Links between environmental conservation, conflict violence and human resilience in northern Democratic Republic of the Congo

Jocelyn TD Kelly[1]*
Danielle N. Roth[2]
Taylor Burl[3]
Michael Vanrooyen[1]

Abstract

The vast majority of wars fought in Africa occur in the continent's biodiversity hotspots. Yet the link between humans, political conflict and environmental conservation is poorly understood. This research aims to contribute to this understanding by assessing how exposure to conflict violence may be associated with harmful environmental behaviours, and how resilience measure through a psychometric scale may modify this relationship. This paper draws on a two-stage cluster randomized survey conducted with 1,798 respondents in conflict-affected northern Congo. A stepwise multi-leveling model was used to examine the relationship between conflict exposure and the outcome of interest – hunting or farming in a protected environmental area. Exposure to war-related abuses – measured a number of different ways – is strongly associated with an individual's likelihood to engage in harmful environmental practices. Lower resilience scores were also associated with the outcome and did not modify the relationship between conflict and environmental degradation.

Background

The vast majority of wars fought in Africa occur in the continent's biodiversity hotspots - yet the impact of war on conversation has rarely been studied (Daskin & Pringle, 2018). Doing so is more critical than ever, however, since climate change and environmental degradation threaten irreplaceable natural environments and levels of political conflict are at their deadliest levels in 50 years (Brooks et al, 2006; Pettersson & Wallensteen, 2015). Understanding the intersection between human populations, political conflict, climate change and environmental conservation is an important frontier in scientific inquiry.

Africa's Congo Basin serves as one of the most large-scale case studies for this phenomenon. The region is home to over 400 species of mammals, many of which are wholly unique to this ecosystem, while forests in the Congo Basin serve as the "lungs" for the world – converting carbon dioxide into oxygen and helping to stabilize the globe's climate in the process (Economist, 2010). Yet this is an area that has also been plagued by decades of conflict-related violence. The Democratic Republic of Congo (DRC), which contains the greatest majority of the forests in the Congo Basin has suffered decades of armed conflict that has had devastating effects on both the humans and the natural environments in this area. In the north of the country where this work was undertaken, an array of splintered armed factions prey on local populations

[1] Harvard Humanitarian Initiative, Harvard University, 14 Story St, 2nd Floor, Cambridge MA 02138, Corresponding author
[2] International Rescue Committee, 419 Boston Ave, Medford, MA 02155 k
[3] Tufts University, 419 Boston Ave, Medford, MA 02155

(Invisible Children, 2018). These groups include the Lord's Resistance Army, Ex-Seleka and Anti-Balaka rebel groups, poorly trained national troops, armed bandits, and violent poaching groups (TRAFFIC, 2017). Looting of goods, destruction of crops, abduction and killing are commonplace in the region.

Populations of the Uélé provinces include a heterogeneous mix of ethnic groups and tribes that can be generally sub-divided into Bantu peoples practicing primarily small-scale agriculture, Nilotic peoples and Mbororo nomadic or semi-nomadic pastoralists. Armed conflict in the Uélés has deeply impacted these groups' livelihood strategies, with competition for access to resources leading to conflicts between Bantu populations and the local Mbororo groups. These conflicts are characterized by disputes over access to water and land for grazing, trampling of crops by livestock, and cattle causing wildlife to leave the area. Tensions are further exacerbated by questions related to immigration and the legality of the Mbororo presence in North and Northeastern DRC (TRAFFIC, 2017) as well as differences in lifestyle, cultural, and religious beliefs (African Union, 2007).

This violence can create sweeping social, political and economic disruptions that fundamentally change the way people interact with their environments (Gaynor et al, 2016). In the DRC, chaos and a breakdown in the rule of law has meant that armed groups, poachers and criminal groups have been able to exploit protected areas while opening new trade routes for illegal natural resources (Beyers, 2011; De Merode, 2007; Nelleman et al, 2010). The main causes of deforestation in the Congo Basin include increases in population density, small-scale agriculture, fuelwood collection and forest's accessibility – all patterns that can be affected by population movement due to conflict (Ernst et al, 2013).

Resilience has emerged as a key area of research and programming in humanitarian settings over the last decade. This is an area of study that is particularly critical when looking at human's ability to respond to shocks such as war and climate change. Yet while resilience has become an important focus of international actors, its conceptual underpinnings, measurement, and programmatic approaches are not always well-defined or systematically measured. Definitions of resilience vary. The United Nations definition is perhaps one of the most widely accepted and applicable; it states resilience is "the ability of a system, community or society exposed to hazards to resist, absorb, accommodate to, and recover from, the effects of a hazard in a timely and efficient manner, including through the preservation and restoration of its essential basic structures and functions" (United Nations, 2009).

In conflict-affected contexts, numerous coping and adaptive behaviors serve as protective factors that enable resilience in the short-term and also contribute to long-term resilience. A qualitative study in the Congo Basin looking at communities affected by the violence from the Lord's Resistance Army (LRA) identified "sharing resources, developing early warning systems, organizing local defense units, and drawing on faith organizations to create a sense of hope and unity" as community coping mechanisms (HHI, 2012). This work highlights both the community-based and individual-based resilience strategies are leveraged by communities affected by political violence in this region. However, little quantitative work has been done to empirically assess how experiencing conflict violence impacts the probability that communities will engage in harmful practices for the environment.

It is probable that highly stressed communities facing threats from violence – including displacement, looting of goods and crops, inability to access farmland and restriction of movement – might be more likely to turn to survival strategies that are detrimental in the long-term. These strategies may include farming and hunting in areas with endangered animals and ecosystems that have been legally protected by the government, such as natural parks and nature reserves. An additional question is whether resilience at both the individual and community level may mediate this relationship. The authors are not aware of any scholarship that uses quantitative methods to look at the intersection of human resilience, conflict and environmental conservation. This survey aims to contribute to this understanding by assessing how exposure to violence may be associated with harmful environmental behaviours, and how individual and community resilience may modify this relationship.

Methods

A cross-sectional study was conducted in two provinces (Haute Uele and Bas Uele) in northern DRC. This work drew on a two-stage cluster random sampling design at the village and household levels. Interviewees were asked to participate in a 60-minute verbally administered survey about war experiences, mental health, and conservation attitudes and behavior. The survey was conducted between March 27th, 2018 and April 28th, 2018 and was administered to 1,798 respondents ages 18-88 in 64 rural communities across in seven districts. These districts included: Ango, Bondo, Dungu, Faradje, Niangara, Poko, Rungu. A random walk technique with a randomly chosen starting direction was used to ensure that each household had equal probability of being sampled. Female enumerators requested interviews with female respondents while male enumerators interacted with male respondents. Only one interviewee per household was sought in order to protect the confidentiality of that person.

The survey was undertaken as a baseline for a larger impact evaluation for a five-year USAID-funded project being undertaken by the non-governmental (NGO) Invisible Children. At the time of the survey, no project activities had yet been undertaken. The Partners Human Research Committee Institutional Review Board approved all research activities. Informed consent was obtained for each individual participating in the research, and permission to continue with the survey was re-affirmed at three points during the survey administration. All local researchers received training in quantitative research techniques. Local researchers had prior experience working in conflict-affected populations and received additional training in recognition of participant distress for austerity. Interviews and focus groups were conducted in the language of the participants' preference, including Zande, Lingala, French, and Arabic.

Survey data was collected and recorded via the Kobo Toolbox (Kobo Toolbox, Cambridge, MA) on Android tablets. This method ensured that the GPS location and duration of the survey was automatically recorded and skip patters in the survey were appropriately administered. Additional data cleaning and verification was undertaken with the survey team. Final analysis was conducted among completed questionnaires. Six questionnaires (0.3%) were excluded due to missing geographic information or incomplete data, leaving a total sample of 1,792.

Conservation, political violence and resilience measures

The dependent variable of interest for this project is harmful environmental practices. This was defined as an individual stating they had either hunted or farmed in an environmentally protected

area (this includes national parks and protected zones where hunting and farming is banned). In the survey, this was assessed through two questions ("Have you ever hunted in a protected area?" and "Have you ever farmed in a protected area?"). Respondents answering yes to either question were coded as having undertaken a harmful environmental practice.

Conflict experiences were assessed through an 11-item scale asking about abuses that respondents may have experienced during the conflict in northern DRC. The items asked about having experienced: looting of a house, looting of goods, being forced to flee from an armed group, being abducted by an armed group, being forced to transport goods, being beaten by an armed group, being forced to kill another person, village attacked by an armed group, being beaten by an armed combatant, being forced to beat another person, being forced to loot another person's goods. An individual was considered to have experienced any conflict trauma if he or she reported any of these experiences. In addition, individuals were asked whether they are currently displaced, and whether they had experienced any ethnically-driven conflict. Finally, village-level data on the number of conflict incidents that occurred in the past 5 years was added to the dataset. This information was available from LRA CrisisTracker, a database and website that closely tracks community-reported incidents in the project area. Incidents include: abduction, rape, looting and killing (Crisis Tracker, 2018).

Two validated psychometric scales were used to assess individual resilience and community resilience in this survey. The questions comprising each scale are given in Table 1. For each question, the respondent could answer agree, don't know, disagree. Agree was given a score of 2, don't know a score of 1 and disagree as score of 0. An aggregate score was created for each scale by adding the values of the response from each question in the scale. A higher score was associated with greater resilience.

Model fitting

A multilevel modeling approach was used to account for the nested structure of the data, with clustering of individuals within districts. In Stata, the *gllamm* command was used to account for the nested structure of the data (Rabe-Hesketh et al, 2002). Independent variables were added in blocks through a stepwise procedure, which allowed the authors to examine how the addition subsequent variables impacted the associations in the model. The models included a random intercept for district to account for the geographic clustering of the sample.

Multilevel Model - Dichotomous Exposure:

$$\text{Logit}\left(Y_{ij} = 1\right) = \beta 0 + b_{0i} + \beta 1 \text{I}(\text{conflict}_i > 0) + \beta 2 X_{ij}$$

In the regression equation above, *i* indexes the district and j indexes the individual. (Yij)* is the indicator for whether an individual (j) in district (i) has reported undertaking harmful environmental practices. β_0+b0i defines the district level odds of a person undertaking harmful environmental practices in village *i* given no conflict holding the individual-level covariates fixed. β1 gives the odds ratio of harmful environmental practices if the village experienced any village-level violence compared to the odds of the outcome with no village-level violence. X_ij contains individual's demographic and other characteristics which are adjusted for in the model. The primary predictors related to conflict experience were added to the model first, including i)

current displacement status ii) conflict victimization (any versus none) and iii) experience with ethnic conflict. The scores for individual and community resilience are then added. Two blocks of additional adjustment variables were then added, variables were chosen based on an understanding of the issue and which variables might be most significantly associated with the outcome. The first block includes demographic variables, including: i) sex ii) age iii) education iv) wealth tertile. Finally, a block of variables related to an individual's access to the park and access to land are added, including: v) proximity to the park vi) land ownership (own versus don't own) vii) documentation of land rights and viii) reason for using the land. As noted before, the individual level characteristics are added to the model in blocks of related variables. Analysis was completed using Stata/SE 14.2 (StataCorp LP, College Station, TX).

Results

Table 2 provides the demographic characteristics of the survey respondents. Table 3 shows the binomial association between the dependent variable and the independent variables. As noted in the methods section, this analysis uses a stepwise modeling approach where blocks of independent variables are added sequentially. Model 1 in Table 4 examines the association between harmful environmental practices and exposure to conflict, the predictors of primary interest. We see that being currently displaced (aOR1.83, $p<0.001$), having experienced any ethnic conflict (aOR1.93, $p<0.001$), and having had any conflict experiences (aOR 2.55, $p<0.001$) in the past are all strongly and significantly associated with the outcome. The measure of conflict at the community level is does not reach significance.

In Model 2 in Table 4, measures of individual and community resilience are added to the model. These measures do not significantly affect the association between conflict and harmful environmental behaviours, although individual resilience is significantly associated with harmful environmental practices. An individual engaging in hunting or farming in a protected area has an individual resilience score that is 0.08 points lower than an individual who does not engage in this behaviour ($p<0.05$). Adding demographic variables in Model 3 does not significantly change these associations. In Model 4, variables related to park access and land use were add. Not surprisingly, proximity to a protected area greatly increased the chances that an individual would hunt or farm in these areas (aOR 4.36, $p<0.001$). In addition, owning land was highly protective against engaging in hunting or farming in protected areas (aOR 0.59, $p<0.05$). Finally, those cultivating land to sell at markets, as opposed to farming at a subsistence level were also more likely to exploit protected lands (aOR 1.66, $p<0.05$). Taken together, the land-related variables significantly modified the relationship between conflict and the outcome but did not impact the individual resilience score.

Limitations

This analysis represents a cross-sectional assessment of the association between resilience, conservation activities and exposure to violence. Because this is not a longitudinal project, this project cannot postulate causal relationships between the variable examined here. Further work, which could include both qualitative and quantitate techniques could further explore the interplay between pro-conservation behaviours and resilience. While every effort was made to emphasize that there would be no compensation for participating in this project, it is possible that respondents were motivated to participate in this research due to an expectation of receiving services. This may have motivated some participants to over emphasized personal or community

risks in the expectation of receiving services. However, it seems unlikely that this would occur on a scale that could bias research results, particularly since surveyors were not affiliated with an NGO and extensively explained the independence of the research from NGO efforts. The questions used to measure PTSD and depression have been previously tested and used in DRC (Bass et al, 2013). However, the measures of individual and community resilience as well as self-efficacy are new in this environment. While the survey was tested and piloted in this setting to ensure it was comprehensible and culturally meaningful, these results should still be interpreted with caution.

Discussion

Exposure to war-related abuses – measured a number of different ways – is strongly associated with an individual's likelihood to engage in harmful environmental practices. In the final model, current displacement, any experience with a conflict abuse, and any experience with an ethnic conflict were highly associated with greater odds of hunting or farming in a protected area. Conflict as measured at the community level did not reach significance in the final model. This may be because, in a highly mobile environment with a large amount of displacement, the effect of the past five years conflict in a given place is not as strong as an individual's personal experience with conflict.

This association between conflict and the outcome was somewhat moderated by land ownership and farming to sell crops rather than for one's own consumption. Landownership was protective against harmful environmental practices; it is plausible that having access to one's own land might reduce one's need to resort to farming in a protected area. Farming in order to sell goods at market (rather than for subsistence) heightened the risk of the outcome, suggesting that farming undertaking in the park may not be purely for subsistence but for profit.

In this study, those who engaged in harmful environmental practices were also more likely to have a significantly lower individual resilience score than those who did not. Given the cross-sectional nature of this study, it is not possible to say which direction causality may lie. It is possible that lower resilience may drive an individual to risk undertaking livelihoods activities in places where they know such actions are banned. It is also possible that hunting and farming in protected areas also brings vulnerabilities such as predation by armed groups and sanctions by park personnel that may impact an individual's perception of themselves as able to recover setbacks and shocks. We do see that, while access to land is highly protective against engaging in harmful environmental activities, it does not mediate the relationship with resilience. These findings may suggest that individual resilience is independent of many of the traditional factors that might be thought to affect resilience, including: wealth, education, access to land, age and sex. This finding suggests this may be a fruitful area for further study. Finding out what factors – and which interventions – may help support resilience could be a fruitful area for further research.

To date, there is limited literature looking specifically at how conflict affects wildlife and biodiversity outcomes, and little consensus on whether conflict may be harmful or potentially protective in these areas (Dudley, 2002). Conflict can sometimes insulate environments from wider economic pressures by making an area inaccessible and too unstable to invest in (Butsic, 2015; Gaynor, 2016). In contrast, poaching, exploitation, displacement and violence could make fragile ecosystems vulnerable to unregulated exploitation (Beyers, 2011; De Merode, 2007,

Dudley, 2002). A recent study in Nature found that large mammal populations are adversely affected by conflict (Daskin & Pringle, 2018).

While the exact pathways that promote this decline are still somewhat unclear, the results of the current study suggest that individuals directly affected by conflict may resort to hunting and farming in protected areas as a survival strategy. In post-conflict environments, programs that promote pro-conservation livelihoods may help reverse trends to exploit the natural environment.

Bibliography

African Union. (2007). Report on the Migrations of Mbororo Nomadic Pastoralists by the Fact-finding Mission dispatched to the Democratic Republic of the Congo and the Central African Republic.

Bass, J. K., Annan, J., McIvor Murray, S., Kaysen, D., Griffiths, S., Cetinoglu, T., ... & Bolton, P. A. (2013). Controlled trial of psychotherapy for Congolese survivors of sexual violence. *New England Journal of Medicine*, *368*(23), 2182-2191.

Beyers, R. L., Hart, J. A., Sinclair, A. R., Grossmann, F., Klinkenberg, B., & Dino, S. (2011). Resource wars and conflict ivory: the impact of civil conflict on elephants in the Democratic Republic of Congo-the case of the Okapi Reserve. PloS one, 6(11), e27129.

Butsic, V., Baumann, M., Shortland, A., Walker, S., & Kuemmerle, T. (2015). Conservation and conflict in the Democratic Republic of Congo: The impacts of warfare, mining, and protected areas on deforestation. *Biological conservation*, *191*, 266-273.

Crisis Tracker, https://www.lracrisistracker.com.

Daskin, Joshua & Pringle, Robert. (2018). Warfare and Wildlife Declines in Africa. *Nature*.

De Merode, E., Smith, K. H., Homewood, K., Pettifor, R., Rowcliffe, M., & Cowlishaw, G. (2007). The impact of armed conflict on protected-area efficacy in Central Africa. Biology letters, 3(3), 299-301.

Dudley, J. P., Ginsberg, J. R., Plumptre, A. J., Hart, J. A., & Campos, L. C. (2002). Effects of war and civil strife on wildlife and wildlife habitats. Conservation Biology, 16(2), 319-329.

Gaynor, Kaitlyn & Fiorella, Kathryn & H. Gregory, Gillian & Kurz, David & Seto, Katherine & Withey, Lauren & Brashares, Justin. (2016). War and wildlife: linking armed conflict to conservation. *Frontiers in Ecology and the Environment*.

Harvard Humanitarian Initiative. (2015). We Mobilized Ourselves: Community Resilience in Areas Affected by the Lord's Resistance Army.

Invisible Children. (2018). Annual Brief: LRA Crisis Tracker 2017.

Nellemann C, Redmond I, and Refisch J (Eds). (2010). The last stand of the gorilla – environmental crime and conflict in theCongo Basin. Arendal, Norway: UNEP.

Rabe-Hesketh S, Skrondal A, Pickles A. GLLAMM Manual. U.C. Berkeley Division of Biostatistics Working Paper Series. Working Paper 160.

StataCorp LP. (2011). Stata/SE 14.0 for Windows. College Station, TX: StataCorp LP.

TRAFFIC. (2017). An Assessment of Poaching and Wildlife Trafficking in the Garamba-Bili-Chinko Transboundary Landscape.

United Nations. (2009). United Nations Office for Disaster Risk Reduction, UNISDR Terminology and Disaster Risk Reduction. Accessed at http://www.un.org/en/development/desa/policy/untaskteam_undf/thinkpieces/3_disaster_risk_resilience.pdf

Table 1. Resilience Scales

Community Resilience	Individual Resilience
1. People in my community feel like they belong to the community. 2. People in my community have hope for the future. 3. People in my community help each other. 4. My community treats people fairly no matter what their background is. 5. My community has effective leaders. 6. People in my community discuss issues so they can improve the community. 7. People in my community work together to improve the community. 8. My community keeps people informed about important news 9. People in my community trust the leaders	1. I feel that I belong in my community 2. I know where to go if I need help 3. I cooperate with people around me 4. I have people in my life who I can respect 5. Spiritual beliefs are a source of strength for me 6. If I am hungry, I can usually get enough food to eat 7. I think it is important to help out in my community

Table 2. Bivariate Associations between Outcome of Interest (Harmful Environmental Practices) and Independent Variables

		OR	P value	Low CI	High CI
Any community-level violence in the past 5 years		0.58	**0.01**	0.38	0.90
Currently displaced		2.68	**<0.001**	1.87	3.86
Have experience ethnically motivated conflict		3.12	**<0.001**	2.08	4.67
Any versus no conflict related experiences		2.05	**<0.001**	1.49	2.82
Individual resilience score		0.91	**<0.001**	0.87	0.96
Community resilience score		0.96	**0.03**	0.92	0.99
Sex		0.78	0.11	0.57	1.06
Age		1.00	0.55	0.99	1.01
Education	No education (ref)				
	Primary education	0.93	0.68	0.66	1.31
	Secondary or higher education	0.79	0.36	0.48	1.30
Wealth	Poorest (ref)				
	Middle	1.08	0.69	0.74	1.56
	Richest	0.73	0.13	0.49	1.09
Near park		3.98	**0.00**	2.77	5.71
Owner of land		0.70	**0.04**	0.50	0.98
Type of land use	Personal use (ref)				
	To sell at market	1.88	**0.00**	1.34	2.65
	Other	0.75	0.45	0.36	1.59

Table 3. Demographic Characteristics of Sample

		Mean	**SE**
Age		37.59	0.33
Individual resilience score (0-14)		8.1	3.65
Community resilience score (0-18)		9.31	4.44
		N	**%**
Currently displaced	No	1,459	81.42
	Yes	333	18.58
Experienced ethnic conflict	No	1,066	59.49
	Yes	726	40.51
Experienced any conflict violence	No	612	34.15
	Yes	1,180	65.85
Sex	Male	896	50
	Female	896	50
Education	No education	834	46.62
	Primary education	685	38.29
	Secondary or higher education	270	15.09
Wealth	Poorest	601	33.54
	Middle	632	35.27
	Richest	559	31.19
Near park	No	1,388	77.46
	Yes	404	22.54
Owner of land	No	30.8	30.8
	Yes	1,240	69.2
Type of land use	Personal use (ref)	695	38.78
	To sell at market	941	52.51
	Other	156	8.71

Table 4. Association of Harmful Environmental Practices with Conflict Exposure: Stepwise Model Fitting

		Model 1				**Model 2**				**Model 3**				**Model 4**			
		OR	P value	Low CI	High CI	OR	P value	Low CI	High CI	OR	P value	Low CI	High CI	OR	P value	Low CI	High CI
Any community-level violence in the past 5 years		1.30	0.35	0.75	2.23	1.32	0.30	0.78	2.25	1.40	0.17	0.87	2.27	0.52	0.11	0.23	1.17
Currently displaced		1.83	**<0.001**	1.25	2.69	1.72	**0.01**	1.17	2.52	1.77	**0.01**	1.18	2.65	1.68	**0.03**	1.05	2.69
Have experience ethnically motivated conflict		1.93	**<0.001**	1.39	2.68	1.93	**<0.001**	1.39	2.69	1.97	**<0.001**	1.41	2.75	1.60	**0.01**	1.12	2.29
Any versus no conflict related experiences		2.55	**<0.001**	1.67	3.89	2.55	**<0.001**	1.66	3.90	2.55	**<0.001**	1.66	3.90	2.25	**<0.001**	1.43	3.52
Individual resilience score						0.92	**0.02**	0.86	0.98	0.92	**0.01**	0.86	0.98	0.91	**0.01**	0.84	0.97
Community resilience score						1.03	0.32	0.97	1.09	1.04	0.21	0.98	1.09	1.05	0.10	0.99	1.11
Sex										1.20	0.33	0.83	1.71	1.30	0.23	0.85	1.98
Age										1.00	0.79	0.99	1.01	1.00	0.48	0.98	1.01
Education	No education (ref)									--	--	--	--	--	--	--	--
	Primary									0.81	0.25	0.57	1.16	0.87	0.46	0.60	1.25
	Secondary or higher									0.78	0.37	0.45	1.35	0.82	0.48	0.47	1.43
Wealth	Poorest (ref)									--	--	--	--	--	--	--	--
	Middle									1.06	0.79	0.71	1.56	0.96	0.85	0.62	1.48
	Richest									0.81	0.31	0.53	1.22	0.78	0.31	0.49	1.25
Near park														4.36	**0.00**	2.89	6.58
Owner of land														0.59	**0.01**	0.40	0.89
Type of land use	Personal use (ref)													--	--	--	--
	To sell at market													1.66	**0.01**	1.12	2.46
	Other													0.66	0.34	0.28	1.55