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The importance of national political context to the impacts of international conservation aid: evidence from the W National Parks of Benin and Niger

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Abstract

National political context is widely understood to be an important factor shaping the ecological and socio-economic impacts of protected areas (PAs) and other conservation interventions. Despite broad recognition that national political context matters, however, there is little systematic understanding about *how* and *why* it matters, particularly in the context of PAs. This article seeks to advance empirical and theoretical understanding of the influence of national political context on the impacts of conservation interventions through study of an international aid project in a large transboundary PA in West Africa. It uses multilevel regression analysis to analyze the variable effects of changes in enforcement—a central mechanism through which the Protected Ecosystems in Sudano-Sahelian Africa project sought to achieve its objectives—in the W National Parks (WNP) of Benin and Niger. We find that differences in national political context relating to governance quality and extent of democratic decentralization moderated the social-ecological effects of enforcement. Increasing enforcement levels in Benin's WNP were associated with significant increases in mammal species abundance while having little average effect on the incomes of households around the Park. By contrast, greater levels of enforcement in Niger's WNP were associated with sharply decreasing income levels among Park neighbors but did not have a statistically significant effect on wildlife populations. These results highlight the importance of national political context to the outcomes of aid-funded conservation efforts. They suggest that state-led PA enforcement will have more positive social-ecological impacts in better-governed, more decentralized countries and that conservation policy centered on PAs should therefore devote greater attention to engagement with higher levels of governance.

1. Introduction

Protected areas (PAs) cover nearly 15% of African land and this figure is set to increase as countries strive to meet their commitments under the Convention on Biological Diversity (Juffe-Bignoli *et al* 2014). International aid has helped fuel this growth and remains the primary source of financing for PAs and other conservation measures across Africa (Bare *et al* in prep., Waldron *et al* 2013). Even as the area set

aside for protection grows, however, questions about the effectiveness of PAs and the aid flows that support them remain. While PAs have reduced deforestation rates in many contexts (Joppa *et al* 2008, Nelson and Chomitz 2011), species populations in PAs have declined across the continent (Craigie *et al* 2010).

Systematic understanding of the socio-economic impacts of PAs also remains lacking in Africa, where the issue is especially controversial given histories of

exclusionary conservation (Garland 2008), widespread rural poverty (World Bank Group 2015), and increasing competition over land (Peters 2013). Numerous case studies of the socio-economic impacts of African PAs are available, but quantitative evaluations that control for potentially confounding factors remain rare (Pullin *et al* 2013).

A new generation of research uses experimental research designs to shed light on the performance of conservation interventions and the mechanisms through which they generate ecological and socio-economic impacts (Miteva *et al* 2012, Ferraro and Hanauer 2014a). However, this literature has devoted little attention to the effect of governance factors generally (cf Nolte *et al* 2013, Pfaff *et al* 2014) and national political context specifically on PA and aid impacts in Africa and many other parts of the developing world.

A substantial literature has explored the interaction of national political context and local conservation outcomes. This literature has focused primarily on natural resource decentralization (e.g. Andersson *et al* 2006, Nelson and Agrawal 2008, Ribot *et al* 2010) and community-based conservation and natural resource management (Brooks *et al* 2012) rather than national parks and other PAs. Parallel research has identified the importance of national political context in shaping PA implementation and impacts (Adams and Hutton 2007, Sanderson and Bird 1998). For example, political instability or armed conflict may undermine effective PA management (Glew and Hudson 2007) or democratic decentralization may empower local communities to demand more equitable forms of conservation (Chhatre 2008). Despite recognition of the importance of national political context, however, the current evidence base is insufficient to identify patterns that may exist across countries to indicate how context moderates PA impact and with what effect (Pullin *et al* 2013). In short, we know that national context matters to PA outcomes but much less about *how* and *why* it matters.

Analytical frameworks to investigate conservation governance processes at multiple levels have been developed (Ostrom 2007, Paavola 2007, Clement 2010), but the relevant scholarship has tended to focus only on one level of analysis and to treat the effect of key factors, like enforcement or participation, as context invariant³ (Pullin *et al* 2013). As a result, there is little available theory about the moderating effect of context in relation to PAs (though studies of national-local governance linkages in other policy domains (e.g. Jaramillo and Wright 2015) promise relevant insights), which limits understanding of the range of causal processes linking interventions to outcomes. Research on this topic is especially important given that extra-local influences on local resource governance may be those most amenable to effective

change through policy (Dietz and Henry 2008). Moreover, information on key factors affecting the magnitude of impacts can provide a basis to improve intervention cost-effectiveness while minimizing harm (Ferraro and Hanauer 2014a).

This article contributes to empirical and theoretical knowledge by testing hypotheses about the role of national political context in moderating the social-ecological effects of international aid for biodiversity conservation in a large transboundary protected area (TBPA) in West Africa. It focuses on the impact of changing levels of enforcement spurred by a large European Union aid project on biodiversity and livelihoods in the adjacent W National Parks (WNPs) of Benin and Niger. These two countries differ along two key national political dimensions: governance quality and extent of decentralization reform. This variation facilitates comparative analysis of the effects of a blanket conservation aid project, Protected Ecosystems in Sudano-Sahelian Africa (ECOPAS), in different political contexts. We use original data to explain how and why the same conservation project led to different outcomes in the two national political contexts.

Extensive literatures on resource commons (Gibson *et al* 2005, Pagdee *et al* 2006, Chhatre and Agrawal 2008) and state-managed PAs (Bruner *et al* 2001, Stoner *et al* 2007, McNally *et al* 2011) find that better enforcement leads to better environmental outcomes. We therefore expect that increasing enforcement will be associated with improved biodiversity outcomes regardless of national context.

Although available evidence is mixed (Naughton-Treves *et al* 2005, Pullin *et al* 2013), we expect that increasing enforcement will lead to decreasing incomes due to the restrictions it places on access to resources. However, studies of environmental aid which find positive impacts in countries with stronger public sector institutions, more political stability, and greater adherence to rule of law (McPherson and Niewsiadomy 2000, Buntaine and Parks 2013) suggest that better national governance and more effective decentralization will mitigate the negative effects of increasing enforcement while enhancing the positive ones. These features increase the likelihood that PA enforcement is routinized and equitably applied. Together with greater decentralization, they should also mean that PA and other authorities can be held accountable for their activities, thereby reducing potentially negative effects of enforcement on livelihoods (Agrawal and Ribot 1999, Chhatre 2008).

We do not expect national political context to operate as an independent effect given lack of support for the conclusion that community-based conservation projects are more successful in more stable, better-governed countries (Brooks *et al* 2012). Rather, we expect that it will be an important moderating influence on the effects of changing enforcement.

³ For an exception, see Galvin and Haller (2008).

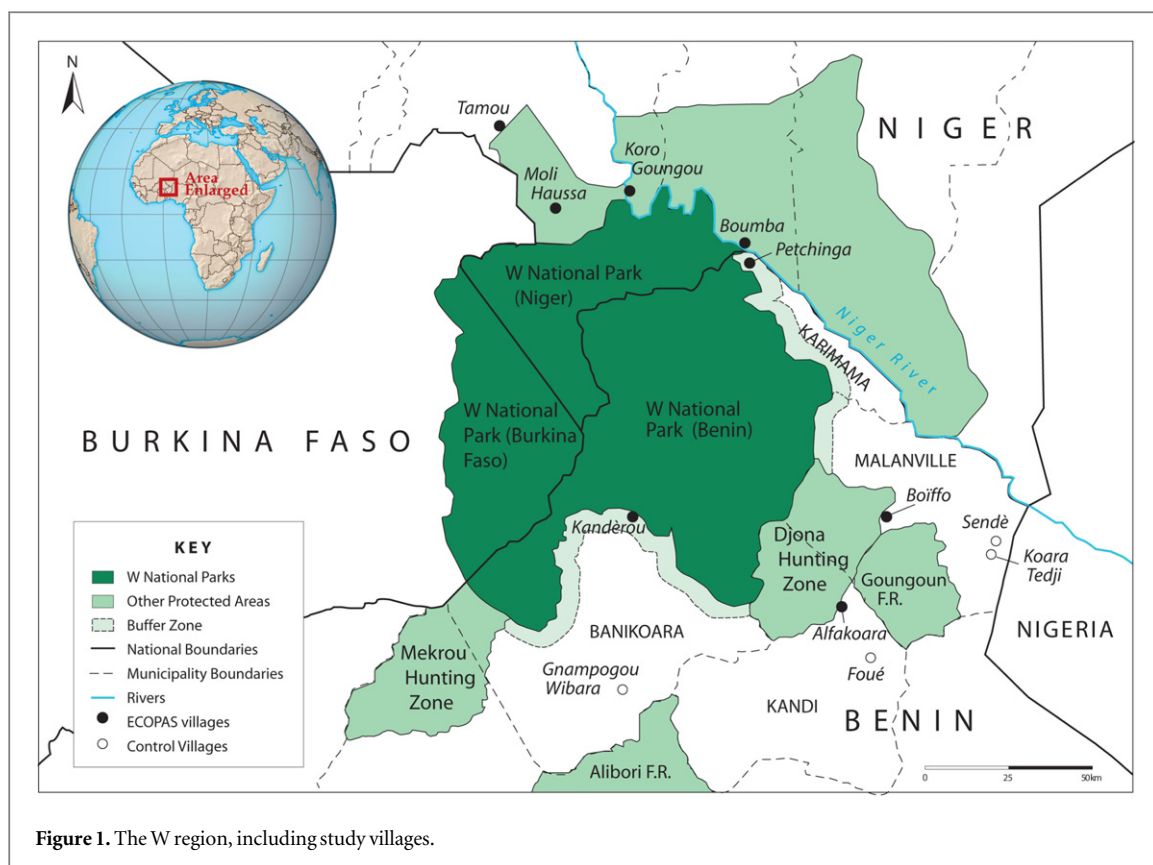


Figure 1. The W region, including study villages.

2. Study area and national political context

2.1. Study area

The transboundary WNP are located at the intersection of Benin, Burkina Faso, and Niger (figure 1; 11.20° N–12.30° N, 2° E–3° E). Administered as one PA during the colonial era, at independence in 1960 it was divided among the three countries. Niger's WNP, which includes the double meander in the Niger River that gives the Park its name, is the most well known of the three Parks while Benin's WNP is the largest, covering more than half of the TBPA (5630 km²). The WNP contain all the major habitat types of the West African savanna belt and are home to the largest populations of elephants (*Loxodonta africana*) and ungulates in the region as well as rare species, such as the western topi (*Damaliscus lunatus korrigum*) and West African manatee (*Trichechus senegalensis*) (Lamarque 2004). More than 450 bird species (Balança et al 2007) and at least 670 plant species (Clerici et al 2007) have been identified in the W region.

Approximately 150 000 people live within 20 km of WNP in Benin, with 13 000 living within a 5 km 'buffer zone' that rings the Park and much of the adjacent Djona Hunting Zone (ECOPAS 2005). An estimated 125 000 people live adjacent to the Park in Niger. Livelihoods in the region center on agricultural and pastoral activities, though hunting, fishing, and use of forest products are also important.

2.2. PA Management and the ECOPAS project

PA management and national political context diverge most significantly in Benin and Niger so this analysis focuses on those two countries⁴. Perhaps the most salient difference between the two countries is the importance accorded to WNP by central government. From independence to the start of the ECOPAS in 2001, Benin's WNP and its hunting zones were de facto open access areas. Prior to 2001, illegal grazing, hunting, fuelwood collection, and agriculture were common and there was virtually no infrastructure and only 12 guards patrolled this vast PA complex (ECOPAS 2005, Hibert et al 2010). The PA was thus largely denuded of large mammals and its continued viability as a National Park was in doubt (Monfort et al 1994, CENAGREF 1999). By contrast, Niger's WNP was better managed, with a government budget line, more extensive infrastructure, and a larger number of staff. When ECOPAS began, cattle grazing in the core of the Park was virtually non-existent and cultivation was limited to border areas (Hibert et al 2010).

PA management institutions in the two countries also differ substantially. Since 1996, Benin's WNP complex has been co-managed by the National Center

⁴ Burkina Faso represents an intermediate case. We also focus on the WNP in Benin and Niger because the separation between them is especially clear: the Mekrou River flows between them. This physical boundary along with the lack of coordination between the two parks prior to and after ECOPAS (see SI) enabled us to treat them as two separate cases.

Table 1. Key elements of national political context relevant to the W region in Benin and Niger.

Element	Benin	Niger
<i>National Governance</i>		
Global percentile rank, average governance scores, 2002–2011 ^a	43%	29%
<i>Decentralization</i>		
First local elections	December 2002	July 2004
Community participation in PA management	Yes, formalized through AVIGREF	No formal institutional mechanism
Municipal participation in PA management	No formal role	No formal role
Local distribution of PA revenues	30% of revenue to villages via AVIGREF (since 2002)	50% of revenue to one local government (since 2006)

^a Based on data from Kaufmann *et al* (2012).

for Wildlife Reserves Management (CENAGREF) and the Village Association for Wildlife Reserve Management (AVIGREF). These institutions share revenues from hunting (legal in Benin, but not Niger), safari tourism, and fines levied for illegal activities, with 30% designated to AVIGREF for community ‘eco-development’. The management structure of Niger’s WNP is more centralized, with no comparable co-management arrangement.

ECOPAS was implemented from January 1, 2001 to December 31, 2008 with the objective of reversing natural resource degradation and conserving biodiversity in the W region ‘for the benefit of local populations’ (ECOPAS 2005). It comprised the largest conservation intervention in the region in the post-colonial period, with a total budget of approximately US\$32 million. More than 60% of the budget supported regional coordination with remaining funds allotted to the three countries according to relative WNP size and perceived need. Benin received \$7.1 million and Niger \$3.5 million (SI).

In Benin, an estimated 90% of ECOPAS funds were spent on enforcement-related activities, from hiring and equipping of park guards to construction of roads and other infrastructure. Passable roads increased from 70 km in 2001 to nearly 1000 km by 2008, while the number of guards more than quadrupled from 12 to 49 during the project (SI). Strengthening enforcement was less a priority in Niger given existing resources, though the project did support this task. The number of park guards increased from 19 to 34 and the number of kilometers of passable roads for enforcement increased 18% from 637 km to 750 km under ECOPAS.

Although most ECOPAS country-level funding directly supported core PA management and enforcement, the project also sought to deliver community benefits, primarily through tourism. Direct spending on tourism development comprised about 5% of the ECOPAS budget in Benin and 10% in Niger (SI).

2.3. National political context in Benin and Niger

National political context differs in Benin and Niger along two key dimensions: governance quality and

extent of decentralization. From 2000 to 2011 (the period spanning ECOPAS implication) Benin was significantly better governed than Niger (table 1), particularly in terms of voice and accountability and political instability (figure S1), which together enable assessment of the processes through which governments are selected, monitored, and replaced. Although both countries are consistently ranked among the world’s poorest countries (World Bank 2013), Benin has been seen as a model of democracy in Africa while Niger has been beset by political instability.

Decentralization reforms are much more advanced in Benin than Niger (table 1). Benin led a wave of democratization in Africa starting in 1989 (Olowu *et al* 1999). A decade later laws were passed mandating devolution of political-administrative powers, primarily to 77 *communes* (municipalities) with fiscal autonomy and new local development responsibilities. The central state maintained authority over National Parks and Hunting Zones, though AVIGREF brings some measure of local representation to PA management even as it remains separate from the decentralized municipal structure. Municipal elections have been held regularly since 2002.

By contrast, Niger’s political history over the past 25 years has been highly unstable. It began a transition to democracy in 1991 (Olowu *et al* 1999). Presidential elections were held in 1993, but the regime was overthrown by a military coup in 1996. By the time decentralization laws were passed in 2002, Niger had already experienced two coups and three constitutions. Decentralization involved transfer of similar administrative powers as in Benin and Niger’s first local elections took place in 2004. Despite some successes, local governments have been hampered by inadequate resources, limited capacity, and weak linkages with civil society and the private sector (Maercklein 2008). National level political instability, particularly another coup and constitution in 2010, has further slowed decentralization reforms.

Like Benin, the government of Niger retains control of WNP and its adjacent PAs. Municipalities have no formal role in management of these areas, though revenues from WNP were shared between central and

local governments for the first time starting in 2006. However, to date, only one of the three eligible municipalities, Tamou, has received revenues. As this example of revenue sharing indicates, there can be a gap between de jure and de facto governance trends. The national level governance indicators along with related qualitative research (Miller 2013) suggest that there are both de jure and de facto differences in governance reforms in Benin and Niger.

3. Data and methods

3.1. Data collection

Data were collected during fieldwork in Benin and Niger from September 2010 to August 2011 based on a household survey, individual and focus group interviews, participant observation, and archival materials. Stratified purposive sampling (George and Bennett 2005) was used to select eight villages within 2 km of WNP specifically targeted by ECOPAS⁵ (figure 1). These villages were chosen to represent the ecological and political variation around the Park in both countries: they cover the relevant climatological zones and municipalities (table S1). We identified study villages based on ECOPAS reports, interviews with former ECOPAS staff, and exploratory visits. Within each village, households were randomly selected using probability proportional to size, based on Bernard's (2006) map sampling method. In the absence of reliable census records, this method ensured a random sample. The final survey included 300 households, evenly divided between villages in Benin and Niger (table S2).

3.2. Outcome indicators

This study used mammal species abundance as the primary indicator for biodiversity outcomes. This indicator derives from annual mammal surveys conducted by Park authorities using a consistent methodology from 2002 to 2008 (SI). It was measured using a kilometric index (KI) expressing the ratio of the total number of individuals by species observed along a transect by the total length of each transect by zone covered (Maillard *et al* 2001). The survey included information on 20 species comprising all observed large and small ungulates, primates, and carnivores (table 2). Overall abundance measures were estimated by taking the mean of observations in each year from all transects for each species and then summing those means. Linear trendlines for the two parks were then calculated using ordinary least squares (OLS) regression. Household perception of change in human-wildlife conflict from 2000 to 2011 was used as a

complementary species abundance indicator, providing household-level information in the post-ECOPAS period.

The main livelihoods indicator in this study is change in household income from the period immediately prior to the start of the ECOPAS project to the period after the project's conclusion (2000–2011), measured on a 10-point scale (SI).

3.3. Modeling the effects of enforcement and national political context

To analyze the effect of changes in enforcement and national political context on biodiversity and livelihoods we developed OLS and multilevel linear regression models (additional detail in SI). OLS models estimated change in household conflict with wildlife (Model 1) or change in household income (Model 4). The independent variables tested were enforcement, national political context, and an interaction term of the two.

Reported change in household ability to use WNP from 2000 to 2011 was used as an indicator of PA enforcement at the household level. Based on this measure, decreases in ability to use the PAs signify higher levels of enforcement. In the absence of data on arrests and fines, this indicator was used to avoid putting survey respondents at risk by asking directly about illegal activities. Although other factors (e.g. health issues or migration) may also affect responses, qualitative research results suggest that changes in ability to use the Park are likely due to changes in enforcement (SI).

A country dummy variable represented national political context in Benin and Niger. Models use an interaction term of enforcement and country to assess the moderating effect of national political context on enforcement. Related research suggests the two aspects of governance discussed above are the most relevant source of national-level variation between the two countries (Miller 2013) even as the country dummy variable probably encompasses additional national level differences. We control for other potentially important variation, such as population and market integration, through village-level indicators (see below).

Models controlled for a series of respondent and household attributes that may also influence outcomes (table S2). OLS models were adjusted for clustering at the village level to correct for correlation at that level (Angeles *et al* 2005). A series of regression diagnostics indicate that OLS assumptions are met and that the model is not misspecified.

To better account for the multi-tiered structure of the data, we also estimated multilevel linear models (SI). We used two-level random-intercept models in which households comprise level 1, and the eight villages in which they are nested comprise level 2. The first multilevel models (Models 2 and 5 in table 3

⁵ In Benin, two villages were adjacent to the Djona Hunting Zone, and in Niger one village was next to the Tamou Reserve. For ease of exposition and because the rules and enforcement regimes governing these PAs are nearly the same as those for the W Parks, this study refers to all villages as bordering WNP.

Table 2. Change in mammal species abundance in the W National Parks and satellite Hunting Zones of Benin and Niger, 2002–2008^a.

English Name	Latin Name	Benin Mean KI ^a	Niger Mean KI ^a	Difference in Mean KI ^a	Benin Change in Abundance	Niger Change in Abundance
Large Ungulates						
African Elephant	<i>Loxodonta Africana</i>	0.091	0.068	No	I*	I
West African Buffalo	<i>Syncerus caffer</i>	0.276	1.039	No	I	D
Roan Antelope	<i>Hippotragus equinus</i>	0.448	0.266	No	I**	D
Defassa Waterbuck	<i>Cobus defassa</i>	0.017	0.017	No	I	D
Western Hartebeest	<i>Alcelaphus buselaphus</i>	0.079	0.045	No	I	I
Small Ungulates						
Common Warthog	<i>Phacochoerus aethiopicus (africanus)</i>	0.169	0.095	No	I	D
Western Buffalo's Kob	<i>Kobus kob</i>	0.042	0.083	Yes*	I	I
Bushbuck	<i>Tragelaphus scriptus</i>	0.027	0.021	No	I	I
Bohor Reedbuck	<i>Redunca redunca</i>	0.006	0.016	No	D	I*
Red-Fronted Gazelle	<i>Eudorcas rufifrons</i>	NP	0.036	NP	NP	I*
Oribi	<i>Ourebia ourebi</i>	0.042	0.099	Yes**	I	I
Gray (Common) Duiker	<i>Sylvicapra grimmia</i>	0.08	0.029	Yes**	I	D
Red-flanked Duiker	<i>Cephalophus rufilatus</i>	0.018	NP	NP	D**	NP
Primates						
Olive Baboon	<i>Papio anubis</i>	0.342	0.348	No	I	I
Patas (Red Monkey)	<i>Erythrocebus patas</i>	0.109	0.118	No	D	I
Green Monkey	<i>Cercopithecus aethiopicus</i>	0.057	0.002	Yes**	I	D
Carnivores						
Lion	<i>Panthera leo</i>	0.005	0.013	No	I	D
African Wild Dog	<i>Lycaon pictus</i>	NP	0.005	NP	NP	I
African Civet	<i>Civettictis civetta</i>	0.001	NP	NP	I	NP
Side-striped Jackal	<i>Canis adustus</i>	0.016	0.012	No	D	I
Total		1.825	2.312			

Sources: CENAGREF and ECOPAS (2008) and Lamarque (2004).^a Abbreviations and symbols: KI: Kilometric Index; I: Increase in species abundance; D: Decrease in species abundance; NP: Species not present; ** $p < 0.01$, * $p < 0.05$, + $p < 0.10$. Difference in Mean KI between Benin and Niger calculated using a two-tailed t-test. Change in species abundance results based on OLS models that regressed kilometric index on year for each species ($n = 845$ for Benin; $n = 504$ for Niger).

below) were unconditional models in which village-level effects were included as the random component (equation 2, SI). We then added the same individual-level independent variables as above along with two village-level variables (distance to Park guard post and distance to major regional market) to create Models 3 and 6.

4. Results

4.1. Biodiversity outcomes

Overall species abundance was greater in Niger's WNP (average KI = 2.3; max = 4.2) than Benin's WNP (average KI = 1.7; max = 2.8; figure 2). The incidence of human-wildlife conflict during the study period was nearly identical in the two countries, with 69% of households reporting such conflict in Benin and 67% in Niger. However, the change in incidence of such conflict from 2000 to 2010 was substantially greater in Benin, with 96% of households reporting a

change in the frequency of conflict with wildlife compared to 66% in Niger.

Direct measures of mammal species abundance show a positive trend in both countries from 2002 to 2008 (figure 2). Results suggest increases in the abundance for 14 of the 18 species surveyed in Benin (78%), including lions and all large ungulates, species targeted for improved management under ECOPAS (table 2; figures S2 and S3). The trendline for this relationship in Niger was similar, although the change in abundance was statistically significant for only two species in Niger, and data were only available for the last four years of the time series⁶. Mean abundance of four of the 20 surveyed species in the WNP of Benin and Niger over the study period exhibited statistically significant difference (table 2). Data limitations for Niger

⁶ The relatively large overall KI measure for Niger in 2006 was due primarily to the presence of exceptional numbers of buffalo (*Syncerus caffer*): the KI for this species in 2005 was 0.26, but it jumped to 3.03 in 2006.

Table 3. OLS and multilevel linear regression model results.

Variables	Change in Conflict with Wildlife			Change in Income		
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Fixed Effects						
<i>Main independent variables</i>						
Country	0.917 (0.992)		0.141 (2.358)	-0.787 (0.931)		-1.413 (0.950)
Enforcement	0.466+ (0.206)		0.339 (0.260)	-0.301 (0.238)		-0.00147 (0.237)
Country*Enforcement	-0.572 (0.341)		-0.278 (0.344)	-0.991* (0.368)		-1.21*** (0.307)
<i>Household level variables</i>						
ECOPAS Participation	1.409** (0.307)		1.409** (0.495)	0.832 (0.722)		0.840* (0.423)
Natural Resource Dependence	-3.220 (2.621)		-0.617 (1.124)	0.479 (0.795)		1.537+ (0.870)
Sex of Household Head	0.586 (0.349)		0.330 (0.585)	-0.480 (0.605)		-0.377 (0.516)
Age of Household Head	-0.008 (0.023)		-0.028+ (0.017)	-0.022+ (0.012)		-0.03* (0.013)
Education Level 1	0.703 (1.206)		0.236 (0.530)	1.243* (0.396)		0.722 (0.459)
Education Level 2	-0.405 (1.468)		-0.330 (0.636)	1.642** (0.438)		0.855 (0.537)
Household Size (ln)	0.160 (0.332)		0.323 (0.438)	-0.328 (0.419)		-0.457 (0.350)
Constant	6.968** (1.591)	7.237*** (0.729)	11.98*** (2.879)	5.594** (1.044)	5.118*** (0.368)	7.771*** (1.392)
<i>Village level variables</i>						
Distance to Guard Post (0 km)			-2.770 (2.722)			-1.213 (1.075)
Distance to Guard Post (12 km)			-3.745 (2.594)			-2.776** (1.070)
Distance to Market (0–24 km)			-0.625 (2.509)			1.027 (0.980)
Distance to Market (25–50 km)			-3.220+			0.445
Random Effects						
var(U_0)		3.938	3.413		.837	.3444
$\rho(U_0)$		6.929	6.759		9.052	7.379
Intra-Class Correlation Coeff.		0.362			0.085	
Observations	202	203	202	291	295	291
R ²	0.149			0.217		
Pseudo-R ² (village level)			0.133			0.588
Pseudo-R ² (individual level)			0.025			0.185

Note: There were 8 villages in the multilevel models. Reference categories were high school education or above (Education), furthest village (47 km) (Distance to Guard Post), and greater than 50 km (Distance to Market). Household members variable was (natural) log transformed. Pseudo-R² at the village level = $(\text{var}(U_0)_{\text{unconditional model}} - \text{var}(U_0)_{\text{conditional model}}) / \text{var}(U_0)_{\text{unconditional model}}$; Pseudo-R² at the individual level = $(\text{var}(\varepsilon_{ij})_{\text{unconditional model}} - \text{var}(\varepsilon_{ij})_{\text{conditional model}}) / \text{var}(\varepsilon_{ij})_{\text{unconditional model}}$; Robust standard errors in parentheses; *** $p < 0.001$, ** $p < 0.01$, * $p < 0.05$, + $p < 0.10$.

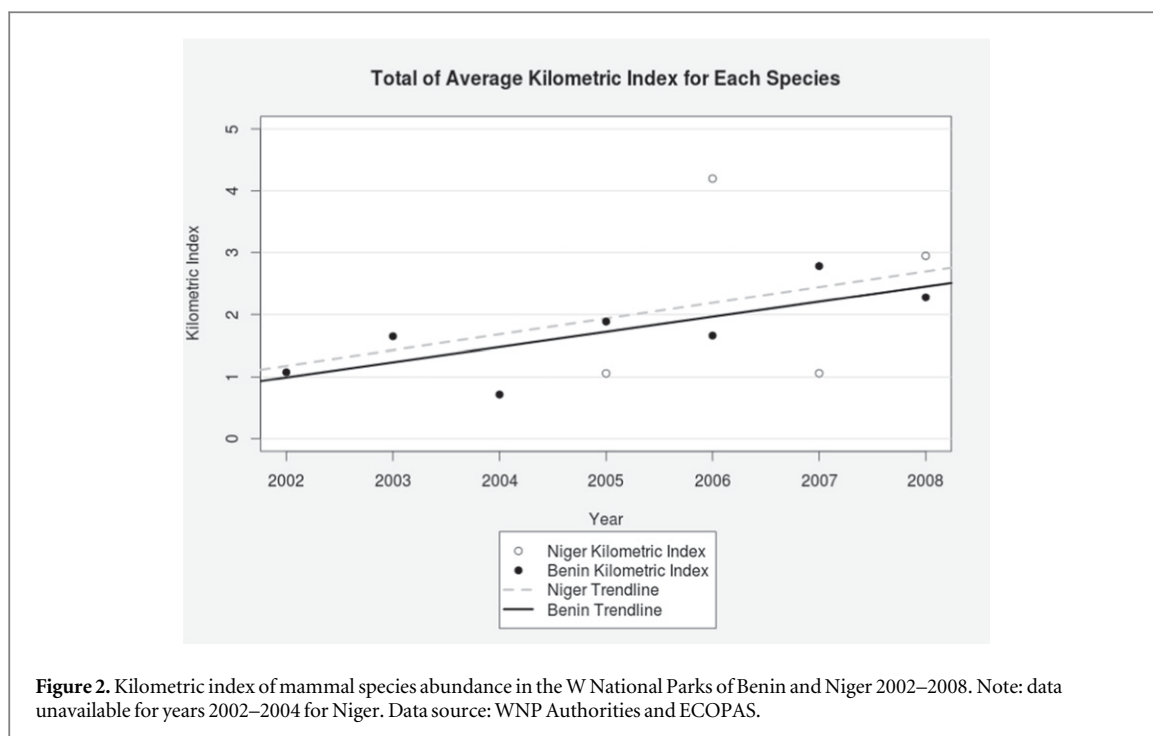
make the trendline questionable for that country and may be a reason why little statistical significance is seen in the results using KI measures.

Regression analysis yielded some evidence of national level differences in biodiversity outcomes (table 3). Higher levels of enforcement were associated with greater increases in species abundance in Benin (Model 1; $p < 0.1$). However, neither country nor the interaction of enforcement and country were statistically significant in any of the regression models (table 3; figure 3). Detailed analysis of whether the

predictive margins were different for any values of enforcement between the two countries also failed to yield statistically significant results.

4.2. Livelihoods outcomes

There was little change in average household income from 2000 to 2011 in the W region of Niger (mean = 5.4) or Benin (mean = 4.8; Prob > $|z| = 0.19$). However, there were important variations and increasing enforcement was associated with sharply decreasing income levels in Niger, whereas in



Benin the effect was relatively constant (table 3; figure 3). At the lowest and mean levels of enforcement, change in income was similar for both countries. However, at the two highest levels of enforcement there was more than a 50% (5/10 point scale) difference in predicted change in income between Benin and Niger. National political context thus mattered for those households experiencing greater levels of enforcement. This finding suggests that households that reported experiencing the two highest levels of enforcement in Niger ($n = 76$; $> 50\%$ of those surveyed) saw the most extreme declines in income.

Residing in a village at a medium distance from a guard post (12 km) was associated with a early 30% decrease in income (table 3). This finding only applied to two villages, Kandèrou and Petchinga, both of which are in Benin. There is some evidence that participation in the ECOPAS project helped improve household incomes regardless of country context: on average, participating households reported a 10% increase in income controlling for other factors ($p < 0.05$).

5. Discussion

Results indicate that the ECOPAS project had positive impacts on biodiversity as measured by mammal species abundance, particularly in Benin's WNP. Increasing levels of enforcement appear to have led to biodiversity improvements in Benin, but were not associated with measures of biodiversity change in Niger. This result is likely due in part to different initial conditions in the two countries: Benin's WNP was

practically denuded of wildlife and Niger's WNP was relatively better managed prior to ECOPAS (Monfort *et al* 1994, CENAGREF 1999). Better enforcement in Benin during ECOPAS then provided a more secure environment for wildlife to return and flourish in that country's WNP.

It may also be possible that differences in habitat type and water availability help explain differences in species abundance. However, the two parks did not differ greatly in these aspects as they both included the same range of habitat types and had comparable annual rainfall (650–800 mm in Niger's WNP and 700–950 mm in Benin's WNP). Though Niger's WNP is slightly drier, it had a greater concentration of waterways and watering holes (ECOPAS 2005). Finer grained ecological research is needed to confirm this conclusion and to better understand how changing enforcement regimes and national political context affect biodiversity outcomes.

Like many donor-funded conservation and development projects implemented across the tropical world over the past quarter century (McShane and Wells 2004), evidence suggests that ECOPAS did not increase average incomes for WNP neighbors in either Benin or Niger. Related research comparing households in matched treatment and control villages also found no significant average treatment effect of ECOPAS on income in Benin⁷ (Miller 2013). However, impacts on income varied considerably and the results presented here suggest that national political context strongly moderated the effect enforcement had on them.

⁷ Security concerns prevented collection of data in control villages distant from WNP in Niger for the current study.

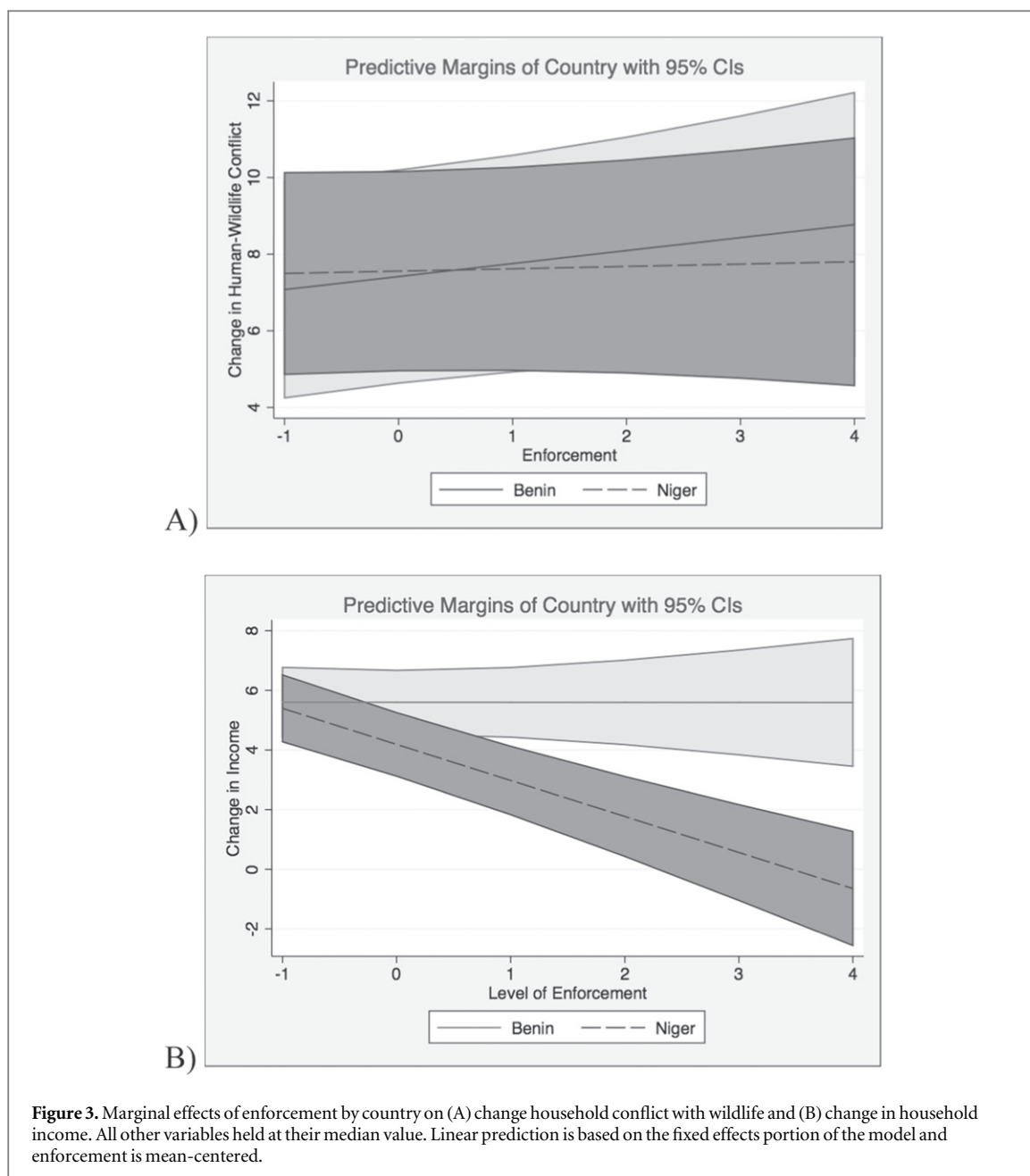


Figure 3. Marginal effects of enforcement by country on (A) change household conflict with wildlife and (B) change in household income. All other variables held at their median value. Linear prediction is based on the fixed effects portion of the model and enforcement is mean-centered.

Increasing enforcement at the household level on its own did not affect income, but in the national political context of Niger the greatest increases in enforcement were associated with sharply decreasing incomes. Political instability and low overall governance effectiveness in Niger as many other contexts (Baland *et al* 2010) have likely been key determinants of the poor economic performance in the country. Economic growth has consistently been lower than in Benin over the past decade (World Bank 2013), which has also meant there have been fewer alternative livelihood opportunities in Niger. At the same time, the populations living near WNP in Niger were much more dependent on natural resources to which access would have been curtailed under increased enforcement than their counterparts in Benin (Prob > |z| = 0.0007). Nearly half of households around

Niger's WNP (47%) derived more than a quarter of their income from natural resources compared to only 23% in Benin.

Varying paces of decentralization reform also help explain these differential effects. The two villages in Niger where the largest number of respondents reported experiencing the maximum change in enforcement, Boumba (45%) and Koro Goungou (63%), are located in municipalities that do not receive revenue from Park receipts under decentralization. By comparison, the two villages located in the municipality that did receive revenues from the Park (Tamou), had considerably fewer households report the highest increase in enforcement (27% in Moli Haoussa and 18% in Tamou).

While the former villages may have experienced more enforcement due in part to their location

immediately adjacent to the Park, the effects were likely exacerbated because they were in municipalities that were less ‘articulated’ (Chhatre 2008) to national democratic institutions such that residents may have had less of a voice in how ECOPAS was implemented. Households in Boumba and Koro Goungou were not only unable to receive benefits brought by Park revenues under decentralization reforms but they also received fewer benefits on average directly from the ECOPAS project (e.g. job and tourism opportunities).

Our findings are subject to some important caveats. First, the relative lack of socio-economic and ecological data from the study area meant that our main dependent variables are perceptions-based measures. Such indicators are widely used in studies of conservation impacts (Pullin *et al* 2013), but more direct measures would be preferable. Our analysis of biodiversity change sought to address potential bias due to perceptions by drawing from direct species count data. Results from other African contexts (Naughton-Treves 1997, Gillingham and Lee 2003) suggest that any bias in our perceptions measure of mammal species abundance is likely less of a concern for large larger mammals (SI). More generally, we note that perceptions can be useful, particularly from a management perspective, even if they do not fully correspond to more direct measures as they provide information on people’s views and can help understand behavior (Lund *et al* 2010).

A second, related concern is the potential for recall bias. Again, data limitations meant that we use reported change over time from before to after the ECOPAS project to construct our dependent variables rather than data collected at two points in time. Such recall data may be inaccurate due to respondents misremembering information, though there is debate about the extent to which different kinds of retrospective data are likely to be reliable (Dex 1995, Groves *et al* 2004). We took several steps to minimize recall bias, including giving survey respondents prompts before questions relating to change over time (SI). Such prompts have been used effectively in other poverty-related studies (e.g. Krishna 2004). We also used focus group interviews and other qualitative data to triangulate survey results.

Finally, limited data for Niger on KI (2005–2008 only) mean results using this measure should be interpreted with caution. While the constrained time scale of KI data and the associated absence of statistically significant species abundance increases make the results for Niger highly uncertain, such limitations do not affect the KI results for Benin or the main regression model results

6. Conclusion

This article contributes to a new generation of research that has focused on rigorous identification of broad

patterns of PA impact (see reviews in Miteva *et al* 2012, Ferraro and Hanauer 2014a) by examining processes producing impact. It has shown the importance of national-level political factors to the ecological and socio-economic impacts of enforcement under a large aid-funded conservation project in the TBPA of the W region. Our findings demonstrate that national political context can have significant effects in combination with other causal variables even if it may not matter directly on its own.

Results of this study suggest that state PA enforcement will have more positive social-ecological impacts in better-governed, more decentralized countries and that researchers and policymakers should explicitly consider national political context in design, implementation, and evaluation of conservation interventions. Failure to do so risks inaccurate conclusions and ineffective policy, particularly given that insufficient engagement with national political context can threaten the sustainability of conservation outcomes (Chhatre and Saberwal 2005).

This article suggests that the increasing focus on identifying causal mechanisms producing conservation impact (Ferraro and Hanauer 2014b) should be complemented by a more systematic examination of context so as to identify broader pathways of impact. Our work could thus be extended by investigation of the effects of different kinds of moderators⁸ beyond national political context, such as differing pre-intervention levels of biodiversity or poverty. Doing so will require more detailed theory and better data due to challenges in estimating conditional causal effects (Ferraro and Hanauer 2014a). There is a particular need to increase contextual variation given that only a small percentage of donor-funded conservation and development projects (Brooks *et al* 2012, Miller 2014) and PAs (Pullin *et al* 2013) have been subject to rigorous impact evaluation. This study from Francophone West Africa, a region that has received less scholarly attention compared to other parts of the continent (Holmes *et al* 2012), contributes to addressing this need, but more comparative evidence is required. Transboundary PAs like the WNP, may serve as especially useful laboratories for further exploring the role of national political context and other factors in shaping conservation outcomes in Africa and beyond.

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⁸ That is, factors that are not affected by a given intervention, but that can affect the magnitude of impacts.

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