In this section, I demonstrate that forest conservation is well predicted by long institutions but not by democracy. I focus on forestry because it is an environmental good that is both long-term and not necessarily collective. Thus, the predictive power of long institutions validates my proposed theory on environmental long 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 2.3 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 (Coppedge et al., 2024; Pemstein et al., 2022).

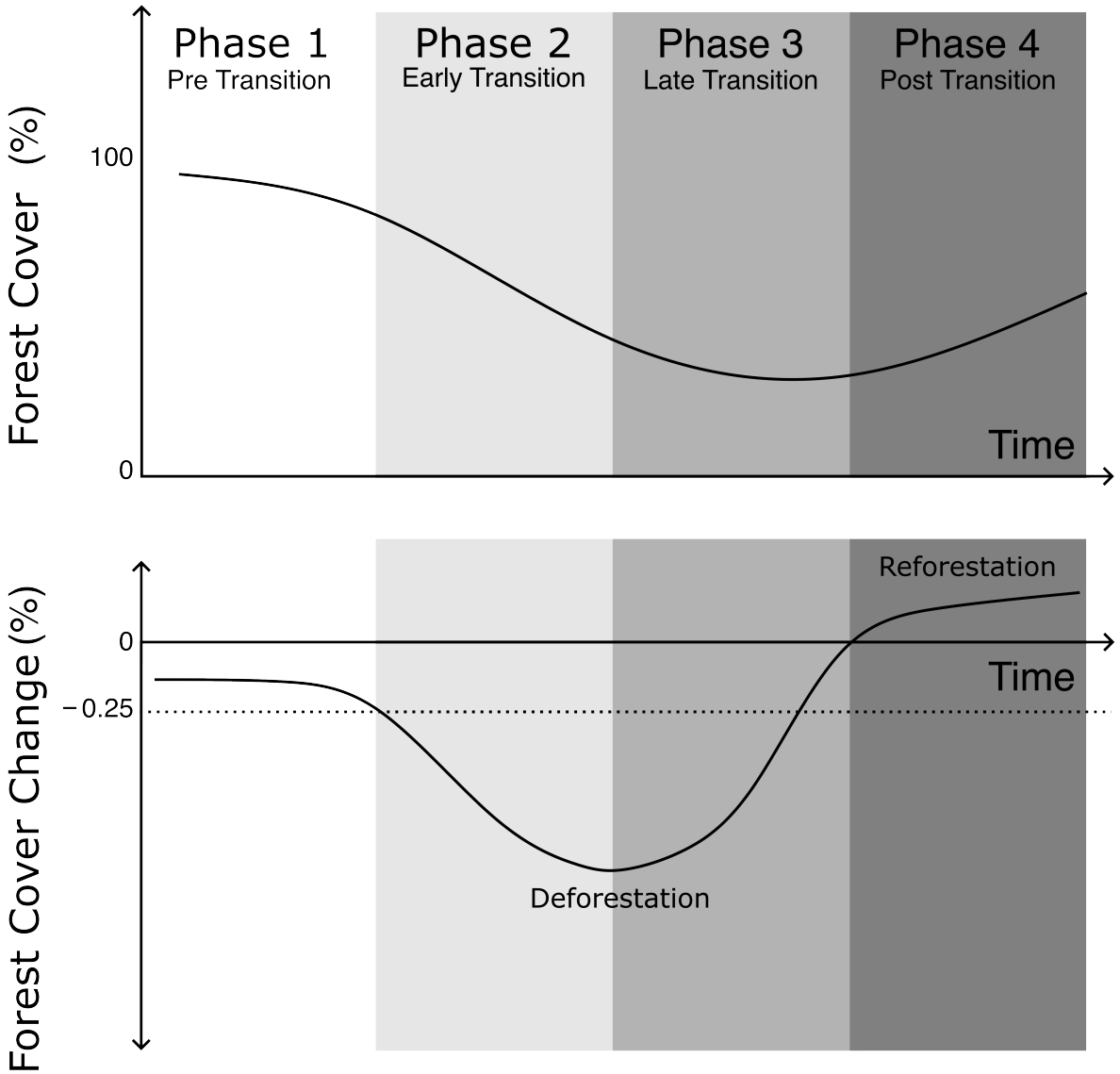
3.2 Adjusting for the Forest Transition Curve

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

[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.

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).

Figure 1: Stylized forest transition diagram, recreated from 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 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:

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

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

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 3 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

Table 3: Main Results

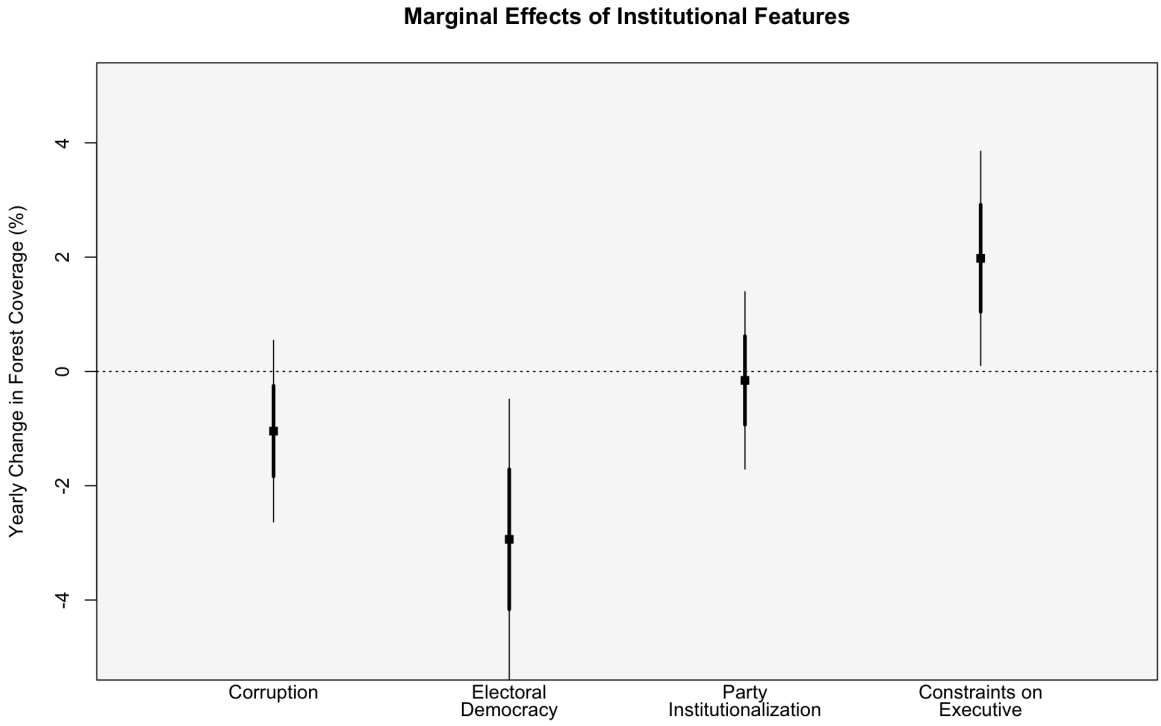
	DV: Forest Change	
	(1)	(2)
Lag Forest Change	−0.184***	−0.183***
	(0.011)	(0.011)
Lag Forest Coverage	−1.391***	−1.403***
	(0.058)	(0.058)
log(Lag GDP per Capita)	−25.301***	−23.299***
	(4.763)	(4.845)
$(\log(\text{Lag GDP per Capita}))^2$	1.887***	1.736***
	(0.302)	(0.309)
GDP per Capita Change	−0.025	−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

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.

Figure 2: Main Results



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 goods theory and the limitations of other theories. I plot results for the institutional variables in Figure 2, which shows 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 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 inter-temporal 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 inter-temporal constraints will allow the provision of long goods like forest conservation.

In sum, these results demonstrate the effectiveness of executive constraints, as a

means for allowing inter-temporal 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 institutions, especially those correlated with democratic institutions.

4 Discussion

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 inter-temporal 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 ex-

plaining the provision of long 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 inter-temporal distribution problem posed by long goods. Institutions vary by their discount rate and by the strength of their inter-temporal 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.

4.0.1 Implications for the Comparative Study of Institutions

The theory and empirics above are explore institutional variation that is independent of traditional autocracy-democracy distinctions. This corresponds 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 goods provision by lowering discount rates and facilitating inter-temporal commitment. Table 4 diagrams these categories by comparing level of democracy to short-term versus long institutions.

Table 4: Institutions for Domestic Environmental Good Provision

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

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).

4.1 Implications for Climate Change

Climate change provides a particularly important example of a long environmental problem. 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 symmetric 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 inter-temporal tradeoffs of climate change has only received recent attention (Finnegan, 2022; 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 inter-temporal commitment?

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

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

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