Outsourcing Wildlife Conservation: A Comparative Analysis of Private and Government Management of Protected Areas in Africa

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Protected areas in Africa

- Protected areas core of wildlife conservation (Watson et al., 2014; Pringle, 2017)
- Protected areas cover 16% of Africa's land area (WDPA, 2020)
- Security, financial, technical challenges limit effectiveness (Lindsey et al., 2018; Coad et al., 2019)
- Increasing trend toward private management (Baghai et al., 2018; Scholte et al., 2018; Lindsey et al., 2020)
  - In Central Africa, 15% of parks "shared management" (OFAC, 2020)

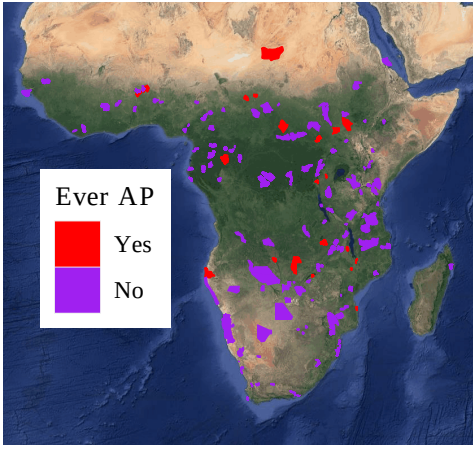
"African Parks is a non-profit conservation organisation that takes on..."

- "the complete responsibility for the rehabilitation and long-term management of national parks in partnership with governments and local communities."
  - Average contract length is 20 years
- Seeks large, (potentially) wildlife-abundant, functioning landscapes
  - large parks "enable full ecological and evolutionary processes to unfold"
- Came to manage 22 parks between 2003 and 2022 in 12 countries: Angola, Benin, CAR, Chad, DRC, Malawi, Mozambique, ROC, Rwanda, South Sudan, Zambia and Zimbabwe
  - "largest and most ecologically diverse portfolio of parks under management by any one NGO on the continent"
- **Law enforcement**, community development, restoration, tourism, infrastructure
- In 2021, 4,000 staff of which 1,300 rangers, supported 200 schools and 30 hospitals, and received 100,000 tourists

Why might governments transfer management?

- Park losing money
  - 97% of AP funding from donors
- AP can better access Western aid and avoid corrupt practices $\Rightarrow$ potentially more effective at law enforcement and community development than government
- AP can increase international tourism

Staggered roll-out difference-in-differences



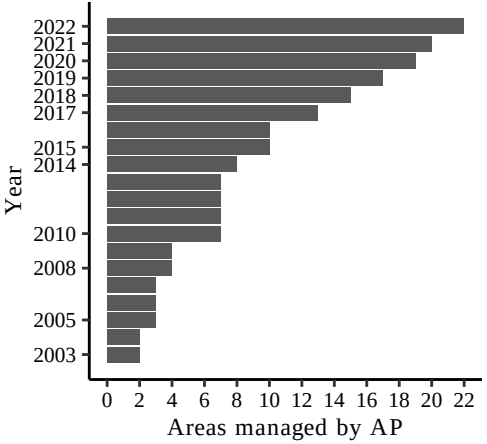


Table: Balance of Treatment and Control Protected Areas on Observables

	Area (km^2) (1)	Longitude (2)	Latitude (3)	DD $>$ 32 C (4)	Precip (m) (5)
Coefficient	1,220	0.855	3.968	30.227	-0.189
Standard Error	(2,820)	(2.399)	(2.831)	(15.176)	(0.159)
Observations	145	145	145	3,442	3,442
Year FE	No	No	No	Yes	Yes
Control Mean	7,669	24.298	-7.362	35.421	1.167

Table: Test for Difference in Pre-Period Outcomes

	Difference	Control Mean	Observations
PIKE (elephant poaching)	0.179	0.437	523
	(0.078)		
log(bird abundance)	-0.215	3.003	139,925
	(0.104)		
1{iNaturalist tourism}	-0.131	0.462	3,442
	(0.057)		
1{eBird tourism}	-0.227	0.510	3,442
	(0.078)		
1{Civilian targeting}	0.025	0.163	3,442
	(0.077)		
1{Battles}	0.073	0.107	3,442
	(0.073)		
1{Protests and riots}	0.020	0.170	3,442
	(0.065)		
Standardized asset wealth	-0.224	0.034	2,594
	(0.113)		

Table: Test for Difference in Pre-Period Mechanisms

	Difference	Control Mean	Observations
Design and Planning	-0.311	0.044	146
	(0.235)		
Capacity and Resources	-0.133	-0.005	147
	(0.308)		
Monitoring and Enforcement Systems	-0.079	0.013	147
	(0.262)		
Decision-Making Inclusiveness	-0.367	0.037	145
	(0.242)		

Wildlife outcomes

- Biodiversity conservation is foremost goal of protected areas
- For inclusion, wildlife data must
  1. be collected consistently or contain information regarding survey effort
  2. have sufficient spatial and temporal coverage
- In Africa, only two datasets meet these criteria:
  1. Monitoring the Illegal Killing of Elephants program measures annual Proportion of Illegally Killed Elephants (PIKE) in 43 parks (8 treatment and 35 control)
  2. eBird measures bird abundance from individual trips in 126 parks (20 treatment and 106 control)

AP management reduces elephant poaching and increases bird abundance

Dependent Variable	ATT	Standard Error	N	Control Mean
PIKE (elephant poaching)	-0.153	(0.069)	578	0.437
log(bird abundance)	0.318	(0.072)	145,200	3.003

Elephant poaching | Bird abundance

Tourism outcomes

- AP may increase tourism due to superior marketing, improved tourism infrastructure, and augmented wildlife populations
- Use proxies due to lack of administrative visits data:
  1. iNaturalist
  2. eBird

AP management increases tourism

Dependent Variable	ATT	Standard Error	N	Control Mean
1{iNaturalist tourism}	0.215	(0.033)	3,625	0.462
1{eBird tourism}	0.190	(0.108)	3,625	0.510

iNaturalist eBird visits

Impacts on people within 25 km of protected areas

- AP may affect local economic development: Asset wealth panel data from Atlas AI
- Changes in park enforcement may affect activities of armed groups or the prevalence of protests and riots: Armed Conflict Location and Event Database (ACLED)

AP management has inconclusive effect on asset wealth, and it increases one measure of conflict but not others

Dependent Variable	ATT	Standard Error	N	Control Mean
Asset Wealth				
Standardized asset wealth	0.102	(0.034)	2,755	0.034
Conflict				
1{Civilian targeting}	0.077	(0.037)	3,625	0.163
1{Battles}	0.050	(0.033)	3,625	0.107
1{Protests and riots}	-0.033	(0.029)	3,625	0.170
Civilian targeting	-0.186	0.535	3,625	1.291

Asset wealth Conflict

Mechanisms

- Why does AP management improve wildlife and tourism outcomes but not armed conflict?
- Management Effectiveness Tracking Tool (METT) is a standardized questionnaire
- 6 treatment and 27 control protected areas have multiple years of data (N = 155)
- Group responses to the METT's 30 questions into four categories
  1. "Design and Planning" captures park's legal framework and whether its strategic design and planning promote effective operations
  2. "Capacity and Resources" relates to availability and management of resources, including staff count and budget
  3. "Monitoring and Enforcement Systems" measures enforcement capacity, appropriateness of legal framework, and understanding of biological conditions
  4. "Decision-Making Inclusiveness" pertains to stakeholder involvement and their influence on management decisions

Mechanisms: Management Effectiveness Tracking Tool (METT) data

Dependent Variable	Coefficient	Standard error	N	Control mean
Design and Planning	0.683	(0.487)	154	0.044
Capacity and Resources	0.581	(0.618)	155	-0.005
Monitoring and Enforcement Systems	0.926	(0.280)	155	0.013
Decision-Making Inclusiveness	-0.292	(0.358)	153	0.037

Conclusion: Compared to government management, private management of protected areas in Africa

- Reduces elephant poaching by 35%
- Increases bird abundance by 37%
- Increase tourism by 37% to 47%
- Increases extensive margin violence against civilians by 47%
- Has no effect on other types of conflict or on asset wealth in nearby communities
- Improves monitoring and enforcement systems by 0.93 standard deviation
  - May also increase design and planning, as well as capacity and resources
  - May decrease decision-making inclusiveness

Appendix

Elephant poaching: ATT = -0.15 (0.07), vs. mean dep. var. of 0.44

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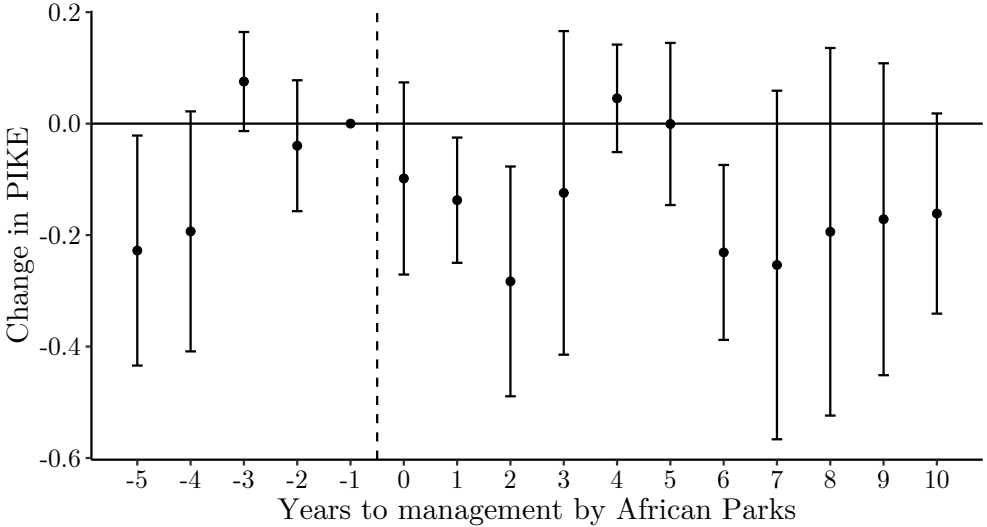
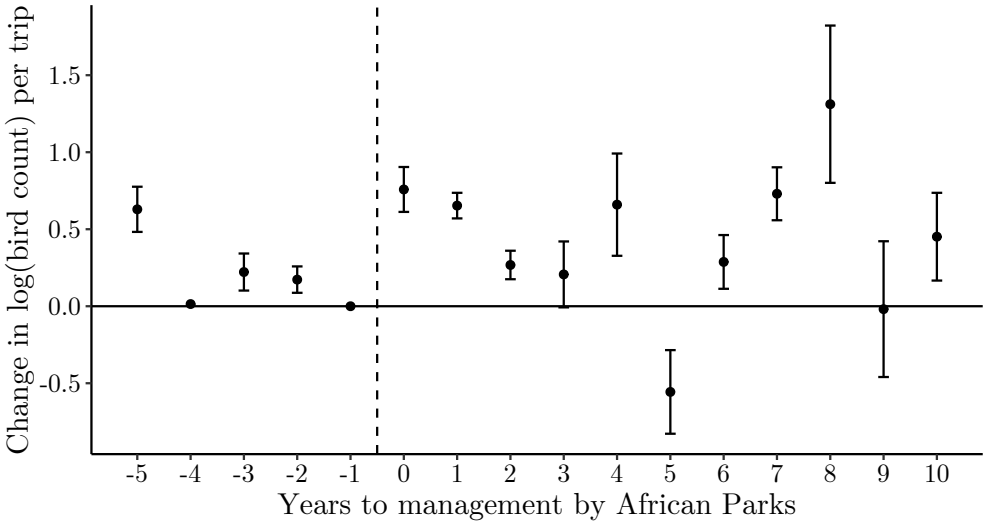
Robust



Bird abundance: ATT = 0.32 (0.07) Back Robust



Elephant poaching robustness Back

- Pre-trends mean more likely to underestimate reduction; had pre-trends continued, Rambachan and Roth (2023) 95% confidence interval is (-0.73, -0.29)
- AP does not affect probability of reporting elephant poaching data (ATT $= -0.06$ with a standard error of 0.14)
- Elephant poaching also decreases in parks nearest to AP (ATT $= -0.10$ with a standard error of 0.10)
- Similar ATT when excluding potential spillover parks from control group (ATT =-0.15 with a standard error of 0.08, compared to our main result of ATT = -0.15 with a standard error of 0.07).

Bird abundance robustness Back

- Pre-trends mean more likely to underestimate increase; had pre-trends continued, Rambachan and Roth (2023) 95% confidence interval is (1.35, 1.73)
- AP increases share of observations in bird-abundant places Figure
- Correcting for location change reduces ATT from 37% to 32% Figure
- AP reduces birder skill Figure
- Lasso effort controls reduce ATT from 37% to 13% Figure
  - Potential controls: linear, squared, and cubed terms for survey hours, numbers of observers, distance covered, and area covered; indicators for stationary count and single observer
- TWFE Figure
- log(bird species) Figure

AP increases eBird observations in bird-abundant locations (ATT = 0.029 with a standard error of 0.012)

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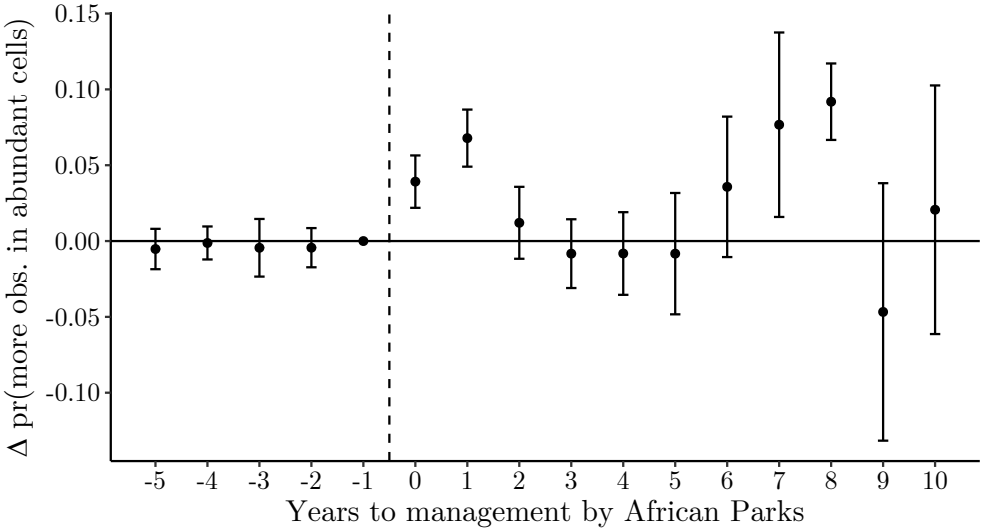

Bird abundance adjusting for location change (ATT = 0.28 with a standard error of 0.07)

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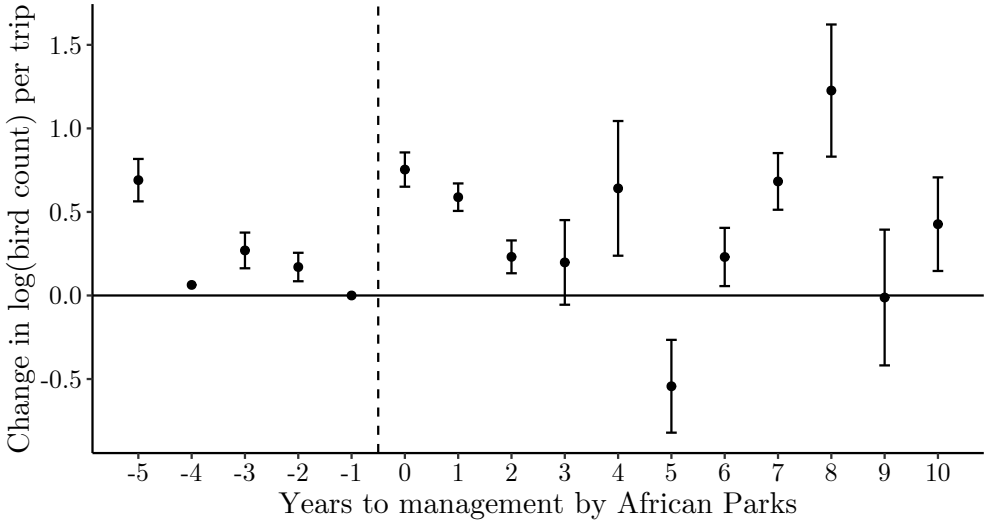

ATT = -0.28 (0.02), vs. mean dep. var. of 0.47

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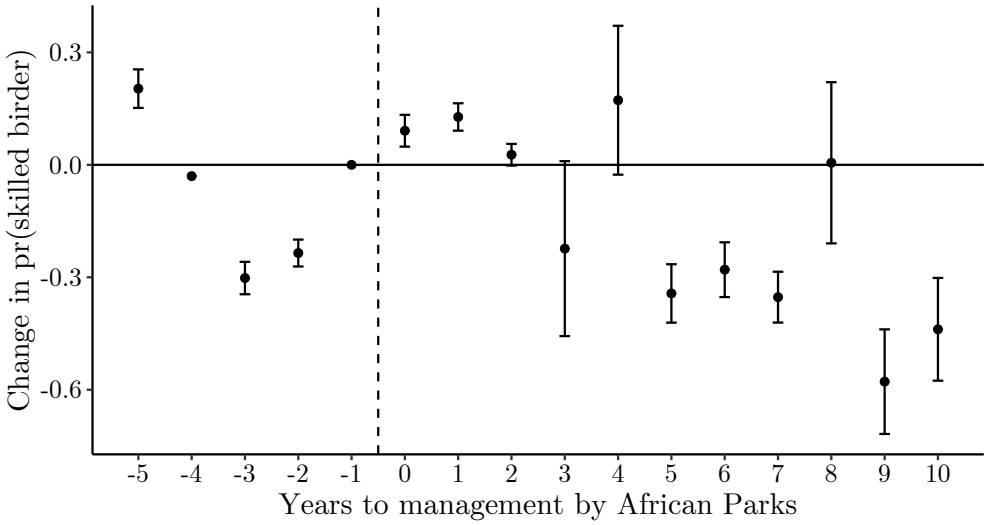
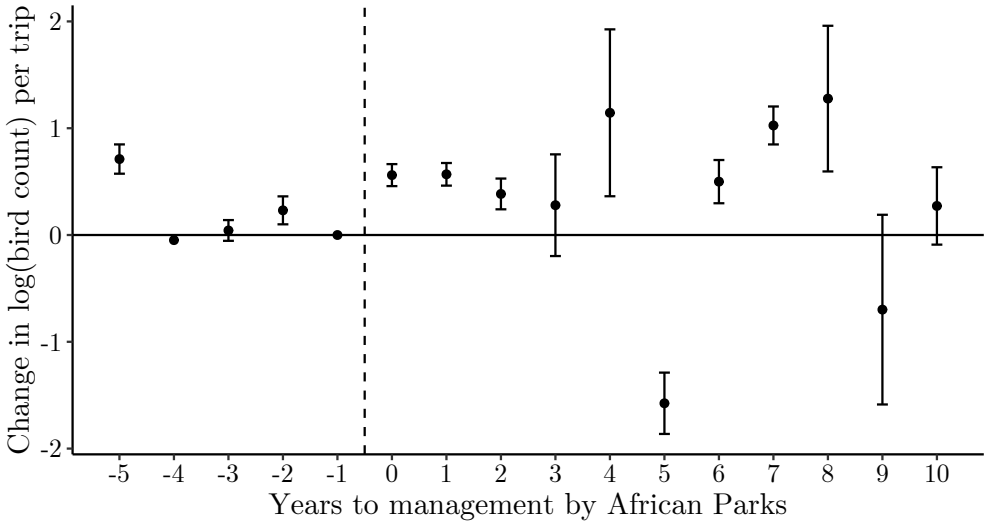


Lasso ATT = 0.12 (0.08) Back



-4 standard error does not blow up with TWFE

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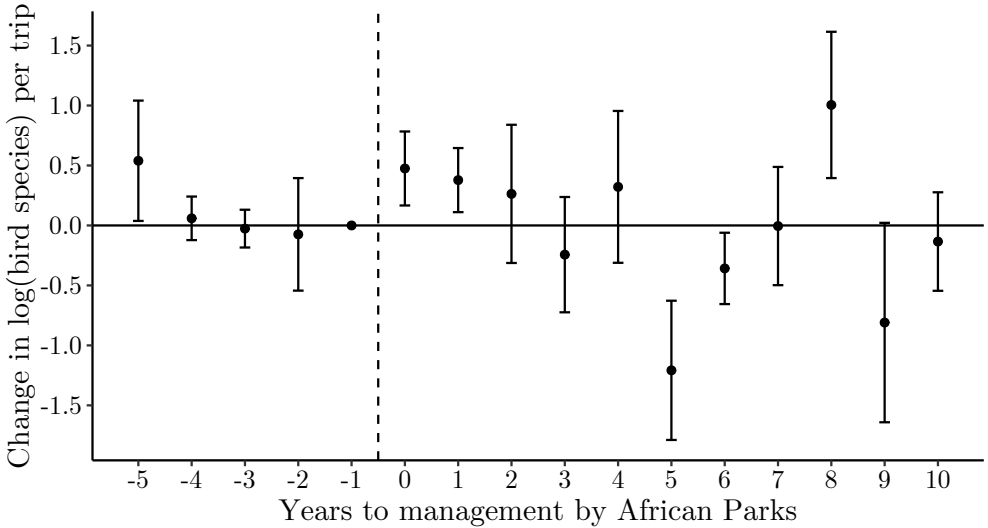
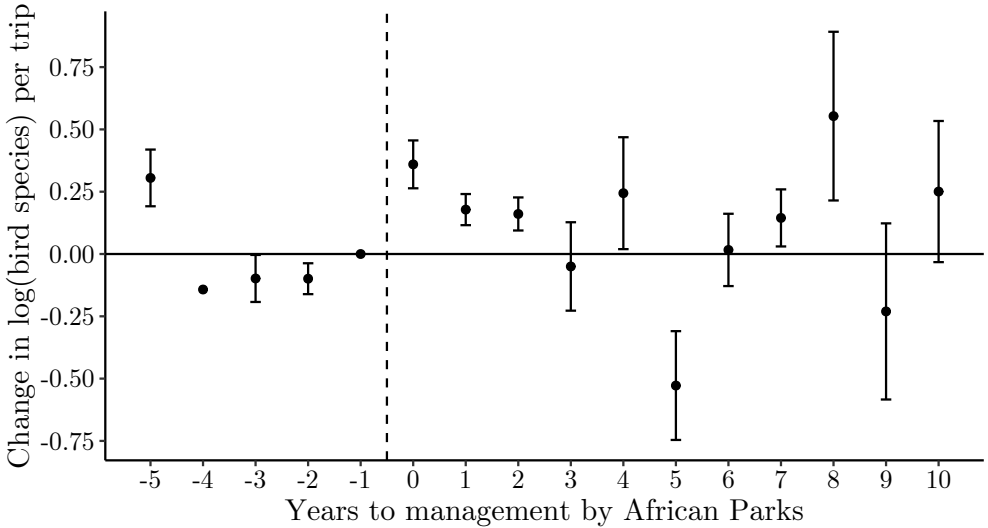


ATT = -0.107 (0.053) Back



Cohort ATT

Back

Table: Average effects of AP management on log(bird species)

Cohort	Coefficient	Standard error	Treated N	Control mean
A. Average treatment effect on the treated by cohort				
2003	-1.291	(0.083)	604	2.188
2008	-0.386	(0.053)	87	2.188
2010	0.092	(0.103)	1,850	2.188
2015	0.168	(0.055)	839	2.188
2017	0.384	(0.185)	123	2.188
2019	-0.133	(0.074)	54	2.188
2020	0.049	(0.051)	1,502	2.188
2021	0.193	(0.044)	1,234	2.188
B. Average treatment effect on the treated (all cohorts)				
All	-0.107	(0.053)	7,574	2.188

1{iNaturalist visits}: ATT = 0.22 (0.03), vs. mean dep. var. = 0.46

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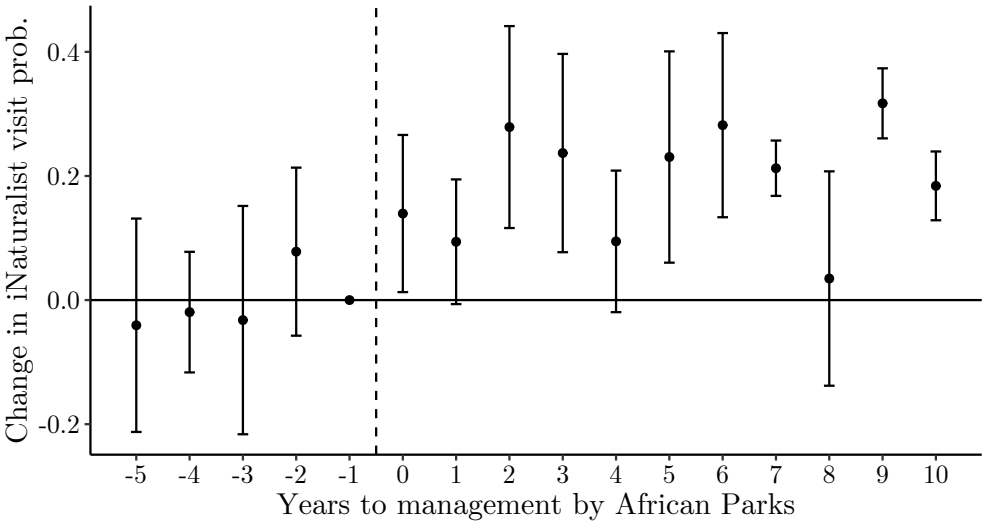
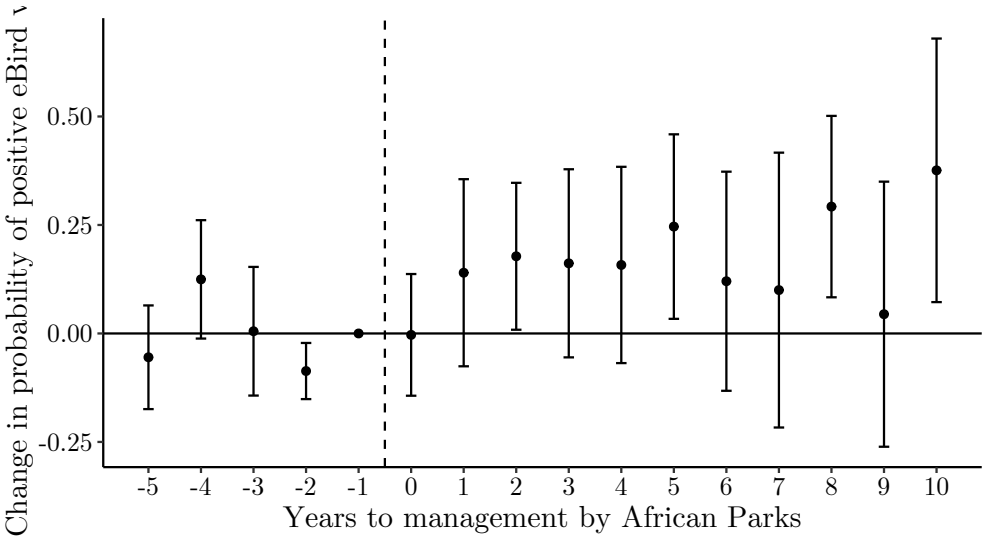
Robust



1{eBird visits}: ATT = 0.19 (0.11), vs. mean dep. var. = 0.51

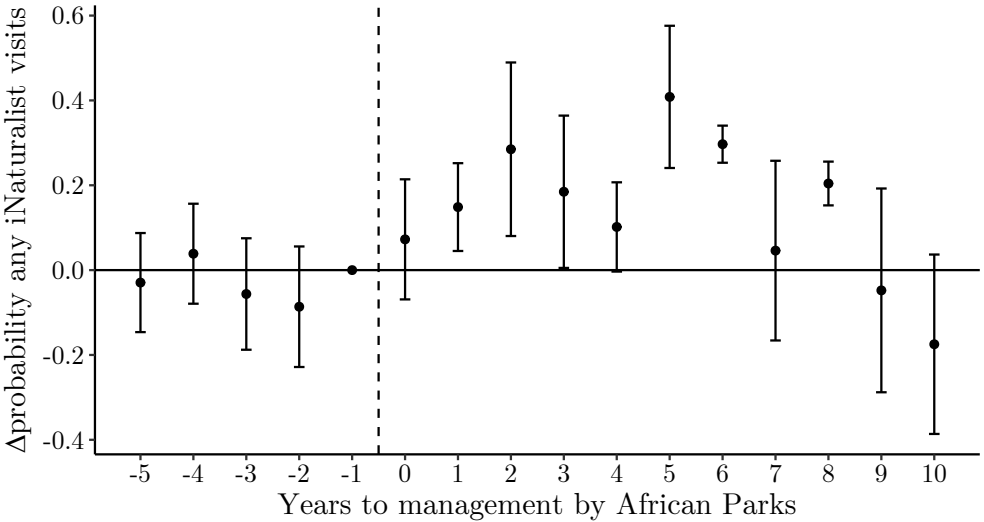
Back Robust



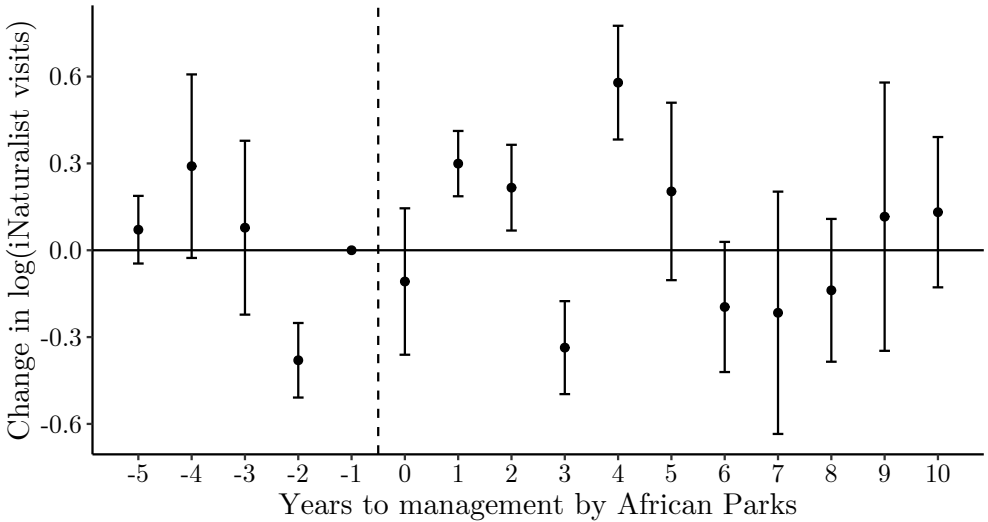
Tourism robustness Back

- Excluding potential staff from iNaturalist data reduces ATT from 0.22 to 0.18 Figure
- log(number of iNaturalist visits per year) as dependent variable Figure
- log(number of eBird visits per year) as dependent variable Figure

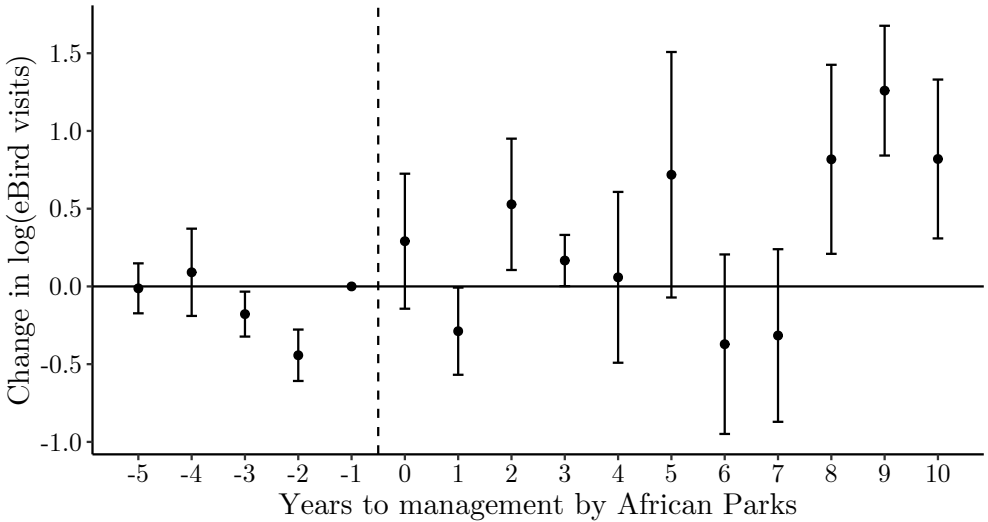
ATT = 0.18 (0.04), vs. mean dep. var of 0.34 Back



ATT = 0.06 (0.04) Back



ATT = 0.26 (0.10) Back



Mean asset wealth within 25 km of parks, 2003-2021

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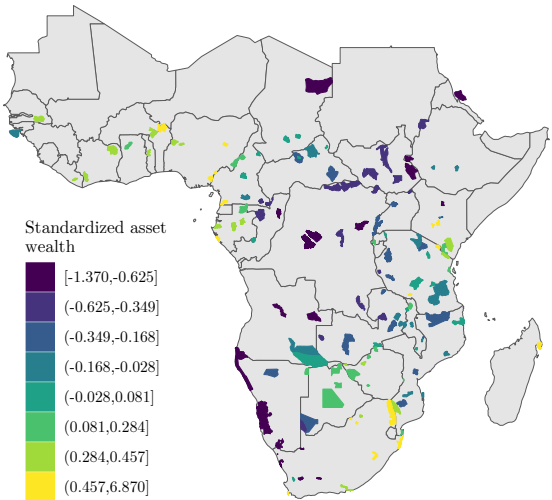

Effect of AP on asset wealth is inconclusive (ATT = 0.10 with SE of 0.03)

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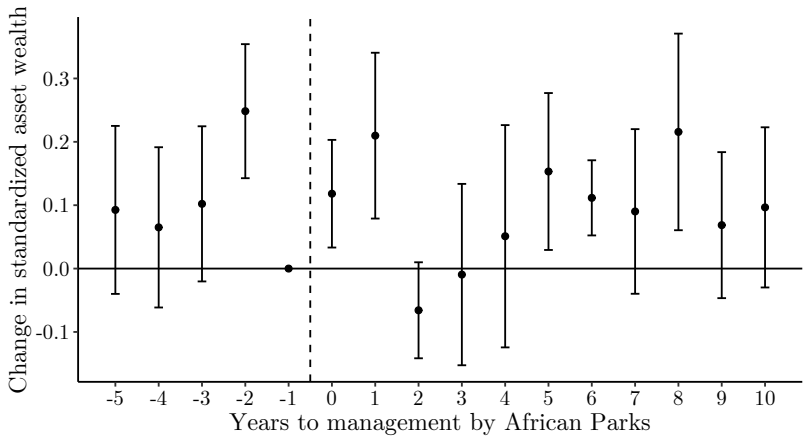
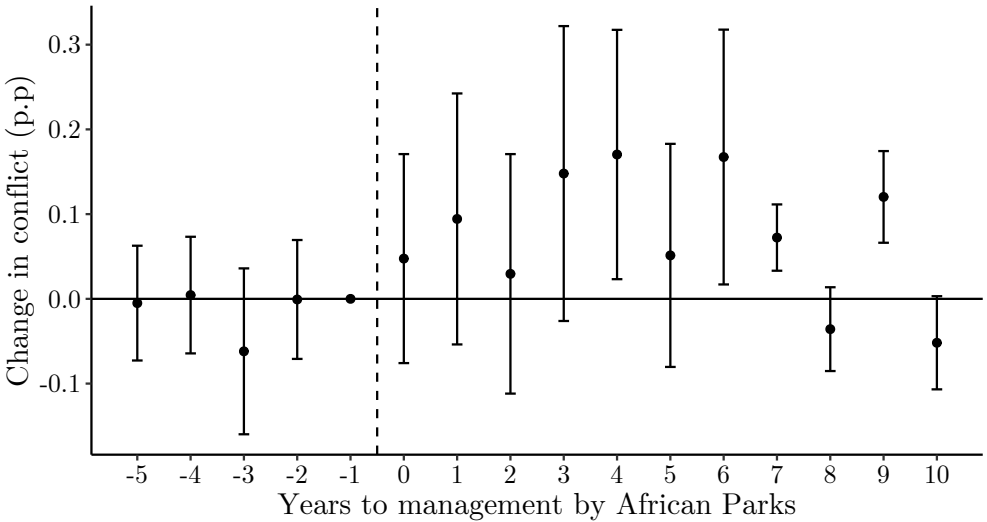


1{Violence against civilians}: ATT = 0.08 (0.04), vs. mean dep. var. of 0.16

Back Other outcomes



AP does not affect other measures of conflict Back

- 1{Battles} Figure
- 1{Protests and riots} Figure
- Violence against civilians (count) Figure

1{Battles}: ATT = 0.05 (0.03), vs. mean dep. var. of 0.11

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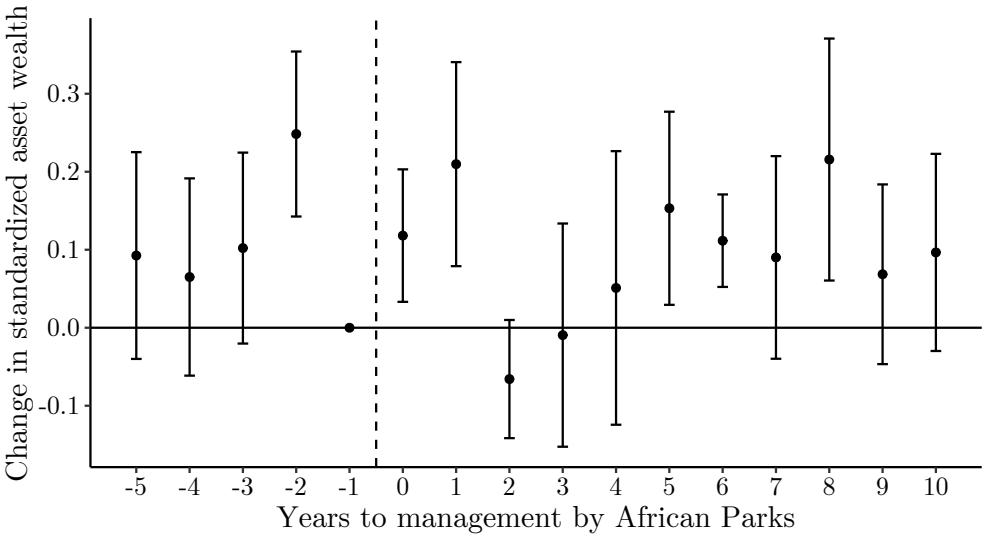

1{Protests and riots}: ATT = -0.03 (0.03), vs. mean dep. var. of 0.17

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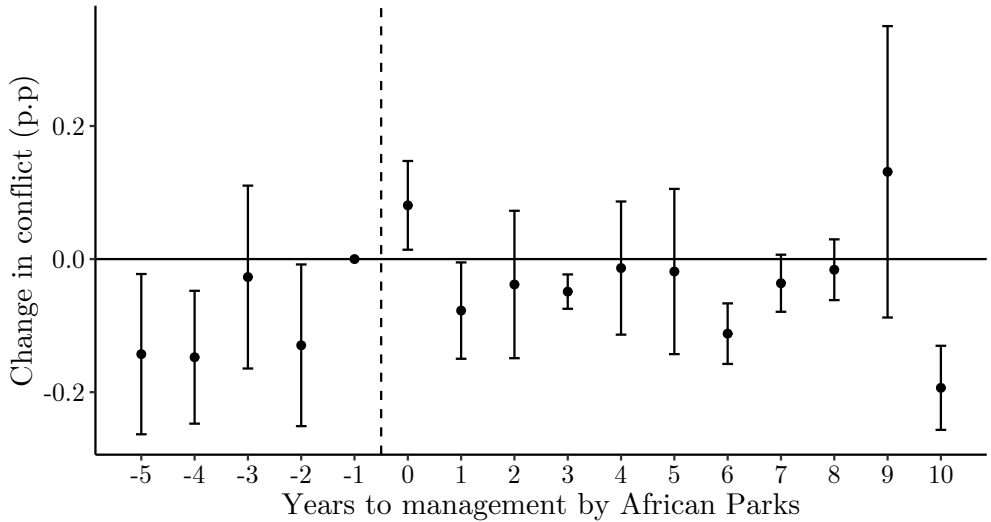

Violence against civilians (count): ATT = -0.19 (0.54), vs. mean dep. var. of 1.29

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