Essays

The Complex Links between Governance and Biodiversity

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Abstract: *We argue that two problems weaken the claims of those who link corruption and the exploitation of natural resources. The first is conceptual and the second is methodological. Studies that use national-level indicators of corruption fail to note that corruption comes in many forms, at multiple levels, that may affect resource use quite differently: negatively, positively, or not at all. Without a clear causal model of the mechanism by which corruption affects resources, one should treat with caution any estimated relationship between corruption and the state of natural resources. Simple, atheoretical models linking corruption measures and natural resource use typically do not account for other important control variables pivotal to the relationship between humans and natural resources. By way of illustration of these two general concerns, we used statistical methods to demonstrate that the findings of a recent, well-known study that posits a link between corruption and decreases in forests and elephants are not robust to simple conceptual and methodological refinements. In particular, once we controlled for a few plausible anthropogenic and biophysical conditioning factors, estimated the effects in changes rather than levels so as not to confound cross-sectional and longitudinal variation, and incorporated additional observations from the same data sources, corruption levels no longer had any explanatory power.*

Keywords: conservation policy, corruption, elephants, environmental policy, forests

Los Complejos Vínculos entre la Autoridad y la Biodiversidad

Resumen: *Argumentamos que dos problemas debilitan las afirmaciones de quienes relacionan la corrupción y la explotación de los recursos naturales. El primero es conceptual y el segundo es metodológico. Los estudios que utilizan indicadores de corrupción a nivel nacional no notan que la corrupción ocurre de muchas formas, en múltiples niveles que pueden afectar al uso de recursos diferentemente: negativamente, positivamente o de ninguna manera. Sin un modelo causal claro del mecanismo mediante el cual la corrupción afecta a los recursos, cualquier estimación de la relación entre corrupción y estado de los recursos naturales debe ser tratada con cuidado. Los modelos simples, ateóricos, que relacionan medidas de corrupción y uso de recursos naturales típicamente no consideran otras importantes variables control que son esenciales en la relación entre humanos y recursos naturales. A manera de ilustración de estas dos preocupaciones generales, utilizamos métodos estadísticos para demostrar que los resultados de un estudio reciente, bien conocido, que postula una relación entre corrupción y disminuciones de bosques y elefantes no son robustos para refinamientos conceptuales y metodológicos simples. En particular, los niveles de corrupción no tuvieron ningún poder explicativo una vez que controlamos algunos factores antropogénicos y biofísicos condicionantes, estimamos los efectos de cambios en lugar de niveles para no confundir la variación transversal y longitudinal e incorporamos observaciones adicionales para las mismas fuentes de datos.*

Palabras Clave: bosques, corrupción, elefantes, política ambiental, política de conservación

Paper submitted July 28, 2005; revised manuscript accepted November 7, 2005

DOI: 10.1111/j.1523-1739.2006.00521.x

Introduction

Government corruption gained popularity as an explanation for environmental degradation with the drastic decline of forests and certain species of wildlife in the 1970s and 1980s (Myers 1979; Hecht & Cockburn 1989; Gibson 1999; Ross 2001). Indeed, it seems only commonsensical that politicians and officials with short time horizons and few legal checks on their power might augment their wealth (and the wealth of their supporters) by supporting the overharvesting of natural resources such as forests and wild animals. Corrupt politicians and bureaucrats have played a key role in environmental degradation, as numerous case studies suggest (Myers 1979; Hecht & Cockburn 1989; Ascher 1999; see Ross 2001 for extensive references).

Given the case study evidence, more recent studies have understandably sought to make more generalizable claims about the connection between corruption and environmental outcomes by testing hypotheses with cross-national data. Exploiting relatively new data sets that offer measures related to national-level governance quality, some analysts have found significant relationships between proxies for politics, corruption, and resource outcomes (Deacon 1994, 1999; Bohn & Deacon 2000). Perhaps the best known of the recent studies is Smith et al. (2003*b*), who find strong relationships between corruption and the decline of elephants, rhinoceroses, and forests. Their results add empirical plausibility to arguments directly linking corruption and biodiversity loss. Others, such as Katzner (2005), used similar methods but generated opposite results. Herein we offer a caution about this new direction in the literature.

Corruption and Natural Resources: the Complex Conceptual Links

There is growing interest in the effect of government quality on economic, political, and environmental outcomes. It is widely accepted that governments that are less corrupt and that have more efficient bureaucracies (i.e., have better governance) produce more effective policy (Tendler 1997). Indeed, several policies emanating from donors, watchdog nongovernmental organizations, and trade groups seek to incorporate explicitly measures to foment the better governance of forest resources (e.g., Transparency International's Forest Integrity Network, the International Tropical Timber Organization's policy forum on criminal activity in the forest sector, the U.S. Government's Congo Basin Initiative, and the Center for International Forestry Research's newly created forest governance division). The World Bank also emphasizes the role of good governance within its forest-sector strategy and more broadly in its poverty-reduction programs (World Bank 1997, 2002). And the United States' Millennium Challenge Corporation seeks to link the process of good governance with environmental measures in deciding how to allocate its portfolio of foreign aid. The objective of checking the abuse of power by officials is laudable.

But corruption cuts across the private and public sectors, takes multiple forms, exists at multiple scales, may have both direct and indirect effects on natural resources, and is almost surely endogenous to the broader socioeconomic systems it infects. These basic features complicate analysis enormously. The existing empirical literature ignores most of this complexity, employing an oversimplified model that yields unreliable results because it rests fundamentally on unstated and untested assumptions. Although it lies beyond the scope of this paper to develop a full-blown theory of the relationship between corruption and the state of natural resources, we offer a few of the basic structural issues to illustrate the inherent ambiguity in this relationship and the danger of reading too much into the results of oversimplified statistical models. It is easy to reverse those results with modest, reasonable changes to the specification of an oversimplified model.

An appropriate benchmark of the links between corruption and natural resources, established from the existing literature (e.g., McPherson & Nieswiadomy 2000; Smith et al. 2003*b*; Katzner 2005), is what we call the *conventional model*. This model assumes that developing countries suffer from entrenched patronage politics, lack the rule of law, have low-paid civil servants, and "nonexistent accountability" (Walpole & Smith 2005). When natural resources become valuable in such a context, officials from top to bottom will be coerced, bribed, or lured into overexploiting valuable species (Laurence 2004). No one within the political system is held responsible for such behavior. Even the injection of foreign aid targeted for conservation is susceptible to these same forces. The result is that resources decline, sometimes precipitously.

Researchers employing the conventional model have thus far focused on national-level political corruption (defined as public office holders' abuse of their power for private gain; Bardhan 1997; World Bank 1997; Transparency International 2004), which is understandable. Data availability sharply limits analysts' ability to study these phenomena at smaller scales. Yet in a recent summary of lessons learned in natural resource conservation activities in Africa, the U.S. Agency for International Development (USAID 2002) emphasizes the importance of good governance at the local level and the considerable variation apparent in local-level resource governance. Moreover, the characteristic of the resources in question (e.g., migratory or stationary, valuable in small or large forms, easy or difficult to access and to monitor) varies enormously within countries. Such characteristics are fundamental determinants of the appropriate structure of resource governance and how deleterious the potential consequences of bad governance, including corruption, might be (Ostrom 1990). Given all the possible subnational variation in resource characteristics and quality of governance, a single measure of corruption at the national level seems highly unlikely to capture whatever true relationship(s) might exist between corruption and resource outcomes.

Even within the realm of national-level political corruption, however, the relationship need not be as neat as the conventional model would have it. Consider, for example, administrative corruption. Administrative corruption can be collusive or noncollusive, the former occurring when public officials conspire with violators of resource-use regulations to facilitate illegal exploitation; the latter occurring when public officials extract rents before approving legal uses, as when a ministry functionary demands a bribe before issuing a logging permit (Smith et al. 2003*a*; Laurence 2004). The direct effect of noncollusive corruption is to increase the cost of resource use, which will tend to slow rather than accelerate degradation. The unstated key assumption in the conventional model is that administrative corruption is collusive, although this is certainly not uniformly true. Little is known about the relationship between collusive and noncollusive corruption. For example, are they complements or substitutes for each other? Furthermore, national-level corruption measures make no distinction between the two forms, making inference problematic (for a review on the concept of political corruption, see Kitschelt [2000]).

The second key distinction is between administrative corruption of the sort just discussed, which concerns compliance with laws and policies taken as given, and political corruption, which is associated with the setting of laws and policies by senior officials (Rose-Ackerman 1978). At the level of political corruption there again emerge at least two countervailing pressures, rendering ambiguous the relation between corruption and resource state. First, insofar as resource extraction is financially valuable, individuals and firms may find it attractive to make (potentially legal) financial contributions so as to induce permissive policies with respect to, for example, fees, access, or emissions. The result may be increased resource degradation through legal overexploitation (OECD 2003). Agricultural, energy, and fisheries policies in many wealthier countries with high governance scores offer good examples.

On the other hand, political corruption historically tends to favor urban populations and manufacturing in developing countries (Lipton 1977; Bates 1981). This commonly leads to overvaluation of the local currency and rural-to-urban migration, reducing the global competitiveness of primary products, diminishing population pressure in many fragile rural areas, and potentially discouraging natural resource exploitation (Wunder 2003).

Furthermore, the links between administrative and political corruption remain very unclear. For example, it may be that where increased competition reduces political corruption and policies that facilitate degradation, administrative corruption may grow as the gains increase to avoid more restrictive resource-use policies (Wilson & Damania 2005). Thus, improvements in one domain need not be accompanied by progress in the other.

Beyond the various, countervailing direct effects of administrative and political corruption, the indirect effects are likewise unclear. The evidence that corruption retards economic growth is considerable (Kaufman 1997). But as a vast literature on the "environmental Kuznets curve" reveals, the effect of slower economic growth on the environment may be positive over some ranges and negative over others (Lee & Barrett 2000; Brock & Taylor 2005). By retarding investment, corruption may slow expansion of the agricultural frontier, pollution of waterways, and direct exploitation of fisheries, forests, and wildlife. On the other hand, slower growth among poor populations can stimulate resource degradation in the absence of emerging livelihoods that do not depend on primary product extraction.

The foregoing, informal mapping of the various pathways through which corruption—of different sorts and at different levels—might affect the state of natural resources, even controlling for prospective confounding variables, underscores that our theoretical understanding about the relationship between corruption and biodiversity remains underdeveloped. Empirical tests are challenged by this underdeveloped theory as well as the difficulties of gathering data at the appropriate spatial scale and of integrating necessary biophysical and sociopolitico-economic data.

But perhaps the biggest problem is the inherent endogeneity of corruption. The state of governance coevolves with the economy and the natural resources base. In observational data it is commonly difficult to disentangle true and spurious correlation—the latter due to common correlation with an omitted relevant variable—much less to move beyond establishing correlation to infer causality. For example, civil wars may lead to corruption in government, but they are also highly likely to affect the ability of that government to protect natural resources. A volatile political system (e.g., transitions from autocracy to democracy in Africa) and even a volatile climate (reducing animal populations, increasing the value of corruption to politicians in the face of bad harvests) may act in the same manner. Low rates of economic growth could increase corruption as stressed bureaucrats seek supplements to their meager government salaries while encouraging government to redouble efforts to protect natural resources that might enhance its tourism revenue, as was the case in Kenya through much of the Moi era.

Testing for Links between Corruption and Biodiversity

The conceptual underpinnings of the conventional model are thus oversimplified, assuming away many of the countervailing effects at different spatial and temporal scales of analysis and neglecting a host of possible confounding variables. Lacking a well-defined theory, one should exercise great caution when interpreting empirical results (Ferraro 2005; Katzner 2005; Walpole & Smith 2005). Statistical findings based on the conventional model are at once tests of the relation under investigation and of the assumptions underlying the statistical model. At the very least, it must be determined whether statistical findings hold under simple robustness checks.

Relatively modest adjustments to statistical specifications used in studies based on the conventional model, even using the same data, can generate completely contrary results. Statistical findings under the conventional model are simply not robust to reasonable changes to the set of explanatory variables or to estimation methods. Our specific statistical results should not be taken as definitive regarding the important debate about the effect of corruption on biodiversity because the results could change completely if one were to include additional variables on as yet unmeasured features of the societies and ecosystems in question or if data could be better matched across spatiotemporal scales of analysis. Our objective was not to offer conclusive results but rather to demonstrate that findings under the conventional model, ours included, should not be taken too seriously.

Toward this end, we used the widely cited Smith et al. paper (2003*b*) as a foil. These authors used national-level indicators of corruption and biodiversity in a cross-national design and found that there are significant and negative relationships between corruption and changes in elephant and rhinoceros populations and in forest cover. Although the authors carefully describe their statistical results in terms of correlations and associations, rather than causal links, the supporting text—and interpretations by many readers we have spoken with worldwide—suggests that corruption causes biodiversity loss. We considered how Smith et al. (2003*b*) generated their findings and demonstrate how they are not robust to simple, appropriate refinements. (We do not revisit Smith et al.'s [2003*b*] rhinoceros analysis because they have only nine observations and thus offer inherently fragile results.) Our critique can be applied equally to other studies in which the conventional model is used, including those that generate results contrary to Smith et al.'s (2003*b*), such as Katzner (2005).

Forests

Empirical research, based on cross-country data that explores the government-related causes of deforestation in particular, has grown rapidly since the early 1990s. Results of earlier case study research show that weak property rights are associated with loss of forest cover (e.g., Repetto & Gillis 1988; Southgate et al. 1996; Alston et al. 1996). Based on panel data, results of cross-national studies substantiated this claim (Deacon 1994, 1999; Bohn & Deacon 2000). These studies did not measure corruption per se, but rather factors directly affected by governments that might affect forests.

In their investigation of forests, Smith et al. (2003*b*) used two different dependent variables—change in total forest cover and change in natural forest cover from 1990 to 1995—to estimate the correlations between forests and governance. They examined the effect of governance scores per capita gross domestic product (GDP), human development index (HDI) score, and population density on change in forest cover. They found that change in total forest cover correlates positively with per capita GDP and governance, but change in natural forest cover does not correlate with governance. The authors therefore suggest that the "result for total cover was driven by the establishment of new plantations in wealthier, better-governed countries."

These conclusions are not robust because Smith et al.'s (2003*b*) comparison of natural and total forest cover is based on different samples. The UN Food and Agriculture Organization (FAO) reports forest cover for all countries, but reports natural forest cover only for developing nations. Thus a correct test of the difference between determinants of natural forest cover versus total forest cover must restrict the total forest cover to developing countries to rule out that the results are purely an artifact of different country samples for each measure of forest cover. When we restricted total forest cover to developing countries and used precisely the same data and ordinary least squares with correction for heteroskedasticity, neither per capita GDP nor governance had any statistically significant relation to changes in total forest cover, whereas HDI was negatively related to forest cover and barely statistically significant at the 10% level (Table 1). Consequently, it appears that Smith et al.'s (2003*b*) results are simply a function of sample-selection bias.

In a graph (Fig. 1) of forest cover and governance there are two clusters of countries: a relatively large group with low governance scores and negative changes in forest cover (Xs, developing countries) and a relatively small group with high governance scores and positive forest cover change (circles, developed countries). The graph shows two best-fit lines, one for developing countries and the other for all countries. The slope of line for developing countries is statistically indistinguishable from the zero-slope line at conventional significance levels. Thus, the only defensible inference to draw is that forest cover tended to increase in developed countries between 1990 and 1995. There are few policy implications from such a result.

Table 1. Forest cover for all countries and developing countries.[a]

	Forest cover (all countries)[b]			*Forest cover (developing countries only)*		
Population density	−0.000	−0.000	−0.000	−0.000	−0.000	−0.000
	(0.52)	(0.19)	(0.89)	(0.42)	(0.49)	(0.52)
Governance	0.232			0.135		
	(7.03)[f]			(1.03)		
HDI[c]		1.956			−1.263	
		(4.08)[f]			(1.77)[e]	
Per capita GDP[d]			0.000			0.000
			(6.54)[f]			(1.47)
Constant	−1.702	−1.930	−0.954	−1.507	−0.307	−1.166
	(9.46)[f]	(6.09)[f]	(8.03)[f]	(3.36)[f]	(0.82)	(8.31)[f]
Observations	94	88	93	66	60	65
r^2	0.28	0.12	0.22	0.02	0.05	0.02

[a] *Robust* t *statistics in parentheses.*
[b] *From Smith et al. (2003b).*
[c] *Human development index.*
[d] *Gross domestic product.*
[e] *Significant at 10%.*
[f] *Significant at 5%.*

Smith et al. (2003*b*) correlate the change in forest cover with mean governance score over a single period. The implications one can draw from such tests are unclear. An average cannot identify whether conditions are improving, deteriorating, or unchanged, so one cannot infer that improvements in governance would lead to increased forest cover. The problem here is that variation in cross-section carries no implications for (unobserved) variation in time series. It would be better to study how the stock of the natural resource changed in response to changes in governance. When we used Smith et al.'s (2003*b*) data to examine changes in forest cover and in governance, rather than their levels, the correlation between the change in governance and change in forest cover was −0.21, which is neither positive nor statistically significant. Simple correlations of levels cannot adequately capture the relationship between biological, economic, and political factors.

Elephants

Smith et al. (2003*b*) used similar techniques to analyze the relationship between corruption and populations of

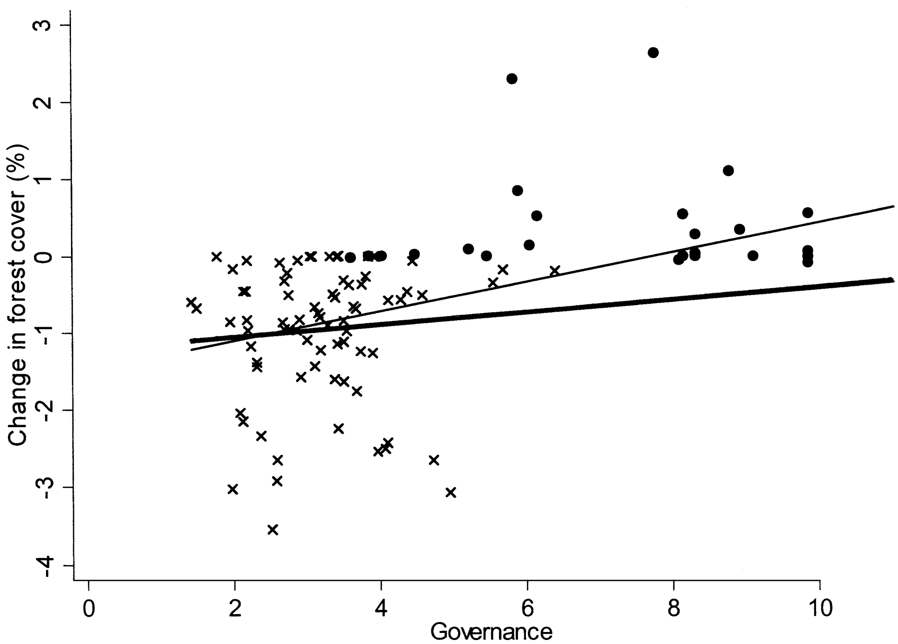

Figure 1. Forest cover and governance, as represented by Transparency International's Corruption Perceptions Index, in developing (Xs) and developed (circles) countries. The thick line with the relatively flat slope is the best-fit line for developing countries, and the thin line with the positive slope is the best-fit line for all countries. The governance score is an index from 0 to 10, with 0 being least corrupt and 10 being most corrupt.

African elephants and black rhinoceroses. As in their study of forests, they tested the effects of governance, per capita GDP, mean HDI, and mean population density, as well as a measure of spending per square kilometer of protected area within countries on changes in African elephant populations. In these tests the authors used stepwise regression and found that only mean governance scores for the period 1987–1994 explain the change in these populations. The authors conclude that "These results suggest that political corruption may play a considerable role in determining the success of national strategies to conserve these two flagship species, despite the international attention they both attract." Once again, these results are not robust. When we added more data from the same series and included omitted variables that are prospectively relevant, Smith et al.'s (2003*b*) results change completely.

Data exist for African elephants over three periods from the same data series that Smith et al. (2003*b*) used—the African Elephant Database 1987 (Burrill & Douglas-Hamilton 1987), 1994 (Said et al. 1995), 1997 (Barnes et al. 1999), and 2002 (Blanc et al. 2003). Smith et al. (2003*b*) used only 1987 and 1994 data, and we used their data, including three updated observations to the publicly available 1987 data, which Dr. Smith helpfully provided. The correlation between change in elephant population and national-level corruption was highly sensitive to specific time periods: the correlation was 0.40 between 1987 and 1997 but changed to −0.32 between 1997 and 2002.

Moreover, the regression results were not robust to inclusion of additional plausible control variables. Simply including a country's latitude changed the results fundamentally. Latitude in fact better explained change in elephant populations than the national corruption measure. Based on Smith et al.'s (2003*b*) data, a regression of the change in elephant population on governance and latitude yielded the following equation: change in elephant $= -73.8\ (<0.01) + 10.1 \times$ governance $(0.14) + -2.4 \times$ latitude (<0.01); $r^2 = 0.78$; $n = 20$.

A properly specified model of a species' population dynamics would include other factors that account for elephant population change, such as covariates reflecting basic anthropogenic and biophysical factors likely to affect elephant fertility and mortality. In a modest step in that direction, we regressed the annual growth rate in national elephant population on the natural logarithm of the lagged elephant population—the coefficient of which then reflected the effect of a 1% change in base-period population on the rate of growth, also measured in percentage terms, and rainfall, measured as two basic biophysical variables likely to affect population growth rates through recruitment rates. Because we expected forest and savannah elephants to respond differently at the same levels of rainfall, given the stark difference in their habitats, we used deviations from country-specific mean average annual rainfall levels during 1987–2002 as our explanatory variable (data from the Global Historical Climatology Network 2004).

We also added two important anthropogenic covariates: presence of civil war and tourists per hectare of protected area. The former is a dummy variable with a value of 1 if there was an intrastate conflict with more than 1000 human deaths; otherwise this value was 0 (Gleditsch & Ward 2004). Tourist data came from the World Bank (2004). Because no data exist on the actual spatial dispersion of tourists or on conservation enforcement levels over the sample time frame, tourists per protected area offer a very rough proxy because the presence of tourists can increase elephants through both the informal enforcement effect of tourists, increased government agents in the field due to tourists, and the incremental revenue tourists provide for conservation activities.

Finally, like Smith et al. (2003*b*), we included a measure of corruption. Standard measures of corruption provide a single, national level of corruption for a country annually. Smith et al. (2003*b*) used the corruption perceptions index (CPI) measure compiled by the organization Transparency Intentional (http://www.transparency.org/surveys/index.html). But CPI data do not cover the years for which they have data on their dependent variables, so they constructed their measure of corruption with another measure of corruption, from the International Country Risk Guide. These two measures of corruption are highly correlated and widely known. We used the latter because it covers the entire period under investigation and is thus more precise.

We hypothesize that growth rates are positively but nonlinearly related to population levels at the beginning period, positively related to rainfall and tourists, and negatively related to civil war (Table 2). The available data for elephant populations are from all periods covered by the African Elephant Database. Those who use these data, however, are specifically warned by the editors against using the data in comparative empirical studies because contributors to these reports use different counting methods over space and time, making any comparison between counts tenuous.

With these various caveats in mind, we regressed the growth rate of national-level data on elephant populations on its lagged level and our explanatory variables with a random effects panel-data estimator with a standard error correction to account for likely heteroskedasticity (Table 3). Results based on population levels rather than growth rates in elephant populations as the dependent variable yielded similar findings. The two anthropogenic factors—civil war and tourists per protected area—were significant predictors of African elephant population change. Civil wars were associated with reduced elephant populations, most likely through mortality (more humans with guns in these zones seek meat and cash) and elephant

Table 2. Hypotheses and variables used in the analysis of elephant populations.

Hypotheses	*Variables*
Previous level of elephants affects elephant population dynamics nonlinearly.	lagged elephant population level, from African Elephant Database (various years)
Rainfall affects fecundity/infant mortality and local labor supply for poaching.	change in 3-year average rainfall before elephant count (elephants have 24-month gestation) (Global Historical Climatology Network 2004)
Civil war increases elephant poaching.	occurrence of civil war in a country at the time of count (Gleditsch 2004)
Increased conservation enforcement decreases elephant poaching.	change in the number of tourists/hectare of protected area (World Bank 2004)
Corruption decreases elephant population due to increased, unsustainable (potentially illegal) offtake.	change in International Country Risk Guide measure of corruption

outmigration. Growth in tourism was positively associated with elephant populations, although the direction of causality in this relation was unclear. The corruption variable was neither significant nor positive as Smith et al. (2003*b*) found.

As one would expect, biophysical factors also mattered to elephant population stocks. Population dynamics appeared to be convex over the sample range in that estimated growth rates were positively and significantly related to the lagged stock level. Stocks were also increasing in deviation from national average rainfall, which others have attributed to rainfall's effect on elephant fecundity, infant mortality, and local labor supply for poaching (Barrett & Arcese 1998).

We do not argue that we have presented an airtight explanation of change in elephant populations. Our results are actually subject to many of the criticisms we made of Smith et al. (2003*b*), the foil we used to underscore our point that statistical inference with respect to the relation between governance and the state of natural resources is inherently suspect due to the complex nature of the relationship, the underspecified nature of the causal relation envisioned between corruption and biodiversity, and the dearth of good data. The point is that once we controlled for a few plausible anthropogenic and biophysical conditioning factors, estimated the effects in changes rather than levels so as not to confound cross-sectional and longitudinal variation, and incorporated additional observations from the same data sources, corruption levels no longer had any explanatory power. This once again underscores the fragility of apparent statistical relationships between measures of central government corruption and conservation outcomes, such as forest cover or the population of a protected species. Although anecdotal and simple statistical evidence leads observers to hypothesize about connections between corruption and conservation, empirical exercises that fail to model explicitly the pathways through which such effects might occur are likely to generate fragile, even misleading results.

Table 3. Random effects panel-data regression model for growth rate of elephants.

Variable	*Estimate (SE)*[a]
Log of lag level of elephants	0.02 (2.26)[c]
Civil war	−0.10 (3.95)[d]
Change in tourists per hectare of protected area	0.03 (2.22)[c]
Change in rainfall	0.08 (1.74)[b]
Change in corruption	0.03 (1.19)
Constant	−0.18 (2.39)[c]
Observations	45
r^2 (overall)	0.37

[a] *Absolute value of z statistics (based on robust SE).*
[b] *Significant at 10%.*
[c] *Significant at 5%.*
[d] *Significant at 1%.*

Conclusion

There is growing interest in explaining conservation outcomes through political processes. But conventional wisdoms about the ill effects of corruption on natural resources are dogged by underdeveloped theory, suspect data, and inappropriate tests. Given the state of theory and tests, inferences as to the complex relationship between governance and biodiversity should be made with great caution.

We have explored the hypothesized relationships between corruption and biodiversity. Corruption and environmental outcomes are commonly the result of sets of political and economic institutions at different levels that are weak or missing (Barrett et al. 2001). Corruption operates on different levels, is of different types, and will have different effects given different kinds of resources.

Consequently, corruption and natural resources might be related, but not in the causal ways commonly posited in simple models. Indeed, the causal relation, if any exists, could plausibly involve corruption reducing, rather than accelerating, natural resource degradation.

We also underscored the fragility of statistical results purporting to provide hard evidence on the links between corruption and biodiversity. Methodological weaknesses in such analyses arise due to the standard problem in observational data that there exists no natural experiment with proper controls already in place. Such concerns, although familiar to social scientists, are perhaps less mainstream within conservation science, although a large number of economic studies of tropical deforestation with relatively sophisticated methods have existed since the late 1980s (e.g., Kaimowitz & Angelsen 1998). Although an understanding of how governance—like corruption—affects resource outcomes is required for better policy making, simple statistical models may at best be misleading and at worst counterproductive. The links between national-level governance and natural resources are many and tangled. Additional work that attempts to bridge the social and natural sciences is clearly needed to better explain these important and complex relationships.

Acknowledgments

We thank R. Barnes, H. Gjertsen, T. Katzner, S. Lahn, D. Squires, and three anonymous reviewers for helpful comments on this study and R. Smith for helpful clarifications regarding the data and methods he and his colleagues used.

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