Capital Stocks and Organizational Resilience in the Annapurna Conservation Area, Nepal

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We have undertaken empirical research to explore relationships between the stock of various capitals and the resilience of conservation area management committees (CAMCs)—the functional decision-making units of community-based conservation—within the Annapurna Conservation Area, Nepal. We surveyed 190 members of 30 CAMCs during the summer of 2007, estimated the capital stocks of each CAMC, and interviewed 13 park officials to assess the degree of resilience of each CAMC during and after the Maoist insurgency (1996–2006). Multiple regression analyses suggest that human and social capital stocks are positively related to the resilience of the CAMCs. Of particular importance are themes of intracommittee trust, help networks, and the duration of members’ tenure on the committees. Furthermore, natural capital stocks showed a parabolic relationship with resilience; the most resilient CAMCs had moderate amounts of natural capital under their jurisdictions.

**Keywords** Annapurna, community-based conservation, human capital, natural capital, Nepal, protected areas, resilience, social capital, sustainability

Capital stock theory has become popular with the emergence of broad conceptual frameworks such as “sustainability” and “resilience” that attempt to emphasize the integrated concept of humans-in-nature (dubbed social–ecological systems by Berkes and Folke 1998). Capital can be defined broadly as a “stock that yields a flow of valuable goods and services into the future” (Costanza and Daly 1992, 38). We can disaggregate stocks into five different types of capital: physical, financial, human, social, and natural (Berkes and Folke 1992; Costanza 2003). Physical capital is the stock of all artifacts, infrastructure, and technologies of the human economy (Costanza 2003). Financial capital is the stock of cash, investments, and savings that
confers purchasing power in the form of money available for production or consumption of goods and services in the modern economy (Costanza 2003). *Human capital* is “the knowledge, skills, competencies and attributes embodied in individuals that facilitate the creation of personal, social and economic well-being” (OECD 2001, 18). *Social capital* refers to the stocks of social networks, associations, norms, and trust that enable participants to act together more effectively to pursue shared objectives or use them for productive purposes (Coleman 1988; Putnam 1995; Grootaert et al. 2004). Pretty and Ward (2001) identify four central aspects of social capital: (i) relations of trust; (ii) reciprocity and exchanges; (iii) common rules, norms, and sanctions; and (iv) connectedness in networks and groups. *Natural capital* is the aggregation of all environmental assets that provide inputs for production, ecological services, and waste assimilation services (Costanza 2003). Natural capital is the only form of capital that builds ecological resilience directly through the provision of ecosystem services and mechanisms to absorb shocks and stresses (Pearce et al. 1989). As such, its critical functions cannot be supplanted by other forms of capital.

The conventional concept of sustainability boils down to the maintenance of capital stocks. Sustainability can be defined as the continued transformation of flows from the capital stocks, without their depletion, into outputs (Brunckhorst 2001). The levels of and changes in the stocks of various capitals can influence the resilience and adaptability of social-ecological systems. In this context, resilience has been defined as the amount of change a system can absorb while maintaining its same structures and functions, the system’s ability to self-organize, and the degree to which the system is capable of learning and adapting (Carpenter et al. 2001). More succinctly, resilience is a system’s capacity to deal with change and continue to develop (Folke and Gunderson 2006). Although both the concepts of sustainability and resilience appear to be similar, there are some nuances that differentiate them. Conventional sustainability involves the maintenance of some “ideal” static state, while resilience preserves the dynamic ability of systems to manage changes. In sustainability, the emphasis is on the steady state of capital stocks. Meanwhile, in resilience the emphasis is on monitoring changes in the stocks of capital that influence the system’s capacity to endure disturbances.

Multiple theorists draw a distinction between the key factors affecting institutional systems as “fast” and “slow” variables (Light et al. 1995; Carpenter et al. 2001; Yorque et al. 2002). Fast variables can change quickly, with time domains on the order of years or in some cases even months, whereas slow variables may turn over on the order of decades (Light et al. 1995). Financial and physical capitals are considered fast variables. Human, social, and natural capitals, on the other hand, are slow variables. It typically takes many years, even decades, for rules, norms, values, and landscapes to change. Human skills and experience develop over similarly long periods of time. It has been argued that the resilience of social–ecological systems is controlled primarily by slow changing variables (Carpenter et al. 2001). This research explores the relative relationships of these different forms of capitals to the resilience of community-based conservation organizations.

Some researchers have used the capitals framework to assess the resilience or sustainability of social-ecological systems (Cocklin and Alston 2003; Abel et al. 2006; Garnett et al. 2007). Others have explored relationships between a particular form of capital and system resilience. Diamond (2005) argues that societies that have persisted over time have taken society-wide measures to protect the stock of capitals,
especially natural capital. The connection between social capital, human capital, and resilience in social–ecological systems has also been a recent focal point of investigation for a number of researchers (Folke et al. 2005; Munasinghe 2007). Munasinghe (2007) emphasizes the role of social capital for building community resilience. He argues that social capital embedded within traditional communities made them resilient to the 2004 Asian tsunami in Sri Lanka. Folke et al. (2005) argue that human capital is critical for understanding disturbances and enhancing the adaptive capacity of complex systems. There is a relative dearth of empirical research in which all the five forms of capital and resilience are studied together. Because these theoretical frameworks (capital stocks and resilience) are critical to understanding complex social–ecological systems, we have undertaken empirical research to explore the relationships between the five forms of capital and the resilience of grassroots conservation committees to the Maoist insurgency in Nepal.

The Study Site and Context

The Annapurna Conservation Area (ACA) is the largest protected area in Nepal (7,629 sq km). In 1992, the Nepali government granted legal authority to the National Trust for Nature Conservation (NTNC)—a national-level nongovernmental organization—to implement a community-based conservation model in the area. The Annapurna Conservation Area Project (ACAP)—a subsidiary of the NTNC—manages ACA with the help of 56 legally instituted grass-roots level conservation area management committees (CAMCs). The National Parks and Wildlife Conservation Act of 1973 defines conservation areas as those reserves managed for integrated conservation and development, in which local communities participate in management, extractive uses of resources are allowed, and tourism is permitted and promoted. The primary goal of ACA is “to foster conservation through rural development” (Heinen and Mehta 1999), and it has achieved reasonable successes moving toward the goal (Baral et al. 2007; Baral and Stern 2010). We consider ACA as an example of a social–ecological system, because the local communities’ extractive uses of resources are an integral part of the conservation area’s ecology. About 120,000 people belonging to various ethnic groups, including Gurung, Magar, Thakali and Manangi, and Hindu castes (mainly Brahman, Chhetri, and lower caste), reside within the area. Owing to ACA’s biological, cultural, and landscape diversity, it is one of the most famous trekking destinations in the world. The highest number of international visitors was 75,278 in 2000, and ACA was financially self-sustaining through the levy of entry fees on international tourists in times of peace (Baral et al. 2008).

CAMCs are local-level organizations created to conserve, manage, and use natural resources within ACA. We explore the degree to which available capital stocks have appeared to enhance the organizations’ resilience in the context of the decade-long Maoist insurgency (1996–2006) as a major disturbance. The insurgency compromised the integrity of Nepali protected areas to a large extent when the Maoist rebels destroyed infrastructure, killed park staff, and forcibly took over some parks (Baral and Heinen 2006). The insurgency also had effects on the performance of CAMCs in ACA starting in early 2004 (Baral and Stern 2010). In this study, we focus specifically on organizational resilience, which we define as the capacity of the CAMCs to maintain their function as agents of conservation.
management during and following the insurgency. Thus, the research focus is somewhat narrower than addressing the broader social-ecological or institutional resilience of the entire conservation area. We draw upon capital stock theory and the resilience concept to address the question: which capital stocks appear to have been most powerfully linked to the organizational resilience of CAMCs within ACA? To our knowledge, no empirical research with quantitative data has tested the relationships between the five forms of capital and organizational resilience. We undertook this comprehensive snapshot assessment of 30 CAMCs in Annapurna to deepen our understanding of these linkages.

**Methods**

**Sampling**

The 1996 Conservation Area Management Regulations required that a CAMC be formed for each village development committee—the lowest level administrative and political unit in rural Nepal—located within the conservation area. There are seven management units (or field bases) for NTNC within ACA: Three lie on the northern slope and four on the southern slope of the Annapurna Himalayas. We selected two management units from the north (Jomsom and Manang) and two units from the south (Ghandruk and Lwang) for the study that we felt to be the most representative of the area as a whole based on our experience, review of reports, and consultation with the staff of ACAP. Lomanthang, the third management unit in the north, is separately managed under somewhat different rules, so it was excluded. Both Sikles and Bhujung in the south are similar to Ghandruk and Lwang in ecological settings, ethnic composition, and economic status. We selected Ghandruk and Lwang to save time and reduce transportation costs. ACAP was originally started in Ghandruk. These four sample management units reasonably represent the diversity of ACA. Ghandruk, Lwang, Jomsom and Manang have 5, 7, 9, and 12 CAMCs, respectively. In Manang, we could not survey the jurisdictions of three CAMCs due to remoteness, time constraints, and language barriers. The total number of CAMC jurisdictions surveyed was 30 (out of the 56 total CAMCs).

The research was undertaken in the immediate aftermath of the insurgency from May to August 2007. While the insurgency officially ended in November 2006, peace had not been completely restored at the time of the research. ACAP staff from the southern sector of ACA, who had fled to nearby Pokhara due to the insurgency, had yet to return full-time to their field offices in ACA. We conducted interviews with all 13 ACAP staff members officially tasked with monitoring the 30 CAMCs in the study that endured the insurgency. The terms of current CAMC members at the time of the research began in 2003, about 1 year before the insurgency escalated in the area in 2004. At the time of the field research, 14 members served on each CAMC’s executive committee. As a result, the sampling frame for the 30 CAMCs consisted of 420 members. We targeted 210 members (seven in each CAMC) for one-on-one interviews. A combination of purposive and simple random sampling was most efficient and representative in our case. We selected the chairs and secretaries purposively, and the other members by drawing a lottery from the name list to reduce potential biases associated with convenience sampling. The interviews were semi-structured, with both closed-ended and open-ended questions.
The study’s unit of analysis is the CAMC. While we could obtain direct measures of three capitals (physical, financial, and natural) associated with each CAMC, no measurements of social and human capitals were readily available. Therefore, we aggregated individual-level measurements collected in our interviews to an organizational level of CAMCs. Specific aggregate measurements and their validity are explained further in the following.

**Measurement of Variables**

**Physical Capital.** The CAMCs are required by law to have an external audit of all their assets annually and to make the auditor’s report public. We thoroughly reviewed the audit reports and found that one-third of the CAMCs in our sample had made complete inventories of their physical assets as of June 2006 and reported their monetary value in the Nepali currency. These secondary data gave reliable estimates of physical capital. When the estimate of properties was unavailable, we generated the inventory of physical assets through interviews with the CAMC secretaries and ACAP rangers. We included office furniture, office buildings, and all office equipment (including items such as calculators, measuring tape, and stationery) to estimate the physical capital of each CAMC. An engineer and four accountants from ACAP, respectively, estimated the local market value of CAMC office buildings and all other physical properties. The first author also verified physical capital in the field whenever it was feasible. Values were converted into monetary units (Nepali Rupee) and totaled. Although each CAMC had invested significant amounts of financial capital in infrastructure development such as road construction, drinking water facilities, micro-hydro plants, and schools, we excluded them from the analysis due to a lack of consistent record-keeping across the CAMCs.

**Financial Capital.** Financial capital was calculated as the sum of money each CAMC had in its bank accounts and the amount it had loaned to local borrowers on interest as of June 2006. These data came from the 2006 audit reports, all of which included these mandatory data, and were expressed in local currency (Nepali Rupee).

**Social Capital.** It is argued that participation, trust, and networks are critical dimensions for measuring social capital (Grootaert et al. 2004); therefore, these dimensions formed the basis of our operationalization. To measure participation, we asked each respondent to estimate the percentage of households participating in activities organized by their CAMCs since 2003. While other forms of trust could also clearly be considered important, our specific trust concept focused on intracommittee trust because of our focus on the organization as the key unit of analysis. We asked each CAMC member how many other members of the committee he/she trusted in general. We avoided discussing the specific names of other members of the CAMC to reduce discomfort in the honest reporting of intracommittee trust. We examined both the means of these responses and their distributions within each CAMC to assess the impacts of variation from one respondent to the next. For both the trust and participation variables, a significant negative linear relationship existed between the mean and the variance \((r < -0.85, p < .001)\). That is, as perceptions of trust and participation increased, variance in response across the members of each CAMC decreased. This indicates a general trend toward consensus. More importantly, from a measurement standpoint, it suggests that means of each of these variables are reasonable proxies of the perceptions of each entire CAMC. To further
justify aggregation of these variables to the CAMC level, we computed the eta-squared statistic ($\eta^2$), which indicates whether individual responses within the same CAMC are more similar than individual responses in different CAMCs (De Dreu and West 2001). Eta-squared statistics for trust and participation were 0.27 and 0.44, respectively, and exceeded Georgopoulos’s (1986) minimum criterion of 0.20. “Networks” were conceptualized as conglomerates of groups or organizations that the CAMC can call upon for help. We asked the members to report entities that their CAMCs called upon for help during the insurgency and its immediate aftermath. The size of the help network was captured by the total number of reported groups and organizations for each CAMC. Because these three proxies for social capital were measured on different scales, we first standardized the unit of measurement by converting them to z-scores. Standardization facilitates the comparison of the three proxies on the same measurement scale. As we had no strong basis for differential weighting, a sum of the z-scores was taken as an index of social capital. Each proxy was also analyzed as a single item.

**Human Capital.** It is a common practice to use educational achievement as a proxy measure for human capital (Coleman 1988; World Bank 2006). Recognizing the multidimensionality of the concept, we also included two other proxies in our study: members’ years of experience on the CAMC and their training. We asked respondents how many years they had spent in formal schooling, how many years they had served on the CAMC, and whether they had received any CAMC-task-related training while serving on the committee. Like social capital, these three proxies were first converted to z-scores then totaled to create an index of human capital. Each was also analyzed as a single item.

**Natural Capital.** As a quantitative measure of natural capital, we used the area of land covered by pastures, water bodies, shrubs, and forests within each CAMC. Agricultural lands were excluded, because they are privately owned and outside the CAMC’s jurisdiction. These secondary data were taken from ACAP’s geographic information systems (GIS) database and measured in square kilometers. Little variation existed in our observations and interviews regarding the quality of natural capital associated with each CAMC. As a result, we limited our measurement to quantity in this respect. This measurement may not be the most advisable in other contexts.

**Organizational Resilience.** Resilience is difficult to measure due to its abstract, multidimensional nature (Cumming et al. 2005). In this study, organizational resilience is defined as the CAMCs’ capacity to endure the Maoist insurgency and still retain essentially the same function. High resilience would be attributed to those CAMCs that endured the negative consequences of the insurgency and showed undiminished performance on their mandated tasks. The Conservation Area Management Regulations of 1996, which lays out the tasks of the CAMCs, specifies that ACAP staff members must closely monitor all tasks performed by the CAMCs to comply with the Regulations. We asked the ACAP staff ($n = 13$) to rate each CAMC they supervised on a 10-point scale regarding its performance throughout the Maoist insurgency and up to the present time (roughly 6 months following the insurgency). Each staff member provided one score for each CAMC for the entire time period. The staff were given three reference points: 10 indicating that the CAMCs carried out all or almost all of their mandated functions; 5 indicating that the CAMCs carried out about half of their mandated functions; and 1 indicating that the CAMCs
completely failed to carry out any of their mandated functions. Two to four staff rated the performance of each CAMC, and an average of their ratings was taken. Standard deviations among the evaluators ranged from 0.0 to 2.3 across the 30 CAMCs. We took the performance rating as the organizational resilience score of the CAMCs. While this performance rating may not capture all the dynamics of resilience, it matched very well with villagers’ perceptions regarding CAMC resilience and our qualitative assessments during the field research (Baral and Stern 2010).

**Data Analysis**

We built a regression model by taking the organizational resilience score (which observes a normal distribution) as the dependent variable and the five forms of capital as independent variables. Theories suggest that higher stocks of capital increase the resilience of a system, and the amount of available capitals following any major disturbance determines whether the system can rebound or survive (Holling 1987; Abel et al. 2006). We don’t use regression to necessarily imply causality in this case. The nature of our measurements do not allow for an unambiguous determination of the directionality of the relationships between the capitals and resilience. We rather use regression to determine which forms of capital were most strongly linked to the resilience of the CAMCs. We hypothesized financial, physical, social, and human capitals to have positive linear relationships with the organizational resilience score. We predicted a parabolic relationship between natural capital and organizational resilience in which resilience would be highest at intermediate levels of natural capital. We therefore used a quadratic term for natural capital in the regression model. Because our proxy for natural capital is related to the amount of land area under a CAMC’s jurisdiction, we follow Ostrom’s (2001) logic that moderate parcel sizes might be most effective for management purposes, as necessary extraction rates might be more likely to exceed replenishing rates in small areas while challenges associated with monitoring and enforcement are much greater on larger parcels. The overall fit of the regression model to the data was assessed by the $F$-test, and the significance of model parameters (the beta values) was assessed by the $t$-test.

Open-ended questions relevant to this research solicited explanations for trust or distrust of other CAMC members and specific narratives about how the CAMCs endured the insurgency. All interviews were recorded. Open-ended responses were transcribed in the Nepali language and then translated into English. These responses were used primarily to provide context and to enhance the interpretation of quantitative results.

**Results**

**Summary Statistics**

We interviewed 190 members of 30 CAMCs, of which 23 (12.1%) were chairs, 23 (12.1%) were secretaries, 144 (75.8%) were general members, 161 (84.7%) were men, and 29 (15.3%) were women. Across ACA, women constituted about 14% of the total membership of CAMCs; thus, our sample reflects the gender distribution of the population. In each CAMC, we interviewed 6.0 ± 1.2 (mean ± SD) members on average, and the overall response rate was about 91%. We could not contact some of the members because they were physically out of the village, sick and bed-ridden,
**Table 1. Summary statistics of the study variables of 30 CAMCs**

<table>
<thead>
<tr>
<th>Variables</th>
<th>Minimum</th>
<th>Maximum</th>
<th>Mean</th>
<th>SD</th>
<th>Measurement unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Organizational resilience score</td>
<td>3.5</td>
<td>9.5</td>
<td>6.82</td>
<td>1.59</td>
<td>1–10 Point scale</td>
</tr>
<tr>
<td>Financial capital</td>
<td>247,902</td>
<td>2,004,264</td>
<td>620,175.58</td>
<td>401,057.14</td>
<td>Nepali Rupee&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>Physical capital</td>
<td>6,000</td>
<td>849,700</td>
<td>190,363.44</td>
<td>224,886.29</td>
<td>Nepali Rupee&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>Natural capital</td>
<td>3.20</td>
<td>194.60</td>
<td>57.95</td>
<td>48.16</td>
<td>sq km</td>
</tr>
<tr>
<td>Social capital:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Participation</td>
<td>−4.45</td>
<td>2.86</td>
<td>0.00</td>
<td>1.83</td>
<td>Index</td>
</tr>
<tr>
<td>Trust</td>
<td>8.33</td>
<td>14.0</td>
<td>12.43</td>
<td>1.37</td>
<td>Estimated percent of villagers participating in CAMC activities</td>
</tr>
<tr>
<td>Help networks</td>
<td>1</td>
<td>8</td>
<td>3.07</td>
<td>1.62</td>
<td>Number of help networks cited by interviewees within each CAMC</td>
</tr>
<tr>
<td>Human capital:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Education</td>
<td>−5.63</td>
<td>5.15</td>
<td>0.00</td>
<td>2.54</td>
<td>Index</td>
</tr>
<tr>
<td>CAMC experience</td>
<td>1.14</td>
<td>9.40</td>
<td>5.62</td>
<td>2.49</td>
<td>Average number of years spent in school</td>
</tr>
<tr>
<td>Training</td>
<td>4.00</td>
<td>10.83</td>
<td>6.68</td>
<td>1.51</td>
<td>Average number of years on committee</td>
</tr>
<tr>
<td></td>
<td>0.0%</td>
<td>88.0%</td>
<td>58.8%</td>
<td>23.2%</td>
<td>Percent of members having specialized training</td>
</tr>
</tbody>
</table>

<sup>a</sup>US$1 = NRs. 75.57 on May 22, 2009.
or, in one case, deceased. No replacement samples were drawn. The average age of respondents was 51.1 ± 12.1 years, with men being older (52.1) than women (45.6; \( t = 2.61, p = .013 \)). The men had more CAMC experience on average (7.1 vs. 4.6 years; \( t = 4.94, p < .001 \)) and more education (6.1 vs. 3.6 years of schooling; \( t = 3.21, p = .003 \)) than the women. There was no significant difference between men and women in the amount of training they had received (\( \chi^2 = 2.17, p = .140 \)).

A summary of study variables is given in Table 1.

Table 2 displays the bivariate correlations between the key study variables. The organizational resilience score showed significant positive linear relationships with both social and human capital. While controlling for the total number of households within the jurisdictions of each CAMC, partial correlations were similar to bivariate correlations (e.g., resilience and social capital: \( \rho_{OR,SC} = .59, p = .001 \), and resilience and human capital: \( \rho_{OR,HC} = .42, p = .023 \)). Only two significant correlations were observed between the capitals: Natural capital showed a significant positive linear relationship with financial capital and negative linear relationship with social capital. While controlling for the number of total households within the jurisdiction of each CAMC, the partial correlation coefficients were similar to the bivariate correlations (natural capital and financial capital: \( \rho_{NC,FC} = .41, p = .029 \), and natural capital and social capital: \( \rho_{NC,SC} = -.45, p = .014 \)). These correlations were not of a magnitude to cause multicollinearity in the regression model.

**Table 2. A bivariate correlation matrix consisting of Pearson’s product-moment correlation coefficients between the study variables (\( n = 30 \))**

<table>
<thead>
<tr>
<th>Variables</th>
<th>OR</th>
<th>FC</th>
<th>PC</th>
<th>NC</th>
<th>SC</th>
<th>HC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Organizational resilience (OR)</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Financial capital (FC)</td>
<td>.080</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Physical capital (PC)</td>
<td>.287</td>
<td>.264</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Natural capital (NC)</td>
<td>-.106</td>
<td>.427*</td>
<td>-.048</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Social capital (SC)</td>
<td>.563*</td>
<td>.036</td>
<td>.350</td>
<td>-.487*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Human capital (HC)</td>
<td>.386*</td>
<td>.154</td>
<td>.274</td>
<td>-.204</td>
<td>.115</td>
<td></td>
</tr>
</tbody>
</table>

*Significant at \( p < .05 \).

Capital Stocks and Organizational Resilience

The regression model reasonably fit the data (\( F_{5,24} = 6.95, p < .001 \)) and accounted for 59.2% of the variance in the organizational resilience score (\( R^2 = .592 \)). Because of the small sample, we ran additional diagnostic procedures to explore the goodness of fit of our regression model. The histogram of residuals mirrored a normal distribution, and there were no outliers or influential cases. Furthermore, the standardized residuals were randomly distributed. The Durbin–Watson test statistic was 2.4. Its value close to 2 validates the assumption of independent errors—that is, the residuals from the regression line (errors) are not correlated with the explanatory variables (see Field 2005). This speaks to the robustness of the model. Tests for multicollinearity were negative. The variance inflation factor (VIF) values were below 1.8 and the tolerance statistics all above 0.6 (a problem arises when the VIF is greater than 10.
Table 3. Regression model of five forms of capital on organizational resilience

<table>
<thead>
<tr>
<th>Explanatory variables included in the regression model</th>
<th>Unstandardized coefficients</th>
<th>Standardized beta coefficient</th>
<th>t</th>
<th>Significance</th>
<th>Partial eta-squared</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>B</td>
<td>SE</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Financial capital</td>
<td>-0.00000074</td>
<td>.00000059</td>
<td>-.186</td>
<td>-1.248</td>
<td>.224</td>
</tr>
<tr>
<td>Physical capital</td>
<td>-0.00000023</td>
<td>.0000011</td>
<td>-.032</td>
<td>-0.217</td>
<td>.830</td>
</tr>
<tr>
<td>Natural capital squared</td>
<td>0.000098</td>
<td>.000031</td>
<td>.541</td>
<td>3.154</td>
<td>.004</td>
</tr>
<tr>
<td>Social capital</td>
<td>0.707</td>
<td>.146</td>
<td>.815</td>
<td>4.856</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Human capital</td>
<td>0.256</td>
<td>.087</td>
<td>.409</td>
<td>2.942</td>
<td>.007</td>
</tr>
<tr>
<td>Constant</td>
<td>6.776</td>
<td>.402</td>
<td>16.855</td>
<td>&lt;.001</td>
<td></td>
</tr>
</tbody>
</table>

*Note.* The model fit statistics are $F_{5,24} = 6.95, p < .001$, and $R^2 = .592$. 
and the tolerance statistic is below 0.2; see Field 2005). A scatter plot with a significant linear trend of observed and predicted values of the organizational resilience score further suggests the robustness of the regression model.

Of the five capitals included in the regression model, three were statistically significant: social capital, human capital, and the quadratic function of natural capital (Table 3). In support of our hypothesis, both social and human capitals showed positive linear relationships with the organizational resilience score. The correlation between the organizational resilience score and natural capital, which is a measure of a linear relationship, was not significant, but the quadratic term of natural capital in the regression model was statistically significant. This supports our hypothesis regarding the curvilinear relationship between natural capital and organizational resilience in which moderate jurisdictional scales have the greatest association with organizational resilience. Contrary to our hypothesis, the model did not reveal significant relationships between the financial and physical capitals and organizational resilience. To explore potential interactions between the five forms of capital, we included 10 two-way interaction terms in the regression model one at a time, but none was statistically significant ($t < 1, p > .10$). We therefore did not include interaction terms in the final regression model.

We also individually regressed each item making up the social and human capital indices on organizational resilience. Within the items that made up the social capital index, help networks ($\beta = 0.883, t = 3.88, p = .001$) and intracommittee trust ($\beta = 0.634, t = 2.79, p = .010$) appeared to be the most critical. Perceptions of local participation were not significant. Within the human capital index, the lengths of CAMC members’ tenure on the CAMCs were most linked with organizational resilience ($\beta = 0.586, t = 2.09, p = .045$). Educational achievement and training did not exhibit statistically significant relationships with organizational resilience.

Partial eta-squared values are an approximate measure of the proportion of total variance observed in the dependent variable (organizational resilience) explained by the model that can be attributed to each explanatory variable. Of the total variance of the organizational resilience score explained by the regression model (59.2%), social, natural, and human capital accounted for the largest portions of the variance, respectively, with social capital explaining nearly twice the variance as each of the other variables (Table 3).

Open-ended responses of CAMC members confirmed the importance of intracommittee trust for the effective functioning of the CAMC in times of strife. When the insurgency escalated, and formal meetings were too risky to hold, CAMC members gave authority to the chairs and secretaries to make decisions about conservation and sustainable development independently of the committee. Under normal circumstances, a majority vote is required to make such decisions. Intracommittee trust allowed the CAMCs to continue to fulfill their functions. Interviews further revealed that highly resilient CAMCs (defined as those having the resilience score more than eight) effectively mobilized local groups when they could not fully function due to the insurgency. For example, forest management committees issued permits for forest products harvesting and took charge of forest monitoring, and women’s groups undertook development activities, such as drinking-water projects, when called upon. CAMC members also commonly asked outside organizations for help in times of need. CAMC members who reported higher numbers of entities upon which they called for help typically included such outside organizations as the United Nations Development Program (UNDP), the Red Cross, and the United...
Nations Children’s Fund (UNICEF). Most CAMCs reported local help networks, but the most resilient ones also tended to report extralocal help networks.

Highly resilient CAMCs also had more members who had served prior terms on the committee. Members reported that the collective knowledge, experience, and skills held by these members allowed them to respond more efficiently to the insurgency. Their institutional memory allowed them to focus less on some of the more mundane challenges faced day-to-day by the committees under normal circumstances (for example, issuing permits or clerical responsibilities) and more upon responding to the new challenges brought on by the disturbance (for example, the breakdown of conservation rules). According to respondents, CAMC chairs and secretaries along with the more experienced and educated members typically negotiated with the rebels to maintain the CAMCs’ performance. The committee members and ACAP staff reported that natural capital remained largely intact in the areas with resilient CAMCs even during the insurgency, except for a few scattered incidents of minor exploitation. The Maoist insurgents killed wildlife to feed their cadres, and their presence emboldened some local sympathizers to illegally harvest timber.

Discussion

Our empirical findings support the claims of other scholars that capital stocks may be critical in building resilience in social–ecological systems (Adger 2000; Gunderson 2000; Diamond 2005; Abel et al. 2006; Munasinghe 2007). The study suggests that the stock of three types of capital in particular—social, human, and natural—were strongly related to the organizational resilience of local CAMCs to the Maoist insurgency in Nepal. While social capital and human capital exhibited positive linear relationships with organizational resilience, natural capital had a parabolic relationship. That is, CAMCs with jurisdictions of intermediate land area tended to be the most resilient. It is likely that all five forms of capital must be present at a certain critical level for organizations to function, but beyond those critical levels, different forms of capital might enhance resilience in different contexts.

Themes of intracommittee trust, help networks, and the duration of members’ tenure on the committees were the elements of social and human capital stocks most strongly related to resilience. As hypothesized by McEvily et al. (2003), intracommittee trust served to sustain goal achievement when formal control mechanisms could not function during the insurgency. Intracommittee trust allowed members to cede responsibility to others when necessary. Help networks also appeared to contribute to resilience. The most resilient CAMCs had both local and extralocal (often international) help networks. Highly resilient CAMCs also had a larger number of more experienced members. These members served as a source of institutional memory and helped to guide the CAMCs in times of turbulence.

Financial capital and physical capital exhibited no significant linear relationships with organizational resilience. This may have been due, at least in part, to the nature of the disturbance. One might hypothesize that greater stores of these capitals could actually attract additional attention from insurgents at the same time they could support organizational resilience to external disturbance. The Maoist rebels set CAMCs’ office buildings on fire, destroyed furniture, and damaged official documents. Most CAMCs deserted their office buildings during the insurgency for security reasons. The rebels also extorted donations from the CAMCs and local communities. Thus, the CAMCs with higher stocks of physical and financial capital
were likely unable to build on these capitals during the insurgency. Even in times of peace, however, the CAMCs commonly operated with minimal physical infrastructure; many did not yet have their own office buildings at the time of this study. Furthermore, we only were able to obtain a single snapshot measure of each of these capitals toward the end of the insurgency. A time series of measurements of financial and physical capital would have allowed for a more detailed assessment of their relationships to resilience and may have revealed significant trends.

The primary source of financial capital for the CAMCs was revenue generated by selling forest products. This helps to explain the correlation between financial capital and natural capital. The significant negative correlation between natural and social capital could imply that abundant natural capital may have lessened the perceived need for collective conservation action. Songorwa (1999) observed a similar situation in Tanzania, and this relationship has also been observed by Ostrom (2001) and Crook and Decker (2006). Alternatively, because our measure of natural capital relied upon the size of the jurisdiction of each CAMC, we may have simply observed an issue of scale in which larger jurisdictions may have harbored weaker social ties.

The findings have some meaningful implications for community-based conservation in this and other contexts. While there can be no standardized predefined pathways for social capital formation (Brechin et al. 2003), organizing collective action and providing opportunities to build networks may help to stem its depletion in times of crisis. Our study suggests that opportunities for experiential learning (as evidenced by the importance of time spent on CAMCs) may also enhance human capital formation. The study also raises a question regarding the most appropriate scales for community-based natural resource governance. While our hypothesis was supported that moderate-sized jurisdictions would be linked with organizational resilience, the coarse-grained measure of this construct limits our ability to speculate on its origins.

Carpenter et al. (2001) have argued that the resilience of social–ecological systems is controlled primarily by slow-changing variables (social, human, and natural forms of capital) rather than the rapidly changing forms of capital (financial and physical). This study suggests that this may commonly be true in the case of the organizations governing them, too. While other contexts have their own mixtures of and interactions between capital stocks, the importance of slow-changing variables in Annapurna suggests some critical lessons for conservation institutions in other community-based conservation efforts. While it is certainly easier for nongovernmental organizations (NGOs) and other conservation agencies to focus most efforts upon fast-changing variables, such as finance and physical infrastructure, slowly changing human and social capital variables may be critical to the resilience of community-based conservation organizations. In Annapurna, each of the capital stocks has likely played a role in the success of community-based conservation, including the financial viability of conservation efforts, the natural and cultural features that make the site an attractive tourism destination, and the physical infrastructure in place to utilize them (Baral et al. 2008). Social capital and human capital, however, appear to be the key variables separating more resilient CAMCs from less resilient ones. These findings align with other studies that have found that inadequate attention to the development of social capital has led to unsustainable conservation efforts (Brandon and Wells 1992; Stern 2008). The findings also further substantiate previous findings that expectations of sustainable long-term conservation returns based on short-term development interventions, which typically make greatest gains in rapidly changing variables, may be unrealistic in many cases (Baral et al. 2007).
Limitations

The study has several limitations. First, it is a cross-sectional study. This design element limits our ability to make causal assertions, as we could not track changes in the stocks of capital over time. Second, we had a small sample size to study complex organizational behaviors. In regression analysis, sample size can be important both for estimation and inference; however, what constitutes an adequate sample size and avoids sample size-related problems is not at all clear. In small samples, estimates are susceptible to the effects of outlying data points. The diagnostic results indicate that our model appears to be robust, because there were no outliers or overly influential singular data points. Third, there are limitations to the generalizability of these findings outside ACA, because the data come from one protected area and one type of disturbance in isolation from all the other events that might have affected these communities. Fourth, the measurement of capital stocks is fraught with difficulty. Although we have used more proxies to measure human capital than others (Coleman 1988; World Bank 2006), we have not controlled for the quality of education and training of the respondents. We also have limited measurements of other capitals as well. For example, we did not measure social cohesion, access to information, communication infrastructure, or empowerment and political action in the measurement of social capital (Grootaert et al. 2004). Our natural capital measurement is a single measure of land area under the jurisdiction of the CAMC that does not directly account for the quality of the capital. In our case, we observed little difference in resource quality, but this would not be a reasonable assumption in other cases. We excluded some infrastructure development projects while measuring physical capital. According to the staff, ACAP strives to distribute funds for such projects more or less equitably between CAMCs within ACA; thus, a mechanism for control, albeit an imperfect one, may limit the impacts of this shortcoming. Fifth, systematic data-keeping is disturbingly scarce in ACA; this further complicated tracking how these variables have changed over time. Finally, the data were collected only 6 to 8 months following the end of the insurgency. A final and conclusive assessment of the resilience of the CAMCs may take years to complete, as the CAMCs continue to reorganize (see Baral, Stern, and Heinen 2010). We consider this research a first attempt to gauge the relative importance of capital stocks to the resilience of community-based conservation organizations. We urge future researchers to expand upon the measurements used in this study.

Conclusions

Building resilience in community-based conservation initiatives is critical if they are to endure disturbances and succeed in the long run. To this end, maintaining or enhancing the stocks of social, natural, and human capital can pay dividends in turbulent times. If international agencies, governments, and NGOs successfully aid the development of social and human capital, then community-based organizations may be expected to show a higher degree of resilience to political instabilities in the developing world. More empirical research is needed to explore whether physical capital and financial capital correlate with resilience in other contexts or whether there is some critical threshold level for these and other forms of capital. Future longitudinal studies would further our understanding of the relationship between changing capital stocks and organizational resilience.
References


