
How do Local Institutions Mediate Market and Population Pressures on Resources? Forest *Panchayats* in Kumaon, India

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ABSTRACT

This article addresses one of the most controversial issues in resource management: how do population and market pressures affect resource use? After examining some shortcomings in several major approaches to the issue, the authors use structural equation analysis to decipher the relative and reciprocal influence of population pressures, markets, and institutional arrangements on forest use in the Kumaon Himalaya in India. By deploying an approach which investigates comparatively the effects of these factors, the article attempts to find a way out of the stultifying positions that participants in the debate on overpopulation and environmental change are forced to adopt. The results presented in the second half of the article are especially interesting, showing that local institutions created by the state play a critical role in mediating the influence of structural and socio-economic variables. The findings thus possess significant implications for all who are interested in co-management of renewable resources by the state and the community.

INTRODUCTION

One of the most controversial issues in resource management is the question of how population and market pressures affect resource use. Participants in a polarized debate on the subject assert two separate answers: according to one group, the effects are immense (Ehrlich and Ehrlich, 1991; Myers, 1987; Wilson, 1992), while a smaller but vocal group suggests the impact to be far more limited (Clark, 1958; Lappé and Shurman, 1989; Simon, 1990). In this article, instead of choosing sides, we find it more fruitful to combine the literature on the impact of population and market pressures with writings that investigate the significance of local community institutions. The specific context of our research is forest use by village communities in the Kumaon Himalaya in India. In analysing the relative and interacting influences of population pressures, markets, and institutional arrangements, the article contributes to the literature on the commons and the decentralized management of land-based natural resources. In highlighting the significance of institutional arrangements in resource management, it undermines Neo-

Malthusian accounts of resource scarcity and degradation. Most importantly, however, by adopting an approach which comparatively examines the effects of variations in institutional arrangements, market forces, and demographic pressures, the article attempts to point a way out of the stultifying positions that participants in the debate have so far been forced to adopt.

Concern with overpopulation is ubiquitous in writings on deforestation, soil degradation, loss of biodiversity, threats to future peace, food scarcities, global warming and underdevelopment. An immense and impressive scholarship thus explains how higher population pressures have contributed to environmental degradation (Abernathy, 1993; Ehrlich and Ehrlich, 1991; Meadows et al., 1992; Meffe et al., 1993; Myers, 1991; Wilson, 1992).¹ Such conceptualizations of the links between population and environment, as Arizpe et al. (1994: 1) point out, pose a stark choice between people's needs and conservation of the environment. Assessments of the relationship between increasing marketization and environmental degradation are similarly, and usually, negative. If local economies are integrated into larger markets, greater market pressures are presumed to lead to higher rates of deforestation. The role played by roads and better transportation links is viewed as critical in this regard (Chomitz, 1995; Fearnside, 1986; Verma and Partap, 1992; Young, 1994).

Much of the existing literature, however, by focusing primarily at the macro-structural level of analysis and looking at aggregate figures on forest area, population, and economic growth, neglects 'the findings and perspectives of micro-level research on specific communities and regions' (Arizpe et al., 1994: 1). By incorporating relationships that affect forest use at a more micro-level it is possible, we suggest, to gain a more process-oriented understanding of how broad structural variables work themselves out as they affect people's behaviour regarding forests. Such an understanding is significant not only theoretically, since it would permit a more precise appreciation of how larger social forces influence the actions of users within a community; it is also indispensable if one is to begin the move towards institutional solutions to problems of resource degradation.

Studies of micro-institutional solutions to resource scarcities have burgeoned in the last twenty years and are now available from multiple disciplines and regions. Political scientists, economists, geographers, and especially anthropologists, have deployed a diverse set of theoretical lenses to examine specific villages and communities in most of the countries of the world. Despite the diversity in the approaches they have used, they are united on one conclusion. Institutions matter. The manner in which communities create, follow, and break formal and informal rules regarding the resources

1. Concern with overpopulation comes to colonize even seemingly unrelated subjects. See, for example, Levi-Strauss summarizing his views on race and culture (1985: 21), Jack Nicholson talking about solar energy (1992: 165), or Crick and Watson talking about their discovery of the double helix structure of DNA (Jaroff, 1993: 59).

they control, the extent to which their autonomy of action is constrained, modulated, and facilitated by their interactions with the state, and the internal differentiation within communities along gender, caste, and class dimensions are critical to understanding how resources will be used. One of the problems in abstracting the lessons of detailed case studies, however, is the enormous cultural, socio-economic, geographical and historical variance from one case to another. Further, little of the case study literature explicitly attempts to analyse environmental degradation in a comparative frame or through quantitative methods. Bilsborrow (1994), in a review of causes of deforestation, could not find a single comparative study at the community level.

This article analyses the experience of more than 275 forest-dependent communities in the Kumaon Himalaya in India by focusing explicitly on the variations among these communities in terms of institutional arrangements, demographic pressures, and market forces. The article is divided into four major sections: after quickly describing the study region in the first section, we use the second section to review some of the main assertions from existing writings on how environmental change is influenced by demography, markets, and institutions. This discussion allows the third section to elaborate the framework of the research. The fourth section (which, together with the third, forms the heart of the paper) undertakes a statistical analysis to operationalize and test the framework presented in the third section. The conclusion examines issues related to participation that emerge through the analysis, and suggests some future directions for research.

KUMAON: THE STUDY SITE

Three districts comprise Kumaon — Almora, Pithoragarh and Nainital. In these districts, a multiplicity of institutional forms constitute the terrain of forest management. We identify three major regimes: Reserved Forests controlled by the Forest Department; Civil Forests managed by the Revenue Department; and community forests managed by village forest councils (Agrawal, 1995a). Of these three types of institutions, we focus on the latter, forests managed through the *van panchayats*.²

The presence of the British in Kumaon in the 1840s is a convenient point of departure for delineating the history of forest management through the *van panchayats*. For the British, forests were primarily a valuable commercial and economic resource. Between 1840 and 1917 they brought under their control

2. Important studies of the *van panchayats* have also been carried out by Somanathan (1990, 1991). For related studies of the commons in India, see Agarwal (1986) whose work on gender and property is especially relevant, Arnold and Stewart (1991), Jodha (1986, 1992), Rangan's work on deforestation (1995), and Sivaramakrishnan's work (1996) on the Joint Forest Management programme.

most of the forests in Kumaon — more than 60 per cent of the entire land area. The process proscribed and greatly limited the customary subsistence rights that villagers possessed. The rules that the colonial state enacted specified elaborate new restrictions on lopping and grazing rights of villagers, prohibited the extension of cultivation, regulated the use of fire that villagers believed led to higher grass production, increased the labour extracted from the villagers, and strengthened the number of official village guards.

The colonial state accomplished such radical changes in *de facto* property rights by force. Its acts of theft and loot, as the local populations perceived them, spurred widespread and sustained popular resistance (Guha, 1989; Weber, 1989). Government officials had hoped that the protests would simmer down and the hills residents would ‘gradually become accustomed to the rules as gazetted and that control may be tightened as years go on’ (KFGC, 1922: 2), but the hill dwellers dashed these sanguine hopes. The incessant, often violent protests by village communities forced the government to appoint the Kumaon Forests Grievances Committee in 1922 to look into the demands of the local populations (Pant, 1922). The committee interviewed more than 5000 hill residents before submitting a set of 31 proposals to the government. Following its recommendations, the state passed the *Van Panchayat Act* (Forest Councils Act) in 1931 which permitted villagers to form relatively autonomous management committees and bring back under their control significant areas of hill forests. This devolution of powers to control and manage forests for subsistence purposes forms one of the earliest examples of co-management of renewable resources by the state and local communities. It emerged as a consequence of a long process of struggle waged by the hill villagers.

Today, more than 3000 *van panchayats* formally control the use of about 35 per cent of the forests in Kumaon; see Table 1 (Agrawal, 1995a: 51). Most of the forests are between 25 and 250 hectares, and provide the villagers with significant subsistence benefits such as fodder, grazing for their animals, fuelwood, and construction timber. Villagers create the rules for day-to-day management in frequently-held meetings.³ While the *Van Panchayat Act* outlines the broad parameters within which the management practices of the *panchayats* take place, villagers themselves craft the specific rules that govern withdrawal of benefits from their forests. They create monitoring, sanctioning and arbitration devices to resolve the vast majority of disputes within the local space, elect leaders from the community, select guards to enforce rules, fine rule breakers, manage finances, and often deploy surplus earnings for the public good within the community. All of the *van panchayats* in the hills are, thus, formally empowered to initiate rule-making procedures and implement the rules they craft so as to use and protect their forest resources in accord-

3. For a discussion of the details of the rules and provisions of the Forest Panchayat Act of 1931, see Agrawal (1995a) and Ballabh and Singh (1988).

Table 1. Distribution of Forest Panchayats in Kumaon Districts

District	Number of panchayats	Area (kms ²)	Percent of total forest in the district
Nainital	202	217	5.5
Almora	1719	2959	75.1
Pithoragarh	1056	1001	30.2
Overall	2977	4177	37.2

Sources: Note on Forest Panchayats compiled by Pithoragarh District Collectorate in 1993; Note on Forest Panchayats compiled by Almora District Collectorate in 1992; Ballabh and Singh (1988: 7); Vaid (1988: 26).

ance with their needs. However, it is appropriate to treat the *van panchayats* in Kumaon as an instance of co-management because despite their considerable autonomy in day-to-day operations, they must rely on state officials in two respects. Forest Department officials provide them with technical help and must be consulted before harvesting such forest products as resin and timber. The *panchayats* also rely on the revenue officials for enforcement of rules and sanctions if recalcitrant villagers refuse to follow local directives.

Van panchayats thus play a highly significant role in the management of a substantial proportion of forests in Kumaon, in the face of considerable pressures to harvest forest products. The population in the hill districts, the number of towns and markets and roads that link settlements have grown enormously in the past four decades (GOI, 1981; Tejwani, 1990). It is in the context of this overall pressure on resources that the activities of forest councils, especially local variations in managing forests, must be considered.

EXISTING RESEARCH

The Overpopulation Literature

Writings on overpopulation enjoy a long history and an impressive theoretical pedigree (Ehrlich, 1968: 15-6; Malthus, 1798, 1803; rpt. 1960). By focusing on changes in human fertility, mortality, migration and numbers, by examining alternative scenarios of regional and global population change, the relationship of population, inequalities and poverty to environmental degradation, and issues related to the carrying capacity of the planet, demographers have successfully underlined the dangers stemming from continuing population growth and its momentum (Lutz, 1994). However, writings on demographic change suffer from a tendency to link environmental degradation in a relatively straightforward fashion with population growth (Abernathy, 1991; Avise, 1994; Demeny, 1986; Durning, 1989; Fischer, 1993; Hardin, 1993; Holdren, 1992; Low and Heinen, 1993; Ness et al., 1993; Pimental et al., 1994).

If thoughtful research on the relationship between population and environment has made one truth evident, however, it is that the relationship is highly complex.⁴ Scholars who blame rising population for environmental degradation (Li, 1991; Raven, 1991; Wilson, 1988: 3; 1992: 328), therefore, appear hasty, even naive. Population growth is an important variable in influencing resource use but its specific impact depends on a multitude of other factors and their interactions. In addition to technological and economic variables (see Ehrlich and Ehrlich, 1991: 7), it is equally important to consider local institutions, policy changes, and cultural variables in understanding resource use and management. After all, if institutions were unimportant in influencing resource use, it would be futile to attempt to affect the direction of environmental change by altering policies!

Market Pressures on Resource Use

A powerful intellectual tradition, from Adam Smith and Karl Marx to present-day environmentalists, emphasizes the role of markets in transforming economic relations of production and resource use patterns. Both Smith and Marx were confident that capitalist economic expansion, through markets and trade, would inevitably transform pre-capitalist productive relations (Brenner, 1977: 26–7). By implication, as market forces expanded, local resource systems would develop closer connections with external market systems and find a greater exposure to demands from a larger system. Greater harvesting and degradative pressures would thus come to impinge on finite local resources.

But neither Marx and Engels, nor Smith, paid much attention to environmental effects of the ‘constant revolutionizing of production’.⁵ Contemporary environmentalists pay attention to economic growth, but argue that expansion of market forces creates greater pressure on limited resources, and ultimately erodes and degrades them (Arizpe and Velazquez, 1994: 23). In the context of the forest councils of Kumaon, and indeed of all community managed resource systems, the perspective of ‘Neo-Smithian Marxists’, to use Brenner’s evocative phrase, holds obvious implications. As markets expand, and common property systems confront cash exchanges, subsistence users are likely to increase harvesting levels because they now exploit resources for cash income as well (Carrier, 1987; Stocks, 1987: 119–20).

4. See Bilsborrow and DeLargy (1991: 125), Blaikie and Brookfield (1987), Caldwell (1984), Jolly and Torrey (1993: 11), Netting (1993: 320), and Whitmore et al. (1990).

5. As Martinez-Alier asserts, ‘There is nowhere in Marx, nor in later Marxists, an analysis of the replacement of used-up means of production in an economy based on exhaustible resources ... a preoccupation with intertemporal allocation of exhaustible resources is generally absent from Marxist economics’ (1987: 219–20). See also Foster (1995) and Grundmann (1991).

Subsistence and market pressures drive the system progressively faster toward environmental degradation.

These theorists ignore the fact that the impact of markets is always mediated by institutions of use that are not the direct or linear result of particular levels of demand or the balance between demand and supply. Under the influence of norms and institutions of use, rural users may forego cash incomes from sale of forest products. In the communities under consideration, users often desired and enforced institutional rules, and requested support from higher centres of political authority (such as the revenue department) in the face of non-compliance with resource management rules.

Studies of Local Communities

In response to the writings of many demographers and resource economists who suggest that overpopulation and market pressures lead to overharvesting, a vehement group of scholars protests the efficacy of local resource managers (Acheson, 1989; Chhetri and Pandey, 1992; Feeny et al., 1990; McCay, 1988; McKean, 1992b; Ostrom, 1990). According to these theorists, local communities can create and sustain local institutions to manage their collectively owned resources quite successfully, often in the face of adverse pressures from the state, demographic changes, and market forces (Acheson, 1987; Brightman, 1987; McKean, 1992a; Peters, 1987; Pinkerton, 1987; Wade, 1988). As O'Connor (1989), Merchant (1989) and Gadgil and Guha (1992) have argued, scarcities are a consequence of the inability to reproduce a given mode of production. They do not represent a situation where 'society runs headlong into "nature" or natural constraints' (Collins, 1992: 181).

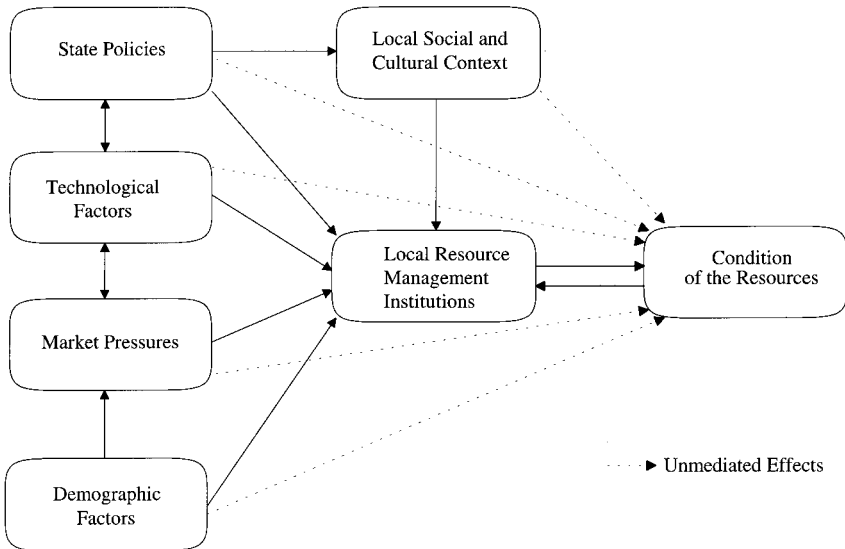
Theorists who focus on the successful and sustainable use of renewable resources by small communities have produced a much-needed corrective to numerical views of environmental degradation. Their emphasis on institutions as humanly devised rules (Bates, 1989; North, 1990) that soften, attenuate, structure, mould, accentuate, and create human actions has helped show that institutions usually mediate the relationship between human behaviour and resources. However, this work, in turn, suffers from several deficiencies. Theorists of community management often tend to reconstruct 'traditional' social organizations, viewing them as relatively harmonious ideals, and as closed systems uninfluenced by external factors (Dyson-Hudson and Dyson-Hudson, 1980: 16). Few of these studies examine the impact of changing demographic variables. In highlighting community, they often ignore politics and how it structures interactions among local populations, both within and between communities. Much of this writing also tends to valorize local participation, without adequately focusing on the specific types of participation that may be critical to the success of resource management. These lacunae, and the focus on single cases, threaten to

hobble the persuasive power of the writings on community management of resources.

FRAMEWORK FOR THE STUDY

According to the analytical frame we adopt, factors such as overpopulation and markets do influence resource use and the consequent condition of the resource, but their effect is mediated by institutions that help guide human activities. Figure 1 indicates the number and complexity of the factors that may influence resource use.

Figure 1. A Theoretical Framework of the Factors affecting Resource Condition



According to the figure, six major factors influence resource condition at the local level: local resource management institutions, the social and cultural context, state policies, technological variables, level of market pressures, and demographic pressures. All of these exert a direct effect on resources (represented by dotted lines), and an indirect effect, mediated by local institutions.⁶

6. The figure does not present a causal model of institutional formation. Thus, arrows leading to 'local resource management institutions' do not suggest that the characteristics of these institutions are a *result* of state policies, technological change, market pressures and so forth. While such factors do, no doubt, influence local institutions, the precise institutional contours are better seen as a result of the actions of local populations who are as much agents in creating such institutions as subject to external, structural factors.

The representation does not pretend to enumerate exhaustively the different factors that may influence resource use, nor to plot precisely their interactions and complexity. It serves chiefly to indicate that the influence of most structural and macro level socio-economic variables on local patterns is mediated by institutions. Structural variables may directly influence the behaviour of users and thus the condition of local resource systems — but this would be only to the extent that no local institutions exist in some contexts, or where despite the existence of such institutions products are harvested illegally because users lack the capacity to enforce rules.

The six factors enumerated in the figure should be viewed as convenient summary statements. In empirical contexts they will be represented by sets of manifest indicators about which one can learn through research. To gather statistically usable information on ‘local resource management institutions’, one might need to collect data on a host of institutional variables such as frequency of elections of office-bearers, financial viability, regularity of meetings, presence of monitoring arrangements, extent of rule breaking, frequency of disputes and conflicts, mechanisms for dispute resolution, and so forth. Market pressure may be indicated by differences in prices of relevant commodities between the nearest market and the study site or distance from roads. Because forests play such an important and complementary part in hill agriculture, greater demand for agricultural products and inputs (as might happen with closer links to outside markets), would also increase pressures on forests. Population pressure may be represented by per capita forest or land availability, biomass availability per animal unit, forest area per household or similar variables. In short, the messiness of real life implies that the conceptual indicators presented in Figure 1 can only be tested through information on what may be called proxy variables. In our operationalization of ‘distance from markets’, through the variable, ‘distance to paved road’, we come up squarely against this issue (see below).

The forest councils of Kumaon, with some simplification of the above framework to make the analysis tractable, provide an excellent empirical instance to test the extent to which different factors contribute to particular patterns of resource use. State policies and technological variables can be assumed to vary relatively little from one local context to another in Kumaon. The villages studied are all located in the same administrative division (Kumaon) and the councils have all been subject to the same law (the Forest *Panchayat* Act of 1931). Differences in government regulations, therefore, are unlikely to have influenced the variations in village level outcomes. Nor do the technological endowments of most of the villages in Almora and Pithoragarh districts differ radically. Their residents pursue similar economic livelihoods, a mix of agriculture and livestock rearing. The techniques used to harvest fodder, fuelwood, and construction timber vary little across villages. Finally, residents of different villages, despite local differences, view themselves as part of the *Kumaoni* culture, and quite distinct even from the residents of the neighbouring hill districts in Garhwal.

There is, however, one difference that is quite striking across villages with regard to forest use. The studied villages are situated at altitudes between 1000 and 2400 meters and possess one of two types of forest: stands of Chir Pine (*Pinus roxburghii*), or mixed oak and other broad-leaved species. Where forests are stands of pine, they are more significant commercially. Resin can be extracted from the trees to yield turpentine, and the forest councils can gain significant levels of cash revenues from their forests. Where forests are mixed stands of oak and other broad-leaved species, they are valued primarily for their subsistence benefits, and villagers are often more alert in protecting them.⁷ Women stand to benefit to a greater extent from mixed forests because the presence of such forests close to the village reduces their labour in collecting fodder and fuelwood. Women's preference for mixed oak forests was clear in numerous conversations. This gendered valuation of different types of forests is striking and obvious. But even the male members of the *panchayats* often reported a lesser preference for pine monocrops. The greater value overall that villagers attached to mixed forests, was obvious in conversations during data collection in the villages as well as in interviews with local NGO members.

Where the other three independent factors are concerned — population pressure, market pressure, and institutional arrangements — villages can differ significantly. In analysing forest use in the Kumaon hills, therefore, we explicitly incorporate local resource management institutions — the *van panchayats* — population and market pressures, and whether the forests are more useful from the point of view of subsistence or generating a cash income for the community.

Data for the ensuing analysis was collected as part of a detailed study of the relative effects of population pressure, market forces, and institutions in influencing the condition of *panchayat* forests. Two types of data collection exercises were undertaken. As part of the first exercise, one of the authors, Arun Agrawal, carried out in-depth studies of 41 randomly selected forest councils. Using instruments developed over two years at the Workshop in Political Theory and Policy Analysis, detailed information was collected on a host of biophysical, socio-cultural, demographic, institutional, economic, record-keeping, and organizational indicators.⁸ For the second exercise, we collected data through mailed instruments on a much smaller number of critical variables from nearly 300 randomly selected forest councils in Almora

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7. There are, of course, other cases where villagers, especially men, are more interested in the cash benefits from their *panchayat* forests (we are grateful to one of our reviewers for pointing this out). A guard is seldom hired to prevent extensive tree felling or resin tapping, however, because such activities are hard to carry out undetected even without a guard. Unlike grazing in the forest or collection of fodder and fuelwood, large scale timber extraction will require the use of trucks or other mechanized equipment. Resin tapping is a long-drawn out activity, and cannot be carried out without knowledge of local villagers.
 8. Copies of the instruments are available upon request.

and Pithoragarh. The analysis in this paper is based on the results of this second data collection strategy.

Almora and Pithoragarh contain the vast majority — more than 93 per cent — of the Kumaoni forest councils (see Table 1), and have also maintained address lists for their forest *panchayats*. The *sarpanches* (heads) of 600 forest councils were sent a two page questionnaire of which 142 were returned as undeliverable mail. After discarding 34 incomplete responses, data on 279 forest councils were deemed valid and reliable and therefore retained for subsequent analysis. This yields a response rate of 68 per cent — 313 responses out of 458 delivered questionnaires. To minimize problems stemming from the use of mailed questionnaires, we deliberately kept the questions simple and short (a translated copy of the questionnaire is available upon request). In addition, to enhance the response rate, we included letters from the district administration officials (the District Magistrate and the Block Development Officer) requesting the forest council chiefs to help us in the research.

The variables in this study fall under two broad categories. The first set of variables contains indicators of pressure on village resources (*ratio of village land to village households*), market pressures (*distance to paved road*), and purpose for which the forest is used (*number of different tree species in the forest*). The number of tree species in the forest, rather than standing for diversity, indicates whether the forest is important for subsistence, especially for women. Forests with one to three tree species are stands of pine and primarily valuable for the cash they can generate through resin tapping. Where the number of tree species is greater, one can safely assume that the forest contains mixed oak and other broad-leaved trees, more valued for subsistence.

The second set of variables relates to institutional characteristics of forest *panchayats*. Institutional variables reflect the basic characteristics of forest *panchayats* (*size of forest user group*, and *age of the forest panchayat*), institutional processes (*number of years since last election*, and *number of meetings between 1990–92*), and monitoring and enforcement arrangements (*number of months a guard was hired*). We use villagers' assessment of their forest as an indicator of the state of the vegetation in the forests (*condition of the forest*).

Population pressure was estimated using the area of village land that is available per household. Rights to *panchayat* forests are allocated by household. The area of village, rather than of forests alone, provides a better approximation of population pressure since some of the main products that are derived from forests (especially fodder, and fuelwood to an extent), can be substituted by agricultural products such as hay, grass growing in fallow fields, and crop residue. Similarly, the number of households in the village (rather than the number of households that are members of the forest council) was used for two reasons. First, there is significant migration out of the hill districts into the plains. As a result the formal number of members in the forest user group is less important in determining pressure on the resource

than the number of actually present households. Second, even if some of the village households do not have the formal right to withdraw benefits from the forest, they might very well be doing so illegally.

The strength with which market forces impact on the local village economy is measured in our analysis by the distance of the village from paved roads (in km). We assume that the major costs for selling bulky forest products in a market would be incurred in getting the products to the paved road. In comparison, the cost of transporting forest products along the road, to a point where the goods can be sold, would be quite small.⁹ The indicator we selected has the obvious merit of being unambiguous. Moreover, our choice of 'distance to paved roads' as a proxy for market pressure is justified in two ways. First, this proxy variable has been used widely as representing the closer integration of local communities in a larger economic system, and as a variable that directly increases deforestation pressures¹⁰ (Sader et al., 1994; Southgate et al., 1991; Verma and Partap, 1992; Young, 1994). According to Rao and Miller (1971: Ch. 4), it is sufficiently justified to use a proxy variable if it is closely associated with other left-out indicators of an unobservable construct. Such an association captures the influence of variables that have been left out of the analysis. Second, mis-estimation because of the use of a less than perfect proxy has been shown to be less serious than mis-estimation due to omission of a specified path or mis-specified equation (McCallum, 1972; Wickens, 1972). If the choice is between using an imperfect proxy or completely omitting an unobservable variable, it is prudent to deploy a proxy variable — although, in Kumaon, this measure of market impact also presents some ambiguities as we will discuss below.

The variable 'size of the forest user group' is presented in terms of the number of households that are involved formally in the activities of the forest *panchayat*, and was used to see if group size affected operational performance and thereby made a difference in the condition of the forest.

We use four indicators of institutional arrangements. Since guards are employed only if institutional rules meaningfully constrain the consumption

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9. The measure also takes into account those situations where timber dealers bring their trucks virtually to the forest, a phenomenon that has been reported in some Kumaon villages, as one of our reviewers pointed out. Without a road close by, no trucks can reach the forest.
 10. Khan (1990: 202) suggests that improved accessibility results in decreased transaction costs which yield economic development: 'all weather roads act as a catalyst that brings together various ingredients to accelerate economic development'. See also Bajracharya (1992: 247) for a similar point of view in relation to mountain environments in South Asia. Rudel and Richards (1990) examine the relevance of roads in labour circulation and integration of rural–urban workplaces. Cruz and Gibbs (1990) see new roads as improving access to forests and promoting logging. Young (1994: 972) confirms their view when he asserts that 'roads provide the way and means by which much deforestation occurs in the humid lowland tropics'. Banskota and Jodha (1992: 101) also see roads as having negative effects on the environment.

behaviour of villagers, and since their reports about rule-breakers are usually noted for action, we have used ‘number of months a guard was hired’ as a convenient proxy to represent levels of enforcement/institutional effectiveness. Three other institutional variables were used as basic indicators of the nature and functioning of the forest councils. ‘Age of the forest *panchayat*’ was used as a possible reflector of the ability of the council to survive; ‘number of meetings in the past two years’ indicated the extent to which the *panchayat* was still functional; and another institutional variable, ‘the number of years since the election of current leadership’, was used as a test of whether regular changes in leadership captured or explained variations in the condition of the *panchayat* forest. Three of the four institutional indicators (‘months a guard was hired’, ‘number of meetings’, and ‘years since last elections’) are also indicators of participation by village residents in the management of the forest. Finally, the condition of the forest — the dependent variable — is represented as a dichotomous variable where villagers were asked to judge whether their community forest was in a good or a bad condition.¹¹ As is obvious, most of the variables on which we asked our respondents to supply data are easy to understand and respond to. Descriptive statistics on all the variables utilized in the analysis are presented in Table 2.

Table 2. Descriptive Statistics of Market, Population and Institutional Variables Used in Simultaneous Path Analysis

Variable	Mean	Median	Standard deviation
Resource pressure (ratio of village land in ha to village population)	3.35	2.00	4.93
Distance to paved road (km)	2.79	2.00	3.34
Size of forest user group (no. of households formally involved in activities)	87.47	70.00	73.94
Number of tree species in the <i>panchayat</i> forest	3.74	3.00	3.03
Age of forest <i>panchayat</i>	31.47	31.00	14.13
Number of years since last election	4.93	3.00	5.10
Number of months a guard was hired	5.91	6.00	4.89
Number of meetings 1990–2	14.44	12.00	8.97
Forest condition	Frequency	Per cent	
Bad	140	50.2	
Good	139	49.8	
N	279	100.0	

11. Number, density, and diversity of trees and other vegetation in the forests would clearly provide a more accurate estimate of the condition of the forest. In the absence of these figures, the assessment by villagers of their resource provides a useful approximation.

The hypothesized relationships among the different indicators on which we gathered information are presented visually in Figure 2 (see below). The figure immediately makes it obvious how misleading it may be to talk in the abstract about the effect of overpopulation or market forces on institutions and forest condition, or the effect of institutional arrangements on resources. It is on some specific aspect of institutions that given socio-economic or structural variables impact. Thus, 'ratio of village land to village population' and 'size of forest user group' are hypothesized to influence forest condition through 'number of months a guard was hired', not through 'elections'. Other aspects of institutions may be autonomously determined within a given community and not be a function of external factors at all (age of the forest *panchayat*, or elections). Still other relationships may exist, but be impossible to estimate quantitatively.¹² Institutions are notoriously difficult to define, as an enormous literature in the social sciences bears witness (Agrawal, 1995b; Bates, 1983; DiMaggio and Powell, 1991; Moe, 1987; North, 1990; Ostrom, 1990). They are even harder to operationalize statistically. Attempts to incorporate institutions in a quantitative analysis run the risk, therefore, of overlooking some vital aspect of the existing institutional arrangements.

The four proxy variables we employ to represent different aspects of institutions in the case of the *van panchayats* in Kumaon relate to institutional persistence (age of the forest council), participation by the villagers in the *van panchayat* activities (elections, number of meetings, and months a guard is hired), and investment by villagers in protecting their resource (number of months a guard is hired). Each of these types of institutional variables theoretically can have an important effect on the condition of the resource, although the strength of the effect will be a function of the context in which resources are managed by the community. We expect some of our indicators (number of meetings, and number of months a guard is hired) to strongly mediate the influence of socio-economic variables such as market, demography, and whether the forest is significant for commercial or subsistence needs. We expect others (age of the forest *panchayat*, and elections) not to be mediating institutional variables at all, and to exert an independent effect on the condition of the forest.

12. To give one example, we expected 'distance to market' to affect an institutional variable that can summarily be called 'frequency of rule breaking'. In turn, 'frequency of rule breaking' would affect the 'condition of the resource'. It is almost impossible, however, to gather reliable data on a variable such as 'frequency of rule breaking'; far more difficult, for example, than information on 'household income'. As a result, we were constrained to ignore this variable and hypothesize only a direct relationship between 'distance from markets' and 'condition of forest'.

THE ANALYSIS AND FINDINGS

Our data set on the forest *panchayats* enables us to assess comparatively the effect of demographic factors, market pressures (as measured by distance from paved road), and institutional arrangements on resource condition. We estimate all of the effects simultaneously as a path model of directly observed variables using LISREL 8 (see Figure 2 below).¹³ The LISREL method, as it is sometimes known, involves simultaneous estimation of a series of effects among directly observed, multiple independent and dependent variables that may include reciprocal causation and interdependence (Jöreskog and Sörbom, 1989).

Unlike traditional path analytic models, where one obtains reduced form equations first, and then solves for the structural parameters (Jöreskog and Sörbom, 1989), in LISREL a path model is considered as a system of equations, all structural coefficients are estimated directly, and the reduced form is obtained as a by-product (Jöreskog and Sörbom, 1993). LISREL thus allows simultaneous estimation of the direct, indirect, and total effects of a series of variables or constructs. In testing a theoretical model of inter-related variables, we hope to find a close fit between the way we propose that the different variables will affect each other and the actual relations among the variables found in our data. Therefore, in structural equation models using LISREL, we test a null hypothesis of no difference between the observed covariance matrix and the covariance matrix implied by our theoretical model.¹⁴

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13. A causal model with directly observed variables, such as the one tested here, is classified as Submodel 2 in LISREL (Jöreskog and Sörbom, 1989: Ch. 4). This is a class of models where the dependent and explanatory variables are directly observed. In these causal models there are no latent variables, only directly measured variables: y 's and x 's. Since there are no latent constructs, a measurement model and the associated factor loadings (represented in LAMBDA-x, and LAMBDA-y matrices), and correlations of measurement error (represented in THETA-DELTA, and THETA-EPSILON matrices) are not relevant and therefore not estimated. Matrices representing factor loadings are fixed to identity, and matrices of measurement error are fixed to zero (Bollen, 1989a: 147). Moreover, in this submodel, the covariance matrix of independent constructs is assumed to be an unconstrained free covariance matrix of x variables (Jöreskog and Sörbom, 1989: 146).
 14. We use a range of measures to test for the closeness of fit between the covariance matrix found in the data and the one implied by our theoretical model of interest: Chi square, root mean square error of estimation (RMSEA), goodness-of-fit index (GFI), comparative fit index (CFI), and the incremental fit index (IFI). Information on how to interpret the values of these indices is available widely (Bentler, 1990; Bollen, 1989b; Hayduck, 1987; Hoyle, 1991; Jöreskog, 1993; Jöreskog and Sörbom, 1989: 26; La Du and Tanaka, 1989; Mulaik et al., 1989; Tanaka, 1993; Yadama and Pandey, 1995).

Findings

Figure 2 and Table 3 present the results of simultaneous path analysis for all observations. All of the indices we mentioned above point to a good fit between the actual covariance matrix and the covariance matrix implied by the model. The path model had a chi-square of 39.52 with 17 degrees of freedom and a probability of 0.0015. Based on Root Mean Square Error of Estimation, our path model has a reasonable fit (RMSEA = 0.069, $p = 0.12$).¹⁵ Direct, indirect, and total effects are available in Table 3. Figure 2 shows only the direct effects. In our analysis, all of the equations are

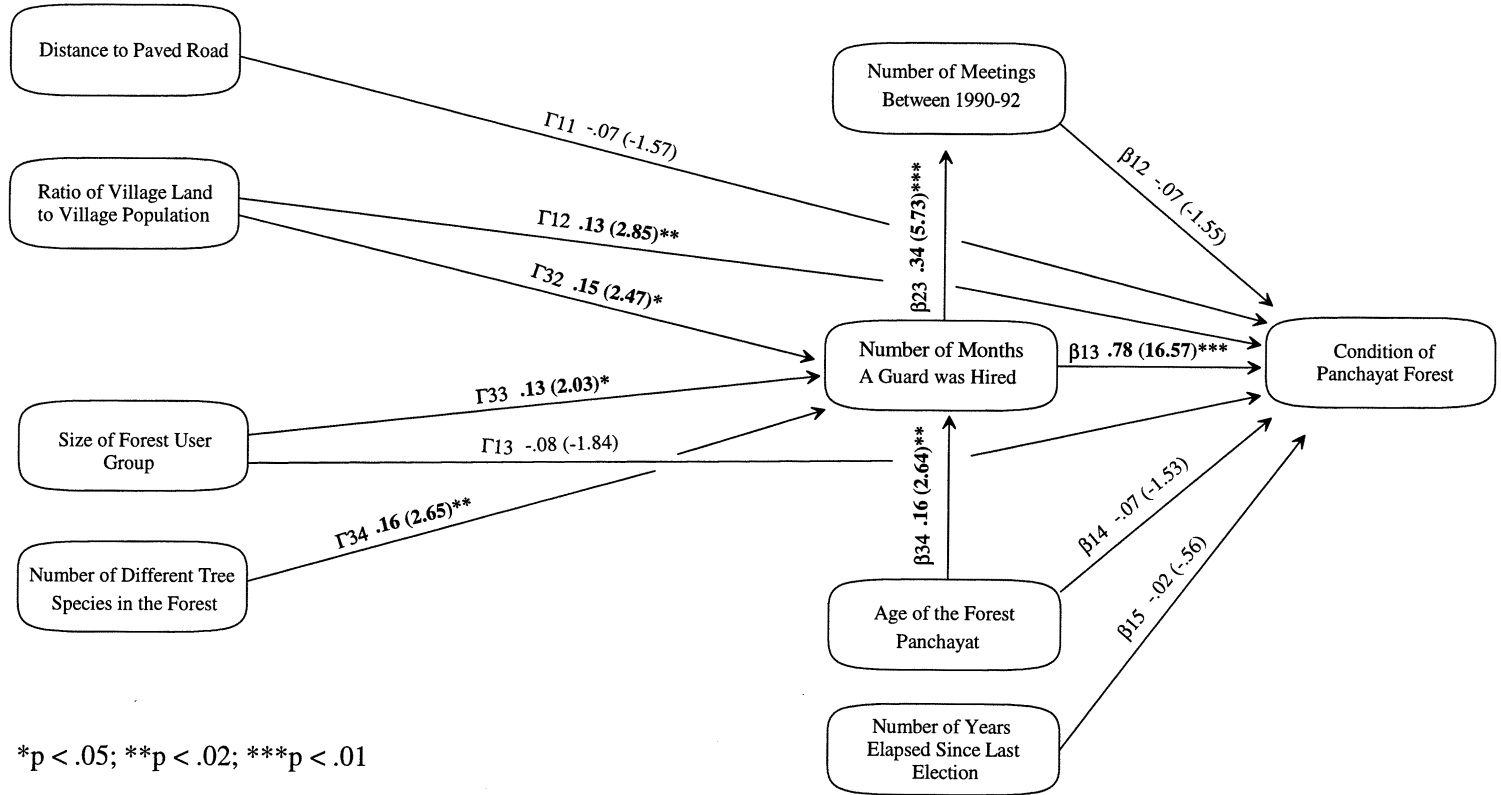
Table 3. Direct, Indirect, and Total Effects of Population, Market Forces, and Institutional Arrangements on Forest Condition

	No. of months guard hired	No. of meetings	Condition of forest
Resource pressure	0.15 (2.47)*	—	0.13 (2.85)**
(village land/ village population)	—	0.05 (2.27)*	0.12 (2.44)*
Distance to paved road (km)	0.15 (2.47)*	0.05 (2.27)*	0.24 (3.89)***
	—	—	-0.07 (-1.57)
	—	—	—
	—	—	-0.07 (-1.57)
Size of forest user group (no. of households formally involved in activities)	0.13 (2.03)*	—	-0.08 (-1.84)
	—	0.04 (1.92)	0.10 (2.02)*
No. of different tree species in the panchayat forest	0.13 (2.03)*	0.04 (1.92)	0.02 (0.25)
	0.16 (2.65)**	—	—
	—	0.06 (2.41)*	0.12 (2.62)**
	0.16 (2.65)**	0.06 (2.41)*	0.12 (2.62)**
Age of the forest panchayat (Years)	0.16 (2.64)**	—	-0.07 (-1.53)
	—	0.05 (2.40)*	0.12 (2.61)**
	0.16 (2.64)**	0.05 (2.40)*	0.05 (0.91)
No. of years since last election	—	—	-0.02 (-0.56)
	—	—	—
	—	—	-0.02 (-0.56)
No. of months guard hired	—	0.34 (5.73)***	0.78 (16.57)***
	—	—	-0.02 (-1.47)
	—	0.34 (5.73)***	0.76 (17.10)***
No. of meetings (1990–2)	—	—	-0.07 (-1.55)
	—	—	—
	—	—	-0.07 (-1.55)

Note: Direct, indirect, and total effects are presented in that order. Direct and total effects are identical in the absence of indirect effects. Indirect effects are identical to total effects in the absence of direct effects. Dashes indicate that a particular effect either is not estimated in our model or is not applicable. * $p \leq 0.05$; ** $p \leq 0.02$; *** $p \leq 0.01$.

15. The other indices have the following values: Goodness of Fit Index equals 0.97; Adjusted Goodness of Fit Index is 0.92; the Comparative Fit Index is 0.92, and the Incremental Fit Index equals 0.93.

Figure 2. Simultaneous Estimation of the Effects of Overpopulation, Access to Markets, and Institutions on Forest Condition



linear and the path coefficients typically signify the change in effect produced by a unit change in the level of cause (Sobel, 1987: 155–6).¹⁶ We discuss below the significance of each of the variables included in the study.

Population Pressure

Resource pressure (area of village per household) has significant direct effects on condition of forest ($\Gamma_{12} = 0.13$, $t = 2.85$) and length of time a guard is hired ($\Gamma_{32} = 0.15$, $t = 2.47$). The indirect effect of resource pressure on forest condition via number of months a guard is hired ($\beta_{13}\Gamma_{32} = 0.12$, $t = 2.44$) and the total effects of resource pressure on forest condition are also significant ($\beta_{13}\Gamma_{32} + \Gamma_{12} = 0.24$, $t = 3.89$). These results confirm the standard expectations although the magnitude of the impact is relatively low (see discussion of institutional variables). When available land per person is high, the forest condition is better. The strong direct effect of resource pressure on length of time a guard is hired, its significant indirect effect on forest condition, and similar indirect and direct effects of resource pressure on forest condition lead us to some interesting conclusions. The indirect effect implies that when there is more per capita land, the incentive/capacity to hire a guard for longer periods increases. In turn, this positively impacts forest condition. This mediated effect is as large as the direct effect of resource pressure on forest condition signifying the importance of institutions in determining forest condition.

Market Pressure

Distance to paved roads has a small and statistically insignificant effect on forest condition ($\Gamma_{11} = -0.07$, $t = -1.57$). This is also the total effect of this variable on forest condition since we did not postulate any mediated effects through institutional variables. The finding is surprising in light of several studies (Chomitz, 1995; Young, 1994) that have documented the impact of new roads on forest clearing. We must undertake an extended interpretation to highlight some of the limitations of the results.

The policy environment in the Kumaon hills prevents any large-scale felling. In other cases where roads adversely affect resource condition, the existing institutional rules scarcely regulate forest clearing, indeed, they may often promote felling of trees for greater income. But in the presence of substantial disincentives to commercial harvesting of forest products in the hills, it is perhaps unsurprising that roads have a negligible effect on resource condition. Other reasons may explain why distance from roads is not a good

16. All of the effects stated and discussed below are standardized effects.

measure of market pressures in the Kumaoni context: for forest products such as fodder, markets might be quite ill-developed. However, both fuelwood and construction timber can be sold in local markets and to this extent, distance from roads is an appropriate measure. This impact seems low. Second, if proximity to roads increases harvesting pressures, it also brings the administrative machinery 'closer' to villages. In line with what Chambers (1983: 13–16) has called 'spatial bias', government officials responsible for overseeing the operations of forest *panchayats* are far more likely to visit villages that are closer to roads than ones that are remotely located and difficult to reach. Again, institutional variables coupled with administrative regulation are important in influencing resource condition. Another possibility, we surmise, is that as roads connect villages with administrative and market centres, villagers are more aware of the value of their forests, and their fragility in the face of commercial exploitation, and, therefore, become more active in protecting them. At the same time, with better transportation, commercial substitutes for at least some of the forest products may become more easily available, as with construction timber.¹⁷

The results also raise the issue of how well distance from roads measures the effects of market pressures on deforestation. A large literature, from which we have already cited, has taken as evident the fact that all-weather roads improve accessibility of forests, increase deforestation pressures, and integrate settlements into larger market economies. Our choice of distance to paved roads as a proxy is based on the assumption that other variables, indicative of market pressure, are closely associated with this proxy variable. In the Kumaoni context, however, it seems that further research would also need to measure market pressures using other indicators. Some of these may be: (a) the extent to which villagers shift labour between forest and farm activities in response to changes in prices of products from these sources; (b) a better assessment to determine the distance of villages from markets where forest products are bought and sold; and (c) over-time data on changes in harvesting patterns in response to road-building. Each of these indicators, it should be noted, would require substantial effort and data-collection intensity.

Size of User Group

A relatively small effect flows from the 'size of user group' to 'number of months a guard is hired' ($\Gamma_{33} = 0.13$, $t = 2.03$). This variable also has a small mediated positive effect on the condition of the resource (see Table 3). However, the total effect on condition of the forest and the indirect effect on

17. In the hill districts, however, few of the forest products are marketed. For the most part, fodder, fuelwood and construction materials (including stone and clay) are drawn from local sources.

the number of meetings is inconsequential. These contradictory effects need some explanation. We suggest that larger groups possess greater capacity to hire a guard because they can raise a greater overall surplus to this end. Smaller user groups, even if they are very interested in protecting their forests by hiring a guard, may simply not possess enough resources to set aside the amounts necessary to allocate sufficient labour and time to protect their forest effectively.¹⁸ But, obviously, this hypothesized relationship cannot hold if group size increases enormously. For very large groups, the costs of co-ordination in organizing the surplus to pay the guard may be quite high. The relationship between group size and forest condition is likely, then, to be non-linear. Because LISREL analysis assumes linear relationships it is possible that we find small and contradictory effects flowing from group size to other variables.

Number of Tree Species

Our results indicate that when there is greater tree diversity in the forests, the likelihood of retaining the services of a guard also improves ($\Gamma_{34} = 0.16$, $t = 2.65$). This statistically significant effect translates into a significant indirect and total effect on the condition of the forest, and a significant but small indirect effect on the number of meetings (see Table 3). These effects are through the institutional variable of 'months a guard was hired' and need to be interpreted with some care. Instead of treating the number of tree species as an indicator of greater diversity, we believe it reflects whether a forest is valuable for subsistence purposes, especially for women (see previous section). If the community forest contains broad-leaved oak species, villagers pay greater attention to preventing rule-breaking behaviour. At the same time, because the forest is more valuable for subsistence, incentives to break rules may be high for members of other villages. To prevent rule-infractions by outsiders, the village community may be forced to hire a guard. The dynamic of these two factors will naturally necessitate a larger number of council meetings in which appropriate fines and sanctions for rule-breakers are discussed. On balance, it seems, greater subsistence value prompts villagers to protect forests better and leads to the resource being in a better condition. Although the importance of subsistence benefits is weighted in gendered ways by community members, our conversations as well as the data from the questionnaire suggest that the 'average member' of the community prefers mixed oak forests.

18. For a more elaborate discussion of this aspect of forest management in the Kumaon, see Agrawal (1995c). A related theoretical discussion of the relationship between group size and its quadratic relationship with effectiveness of the group is available in Buchanan and Tullock (1962).

Age of the Forest Panchayat

Age of forest *panchayat* has a strong direct effect on the length of time a guard is hired ($\beta_{34} = 0.16$, $t = 2.64$) but an insignificant direct effect on forest condition ($\beta_{14} = -0.07$, $t = -1.53$). The indirect effect, via guard, however, is statistically significant ($\beta_{13}\beta_{34} = 0.12$, $t = 2.61$). These results indicate that the longer a forest *panchayat* is in operation, the greater the likelihood that it will formalize the position of a guard to monitor the condition of the forest. The results also show that the longer a *panchayat* is in existence, along with the likelihood of increased monitoring there is also a greater likelihood of meetings ($\beta_{23}\beta_{34} = 0.05$, $t = 2.40$) to resolve conflicts and sanction rule-violators. Continued survival of the forest *panchayats*, then, does have a positive effect on the condition of the resource, as well as on the likelihood of regular meetings, but the overall effect is small.

Years Elapsed Since Last Election

We hypothesized that if a forest *panchayat* recently conducted elections, signifying a more active institution, it is likely that its forest would be judged to be in a better condition. The results indicate an insignificant effect of years elapsed since the last election on forest condition ($\beta_{15} = -0.02$, $t = -0.56$). Recent elections, thus, do not seem to be a critical precondition to improve forest status.

Months a Guard was Hired

The number of months a guard was hired has a very strong and statistically highly significant direct effect on forest condition ($\beta_{13} = 0.78$, $t = 16.28$). Prolonged presence of a guard also had a strong direct effect on the number of meetings held ($\beta_{23} = 0.34$, $t = 5.73$). It is evident from the analysis that the capacity of a forest council to monitor and impose sanctions on rule-breakers is paramount to maintaining the forest in good condition. Nor should the presence of a guard be taken simply as a formal mechanism that ensures greater protection. It is also an indication of the informal commitment of the *panchayat* and the village community to protect their forests. Hiring a guard costs money. The funds have to be generated within the village and earmarked for protection of the resource. If there was scant interest in protecting the forest, villagers would have little interest in setting aside the money necessary to hire a guard.

The positive effect of a guard on the number of meetings is also to be expected. The guard's reports to the *panchayat* officials regarding rule violations must be acted upon. Effective monitoring thus implies a greater necessity to meet and decide upon necessary action in each detected case of

infringement. More meetings may also become necessary to resolve conflicts with rule-breakers and recalcitrant individuals who might be unwilling to pay fines.

Number of Meetings

The direct effect of meetings on forest condition was insignificant ($\beta_{12} = -0.07$, $t = -1.53$). It is theoretically plausible to posit that if villagers meet more frequently to discuss resource conservation and use, the condition of the resource is likely to be better. The results from this study do not support this proposition. Regular meetings, it seems, are insufficient to lead to better resource condition. They must be followed up by concrete action in the form of efforts to protect the resource from rule-breakers. This, our analysis indicates, may be captured by the variable, 'number of months a guard is hired'.

It is also plausible that forest condition may bear a reverse causal relationship with more or less meetings. If the forest is in a bad condition, forest *panchayat* officials may initiate more meetings to deal with rule infringements and rule breakers. In our analysis we did not estimate the path from forest condition to number of meetings for two reasons: our analysis indicated that there was no statistically compelling reason to free the path from forest condition to meetings;¹⁹ and, in spite of a lack of statistical reasons, but motivated by theoretical concerns, we attempted to test for reciprocal causation between meetings and condition of forest. Such a test would have shown if the number of meetings depended on the condition of the forest. Unfortunately, the solution for a reciprocal test did not converge in our analysis and we had to settle for a test of the effect of meetings on forest condition.

A DISCUSSION BY WAY OF CONCLUSION

This article set out to examine the comparative significance of market forces, population pressures, and institutional variables as they influence resource use. Rather than providing a definite answer, our work should be seen as pointing toward an approach to combine the analysis of different variables, and presenting some highly suggestive findings. Unlike much

19. In LISREL, we obtain a modification index for every path that is not estimated in a path model. The modification index, for each fixed path, is an estimate of the decrease in chi-square or improvement in model fit that will be obtained if that path is freed and estimated (Jöreskog and Sörbom, 1993: 26). The value of the modification index for the path from condition of forest to meetings is not large enough (7.96) to warrant an estimation of this path solely on statistical grounds.

existing literature that tends to remain focused either on larger socio-economic variables such as demography and the economy, or on micro-level cultural and institutional processes within single communities, our analysis attempts to provide a way of bringing together these two approaches. We suggest that socio-economic forces are important in influencing resource management and the condition of renewable resources, but that their influence is usually mediated through community institutions. To assess the impact of these variables on spatially situated users, then, it is essential to understand the nature and characteristics of local institutions.

Institutions themselves are aggregates of specific practices and rules that on the one hand frame and guide user behaviour but, over time, are an outcome of the actions of users, just as resource management outcomes are an aggregate of the activities of people. To say, therefore, that institutions are important in shaping resource management outcomes is not enough. The greater need is to specify the types of practices and sets of rules that are most important in a given context. Without a knowledge of the context, of the history and politics within which user groups have emerged, it may not be possible even to identify which aspects of institutions will be crucial, let alone assess the relative importance of different aspects. Without disaggregating different aspects of institutions and the forms of participation that characterize user behaviour, one is likely to fail in any attempt to understand the links between various factors that affect the status of resources.

Our analysis indicates that of the various forms of participation we examined — regular elections, frequency of meetings, or investment in monitoring and protection — the most important was the level of investment in monitoring and guarding. A large literature, especially from the 1960s, has examined the virtues of participation in ensuring the success of micro-level institutions as well as state-initiated development projects (Conyers, 1983; Hicks, 1961; Maddick, 1963; Rondinelli, 1981, 1983; Slater, 1989, 1990; Uphoff, 1986). While earlier literature often viewed participation in an undifferentiated fashion, more recent writings have begun to unpack the 'black box' of participation (Drijver, 1991). At least two categories are now almost universally accepted in disaggregating participation: decision-making and implementation. The forest *panchayats* are all entitled to create the rules for day-to-day operational activities. In terms of implementation, our research indicates that unless local communities (possess and) exercise the rights to participate in protecting their resources and monitoring their condition, the benefits from other forms of participation may well be nullified. This is, of course, not to say that informal participation and means of monitoring and protection are unimportant. In many contexts they are critical. On the other hand, comparison of the Kumaon experience with other cases may be misleading if levels of informal participation and monitoring vary enormously, and the meaning attached to formal participation and monitoring differs as well. By drawing upon 279 instances located within a roughly similar cultural, administrative, and ecological context, we

have limited substantially the problems inherent in intercultural comparisons. Given similar levels of informal protection of resources, we can say that higher investment in formally guarding community forests is associated with better forest condition.

At the same time as we use the dual classification of participatory activities, it may be fruitful to point out that within these broad divisions one can still discriminate further, and that a set of causal effects may exist among the different aspects of participation. Thus, if we look at the forest *panchayats*, a number of issues may be important. Who attends the meetings of the forest *panchayats*? What proportion of the village community attends general meetings? What kinds of decisions are made by whom? To what extent and by whom are forests informally monitored? Who collects fines? How are the *panchayat*'s surpluses spent? Information on these questions would be very helpful in delineating the relationship among different participatory activities and their impact on forest condition. In the next stage of our project we aim to uncover more detailed information on participation.

It will be especially necessary to pay attention to the gendered aspects of participation, authority and decision-making, and rule-violations. Gender was not an explicit focus of this research because under the current patterns of exercise of local authority and use of forests, it is invariably men who occupy leadership positions in the forest *panchayats*, and women who bear the brunt of the tasks of fodder collection, fuelwood gathering, and grazing. But in some villages women have begun to play a role in rule-enforcement, and a detailed study of the effects of this development is necessary. A study of how gender variations in the exercise of decision- and rule-making authority influence forest condition would have significance beyond just the Kumaon context.

The results described in this article should be taken as indicative of some highly interesting possibilities. They are especially interesting because the relatively autonomous councils which we examined were instituted by the state. While Kumaon possesses a strong tradition of local resource management by local populations, it was the state that formalized traditional local institutions in 1931, encouraged the formation of new institutions, and provided the newly formed councils with some degree of higher-level institutional recognition and support. While today the forest councils admittedly need more administrative support, their sixty-year history holds significant lessons for sustainable management of forests, and for partnership between government and local populations in other regions of the world.

As future research we suggest two directions. First, our findings are based on cross-sectional data. As a result, while we can draw some conclusions about how *levels* of population, market forces, and different institutional rules impact forest condition, we cannot make any statements about how changing levels of these factors would impact *rates* of deforestation/forest preservation. It may thus be possible that institutional arrangements are very important (as we find) in determining the condition of resources at a point in

time, but demographic and market related variables become far more significant in influencing *changes* in vegetation density. Until studies based on inter-temporal data incorporating a range of demographic, price, and institutional variables are conducted, the question must remain open. Existing research, its claims notwithstanding, have by no means settled the question.²⁰ Second, it is necessary to examine further the ways in which rule-infringements and conflicts are implicated in forest use patterns. While our data focus on frequency of meetings and monitoring and protection, institutional effectiveness and the impact of rules on human behaviour cannot be fully assessed without knowledge about the extent to which rules are actually observed. The detailed data we have collected on 40 forest councils in the Kumaon will help in untangling the second of these issues to some extent. For further quantitative analysis and definitive conclusions, however, we need to carry out more extended research.

ACKNOWLEDGEMENTS

We owe this paper, in more ways than can be mentioned, to the immense cooperation which the first author received from villagers in Kumaon and the Kumaon Forest *Panchayat* Research Team. Special thanks go to Sushree Meenakshi Shailaja, Sri Nikunj Bharati, Taradutt Pandey and Tara Singh Bisht. Venkatesh Bala, Steve Day, Steve Dembner of *Unasylva*, Sabine Engel, Clark Gibson, David Gillespie, Franque Grimaud, Margaret McKean, Kimberly Pfeifer, Elinor Ostrom, Steven Sanderson, Leslie Thiele and Mary Beth Wertime provided valuable comments through the various drafts of the paper. The paper has benefited greatly from the responses of the participants at the Seminar on Landed Property Rights in Stowe, Vermont (17–21 August 1994). We would like especially to mention the aggressive questioning by Robert Repetto which helped us rethink some aspects of the paper. Comments from three anonymous referees have substantially improved our argument, and prevented us from making several obvious errors. We are deeply appreciative. Grants from the Division of Sponsored Research at the University of Florida and the World Wildlife Fund made the fieldwork possible. The writing of the paper was supported by a grant to the first author from the Social Science and Research Council, and to the second author from Washington University, St. Louis.

20. See Palloni (1994) for an extensive review.

REFERENCES

- Abernathy, Virginia (1991) 'Comment: The "One World" Thesis as an Obstacle to Environmental Preservation', in K. Davis and M. Bernstam (eds) *Resources, Environment, and Population: Present Knowledge, Future Options*, pp. 323–8. New York: Oxford University Press.
- Abernathy, Virginia (1993) *Population Politics: The Choices that Shape Our Future*. New York: Plenum Press/Insight Books.
- Acheson, James (1987) 'The Lobster Fiefs Revisited: Economic and Ecological Effects of Territoriality in Maine Lobster Fishing', in Bonnie J. McCay and James M. Acheson (eds) *The Question of the Commons: The Culture and Ecology of Communal Resources*, pp. 37–65. Tucson, AZ: The University of Arizona Press.
- Acheson, James (1989) 'Where have all the Exploitations Gone? Co-management of the Maine Lobster Industry', in F. Berkes (ed.) *Common Property Resources*, pp. 199–217. London: Belhaven.
- Agarwal, Bina (1986) *Cold Hearths, and Barren Slopes: The Woodfuel Crisis in the Third World*. London: Zed Books.
- Agrawal, Arun (1995a) 'Population Pressure = Resource Degradation: An Oversimplistic Equation?', *Unasylva* 46(2): 50–8.
- Agrawal, Arun (1995b) 'Institutions for Disadvantaged Groups'. Paper prepared for the Department of Policy Coordination and Sustainable Development, Contract #DPCSD/95-040 (mimeo).
- Agrawal, Arun (1995c) 'Small is Beautiful but is Larger Better? Group Size and Successful Collective Action around Forest Management in Kumaon Himalayas, India'. Paper presented at the First Open Meeting of the Human Dimensions of Global Environmental Change Community, Duke University, Durham (1–3 June).
- Arizpe, Lourdes and M. Velazquez (1994) 'The Social Dimensions of Population', in L. Arizpe, M. Priscilla Stone and D. Major (eds) *Population and Environment: Rethinking the Debate*, pp. 15–40. Boulder, CO: Westview.
- Arizpe, Lourdes, M. Priscilla Stone and David Major (eds) (1994) *Population and Environment: Rethinking the Debate*. Boulder, CO: Westview.
- Arnold, J. E. M. and W. C. Stewart (1991) 'Common Property Resources Management in India'. Tropical Forestry Paper No. 24. Oxford: Oxford Forestry Institute, University of Oxford.
- Awise, J. (1994) 'The Real Message from Biosphere 2', *Conservation Biology* 8(2): 327–9.
- Bajracharya, B. B. (1992) 'Infrastructural Development Imperatives for Sustainable Mountain Agriculture', in N. S. Jodha, M. Banskota and Tej Partap (eds) *Sustainable Mountain Agriculture*, Vol. 1, pp. 235–51. New Delhi: Oxford and IBH.
- Ballabh, Vishwa and Katar Singh (1988) 'Van (forest) Panchayats in Uttar Pradesh Hills: A Critical Analysis'. Research Note. Anand, India: Institute for Rural Management.
- Banskota, M. and N. S. Jodha (1992) 'Mountain Agricultural Development Strategies: Comparative perspectives from the countries of the Hindu Kush-Himalayan region', in N. S. Jodha, M. Banskota and Tej Partap (eds) *Sustainable Mountain Agriculture* Vol. 1, pp. 83–114. New Delhi: Oxford and IBH.
- Bates, Robert (1983) *Essays in the Political Economy of Rural Africa*. Berkeley, CA: University of California Press.
- Bates, Robert (1989) *Beyond the Miracle of the Market: The Political Economy of Agrarian Development in Kenya*. Cambridge: Cambridge University Press.
- Bentler, P. M. (1990) 'Comparative Fit Indexes in Structural Models', *Psychological Bulletin* 107: 238–46.
- Bilsborrow, Richard (1994) 'Population, Development and Deforestation: Some recent evidence', in Proceedings of the United Nations Expert Group Meeting on Population, Environment and Development, *Population, Environment and Development*, pp. 117–34. New York: United Nations.
- Bilsborrow, Richard and P. DeLargy (1991) 'Landuse, Migration and Natural Resource

- Degradation: The Experience of Guatemala and Sudan', in K. Davis and M. Bernstam (eds) *Resources, Environment, and Population: Present knowledge, future options*, pp. 125–47. New York: Oxford University Press.
- Blaikie, Piers and Harold Brookfield (1987) *Land Degradation and Society*. London: Methuen.
- Bollen, K. A. (1989a) *Structural Equations with Latent Variables*. New York: Wiley.
- Bollen, K. A. (1989b) 'A New Incremental Fit Index for General Structural Equation Models', *Sociological Methods and Research* 17: 303–16.
- Brenner, R. (1977) 'The Origins of Capitalist Development: A Critique of Neo-Smithian Marxism', *New Left Review* 104: 25–93.
- Brightman, Robert A. (1987) 'Conservation and Resource Depletion: The Case of the Boreal Forest Algonquians', in Bonnie J. McCay and James M. Acheson (eds) *The Question of the Commons: The Culture and Ecology of Communal Resources*, pp. 121–41. Tucson, AZ: The University of Arizona Press.
- Buchanan, James and Gordon Tullock (1962) *The Calculus of Consent*. Ann Arbor, MI: The University of Michigan Press.
- Caldwell, John (1984) 'Desertification: Demographic Evidence, 1973–83'. Occasional Paper No. 37. Canberra: Australian National University.
- Carrier, J. (1987) 'Marine Tenure and Conservation in Papua New Guinea: Problems in Interpretation', in Bonnie J. McCay and James M. Acheson (eds) *The Question of the Commons: The Culture and Ecology of Communal Resources*, pp. 142–70. Tucson, AZ: The University of Arizona Press.
- Chambers, Robert (1983) *Rural Development: Putting the Last First*. Harlow: Longman.
- Chhetri, R. and T. Pandey (1992) 'User Group Forestry in the Far-Western Region of Nepal'. Kathmandu, Nepal: ICIMOD.
- Chomitz, Ken (1995) 'Roads, Land, Markets and Deforestation: A Spatial Model of Land Use in Belize'. Paper presented at the First Open Meeting of the Human Dimensions of Global Environmental Change Community, Duke University, Durham NC (1–3 June).
- Clark, Colin (1958) 'Population Growth and Living Standards', in A. Agarwal and S. P. Singh (eds) *The Economics of Underdevelopment*, pp. 32–5. London: Oxford University Press.
- Collins, Jane (1992) 'Marxism Confronts the Environment: Labor, Ecology and Environmental Change', in S. Ortiz and S. Lees (eds) *Understanding Economic Process*, pp. 179–88. Lanham, MD: University Press of America.
- Conyers, D. (1983) 'Future Directions in Development Studies: The Case of Decentralization', *World Development* 14(5): 593–603.
- Cruz, Wilfrido and Christopher Gibbs (1990) 'Resource Policy Reform in the Context of Population Pressure: The Philippines and Nepal', *American Journal of Agricultural Economics* 72(5): 1274–8.
- Demeny, P. (1986) 'Population and the Invisible Hand'. Paper #123. New York: Center for Policy Studies, Population Council.
- DiMaggio, Paul J. and Walter Powell (eds) (1991) *The New Institutionalism in Organizational Analysis*. Chicago, IL: The University of Chicago Press.
- Drijver, C. A. (1991) 'People's Participation in Environmental Projects in Developing Countries', *Landscape and Urban Planning* 20(1–3): 129–39.
- Durning, A. (1989) *Poverty and the Environment: Reversing the Downward Spiral*. Washington, DC: Worldwatch Institute.
- Dyson-Hudson, Rada and Neville Dyson-Hudson (1980) 'Nomadic Pastoralism', *Annual Review of Anthropology* 9: 15–61.
- Ehrlich, Paul (1968) *The Population Bomb*. New York: Ballantine.
- Ehrlich, Paul and Anne Ehrlich (1991) *The Population Explosion*. New York: Touchstone, Simon and Schuster Inc.
- Fearnside, Philip M. (1986) *Human Carrying Capacity of the Brazilian Rainforest*. New York: Columbia University Press.
- Feeny, David, Fikret Berkes, Bonnie McCay and James Acheson (1990) 'The Tragedy of the Commons: Twenty Two Years Later', *Human Ecology* 18(1): 1–19.

- Fischer, G. (1993) 'The Population Explosion: Where is it Leading?', *Population and Environment* 15(2): 139–53.
- Foster, John Bellamy (1995) 'Marx and the Environment', *Monthly Review*: 108–23 (July/August).
- Gadgil, Madhav and Ramchandra Guha (1992) *This Fissured Land: An Ecological History of India*. Berkeley, CA: University of California Press.
- GOI (Government of India) (1981) *General Population Tables, Uttar Pradesh*. New Delhi: Census of India.
- Grundmann, Reiner (1991) *Marxism and Ecology*. New York: Oxford University Press.
- Guha, Ramchandra (1989) *The Unquiet Woods: Ecological Change and Peasant Resistance in the Himalaya*. Delhi: Oxford University Press.
- Hardin, Garrett (1993) *Living Within Limits*. New York: Oxford University Press.
- Hayduck, Leslie A. (1987) *Structural Equation Modeling with LISREL: Essentials and Advances*. Baltimore, MD: Johns Hopkins University Press.
- Hicks, U. (1961) *Development from Below: Local Government and Finance in Developing Countries of the Commonwealth*. Oxford: Clarendon Press.
- Holdren, C. (1992) 'Population Alarm', *Science* 255: 1358.
- Hoyle, R. (1991) 'Evaluating Measurement Models in Clinical Research: Covariance Structure Analysis of Latent Variable Models of Self-Conception', *Journal of Consulting and Clinical Psychology* 59(1): 67–76.
- Jaroff, L. (1993) 'Happy Birthday, Double Helix', *Time* 141(11): 56–9.
- Jodha, Narpat S. (1986) 'Common Property Resources and Rural Poor in Dry Regions of India', *Economic and Political Weekly* 21(27): 1169–81.
- Jodha, Narpat S. (1992) 'Common Property Resources: A Missing Dimension of Development Strategies'. World Bank Discussion Paper. Washington, DC: The World Bank.
- Jolly, C. and B. Torrey (1993) 'Introduction', in C. Jolly and B. Torrey (eds) *Population and Land Use in Developing Countries*, pp. 1–14. Washington DC: National Academy Press.
- Jöreskog, K. G. (1993) 'Testing Structural Equation Models', in K. A. Bollen and S. J. Long (eds) *Testing Structural Equation Models*, pp. 294–316. Newbury Park: Sage Publications.
- Jöreskog, K. G. and D. Sörbom (1989) *LISREL 7: User's Reference Guide*. Mooresville, IN: Scientific Software, Inc.
- Jöreskog, K. G. and D. Sörbom (1993) *LISREL 8: Structural Equation Modeling with the SIMPLIS Command Language*. Chicago, IL: Scientific Software International, Inc.
- KFGC (Kumaon Forest Grievances Committee) (1922) 'Report of the Forest Grievances Committee for Kumaon' (mimeo).
- Khan, Quaiser M. (1990) 'Transaction Costs Approach for Estimating Development Benefits of Rural Feeder Roads', *Transportation Research Record* 1274: 202–10.
- La Du, T. J. and J. S. Tanaka (1989) 'Influence of Sample Size, Estimation Method, and Model Specification on Goodness-of-Fit-Assessments in Structural Equation Models', *Journal of Applied Psychology* 74: 625–35.
- Lappé, Frances Moore and Rachel Shurman (1989) *Taking Population Seriously*. London: Earthscan.
- Levi-Strauss, C. (1985) *The View from Afar*. Chicago, IL: University of Chicago Press.
- Li, Jing-Neng (1991) 'Comment: Population Effects on Deforestation and Soil Erosion in China', in K. Davis and M. Bernstam (eds) *Resources, Environment, and Population: Present Knowledge, Future Options*, pp. 254–8. New York: Oxford University Press.
- Low, B. and J. Heinen (1993) 'Population, Resources and Environment: Implications of Human Behavioral Ecology for Conservation', *Population and Environment* 15(1): 7–41.
- Lutz, Wolfgang (1994) 'World Population Trends: Global and Regional Interactions between Population and Environment', in Lourdes Arizpe, M. Priscilla Stone and David C. Major (eds) *Population and Environment: Rethinking the Debate*, pp. 41–65. Boulder, CO: Westview Press.
- Maddick, H. (1963) *Democracy, Decentralization and Development*. Bombay: Asia Publishing House.

- Malthus, T. (1960) *On Population* (First Essay on Population, 1798, and Second Essay on Population, 1803). New York: Random House.
- Martinez-Alier, Juan (1987) *Ecological Economics: Energy, Environment, and Society*. Oxford: Basil Blackwell.
- McCallum, B. T. (1972) 'Relative Asymptotic Bias From Errors of Omission and Measurement', *Econometrica* 40(4): 757–8.
- McCay, Bonnie (1988) 'Muddling through the Clam Beds: Cooperative Management of New Jersey's Hard Clam Spawner Sanctuaries', *Journal of Shellfish Research* 7: 327–40.
- McKean, Margaret (1992a) 'Success on the Commons: A Comparative Examination of Institutions for Common Property Resource Management', *Journal of Theoretical Politics* 4(3): 247–82.
- McKean, Margaret (1992b) 'Management of Traditional Common Lands (Iriaichi) in Japan', in Daniel Bromley (ed.) *Making the Commons Work: Theory, Practice and Policy*, pp. 63–98. San Francisco, CA: Institute for Contemporary Press.
- Meadows, D., D. Meadows and J. Randers (1992) *Beyond the Limits: Confronting Global Collapse, Envisioning a Sustainable Future*. Post Mills: Chelsea Green.
- Meffe, G., A. Ehrlich and D. Ehrenfeld (1993) 'Human Population Control: The Missing Agenda', *Conservation Biology* 7(1): 1–3.
- Merchant, Carolyn (1989) *Ecological Revolutions: Nature, Gender and Science in New England*. Chapel Hill, NC: The University of North Carolina Press.
- Moe, Terry (1987) 'Interests, Institutions and Positive Theory: The Politics of the NLRB', in *Studies in American Political Development*, pp. 3–22. New York: Oxford University Press.
- Mulaik, S. A., L. R. James, J. V. Alstine, N. Bennett, S. Lind and D. Stilwell (1989) 'Evaluation of Goodness-of-Fit Indices for Structural Equation Models', *Psychological Bulletin* 105: 430–45.
- Myers, Norman (1987) *Not Far Afield: US Interests and the Global Environment*. Washington, DC: World Resources Institute.
- Myers, Norman (1991) 'The World's Forests and Human Populations: The Environmental Interconnections', in K. Davis and M. Bernstam (eds) *Resources, Environment, and Population: Present Knowledge, Future Options*, pp. 237–51. New York: Oxford University Press.
- Ness, G., W. Drake and S. Brechin (eds) (1993) *Population-Environment Dynamics: Ideas and Observations*. Ann Arbor, MI: University of Michigan Press.
- Netting, Robert (1993) *Smallholders, Householders: Farm Families and the Ecology of Intensive, Sustainable Agriculture*. Stanford, CA: Stanford University Press.
- Nicholson, Jack (1992) 'Solar Electricity', in D. Henley and D. Marsh (eds) *Heaven is Under our Feet*. New York: Berkeley Books.
- North, Douglass (1990) *Institutions, Institutional Change and Economic Performance*. Cambridge: Cambridge University Press.
- O'Connor, James (1989) 'Capitalism, Nature, Socialism: A Theoretical Introduction', *Capitalism, Nature, Socialism* 1: 11–38.
- Ostrom, Elinor (1990) *Governing the Commons: The Evolution of Institutions for Collective Action*. New York: Cambridge University Press.
- Palloni, Alberto (1994) 'The Relation between Population and Deforestation: Methods for drawing causal inference from macro and micro studies', in L. Arizpe et al. (eds) *Population and Environment: Rethinking the Debate*, pp. 125–66. Boulder, CO: Westview Press.
- Pant, G. (1922) *The Forest Problem in Kumaon*. Nainital, India: Gyanodaya Prakashan.
- Peters, Pauline (1987) 'Embedded Systems and Rooted Models: The Grazing Lands of Botswana and the Commons Debate', in Bonnie J. McCay and James M. Acheson (eds) *The Question of the Commons: The Culture and Ecology of Communal Resources*, pp. 171–94. Tucson, AZ: The University of Arizona Press.
- Pimental, D., R. Harman, M. Pacenza, J. Pecarsky and M. Pimental (1994) 'Natural Resources and an Optimal Human Population', *Population and Environment* 15(5): 347–69.
- Pinkerton, Evelyn (1987) 'Intercepting the State: Dramatic Processes in the Assertion of Local Comanagement Rights', in Bonnie J. McCay and James M. Acheson (eds) *The Question of*

- the Commons: The Culture and Ecology of Communal Resources*, pp. 344–69. Tucson, AZ: The University of Arizona Press.
- Rangan, HariPriya (1995) 'Contested Boundaries: State Policies, forest classifications, and deforestation in the Garhwal Himalayas', *Antipode* 27(4): 343–62.
- Rao, Potluri and Roger L. Miller (1971) *Applied Econometrics*. Belmont, CA: Wadsworth Publishing Company, Inc.
- Raven, P. (1991) 'Winners and Losers in the Twentieth-Century Struggle to Survive', in K. Davis and M. Bernstam (eds) *Resources, Environment, and Population: Present Knowledge, Future Options*, pp. 259–67. New York: Oxford University Press.
- Rondinelli, Dennis (1981) 'Government Decentralization in Comparative Perspective: Theory and Practice in Developing Countries', *International Review of Administrative Sciences* 47(2): 133–45.
- Rondinelli, Dennis (1983) 'Implementing Decentralization Programs in Asia: A Comparative Analysis', *Public Administration and Development* 3: 181–207.
- Rudel, Thomas and Samuel Richards (1990) 'Urbanization, Roads and Rural Population Change in the Ecuadorian Andes', *Studies in Comparative International Development* 25(3): 73–89.
- Sader, S. A., T. Sever and J. C. Smoot (1994) 'Forest Change Estimates for the Northern Peten Region of Guatemala 1986–90', *Human Ecology* 22: 317–32 (September).
- Simon, Julian (1990) *Population Matters: People, Resources, Environment and Integration*. New Brunswick: Transaction Publishers.
- Sivaramakrishnan, K. (1996) 'Forests, Politics and Governance in Bengal, Vols. 1 and 2'. Thesis. New Haven: Yale University (unpublished).
- Slater, David (1989) 'Territorial Power and the Peripheral State: The Issue of Decentralization', *Development and Change* 20(3): 501–31.
- Slater, David (1990) 'Debating Decentralization: A Reply to Rondinelli', *Development and Change* 21(3): 501–12.
- Sobel, M. E. (1987) 'Direct and Indirect Effects in Linear Structural Equation Models', *Sociological Methods and Research* 16(1): 155–76.
- Somanathan, E. (1990) 'Public Forests and Private Interests: Deforestation and Forest Policy in the Central Himalaya'. New Delhi: Indian Statistical Institute (mimeo).
- Somanathan, E. (1991) 'Deforestation, Property Rights, and Incentives in Central Himalaya', *Economic and Political Weekly* 26(4): 37–46.
- Southgate, Douglas, R. Sierra and Lawrence Brown (1991) 'The Causes of Tropical Deforestation in Ecuador: A Statistical Analysis', *World Development* 19(9): 1145–51.
- Stocks, Anthony (1987) 'Resource Management in an Amazon Varzea Lake Ecosystem: The Cocamilla Case', in Bonnie J. McCay and James M. Acheson (eds) *The Question of the Commons: The Culture and Ecology of Communal Resources*, pp. 108–20. Tucson, AZ: The University of Arizona Press.
- Tanaka, J. S. (1993) 'Multifaceted Conceptions of Fit in Structural Equation Models', in K. A. Bollen and J. S. Long (eds) *Testing Structural Equation Models*, pp. 10–39. Newbury Park, CA: Sage Publications.
- Tejwani, K. (1990) 'Bio-Physical and Socio-Economic Causes of Land Degradation and Strategy to Foster Watershed Rehabilitation in the Himalayas', in N. Sah, S. Bhatt, and R. Pande (eds) *Himalaya: Environment, Resources and Development*, pp. 378–85. Almora, India: Shree Almora Book Depot.
- Uphoff, Norman (1986) *Improving International Irrigation Management with Farmer Participation: Getting the Process Right*. Boulder, CO: Westview Press.
- Vaid, O. (1988) 'Panchayati Vanon ka sudridhikaran', Part I. Kumaon Commissionerate (mimeo).
- Verma, L. R. and T. Partap (1992) 'The Experiences of an Area Based Development Strategy in Himachal Pradesh, India', in N. S. Jodha, M. Banskota, and Tej Partap (eds) *Sustainable Mountain Agriculture* Vol. 2, pp. 609–36. New Delhi: Oxford and IBH.

- Wade, Robert (1988) *Village Republics: Economic Conditions for Collective Action in South India*. Cambridge: Cambridge University Press.
- Weber, Thomas (1989) *Hugging the Trees: The Story of the Chipko Movement*. New Delhi: Penguin.
- Whitmore, Thomas et al. (1990) 'Long Term Population Change', in B. L. Turner et al. *The Earth as Transformed by Human Actions: Global and Regional Changes in the Biosphere over the Past 300 Years*, pp. 25–39. New York: Cambridge University Press.
- Wickens, Michael R. (1972) 'A Note on the Use of Proxy Variables', *Econometrica* 40(4): 759–61.
- Wilson, E. O. (ed.) (1988) *Biodiversity*. Washington DC: National Academy Press.
- Wilson, E. O. (1992) *The Diversity of Life*. New York: W. W. Norton.
- Yadama, Gautam and Shanta Pandey (1995) 'Effect of Sample Size on Goodness-Of-Fit Indices in Structural Equation Models', *Journal of Social Service Research* 20(3/4): 49–70.
- Young, Kenneth R. (1994) 'Roads and the Environmental Degradation of Tropical Montane Forests', *Conservation Biology* 8(4): 972–6.

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