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Protected Areas and Spillovers on Corruption

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Aksel Sundström
Stephen Dawson
Sharon Pailler

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Abstract

Do nature protected area (PA) establishments change local corruption levels? This article presents a theory of spatial spillovers, predicting (a) less corruption in areas inside protection, through increased government oversight and (b) more corruption outside of PAs because of corrupt activities' displacement. To test these expectations we match geo-spatial information on the timing of the establishment of PAs in Africa with over 200,000 geo-coded Afrobarometer survey respondents. Our difference-in-differences approach finds little evidence of reductions in corruption inside PAs. However, we report an increase in experiences with bribery for respondents living in adjacent areas. Mechanism tests demonstrate an increased presence of police officers in these areas as well as larger effects in areas around PAs that attract tourists. We contribute to insights on linkages between conservation and government quality, a relationship with increasing relevance due to the expansion of PAs around the world.

Aksel Sundström
The Quality of Government Institute
Department of Political Science
University of Gothenburg
aksel.sundstrom@pol.gu.se

Stephen Dawson
The Quality of Government Institute
Department of Political Science
University of Gothenburg

Sharon Pailler
Research Director, ASPCA

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1 Introduction

Environmental regulations, such as protected areas (PAs), are crucial to meet global biodiversity preservation targets and described as the 'last line of defense' for conserving nature (Joppa, Loarie, and Pimm 2009). Yet, PAs are repeatedly discussed in relation to corruption in government. Robbins' (2000) theory of 'rotten institutions' suggests that behavior such as bribery corrodes PAs, as it makes officials lax in enforcing rules to hinder violations. This matters since fear of misappropriation of funds can discourage international donors to finance conservation schemes in the Global South (Packer and Polasky 2018). The presence of corruption in government institutions and conserving biodiversity through PAs are therefore both two policy goals of high relevance. However, knowledge of how the two processes are related is underdeveloped (Hanson and McNair 2014). Similarly, economists and political scientists such as Ferraro (2005) and Barrett et al. (2006) note that links between corruption and environmental regulations are more complex than often assumed. This article provides a new perspective to this discussion by analyzing the impact from the establishment of PAs on the spatial distribution of local corruption.

We aim to gain a further understanding of spillover effects, in the form of changes in local corruption, from PAs. We ask: To what extent do PAs affect local levels of corruption experiences and perceptions? We outline a theoretical framework of how PA establishment can reduce local corruption *inside* the area due to (i) the inflow of staff that are motivated to uphold rules and not entrenched in local networks, (ii) the perceived spotlight from central authorities on officials in sectors beyond conservation and (iii) a disruption of how resources are extracted. A further spatial implication of our argument is that the benefits within PAs might be coupled with negative changes *outside* these areas, as some corrupt behavior could move to nearby locations with less scrutiny and new opportunities for illicit payments. Our reasoning has observable implications with regards to heterogeneity of these effects that depend on park governance structures, the displacement of police activities, and the level of tourism a PA attracts.

This argument is relevant beyond the discussion of nature protection and ties into literature which holds that experiences with state institutions can affect people's view of government (Kumlin and Rothstein 2005; Martinangeli et al. 2024). The larger question in this article therefore speak to a larger discussion related to challenges associated with combating illicit behavior through institutional design: whether regulations give rise to 'red tape' and new room to maneuver for rent-seeing bureaucrats (Kaufman 1977) or, to the contrary, if regulations result in less misbehavior (Levi 1988; Ostrom 1990).

We investigate this question focusing on the context of the African continent, a region where many countries have invested considerably in conserving biodiversity through PAs, whilst at the same time battling bribery in local authorities. We match the geo-spatial data on the establishment of PAs with the location of close to 215 000 Afrobarometer survey respondents in 30 countries, between 2002-2018. Our focus is on changes in perceived and experienced local corruption. We use a generalised difference-in-differences (DiD) approach with inverse probability of treatment weighting (IPTW) and PA fixed effects to compare individuals inside and close to PAs with those living far away. We also compare individual living inside or close to PAs with the same areas prior to PA establishment. To test the mechanism of how PAs can affect local corruption, we develop novel data approaches regarding the location of tourist attractions and their proximity to PAs using OpenStreetMap (OSM) data.

Contrary to our first expectation, the results from our DID estimations suggest little difference between those living inside a PA and those living far away from a PA. However, we note a significant increase in local corruption in areas outside of PAs, and increases are stronger for those who live within 10km of a PA. These results are particularly robust regarding experiences with having paid a bribe to the police in those areas. While we find little evidence that increased central scrutiny can deter corruption in PAs, we do detect a displacement of the police to the areas surrounding PAs and stronger effects for perception and experience-based measures in areas around PAs with a considerable – but not very large – level of tourism activity.

This article contributes to three different veins of research. First, our focus complements the small but growing number of studies on the politics surrounding PA establishments (Alger 2023; Beacham 2023, 2024; Mangonnet, Kopas, and Urpelainen 2022), by providing the novel insight that such establishments may also impact local institutional quality. Second, our finding that the introduction of PA institutions can increase bribery in areas outside state authorities' attention speaks to work in the corruption literature on displacement effects from anti-corruption programs (Dávid-Barrett and Fazekas 2020). Third, this article provides a new perspective to a scholarly discussion on the influence from natural resource conservation, which largely has focused on the broader societal impact from PAs (West, Igoe, and Brockington 2006) and the socio-economic impact from such establishments (De Sherbinin 2008; Andam et al. 2010; McKinnon et al. 2016; Naidoo et al. 2019). Finally, this article's findings has also relevance for policy, given recent international commitments in the UN global biodiversity targets to protect 30 percent of the Earth's surface by the year 2030 (CBD 2021; Michaelsen, Sundström, and Jagers 2024). There is, hence, a pressing need for a range of actors to understand the nuances of how PA establishments may impact local institutional quality.

2 Prior research on corruption, natural resources and PAs

PA regulations are instrumental to achieve sustainable outcomes, where harvesters are limited in their resource use (Dietz, Ostrom, and Stern 2003). If efficiently managed, PAs may be a successful strategy to uphold biodiversity (Nolte et al. 2013; Muñoz Brenes et al. 2018). This insight matters since governance of reserves in low-income countries are often malfunctioning in practice (Gibson, Williams, and Ostrom 2005; Halpern 2014), especially due to corruption, the misuse of public power for private gain (Robbins 2000).[1] Studies suggest that large-scale corruption reduces decision-makers' tendency to designate areas as protected (Amacher 2006).[2] Our focus is instead on small-scale transactions which can take a myriad of shapes, such as favors and kickbacks, but often is thought of as bribes.[3]

Bribery cripples conservation regulations and studies across regions illustrate how this takes numerous shapes; First, it increases access to PAs since people may

[1] There are national-level correlations between corruption levels and, for example, deforestation (Koyuncu and Yilmaz 2009).

[2] E.g. large farmers in Latin America that bribe politicians for subsidies to convert lands (Barbier, Damania, and Léonard 2005; Bulte, Damania, and López 2007).

[3] Termed *petty* corruption, involving officials (to be contrasted to *grand* corruption that targets decision makers), divided into collusive acts (where officials turn a blind eye to law violations) and non-collusive, when officials ask for payments for services citizens are entitled to (Smith et al. 2003).

collude with officials to gain entry (Hanson and McNair 2014). Second, it affects usage intensity, as bribes can allow harvesting exceeding permitted limits (Sundström 2013). Third, such payments help officials to lure landowners from land which is sold to companies seeking to extract resources (Chayes 2017). Fourth, bribery enables industrial actors to initiate activities in PAs (Beevers 2015). Fifth, it may make resources harvested inside PAs appear legal through the falsification of documents (Smith et al. 2003). Sixth, bribery assists the smuggling of illegally harvested goods across borders (Gore, Ratsimbazafy, and Lute 2013). A final illustration is how conservation funds are pocketed, through e.g., selling monitoring equipment or hiring 'ghost employees' as rangers that in reality does not exist (Cavanagh 2012), or how funds for benefit-sharing only reach local leaders (Smith and Walpole 2005).

This suggests that corruption erodes the effectiveness of PA management. Yet, as Katzner (2005) notes, the relationship between corruption and conservation is highly complex and Barrett et al. (2006) describe these links as "many and tangled" (p. 1365). To date, we lack a clear understanding of spatial spillovers from PA institutions on local levels of corruption. This hints at a blind-spot in the literature. Regarding definitions, spillover effects is a term used to describe unintended effects from individual behavior (Truelove et al. 2014). We extend this concept to be understood as unintended effects on local levels of corruption from PA regulations.[4]

[4]Our use of this term differs from conservation scientists, denoting spillovers as effects on animal populations outside a PA (Stamoulis and Friedlander 2013). There is also a discussion in management studies on spillovers between organizational levels, e.g. when the public's perception of legitimacy of one actor has an impact on the legitimacy of other actors (Haack, Pfarrer, and Scherer 2014).

3 Theory

3.1 Changes in corruption norms

Corruption is a 'wicked problem', both difficult to spot and change (Rose-Ackerman 1999). It matters how widespread it is locally and how ingrained it is in norms that structure citizens' and officials' interactions (Bardhan 1997). When corruption is rife, changes are difficult as citizens and officials often infer that most other actors will engage in bribery (Dong, Dulleck, and Torgler 2012). Anti-corruption scholars grapple to understand how such equilibriums can be shifted and whether incremental reforms can set in motion virtuous circles of reduced corruption or if only overhauls of change across sectors is what works (Rothstein 2011).

Attempts to tackle corruption often center on shifting the costs and benefits of bribery, and has involved external efforts to break up established networks. An example is staff-rotation schemes, instigated to hinder officials to establish ingrained ties with locals (Fjeldstad 2003). Importantly, changes in corruption in one specific sector might create ripples, leading to transformations across spheres in the community. Isaksson and Kotsadam (2018) theorizes on how events that lead to change in corruption can have effects beyond the directly affected sector. If external events or actors manage to "establishing standards of conduct that delegitimize and stigmatize corrupt practices" (p. 147), these notions can travel in the locality. They argue that such events "could potentially influence social norms and thereby instigate institutional change" (p. 147). A further way to understand local diffusion of norms about bribery draws on the perspective where corruption is seen as a collective action problem: When people think that a sufficiently large portion of officials and neighbours are engaged in – or reject engagement in – bribery, it shapes their overall impression of state authorities (Persson, Rothstein, and Teorell 2013). We believe such considerations to be in play when people's corruption perceptions in a community are affected by institutional change.

3.2 How PAs could affect perceptions and experiences of corruption

The establishment of PAs may shape a range of attitudes of people in their vicinity, including; motivations to preserve nature (Agrawal, Chhatre, and Gerber 2015), perceptions of state authorities (Macura et al. 2011), and trust towards conservation management (Gillingham and Lee 1999). We deem it likely that people's assessments of officials' tendency to engage in bribery are also malleable to events following the establishment of a PA. With regards to the area *inside* of PAs, we suggest that we could witness a *decrease* in corruption and that this could happen because of one or several of three different processes, outlined below.

(i) Inflow of new and educated staff

When PAs are introduced to a locality, there might be an inflow of new personnel tasked to manage the area, such as rangers, service staff or people handling tourists. Given that these people come from the outside, they are possibly not as embedded in local networks of bribery as residents. This introduces uncertainty among actors (of whom might tell authorities if bribes are suggested and established patterns of favors) and therefore could disrupt local equilibria of corrupt practices. This notion mirrors the idea that bureaucrats that are new to a locality are less likely to ask for bribes because they are not yet familiar with entrusted networks (Abbink 2004).

Moreover, the personnel in PAs could very well be trained in conservation practices and uphold certain professional norms of combating poaching (and factors facilitating poaching, such as corruption). In other words, there might be a different 'ethos' among staff with conservation education and training. If PA institutions that are established include staff that are well educated and manage to uphold an esprit de corps — i.e., the feeling of loyalty among civil servants to an organization's goal (Rauch and Evans 2000) — with a norm of protecting resources, this could make them committed not to take bribes when interacting with officials or citizens. This idea resonates with Kaufman (1960), who studies how forest rangers uphold a culture where employees internalize certain professional values and are not captured by local interests. An ideal outcome after the insertion of staff from central authorities could therefore be one of personnel that abstain from taking or paying bribes, setting an example of how impartial servants are meant to act. In such a scenario, PAs could function as 'pockets of efficiency' in otherwise dysfunctional settings (Evans 1989).

(ii) Perceived spotlight from central authorities

With investments in protecting an area from exploitation, there will be an increase in monitoring and surveillance from central authorities. This can be about rangers employed in the PA, but also about more fiscal controls, as these investments are likely coupled with instruments such as audits and other means to ensure that funds are not siphoned off. In sum, this could create the perception that the locality is now under the 'spotlight' of central authorities, with more scrutiny of what happens in an otherwise distant locality. Such increased scrutiny could plausibly affect practices in sectors beyond conservation. For instance, a policeman that regularly ask for fees from drivers (to make them evade charges), could now perceive more risks with their practices. Behavior that was previously normalized could now be associated with a higher risk of reprimands from central authorities. The feeling of increased surveillance from the center in PAs could make officials more cautious in everyday practices in these areas. This is in line with ideas that institutional reforms hinder corruption if they introduce uncertainty among bureaucrats that change the calculus that one can violate rules without being sanctioned (Rose-Ackerman 1999). We suggest that changes in corruption practices will create ripples in the local community, where PA establishments affect local officials' and citizens' tendency to be involved in bribery in areas becoming protected. The process we envision is one of norm transmission: seeing that the newly-arrived conservation staff are less corrupt could have an effect on peoples' perception of state authorities in general. That is, we build on the suggestion that external events can affect local standards of whether the use of bribery is condemned or not (Knutsen et al. 2017; Isaksson and Kotsadam 2018) and we assume that people's assessment of whether to engage in local corruption or not will be affected by their perception of how other people act (Dong, Dulleck, and Torgler 2012; Persson, Rothstein, and Teorell 2013).

(iii) Disruptions to resource extraction

The literature suggests that introducing PAs is often a process far from frictionless, as they present local residents with restrictions on harvesting activities they rely upon for their livelihood and, in a similar fashion, disturb activities of poachers in the area (Duffy and St John 2013; Gore 2017). Corrupt resource management institutions are 'rotten' (Robbins 2000). In such conditions, local networks can hamper attempts to conserve nature and resources are often accessed through corrupt deals with local power players that benefit from extraction, such as hunting game or collecting timber (Sundström 2016). Officials, such as policemen or clerks, can be involved in these deals by asking for money or favors in return for access to restricted areas. In dysfunctional local institutions, the role of entrenched and long-lasting relations is important, as predictability in people's tendency to engage in bribery lowers transaction costs in corrupt deals (Lambsdorff 2002). Having a PA established in such settings could disrupt these activities, by setting up a stricter regime, and a system of monitoring. With the presence of rangers, there will likely be a stark change in how people can extract resources and officials opportunities to benefit from this. If the PA institution manages to uphold standards, it might affect people in the area not being able to engage in rule violations, facilitated by payments to officials.

We acknowledge that the above reasoning could build on an idealized view of PA governance, and we hold it as plausible that there are many cases on the African continent where rangers are recruited locally, where these establishments are not meaningful enough to alter local status quo and where resource extraction is not significantly altered and could even give rise to new opportunities for corrupt behavior. Still, all things alike, we expect areas inside PAs to witness a change and formulate the following expectation:

Hypothesis 1 *Areas where PAs are established experience a decrease in local corruption perceptions and experiences.*

An implication of our spatial framework is that the benefits of reduced practices of corruption within PAs might be coupled with negative changes outside these areas. We suggest that this could take place because of processes of ’displacement.’ If actors were to perceive that the increased spotlight from state authorities’ attention reduce their income from bribery, it is possible that they for rational reasons would relocate their practices to areas with less perceived scrutiny from the center. From this follows that we would see a displacement of some behaviors that are associated with corruption. This should refer to corruption-related activities that are spatially flexible: police can set up random checks along roads (“shakedowns” to collect an extra toll on travelling residents) in areas where central authorities are less visible. This might push e.g. aspects of police corruption out from areas turned to PAs. It could also refer to people in the locality choosing to work elsewhere (e.g. the teacher wishing to hold a position where absenteeism is not perceived as a risky behavior). In other words, officials in area X that are accustomed to use corrupt behaviors to increase their income (e.g., clerks that take extra fees to provide their public services) are incentivized to relocate such practices to neighboring areas outside of X after it has become protected. This reasoning has similarities to the argument about unintended effects from anti-corruption reforms by Dávid-Barrett and Fazekas (2020), suggesting that those wishing to engage in corrupt activities have reasons to avoid sectors that are tightly controlled by authorities. We build on this insight and propose that these considerations could be geographical in nature. In sum, we suggest that we should observe an increase in local levels of corruption experiences and perceptions outside of PAs, that decrease with the distance from these borders.

Besides displacement of activities, the areas outside of PAs might also function as 'honey pots', in the words of Knutsen et al. (2017), where officials such as police officers are attracted because of new opportunities of side payments. It is plausible that areas outside of PAs pull actors that seek lucrative ways to get illicit side payments. Anecdotally, it is illustrated that areas near PAs are considered 'plum posts' (highly desired positions) that are profitable for police officers, because they enable a toll on economic activities (Petchkaew 2023). As such, this reasoning would imply that we should expect an increase in police presence in areas outside of PAs. Further, there is important heterogenity between protected areas. PAs that attract domestic and international flows of tourism (because of e.g., scenic views, safari tours or hunting opportunities) stand in contrast to those that do not, because the presence of tourists and surrounding economic activities also enable opportunities for bribery. This points to the expectation that PAs that attracts visitors and tourism investments are likely those where we would expect to see larger increases in corruption in the buffer zones outside of PAs. We therefore expect:

Hypothesis 2 *Areas outside those where PAs are established experience an increase in local corruption perceptions and experiences.*

4 Data and approach

4.1 Data

4.1.1 Survey data

We examine the effects of PAs on local corruption in Africa. To do so, we use geocoded Afrobarometer data, linking clusters of survey respondents (enumeration areas) to GPS-points (BenYishay et al. 2017).[5] The Afrobarometer Data (2016) survey collects information about public attitudes surrounding governance and corruption, as well as basic demographic information. We use data from rounds 2-7 (2002-2018), as some of the variables of interest in round 1 were not consistent with the other rounds. This results in a final sample of 228,360 survey respondents across 22,173 enumeration areas.

We focus on two items that estimate local corruption. One question captures corruption perceptions. Respondents were asked: "How many of the following people do you think are involved in corruption, or haven't you heard enough about them to say?" Here, we focus on the question that relates to the police. Answers are coded on a 0-3 scale, with higher values indicating more widespread corruption.[6] A second question gauges experiences with corruption and reads: "In the past year, how often (if ever) have you had to pay a bribe, give a gift, or do a favor to government officials in order to avoid a problem with the police?".[7] We recode these answers to a dummy variable which equals '1' if an individual has paid a bribe to police in the past year, and '0' for those that responded 'Never'.

4.1.2 Proximity to protected areas

For protected areas (PAs), we rely on the World Database on Protected Areas (WDPA) (UNEP-WCMC et al. 2019). The WDPA is part of a collaboration between the UN Environment Programme (UNEP) and the International Union for the Conservation of Nature (IUCN) and stores the characteristics of protected areas (such

[5]The Afrobarometer survey draws a clustered, stratified, multi-stage, area probability sample. See Appendix A2 for information of the countries sampled in each survey round.

[6]Respondents could respond "All of them", "Most of them", "Some of them" and "None".

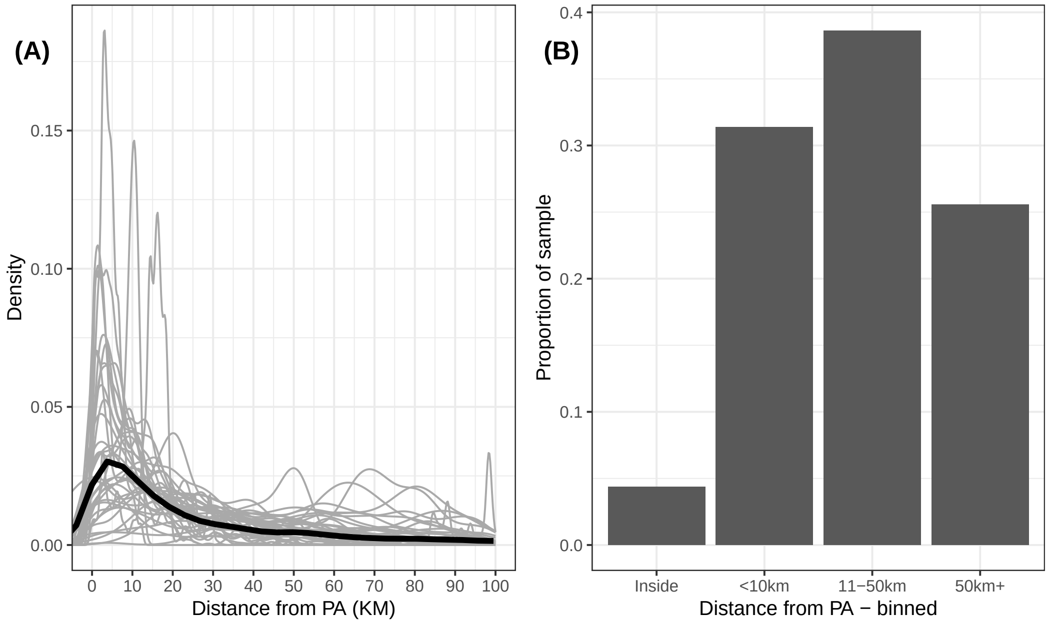
[7]Respondents could respond "Never", "Once or twice", "A few times", and "Often".

as their name, year of establishment, size, governance structure, etc.) as well as their precise geographic location. PAs are recorded as spatial polygons or points that approximate PA centroids. As we are interested in differences between those who live on either side of the border of a PA, we consider only polygon geometries in this study.[8] The WDPA is compiled by a combination of governmental and non-governmental agencies who report information about PAs in their territory to Protected Planet. The completeness of the data for PAs therefore varies considerably between countries, though each country in the Afrobarometer is also present in the WDPA.

We capture the proximity of respondents to PAs in several ways. First, and for the purposes of testing hypotheses, we create a series of variables for each survey enumeration area (typically a city, town or village) that indicate whether that enumeration area lies within a PA, or within a series of distance ranges outside of at least one PA (10km and 50km) within the same country. In cases where an enumeration area lies within a certain range of several PAs, we also record the count of PAs within this range. In addition, we also calculate the proximity of respondents to the single nearest PA within the same country, as well as the characteristics of this PA as recorded by the WDPA.

[8] Examples of the few type of features we do not capture are, thus, monuments or certain rare heritage sites, which in all only a very small portion of the data.

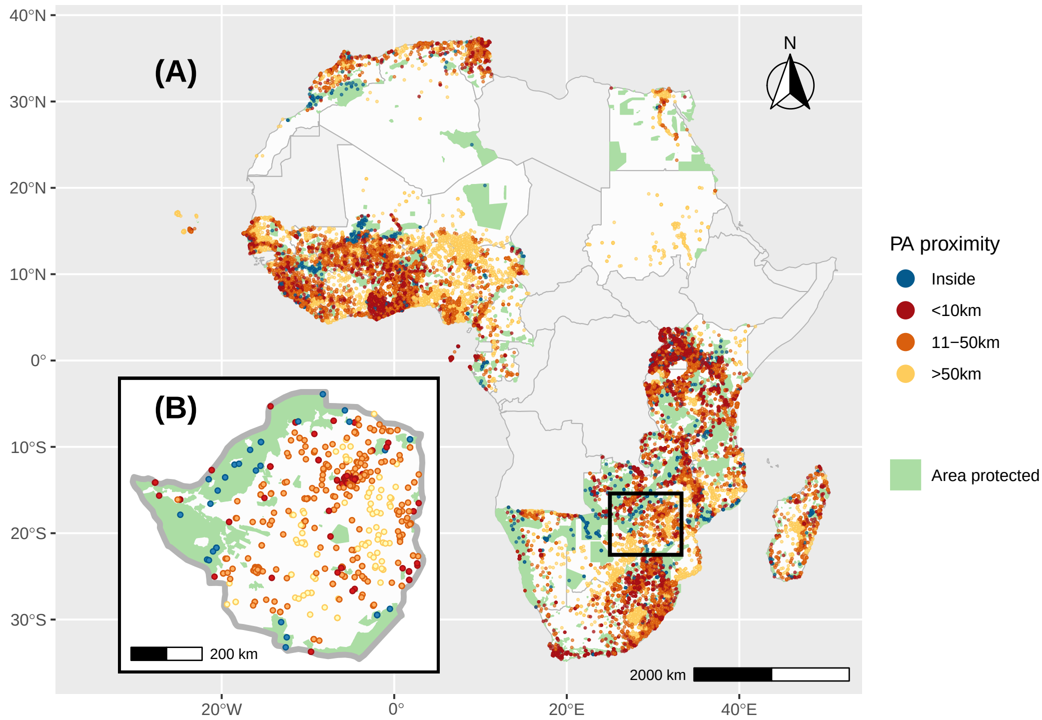
Figure 1: Proximity to protected areas



Note: Light grey lines in Panel A represent individual countries, while the thick black line represents the pooled density.

Figure 1 illustrates the distribution of our sample across space relative to protected areas, using the proximity to the closest PA in the same country. We consider everyone who lives inside a PA equally, regardless of their proximity to the border from the inside. Considering those outside of PAs on a continuous scale and those on the inside categorically may introduce bias to our estimates. We therefore also present the data in distance bins to compare groups who live in or to varying degrees outside protected areas. This is illustrated in panel B in Figure 1. The figure demonstrates that around 4% of the sample (close to 10,000 respondents) live inside an existing PA. Panel A in Figure 2 maps protected areas and the geo-location of respondents from the Afrobarometer, colour-coded by their proximity to their nearest PA. Panel B magnifies the Zimbabwean case to more clearly demonstrate the structure of the data.

Figure 2: Survey respondents proximity to protected areas: mapped



Note: Panel A shows the spatial distribution of protected areas (green) in Africa as of 2023 for countries in our sample. Afrobarometer enumeration areas are plotted as points, colored by their proximity to PAs at the time the survey was taken. Panel B shows a magnification of Zimbabwe as an illustrative example.

4.2 Empirical strategy

Our baseline regression estimates the linear effect of residing inside a protected area on perceptions and experiences of local corruption in the following way:

$$\text{corruption}_{icy} = \beta_1 \text{protected} + \alpha_j + \rho_y + \gamma X_i + \epsilon_{icy} \tag{1}$$

where the measure of corruption for individual i in enumeration area cluster c in year y is regressed on a dummy indicator of whether or not they live in a protected area, as determined by geocoded Afrobarometer data and the WDPA. In the case of H2, we are also interested in the areas immediately outside of PAs. We therefore estimate the following equation:

$$\text{corruption}_{icy} = \beta_1\text{protected} + \beta_2\text{<10km} + \beta_3\text{11-50km} + \alpha_j + \rho_y + \gamma X_i + \epsilon_{icy} \quad (2)$$

where the measure of corruption for individual i in enumeration area cluster c in year y is regressed on a series of dummy indicators of whether or not they live in a PA, within 10km on the outside of a PA, or between 11-50km outside of a PA. While in equation 1 the comparison group is all who do not reside inside a PA, whereas in the case of equation 2 the comparison group is those who live far away (>50km) away from a PA.

To increase causal inference, we use a generalized difference-in-differences design in our baseline models using country (α_j) and year (ρ_y) fixed effects. Country fixed effects control for time-invariant differences between countries, such as political institutions, whereas year fixed effects control for unobserved factors that vary over time but are constant across countries, such as international agreements or the value of natural resources. In all regressions we also control for a vector of individual level control variables (X_i), specifically age, education, employment status, gender and whether they live in an urban area. We also employ a more conservative approach in some models by including PA fixed effects – effectively limiting comparisons to individuals who live inside and outside the same PA.

4.3 Addressing endogeneity

Inherent in this approach is a risk of endogeneity since the location of PAs is non-random and and likely subject to not only biological and geological considerations, but also political and social. For example, protected areas may be less likely to be established in highly corrupt (though biodiverse) regions, as corruption can obstruct the enforcement of protection regulations and restrict economic benefits of conservation such as tourism. We therefore attempt to navigate this particularly acute risk by considering the likelihood of respondents (or more accurately enumeration areas) being protected in the first place.

To do this, we use propensity score matching to generate inverse probability of treatment weights (IPTW). In this procedure, we consider our treatment variable – residing inside a protected area – as the dependent variable that we regress on a series of predictors that may be responsible for the endogenous placement of PAs. Specifically, we estimated a logistic regression of local protection on local levels of biodiversity, the local human development, the proximity from the EA to the nearest worked valuable natural resource (gems, diamonds, gold and oil), whether the EA is in an urban or rural area, and whether the EA is in an ethnic homeland of a politically included group, as PA allocation can be subject to ethnic favoritism (Dawson et al. 2024). This model was used to generate propensity scores that together with actual treatment status are used to calculate the IPTW. This weight is then simply added to the regression equations outlined above. This approach effectively brings greater balance to treatment and control groups, by giving more influence to observations in protected areas that are most similar to observations in non-protected areas, and vice versa.[9]

5 Results

5.1 Main results

In Table 1, Models 1-2 and 5-6 present the results from equation 1. Models 3-4 and 7-8 investigate the spatial nature of the relationship outside of PAs referred to in equation 2. Results are presented for the two corruption measures: individual perceptions and experienced bribes. All models include country-year fixed effects, and models 2, 4, 6 and 8 include more conservative PA fixed effects.

Table 1: Main Analysis

	Perceptions				Bribes			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Protected Area	-0.007	-0.019	0.031	-0.009	0.006	0.000	0.011	0.007
	(0.018)	(0.021)	(0.020)	(0.023)	(0.008)	(0.009)	(0.009)	(0.010)
<10km			0.050***	0.004			0.008*	0.010*
			(0.010)	(0.011)			(0.003)	(0.004)
11-50km			0.047***	0.022*			0.005+	0.007*
			(0.009)	(0.009)			(0.003)	(0.003)
Num.Obs.	201148	201148	201148	201148	220791	220791	220791	220791
Country-year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
PA FE	No	Yes	No	Yes	No	Yes	No	Yes
R2	0.116	0.147	0.117	0.147	0.085	0.107	0.085	0.108
R2 Within	0.008	0.005	0.008	0.005	0.014	0.013	0.014	0.013

Note: The table reports OLS estimates. Robust standard errors clustered by enumeration area in parentheses. Unit of observation is the individual survey respondent. All models include inverse probability of treatment weights (IPTW). Significance levels: $^{***}p < .001$; $^{**}p < .01$; $^{*}p < .05$; $^{+}p < .1$.

Across the two measures, contrary to our expectations outlined in hypothesis 1, we observe no anticipated negative effect of living inside as opposed to outside a protected area on corruption levels. This is the case both for measures relating

[9] For the analysis and further discussion on the matching process, see Appendix C.

to perceptions of corruption in the police, and experiences with paying bribes to the police. When we introduce proximity range dummy variables, however, we observe indications of increases of corruption perceptions *and* experiences in the areas immediately outside PAs, relative to areas far away from PAs. Even in the more conservative specifications in models 4 and 8, there is a significant indication that areas outside the border of PA experience increases in local corruption. More specifically, model 8 demonstrates a larger increase in experiences with paying bribes to police the closer one lives to a protected area. Living witin 10 kilometers of a protected area increases the chances of an individual having paid a bribe to the police in the last year by roughly 1 percentage point which, considering the average likelihood of reporting having paid a bribe of 10.7%, is a substantial effect. Thus, while there is little difference in corruption perceptions and experiences between those living inside vis-á-vis outside PAs, we do find evidence that PAs can have negative side-effects on local corruption outside their borders, supporting our hypothesis 2.[10]

5.2 Robustness tests

In addition to making our primary comparison across space (those living varying distances away from PAs), we can also consider comparisons of the same areas at different points in time relative to the establishment of PAs. In this section, we use an alternative approach which directly compares individuals in each proximity range before and after the establishment of a PA (Isaksson and Kotsadam 2018; Knutsen et al. 2017). Each model presented in Table 2 also contains PA fixed effects,

[10] For an analysis of alternative corruption items, see Appendix Table A.3.

constraining the comparison to individuals who lived inside, or close to the *same* PA before and after its establishment. The number of observations is significantly reduced with this approach – particularly in the case of models 1 and 3 – due to the limited number of observations in areas pre-PA establishment. The results of this alternative approach are very similar to those presented in Table 1, and in fact demonstrate a greater magnitude effect of living outside PAs on local corruption relative to the same areas before those PAs existed.

Table 2. Alternative approach

	Perceptions			Bribes		
	(1)	(2)	(3)	(4)	(5)	(6)
Active PA	0.034			-0.011		
	(0.097)			(0.027)		
Active PA <10km		-0.004			0.017*	
		(0.025)			(0.008)	
Active PA 11-50km			0.055*			0.015+
			(0.026)			(0.009)
Num.Obs.	9627	79305	156030	10580	85551	169478
Country-year FE	Yes	Yes	Yes	Yes	Yes	Yes
PA FE	Yes	Yes	Yes	Yes	Yes	Yes
R2	0.196	0.153	0.140	0.170	0.120	0.112
R2 Within	0.005	0.004	0.004	0.012	0.013	0.013

Note: The table reports OLS estimates. Robust standard errors clustered by enumeration area in parentheses. Unit of observation is the individual survey respondent. Each model directly compares areas around active and inactive PAs. All models control for PA and country-year fixed effects. Significance levels: ***p $<$ .001; **p $<$ .01; *p $<$ .05; $^{+}$p $<$ .1.

5.3 Mechanism test: Central oversight and state officials

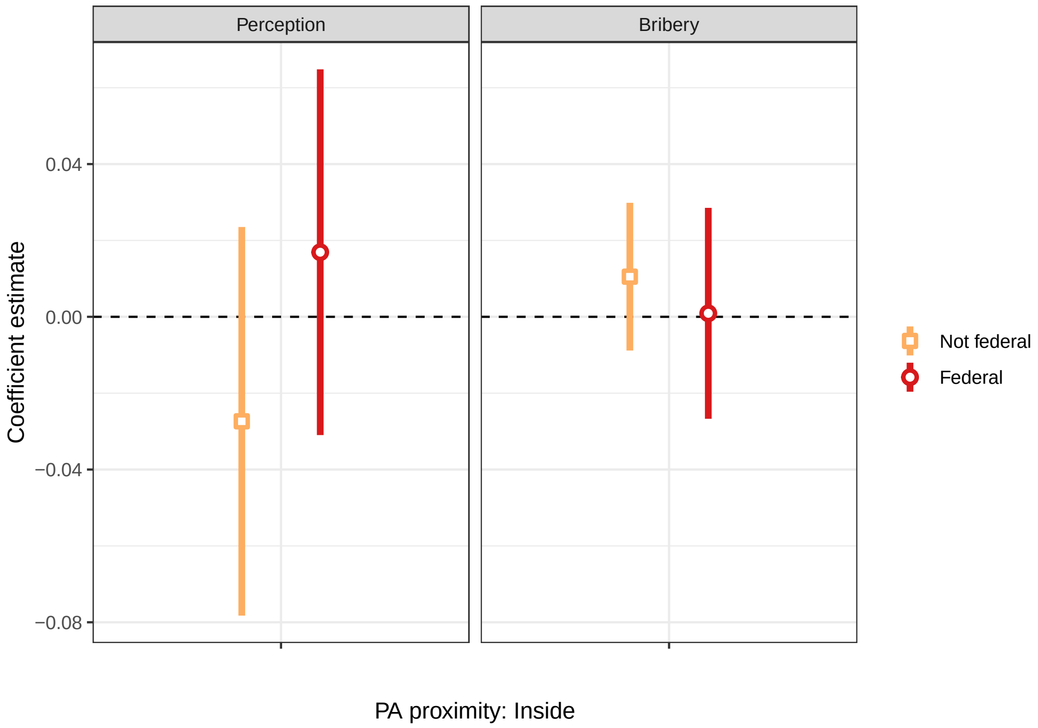
In addition to these baseline results, we also consider several mechanisms through which we contend that living inside or close to PAs may affect local corruption.

First, we suggest the effect on the area within a PA to be particularly acute when the PA is centrally governed by national or federal agencies. The inflow of educated staff, perceived spotlight from central authorities, and disruptions to resource extraction should all be more pronounced in PAs governed by the state (e.g., national parks). Because these parks tend to be associated with much more investments from government – often being denoted a national park because of more precious biodiversity and visitor potential – there is much higher stakes at making sure funds invested are allocated correctly. As such, it is possible that state governed PAs will be associated with more spotlight from central authorities than those managed by NGOs or private actors.

To investigate this aspect, we replicate Models 1 and 5 from Table 1 and create a new set of distance dummy variables that indicate whether a survey respondent lives inside or close to a centrally governed or non-centrally governed PA, respectively. This information is derived from the WDPA. We collapse the classifications detailed in the WDPA and consider here the distinction between those governed by federal/national agencies and otherwise. The second group contains PAs governed by subnational agencies, individual/private organizations, non-state bodies, and those for which information is not recorded. Federal PAs comprise around 50% of protected areas in our sample. In this set-up, our expectation is that corruption will decrease inside federal PAs relative to non-federal PAs.

Figure 3 presents a coefficient plot of the heterogenous effects of PAs with different governance structures on perceptions and experiences of corruption in the police. Results do not suggest a significant difference between the effects of federal and non-federal PAs for those living inside those areas. This is the case for both corruption measures. We do therefore not find support for the idea that governance structure is responsible for the effects of PA establishment on local corruption.

Figure 3: Disaggregating effects by park governance type



5.4 Mechanism test: PAs as honeypots

An alternative mechanism proposed to explain the increase in corruption levels outside of PAs is that PA establishment brings with it the creation of economic opportunities and development in conservation and tourism-related industries. In this section we test the viability of this mechanism by investigating two observable implications: (1) there should be an increase in police presence in the areas surrounding PAs and (2) the effect of PAs on corruption should be moderated by the extent of tourism related to the PA.

First, corrupt officials such as police officers should be attracted to operate in the areas surrounding PAs to illicit bribes in return for access to them and/or the extraction of resources from them. We therefore anticipate a greater presence of police officials in the areas surrounding PAs. We test this by utilizing questions answered by the Afrobarometer survey enumerators on whether they witnessed any police officers or police vehicles in the enumeration area. In Table 2, we use a similar approach to our main analysis, though the unit of analysis is the enumeration area-year. We present two models: one with country-year fixed effects, and one which adds district (administrative area level 2) fixed effects for a more conservative specification, effectively comparing the effect of proximity to protected areas on police presence *within* districts. We also control for whether the enumeration area is in an urban area.

In line with expectations, Table 2 indicates that police officials are more present in areas immediately outside PAs. Moreover, enumeration areas within 10km of the borders of a PA are the most likely to see an increase in the levels of police officials on the ground. Based on a comparison within districts in model 2, we report approximately a 4 percentage point increase in the likelihood of the police being present in an enumeration area within 10km of a PA compared to enumeration areas over 50km away from a PA. The baseline likelihood of police presence in enumeration areas in our sample is 30.9%.

We test the moderation effect of tourism by considering heterogenous effects across PAs that attract different levels of tourism. While some PAs such as strict conservation areas are to varying extents closed off to visitors, others - such as national parks - attract tourists in large numbers, generating considerable economic

Table 3: Police Presence

	(1)	(2)
Protected Area	-0.014	0.017
	(0.027)	(0.031)
<10km	0.022*	0.039*
	(0.010)	(0.017)
11-50km	0.019*	0.032*
	(0.009)	(0.015)
Num.Obs.	26171	26022
Year FE	Yes	Yes
Country FE	Yes	No
District FE	No	Yes
R2	0.169	0.367
R2 Within	0.075	0.056

Note: The table reports OLS estimates. Robust standard errors clustered by enumeration area in parentheses. Unit of observation is the enumeration area-year. All models include inverse probability of treatment weights (IPTW). Significance levels: $^{***}p < .001$; $^{**}p < .01$; $^{*}p < .05$; $^{+}p < .1$.

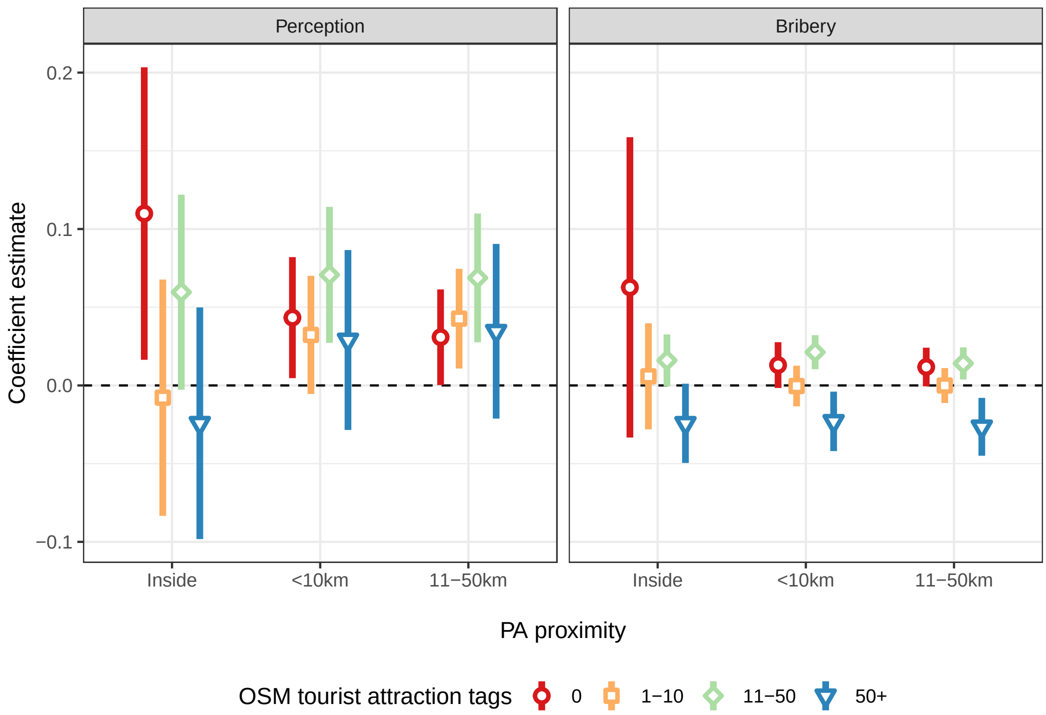
activity within and around those parks. To measure the level of tourism relating to PAs in the African continent, we utilize tourist attraction geo-referenced point data from OpenStreetMap (OSM) and carefully created a set of original variables for this purpose. We identify any OSM point entry that includes a tourism ″tag″, the most common of which in our case being ″hotel″, ″guest house″, or ″viewpoint″ (see a description and discussion of this data collection and construction of these variables in Appendix A2). We merge these tags with the WDPA polygon data by adding a 10km buffer around each PA and counting the number of tourism tags that fall within each of these buffers.[11] This results in a number of tourism tags for each PA, which we equate to more or less tourism. We then recode this into an ordinal variable with four levels: PAs with 0 tourism tags (40.2% of PAs), those with

[11]We use a 10km buffer as tourist-related institutions are frequently located outside rather than inside PAs. Nevertheless, we analyse a variety of buffer ranges in the appendix, and correlate these with a subsample of PAs where tourist visitor numbers are recorded and available. The 10km buffer correlated the highest with these visitor numbers (R=0.85).

1-10 tags (35.9%), those with 11-50 tags (17.3%), and those with >50 tags (6.5%).

Figure 4 presents a coefficient plot of the effect of these different groups of PAs on the two measures of corruption. These models replicate the approaches taken in models 3 and 7 in Table 1. While the effect does not appear to be linear across levels of tourism, there is indication that PAs with 11-50 tourism tags increase corruption to a greater extent than other levels, and this is fairly consistent across different corruption measures. Interestingly, however, the most touristic PAs (those with more than 50 OSM tags) are seemingly not conducive to increases in local corruption - and even appear to be associated decreases in bribery relative to areas over 50km away from these areas. This is perhaps indicative of a qualitative difference between PAs with very high levels of tourism and those where tourism is developing.

Figure 4: Disaggregating effects by the number of tourism attractions



6 Conclusion

This study takes a first step in considering the socio-political spillovers of nature protection. By considering the perspectives of citizens who live in, or close to, protected areas in Africa, we present evidence that the establishment of PAs can have unsavory consequences for levels of local corruption in adjacent areas. We present a spatial theory of the societal consequences of conservation institutions, and test derived expectations about areas inside and outside of PAs. Our findings point to little effect inside PAs themselves, but a marked increase in experiences of bribery in the areas surrounding PAs. Furthermore, we find evidence for an increase in police presence around PAs, and that areas around PAs with a developing tourism presence are at greater risk of corruption increases.

These findings provide new insights to our knowledge on the intricate linkages between institutional quality and nature protection areas. Specifically, we highlight that PAs may bring negative spillover effects — possibly by displacing corrupt activities out from these protected areas. This resonates with the caution voiced in the United Nations Anti-Corruption Toolkit: "reforms that increase uncertainties and the risk of criminal punishment or financial losses tend to reduce corruption.. [but] reforms must be broad-based and systemic, or corrupt conduct may simply be displaced into other areas or activities" (UNODC 2024, p. 20). It also speaks to the findings of Dávid-Barrett and Fazekas (2020), suggesting that actors engaged in corruption behave strategically to avoid tightly-controlled sectors. Our theory and empirical findings have novel implications and suggest that such strategies can also be geographical, as increased oversight in certain areas can create spatial spillovers to peripheral areas outside of government scrutiny.

While our tests are conservative, there are restrictions to inference that we must also be aware of with the data used. First, our data comes from several Afrobarometer rounds that sample different enumeration areas, so we are unable to consider the same respondents or even EAs (in most cases) at different points in time. We are also unable to corroborate whether the composition of EAs is comparable over time which can be problematic for over-time comparisons. For example, one of the primary human costs associated with protected areas is that they often result in the (oftentimes forced) displacement of local inhabitants. PA establishment is therefore likely associated with demographic shifts in the population. While this does not preclude our theoretical approach (rather we theorize about the relocation of corrupt individuals/practices to areas outside of PAs), it may restrict claims of causal inference. Nevertheless, we attempt to navigate these issue by basing our conservative estimations on comparisons between individuals living inside/close to and far away from the same PAs (while controlling for the likelihood of PA establishment in the area), as well as people living in the same areas before and after PA establishment. We therefore urge more research on this topic, using complementary types of methods and materials.

Understanding the effects from PAs on local corruption have high relevance, given recent trends in policy. The Kunming-Montreal Biodiversity Framework, ratified by 196 countries in 2022, sets the ambitious target to protect 30 percent of Earth's surface by the year 2030 (CBD 2021). On the African continent, such an expansion would translate to an average increase of about 50 percent of the area under protection. This highlights the pressing need to understand whether the establishment of conservation institutions may bring spillover effects on institutional quality and local corruption in government conduct.

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Supplementary Material

Table of Contents

A Additional Data

A.1 Afrobarometer

Table A1: Afrobarometer sample by country and round

Country	R2	R3	R4	R5	R6	R7
Algeria	0	0	0	1204	1200	0
Benin	0	1198	1200	1200	1200	1200
Botswana	1200	1200	1200	1200	1200	1198
Burkina Faso	0	0	1200	1200	1200	1200
Burundi	0	0	0	1200	1200	0
Cameroon	0	0	0	1200	1182	1202
Cape Verde	1268	1256	1264	1208	1200	1200
Côte d'Ivoire	0	0	0	1200	1199	1200
Egypt	0	0	0	1190	1198	0
Eswatini	0	0	0	1200	1200	1200
Gabon	0	0	0	0	1198	1199
Gambia	0	0	0	0	0	1200
Ghana	1200	1197	1200	2400	2400	2400
Guinea	0	0	0	1200	1200	1194
Kenya	2398	1278	1104	2399	2397	1599
Lesotho	1200	1161	1200	1198	1200	1200
Liberia	0	0	1200	1199	1199	1200
Madagascar	0	1350	1350	1200	1200	1200
Malawi	1200	1200	1200	2408	2400	1200
Mali	1283	1244	1232	1200	1200	1200
Mauritius	0	0	0	1201	1200	1200
Morocco	0	0	0	1196	1200	1200
Mozambique	1400	1198	1200	2400	2400	2304
Namibia	1199	1200	1200	1200	1200	1200
Niger	0	0	0	1199	1200	1200
Nigeria	2428	2363	2324	2400	2400	1600
Senegal	1200	1200	1200	1200	1200	1200
Sierra Leone	0	0	0	1190	1191	1200
South Africa	2400	2400	2400	2399	2390	1840
Sudan	0	0	0	1199	1200	888
São Tomé & Príncipe	0	0	0	0	1196	1200
Tanzania	1223	1304	1208	2400	2386	2400
Togo	0	0	0	1201	1200	1200
Tunisia	0	0	0	1200	1200	1199
Uganda	2400	2400	2431	2400	2400	1200
Zambia	1198	1200	1200	1200	1199	1200
Zimbabwe	1104	1048	1200	2400	2400	1200

A.2 OpenStreetMap data

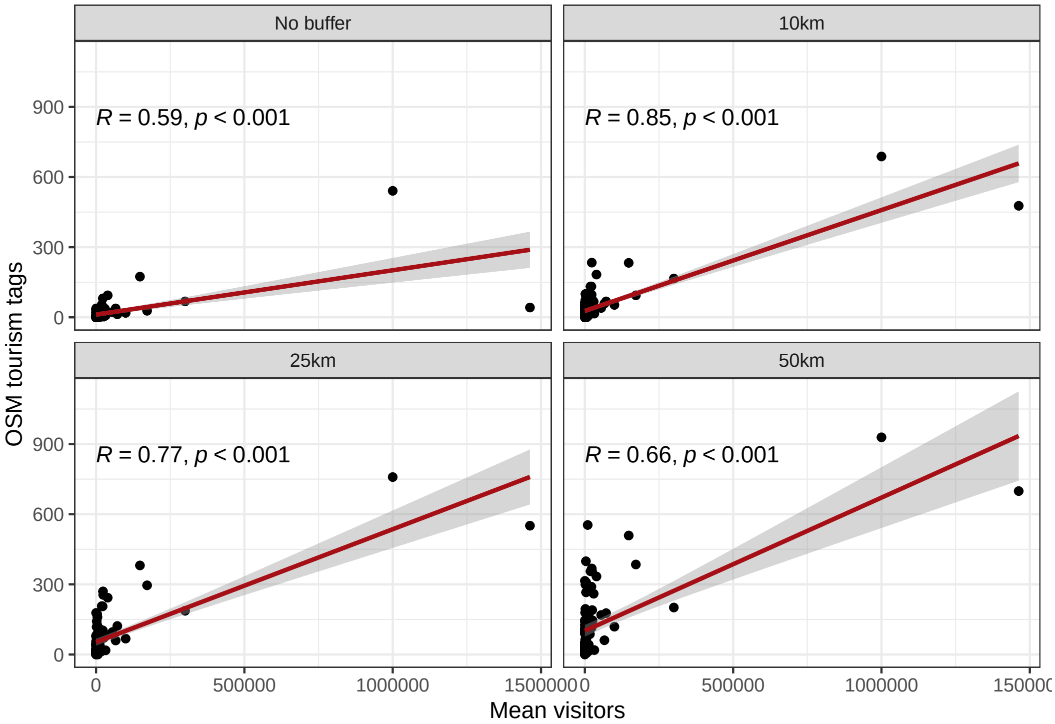
This section details the validation process of the OpenStreetMap (OSM) tourism tag data. Our approach is to rely on the data of Balmford et al. (2015) who estimate the number of visitors to PAs around the world 1998-2007. However, their analysis is based on around 500 PAs globally and 95 in Africa (compared to over 5500 in our African sample). We therefore look to OpenStreetMap: geo-spatial data based on user self-reporting of points of interest. In this instance, we consider all points that include a tourism 'tag'. Below, table A2 demonstrates the 10 most frequent tourism tags in the OSM data in Africa.

Table A2: OSM tourism tag frequency: top ten

OSM tag	Frequency
hotel	21768
guest_house	11293
viewpoint	8589
attraction	8426
information	8041
apartment	6398
camp_site	5560
artwork	4057
hostel	3045
picnic_site	1617

Our intuition is that protected areas with the most tourism tags inside – or in close proximity – on average attract more visitors. To validate this, we create buffers around PAs of varying distances (no buffer, 10km, 25km, 50km) and count the numer of OSM tourist tags within each PA + buffer zone. We then correlate this PA-specific figure to the Balmford et al. (2015) data for PAs where tourism numbers are available. Plots illustrating the correlation between tourism numbers and OSM tourism tags for each buffer are presented below. We use the 10km buffer as our preferred measure as it has the highest correlation with the number of PA visitors. This buffer is the basis of the tourism analysis presented in Figure 4 in the main paper.

Figure A1: Correlations between PA tourist visitor figures and OSM tourism tags in Africa across different buffers



A.3 Alternative corruption measures

Table A2: Replication of main results using alternative corruption measures

	Perceptions			Bribes		
	Police	Local council	Nat. gov	Police	Doc/permit	Service
Protected Area	0.031	0.039*	0.013	0.011	0.002	0.001
	(0.020)	(0.020)	(0.020)	(0.009)	(0.007)	(0.008)
<10km	0.050***	0.053***	0.040***	0.008*	0.004	-0.001
	(0.010)	(0.009)	(0.009)	(0.003)	(0.004)	(0.003)
11-50km	0.047***	0.029***	0.031***	0.005+	0.000	-0.005
	(0.009)	(0.008)	(0.009)	(0.003)	(0.003)	(0.003)
Num.Obs.	201148	187627	193503	220791	220818	220517
Country-year FE	Yes	Yes	Yes	Yes	Yes	Yes
R2	0.117	0.095	0.087	0.085	0.081	0.065
R2 Within	0.008	0.007	0.006	0.014	0.013	0.006

Note: The table reports OLS estimates. Robust standard errors clustered by enumeration area in parentheses. Unit of observation is the individual survey respondent. All models include inverse probability of treatment weights (IPTW). Significance levels: $^{***}p < .001$; $^{**}p < .01$; $^{*}p < .05$; $^{+}p < .1$.

B Matching

B.1 Approach

Given that the placement of protected areas is plausibly subject to similar human and societal factors as perceptions and experiences of corruption, we attempt to strengthen the causal inference of our approach by improving the balance between treatment and control group with regard to the likelihood of treatment. To do this, we implement propensity score estimation to generate the inverse probability of treatment weights (IPTW). This process effectively estimates the likelihood of a given enumeration area-year being treated (protected) based on a series of pre-defined covariates that could potentially influence both treatment assignment (PA establishment) and the outcome (local corruption). The propensity scores produced by this model are then used to calculate a weight that is assigned to each enumeration area-year for the main analysis. Effectively, more weight is attributed to observations that are less likely to be treated according to the PS model, and vice versa. This approach reweights the population to create a pseudo-population where the treatment assignment is independent of covariates. To guard against influential observations (those close to a PS of 0 or 100), we follow Cole and Hernán (2008) and calculate a stabilized IPTW as follows:

$$\text{Stabilized IPTW} = \frac{P(T = t)}{P(T = t \mid X)} \tag{A1}$$

where $P(T = t \mid X)$ is the predicted probabilities of a denominator model including covariates and $P(T = t)$ is the is the predicted probabilities of a numerator model (intercept only).

B.2 Application

As treatment is at the enumeration area-year level, we select covariated for the propensity score generation model based on their potential to influence both the spatial allocation of treatment and corruption perceptions and experiences. The denominator model also includes country and year fixed effects. The covariates selected are as follows:

- Biodiversity, as measured by the number of recorded species at a geographic location by the IUCN.
- Distance from the enumeration area to the nearest mineral resource (gems , diamonds, gold, and petroleum). Governments may avoid placing PAs in areas rich with mineral resources in order to facilitate extractive industries, which may also be more liable to corruption. These data come from the

Gemstone Dataset, Diamond Dataset, Goldata, and Petrodata, respectively (Balestri and Maggioni 2014; Lujala, Ketil Rod, and Thieme 2007).

- Whether the enumeration area is in an urban or rural area, as large PAs are unlikely to be in urban areas which may also be more corrupt. This variable is recorded by Afrobarometer enumerators.

- Whether the area is is the ethnic homeland of politically included/excluded area. While ethnicity is closely related to patronage networks in some communities in Africa, research also demonstrates an ethnic bias in the allocation of PAs (Dawson et al. 2024). This data is taken from the Ethnic Power Relations (EPR) geo-spatial dataset (Vogt et al. 2015).

- Human development. The development of a region is likely to relate closely to both the state's willingness and ability to establish protected areas and levels of corruption in the ares. This is measured by the Subnational Human Development Index (SHDI) at the admin 2 (district) level (Smits and Permanyer 2019).

Table A3. Binomial regression analysis used to generate propensity scores for matching

	(1)	(2)
Biodiversity	0.002***	
	(0.000)	
Distance to resource	0.002***	
	(0.000)	
Urban	-0.536***	
	(0.086)	
Ethnic inclusion	-0.452***	
	(0.097)	
SHDI	-7.411***	
	(0.821)	
Intercept	-3.810***	-3.229***
	(0.828)	(0.032)
Country FE	Yes	No
Year FE	Yes	No
Num.Obs.	26323	26323
AIC	7494.0	8523.8
Log.Lik.	-3691.003	-4260.894

Note: The table reports results of a binomial regression analysis. The unit of analysis is enumeration area-years. The dependent variable is whether an enumeration area is protected or not (0-1). Robust standard errors clustered by enumeration area in parentheses. Significance levels: $^{***}p < .001$; $^{**}p < .01$; $^{*}p < .05$; $^{+}p < .1$.

C References (Appendix)

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