

People's Participation in Forest Management in India

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Abstract

Forests used to be an important source of revenue for the government of India, which is no longer the case, because of large-scale deforestation. Proper forest management is needed to regenerate degraded forests, yet the government is powerless when people refuse to participate. However, there might be conditions that are more conducive for people's participation in forest management and this paper draws lessons from practical settings in which people do participate. Participation was initiated by government employees, a local leader, or through a strong community.

A comparative analysis between three institutional settings in different states of India demonstrates the importance of empowering people in managing forests. There is a clear role for the state, which is to facilitate the people and to motivate their participation. Fieldwork was carried out in about 10 villages per state. On average 13 households were interviewed in each village. This led to a data set that is analysed in this paper with two techniques.

A factor analysis is performed on 10 to 12 participatory indicators of each household. In each institutional setting, social indicators turn out to be the main consideration in participation. Economic indicators follow as the second most important consideration. A regression analysis is carried out using the primary data. The main conclusion is that a high dependence on the forest and good forest quality enhances voluntary people's participation.

Keywords: Forest management, people's participation, rural India, factor analysis, multiple regression.

JEL-codes: C31, Q23.

1. Introduction

Hardin's (1968) tragedy of the commons suggests either state intervention or privatisation of property rights to preserve common-pool resources. Institution building at the community level for managing common-pool resources has emerged as a third possibility (Ostrom, 1990; Bromley, 1991a, 1991b; Ostrom *et al.*, 1994). This third possibility has been applied in rural India to the case of forest management. A number of studies signalled the importance for people's involvement in forest management (Chopra *et al.*, 1990; Palit, 1993; Sarin, 1996; Poffenberger and McGean, 1996). These studies show that in many institutional settings of rural India, forests are better managed when voluntary people's participation is secured. Hence, there exist many situations where people's participation is desired, and it is interesting to find conditions under which voluntary participation takes place. This paper studies the link between participation and socio-economic variables to explore the involvement of people in forest management.

This paper is organised as follows. Section 2 outlines some general patterns from different institutional settings in three Indian states: Haryana, Uttar Pradesh and Bihar. A field survey is designed to find, besides state-wise suggestions, a general strategy for forest management. A factor analysis on indicators of participation identifies different choice situations (Section 3). Section 4 discusses general patterns that enhance participation, using multiple regression. This paper concludes by pointing out factors that should be part of a general strategy for successful forest management.

2. Forest management in three Indian states

I conducted a study in three states of India: Haryana, Uttar Pradesh and Bihar in 1995 and 1996, spending 4 months in the field (Lise, 1997). Each case attempts to involve local people in forest management. Forest use is co-ordinated through regular meetings at the village level.

In Haryana joint participatory forest management, as the process is named after a resolution by the Indian government in 1993, originated from a siltation problem in the Sukhna lake. Deforestation was identified as the main reason for this siltation problem and the forest department initiated new plantations, but the survival rate of the trees was very low. Representatives of the state went to a village called Sukhomajri, which is situated at the root of the river leading to the Sukhna lake, to inquire about their reason for destroying the new plantations (Mishra and Sarin, 1987, personal communication; Mishra, 1996). Daulat Ram, a villager from Sukhomajri, suggested constructing a dam for irrigation water. This negotiation process between the state and villagers resulted in the birth of social fencing where the people protect the new plantations, while getting water from the dams. This experience resulted in a strategy for forest officials to conserve and recreate forests in a much cheaper way by helping the people in return for their participation.

Since 1977 the state of Haryana has leased the forest to a number of villages. Villagers had the opportunity to create a council to manage their forest. All residents of the village became members of that council. In most villages the state has built dams to serve a double purpose: to check soil erosion of the hilly area of the forests and to provide irrigation water to the land of the villagers. Besides damwater the villagers can collect resources, such as fodder, fuelwood and fibre grasses from the forest. It is problematic to share damwater equally, because of variation in the landholding pattern. This inequality in landholding can undermine the willingness to participate of landless people. To compensate these people, every villager has a right to the same amount of water from the dam. Landless people can sell their rights to landowners. Ideally, such mechanisms should work, but it is very difficult to install such a mechanism. In some cases, it was overruled by more powerful landowners who are only interested in the water and indifferent about participation of other people in forest protection.

Chakriya vikas (rotational development) in Bihar is a continuation of the successes in Haryana. It started as a sharing model, under which people could contribute land and labour to resolve a deadlock situation of economic stagnation. The investment strategy is to bank on trees as a long-term sustainable income, while maintaining short-term crop to meet the direct food demand. A non-governmental organisation encourages villagers to pool private land to be subjected to a multi-tiered cropping pattern including (fruit) trees. The output from the pool is shared in three equal parts among people who pool land, people who plant and maintain the saplings, and a village fund. This is called the 1:1:1 sharing mechanism. This case is a very exceptional because villagers in one of the most remote places in India must save 33% of their communal income from the pool.

Private production and income are excluded, so the total overall saving rate at the household level is lower, but still remarkable. The sharing mechanism is possible because it is a prerequisite for initiating the process at the village level; it is a prenegotiated sharing rule, from which the process starts. The village fund is to be used for development of the village like building schools, wells, roads, or to maintain the pool. The role of the state is negligible in these projects. The people who work on the pool receive a stipend, besides a part of the output from the pool. The pool is generally created on wasteland. The village societies are organised very well, all villagers are involved and meetings are held every fortnight.

Van panchayats (forest councils) in the hills of Uttar Pradesh originated before independence from British rule. Large-scale protests of the people by setting the forest on fire prompted the state to allow the people self-organisation by giving them formal rights for managing a communal forest. It led to an organised way of managing a common-pool resource with a common property regime. An autonomous village organisation emerged to manage a communal forest. Since 1931, in the hills of Uttar Pradesh, the state allows for the creation of forest councils by villagers. A forest council consists of a committee that decides on how to use the forest. Forest councils are organised quite well, perhaps because of a fairly equal land and cattle holding. By their permission, resources such as fuelwood, fodder and timber can be collected from the forest. The role of the state is much less pronounced in Uttar Pradesh than in Haryana, due to the remoteness of the forest, which forms a physical barrier, making state control fairly difficult. Van panchayats have a clearly privileged position and that is perhaps the reason why they are against conversion into joint forest management, which is coming up separately in the plains; Van panchayats persist in the hills (Saxena, 1997).

Table 2.1 points out the diversities between the three institutional settings. The different amount of state involvement is the most distinguishing factor among the three institutional settings. The rights of the people also differ across the common forests. It is state property in Haryana, common property in Uttar Pradesh and pooled private property in Bihar. The institutional background is very different in the three cases; for example each has a different history and different sharing rules for the resources. The institutional settings also differ in forest quality, in types of forest resources and in organisation of the village council. In spite of all these (extreme) differences, there are also things in common. For instance in all three cases forests are managed by a well-defined group of people and people are free to choose their level of participation. Participation of people is the joining element. So these three case studies give a quite diverse insight in the process of people's participation.

Table 2.1 Basic feature of the three case studies on forest management.

State	Haryana	Bihar	Uttar Pradesh
Name of local organisation	Hill Resource Management Society	<u>Gram sabha</u> (village council) for rotational development	<u>Van panchayat</u> (forest council)
Frequency of the meetings	Once per month	Twice per month	Once per two months
Started in	1977	1984	1931
Initiated by	State	Non-governmental organisation	People
Property regime	State	Private (group)	Common
Number of organisations	48	44	4645
Forest quality	Degraded	Very degraded	Well-stocked
Kind of forest resources	Grass, scrubs, small trees	Multi-tiered cropping pattern	Pine, oak
Kind of village council	Elected village body	Like Haryana, but whole village is involved	Nested structure

Source: Based on Lise (1997) and reinterpretation of my fieldwork.

3. Factor analysis

Data is collected at the household level to provide the necessary information for estimating people's role and strategies at the institutional level. The random sample consists of 385 households in 32 villages in three states (127 in Haryana, 123 in Bihar, 135 in Uttar Pradesh). This primary survey generates varied information about the following socio-economic variables:

- their attitude to the environment: 4 standard questions;
- their attitude to the village council: 10–12 'site' specific questions;
- ownership of land, cattle and private assets;
- income from different sources, consumption and capital;
- name, village, caste, religion of the interviewee;
- of each family member: name, sex, age, education, position in family, employment, and salary.

For measuring attitudes to the village council, the respondents are asked the same set of questions. The answers to these questions are interpreted as *indicators of participation*: their personal attitude towards the village council. These indicators are scaled as an integer value in a range from one to five, where one means total disagreement and five means total agreement with one particular aspect of participation with respect to the village council. A factor analysis¹ is applied on these indicators of participation.

A factor analysis, which is a method for translating a large set of variables into a few independent choice variables, separates participatory indicators into a set of principal components, known as factors. Each factor represents an independent choice. Table 3.1 and Table 3.2 show the result, which is quite diverse for all the three states. As a rule of thumb, variables with a coefficient in absolute value above 0.5 are said to be dominating in a factor. Another rule of thumb is that all factors with an eigen value larger than one should be used in the analysis. These rules yield two, four, and three factors in respectively Haryana, Uttar Pradesh, and Bihar. Where it is difficult to understand why these numbers of factors are derived, we shall see that it has a clear interpretation: the number of factors tells us the dimensionality of participation in each state.

For the case of Haryana, we can see from Table 3.1 that the dominating variables in the first factor, which explains 45% of the variation, are all related to people's attitude towards the meetings. This is typically a social aspect of participation. The dominating variables in the second factor, which explains 14% of the variation, express contribution to and benefiting from participation as well as agreement to decisions. The interest to attend the meetings and the purpose it serves to the participants has again a high factor loading. While economic considerations are important in the second factor, three participatory indicators related to meetings are also dominant. These three participatory indicators relate to the acceptance of the meetings, whether they can conform themselves to the discussions in the meetings. The second factor represents people's economic

¹ See for example Harman (1967).

benefit and contribution and their acceptance of the village council. This shows that participation in forest management in Haryana consists of two dimensions.

Table 3.1 Grouping of participatory indicators into principal components: Haryana and Bihar.

State	Haryana		Bihar		
Level of participation	Social	Economic	Social internal	Economic	Social external
Factor	1	2	1	2	3
Planting in the forest	0.383	0.044			
Contribution to the forest/pool	0.226	0.698	0.172	0.650	-0.152
Benefiting from the forest/pool	0.094	0.832	0.098	0.808	0.072
Ability to use the pool			0.082	0.742	0.299
Benefits from using the pool			0.156	0.706	0.233
Importance of meetings			0.535	0.065	0.338
Agreement with decisions	0.049	0.876	0.832	0.164	0.165
Attendance of meetings	0.797	0.195	0.787	0.342	0.033
Ability to influence decisions	0.682	0.416	0.868	0.122	0.087
Frequency of meetings	0.792	-0.126	-0.020	0.021	0.568
Interest in the meetings	0.640	0.531	0.292	0.141	0.721
Gain from meetings	0.611	0.529	0.271	0.251	0.775
Suggesting in meetings	0.584	0.395	0.280	0.415	0.172
Percentage of variance explained	45.1%	14.5%	36.0%	12.3%	10.0%
Number of observations	127		123		

Note: Numbers in bold face denote a dominating indicator (factor loading ≥ 0.5 or ≤ -0.5). An empty cell means that the observations on that indicator are missing.

Source: See text.

Table 3.2 Grouping of participatory indicators into principal components: Uttar Pradesh and all India

State	Uttar Pradesh hills				All three cases	
Level of participation	Social internal	Economic	Social external	Benefiting	Social	Economic
Factor	1	2	3	4	1	2
Planting in the forest	0.048	0.867	0.000	0.035		
Contribution to the forest/pool	0.177	0.617	-0.024	0.493	0.184	0.797
Benefiting from the forest/pool	0.233	0.109	-0.074	0.782	0.111	0.815
Ability to use the pool						
Benefits from using the pool						
Importance of meetings	0.095	0.053	0.885	-0.115		
Agreement with decisions	0.771	0.239	-0.165	0.156	0.580	0.427
Attendance of meetings	0.594	0.421	-0.139	-0.026	0.714	0.229
Ability to influence decisions	0.810	0.180	-0.101	0.116	0.798	0.215
Frequency of meetings	0.275	0.143	-0.474	-0.415	0.594	-0.068
Interest in the meetings	0.842	-0.037	0.086	0.003	0.804	0.188
Gain from meetings	0.815	0.006	0.175	0.131	0.775	0.250
Suggesting in meetings	0.488	0.451	0.305	-0.274	0.512	0.309
Percentage of variance explained	35.4%	11.9%	10.7%	9.2%	45.6%	11.9%
Number of observations	135				385	

Note: Numbers in bold face denote a dominating indicator (factor loading ≥ 0.5 or ≤ -0.5). An empty cell means that the observations on that indicator are missing.

Source: See text.

In the case of Uttar Pradesh, the dominating variables in the first factor, which explains 35% of the variation, are all related to people's participation in evaluation and decision making which typically symbolises a social choice. It also symbolises the acceptance of the local organisation. The dominating variables in the second factor, which explains 12% of the variation, express people's contribution to the forest *panchayat*, which typically symbolises an economic choice. Both the third and the fourth factor are dominated by a single variable. The third factor is dominated by the importance of the meetings and almost negatively dominated (factor loading -0.47) by the frequency of the meetings. This means that people, who consider the meetings to be important, also believe that the meetings are not held frequently. The third factor represents people's attitude towards the functioning of the meetings. The fourth factor is dominated by the amount of benefits from participation, while the amount of contribution (factor loading: 0.49) and the frequency of the meetings (-0.41) are quite important, but not dominating. This means that when the meetings are less frequent, people tend to contribute more to and benefit more from the communal forest. The fourth factor resembles the level of benefits from participation. The factor analysis shows that participation in Uttar Pradesh hills is four-dimensional.

In Bihar, three factors are found and to each factor a very distinct meaning can be given. The first factor shows the extent people have appreciation for the meetings and respect for the decisions; whether they accept the local organisation or not. These are typical social considerations about how people appreciate the meetings, so let us call this factor *internal* social participation. It reflects to which extent people identify themselves with the village council; whether the council is internally coherent. The second factor shows the extent of contribution to and benefits from pooling, whether they are economically involved in the local organisation or not. It appears natural to label this factor as economic participation: the extent to which the village council enhances people's welfare. It reflects the impact of the village council on the villagers and their willingness to improve the forest through this village council. The third factor shows to which extent meetings are seen as frequent and useful; whether the village council is perceived as effective or not. This consists again solely of social considerations about acceptance of the meetings as a means to communicate, call this *external* social participation. This shows that participation in pooling consists of three dimensions.

The first and the third factor of Bihar are joined in Haryana and Uttar Pradesh, with one exception in each case. In Haryana, acceptance of decisions has become a part of the second factor, while in Uttar Pradesh, the frequency of the meetings dominates the third factor alone. Contribution and benefiting of Bihar's second factor are also found in Haryana, but in Uttar Pradesh, contribution and benefiting are split over the second and the fourth factor.

Pooling of all observations leads to an average choice irrespective of the institutional set-up. This situation most resembles the case of Haryana. Two factors are found. In the first factor, all coefficients that are related to meetings dominate. In the second factor, both coefficients that are related to economic aspects of participation dominate. Hence, on the combined level we see a clear division of the participatory choice into two components, where social considerations are most important; economic considerations con-

stitute the second main important consideration. It is noteworthy that the first two factors at the state level and the combined level have a great resemblance: they represent similar choice situations in each institutional setting:

1. Social participation.
2. Economic participation.

This result is no real surprise, because most indicators are on the social aspects of participation. The result could only be decisive, if an equal number of indicators were considered.

Let the sum of the participatory indicators be called *overall participation*. In the analysis that follows all derived factors and the total sum shall be used as different representations of the level of participation.

4. Suggestions for improving forest management

This section identifies under which conditions a person is most likely to participate in forest management. Links between several socio-economic variables and participation are found with the help of multiple regression analyses. This section discusses these links. Table 4.1 shows the general patterns for the three institutional settings. The following equation is estimated 15 times:

$$\begin{aligned} q = a + b_1RES + b_2FORDEP + b_3AVAGE + b_4EDU15 + b_5EDUS + \\ b_6FMRAT + b_7CONPC + b_8INCPC + b_9CAPPC + b_{10}CASGR + \\ b_{11}RELNR + error \end{aligned} \quad (4.1)$$

Where q is the level of participation, a is a constant, b_i is the coefficient of a socio-economic variable. Table 4.2 shows the meaning of the variables. Table 4.1 and Table 4.3 show the outcome of the t -statistics of the coefficients for each socio-economic variable.

Table 4.1 Meaning of the variables that are included in the regression.

Variable	Meaning and definition
\hat{e}	The level of participation, based on the principal components or total sum of participatory indicators*
<i>RES</i>	The level of resources, based on the principal component of three indicators: present quality, change in quality over a period of 10 years, availability of resources*
<i>FORDEP</i>	Forest dependence: total use of forest goods, like fuelwood, fodder, timber, divided by total need per family†
<i>AVAGE</i>	Average age in the family
<i>EDU15</i>	Average level of education in the family of members older than 15 years.
<i>EDUS</i>	Years of schooling of the respondent
<i>FMRAT</i>	Female-male ratio (number of female family members divided by the number of male family members times 2000).
<i>CONPC</i>	Consumption per capita
<i>INCPC</i>	Income per capita
<i>CAPPC</i>	Capital per capita
<i>CASGR</i>	Caste group (higher number means a lower caste)
<i>RELNR</i>	Religion group (1=Hindu, 2=Muslim, 3=Christian)

* The level of participation and the level of resources are normalised between zero and one. The minimum value resembles the case where the respondents answered 'not at all' all the time; this value is not necessarily attained.

† Forest dependence is by definition normalised between zero and one.

Table 4.2 Links between socio-economic variables and levels of participation: Haryana and Bihar.

State:	Haryana			Bihar			
Participation:	Overall	Social	Economic	Overall	Social (int.)	Economic	Social (ext.)
Constant	0.271851 (1.75)	0.408832 (2.78)	0.163917 (0.95)	0.522572 (4.20)	0.891655 (10.19)	0.50166 (3.44)	0.461775 (4.70)
RES	0.25688 (2.83)	0.087189 (1.02)	0.314025 (3.11)	0.324014 (3.29)	0.055233 (0.80)	0.326455 (2.82)	0.167769 (2.15)
FORDEP	0.312732 (3.48)	0.186903 (2.19)	0.268854 (2.68)				
AVAGE	-0.00284 (1.26)	-8.9E-05 (0.04)	-0.00382 (1.53)	0.001745 (1.02)	0.000349 (0.29)	0.000237 (0.12)	0.002356 (1.74)
EDU15	-0.02791 (2.68)	-0.02395 (2.43)	-0.01257 (1.09)	-0.00083 (0.10)	-0.01358 (2.29)	0.016892 (1.71)	-0.0034 (0.51)
EDUS	0.008843 (1.70)	0.014284 (2.90)	-0.00289 (0.50)	0.007962 (1.78)	0.006307 (2.01)	-0.00225 (0.43)	0.007126 (2.02)
FMRAT	-5.4E-05 (0.83)	-4E-05 (0.65)	-1.6E-05 (0.22)	4.5E-06 (0.09)	-2E-05 (0.61)	-5E-06 (0.09)	4.72E-05 (1.25)
CONPC	8.88E-06 (0.69)	3.34E-06 (0.27)	8.6E-06 (0.60)	-6.9E-05 (2.51)	-7.1E-08 (0.00)	-6.6E-05 (2.04)	-4.1E-05 (1.88)
INCPC	5.72E-06 (0.93)	-7.5E-06 (1.28)	1.83E-05 (2.68)	2.84E-06 (0.15)	-1.1E-05 (0.85)	-3.5E-06 (0.16)	2.7E-05 (1.81)
CAPPC	4.5E-08 (0.69)	1.52E-07 (2.43)	-1E-07 (1.42)	1.75E-07 (0.26)	-5E-07 (1.05)	8.5E-07 (1.07)	-6.2E-08 (0.12)
CASGR	0.03121 (1.79)	0.044342 (2.68)	-0.01136 (0.58)	-0.00887 (0.77)	-0.01065 (1.31)	-0.00258 (0.19)	-0.00152 (0.17)
RELNR	0.006822 (0.23)	-0.05855 (2.13)	0.09416 (2.91)	0.029683 (1.34)	0.024992 (1.61)	-0.00068 (0.03)	0.017036 (0.98)
Adjusted R ²	0.214	0.199	0.163	0.0153	0.024	0.088	0.097

Note: empty cell: variables excluded from regression, because of missing observations. The value in parenthesis is the *t*-statistic.

Source: see text.

The age and the sex of the respondent are excluded from the regression because they did not lead to any significant result. This omission led to some changes in the remaining coefficients. The most interesting change is found in Bihar where education becomes significant for social (internal and external) participation. Note that the adjusted R² is low (<0.215) and even negative for economic participation in Uttar Pradesh. In the latter case we find that none of the included variables are significant and, hence, do not provide any explanation for economic participation. It is interesting to see from Table 4.1 that economic participation is mainly explained by forest dependence, resource quality or by indicators of wealth.

Table 4.3 Links between socio-economic variables and levels of participation: Uttar Pradesh and all India.

State:	Uttar Pradesh hills					All three cases		
Participation:	Overall	Social (in-ternal)	Economic	Social (external)	Benefiting	Overall	Social	Economic
Constant	0.412372 (3.65)	0.431557 (3.93)	0.544607 (5.05)	0.442129 (4.02)	0.4956 (4.55)	0.421122 (7.51)	0.432555 (8.33)	0.518095 (7.33)
RES	0.05865 (0.82)	0.027428 (0.39)	0.010679 (0.16)	-0.12674 (1.81)	0.205282 (2.95)	0.250797 (4.93)	0.140424 (2.98)	0.252235 (3.93)
FORDEP	0.191424 (3.09)	0.223176 (3.70)	0.033636 (0.57)	-0.1095 (1.81)	-0.02031 (0.34)			
AVAGE	-0.0032 (1.94)	-0.00318 (1.98)	-0.00146 (0.93)	0.004205 (2.61)	-0.00096 (0.60)	-0.00036 (0.34)	-3E-05 (0.03)	-0.00218 (1.61)
EDU15	0.00084 (0.15)	0.005181 (0.93)	-0.00518 (0.94)	0.010157 (1.81)	-0.0061 (1.10)	-0.00534 (1.22)	-0.00396 (0.98)	-0.00394 (0.71)
EDUS	0.003189 (0.91)	0.003353 (0.98)	-0.00107 (0.32)	0.000935 (0.27)	0.003576 (1.05)	0.005515 (2.16)	0.006505 (2.75)	-0.00206 (0.64)
FMRAT	0.000249 (1.67)	0.000297 (2.04)	-5.4E-05 (0.38)	0.000101 (0.70)	-8.8E-05 (0.61)	5.36E-05 (2.00)	6.57E-05 (2.65)	-1.4E-05 (0.40)
CONPC	1.08E-05 (1.27)	9.71E-06 (1.18)	-8.8E-07 (0.11)	4.56E-06 (0.55)	-3.4E-06 (0.42)	-7.2E-06 (1.07)	-5.9E-06 (0.95)	-5.3E-06 (0.62)
INCPC	-4.1E-06 (1.01)	-4.8E-06 (1.20)	2.73E-06 (0.70)	-3.4E-06 (0.85)	5.91E-07 (0.15)	-1.7E-06 (0.49)	-4.2E-06 (1.34)	5.38E-06 (1.25)
CAPPC	-1.1E-07 (0.29)	-3.2E-07 (0.84)	3.62E-07 (0.96)	2.94E-08 (0.08)	4.05E-09 (0.01)	-1.7E-08 (0.32)	3.7E-08 (0.73)	-5.5E-08 (0.80)
CASGR	-0.00919 (0.41)	0.000135 (0.01)	-0.01153 (0.54)	-0.00842 (0.39)	0.008783 (0.41)	0.020827 (2.64)	0.02749 (3.77)	-0.0186 (1.87)
RELNR								
Adjusted R ²	0.099	0.166	-0.049	0.14	0.012	0.182	0.19	0.036

Note: empty cell: variables excluded from regression, because of missing observations.

The value in parenthesis is the *t*-statistic.

Source: see text.

We can interpret the multiple regression outcomes of Table 4.1 and Table 4.3 as follows. The regression outcomes are quite diverse over the four institutional settings, but some general patterns are apparent. First of all, each time the level of resources is positively significant, which happens in 9 out of 15 cases. This shows that participation is enhanced when the people perceive their resource as being of a good quality. A similar conclusion can be drawn for the forest dependence. This link is significantly positive in 5 out of 8 cases, meaning that high forest dependence is an important attribute for stimulating people's participation in forest management. Better resources and increased dependency on the forest lead to a higher level of participation. This suggests that improving levels of resources strengthen people's participation. A higher level of forest dependence means that the people have a higher stake in the forest, which is reflected in their higher level of participation.

The indicator of the average age in the family is only significant in Uttar Pradesh. This significance implies that younger people in Uttar Pradesh agree with the current process of the meetings (internal social participation). On the other hand older people find the meetings very important and would like to have the meetings more frequently (external social participation).

When we look at the two indicators for education, we see a very diverse result. On the one hand, a low average level of education in the family (two times in Haryana and once in Bihar) and on the other hand, a higher level of education of the respondent (once in Haryana, twice in Bihar, twice in the combined sample) enhances participation.

The linkage with gender is of interest. A high number of women in the family is linked positive and significant to internal social participation for the case of Uttar Pradesh hills. The positive link between gender and participation in Uttar Pradesh indicates that more involvement of women strengthens the institution of people's participation in Uttar Pradesh. Let us focus for the time being on women's participation and note that as compared to Haryana and Bihar, the productivity of cultivated agricultural land is highest in Uttar Pradesh hills. This is very remarkable, because in Uttar Pradesh hills, all agricultural land is rain-fed and agriculture is not mechanised. Compare this to Haryana, where a part of land is under irrigation and agriculture is partially mechanised. In the hills the main agricultural burden is taken by women, while this is generally not so in Haryana and Bihar. The higher productivity may be due to the smaller land-holdings in the hills, which is subjected to a high labour input and in contrary to Haryana and Bihar, droughts are rare in the hills. This link suggests that women's involvement in agriculture have a strong positive influence on agricultural output. It is remarkable that we find a positive link twice between gender and participation for the combined sample.

The link between wealth, measured as consumption, income or capital, and participation is positive in Haryana and negative in Bihar. This shows that the participatory process in Haryana has the co-operation of rich people. This is not very surprising, since land-owners have an interest in obtaining a right to damwater. In Bihar there is no such incentive and landless people co-operate because of the availability of labour in the pool of land.

The link between caste and participation is significant and positive in Haryana. In Bihar and Uttar Pradesh it is negative, but not significant. This shows for Haryana, that people from a lower caste participate more. The same link is also found for the combined sample. Finally, the link between religion and social participation is negative and the link with economic participation is positive in Haryana. It is insignificant in Bihar. This shows that social cohesion is easier to attain when most of the people are Hindus. Economic co-operation is more easily obtained by involving sufficient non-Hindus.

5. Conclusions

This paper presents investigations in three states where people's participation in forest management is favoured. The institutional settings are quite different. The amount of state involvement is the most distinguishing feature.

A factor analysis on indicators of participation results in two important considerations for participation: social and economic. The attitude towards meetings in the village (social participation) is the most important consideration in each case.

An econometric analysis shows under which conditions a person is most likely to show a high level of participation. When the condition of the forest is good and/or when people are dependent on the forest, participation goes up. Low average levels of education in the family and high levels of education of the respondent enhance participation. Greater involvement of women in the community stimulates participation.

A high level of people's participation facilitates the initiation of a participatory institution. Once an institution is created a lower level of participation is needed to keep the participatory process going. This paper presents an empirical study of people's participation in forest management in various situations. Identification and recognition of a key-role of the people in forest management is a possible way to prevent deforestation.

Based on the foregoing factor analysis and multiple regression analysis, a strategy for successful forest management can be derived. It seems reasonable to suggest that the state take the first move, because they possess resources, which local people lack. Taking the first move does not mean that a top-down approach should be followed. The process should commence in those villages where participation is most likely to take place, as we concluded from the regression patterns. For instance, the best chances for voluntary participation can be found among the villagers who depend highly on the forest and perceive the quality of the forest as good. Having improved the chance of a successful start for forest management, the successful village can then serve as an example for other villages to extend the process. Motivated by successes in the first stages, resources can be mobilised to replicate the process in villages with less favourable circumstances. Hence, the process should not be bottom-up either, but it should be an interaction between the state and the people, leading to a win-win situation. Transparency of the state and legal rights for the people are important aspects for success as well.

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References

- Bromley D.W. (1991a). *Environment and Economy: Property Rights and Public Policy*. Oxford: Basil Blackwell.
- Bromley D.W. (1991b). Testing for Common versus Private Property: Comment. *Journal of Environmental Economics and Management* 21:92-96.
- Chopra K, G.K. Kadekodi and M.N. Murty (1990). *Participatory Development, People and Common Property Resources*. New Delhi: Sage publications.
- Hardin G. (1968). The Tragedy of the Commons. *Science* 162:1243-1248.
- Harman H.H. (1967). *Modern Factor Analysis*. Chicago: The University of Chicago press.
- Lise, W. (1997). *An Econometric and Game Theoretic Approach to Common Pool Resource Management: Case Studies in Rural India*. Delhi School of Economics, University of Delhi, India. PhD Thesis.
- Mishra, P.R. (1996). *Amar Sandesh, Daula ka Sukhomajri* (in Hindi). Daltonganj: Society for Hill Resource Management School.
- Mishra, P.R. and M. Sarin (1987). *Social Security through Social Fencing: Sukhomajri and Nada's Road to Self-sustaining Development*. Personal communication. Unpublished.
- Ostrom E. (1990). *Governing the Commons, The Evolution of Institutions for Collective Action*. Cambridge: Cambridge University press.
- Ostrom E., R. Gardner and J. Walker (Editors) (1994). *Rules, Games and Common-pool Resources*. Michigan: Ann Arbor, The University of Michigan press.
- Palit S. (1993). *The Future of Indian Forest Management: into the Twenty-first Century*. New Delhi: Ford Foundation. Joint Forest Management Working Paper 15.
- Poffenberger M., B. McGean (Editors) (1996). *Village Voices, Forest Choices, Joint Forest Management in India*. Delhi: Oxford University press.
- Sarin M. (1996). *Joint Forest Management: The Haryana Experience*. Ahmedabad: Centre for Environment Education.
- Saxena N.C. (1996). *Towards Sustainable Forestry in the U. P. Hills*. Mussoorie - 248179: Centre for Sustainable Development, Lal Bahadur Shastri National Academy of Administration.