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Explaining Success on the Commons: Community Forest Governance in the Indian Himalaya

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Summary. — In the past two decades, scholarship on resource use and management has emphasized the key role of institutions, communities, and socio-economic factors. Although much of this writing acknowledges the importance of a large number of different causal variables and processes, knowledge about the magnitude, relative contribution, and even direction of influence of different causal processes on resource management outcomes is still poor at best. This paper addresses existing gaps in theory and knowledge by conducting a context-sensitive statistical analysis of 95 cases of decentralized, community-based, forest governance in Himachal Pradesh, and showing how a range of causal influences shape forest conditions in diverse ecological and institutional settings in the Indian Himalaya. In focusing attention on a large number of cases, but drawing on findings from case studies to motivate our analysis and choice of causal influences, our study seeks to combine the strengths of single case-oriented approaches and larger-*N* studies, and thereby contributes to a more thorough understanding of effective resource governance.
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Key words — resource governance, community-based conservation, local institutions, monitoring and enforcement, gender and environment, South Asia, Himalayas

1. INTRODUCTION

In the past two decades, scholarship on resource use and management has emphasized the key role of institutions, communities, and socio-economic factors. Literatures on common property (Ostrom, 1990), political ecology (Neumann, 1998), rural sociology (Goldman & Schurman, 2000), resource economics (Lise, 2000), and environmental politics (Gibson & Marks, 1995) examine what explains variations in resource governance and conditions. Even those who downplay certain kinds of institutions are willing to acknowledge the importance of communal institutional forms (Campbell *et al.*, 2001; Virtanen, 2002; cf. Rangan, 1997; Ribot & Peluso, 2003). Much of this writing emphasizes the importance of many different causal variables and processes.

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But existing knowledge about the magnitude, relative contribution, and even the direction of influence of different causal processes remains poor at best (Agrawal, 2001).

Relevant knowledge about the magnitude and relative importance of different causal variables is still relatively poor in part because of the analytical approach that dominates studies of resource management and conservation. Much of this literature relies on a case study or comparative case study approach (Baland & Platteau, 1996; Berkes, 1989, 2004; NRC, 1986). Statistical analyses are far more rare, especially those based on data from the local level. Case studies can be remarkably effective in providing in-depth knowledge of specific conjunctures and highlighting the importance of causal processes significant in those conjunctures. They can potentially also be invaluable tools to identify the direction of causal forces and specify the contextual features that lend a particular cause its leverage over outcomes (Ragin, 1997). But they are less effective when the objective is to assess the magnitude or relative importance of different causal factors (Goldthorpe, 1997). This paper adds to existing theory and knowledge by examining how a range of causal influences shape forest conditions in diverse ecological and institutional settings in Himachal Pradesh in the Indian Himalaya. Our study is based on a context-sensitive statistical analysis of 95 instances of decentralized, community-based, institutionalized governance of forest resources. We use statistical techniques to probe potential causal mechanisms, but also draw on findings from case studies and intensive fieldwork to motivate our analysis, choice of causal influences, and interpretation of regression results. Our study thus combines the strengths of single case-oriented approaches and larger-*N* studies, and contributes to a more thorough understanding of effective resource governance.

The ensuing discussion considers five classes of causal influences: biophysical, demographic, economic, institutional, and socio-political. Existing studies have recognized each of these as being instrumental in influencing resource governance outcomes (Alvarez & Naughton-Treves, 2003, p. 269; Brown & Pearce, 1994; Rocheleau & Edmunds, 1997). For each category of influence, we examine variables that have been highlighted in the literature and which appear relevant to the Himachal Pradesh context as discussed below. In general terms, our paper engages discussions related to common property and analyses of local governance of forest resources. More specifically, it highlights two important issues. The first relates directly to the many different causal influences emphasized in the case study literature on forest governance. Our analysis shows that within each class of causal influence, there are at least some variables that exercise statistically significant effects on outcomes. Thus, much case study literature on the commons is on target in the specific types of causal influences that it has highlighted. However, it may also be off target in the causal influences that particular case studies have ignored. Empirical measures of the theoretical constructs that serve as independent variables in causal analyses are often correlated, even if only to some degree. It is reasonable to infer, therefore, that empirical analyses that focus only on a restricted set of causal influences likely inflate the significance of the variables they consider even as they ignore the relevance of excluded variables. Studies that focus on single cases are especially prone to such biases. Our position does not imply that systematic studies must always analyze the effects of scores of independent variables. Rather, we make a plea for the inclusion of variables known to be theoretically among the most important in the social and ecological contexts being studied.

The second finding, a direct corollary of the methodological point above, concerns the important causal role of biophysical variables in explaining local resource condition. In the analysis that follows, biophysical factors prove to be critically important in explaining variation in the dependent variable: forest condition. The importance of this finding for the literature on common property lies in the fact that the general context of our study shares many features with the general context of studies of common property: high ecological and social variability. Indeed, a number of major scholars have explicitly identified high levels of variation in biophysical factors, and therefore resource flows, as the source of pressures for self-organization and local cooperation (Scott, 1976; Wade, 1994; see also Baland & Platteau, 1996; Berkes, 1989; NRC, 1986; Ostrom, 1990). Our results suggest that when scholars of commons seek to explain resource governance-related outcomes in ecologically and socio-culturally variable contexts, they need to attend more carefully to the influence of biophysical factors on socio-cultural conditions and resource governance outcomes.

In the next section of the paper, we provide a brief description of the Himachali context, especially highlighting aspects relevant to the ensuing analysis. We then describe our methods, explain the variables used in the statistical analysis, and outline the model to be tested. After discussing the results of the analysis and the theoretical issues concerning findings related to the different variables, we conclude with a discussion of the scope of our paper, and implications for future studies of the commons and local resource governance.

2. ECOLOGICAL AND INSTITUTIONAL ASPECTS OF FOREST GOVERNANCE IN HIMACHAL PRADESH

The state of Himachal Pradesh is ecologically highly diverse owing to distinct climatic and physiographic factors. Nestled in the western Himalaya, its elevation varies from 350 to 7,000 m above mean sea level. With nearly 3,200 identified plant species, forests in Himachal constitute its most important biological wealth. More than two-thirds of the state is administratively classified as forest (37,600 sq. km). However, only about 25% of this area is dense forest, with about a third being permanent snow, and approximately 10% classified as protected areas.

Steep altitudinal gradients shape variations in forest characteristics. Beginning with sub-tropical scrub forests in the foothills, species composition and biological diversity change with elevation (see Figure 1). The lower hills (below 900 m) are a mosaic of dry scrub, and dry and moist deciduous forests. They are interspersed with stands of Himalayan Pine (*Pinus roxburghii*), dominant between 1,000 and 2,000 m. Oak (*Quercus* spp.) and deodar (*Cedrus deodara*) make their appearance at 1,800 m, and are present in single or mixed stands with Rhododendron (*Rhododendron* spp.) up to a height of 3,000 m. Beyond 3,000 m, Silver Fir (*Abies pindrow*) and Spruce (*Picea smithiana*) are dominant in single or mixed stands. Mixed stands of Silver Fir and Birch (*Betula alnoides*) typically characterize the transition from mixed forests to alpine meadows. The tree line ends at approximately 3,700 m. Studies of high levels of ecological variability in factors such as temperature and moisture have pointed to their relationship with levels of plant biodiversity elsewhere (Brockway, 1998). Himachal Pradesh is no exception. Altitudinal effects on vegetation played an important role in our research design and sample selection.

The population of Himachal Pradesh was 6.01 million in 2001. The average population density (108 persons per sq. km) varies from 2 persons in the cold desert district of Lahaul and Spiti to 330 persons in Hamirpur district. The urban population is concentrated in 59 towns and smaller settlements. The overwhelming majority of the population is rural (more than 90%), living in more than 16,000 villages (DOP, 1997). Although the net sown area is less than 15%, agriculture is the occupation of nearly two thirds of the population (DOP, 1997). Forests are critical to hill agriculture, and also contribute directly to livelihoods. Over the last century, they have provided land for distribution to the landless, been the sites of extensive road construction and infrastructure development, and served as important commercial resources by providing resin for turpentine (*Pinus roxburghii*), raw materials for paper and pulp (bamboo (*Bambusa bambos*) and bhabhar grass (*Euloliopsis binata*)), and wood packing cases for Himachal Pradesh's important fruit industry.

In this context of high population density and competing uses, a number of different institutional mechanisms to secure the formal participation of local residents are in evidence across the forested landscape in Himachal Pradesh. Such institutional arrangements include self-initiated systems, cooperatives, corporate clan-owned forests, sacred forests, and comanaged forests. Through these arrangements, communities in Himachal Pradesh govern the full range of different forest types found in the state.

3. FORESTS AND INSTITUTIONS: NOTES FOR AN ANALYTICAL FRAMEWORK

Classifications such as open access, private, community, and state ownership are too coarse grained according to scholars of the commons and property rights to convey variations in institutional arrangements at the community level (McKean, 1992). Not only are these classifications coarse, but they are also inadequate as causal explanations of outcomes: it is insufficient to say that resources are better governed simply because they are under common or private property regimes, or in a bad condition because they are managed by governments (Dietz,

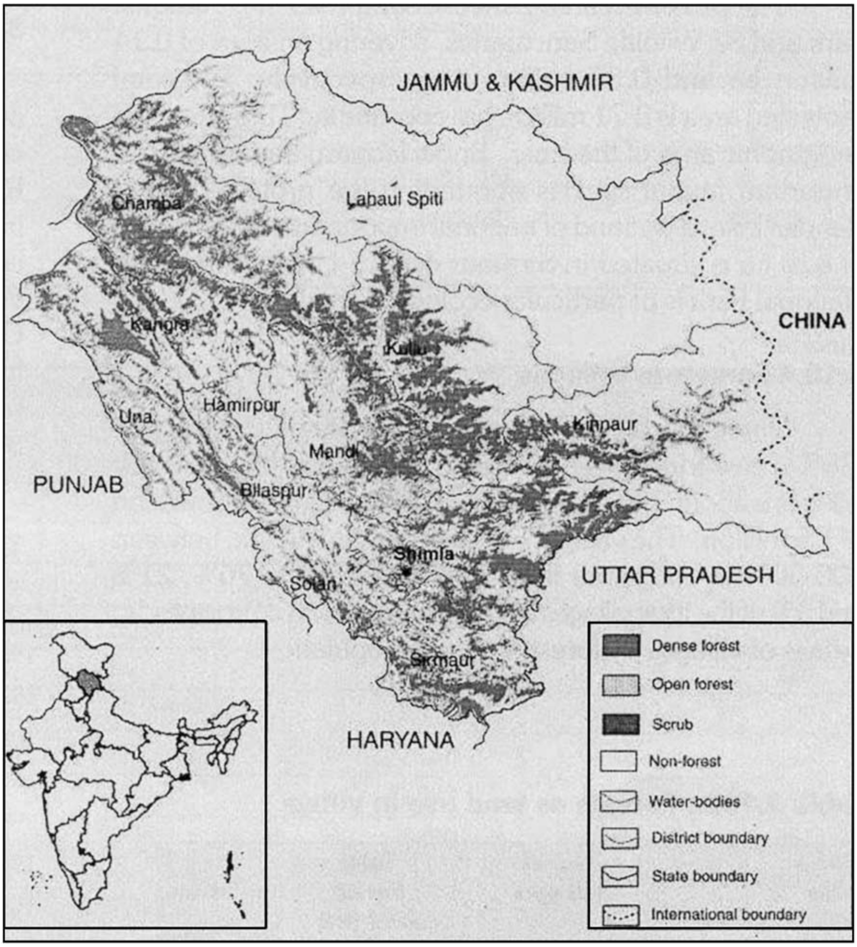

Figure 1. *Vegetation cover and districts in Himachal Pradesh.*

Ostrom, & Stern, 2003). Rather than replace a coarse-grained set of categorical variables with finer-grained categorical variables such as cooperative, comanagement, or sacred, we base our analysis on underlying institutional variables that are common to the different community-level governance regimes, and which are more directly related to causal processes.

Thus, for our analytical framework, we draw upon property rights and new-institutionalist theories (McKean, 1992; Ostrom, 1990, 2003). Since the theoretical literature on the subject is well developed, we do no more than summarize the most important elements of the argument, and focus primarily on the empirical analysis. According to institutionalists interested in resource governance, forest conditions are a function of a large number of factors of which institutional variables are an extremely important set. Resource characteristics and biophysical variables form the context within which socio-political and economic characteristics of users and institutional variables shape resource management outcomes. Institutional variables include those related to existence, representation of users, enforcement of rules, and relationship with external authorities (see Agrawal, 2001 for a review).

The specific causal mechanisms at work in the different categories of institutions are a result of the varying configurations of underlying institutional factors. To identify the effects of institutional variables on resource conditions, however, it is necessary to take into account the role of the biophysical, economic, social, political, and demographic context as well. Although institutional theories recognize the importance of these contextual factors (Ostrom, 2005), it is a rare study that explicitly incorporates variables representing all these classes of influences into the analysis. It is precisely this gap in the literature that our paper seeks to fill.

4. METHODS, STUDIED VARIABLES, DATA, AND STATISTICAL MODEL

We collected data in 2001 in 205 forests across Himachal Pradesh. The present article is based on the subset of 95 cases where village communities and groups of individuals in a village community jointly manage forests. The remaining 110 cases of forests are managed by the forest or the revenue department. We selected villages for data collection across the altitudinal gradient in the state, sampling equally from the lower hills (<900 m above mean sea level), middle hills (between 900 and 1,800 m), and high hills (>1,800 m). Within each elevation class, we selected cases to represent different institutional regimes, in proportion to their distribution across the three elevation classes. This strategy of case selection, while not random, ensures that all major types of forests and institutional regimes are represented in our sample. Further, this sample selection strategy also ensures that the cases are not picked on the basis of variations in the value of the dependent variable. We should note that it is near-impossible to identify a fully random sample for local institutional or forest types owing to the non-existence of any comprehensive lists that contain the relevant information.

In collecting data, we were especially attentive to a suite of biophysical, economic, demographic, institutional, and socio-political variables as described below. The questions we used during our field work come from the set of data collection instruments developed by the International Forestry Resources and Institutions (IFRI) Program at Indiana University (Poteete & Ostrom, 2004; the full set of instruments can be obtained from the Workshop in Political Theory and Policy Analysis at Indiana University). We trained our field investigators regarding the meaning of different questions, our analytical framework, and in conducting individual and group interviews in villages. Our unit of analysis is the management unit at the community level. Responses to questions were triangulated by multiple interviews with different individuals and groups within a community. These groups and individuals included upper and lower caste men and women, decision makers, and where relevant, guards and other office-holding individuals in the local community institutions.

The dependent variable in our analysis is “Forest Condition.” It is measured by an index, based on group responses for the condition of the forest from (1) upper caste men, (2) upper caste women, (3) lower caste men, (4) lower caste women, (5) forest department guard, and (6) the investigators for each village. All responses for a village forest were averaged into a single measure to yield the Forest Condition Index, a continuous variable whose value varies between 1 for very bad forest condition and 5 for very good forest condition. The index correlates highly with all the component responses. We also collected forest plot data on number of trees and their diameter at breast height for a subset of 30 forests. The correlation between forest condition index and average stem density is 0.68. We therefore use the index based on community group responses for the condition of forests as a reasonable proxy variable to represent forest condition. We realize that using community perceptions as a proxy for forest condition introduces a measure of subjective error in our analysis. However, the index also includes the assessment of the investigators who had experience in collecting forest plot data and therefore were conversant with biological measures. The Forest Condition index correlates highly with the assessment of the investigators ($r = 0.80$), increasing our confidence in the use of the index as our dependent variable. Needless to say, if resources had permitted, the collection of biological data for every forest would have improved both our analysis and the confidence in our findings.

To explain the observed variations in Forest Condition, we operationalized the following ordinary least squares (OLS) regression model according to which Forest Condition is a linear function of a suite of causal variables and a randomly distributed error term:

$$\begin{aligned}\text{Forest Condition} &= \alpha + \beta\ (\text{biophysical}) + \gamma\ (\text{economic}) \\ &\quad + \delta\ (\text{demographic}) + \eta\ (\text{institutional}) \\ &\quad + \lambda\ (\text{socio-political}) + \varepsilon, \varepsilon \sim N(0, \sigma^2)\end{aligned}$$

where biophysical = (elevation, aspect, rain, conifer); Economic = (treecrop, distance to market, fodder supply, utility, adverse effect, utility * conifer); Demographic = (size, population change, cattle months, migratory sheep, cattle number); Institutional = (duration, guard, comanage, competition, fines, fines * size); and Socio-political = (landless, village conflict, gender relations, and gender conflict). Our choice of an OLS model was influenced by the nature of our dependent variable: it is continuous and symmetric around the mean. Table 1 provides the basic summary statistics for our independent variables.

"Elevation" is an important influence on forest ecology and condition in mountain regions because it affects a host of other variables, including temperature, energy demands, accessibility, and agricultural possibilities. We measured it for each sampled forest as an important biophysical variable that should be positively related to forest condition. "Aspect" and "Conifer," two other biophysical variables on which we collected data are dichotomous, and represent independent features of biophysical processes. Conifer is coded as "1" when coniferous species constitute more than 80% of the woody vegetation in a forest. We hypoth-

Table 1. *Summary statistics for the variables (n = 95)*

Variable	Mean[a]	Standard deviation	Minimum	Maximum
Forest Condition	3.23	0.85	1	5
Biophysical variables				
Elevation (m)	1125.55	666.5	400	3,450
Log of elevation	6.86	0.57	5.99	8.15
Aspect	41	NA	0	1
Conifer	24	NA	0	1
Rain (mm)	1588.5	505.87	866	2297
Economic variables				
Treecrop	6.14	16.46	0	98
Distance to market	3.06	1.28	1	5
Fodder supply	59.31	21.15	10	100
Utility	3.06	1.06	1	4.75
Adverse effect	1.33	0.57	1	3
Utility * Conifer	0.79	1.44	0	4.75
Demographic variables				
Size (no. of households)	117.15	177.44	1	1,200
Population change	0.26	0.14	0	0.84
Cattle-Months	5.57	5.00	0	12
Grazing of migratory sheep	0.74	1.35	0	6
Cattle-Number	159.41	327.16	0	2,000
Institutional variables				
Duration	2.82	1.46	1	5
Guard	15	NA	0	1
Comanage	31	NA	0	1
Competition	0.22	0.55	0	2
Fines	18.26	64.52	0	500
Fines * Size	10679.88	64979.77	0	600,000
Socio-political variables				
Landless	0.20	0.21	0	0.88
Village conflict	0.77	0.87	0	3
Gender relations	1.99	0.57	1	3
Gender conflict	9	NA	0	1

[a] For dichotomous variables, the value is the number of positive responses.

esize that it is positively related to forest condition, because subsistence utility of coniferous species to villagers is likely low, and there are significant government restrictions on commercial harvesting. Aspect is coded as "1" if the forest is located on slopes facing north, northeast, or northwest. In Himachal Pradesh, north-facing slopes are generally moister and assist in vegetative growth compared to south-facing slopes that receive direct sunlight and are more arid. Aspect should also bear a positive relationship with forest condition. Finally, we also use data on "Rainfall" to take into account precipitation effects on forest condition, and hypothesize that the relationship will be positive. However, our rainfall data are drawn from official sources and exists only at the district level. It is relatively coarse data whose limitations we could not overcome owing to resource constraints during data collection.

To measure different aspects of local economic conditions, economic relationships of households to forests, and the articulation between localities and markets, we use a set of variables broadly categorized as "Economic Variables." "Treecrop" measures the amount of private land devoted to horticulture and is one of our measures of market pressure. The high incidence of fruit production in the state prompts the use of this variable. We expect "Treecrop" to be negatively correlated to forest condition. In one of our models, we used "Cashcrop" as an alternative measure of market influence—this second variable indicates the amount of private land dedicated to non-tree cash crops in the village, and we expect it also to have a negative relationship with forest condition. "Market" measures the road distance to the nearest market, a commonly used indicator of market pressure (Angelsen & Kaimowitz, 1999; DeVelice & Martin, 2001). We rescaled distance in kilometers so that this variable ranges from 1 (for less than 1 km) to 5 (for more than 20 km). We expect it to be positively related to forest condition: greater the distance from market, better the forest condition. "Fodder Supply" indicates the proportion of fodder that comes from non-forest sources for the village as a whole. We include it as an indicator of the extent to which villagers rely on forests for their livestock's fodder needs, and anticipate that the relationship of forest condition with fodder supply should be negative. Greater supply of fodder from non-forest sources reduces dependence on forests, and therefore incentives to manage them. Average benefits that villagers receive from the forest for their household subsistence activities are indicated by "Utility," an index of group responses ranging from 1 for very low to 5 for very high. Higher the utility, the better should be the condition of the forest, because villagers are more likely to be interested in protecting forests with greater utility. "Adverse Effect" indicates the extent to which villagers would be adversely affected where the forests are no longer available. The variable is coded from 1 to 3 where a coding of "1" indicates highly adverse effects, and "3" indicates no adverse effects. We expect that villagers will be more interested in protecting forests whose absence will affect them more adversely, and therefore this variable should have a negative relationship with forest condition (because it is reverse coded). Coniferous forests are generally not as useful for subsistence purposes as mixed or broad-leaved forests. To examine whether there are any interaction effects between perceived utility and the type of vegetation, we use an interaction term, "Utility * Conifer." We expect this term to have a negative sign because high utility coniferous forests are valued for their harvestable timber, and therefore likely to be in worse condition.

A large amount of literature has argued for the importance of population and related demographic processes in influencing forest condition. Because of the significant importance placed on these processes in the existing literature, we use demographic indicators that would take into account both human and livestock population pressures. We include measures of animal population because consumption pressures on forests can be high even with a low human population if per household animal holdings are high. "Size" corresponds to the number of households as the basic measure of population effects in the largely subsistence economy of rural Himachal Pradesh. We expect, on the basis of much of the literature on population and resources, that it will have a negative relationship with forest condition. "Population Change" in percentage terms over the previous decade signifies the rate of change of population. We anticipate that the higher the rate of change, the worse the condition of the forest. For animal population, we use three variables. The first "Grazing of Migratory Sheep" indicates the number of months for which migrant shepherds use forest resources. Higher number of months for which migratory sheep browse in the forest should lead to a worse forest condition. "Cattle-Months" indicates the number of months for which village animals graze in the forest. Finally, "Cattle-Number" represents the number of village cattle that graze in the community forest. Both these variables should be negatively related to forest condition.

Institutional factors, especially in the literature on common property but also more generally, have come to be viewed as extremely important in shaping access to forest resources and the nature of activities that occur in forests. They are therefore also very important in influencing forest conditions. In our analysis, we use several variables to take different aspects of institutions into account. "Duration" is the number of years for which community-based conservation has been in force in a given case. It ranges from 1 to 5, with 1 denoting very recent initiatives (post-1990) and 5 standing for older community-based management systems (pre-1930). We anticipate that older institutions will have a positive impact on forest condition because over time, the local residents who are subject to these institutions would have addressed operational and functional problems. "Guard" and "Comanage" are dichotomous variables. If the local community hires a guard for enforcement the variable is coded 1, otherwise it is coded 0. Similarly, if government or forest department officials are involved in facilitating decision making within local community institutions, the variable is coded 1, otherwise 0. We expect both of these variables to have a positive sign. "Competition" represents whether more than one individual competes for positions in the executive body of the community organization. It varies between 0 and 2, where 0 indicates no competition, and 2 indicates that there is almost always some competition. Greater competition indicates that positions on the executive body of community-level forestry institutions are more meaningful, and therefore, it is likely to be positively related to forest condition. "Fines" measures the number of individuals fined by the community institution in the past two years. We view this variable as an indicator of the extent to which institutional enforcement is actually present in a village, and expect it to have a positive relationship with forest condition. Finally, we include an interaction term "Fines * Size" because we expect rule enforcement to become more critical as group size increases (see Poteete & Ostrom). Collectively, the different institutional variables allow us to examine whether, and the extent to which the longevity of community institutions, differences in their functioning, and the strictness of enforcement are related to the condition of the forest.

Socio-economic and socio-political variables at the village level affect the ability of users to cooperate with each other in conserving forests, as also the dynamics of forest governance regimes (Kant, 2000). While we have already discussed a range of socio-economic variables, the more political variables constitute the final set of causal influences our model examines. "Landless" is the proportion of households with less than 0.4 ha of agricultural land. This variable potentially affects forest condition in two ways. It likely increases harvesting pressures on the forest, and therefore exerts a negative effect on forest condition. But a higher proportion of landless in the village is also likely to increase overall dependence of villagers on the forest, potentially prompting them to try to protect it better. "Village Conflict" measures the level of reported conflict in the village, ranging from 0 for no conflict to 4 for violent conflict. Higher levels of conflict should bear a negative relationship with forest condition. In addition, we also include two gender-related variables in the analysis. Indeed, several authors have highlighted the important role of gender and meaningful women's participation in the success of community-based conservation (Agarwal, 2001; Rocheleau & Edmunds, 1997). "Gender Relations" measures whether women hold positions of power in village organizations, ranging from 1 for equitable distribution between men and women in these positions to 3 for distribution that greatly favors men. We expect women to be more active in protecting forests in areas where forests are not in a good condition, and therefore, lower levels of this variable should be related to higher involvement of women in decision-making positions. "Gender Conflict" is a categorical variable for the presence or absence of conflict in the village along gender lines (coded 1 if gender conflicts are present). The presence of gender-related conflicts, we expect, will be negatively related to forest condition.

Our statistical analysis thus takes into account a broad array of variables. By examining their effects on forest condition simultaneously, we hope to identify the extent to which each variable exerts independent causal effects on outcomes even when the impact of other theoretically relevant variables is taken into account.

5. RESULTS AND DISCUSSION

The results of our analysis are presented in Table 2 and described below. The table lists the regression coefficients of variables we used in three different models. We include the results for three models to examine the sensitivity of the estimates in the first model to changes in model specification. It is clear that the coefficient estimates and standard errors are similar across the models: for no variable do the coefficient estimates change by more than one standard error across the three models. The first column in the table presents the results of the model that most closely conform to the variables discussed above. The overall similarity of the coefficients, their standard errors, and statistical significance, and the different indicators of model fitness such as the R^2, the adjusted-R^2, and the F-statistic suggest that the statistical relationships in the initially specified model are robust against perturbations. The

Table 2. *Dependent variable—Forest Condition*

Variable	Model 1	Model 2	Model 3
Biophysical variables			
Log of elevation	0.417 (0.145)***	0.29 (0.145)**	0.414 (0.147)***
Aspect	0.683 (0.128)***	0.683 (0.128)***	0.682 (0.129)***
Rain (mm)	−0.0004 (0.00013)***	−0.0004 (0.00013)***	−0.0004 (0.0001)***
Conifer	1.536 (0.457)***	1.598 (0.461)***	1.52 (0.463)***
Economic variables			
Treecrop	−0.007 (0.004)*		−0.007 (0.004)**
Cashcrop		0.004 (0.003)	
Distance to market	−0.269 (0.052)***	−0.259 (0.052)***	−0.27 (0.052)***
Fodder supply	−0.008 (0.003)**	−0.009 (0.003)***	−0.008 (0.003)**
Dependence	0.35 (0.117)***	0.378 (0.118)***	0.348 (0.118)***
Utility	0.18 (0.068)**	0.171 (0.068)**	0.18 (0.069)**
Utility ∗ Conifer	−0.406 (0.143)***	−0.435 (0.144)***	−0.403 (0.145)***
Demographic variables			
Population change	−1.639 (0.494)***	−1.462 (0.495)***	−1.65 (0.506)***
Size	0.001 (0.0006)**	0.001 (0.0006)**	0.0013 (0.0007)*
Grazing of migratory sheep	0.221 (0.068)***	0.218 (0.069)***	0.223 (0.070)***
Grazing of cattle (months)	−0.038 (0.015)**	−0.04 (0.015)**	−0.038 (0.015)**
Grazing of cattle (number)	0.0005 (0.0002)**	0.0005 (0.0002)**	0.0005 (0.0002)**
Area of forest			−0.00002 (0.0001)
Institutional variables			
Guard	−1.22 (0.200)***	−1.161 (0.203)***	−1.1214 (0.202)***
Comanage	−0.528 (0.156)***	−0.510 (0.156)***	−0.526 (0.157)***
Duration	0.130 (0.053)**	0.102 (0.052)*	0.131 (0.054)**
Competition	0.433 (0.152)***	0.458 (0.152)***	0.428 (0.156)***
Fines ∗ Size	-5.60^{e-06} (1.58e−06)***	-5.77^{e-06} (1.59e−06)***	-5.61^{e-06} (1.59e−06)***
Socio-political variables			
Gender relations	0.235 (0.108)**	0.267 (0.109)**	0.236 (0.109)**
Gender conflict	0.418 (0.226)*	0.452 (0.226)**	0.41 (0.231)*
Landless	0.657 (0.314)**	0.834 (0.311)***	0.656 (0.316)**
Village conflict	−0.131 (0.074)*	−0.181 (0.076)**	−0.132 (0.075)*
No. of observations	95	95	95
R^2	70.28%	70.07%	70.30%
Adjusted-R^2	60.09%	59.8%	59.54%
F-statistic	$F_{(24,70)} = 6.90$	$F_{(24,70)} = 6.83$	$F_{(25,69)} = 6.53$
Root MSE	0.537	0.539	0.540
Prob > F	0.0000	0.0000	0.0000

*, **, and *** signify statistical significance at 0.1, 0.05 and 0.01 levels, respectively.

R^2 for the three models is 70.28%, 70.07%, and 70.30%; and the adjusted-R^2 is 60.09%, 59.8%, and 59.54%, respectively. These numbers indicate that the basic model explains a high proportion of the observed variance. The F-statistic for the three models is 6.90, 6.83, and 6.53, with $p < 0.00001$ for each model. The residuals for all three models are normally distributed. To check for heteroskedasticity, we used the Breusch–Pagan Test, and for the possibility of non-linearities the Ramsay Regression Specification Error Test (RESET). We also examined whether individual observations have a strong influence by using the Cook's Distance and Leverage statistics. These diagnostics indicate that the models are well specified, and add to our confidence in the scope of our findings. Finally, we calculated the Variance Inflation Factor for each variable to check for multicollinearity. The scores for the different variables indicate that collinearity is an issue only with Conifer and Utility * Conifer which are strongly correlated. However, we did not omit either of these variables for theoretical reasons as discussed above.

In assessing the results of the analysis, the first important point to note is that all the different categories of causal influences include at least some statistically significant variables even if there are other variables that are not highly significant. Some of the observed relationships do not conform to the stated hypotheses in the previous section. Exploring these variables and relationships in greater detail helps identify connections among the hypothesized causal and outcome variables that may be instructive in other contexts as well.

For biophysical factors, all the variables included in the analysis are statistically significant. The coefficient for the logged value of "Elevation" confirms that forests in higher elevations are likely to be in better condition. The result for "Aspect" indicates that north-facing slopes, as hypothesized, are more likely to have forests in good condition. Coniferous forests tend to be in better condition than mixed or broad-leaved forests. However, rainfall has a negative sign, indicating that forests in districts with higher levels of rainfall are in worse condition. We believe that the measure of total rainfall at the district level that we used is likely inadequate to capture the complexities in the relationship between rainfall patterns and forest condition, especially since the administrative districts in Himachal Pradesh do not follow ecological boundaries. But overall, the results suggest that biophysical variables play a very important role in shaping forest conditions, and studies of forest governance need to take these variables into account so as not to overemphasize the role of socio-economic or institutional influences over forest condition.

Economic and demographic variables have received perhaps the most careful and general attention in studies of conservation. The well-known equation, "$I = P * A * T$" summarizes the conviction of many that the conjunction of Population, Affluence, and Technology defines Impact on environmental outcomes (Ehrlich & Ehrlich, 1990). Consider the six economic variables in our analysis: Treecrop, Distance to Market, Fodder Supply, Utility, Dependence, and the interaction term Utility * Conifer. The first two are related to the impact of market forces, the remaining four concern the role of forests in the household and village economy.

All the variables are statistically significant, although not always in the hypothesized direction. Treecrop has a negative relationship with forest condition (as hypothesized), indicating that the greater the prevalence of fruit trees in village agriculture, the less likely are forests to be in a good condition. Our data also indicate that forests are likely to be in a better condition the closer the markets are. Although our results contrast with those in a significant literature on the effects of roads and markets (Angelsen & Kaimowitz, 1999; Southworth & Tucker, 2001), a number of recent studies have reported similar findings as ours (Gautam, Shivakoti, & Webb, 2004; Rudel, Bates, & Machinguiashi, 2002). We account for the observed relationship by suggesting that distance from roads can also be a proxy for distance from government offices, and that official presence acts as a disincentive to deforestation. Thus, in contexts where state officials are effectively present in local contexts, distance from roads or markets is not an efficient measure of economic pressures because its effects are confounded by those of government influence. Indeed, other studies that explain greater forest density in locations closer to roads essentially use a similar explanatory mechanism (Agrawal & Yadama, 1997; Alvarez & Naughton-Treves, 2003; Nagendra, Southworth, & Tucker, 2003). In contrast, the Treecrops variable is a more direct representation of articulation with external market forces given the social and political economy of Himachal Pradesh. It indicates whether village forests face pressure for logging as a result of demands for wood from owners of apple orchards and similar fruit tree crops. Cashcrop also represents the articulation of village communities with markets. But in the specific context of Himachal Pradesh where forest land is not being converted for cultivation, this variable does not capture the influence of markets on forest conditions to the same degree as Treecrop.

The third economic variable we use, Fodder Supply, indicates the proportion of fodder realized from non-forest sources, and has a negative relationship with forest condition as hypothesized. In a similar fashion, the variable Utility, which indicates the overall subsistence benefits from forests to villagers, is positively related with forest condition. The results for both variables can be interpreted to mean that when villagers assess their community forest to be more useful for subsistence and livelihoods, they make greater efforts to protect forests. Other scholars have remarked upon the extent to which livelihoods of the poor are dependent on forests, and the complexity of the concept of dependence (Fisher, 2004). Our conclusion that communities are likely to try to protect and maintain forests when they rely on them for subsistence is supported at least in part by Lise's (2000) finding for three Indian states (Haryana, Uttar Pradesh, and Bihar) that high levels of forest dependence encourage greater participation in forest governance.

Adverse effect—how villagers perceive the loss of the forest to affect them—is positively related to forest condition. This finding is contrary to our initial hypothesis, and underscores the complexity of the concept of dependence (Beckley, 1998; McSweeney, 2002). We believe that two different factors may be used to explain the tension between the results for Fodder Supply and Utility, and Adverse Effect. The joint result for these three variables suggests that it is subsistence rather than general benefits from forests that prompt villagers to express the need to conserve forests. Further, it is likely that when subsistence benefits of forests are highlighted in a question, villagers are more likely to express the need to protect forests than when a more abstract question about how they will be affected by loss of forest. It is also possible that when villagers do not view a forest as important to them, its condition is better because villagers are not extracting too much from the forest.

The final economic variable is the interaction term, Utility * Conifer, and it has a negative relationship with forest condition. This result indicates that for coniferous forests, higher the utility, lower the condition of the forest. Coniferous forests are typically used for timber and the negative coefficient of the interaction terms—coupled with positive coefficients for both Utility and Conifer—suggests that if villagers view such forests as having high utility (in terms of the supply of timber), the forests are likely not to be in a good condition. A corollary implication may be that mixed and broadleaved forests that are seen as having high utility are more likely to be in a better condition. This interpretation of the coefficient is consistent with the results for the two variables, Fodder Supply and Utility.

All the five demographic variables in our analysis (Size, Population Change, Grazing of Migratory Sheep, Cattle-Months, and Cattle-Number) are statistically significant, but the unexpected signs for some of them indicate that some theoretically interesting causal processes may be at play. Consider the first two variables related to population size and the rate at which population changes. Size has a positive relationship with Forest Condition and Population Change has a negative relationship. The results plausibly indicate that the greater the rate of population change, the more likely are community forests to be in a bad condition. A possible causal mechanism that may explain this finding is that when population changes are rapid, it is more difficult for users to change existing forest use and management practices and for existing institutions to accommodate the impact of change. The unexpected positive relationship of Size (number of households) holds for all three models. It would appear that for the range within which household numbers vary in our dataset, more people leads to better forests. This result is similar to what Tiffen, Mortimore, and Gichuki (1994) point out in their work on soil erosion in Kenya. Larger numbers of people may adopt more labor-intensive agricultural technologies and provide greater labor to invest in land improvement, thereby reducing soil erosion. In a similar fashion a larger number of people, as long as this number is not excessive, can improve forest condition by increasing aggregate household contributions for conservation and strengthening the institutions that facilitate conservation.

The signs of coefficients for livestock related variables also do not always accord with our hypothesized relationships. For Cattle-Months, the association with forest condition is negative as hypothesized. For Grazing of Migratory Sheep, however, the forest condition is positively related to the number of months sheep are present in the community forest. We believe that both for this and the Cattle-Numbers variable, reverse causality may be at work. That is, migrant shepherds may be taking their sheep to forests that are in better condition, and villagers may be sending more cattle to better forests, rather than it being the case that more grazing by cattle and more months of the presence of migrant sheep produces better forests.

In model 3, we examine whether the area of forest is important in influencing its condition. Our hypothesis was that larger forests should be in better condition. The results do not support the hypothesized relationship. We conclude that like other demographic variables, there is no direct relationship between forest size and condition. Just as the effects of population size are mediated by a large number of institutional, economic, and socio-political variables, so are those of greater availability of forested land. Once these other factors are taken into account, forest area does not have a statistically significant effect on forest condition.

A large number of existing studies have asserted the critical importance of institutional and socio-political factors in shaping resource use, governance, and outcomes (Armitage, 2002; McKean, 1992; Ostrom, 1990). If some have asserted the importance of local control in reducing resource extraction from forests (Edmonds, 2002), others have pointed to the significant differences that de facto institutional arrangements produce in forest governance-related outcomes (Agrawal & Yadama, 1997; Wily, 2001).

In our analysis, we used only five of the six institutional variables that we had initially chosen: Duration, Guard, Comanage, Competition, and Fines * Size. The variable, Fines, turned out to be highly correlated with Size, the demographic variable we use to represent population of the village ($r = 0.75$), and with the interaction term, Fines * Size ($r = 0.92$), leading to collinearity in the regression models. Both because we have other institutional variables (Guard) that tap into the issue of enforcement in a roughly similar way as does Fines, and because the variables Size and Fines * Size appear to us to be theoretically more important, we dropped Fines from our analysis. Size is theoretically more important because it represents the demographic argument that number of people who use a resource affects the condition of the resource, and its conservation. Fines * Size is theoretically important because it tests for the possibility that in villages with larger number of households, there may be scale effects associated with enforcement.

The five institutional variables are all statistically significant. The time for which a local community-level institution has been in existence (Duration) is positively related to forest condition. The coefficient for Guard is also statistically significant, but the sign is negative, indicating that in forests that are in good condition, there is less enforcement. The negative sign for guard is in tension with the findings of a number of studies in which the presence of locally appointed and paid guards is associated with forests that are in good condition (Gibson, Williams, & Ostrom, 2005; McKean, 1992). Our interpretation of this finding is that in the studied cases, villagers are more likely to hire guards and impose fines more frequently if their forests are not in a good condition in an effort to improve their forests. Thus, the causal arrow suggested by our data runs in the reverse direction from what we had hypothesized. Two different factors may be at work. Villagers hire guards either when they see adverse changes occurring in forests that were earlier in good condition, or they hire guards for forests whose future conditions they believe they can improve. Thus, the current condition of forests is not a good proxy for the causal relationship at work. The variable Comanage, representing government officials' involvement in community decision making, is negatively related with forest condition and prospects for conservation. We pose three likely explanations based on qualitative evidence: powerful external figures hinder the adoption of governance rules that are best suited to local conditions; comanagement processes introduce new and sometimes large amounts of external funds into the local context, a development that may exacerbate the ill effects of powerful external figures; and finally, comanaging government officials often devolve control over forests that are not in a good condition to begin with. Indeed, in Himachal Pradesh, the forest department devolved control over forests beginning in the 1980s, when there was significant bureaucratic reluctance against participating in comanagement. The forests that local communities came to comanage were often therefore in poor shape.

Greater competition in the selection of office bearers in community institutions is associated, as hypothesized, with better forest condition. Finally, Fines * Size has a negative sign. Especially in combination with the positive sign for Size, this finding suggests that in larger groups, a high incidence of fines is negatively associated with Forest Condition. The reason may be that as group size increases, more fines are particularly detrimental to features of community—trust, reciprocity, conservationist-norm-oriented activities—that confer positive valence upon community-based conservation. It may also be the case that smaller communities address the problem of enforcement without relying on monetary fines.

The coefficients of the socio-political variables (Landless, Village Conflict, Gender Relations, and Gender Conflict) are also statistically significant. These variables represent also the specific effects of group heterogeneity on forest condition (Poteete & Ostrom, 2004; Varughese & Ostrom, 2001). We find that greater landlessness is positively related with forest condition, which may indicate that villagers attempt to protect forests better when landlessness is higher. This result reflects the situation in Himachal Pradesh: low levels of social and economic inequality at the village level. In such a situation, it is likely that Landless captures subsistence dependence rather than heterogeneity within the community. Higher levels of Village Conflict are related to forests in worse condition. More conflict-ridden social relationships in the village likely make decision making around forest protection difficult, as pointed out by some other scholars as well (Johnson & Forsyth, 2002).

The relationship of the two gender variables—Gender Relations and Gender Conflict—with Forest Condition is quite interesting. The positive sign of the first one of these indicates that one of the major arguments advanced by gender theorists is likely on target: that involvement of women in institutionalized decision making improves the prospects for better resource conservation (Agarwal, 1998, 2001; Sarin, 1995). As ethnographic and sociological studies of household division of labor in hill areas have noted, women are typically charged with collection of forest products such as fodder and firewood. If they are in leadership positions, they can create regulatory mechanisms that are more suited to the local context as well as their needs for forest products. The analysis also indicates that the presence of gender conflicts is positively associated with better forest condition. The causal implication of these two variables taken together is that women are likely involved in decision making and positions of power only after there is some conflict related to gender issues. Clear examples illustrating these gender dynamics occurred in the community forests of Shanag in Kullu, and Thalli and Kuthah in Mandi. In all three villages, women gained decision-making positions only after local forests were viewed as deteriorating rapidly. Women as a group were most affected by this decline, and there were substantial disagreements within the village community around how to address these issues. Gender-related conflicts thus do not necessarily produce negative effects as far as women's participation in decision making is concerned.

Table 3 presents information about how and to what extent the causal variables included in our analysis affect the predicted value of the outcome variable: forest condition. The second column of the table is an array of the coefficients of the variables, as derived from model 1. The third and fourth columns indicate the value of the independent variable at the 25th and the 75th percentile levels. The fifth column indicates how the predicted value of Forest Condition changes in response to a change in the causal variable from the 25th to the 75th percentile. The final column lists the mean effect on the predicted value of Forest Condition. In simple terms, we may say that Table 2 indicates how well the data fit the regression line in an *n*-dimensional space where "*n*" is the number of variables, and Table 3 indicates how much the regression line (or the dependent variable) is affected by changes in the value of the causal variables.

Even a cursory look at the table is sufficient to show the large contribution of biophysical variables to the predicted value of forest condition. Elevation and Conifer generate the greatest change in forest condition with changes in their value. Further, elevation is correlated with several other independent variables. The implication is obvious—studies of local resource governance that set aside the treatment of biophysical variables and focus mainly on socioeconomic, demographic, and/or institutional variables to explain forest condition likely overestimate the impact of the variables included in the analysis. One may defend the omission of biophysical variables from an analysis on the ground that although changes in these variables may produce substantial changes in forest condition, there is little that can be done about

Table 3. *Mean predicted value of Forest Condition*

Variable	Model coefficients	25th percentile	75th percentile	Effect on Forest Condition	Mean effect
Biophysical variables					
Log of elevation	0.417	6.31	7.378	0.446	2.866
Aspect[a]	0.683	0	1	0.683	0.683
Rain	−0.0004	1,069	2,297	−0.528	−0.684
Conifer[a]	1.536	0	1	1.536	1.536
Economic variables					
Treecrop	−0.007	0	5	−0.035	−0.043
Distance to market	−0.269	2	4	−0.538	−0.825
Fodder supply	−0.008	40	75	−0.2998	−0.508
Utility	0.18	2	4	0.36	0.552
Adverse effect	0.35	1	2	0.35	0.468
Utility * Conifer	−0.406	0	1	−0.406	−0.32
Demographic variables					
Size (no. of households)	0.001	20	152	0.181	0.161
Population change	−1.639	0.166	0.333	−0.273	0.426
Cattle-Months	−0.038	0	12	−0.457	−0.213
Grazing of migratory sheep (months)	0.221	0	1	0.221	0.164
Cattle-Number	0.0005	0	150	0.082	0.088
Institutional variables					
Duration	0.130	2	4	0.26	0.367
Guard[a]	−1.22	0	1	−1.22	−1.22
Comanage[a]	−0.528	0	1	−0.528	−0.528
Competition	0.433	0	1	0.433	0.096
Fines * Size	-5.60^{e-06}	0	400	−0.0022	−0.0598
Socio-political variables					
Landless	0.657	0.027	0.277	0.164	0.133
Village conflict	−0.131	0	1	−0.131	−0.101
Gender relations[b]	0.235	1	3	0.472	0.469
Gender conflict[a]	0.418	0	1	0.418	0.418

Note: The figures in the fifth column denote the absolute contribution to the value of *Y* over the inter-quartile range of *X* (for dichotomous variables, the difference is between the effect for 0 and 1).

[a] Denotes a dichotomous variable.

[b] The range for "Gender Relations" is between 15th and 85th percentile, respectively, because the inter-quartile range is constant at the value of 2.

them. Therefore, from a policy standpoint, it is unnecessary to be concerned about variables such as elevation, aspect, or rainfall. We disagree. Inclusion of relevant variables in an analysis helps generate a more precise and therefore valuable sense of the power and limits of the causal factors that policy interventions *can* influence.

The important influence of biophysical variables on outcomes is quite probably related to the high variability of ecological and biophysical conditions in Himachal Pradesh. Our inferences about the importance of including biophysical variables in analyses of common pool resource related outcomes are especially germane to other contexts characterized by significant variability—typically ones with which scholars of the commons are often concerned. Much of the work on fisheries, in mountainous regions, and in semi-arid environments will fit the description of a context that has high and localized variability in biophysical conditions.

A second point to note is that changes in values of the demographic variables included in our analysis have a smaller overall effect on the predicted value of Forest Condition in comparison to Institutional Variables. Among the different demographic variables, the one that affects outcomes most is population change rather than the absolute number of user households. We can say that in contexts such as that of Himachal Pradesh, and for the range of variation in demographic variables that our data represent, the arguments of many social scientists that there is no straightforward link between population levels and resource degradation are well directed (Leach & Mearns, 1996; Tiffen *et al.*, 1994; Varughese & Ostrom, 2001). This link is mediated through institutional form. The strength and resilience of institutional enforcement and the durability of institutions are highly significant factors. Our analysis, thus, confirms much scholarship on the importance of locally negotiated institutional arrangements.

A third important finding worth highlighting is the role of gender-related variables in our analysis. The variables concerning gender that we include in our model are each statistically significant. Changes in the values of both produce substantial impact on the predicted value of forest condition. This impact exists above and beyond the effects of a large number of other causal variables included in the analysis. Our study also indicates that women's participation in forestry-related community institutions is not an easy or smooth process in rural contexts where they are typically assigned more burdensome parts of household and agricultural labor. But the positive association of gender-related conflicts and forest condition suggests that such obstacles ultimately have a positive effect on forestry outcomes.

6. DISCUSSION AND CONCLUSION

In conclusion, it is useful to highlight two issues fundamental to our study—one relates to methods, the other concerns how contextual factors imbue specific variables with their causal significance. In this study, we have opted for an approach that can harness the strengths of a multivariate, large-*N* driven analysis in detecting patterns in large amounts of data—something that is not easy to accomplish by a case-oriented approach. But it should be obvious that our statistical analysis of data, choice of variables, manner of operationalizing the variables, and interpretation of regression coefficients have relied on the findings of many case studies on local resource governance, and our own intensive field-based empirical work. We have highlighted the importance of conducting statistical work on local resource use and governance because so much of the literature on the subject is driven by single case-oriented analytical lens. Undoubtedly, it is easier to identify causal mechanisms in intensive studies of specific cases—perhaps a factor that explains why so much existing work on the subject has relied on fieldwork and case analysis.

Our data analysis suggests however that the generalizability of causal mechanisms identified in case studies can be ascertained only by undertaking statistical–analytical work to detect broad patterns in the data: something at which fieldwork and case analysis are weak. But an intimate knowledge of field conditions and the context of the data—what we call "thick reading" and "close analysis"—are critical to interpret statistical patterns. To illustrate, during fieldwork in the villages of Shanag, Thalli, and Kuthah, we learned of the involvement of women in decision-making positions as local forests deteriorated. We also learned about the tense social interactions surrounding the decline of community forests and the incorporation of women in decision-making positions. However, whether this set of gender-and-forest interactions was relevant for the full sample of representative cases on which we were collecting data could not become obvious until we had carried out our statistical analysis. On the other hand, the knowledge of what was happening in the field was essential to give meaning and significance to the correlation we observed between forest conditions, and gender relations and gender conflict.

The same process of interpreting the data and statistical results helped us make sense of the relationships we identified between forest condition and the presence of a guard. The importance of aspect and its relationship to forest condition, similarly, became apparent as a result of what our interviewees told us about how it helps tree growth. We interpret the variables, Utility and Fodder Supply, to indicate that residents protect forests better when they consider them as providing more subsistence benefits. This interpretation is again based on what we learned in the field. A rigorous test of competing hypotheses about causal direction would require longitudinal data for the sampled villages. The cited examples of the relationships between statistical correlations and their interpretation should, however, convey our sense that the conventional tension between case study work and statistical analysis is an artifact of particular methodological commitments. Careful, meaningful, and systematic knowledge about how resource governance unfolds and is shaped requires an inescapable conversation between statistics and contextual expertise.

These observations about method are related to what our study tells us about the interconnections between context and the relevance of specific variables. Consider two variables we use in our analysis: Elevation and Distance to Market. Variation in Elevation is one of the central factors in our analysis that explains differences in Forest Condition, our dependent variable. It is in significant measure this variable that prompts us to call for greater attention to biophysical variables in analyses of the governance of the commons. It is related to many of the other independent variables we use: Treecrop, Cashcrop, Size, Grazing by migratory sheep, Months of grazing by cattle, Duration, and Guard. Many of these relationships seem evident—for example, size of villages should decline as one moves to a greater elevation in mountain regions. However, if in a particular study, data exist only on village size and the information on elevation is ignored, the reported relationship between forest condition and village size will likely be an over- or under-estimate. Elevation produces an impact on forest condition through the way it affects these other variables to which it is related rather than a direct raw impact.

One can interpret the importance of elevation on forest condition in our analysis in another way as well. It is quite possibly a proxy for temperature (a variable on which we could not gather local data, and which is therefore not included in our analysis). Elevation, therefore, likely also represents the effects of temperature on forest growth, demand for firewood and cooking materials, agricultural growth possibilities and thus Treecrop and Cashcrop, and so forth. It is no surprise that changes in this variable have large effects on the state of the dependent variable.

The idea can also be illustrated in a different manner with reference to the important role of distance to market in our analysis. In our data, closeness to the market is associated with forests that are in better condition. The finding runs counter to that in many existing studies, as noted. Our reinterpretation of the statistical relationship is that distance to market confounds the effects of market pressures and official constraints on harvesting of forest product. This reinterpretation is driven especially by an awareness of the political–economic geography of Himachal Pradesh where the presence of the state is near ubiquitous, and its influence runs along channels created by roads. Similarly, the scale at which variations in the influence of roads on forest condition become discernible is far finer than it would be in a context where population density is low.

Our study, thus, underscores the importance of contextual variations and awareness of such variations in knowing how to specify and operationalize the variables of interest. This need for intimate familiarity with data, informed by knowledge of field conditions, has a prime implication for the study of the commons. Variations in how the same factors operate and should be operationalized in different macro-contexts should make us pessimistic about the possibility of a universal theory of the commons. What Jon Elster suggests about the study of local justice—"it is a very messy business, and… it may be impossible to identify a set of necessary and sufficient conditions that constitute a theory of local justice" (1992, p. 14)—is likely also true for the study of the commons and local resource governance.

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