Armed Conflict, Community Forest User Groups, and Natural Resource Management

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Abstract

The bi-directional relationship between armed conflict and natural resources is complex, shaped by social and ecological mechanisms. While the literature has been successful documenting consequences of armed conflict on wildlife, there has been less research examining the specific causal mechanisms through which armed conflict harms natural environments. We use an institutional analysis and development (IAD) approach to explore the social and ecological factors that drive the relationship between armed conflict and the resilience of resource management. Our setting is 21 community forests and their user groups in the Chitwan Valley of Nepal from 1995 through 2010—a period that spans the beginning, middle, and end of the violent Maoist insurgency. We show that armed conflict weakens community forest conservation programs and financial resources. However, within this broader context, the most vulnerable user groups appeared to be those tasked with overseeing larger community forests and more management activities.

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Introduction

The bi-directional relationship between armed conflict and natural resources is complex, shaped by social and ecological mechanisms. Numerous studies have explored whether the presence of natural resources may trigger armed conflict or may prolong it (Collier and Hoeffler, 1998; Rustad et al. 2008; Bohle and Funfgeld, 2007). Because natural resources are valuable, groups may engage in violence to control these goods if normative political, social, and economic routes prove unsuccessful. However, recent work has found little evidence that countries with more resources are more prone to armed conflict, suggesting that this relationship is weak, or may operate on local rather than larger geopolitical scales (Rustad et al., 2008; Brunnschweiler and Bulte, 2009).

Most prior research has focused on the impacts armed conflict has on natural resources. This research offers useful frameworks for thinking about the mechanisms by which armed conflict affects natural resources. Some literature suggests that, in the short term and at very local scales, there could be unexpected consequences of conflict. For example, armed conflict could lead to demilitarized zones that greatly reduce human disturbance (Beyers et al. 2011), or armed conflict could depress economic activity and related rates of natural resource extraction (Hanson et al., 2009). Overall, however, armed conflict usually has negative effects on natural environments. For example, Beyers et al. (2011) examined elephant densities in the Democratic Republic of Congo before and after a recent civil war and found that the conflict led to decreased elephant abundance. Chase and Griffin (2011) concluded that the Angolan civil war greatly reduced elephant populations, and these populations began to recover significantly after the civil war ended. And Loucks et al. (2009) documented negative changes in species richness in Cambodia as a result of armed conflict. These deleterious effects of conflict are not limited to

forests, and some have argued that freshwater ecosystems are even more vulnerable to armed conflict (Francis, 2011). Understanding the multiple, causal mechanisms driving feedbacks between conflict and resource availability is central to developing strategies to mitigate natural resource loss during rapid, often catastrophic social change.

While the research literature has been largely successful documenting consequences of armed conflict on wildlife (Beyers et al. 2011; Lindsell et al. 2011; Chase and Griffin, 2011; Loucks et al. 2009), there has been far less research examining the specific causal mechanisms through which armed conflict harms natural environments. For example, armed conflict may have both direct and indirect effects: warring forces might directly harm or destroy forests and wildlife during combat, but conflict could also indirectly harm natural resources by disrupting usual management plans and regular protections previously set up to guard these resources (Beyers et al. 2001). It is critical to understand how armed conflict leads to decreased biodiversity or species abundance because knowledge of the mechanisms may allow supports to be put in place once an armed conflict begins. Direct effects of armed conflict may be highly visible, such as insurgents in Turkey deliberately targeting forests for burning as a way to destroy resources (Van Etten et al. 2008). Indirect, effects, however, are more potentially more diffuse and more difficult to study. For example, de Merode et al. (2007) studied how anti-poaching patrols varied in periods before, during, and after armed conflict in the Democratic Republic of Congo. They suggest that patrol efforts may need to be heightened in periods of conflict because there was an overall increase in poaching during wartime.

In this paper, we use an institutional analysis and development (IAD) approach (Ostrom 2010) to explore the social and ecological factors that drive the relationship between armed conflict and the resilience of resource management activities. The impacts of war are likely to be heterogeneous and contingent on different institutions' abilities to cope. Thus, an IAD approach allows us to consider the multiple organizations, entities, and stakeholders who have an interest in the natural environment, as well as their differential abilities, motivations, and resources for

responding to sociopolitical strife. The setting of our analysis is 21 independently controlled community forests and their user groups in the Chitwan Valley of Nepal from 1995 through 2010--a period that spans the beginning, middle, and end of the violent Maoist insurgency in Nepal. We test how different forms of conflict affect resource management activities, and how institutional characteristics affect the vulnerability or resilience of community forests to natural resource degradation. As found elsewhere, we show that armed conflict weakens community forest conservation programs and financial resources. However, within this broader context, the most vulnerable user groups appeared to be those tasked with overseeing larger community forests and more management activities.

Setting, Background, and Hypotheses

The Chitwan district of Nepal is located in the Terai, a biodiverse, subtropical region of low-elevation plains along the southern border with India. In the 1950s, the Nepalese government (with assistance from the US Agency for International Development) introduced the Rapti Valley Land Development Project to eradicate malaria and clear primary forest for farmland (Ghimire 1992; Shivakoti et al. 1999; Axinn and Yabiku 2001). By the end of the 1960s, the fertile Chitwan Valley became a major farming region with ample forest products nearby, and migration, services, and infrastructure expanded across the area (KC and Suwal 1993; Guneratne 1996; Axinn and Yabiku 2001). In 1973, the government established The Chitwan National Park, home to endangered, high-profile species such as the Bengal tiger and one-horned rhinoceros, with armed protection at its borders.

By the 1990s, forest resources in the Chitwan area and beyond had become severely degraded by overuse, leading to the Nepal Forest Act of 1993 that established a community forest system to enhance protection of land resources. Management activities were coordinated by local community groups (Forest User Groups; FUGs) who depend on these forests for their livelihoods. While community forestry in Nepal has proven to be successful over the long-term,

the management capability of these new institutions was challenged by the armed conflict in the late 1990s and 2000s. Qualitative and anecdotal evidence suggest that FUG practices in Chitwan were curtailed and became less effective during the uprising. However, to date no studies have explored drivers of the substantial variation in community forest vulnerability due to institutional characteristics experienced during this period.

The conflict in Nepal lasted from 1996 to 2006, and it was started by the Maoist Party of Nepal (Williams et al. 2012). The conflict was sometimes called the “people’s war,” and the Maoist goal was to was to remove the Nepali monarchy, which was seen as ineffective at addressing Nepal’s persistent problems such as poverty (Bhattacharya, 2013; Nepal et al. 2011). The armed conflict was mostly a series of guerilla-style attacks rather than large battles, although over the 10 year period it is estimated that over 12,000 people were killed, including civilians, government forces, and Maoist fighters (Office of the High Commissioner for Human Rights, 2012). A key feature of the conflict is that while violent incidents were generally small and involved few participants, the number of incidents was large, and thus all regions of the country were affected. The number of alleged unlawful killings, sexual violence, disappearances, and torture totaled more than 8,000 separate incidents (Office of the High Commissioner for Human Rights, 2012).

We use the institutional analysis and development (IAD) framework to develop our hypotheses. An IAD approach is ideal because it places in the foreground the role of institutions. Also, the approach suggests which factors are the most relevant, including factors from the social, ecological, and institutional systems, even when those factors span multiple scales or levels of analysis. In the setting of community forests in Chitwan, the contextual factors most likely to affect how community forest user groups responds to the institutional disruption from armed conflict are 1) the natural biophysical properties of the forest that each forest user group maintains, 2) the characteristics of individuals and leaders in the community forest user groups, and 3) the rule structures of those user groups. This factors can be likened to what have been

called “exogenous variables” in an institutional analysis (Ostrom 2005). These factors describe the setting in which actions unfold.

The outcome that we examine is forest user group management success. By management success we mean two key outcomes that define forest user groups, which in this settings are its ability to conduct conservation program activities and generate income. A main reason community forestry exists in Nepal is to maintain forest health; if FUGs cannot continue their conservation program activities, it weakens both the forest ecosystems and the reasons for the FUGs existence as relevant institutions. Another reason for community forestry is to benefit local communities. Although FUG member households collect natural resources from the forests directly, household also receive benefits through programs that FUGs operate from income generating activities, such as timber sales. These benefits include running women’s groups or other collectives, or providing subsidies to households purchase alternative fuel systems. If FUGs cannot generate income and provide these benefits, it weakens the collective nature of FUGs and places at risk the community forestry system.

Overall, we predict that armed conflict events in Chitwan will be negatively associated with FUG management success, conceptualized as conservation program activities and income. We base this prediction on prior literature that has found violent conflict events have harmful consequences for ecological systems. Our contribution of this paper, however, is not simply to replicate in Chitwan a pattern of findings that has been found in diverse ecosystems across the world. Our aim is to delve more deeply into the institutional operations of these forest user groups and examine the specific pathways by which armed conflict creates institutional vulnerability. In other words, understanding how armed conflict affects community forest user groups cannot be achieved without thoroughly thinking through the mechanisms of how conflict interacts with forest user group institutions.

Our second set of predictions are what institutional factors lead to greater vulnerability. First, we hypothesize that the negative effect of armed conflict will be stronger for FUGs that

have fewer biophysical resources. In the Chitwan setting, forests that are less productive and smaller yield fewer benefits for its members. In addition to the fodder, fuel wood, and thatch that FUG member households harvest from the forests for their individual use, a main source of income for the FUG organization is timber sales. Individual member households are forbidden from harvesting timber, and timber can be collected and sold only for the benefit of the FUG organization itself. Although there is biophysical variability across the forests, with some forests having more timber species than others, in general larger forests have potentially greater timber sales and institutional income than others. Smaller forests, with less timber resources and income, may have fewer financial reserves to cope with the disruption that armed conflict may bring.

Second, we hypothesize that the negative effect of armed conflict will be more harmful for community forests characterized by community attributes that make collective action more difficult: large size and low education. Community forest user groups with large numbers of members may find it harder to solve problems due to the problems of achieving consensus in large groups (Ostrom 2005). Yet it is difficult to make predictions for the effects of size, since larger institutions often have more resources for dealing with issues of scale (Ostrom 2005; Poteete and Ostrom 2004). Gautam (2007), for example, reported that the relationship between forest user group size and forest health outcomes was inconsistent. Overall, we predict that larger forest user groups will be more negatively affected by armed conflict, but this hypothesis is tentative. We also predict that low education of community forest members and leaders will worsen the effects of conflict. Individuals with low education might be less equipped to make use of information, communicate with others, and deal with uncertainty (Barham and Chitemi 2009; McCarthy, Dutilly-Diane, and Drabo 2004).

Third, we hypothesize that armed conflict will be more harmful for community forest user groups that have poor rule structures: irregular meetings, or exclusionary or undemocratic processes. Community forest user groups with more meetings are expected to be better

positioned to deal with unexpected challenges because there is an established process for making decisions and receiving input from stakeholders (Banjade et al. 2007). The importance of communication, which is facilitated by regular meetings, has been shown for many natural resource management organizations (Cason and Khan, 1999; Gibson and Koontz, 1998; Dahal and Chapagain 2008). Violence and armed conflict is likely to curtail meetings and thus negatively impact the ability of forest user groups to communicate effectively with their members. In addition, forest user groups that promote leadership participation from all their members are likely to be best positioned to deal with uncertainty. In Nepal, women, indigenous, and lower caste (*dalit* or untouchable caste) people have often been excluded from societal resources and participation in governance, including community forests (Thoms 2008; Timsina 2002). Elites may benefit from using exclusionary policies to preserve goods with high subtractability (Ostrom 2005), such as forest resources, for their own use. In times of armed conflict and violence, however, these same policies may make it difficult for community forests recognize challenges, gain consensus, and adapt their management policies.

In sum, we predict that the vulnerability of FUG management success will be strongly related to FUG institutional characteristics. Specifically, we predict that the deleterious effect of armed conflict will be stronger for FUGs that have fewer biophysical and social resources, including community attributes, and rule structures (Ostrom 2010). These features may reduce the ability of institutions to respond quickly to disturbances.

Data, Measures, and Methods

Data. The data for our hypotheses were collected as part of the Chitwan Valley Family Study (CVFS). Since 1996, the CVFS has extensively measured social change and family behaviors in the western Chitwan Valley of Nepal, and recently has begun measurement of socio-ecological factors. In 2010, interviews with all FUGs in the study area were conducted. These surveys interviewed FUG management committee leaders and collected information on

current practices as well as retrospective information about FUG conservation practices, institutional rules, perceived problems, income sources, and expenses. These retrospective data covered the time from the founding of the FUG until 2010. Separately, data on the armed conflict event that happened in Chitwan District were collected from a variety of sources, including the South Asian Terrorism Portal and other news media (Williams et al. 2012). These data contain the date of each conflict event, the nature of the event (gun battle, bombing, beating, arrest, killing, disappearance, or kidnapping), and the number of people involved.

Dependent variables. Because our aim is to examine how conflict affects the management capabilities of FUGs, we chose two outcomes that characterize FUG functions: 1) the count of conservation programs, and 2) their total income. Conservation programs included in the count are plant nurseries, plantation programs, alternative energy programs, silviculture programs, awareness programs, and other training programs. Total income is the total annual income from all sources, such as collection fees for members, tourist fees, and timber sales. Income is an important outcome, because this allows FUGs to conduct conservation programs and provide other benefits to members.

Independent variables. Our two main independent variables are conflict events and FUG institutional characteristics. Conflict events are the total number of armed conflict events across all categories in Chitwan district. As we develop our work further, we will explore if the violent conflict type (bombs versus arrests, for example) impact FUGs differently, but our analyses her combine all conflict events. FUG institutional characteristics are categorized according to an institutional analysis and development framework. Potential biophysical resources are measured by the size of the FUG's community forest in hectares or square kilometers. Community attributes are measured by the size of the FUG's member base (whether it is a large FUG or not; defined as 900+ members) and the educational level of the FUG committee chairperson. Rule structures are measured by how many meetings the FUG holds and the level

of diversity in the FUG management committee (defined as the % of women, lower caste, and indigenous people).

Method of analysis. Both the FUG data and conflict data were measured yearly. Thus the 21 FUGs contribute a separate observation for each year, from their founding until 2010. Observations, therefore, are not independent. To account for this clustering, random effects models with a random intercept are used. Also, the conflict measures are lagged, such that conflict in the preceding year is used to predict the count of conservation programs (or income) in the current year. In addition, logarithmic transformation are used on the number of conflict events because of the skewed distributions. Our model building approach is to first examine the main effects of armed conflict and institutional characteristics on FUG activities. Then, using interaction models, we test if the effects of armed conflict are moderated by institutional characteristics.

Results

(Table 1)

We briefly discuss a few descriptive statistics in Table 1. In terms of dependent variables, the forest user groups averaged 1.3 conservation program activities per year. Yearly forest user group income averaged 7.1 *lakh* (1 *lakh* is the equivalent of 100,000 Nepali rupees). Armed conflict due to the Maoist insurgency averaged 119 separate events per year. Forest user groups managed community forests that averaged 236 hectares, or 2.36 square kilometers. Almost half, or 43% of user groups, had more than 900 households as members, and the average education of forest user group committee leaders was 7.8 years. On average, the user groups had 19 yearly meetings, and the representation of diversity on the leadership committees was 52% (defined as women, lower caste, or indigenous peoples).

The number of cases for most variables was 231, which means the average community forests contributed 11 years of observations (231/21 = 11). The maximum period of observation

was from 1996 to 2010 (15 years), but not all community forests were in existence throughout this time. The observations for income are less (N=177) due to missing data on income. At present, we use listwise deletion to handle these missing observations, but future analyses will explore sensitivity tests using multiple imputation to assess if different approaches to missingness yield different results.

(Table 2)

Table 2 present the multivariate results. Model 1 presents the relationships between the yearly total of conservation programs and the predictors: prior year (lagged) armed conflict and forest user group institutional characteristics. There is a significant association between armed conflict and conservation programs. As predicted, as the logged armed conflict in the prior year increases, conservation programs significantly decrease. This supports hypothesis 1 and generally confirms prior findings in the literature. None of the other institutional characteristics show significant relationships with conservation program activity, except for the yearly number of meetings: when forest user groups had more meetings, they had significantly higher conservation activities.

Models 2-6 test how institutional characteristics moderate, or interact with, the relationship between armed conflict and conservation program activity. The sole significant moderating relationship is in model 5 for the number of meetings (a negative interaction between armed conflict and meetings). As the number of yearly meetings increases, the association between armed conflict events and program activities becomes more negative.

(Table 3)

Table 3 examines forest user group yearly income. Model 1 presents the non-interactive models. Similar to the results for conservation program activities (and consistent with theory and prior literature), forest user group yearly income significantly decreases when there is higher levels of armed conflict in the prior year. Also consistent with expectations, larger community

forests have significantly higher income (the area of the community forest is a rough proxy for productivity and potential resource wealth, especially timber sales).

Models 2-6 examine moderating relationships. Model 2 shows a significant negative interaction between armed conflict in the prior year and community forest size. Specifically, as the community forest size increases, the relationship between armed conflict and income becomes more negative. Model 5 shows a significant negative interaction between the number of meetings and armed conflict: when the number of yearly meetings increases, the association between armed conflict and income becomes more negative.

Discussion

Our results confirm prior literature that has found that conflict has negative effects on the management of natural resources. Specifically, we found that the yearly number of armed conflict events in Chitwan was associated with fewer numbers of FUG conservation programs and lower FUG annual income.

Our research goes beyond prior work by applying an institutional analysis and development framework and asking what institutional characteristics of FUGs increase vulnerability to the negative effects of armed conflict. The results were contrary to what we expected. We had predicted that forest user groups with more natural and social resources and stronger rule structures would cope better with conflict. Our results, however, suggested the opposite. When there were significant moderating relationships of institutional characteristics, these interactions were negative. For the outcome of conservation programs, forest user groups with more yearly meetings experienced more negative consequences of conflict. Thus, in contrast to buffeting the impact of armed conflict, user groups with more meetings appeared to have suffered more reduction in their conservation programs. Similar results were observed for the outcome of yearly income. Forest user groups with larger forests experienced more negative impacts on income from conflict than forest user groups managing smaller forests. And forest

user groups with more meetings experienced more negative impacts of armed conflict on income than forest user groups with fewer meetings.

Although we are cautious in making too strong conclusions from these results, the patterns are consistent: more negative consequences of conflict for forest user groups with apparently “stronger” institutional resources. One interpretation of these patterns is that the highest vulnerability rests with institutions that have more responsibility--such as larger forests--and subsequently more bureaucratic apparatuses (i.e., more committee meetings). Armed conflict creates more disruption for institutions that are tasked with overseeing larger community forests and more management activities.

We plan several revisions to our analyses in the future. We are in the process of gathering additional data that provides spatial measurement of armed conflict events. As used in the current analyses, the conflict events have yearly temporal resolution, yet they are non-spatial. The model assumes, therefore, that a conflict event anywhere in Chitwan District has the same association with all community forests, regardless of the distance from the event to the community forest. This would violate the often quoted “first law of geography”: “everything is related to everything else, but near things are more related than distant things” (Tobler 1970). Some conflict events, such as killings, are the most serious and news of their occurrence spreads rapidly, and these events cast a shadow on the entire district. But a key feature of the conflict was the widespread occurrence of many low-intensity events, e.g., small bombing blasts in which no one was killed. These events may have very local impact. In addition, we plan to examine conflict events by type. Our current analysis combines all events, but the data have separate information by type: gun battle, bombing, beating, arrest, killing, disappearance, or kidnapping. If some events more than others (such as killings) impact forest user group management activities more, then a model that disaggregates conflict type will be better specified. Overall, we expect that an approach that incorporates the spatial distribution of conflict and the diversity of armed conflict events will yield better models and hypothesis testing.

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Table 1: Descriptive Statistics

	Mean	SD	Min	Max
Number of different conservation programs	1.27	1.46	.00	6.00
Total income, in *lakh*	7.10	18.49	.00	161.91
Total armed conflict events, prior year	119.35	148.01	.00	455.00
Community forest area in square km	2.36	2.54	.11	12.07
Communty forest user group has more than 900 member households (yes/no, 1	.43	.50	.00	1.00
Community forest management committee average education, years	7.76	2.77	.00	15.00
Community forest management committee yearly meetings	19.03	11.57	1.00	50.00
Community forest management committee diversity (% women, *dalit,* indigenou	.52	.25	.08	1.00

N=231 commuity forest user group observation years for all variables across the 21 community forests, except income (N=177 observation years)

Table 2: Relationship between Conservation Programs, Armed Conflict, and Institutional Characteristics

	1	2	3	4	5	6
Logged armed conflict events	-0.035*	-0.014	-0.019	-0.028	0.021	0.004
	(-2.321)	(-0.722)	(-0.946)	(-0.626)	(0.746)	(0.095)
Community forest area in square km	0.018	0.049	0.015	0.018	0.020	0.016
	(0.146)	(0.390)	(0.122)	(0.146)	(0.159)	(0.130)
Community forest area in square km * Logged armed conflict events		-0.009				
		(-1.570)				
Communty forest user group > 900 members	0.120	0.122	0.214	0.118	0.152	0.104
	(0.895)	(0.917)	(1.364)	(0.881)	(1.142)	(0.776)
Communty forest user group > 900 members * Logged armed conflict events			-0.036			
			(-1.148)			
Management committee average education	0.016	0.015	0.014	0.018	0.015	0.017
	(0.891)	(0.850)	(0.783)	(0.802)	(0.846)	(0.984)
Management committee average education * Logged armed conflict events				-0.001		
				(-0.170)		
Management committee yearly meetings	0.026**	0.025**	0.025**	0.026**	0.032***	0.026**
	(3.215)	(3.114)	(3.164)	(3.200)	(3.822)	(3.278)
Management committee yearly meetings * Logged armed conflict events					-0.003*	
					(-2.359)	
Management committee diversity	0.330	0.293	0.239	0.328	0.284	0.556
	(1.067)	(0.945)	(0.749)	(1.058)	(0.926)	(1.492)
Management committee diversity * Logged armed conflict events						-0.071
						(-1.087)
Intercept	0.542	0.516	0.577	0.525	0.433	0.401
	(0.986)	(0.939)	(1.046)	(0.940)	(0.789)	(0.711)
N (community forest observation years)	231	231	231	231	231	231

*p<.05, **p<.01, ***p<.001, two-tailed tests
z-statistics are presented in parentheses

Table 3: Relationship between User Group Income, Armed Conflict, and Institutional Characteristics

	1	2	3	4	5	6
Logged armed conflict events	-0.653+	-0.105	-0.882+	0.521	0.752	-1.400
	(-1.758)	(-0.230)	(-1.669)	(0.477)	(1.077)	(-1.396)
Community forest area in square km	0.045***	0.055***	0.046***	0.045***	0.046***	0.045***
	(4.134)	(4.700)	(4.201)	(4.136)	(4.092)	(4.165)
Community forest area in square km * Logged armed conflict events		-0.003*				
		(-2.072)				
Communty forest user group > 900 members	-1.245	-1.193	-2.692	-1.462	-0.763	-0.734
	(-0.401)	(-0.389)	(-0.695)	(-0.471)	(-0.247)	(-0.231)
Communty forest user group > 900 members * Logged armed conflict events			0.476			
			(0.611)			
Management committee average education	0.424	0.397	0.455	0.856	0.394	0.382
	(0.908)	(0.859)	(0.969)	(1.426)	(0.855)	(0.812)
Management committee average education * Logged armed conflict events				-0.152		
				(-1.144)		
Management committee yearly meetings	0.254	0.227	0.259	0.243	0.372+	0.253
	(1.236)	(1.121)	(1.269)	(1.181)	(1.741)	(1.235)
Management committee yearly meetings * Logged armed conflict events					-0.079*	
					(-2.363)	
Management committee diversity	4.260	3.691	5.732	4.104	3.041	0.049
	(0.579)	(0.507)	(0.742)	(0.559)	(0.417)	(0.005)
Management committee diversity * Logged armed conflict events						1.343
						(0.802)
Intercept	-9.611	-10.471	-10.139	-12.676	-11.430	-7.069
	(-1.131)	(-1.248)	(-1.190)	(-1.423)	(-1.337)	(-0.779)
N (community forest observation years)	177	177	177	177	177	177

*p<.05, **p<.01, ***p<.001, two-tailed tests
z-statistics are presented in parentheses