COMMON POOL RESOURCES AND THE DEVELOPMENT PROCESS: EVIDENCE FROM INDIA

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Abstract

This paper analyses recent evidence on the role of common pool resources (CPRs) as development drivers and safety net providers. In the context of alternative development paradigms, multiple-use common pool resources have come under consumptive pressures from local, regional, national and international stakeholders. The important issue that emerges is the extent and manner in which common pool resources would continue to be relevant to sustainable livelihoods in the context where markets and globalisation dominate development. Using a simultaneous equations framework with poverty and value of collections from CPRs as the endogenous variables, the interlinkages between development and CPRs are explored. The effect of exogenous variables such as the role of privately owned assets, access to infrastructure and existence of management regimes for CPRs is also examined. We find that while the safety net role of CPRs is dominant, regional differences in their role as development drivers emerge.

[1] This paper is partly based on the work-in-progress on an ongoing project in collaboration with the University of Cambridge, UK. The project is funded by UK Department for International Development (DFID).

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I. Introduction

This paper seeks to discuss issues emerging from current evidence on common pool resources in India, and the developments that have been taking place for management of these resources over the past two decades. The study focuses on the role played by common pool resources (CPRs) in poverty alleviation and development oriented strategies in India, as viewed by different stakeholders.

CPRs as Safety Nets or Drivers of Development

The literature on CPRs has given rise to alternative hypotheses with regard to their role in development. Studies rooted in different regions of India have suggested that CPRs play diverse roles in relation to rural livelihoods. In particular, two aspects of the relevance of CPRs have received attention:

- the role of CPRs in supplementing rural livelihoods and acting as safety nets specially in times of agricultural crises. This can be alternatively characterised as the "substitution" between CPR based means of livelihood and the other primary source of rural livelihood, i.e. agricultural income.
- the second aspect which has also drawn considerable attention in the literature is the complementarity between agricultural output and the use of CPRs as inputs to agriculture. A large part of agricultural inputs such as fodder, grazing grounds and irrigation water are made available through the conservation of common property resources. By this contention, there should exist a complementarity between development, in particular agricultural development and the conservation of CPRs

This paper constitutes an attempt at testing the above hypotheses with the help of a large dataset made available by the National Sample Survey Organisation in India.

The paper is divided into sections as follows. Section II presents a brief overview of the evidence from earlier studies, on the scope and utilisation of CPRs in India. Section IIIa focuses on the present database i.e. the National Sample Survey data (NSSO), and discusses summary results based on the dataset while section IIIb presents the results from a preliminary factor analysis. Section IV details the model structure and variables for a simultaneous equation based framework for analysis and Section V details the results from the estimation. Section VI presents the concluding remarks of the study.

II. Common Pool Resources : Evidence from Previous Micro Studies

Common Pool Resources (CPRs) are defined in the Indian context as non-exclusive resources to which the rights of use are distributed among a number of owners. These co-owners are generally identified by their membership of some other group such as a village or a tribe or a particular community. Most micro-studies on use and access of CPRs in India have adopted this as a broad working definition. The present study accepts this definition, without restricting the definition to include only common property resources which have well specified property regimes. CPRs thus include community pastures and forests, wastelands, common dumping and threshing grounds, watershed drainages, village ponds, rivers and other common pool water bodies. They are resources with varying degrees of access on which multiple and often overlapping property rights and regulatory regimes exist. Such rights of access include those defined on different categories of government forests.

Thus, a complex web of legal and conventional rights and concessions determine access to land and its product. Ground rules vary from region to region. So do the agro-ecological conditions and correspondingly the context in which CPRs are to be viewed. Further, approaches to the placement of the commons in the broader economic and social context of communities vary. Such conceptual differences in the approach to the commons impinge on methodologies that are appropriate for studying their contribution to the generation and sustenance of livelihoods. In the

Indian context, the magnitude, role and significance of CPRs in India's rural economy have been examined using one or more of three methodologies and sources of information specific to them. These are:

- Data and information from micro studies carried out in different parts of India in the last decade or more
- Data obtained from a recent country-wide survey conducted by the National Sample Survey Organization
- Indirect evidence from a reclassification of land use data as also a comparison with remote sensing data

Each of these approaches views CPRs as resources, which contribute to economic well-being and hence assist in augmenting and framing policies for removal of poverty.

Evidence from Micro-studies

Several micro-studies have documented the size, status and utilization of CPRs in different parts of the country. The decline in CPRs has been an area of particular interest to most researchers. While common land can be depleted in terms of both decline in area and decline in physical productivity, the decline in area has been much better documented in the past, such as through records on village land use. Jodha's study of 82 villages from seven states in the dry regions in India (1997) found that between 1950-52 and 1982-84, CPR land as a percentage of total village area declined by 31% in some states and by a high of 55% in others. According to another study (Pasha 1992), the area under CPRs has declined by about 33 percent over a period of 20 years. The decline in terms of both area and quality were marked in the arid zones (Jodha 1985). Changes in the institutional arrangements, including the legal status, underlying these resources have been identified as a major causal factor behind this decline (Jodha 1997, Pasha 1992, Iyengar and Shukla 1999, CWS 2001). Another study (Chopra et al 1989) used secondary data on land use to establish that the size of CPRs (including forests) had reduced by 4% in one state (Maharashtra) and by 30% of the total CPR area in another (Haryana) in the period from 1970-71 and 1986-87. On similar lines, a recent study in Andhra Pradesh (CWS 2001) locates rapid decline in terms of both quantity and quality of village common lands between the 1970s till date, ranging from a decline of 20% to 65% of the original size of the village commons in the

early 1970s. Qualitative decline is measured in terms of the loss in vegetation and available species in this study.

The two main factors that have been held responsible by several studies for the privatization of what was earlier common land are

- Encroachments by rural households and
- Government policies on redistribution of land among poor households for purposes of housing and cultivation,

Apart from problems regarding the size of the holdings distributed among different socio-economic groups, it has also been argued that the 27 to 45% of the poor households receiving land disposed it of because they lacked the complementary resources needed to develop and cultivate it. Similarly evidence on the inability of the poor to put land under productive use has been noted by others such as Iyengar and Shukla (1999), largely due to the lack of technical skills guidance and inputs. Hence, they conclude that in the case of conversion of open access wastelands into CPRs, some property rights regimes would need to be defined. Further, from this viewpoint, privatization of CPRs could succeed as a solution for regeneration of CPRs and as a source of livelihood for even the poor, if the necessary techno-economic inputs could also be supplied to those poor who are granted such CPRs for private cultivation. In a related context, Chopra and Gulati (2001) argue that institutional change can positively influence the productivity of natural resources by creating well-defined property rights, thereby mitigating poverty in rural areas.

Alongside land reforms, the imposition of village level democratic institutions replacing traditional formal and informal arrangements for regulating CPRs has also been held responsible for making the poor worse-off in terms of access to CPRs. According to one study, 50 to 80% of the privatized CPR land went to people who already had relatively more land (Jodha 2000). Thus, despite the underlying concern to help the poor the privatization of CPRs failed to achieve the desired equity objectives as far as land reforms were concerned. The lack of clear perceptions and institutional arrangements to enforce new initiatives has also been held responsible for the low impact of schemes taken up under the social forestry programme (Jodha 2000). The limitations placed on collection of land and water-based CPRs due to intensive

agricultural development programmes have also been documented elsewhere (Beck and Ghosh 2000). On the other hand it has also been argued by some that the modernization of rural economies inevitably leads to the decline and erosion of CPRS and their management practices (Iyengar 1988).

The literature has repeatedly stressed on the need for effective people's participation in preventing over-exploitation of the CPRs by the better off and in protecting the forests in particular. Alongside this, the need to focus on the continuing important role of CPRs in reducing income disparities in the rural areas and as buffers when agriculture or other sources of livelihood fail continues to be highlighted by researchers.

It is also important to study the links between private property resources and common property resources in the context of not only the direct production relationship but also in terms of the maintenance of CPRs for livelihood sustenance over generations. Although the composition of CPRs accessed by the poor differs across agro-climatic zones, CPRs continue as being crucial resources for the poor on one hand, while, on the other there is evidence for the systematic exclusion of the poor from access to CPRs.

IIIa. A Comprehensive Survey Based Approach: Evidence from the NSSO

The survey (NSSO 1999) relates to CPRs in the life and economy of the *rural* population. The major contribution of the report is that it provides for the first time in India a comprehensive State and National level database on the size, utilization and contribution of CPRs. It also provides disaggregated information at the State level in terms of agro-climatic zones.

The study aims at an assessment of the CPRs in terms of their contribution to the lives of the rural people. Thus, the role of CPRs in providing biomass fuel, irrigation water, fodder for livestock and other forms of economic sustenance has been the main focus. The results are based on a comprehensive survey of 78,990 rural households in 10978 villages across the country[2].

[2] The details of the methodology used in the survey are given in Appendix 1.

The NSSO defines common property resources as resources that are accessible to and collectively owned/held/managed by an identifiable community and on which no individual has exclusive property rights. Two different concepts have been used to determine the size and access to CPRs in this report. The *de jure* approach was used for collection of data on the *size* of CPRs. In this approach only those resources were treated as CPRs which were within the boundary of the village and were formally held (by legal sanction or official assignment) by the village panchayat or a community of the village. The second approach, *de facto* approach, was adopted for collecting information on *use* of CPRs. According to this approach CPRs were extended to include all resources which were in use by the community by convention irrespective of ownership, and even if they were located outside the boundary of the village. The size of CPRs was therefore based on a stricter *de jure* definition while the "use" data took into account the actual position with regard to access. Government forests (which have been classified into three categories in India as per their legal status: reserved forests allowing restricted access, protected forests allowing access to locals and unclassed forests (all other)) have also been treated in this manner, thereby distinguishing between the conceptual basis for defining size and use.

Summary Findings

Table 1 provides some country level summary statistics on CPRs as estimated by the NSS. It becomes clear from the table that CPR form a substantial part of the total geographical area.

Table 1: All India Summary Findings

I. Size of Common Property Land Resources (CPLR)	
Percentage of CPLR in total geographical area	15 %
CPLR per household (ha)	0.31
CPLR per capita (ha)	0.06
Reduction in CPLR during last 5 years(per 1000 ha)	19 ha
II. Collections from CPR	
Households reporting collection of any material from CPRs	48 %
Average value of annual collections per household (Rs)	693
Ratio of average value of collection to average value of consumption expenditure	3.02 %
III. Nature of use of CPRs (*data per household*)	
Share of fuelwood in value of collection from CPRs	58%
Average quantity of fuelwood collected from CPRs annually	500 kg
Average quantity of fodder collected from CPRs annually	275 kg

Comparative Evidence from Micro-Studies

The NSS provides estimates for the contribution of CPRs to the rural economies at the state level, in terms of the access and utilization of CPRs, especially fuelwood. It is of interest to compare these findings with the evidence gathered by micro-studies in a few states of India. We select four such states – Punjab, Karnataka, West Bengal and Gujarat. Table 2 summarises findings from the micro studies while Table 3 presents similar findings from the NSS data for these four states.

Table 2: **Evidence from Micro Studies on Access and Utilisation for Major States**

State	*Gujarat*	*Karnataka*	*Punjab*	*West Bengal*
Period of Study	1996	1989-90	1990/91-92/93	1994 – 96
Author/s	Iyengar and Shukla (1999)	Pasha (1992)	Singh, et.al (1996)	Beck and Ghosh (2000)
Region/Ecosystem	-	Across diverse Agro-climatic zones	Dasuya-Langerpur Watershed/ Kandi region	Across major agro-ecologic-al zones
Sample size (no. of villages)	15	3	8	7
Sample size (no. of households)	-	Poor 51 Non-poor 89	Landless 52 Cultivating 147	Poor 313 Non-poor 162
Proportion of CPLR to total area	-	36.6%	34%	-
Contribution of CPRs to gross annual income -Poor/landless -Non-poor/ Cultivating	 1.1-22.1% 0.1-11.4% *	 10% 6.2%	 27.3% 22 %	 12% 0.13% - 5.62%
Annual consumption from CPR (Kgs/ household) Fuelwood Fodder	- 2566 9632	 397 1387	 –	

* This gives the share in consumption expenditure for the state

Table 3: Evidence from NSSO on Access and Utilisation for Major States

State	*Gujarat*	*Karnataka*	*Punjab*	*West Bengal*
Sample size (no. of households)	2939	3152	2533	5312
Proportion of CPR to total area	27%	10%	1%	2%
Ratio of the value of collection to cons-umption expenditure	2.77%	2.90%	2.76%	2.09%
Annual consumption of Fuelwood* from CPR(Kgs/ household)	877 (483)	1446 (484)	841 (550)	742 (324)

The NSSO study is based on a substantially larger sample as compared to the micro studies. However, the proportion of CPR area in total geographical area falls in the same range as reported from the micro-studies. On average, the NSSO reports lower percentages for the value of collection to consumption expenditure. Further in qualitative terms, the relative dependence of the poor is more than of the non-poor. And this is corroborated by the NSS. Further, the country wide survey also corroborates the more critical dependence of the poor on CPRs for fuelwood in almost all parts of the country.

It is important to understand that the two approaches to the study of CPRs are complementary. They help to throw light on different aspects of the study of the commons. Large data sets are of use in determining drivers of development and pressures on land and related assets. To complement such study of the overarching issues, we need in-depth views of governance in relation to the social construction of resources and their meaning. In depth studies are also called for in understanding the impact of decentralization and devolution of power. Policy makers need to use both these sets of knowledge in an iterative mode in order to keep in touch with peoples' aspirations and impact their well-being levels.

IIIb. A Preliminary Data Analysis

This section attempts to address the above issues thorough a state-level analysis of the linkages between CPRs and their determinants, and the strength of these relationships. Table 4 gives the descriptive statistics on the variables that have been used in the analysis, for 24 states. CPR availability is defined as availability per hectare of geographical land. The mean and standard deviation of CPR as a percentage to geographical area across 24 states is 11.22 and 8.45 respectively.

Table 4: Variables for Factor Analysis

Variable description	*Code*	*Mean*	*Std. Dev.*
Per capita Agricultural GDP (Rs)	Agripc	2147.62	1068.17
Rural Poverty (%)	Rpov	36.79	11.32
Proportion of Rural Population in Total(%)	popcent	76.84	9.70
Literacy Rate (percent literates)	literacy	50.27	13.26
Density of Rural Population (per sq.km)	Density	216.27	164.35
Proportion Employed in Industry (%)	indprop	19.33	25.16
Livestock (per unit of net sown area)	Livensa	0.0046	0.0026

The variables listed in Table 4 were considered for a factor analysis, in an attempt to capture different influences on CPRs. Broadly three categories of variables were identified for the analysis. These sought to capture the three important factors:

- the influence of poverty and lack of sufficient means of livelihood,
- the linkage with agricultural output and livestock and,
- the role of developmental impacts such as urbanization and alternative industrial employment.

Table 5 reports the detailed findings of the factor analysis with respect to the above mentioned variables, in order to identify the key factors and the directions in which they influence CPRs at the state-level. The results presented in table 5 are based on the orthogonal (varimax) rotation. The eigen values obtained revealed that two factors were sufficient for explaining 90% of the variation, with the first factor explaining 65% of the variation. For purposes of analysis, we focus on the first set of factor loadings since there has been considerable debate in the literature on the relevance of interpretation of subsequent loadings. It maybe noted that following standard norms, the results are acceptable in as much as the uniqueness is within 0.5, thus the communality characteristic is satisfactory.

Table 5: Results from Factor Analysis

Variable	*Rotated Factor Loadings*	*Uniqueness*
Agripc	-0.13661	0.44012
Rpov	0.61634	0.20027
Popcent	0.72020	0.42840
Literacy	-0.39140	0.36299
Density	0.29212	0.24182
Indprop	-0.34215	0.50938
Livensa	0.75304	0.24219

The factor loadings in Table 5 seem to point towards certain directions. Considering the per capita agricultural GDP as an indicator of the agricultural development of the state, the negative loading on this variable and the positive and relatively high loading on poverty, indicates that the safety net influence of CPRs still reigns supreme. The positive and relatively high loading on livestock as a proportion of net sown area also points in the same direction. The positive loadings on population density and proportion of rural population also add to the substitution argument.

Thus, the contribution of CPRs continues to be more in the context of a survival strategy for the rural population. The negative loadings on literacy and the proportions employed in industry, point towards the influences of urbanisation and industrial development on CPRs. With development, the pointers seem to be towards a reduction of the dependence on CPRs, quite beyond both the hypothesis of dependence on the basis of either livelihood based survival strategies or complementarities in agricultural production. Of course, certain complementarities in the production process between private and common pool resources would continue – particularly in the agriculturally developed zones, such as those between fodder and livestock, pumpsets and extraction of groundwater for agriculture.

The extent of mechanisation in agriculture is a case for illustration. The extent of mechanisation of agriculture would determine the interpretation of the high loading on livestock.. Thus, in a less mechanised agriculture one would expect a tendency to have complementarity in the production relations. However, increasing mechanisation reduces the requirement for cattle, thus having implications for the complementarity argument. As mechanisation proceeds, as a fall out of development, complementarities could get diminished. Thus, one would expect to see pockets of

intensive complementarity, (say linking groundwater with increased agricultural productivity), alongside large regions of reduced complementarity.

Thus, the analysis indicates that long term implications for the breakdown of the survival strategy and collective interest in defining the status of CPRs needs to be taken into account. The preliminary statistical analysis indicates, that even given the present state of development in India, which is in fact quite differentiated across the component states, there is a need to focus on CPRs beyond the evidence so far provided by the micro studies.

For instance, it becomes evident that among issues that have been neglected in the literature and policy on CPRs is their role as providers of eco-system services to downstream rural and urban areas. This aspect assumes greater importance in the context of a developing economy where one would expect to see rapid changes in the attitudes towards CPRs and the associated management regimes with rapid urbanization and the opening up of alternatives means of livelihood to rural population. While this is not an attempt to undermine the role played by CPRs in sustaining rural livelihoods, the fact remains to be explored as to whether different states in India are doing differently with regard to CPRs, depending on their developmental status. The next section attempts a more rigorous econometric approach utilising the information gathered in the NSSO survey.

IV. Modelling Links between CPRs and Poverty : A Simultaneous Equation Framework

The NSS 54th round collected information on common property resources at both the household and village levels for the first time in India. The survey was of 6 months duration over the period January 1998 to June 1998. The following analysis is based on the dataset for rural households.

Variables for the Econometric Estimation

A two equation simultaneous system, based on a 3 SLS estimation procedure was used for the analysis. Table 6 presents the summary statistics on the variables used in the analysis[3]. The

[3] The pairwise correlation coefficients are presented in Appendix 2 in the paper.

estimation exercise was conducted at the village level, using data from 5056 villages, after pooling data from the household and village datasets. For all the household level variables such as the value of per capita collections of fuelwood and fodder from CPRs, the average values for the village were taken. Similarly, in estimating poverty at the village, the proportion of households classified as poor was considered. The endogenous variables used for the two equations were;

- the proportion of poor households in the village and
- the value of per capita collections of fuelwood and fodder from village commons

Table 6 Summary Statistics on Variables used in the 3SLS Estimation

Variable Description	*Variable Name*	*Mean Value*	*Standard Deviation*	*Number of Observations*
Exogenous Variables Average land possessed per household in the village (in ha)	Avgland	1.34	143.38	4111
Presence of secondary school in the village (=1 if present)	secsch	1.42	1.29	5038
Presence of a public telephone facility in the village(=1 if present)	phone	1.98	1.58	5037
Presence of metalled road in the village (=1 if present)	metrod	1.86	1.25	5034
Presence of a local forest man-agement body (=1 if present)	fmbody	1.96	0.201	4918
Presence of a body managing irriga-tion water (=1 if present)	manirr	1.88	0.31	4909
Presence of a body managing water for other uses (=1 if present)	manoth	1.86	0.33	4965
Proportion of households owning livestock in the village	ownlive	0.66	0.27	4260
Proportion of households owning diesel/electric pumpsets in village	ownpump	0.28	0.21	2285
CPR available per capita (de jure)	CPRpcj	0.73 ha	360.13	3628
Endogenous Variables Annual value of collections from commons (in Rs per capita)	valffpc	55.36	167.15	4154
Proportion of poor households in the village	typepoor	0.269	0.203	2711

The exogenous variables used in the analysis can be grouped into three broad categories, apart from the per capita availability of CPR:

- privately owned assets – proportion of households in the village owning diesel or electric pumpsets, proportion of households owning livestock, average land possessed per capita in the village
- infrastructural variables – presence (or otherwise) of a secondary school in the village, whether there is a public telephone facility in the village and, whether the village has a metalled road
- Management bodies for CPRs – presence (or otherwise) in the village of a local forest management body, a body managing irrigation water and, any body managing water for uses other than irrigation

We discuss below some relevant aspects of the key variables used in the estimation process.

Joint Forest Management & Management of Water Bodies

Besides the local bodies for forest management formed under the Joint Forest Management schemes of the state forest departments, other local bodies such as self-initiated groups and Van Panchayats, recognised by forest authorities are included in the survey. It is revealing that 96% of the villages do not have such bodies for managing forest resources. The data reveals that more than 88% and 86% of the villages do not have any local bodies for managing the common water resources either for irrigation or for other uses respectively.

Household Types

The means of livelihood of a household have been used in classifying the "type" of household in the data. The means of livelihood are decided on the basis of the sources of the household's income during the last 365 days preceding the date of the survey. For the rural household the following classifications as based on the sources of income from economic activities, are thereby used: 1- self-employed in non-agriculture; 2 – self-employment in agriculture; 3 – wage-paid manual labour (rural labour); 4 – wage-paid non-manual employment.

Wage paid manual labour in agriculture, i.e. an agricultural labourer, is defined as one following one or more of the following agricultural occupations in the capacity of a labourer on hire or on exchange: farming, dairy farming, production, cultivation, growing and harvesting of any horticultural commodity, raising of livestock, bees or poultry and involvement in other farm activities, such as forestry or timbering operations, preparation for market or delivery to storage, etc. Wage paid manual labour in fisheries is however, include din other labour and not agricultural labour.

Land Owned & Land Possessed

A plot of land is considered to be owned by the household if permanent heritable possession with or without the right to transfer the title is vested in a member or members of the household. It maybe noted that land held in owner like possession under long term lease or assignment is also considered as land owned. It was found that the average size of land holdings owned was 1.1 ha with a standard deviation of 2. 4.29% of the households did not own any land. The average size of land owned varied widely across regions, from a minimum of 0.01 ha to a maximum of 76.9 ha.

A classification of households on the basis of land owned by them was attempted. For these purposes the size-class of land holdings as per the agricultural census was adopted[4]. The data reveals that out of a total of 65,671 households reporting data on land owned, marginal and small households together constitute more than 67% of the sample. The average land ownership holding at 1.1 ha falls in the "small" size-class.

Land possessed is given by:

Land owned including land under "owner like possession" (long term lease of 30 years or more) + land leased in – land leased out + any land otherwise possessed by the household which is neither owned nor leased in. The last item includes for instance, encroached land. It would thus include all public/institutional land possessed by the household without title of ownership or occupancy right.

[4] Appendix 3 gives the distribution of households according to the land holdings.

As regards lease, land given to others on rent (or free) by the owner of the land, without the owner surrendering the right of permanent heritable title is defined as land leased out. Correspondingly, land leased in is defined as land taken by a household on rent (or free) without any right of permanent or heritable possession.

The distinction between land owned and land possessed is important in the rural context where agricultural cultivation is the most important occupation. Given the fact that land possessed is a broader definition than land owned, it is found that the proportion who do not possess land is lower at 3.66%, than those not owning land. On an average, the size of land possessed is about the same as that owned at 1.11 ha. Looking at state-region differences, the variation across states between the two land ownership and possession figures varies between 5-10%, with some states reporting higher numbers for land owned, and others for land possessed. The data also reveals that the average net sown area across households is also comparable with the data on land owned and land possessed at 1.11 ha.

Infrastructure and other facilities

At the village level it was observed that on an average, an all weather road or a metalled road was available either within the village or within a distance of two kms outside the village. On an average, a railway station was available at a distance of more than 10kms from the village while a post office was available within a distance of 2 kms outside the village. Public phones were available on an average only at a distance of 2 to 5 kms outside the village. Both commercial and rural banks were available at a distance of 5-10 kms from the village. While most villages had a primary school within the village, secondary and higher secondary level schools were located on an average at a distance of 2 to 5 kms and 5-10 kms respectively, outside the village[5].

Possession of Livestock

The data reveals that 54.58% of the households had possessed some livestock during the one year preceding the survey. Given a total of 65,535 households who responded to this item, this implies that 35772 households did possess livestock.

[5] Appendix 4 gives the frequency distribution of villages according to the availability of different facilities.

Quantifying the poor

The data provides very little information in terms of stratifying the sample by economic status. Equating agricultural labour households with the less well off in the rural context, provides a possible starting point for an analysis. It was observed that 2711 villages had households which were classified as "agricultural labour" households, with 17 villages reporting only such households. Across the entire sample, it was found that on an average, 26% of the households in each village could be classified as poor by this definition. *Since there is no direct evidence on poverty in the database, we define poor households as those which own less than 1 hectare of land and do not possess livestock.*

V. Results from the Estimation

The two equations used in the estimation can thus be summarised as follows:

Typepoor = f (valffpc, CPRpcj, avgland, ownlive, secsch, metrod, phone, ownpump)

Valffpc = f (typepoor, CPRpcj, avgland, ownlive, metrod, fmbody, manirr,manoth)

In estimating the simultaneous equation system, various alternative specifications were estimated in order to better understand the underlying hypotheses. Appendix 5 gives the frequency distribution of villages across states in the dataset. The component states of India are quite differentiated in terms of their economic development. These states can therefore be further grouped in terms of their stage of development. For estimation purposes, we consider alternative specifications as follows:

- across all the states
- agriculturally developed states
- industrially developed states
- agriculturally least developed states

For purposes of identifying the agriculturally most developed and the agriculturally least developed states, the states were ranked according to the per capita income from agriculture[6].

[6] Source: Profile of States, Centre for Monitoring Indian Economy, March 1997.

The four states with the highest ranks were Punjab, Haryana, Karnataka and Gujarat. Correspondingly, the lowest ranking states in terms of per capita income from agricultural sector were Bihar, Tamil Nadu, Jammu and Kashmir, Uttar Pradesh and West Bengal. During the estimation, Jammu and Kashmir has not been included since the data is incomplete. Similarly, the per capita income from industry sector has been used for ranking states according to their industrial development. Punjab, Tamil Nadu, Maharashtra and Gujarat are the industrially most developed while Bihar, Jammu and Kashmir, Orissa, Rajasthan and Uttar Pradesh were the least developed.

As mentioned in the preceding section, the two endogenous variables, per capita value of fuelwood and fodder collections from commons and the proportion of poor households in the village, were regressed on a set of exogenous variables using a simultaneous equation specification, and a three stage least squares regression technique. The results from alternative specifications are summarised in table 7.

Table 7 Results from Simultaneous Equation Estimation

Variables	*1. India (All States)*	*2.Agriculturally Developed States*	*3. Industrially Developed States*	*4.Agriculturally Least Develop-ed States*
Typepoor				
Valffpc	-.002*	-0.001*	-0.002*	-0.004*
CPRpcj	-.00001	-.0001	.00002	
Avgland	9.60e-06	.00002	.00009	-.0005*
Ownlive	-0.031	0.128	-.029	0.026
Secsch	0.008	0.011	-.028	0.011
Metrod	-0.011	0.054	.007	
Phone	-0.027*	-.017	-.022	-.053
Ownpump	-0.17*	-.37*	-.202*	
Constant	0.42*	0.32*	0.417*	0.41*
P-value of equation	0.0000	0.0014	0.0000	0.0176
Valffpc				
Typepoor	138.89*	415.07*	21.46	192.78*
CPRpcj	-0.012	0.095*	.0091	
Avgland	0.008	-0.034	.028**	
Ownlive	22.24*	56.29*	27.007*	30.98*
Metrod	-12.49*	-31.62	-41.11*	-13.67*
Fmbody	37.21*	53.37	34.09**	18.75
Manirr	-14.69*	-15.89	-28.85*	-21.64*
Manoth	19.22*	72.79*	15.85*	
Constant	-8.22	-90.25*	37.58*	-42.57
P-value of equation	0.0001	0.0027	0.0000	0.0046
Number of observations	1333	308	497	614

Note: The entries in the table give the coefficient values obtained from the estimation. * denotes that the corresponding t-statistics is significant at the 5% level while ** denotes significance at the 10% level.

The results presented in the above table point towards some interesting conclusions. It is to be noted that both the endogenous variables become significant explanatory variables across the two equations in all the specifications except in the specification for the industrially developed states.

Considering the first specification, across all the Indian states, the results reveal that, better the asset position the lower is poverty. The variable "ownership of pumpsets" captures the influence of assets in explaining poverty. The lower the per capita collections the higher is poverty while the presence of a phone in the village points to the fact that access to infrastructure is associated

with lower poverty. The equation on CPR collections reveals that higher poverty is associated with higher per capita collections. The presence of a metalled road as an indicator of infrastructure and access to alternative opportunities shows that the development indicators are related inversely to the reliance on CPRs. The presence of bodies managing irrigation water shows the characteristics of a private property. The ownership of livestock is associated positively with CPR collections, since higher livestock would mean greater fodder collections. The presence of a local forest management body impacts positively on CPR collections. Similarly, the presence of local bodies for managing common water resources other than irrigation water also impacts positively on CPR collections per capita. On the whole, at the all India level, the safety net role of CPRs emerges as significant.

The agriculturally developed states of Punjab, Haryana, Karnataka and Gujarat, have similar implications for the poverty equation except for the fact that the infrastructure variables (phone) is no longer a significant explanatory variable. As far as factors influencing CPR collections is concerned, the presence of managerial bodies is no longer significant although the availability of CPRs becomes important, while the ownership if livestock continues to be a significant explanatory factor. Infrastructure is once again no longer important for explaining the CPR-poverty relationship. While poverty is evidently still an important factor influencing the value of collections, the availability of CPRs influencing the value of collections as an independent causal factor, could be pointing alongside the safety net argument, to the presence of the complementarity relationship between CPRs and private property.

Considering the industrially developed states of Maharashtra, Punjab, Tamil Nadu and Gujarat, the results on the factors explaining poverty are similar to those obtained for the agriculturally developed states. However, the results on the value of CPR collections differ partially. For these states, poverty is no longer an important explanatory variable explaining dependence on CPRs. Instead, land possessed by households in the village becomes a significant explanatory variable. Thus, asset ownership as reflected through the land possessed and livestock possessed, along with the importance of management bodies for CPR management, gives rise to the reasoning that the collections from CPRs are driven more by private property links rather than by poverty per

se. The hypothesis of complementarity between CPRs and private property resources is upheld for these industrially advanced states.

Finally, a look at the agriculturally least developed states of Bihar, Tamil Nadu, West Bengal and Orissa, where evidence from micro-studies would lead one to expect the strongest links between poverty and CPR collections, in as much as the safety net argument is valid. It is to be noted that specifications with identical exogenous variables as the earlier estimations do not work in this case since the overall explanatory power of the equation was very poor with such specification. Instead, the estimation results presented in table 7, represent the specification that yielded the best results econometrically. It is found that the CPR-poverty linkage is obviously a strong one. Additionally, the land possessed becomes an important explanation for in these states, which is an expected outcome for the less developed states; villages in most of these states also have lesser access to alternative opportunities for employment and income generation. While poverty and the ownership of livestock impact positively on the value of collections, the access to infrastructure impacts negatively.

VI. Concluding Remarks

The simultaneous equation framework yields interesting results. At the All-India level, the CPR-poverty relationship continues to hold with CPRs playing the role of safety nets for the poor. This is also true of the predominantly agricultural states. However, the emergence of a complementarity between CPRs and PPRs in the developed states is revealing. It points towards the possibility of CPRs acting as development drivers. Policy aimed at CPR conservation should take note of this changing role and examine possibilities of value addition linked to CPR based activity. Such initiatives shall constitute another instance of a complementarity between environmental conservation and, income and employment generation.

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APPENDICES

Appendix 1: Methodology for the NSSO Survey of CPRs in India

A stratified multi-stage sampling design was adopted for the survey. The first stage units for the sampling were census villages while the ultimate stage units were the households that were to be surveyed. The survey period was January – June 1998. In all 10,978 villages were planned to be surveyed of which, 5242 were allocated to the Central sample and the rest to the State sample. The former was surveyed mainly by the NSSO field staff while the latter was surveyed by State agencies. For purposes of the present discussion, the focus is only on rural areas and is therefore based on the data collected from villages in the Central sample only. The main schedules used in the 54th round were schedule 1 on consumer expenditure, schedule 3.3 on village facilities and common property resources, and schedule 31 which related to Cultivation Practices and Common Property Resources apart from other heads. For schedule 31, 16 households were planned to be surveyed in each village and in all 78,990 rural households were surveyed for the study.

The list of census villages of the 1991 population census for each state formed the sampling frame. From these list of villages, three strata were initially identified by identifying villages with no population, very small population (range 1 – 50) and very high population (more than 15000). The remaining villages were subsequently considered for the formation of the general strata. The total All India sample of 5242 villages for the Central sample was allocated to the different states in proportion to their investigator strength. Whereas for villages with a very small or no population the sample size allocated ranged between 2 to 6 villages, the number of villages for stratum 3 with high population was either 2 or 4, depending on whether the number of such villages in the stratum was less than 20 or more. The remaining sample was allocated to the general strata in each state in proportion to their population.

For selecting households, all the households of a sample village were first classified into three strata. These were households engaged in free collection (other than fuelwood and marine fishing), households possessing land less than 0.40 ha and all the rest formed strata 3. As mentioned earlier, for schedule 31 a sample of 16 households from each selected village was surveyed. The 16 households selected from such a sample village, were allocated among these three household strata in proportion to the number of households in each sampling frame subject to a minimum allocation of 4,2 and 2 households respectively in strata 1, 2 and 3. The sampled households were selected by circular systematic sampling with random starts in each stratum.

It becomes fairly obvious from the above brief description of the sampling procedure that the sampling was done in a comprehensive and unbiased manner, keeping in view the need to develop a dataset that would accurately reflect the state-level macro picture. It is of interest to see how far these overall state and all India level estimates on contribution of Common Property Resources compare with the evidence gathered by micro studies conducted in different states of India.

Appendix 2 : Pairwise Correlation Coefficients on Variables Used in the Econometric Estimations

	CPRpcj	avgland	ownlive	ownpump	secsch	metrod	phone	fmbody	manirr	manoth	valffpc	typepoor
CPRpcj	1.0											
Avgland	0.08	1.0										
Ownlive	-0.01	0.22	1.0									
Ownpump	-0.01	0.24	0.29	1.0								
Secsch	0.06	10.01	-0.2	-0.09	1.0							
Metrod	0.05	-0.04	-0.26	-0.04	0.27	1.0						
Phone	0.07	0.02	-0.19	-0.003	0.30	0.32	1.0					
Fmbody	0.07	0.005	0.04	-0.02	-0.002	-0.04	-0.01	1.0				
Manirr	0.01	-0.04	-0.10	-0.03	0.065	0.09	0.09	0.04	1.0			
Manoth	-0.01	0.001	-0.05	-0.006	0.072	0.08	0.06	0.09	0.26	1.0		
Valffpc	-.001	0.065	0.100	-0.041	0.083	0.139	0.122	-0.07	0.024	-0.033	1.0	
Typepoor	-.008	-0.02	-0.086	-0.161	0.035	-0.018	0.006	0.05	-0.063	0.019	-0.012	1.0

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Appendix 3: Size-class Distribution of Land Owned

Category	*Size-Class (ha)*	*Percentage households*
Marginal	Less than 1	55.19
Small	Less than 1.99 & Greater than 1	12.21
Semi-medium	Less than 3.99 & Greater than 2	8.77
Medium	Less than 9.99 & Greater than 4	4.26
Big	Greater than or equal to 10	19.57

Appendix 4: Availability of Facilities in Villages

Facility Type	*Total no. of Villages*	***Availability of Facility (percentage villages)***				
		Within Village	Outside Village: upto 2 km	2-5 km	5-10 km	above10 km
All weather road	5038	72.04	10.42	9.07	4.74	3.73
Metalled road	5034	60.23	13.31	12.93	7.23	6.30
Railway Station	5031	2.37	3.64	9.47	15.19	69.33
Post Office	5041	48.62	19.78	21.82	6.39	3.39
Public Telephone	5037	30.44	9.25	17.41	17.51	25.39
Commercial Bank	5038	13.91	9.83	24.55	24.04	27.67
Rural Bank	5032	9.68	7.85	22.73	24.86	34.88
Primary School	5039	88.70	7.34	2.86	0.54	0.56
Secondary School	5038	35.27	16.42	27.03	13.52	7.76
Higher Secondary School	5033	12.60	9.40	24.14	23.96	29.90

Appendix 5: Frequency Distribution of Villages Across States

State / UnionTerritory	*Number of Villages*	*Cumulative Percentage*
Andhra Pradesh	364	7.20
Arunachal Pradesh	49	8.17
Assam	245	12.22
Bihar	476	21.64
Goa	16	21.95
Gujarat	190	25.71
Haryana	79	27.27
Himachal Pradesh	127	29.79
Jammu & Kashmir	109	31.94
Karnataka	191	35.92
Kerala	182	39.52
Madhya Pradesh	369	46.82
Maharashtra	344	53.62
Manipur	55	54.71
Meghalaya	70	56.09
Mizoram	40	56.88
Nagaland	56	57.99
Orissa	220	62.34
Punjab	162	65.55
Rajasthan	228	70.06
Sikkim	60	71.24
Tamil Nadu	326	77.89
Tripura	76	79.39
Uttar Pradesh	637	91.99
West Bengal	337	98.66
Andaman&Nicobar Islands	38	99.41
Chandigarh	4	99.49
Dadar & Nagar Haveli	4	99.56
Daman & Diu	4	99.64
Delhi	14	99.92
Pondicherry	4	100.00
Total	*5056*	