

Livestock and poverty reduction in India: Findings from the ODI Livelihood Options Project



Priya Deshingkar, John Farrington, Laxman Rao, Shaheen Akter
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Discussion Paper No. 8
Targeting and Innovation

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Acronyms and abbreviations

AP	Andhra Pradesh
BC	Backward Caste
BYP	Backyard Poultry
CPR	Common Pool Resource
DFID	Department for International Development
FAO	Food and Agriculture Organization of the United Nations
FC	Forward Caste
FGD	Focus Group Discussion
GDP	Gross Domestic Product
GOI	Government of India
HH	Household
ILRI	International Livestock Research Institute
IRDP	Integrated Rural Development Programme
LO	Livelihood Options
MP	Madhya Pradesh
NGO	Non Governmental Organization
NSSO	National Sample Survey Organization
NTFP	Non-timber Forest Products
NWDPRA	National Watershed Development Project for Rainfed Areas
OC	Other Caste
ODI	Overseas Development Institute
PDS	Public Distribution System
RIR	Rhode Island Red (high yielding chicken breed)
SC	Scheduled Caste
SLU	Standard Livestock Unit
ST	Scheduled Tribe
WLH	White Leg Horn (high yielding chicken breed)

Glossary of terms

Backward Castes	Intermediate castes between Scheduled Castes and upper castes. Also known as Other Backward Castes, they are basically service castes in the traditional hierarchy such as carpenter, barber, potter, ironsmith etc.
Caste system	A rigid hierarchical system of Hindu society comprising endogamous social classes (castes) based on ritual purity. Castes with 'unclean' occupations have lower status. Official classification groups them into three categories: Scheduled Castes, Backward Castes and Forward Castes.
General category	Upper castes in the Hindu caste hierarchy, also known as 'open category' or 'Forward Castes' for administrative purposes. We used 'other castes' in this paper.
<i>Kharif</i>	First crop season after the monsoons, i.e. June to September.
Lambada	Nomadic non-indigenous Scheduled Tribe migrated to the south from north India, now a settled community.
Madiga	A major Scheduled Caste in AP; more backward than malas.
Mala	A major Scheduled Caste in AP with relatively higher status than madiga
Mandal	Intermediate administrative unit in AP between district and village comprising 20–25 villages.
Ovines	Sheep and goats are collectively referred to as ovines.
<i>Rabi</i>	Second crop following <i>kharif</i> , usually October–February
Reddy	An upper caste in AP. Traditionally farmers now diversified into services and business/trade.
Scheduled Castes	Former untouchables with lowest status in Hindu caste hierarchy.
Scheduled Tribes	Tribal communities scheduled or notified by the President of India. STs are traditionally outside the Hindu caste hierarchy.
Summer	Third crop following <i>Rabi</i> , usually March–May

List of selected villages

OP	Well connected village of Chitoor district, Andhra Pradesh
VP	Poorly connected village of Chitoor district, Andhra Pradesh
KO	Well connected village of Krishna district, Andhra Pradesh
KA	Poorly connected village of Krishna district, Andhra Pradesh
GU	Well connected village of Medak district, Andhra Pradesh
MD	Poorly connected village of Medak district, Andhra Pradesh
PR	Well connected village of Ujjain district, Madhya Pradesh
LJ	Poorly connected village of Ujjain district, Madhya Pradesh
GG	Well connected village of Mandla district, Madhya Pradesh
PT	Poorly connected village of Mandla district, Madhya Pradesh
SM	Well connected village of Tikamgarh district, Madhya Pradesh
MB	Poorly connected village of Tikamgarh district, Madhya Pradesh

Executive summary

This paper is based on data collected under the Livelihood Options Project,¹ a three year DFID funded policy study located in the Indian States of Andhra Pradesh (AP) and Madhya Pradesh (MP). The purpose of the project was to identify factors promoting or impeding diversification out of low productivity livelihoods, and identify the policy changes necessary to support upward trajectories and prevent downward ones.

This paper explores the role of livestock in rural livelihoods and its potential to assist people in escaping poverty using a combination of quantitative and qualitative methods. The main conclusions are that:

- The livestock economy is gaining in importance with changing consumer tastes towards meat and dairy products.
- Farm size, the extent of, diversification and total assets all correlated positively with livestock ownership.
- Poorer households gain more than the richer from diversification in general and diversification through livestock in particular.
- Dairy farming is spreading especially in areas that are well connected with urban markets. Where veterinary backup and credit are accessible, small and marginal dairy farmers have benefited. However, caste-related constraints prevent certain social groups from engaging in dairying and certain other livestock activities because many upper caste people are reluctant to purchase milk or livestock products directly from them.
- Poorer households are less likely to keep larger species without external support.
- Small ruminants, especially goats, and backyard poultry offer better prospects to landless and marginal farmers for escaping poverty.
- Seasonal migration is rapidly gaining in importance in marginal areas but its relationship with livestock keeping is complex. Households with at least one migrant tend to keep fewer bovines, but this may simply be because their smaller farm size does not warrant keeping bulls, and dairy is associated in any case with higher income households. Migrant households do tend to keep goats and poultry.
- There are serious questions over the environmental sustainability of livestock keeping practices, for instance in relation to free-grazing and the deterioration of communal grazing lands and these need to be urgently addressed through appropriate institutional, technological and policy reform.
- A wide range of arrangements exist for joint rearing of livestock and poor people benefit from the livestock economy partly as share-rearers and herders, and partly as livestock owners in their own right. However, herding has negative consequences too especially for children who are commonly employed for this purpose.

1. www.odi.org.uk/livelihoodoptions.

- In general, the poor are less able to increase their welfare through livestock than the rich and the poor would be pushed back into depending on CPRs and traditional occupations if sectoral interventions are not tailored carefully towards being more pro-poor. In order to move out of poverty through livestock, the poor require support to better access to technology, capital and information.
- Location-specific differences should be given priority in livestock intensification programs using appropriate mapping. Such programs should be based on pro-poor technology which poorer people can afford.

1 Introduction

In traditional crop–livestock economies animals are an important asset and are kept to provide a steady source of products, draught power and capital when needed (Roland-Holst 2007). Compared to land, livestock is a more flexible asset that can be relatively rapidly built up and drawn down depending on particular household circumstances and external environmental conditions. Thus animals can be bought when the household has funds to spare and there is plenty of fodder and grass available, or sold when there is urgent need for money for marriage, sickness or education or when there is drought. On the other hand, livestock are subject to covariant risk (drought, flooding, epidemic disease), and the loss of large livestock units, or the pressure to sell them while prices are low (e.g. during drought) in order to meet cash needs, can be devastating to the household economy.

Livestock enterprise is also perceived by many to be a more pro-poor option than land-based enterprise because the distribution of the former tends to be more equitable than land (Ravishankar and Birthal 1999). Although small and marginal farms account for only 32% of the total land in India they own 59% of total bovines and 64% of total ovines (Rao et al. undated). Pasha (2005) further notes that although the bottom 60% of rural households own only 41% of total milch animals, their share in ownership of bovines is showing an increasing trend. Further, around two thirds of livestock, particularly cattle, sheep/goats and poultry, are maintained by small and marginal farmers and landless labour. By contrast with buffaloes, there is no evidence that new breeds for milk production (i.e. crossbreds) are being kept predominantly by medium/large farmers, suggesting that they are in some measure a scale-neutral technology. However, what is important to bear in mind in the Indian context is that poverty is associated with membership of the Scheduled Castes and Tribes (SCs and STs) and that higher castes are unlikely to purchase milk from them especially in the more traditional villages, so that this will place a limit on the extent to which SCs and STs can engage in milk production for sale.

India is predominantly a mixed crop–livestock economy where landless households and poor farmers use a combination of family labour, crop residues produced on their own land, purchased feed and free grazing to rear animals. India continues to have one of the largest populations of livestock in the world with nearly 185 million cattle according to the 2003 livestock census.¹ In addition the country has 88 million buffaloes, comprising 58% of the world's buffaloes; around 123 million goats, and 51 million sheep,² comprising 5% of world's sheep. Animal/land ratios are high: an average land holding size of 1.57 ha supports nearly 2.94 bovines and 1.14 ovines.³ Since stall-feeding is still limited, pressure on common property resources is intense.

However, livestock numbers in relation to human populations appear to be going down. Table 2 below indicates that livestock numbers per 1000 of the rural population at the all-India level in 2003 were lower at 654 compared to 749 for 1992, the biggest reduction taking place for indigenous cattle, while crossbreds increased, and there was little change in buffalo, sheep or goats, suggesting that nondescript cattle are being replaced by more specialized milk enterprises

1. Down from 205 million in 1992.

2. National livestock census data broken down by state and livestock type are given for 1992, 1997 and (provisional data) for 2003 in Annex tables A1.1–A1.3.

3. Rao et al. undated.

(crossbreds; buffalo) or, in their draught role, by mechanical power, with sheep and goats continuing to fill niches (in terms of ecology, livestock products and size of unit) which are important for the poor.

Table 1. *Distribution of livestock ownership by farm size—all India*

Farmer category	Crossbred	Indigenous cattle	Total cattle	Buffaloes	Sheep and goats	Poultry
Large	1.1%	1.6%	1.6%	4.8%	4.7%	1.1%
Medium	7.7%	8.3%	8.3%	14.4%	9.7%	4.2%
Semi-med	13.8%	16.8%	16.6%	20.2%	15.0%	14.4%
Small	18.4%	24.3%	24.0%	21.7%	19.3%	19.1%
Marginal	55.9%	46.5%	47.1%	36.1%	46.2%	54.8%
Landless	3.1%	2.4%	2.4%	2.8%	5.1%	6.4%
Total	100	100	100	100	100	100

Source: Calculated from the Distribution of Land and Livestock Holdings in India, 1992 (NSSO), Land and livestock holdings NSSO 1997 Ministry of Statistics and Programme Implementation, GOI.

Note: Up to 0.5 acre: submarginal farmer; up to 1.25 acres: semi-marginal; up to 2.5 acres: marginal; up to 5 acres: small; up to 10 acres: semi-medium; 10–25 acres: medium; >25 acres: large.

Table 2. *Changing density of ownership by livestock type, all India, 1992–2007.*

All India	Crossbred cattle	Indigenous cattle	Cattle	Buffaloes	Sheep	Goats	All livestock	Poultry
Livestock/1000 rural population 1992	24	301	325	134	81	183	749	488
Livestock/1000 rural population 2003	33	216	250	132	83	168	654	617
Livestock/1000 rural population 2007 ^a	44	144	184	130	85	154	565	762

Source: Livestock Census 1992 and 2003, Human Census 1991 and 2001.

a. 2007 figures are estimates, the authors forecasted them based on annual geometric growth of livestock per 1000 rural population calculated from the previous two data points using the formula: current value = last value(1+(ln(last value/earlier value)

*(Number of years between two values)²/100).

A notable trend in recent years has been a sharp increase in goat-keeping among the poor. Numbers have increased rapidly in the last five decades from 47.2 million in 1951–52 to 115.3 million in 1991–92 with a mean rate of increase of 1.7 million per year (3.6%) (Table 3). This rate of increase is much higher than that found in the case of other economically important livestock such as cattle, buffaloes and sheep. According to current projections the number of goats will reach 137 million by 2005 and stabilize after that. Assuming annual geometric growth since 1990 our prediction is 131 million by 2010.

Table 3. *Changing trend in goat ownership, all-India, 1951–2010*

Goats (thousand)	1951	1961	1970	1980	1990	2000	2010 ^a
Total	47,200	60,864	66,526	86,900	115,300	123,000	130,952

Source: Livestock Census (1992).

a. An estimate of the authors based on annual geometric growth calculated from the previous two data points using the formula: current value = last value(1+(ln(last value/earlier value)*(number of years between two values)²/100).

2 Economic importance of livestock

By all accounts the importance of livestock in livelihood portfolios and the country's economy is increasing. The contribution of livestock to India's GDP increased from 4.8 to 5.9% between 1980 and 1998 and then up to 10% in 1994–95 (Rao et al. undated; Pasha 2005). Its contribution to agricultural GDP increased from 13.9 to 23.4% during the same period (Rao et al. undated). Recent estimates from the FAO put the output value contribution from the Indian livestock sector to national GDP at about 40.6% of the total contribution from agriculture and allied sectors. As of 2000 the total value of livestock output was estimated at about US\$35 million.

Commonly cited reasons for this rising trend are: changing dietary preferences towards meat, poultry and milk associated with increasing incomes and urbanization as well as the rapid spread of the dairy industry. However, in some of the contexts reported in this paper (e.g. some villages in AP), drought has made crop cultivation more risky, and increases especially in goat and sheep numbers may be in part a response to this phenomenon.

Increases in the sector have been mainly due to increases in numbers of livestock though there have also been increases in productivity, associated with, for example, the introduction of cross-bred cattle for dairy purposes. Policymakers and researchers are now trying to bring in technological changes in breeds, feeds, rearing practices, veterinary care and yields but progress in this direction has been limited, especially among low income producers. There is a need for a greater understanding of the constraints faced by the poor in adopting new breeds and technologies and it is hoped that the findings presented in this paper will provide useful insights from the field.

3 Macro level trends in AP and MP

Trends in livestock keeping differed between the two states under consideration. In Andhra Pradesh, livestock densities rose significantly from 677 per 1000 rural population in 1992 to 873 in 2003 (Table 4). During this time overall poverty rates in the state declined by 22.2% in 1993 to 15.8% in 2000, but it would be inappropriate to infer simply from these data a positive relationship between poverty reduction and livestock keeping. A marked increase is seen in the number of sheep, goats and crossbred cattle. Sheep and crossbred cattle have been promoted through government animal husbandry programs and matching credit schemes. With the right backward and forward linkages, they are high-return options even for those without land. Buffalo numbers have also increased but not as dramatically, probably because crossbred cows are more profitable. At the same time there is a sharp decrease in indigenous cattle. The trend with respect to goats is somewhat surprising given the strongly anti-goat stance of the State government which imposed severe restrictions on goat-keeping (more on this below). In fact the rate of increase in goats has been greater than in MP (although overall densities remain much lower). A rise in goat numbers could indicate a rise in wealth but an inability to take advantage of schemes to promote sheep and cattle due to unavailability of veterinary services, stall feeding facilities and fodder crops. We return to the subject of goats at a later point in the paper. Poultry numbers are very high in AP and it is the leading State in egg and chicken production with a number of large poultry farms set up by wealthy farmers. These are reported to operate with considerable economies of scale, and have begun to dominate urban markets for poultry meat and eggs, so that small producers are increasingly limited to local markets.

Table 4. *Changing patterns of livestock ownership by type, MP and AP States, 1992–2007*

States	Crossbred cattle	Indigenous cattle	Cattle	Buffaloes	Sheep	Goats	Livestock	Poultry
Livestock/1000 rural population AP, 1992	10	215	225	188	160	89	677	1026
Livestock/1000 rural population AP, 2003	20	148	168	193	387	114	873	1846
Livestock/1000 rural population AP, 2007 ^a	34	93	119	198	729	142	1095	2930
Livestock/1000 rural population MP, 1992	4	560	564	157	16	165	919	232
Livestock/1000 rural population MP, 2003	7	420	427	171	12	184	804	264
Livestock/1000 rural population MP, 2007 ^a	11	299	308	186	9	204	697	298

Source: Calculated from Livestock Census 1992 and 2003, Human Census 1991 and 2001.

a. 2007 figures are estimates, the authors forecasted them based on annual average growth of livestock and rural population calculated from the previous two data points using the formula .

In the case of Madhya Pradesh, livestock densities have decreased, possibly indicating diversification into other activities due to the non-availability of fodder and growing seasonal migration. While the number of cross-bred cattle has increased, it is noticeable that numbers remain very low at just 7 animals per 1000 of the population against 20 in Andhra Pradesh. And although the number of indigenous cattle has gone down it still remains more than twice as high as AP implying that the State appears more traditional in its pattern of livestock keeping. There is little tradition of sheep rearing, and numbers have declined in the last decade, while the number of goats has increased and is much higher than AP. It should be noted that the population of goats and buffaloes decreased between 1992 and 1997 but the 2003 livestock census shows an increase in both (GOI 2006).

Unlike the all India average, the ownership of bovines and ovines is not as heavily skewed towards marginal farmers. Medium and large farmers own more cattle and buffaloes than marginal farmers. The same is true of sheep and goats as well. Marginal farmers do slightly better on poultry, owning nearly 30% of it. In contrast in AP the ownership of bovines and ovines is heavily skewed towards marginal farmers. Poultry is clearly an enterprise for the poor; while the landless own nearly 30% of all poultry, marginal farmers own 52%.

Table 5. *Distribution of livestock ownership in AP by farm size category*

Farmer category	Crossbreds	Indigenous cattle	Total cattle	Buffaloes	Sheep and goats	Poultry
Large	0.9%	0.4%	0.4%	1.3%	0.1%	0.3%
Medium	3.7%	3.1%	3.2%	5.7%	3.8%	2.5%
Semi-medium	6.8%	10.2%	10.0%	12.7%	7.3%	7.8%
Small	9.0%	13.6%	13.3%	14.6%	13.9%	8.1%
Marginal	79.7%	70.2%	70.5%	59.3%	63.5%	51.7%
Landless	.0%	2.5%	2.6%	6.3%	11.4%	29.6%
Total	100	100	100	100	100	100

Source: Calculated from the Distribution of Land and Livestock Holdings in India, 1992 (NSSO), Land and Livestock Holdings 1997 (NSSO), Ministry of Statistics and Programme Implementation, GOI.

Table 6. *Distribution of livestock ownership in MP by farm size category*

Farmer category	Crossbreds	Indigenous cattle	Total cattle	Buffaloes	Sheep and goats	Poultry
Large	2.7%	2.3%	2.3%	10.1%	2.0%	0.8%
Medium	26.7%	15.1%	15.4%	24.2%	11.9%	7.6%
Semi-medium	27.2%	29.3%	29.3%	26.0%	29.9%	19.7%
Small	14.5%	26.9%	26.6%	20.8%	24.6%	24.0%
Marginal	18.9%	22.5%	22.4%	14.5%	25.7%	29.8%
Landless	10.0%	3.9%	4.0%	4.3%	5.9%	18.1%
Total	100	100	100	100	100	100

Source: Calculated from the Distribution of Land and Livestock Holdings in India, 1992 (NSSO), Land and Livestock Holdings 1997 (NSSO), Ministry of Statistics and Programme Implementation, GOI.

4 Methodology

Study design

Field work for the Livelihood Options (LO) study was conducted in six districts in all, with one district each from three regions of AP, and the same pattern for MP. The intention in each State was that these three regions should represent divergent historical, political and agro-ecological conditions and therefore distinct patterns of livelihood evolution and diversification. The regions chosen for AP were Telangana, Rayalaseema and Coastal Andhra, and for MP, Malwa, Bundelkhand and Mahakoshal. After considerable discussion with key informants a decision was taken to locate the fieldwork within Medak, Chittoor and Krishna districts of the three AP regions, and Ujjain, Tikamgarh and Mandla districts of the three MP regions. Within each district, two contrasting villages were selected for detailed household level study. The selection of villages was guided by a number of different criteria including proximity to urban areas, roads and markets; social and economic indicators of development; absence of factionalism and extremism; coverage by pro-poor programs; whether studied in the past (as this would facilitate longitudinal analysis) as well as the presence of civil society organizations.

The summary information of the selected districts and villages is shown in Box 1 (details are available in Farrington et al. 2006).

Data collection methods

Basic information on occupation structures, caste, annual income and asset ownership for the period 2001/02 was collected through a census survey in 2002 that covered all 4647 households in AP and all 1297 in MP. A total of 360 households were chosen for more intensive study in AP and a similar number in MP. Sample sizes for the villages varied from 40–80 households, depending on the size of the village, and were selected through stratified random sampling by landholding and caste. This was done because land and caste¹ continue to be major axes of wealth and power.² In addition to this, qualitative data were also collected from district and Mandal-level officials, key informants at the village level, and poor households across all locations. Focus group discussions (FGDs) were used as a tool to understand structures of power and patronage as well as exclusionary processes and how these impacted on beneficiary selection, identification of contractors and works as well as village-level modifications to wages adopted during the program. One research officer was based in each village for the entire duration of the data collection, so that ‘participant observation’ methods were also used.

1. Studies on caste and poverty have shown that poverty is worse among historically marginalized groups (Borooh 2005), and in AP and MP, as in the rest of India, these are the dalits (SC) and tribals. The dalits are the lowest in the Hindu hierarchy, the so-called ‘untouchables’ who had to do ‘unclean’ jobs such as skinning carcasses and cleaning out latrines and drains. Although the practice of untouchability was abolished in 1955, discrimination still continues and dalits are among the poorest and least educated in India. The tribals have suffered from large-scale displacement and destitution due to the destruction of indigenous forest-based livelihood systems.

2. Our research suggests some changes in this pattern, namely that landlessness is now less associated with poverty, since the landless have more flexibility than marginal farmers to take advantage of opportunities for remunerative work outside agriculture as and when they arise (Deshingkar and Start 2003).

Box 1: Summary information for sample districts and villages in AP and MP

ANDHRA PRADESH		
Chittoor (Rayalseema) OP (near) & VP (far) ¹	Krishna (Coastal Andhra) O (near) & KA (far)	Medak (Telangana) GU (near) & MD (far)
Semi-arid, tank and tube well irrigated, well connected with large cities, groundnut, paddy, mulberry, tomato BCs have emerged as powerful in remote village recently More equitable land holding Both villages OP and VP are drought prone but VP has more labour market linkages Rich keeps more livestock Livestock keeping is more stable in OP than in VP over the recent years	Agriculturally prosperous, canal irrigated, intensively farmed paddy, pulses, sugarcane Mixed caste but Forward Caste (FC) dominated Polarized land distribution KO better-off and well connected than KA KO-Livestock keeping is lower than poorer villages, lower castes keep more than the higher castes; KA- livestock raising is higher, higher castes keep more	Semi-arid, socially backward, mainly tank and tube well irrigated or rainfed agriculture, sorghum, paddy, cotton, maize Traditional caste hierarchy Land distribution still along feudal lines in remote village GU lies in the industrial zone with recorded livestock keeping and MD is a remote village with livestock raising higher than GU
MADHYA PRADESH		
Ujjain (Malwa) PR (near) & LJ (far)	Tikamgarh (Bundelkhand) GG (near) & PT (far)	Mandla (Mahakoshal) SM (near) & MB (far)
Agriculturally prosperous. Deep black cotton soils, semi-arid, tube well irrigated, soybean and wheat. Mixed caste Polarized land distribution Commercial dairying has long been practised in PR, declining trend of livestock in LJ	Hilly, forested, often infertile shallow black soils. Limited irrigation and limited spread of intensive agriculture. Rice & pulses Large number of tribals More equitable land holdings Uncontrolled encroachment of common land is observed in GG partly causing downward trend of livestock Deforestation and restriction on free grazing in PT is largely responsible for the downward trend of livestock, particularly large ruminants	Average agricultural development. Medium to shallow black soils, well and tank irrigation, soybean, pulses, rice and wheat. Caste hierarchies from feudal legacy Polarized land distribution Access to market is better in SM than in MB In SM stall-feeding technology is introduced recently due to shrinkage of grazing land In MB livestock was not historically important

1. Villages are given a two-letter code to protect their anonymity. OP, KO and GU are well connected villages in AP; VP, KA and MD are poorly connected villages in AP; PR, GG and SM are well connected villages in MP; and LJ, PT and MB are poorly connected villages in MP.

Three quantitative surveys were conducted. The first was a census—where every household was covered. The questionnaire was pre-tested, revised and translated. It was designed to collect basic information on demographics, occupation structure, income, assets and access to pro-poor programs.

Next, two seasonal surveys were conducted one for *kharif*, the main growing season and another for *rabi*.³

The samples for these surveys were selected by stratifying the population based on the census data. The stratification was done on the basis of landholding and caste. Proportionately more households were selected from the category of the landless poor to ensure that diversity within poor groups was captured.

The sample was studied first for the preceding *kharif* season and covered the cropping pattern, farm budgets, crop area, marketing, and prices. The same sample was surveyed in *rabi*. A much smaller number of households, roughly 15 per village were chosen for detailed life histories to understand life shaping events and trajectories.

Analytical framework

This paper mostly uses tabular analysis to present the results in ratios and percentages. However, household income–livestock asset relationships and livestock ownership are analysed using a multivariate framework. Household resources and external factors affect household income in a number of ways. According to neo-classical models of farm households, total household income is the aggregate measure of output flows generated by asset flows through activities, and so total income is expressed as a function of asset variables (human, physical and social) as well as household characteristics and other uncontrollable variables such as infrastructure, institution, market condition etc. (Tylor and Yunez-Naude 2000; Zeller and Minten 2000; Winters et al. 2001). According to livelihood approaches, livelihood and income are not synonymous but they are nevertheless inseparably connected because income is the most direct and measurable outcome of the livelihood process (Ellis 2000). The livelihood approach emphasizes the role of household resources as determinants of activities and highlights the link between assets, activities and incomes. In this paper, our approach was somewhat heuristic: we specified an income equation drawing on the relationships between assets, activities and other variables with total income.

3. Only one seasonal survey was conducted in the MP villages, *Kharif* season comprises June–September period and *Rabi* season comprises October–February period.

5 Study findings: Broad patterns

Livestock and farmer category

Out of a total of 4647 households in AP census survey, 40% either owned livestock or held them under various sharing arrangements; this was rather lower than in the MP case (68%, Table 7). We attribute this more to the characteristics of the individual villages surveyed than to any wider differences between the states: for instance, some AP villages were seriously drought-affected. Village to village differences in AP (adoption rate ranged from nearly 19 to 63%) was much higher than MP (adoption rate ranged from almost 47 to 73%).

In MP, livestock ownership was most widespread in Tikamgarh (73% of households had livestock) followed by Ujjain (71%) and Mandla (58%). Tikamgarh and Ujjain have still relatively large tracts of grazing land. In terms of villages, MB had 75% of the houses owning livestock, followed by LJ and SM (72%), then PT and PR (69%) were close behind. Lowest levels were recorded in GG (46.5%).

There appears to be a strong link between land ownership and livestock ownership; about 94% of the large farmer households owned livestock in AP and the rate was even higher in MP (about 96%). Correlation coefficient between standard livestock unit (SLU) and land area in acres was much higher in MP (0.56 in MP and 0.18 in AP), nonetheless statistically highly significant in both states.¹ This correlation pattern probably corresponds to the dominance of large ruminants in MP, particularly indigenous cattle, which require more fodder/grazing land whilst AP livestock is dominated by poultry, which require no fodder/grazing land.

A fair number of landless, submarginal, semi-marginal and marginal farmers also owned animals. Although livestock keeping is popular among the landless, this group keeps lower SLUs than other groups in both AP and MP.² As many as 22.9% of landless households in AP and 31.5% of landless households in MP owned animals. This was possible because they could either purchase feed or in the case of coastal villages with assured irrigation, they could lease in productive land which they then could use for fodder or grazing or they could keep poultry, goat or stall-fed animal. In AP more than 52% of the landless with livestock raised poultry; a half of them resided in the well connected village KO. This implies that development of infrastructure could help the landless to diversify livelihoods through a species that requires no land. Another 9% kept cows and 6% kept goat. In all cases most of these landless farmers were located in the well connected villages.

The level goes up sharply for those who have even a tiny plot of land: in MP, 62.5% of the submarginal and 63.3% of the semi marginal households have animals. The figure for marginal households is 71% in MP and more than 62% in AP. Livestock ownership is therefore concentrated among smallholders and landless households in our study villages, a trend that is closer to the all India average.

1. Definition of SLU is given in Table 9.

2. Descriptive tables are provided in Appendix 2.

Table 7. Proportion of farms owning livestock, by farm size category: Andhra Pradesh and Madhya Pradesh

Land Categories	Andhra Pradesh			Madhya Pradesh		
	With Livestock %	Without Livestock %	Total	With Livestock %	Without Livestock %	Total
Large	93.5 (29)	6.5 (2)	100 (31)	95.5 (42)	4.5 (2)	100 (44)
Medium	79.5 (130)	20.5 (36)	100 (166)	94.9 (131)	5.1 (7)	100 (138)
Semi-medium	66.0 (163)	34.0 (84)	100 (247)	87.2 (163)	12.8 (24)	100 (187)
Small	65.9 (292)	34.1 (166)	100 (458)	80.2 (182)	19.8 (45)	100 (227)
Marginal	62.3 (301)	37.7 (193)	100 (494)	70.9 (144)	29.1 (59)	100 (203)
Semi-marginal	51.1 (240)	48.9 (232)	100 (472)	63.3 (93)	36.7 (54)	100 (147)
Submarginal	35.1 (80)	64.9 (162)	100 (242)	62.5 (35)	37.5 (21)	100 (56)
Landless	22.9 (570)	77.1 (1967)	100 (2537)	31.5 (93)	68.5 (202)	100 (295)
All/Total	39.6 (1841)	60.4 (2806)	100 (4647)	68.1 (883)	31.9 (414)	100 (1297)

Pearson correlation coefficient between land and standard livestock unit is 0.175 in AP and 0.56 in MP, both are statistically highly significant at 1%.

Based on 2002 census data for 2001/02, figures in parentheses are frequencies.

Livestock types by caste categories

Moving on the census data we note that caste-specific differences are visible in many cases (Table 8). The general category (OC) keeps more poultry in AP (2046 birds per 100 households) but none in MP.³ This is because poultry technology is more developed in AP and the general caste is much ahead of reaping the benefits of such development. Goats are distributed among all Backward Castes including Scheduled Tribes and Scheduled Castes but in MP, Scheduled Caste farmers keep more goats than other caste categories. Large ruminants are widely distributed among different categories; nonetheless OC keeps more buffaloes in AP (61 heads per 100 households compared to 27 heads per 100 households in MP) and Scheduled Tribes keep more cows in MP (89 heads per 100 households compared to 43 heads per 100 households in AP).

3. Average number of poultry per 100 households in AP (742 birds) appear much higher than the country rural average of 123 birds per 100 households in 2002/03, whilst at the same time the MP average is much lower (GOI 2006).

Table 8. *Distribution of livestock by types and caste category, AP and MP, 2001/02*

Village	Bullock	Cows	Buffaloes	Goats	Sheep	Pigs	Poultry
AP (Livestock/100 households)							
ST	38	43	16	17	6	32	58
SC	12	13	23	13	7	1	64
BC	23	18	37	18	49	0	182
OC	22	14	61	3	6	0	2046
Total	21	16	42	12	26	1	742
MP (Livestock/100 households)							
ST	69	89	12	14	0	0	66
SC	45	38	11	46	1	8	11
BC	88	78	47	24	1	0	8
OC	21	50	27	0	0	0	0
Total	76	72	36	25	1	1	15

Data source: Census survey 2002, ODI

6 Explaining variations in income and livestock keeping

The objective of the following multivariate analysis is to provide further insights into how household income is correlated with livestock and other asset variables. The variables included in this analysis are presented in Table 9. To control for variation in household size, dependent and independent variables are normalized by household adult equivalent units.

Table 9. *Definition of variables in the income function*

Variables	Definition
Y	Log of household net annual income per adult equivalent, conversion factors used to calculate adult equivalent are: males older than 14 years = 1, females older than 14 years = 0.8 and children 14 years or younger = 0.5.
SLU	Log of standardized livestock unit per adult equivalent. Conversion factors used to calculate SLU are: bull = buffalo = 1, cow = 0.7, goat = sheep = 0.1, pig = 0.4, poultry = duck = 0.02.
Assets	Log of total value of assets (other than land and livestock) in India Rupees (INR) ¹ per adult equivalent.
Land	Log of total land owned in acres per adult equivalent.
WetL	Log of proportion of wet land to total land owned.
Schooling	Log of household years of schooling per adult equivalent.
Diversity	Diversification index (Herfindahl-Hirschman index) per adult equivalent ²
D1	Dummy variable for household member migration (1 = yes, 0 = no).
D2	Dummy variable for household having remittance income (1 = yes, 0 = no).
D3	Dummy variable for money lender loan for investment (1 = yes, 0 = no).
D4	Dummy variable for bank loan for investment (1 = yes, 0 = no).
D5	Dummy variable for Scheduled Tribes (1 = yes, 0 = no).
D6	Dummy variable for Scheduled Caste (1 = yes, 0 = no).
D7	Dummy variable for Backward Caste (1 = yes, 0 = no).
V1–V5	Village dummies: In AP, V1 = 1 for VP, V2 = 1 for KO, V3 = 1 for KA, V4 = 1 for GU, V5 = 1 for MD; in MP, V1 = 1 for LJ, V2 = 1 for GG, V3 = 1 for PT, V4 = 1 for SM, V5 = 1 for MB.

1. INR (India Rupees). In March 2008, USD 1 = INR 39.89.

2. The value of this index ranges from 1 to number of activities taken into account (6 in this case). The higher the value of the index the greater the diversification.

On choosing the variables, the theoretical link between asset, activity, income and other variables affecting the choice of activity as discussed in section 4 was taken into consideration. We would expect the sign of the first six continuous variables to be positive; any increase of these variables would result in an increase in income. Table 10 presents the mean and standard deviation of the variables. The variables are divided with adult equivalent units to normalize for differences in household size. Normalization of all variables and then express them in natural log put a restriction on income equation that we found valid by F-test. On average, most of the variable means are higher in MP except that average schooling is higher in AP where proportionately more households depend on money lender loan.

Table 11 presents the income elasticity with respect to livestock unit, assets, land, education and livelihood diversification. All elasticities are positive as expected and are significant except average individual education in MP.¹ In terms of size of the response, livestock and land appear to play an important role in MP. In both AP and MP, the size of the elasticity is much higher for average

1. The variables are the individual unit's share in the household since they are expressed in per adult unit.

individual diversification indicating that it has more immediate effect on income than the asset variables, which may have much longer term effects on income than a year. The effects of assets and diversification are very similar in both States.

Table 10. Mean and standard deviation of annual income and related variables

Variables	Andhra Pradesh		Madhya Pradesh	
	Mean	Standard deviation	Mean	Standard deviation
Annual income per adult equivalent (INR)	6595.17	8736.40	6621.48	11329.15
Standardized livestock unit per adult equivalent	0.27	1.55	0.38	0.53
Assets per adult equivalent (INR)	2496.59	9408.86	3118.16	12350.20
Land owned per adult equivalent (acres)	0.36	0.94	0.99	1.03
Schooling per adult equivalent (years)	5.31	3.91	3.68	2.92
Diversity per adult equivalent	0.44	0.26	0.56	0.43
D1, member migration (1 = yes)	0.17	0.38	0.32	0.47
D2, remittance income (1 = yes)	0.03	0.18	0.07	0.25
D3, money lender loan (1 = yes)	0.33	0.47	0.17	0.38
D4, bank loan (1 = yes)	0.17	0.38	0.20	0.40
D5 Scheduled Tribes (1 = yes)	0.03	0.18	0.11	0.32
D6, Scheduled Caste (1 = yes)	0.18	0.38	0.17	0.38
D7, Backward Caste (1 = yes)	0.47	0.50	0.67	0.47

Table 11. Elasticity of household income with respect to different variables by States, 2001–2002

Elasticity with respect to ^a	Andhra Pradesh (AP)		Madhya Pradesh (MP)	
	Elasticity	Standard error	Elasticity	Standard error
Livestock	0.027***	0.010	0.138**	0.063
Assets	0.042***	0.003	0.043**	0.018
Land	0.171***	0.014	0.228***	0.066
Wet land prop	0.097***	0.028		
Education	0.121***	0.023	0.090	0.082
Diversification	0.367***	0.033	0.371***	0.140

*** significant at 1%, ** significant at 5%, * significant at 10%

a. Variable definition is given in Table 9, detail results are in Appendix 2.

The income model was estimated by ordinary least squares method for the full sample as well as for different quintile groups (estimated models are presented in Appendix 3).² F-tests suggested separate regressions. Also we conducted a Hausman test for simultaneity between income and livestock units. The test result suggested that the problem was not serious. In AP the problem was significant at the 10% level but in MP was not. The independent variables explained the variation in income per adult equivalent highly significantly. The log transformation was conducive to resolution of the unequal variance problem, and to easy interpretation of the results. The coefficients in this double log form represent the elasticity of income per adult equivalent for the respective variables.

The regressions were repeated to reflect particular differences in relation to the variables specific to certain household income quintiles. Thus, for instance, households in the bottom end of income

2. Full sample in this case comprises 4556 households in AP and 283 households in MP, for other households income data were not collected or were missing.

distribution do not own much livestock and on the other hand households in the top are known to migrate little. The responses in subsamples, without the poorest or richest quintiles were, therefore, expected to be different and this was confirmed.

In AP, the exclusion of the top income quintile (quintile 5) made livestock a non-significant determinant of income, suggesting that livestock is a particularly important contributor to income among the better-off (Table 12).

Table 12. *Elasticity of household income with respect to different variables by quintile groups, Andhra Pradesh, 2001–2002*

Elasticity with respect to ^a	Quintiles 1–4		Quintiles 2–5		Quintiles 2–4		Quintiles 3–5	
	Elasticity	Std. error	Elasticity	Std. error	Elasticity	Std. error	Elasticity	Std. error
Livestock	0.010	0.010	0.032***	0.009	0.011*	0.006	0.019*	0.010
Assets	0.019***	0.003	0.036***	0.003	0.010***	0.002	0.028***	0.003
Land	0.069***	0.014	0.144***	0.012	0.024***	0.008	0.161***	0.014
Wet land prop	0.074***	0.028	0.071***	0.026	0.040**	0.017	0.044	0.030
Education	0.026**	0.015	0.125***	0.013	0.031***	0.009	0.144***	0.014
Diversification	0.229***	0.023	0.248***	0.021	0.103***	0.014	0.170***	0.022

*** significant at 1%, ** significant at 5%, * significant at 10%

a. Variable definition is given in Table 9, detail results are in Appendix 2.

As Table 13 indicates, in MP, the size of the elasticity is very similar to AP but important variables become non-significant when either or both of the poorest and richest quintiles are excluded. In particular the group without the richest quintile responds significantly only with respect to the change in land.

Table 13. *Elasticity of household income with respect to different variables by quintile groups, Madhya Pradesh, 2001–2002*

Elasticity with respect to ^a	Quintiles 1–4		Quintiles 2–5		Quintiles 2–4		Quintiles 3–5	
	Elasticity	Std. error	Elasticity	Std. error	Elasticity	Std. error	Elasticity	Std. error
Livestock	0.083	0.055	0.077	0.060	0.019	0.045	0.105*	0.061
Assets	0.022	0.016	0.032**	0.016	0.020*	0.012	0.032*	0.018
Land	0.138**	0.056	0.167***	0.060	0.080**	0.041	0.145**	0.063
Education	0.041	0.066	0.066	0.076			0.087	0.072
Diversification	0.182	0.149	0.221*	0.121			0.323***	0.120

*** significant at 1%, ** significant at 5%, * significant at 10%

a. Variable definition is given in Table 9, detail results are in Appendix 2.

Most of the estimated elasticities are robust as shown by the different version of the models in AP and MP, with and without dummy variables for institution, social status and location (Tables 14 and 15). The results reported above controlled for all these effects, since otherwise they would create omitted variable bias. When location dummies were excluded, livestock became a non-significant determinant of income in AP. This is due to the correlation of livestock with location resulting in biased elasticity and standard error.

Table 14. *Elasticity of household income with respect to different variables with and without dummies, Andhra Pradesh, 2001–2002*

Elasticity with respect to ^a	All variables		Without dummies		Migration, credit and caste		Village dummies	
	Elasticity	Std. error	Elasticity	Std. error	Elasticity	Std. error	Elasticity	Std. error
Livestock	0.027***	0.010	0.014	0.010	0.009	0.010	0.033***	0.010
Assets	0.042***	0.003	0.044***	0.003	0.044***	0.003	0.044***	0.003
Land	0.171***	0.014	0.159***	0.013	0.159***	0.013	0.175***	0.014
Wet land prop	0.097***	0.028	0.089***	0.026	0.100***	0.026	0.092***	0.027
Education	0.121***	0.023	0.152***	0.014	0.142***	0.015	0.135***	0.014
Diversification	0.367***	0.033	0.492***	0.022	0.482***	0.022	0.375***	0.023

*** significant at 1%, ** significant at 5%, * significant at 10%

a. Variable definition is given in Table 9, detail results are in Appendix 2.

Table 15. *Elasticity of household income with respect to different variables with and without dummies, Madhya Pradesh, 2001–2002*

Elasticity with respect to	All variables plus dummies		Without dummies		Migration, credit and caste dummies		Village dummies	
	Elasticity	Std. error	Elasticity	Std. error	Elasticity	Std. error	Elasticity	Std. error
Livestock	0.138**	0.063	0.162**	0.067	0.118*	0.065	0.175***	0.067
Assets	0.043**	0.018	0.071***	0.018	0.051***	0.018	0.063***	0.018
Land	0.228***	0.066	0.266***	0.059	0.298***	0.059	0.229***	0.069
Education	0.090	0.082	0.204***	0.073	0.162**	0.076	0.164**	0.079
Diversification	0.033***	0.140	0.198	0.141	0.316**	0.139	0.239*	0.147

*** significant at 1%, ** significant at 5%, * significant at 10%

a. Variable definition is given in Table 9, detail results are in Appendix 2.

In MP, education became a non-significant variable when all dummies were included and livelihood diversification became non-significant when all dummies were excluded. Thus diversification and education in MP was more influenced by institutions, social status and location.

The full models reported in Appendix 3 show that the dummy variables constructed to capture institutional, social and location-specific effects were highly significant in majority cases but the level of significance varied widely between quintile groups. For simplicity we mainly focus the discussion on full sample models for AP and MP to explain the effects of the dummy variables.

The signs of the coefficient for migration, institutional loan and caste variables representing lower social status reflected our expectation. Average per capita income was higher for households having at least one migrating member, and even higher for those reporting remittances from migration. Income of the Scheduled Tribes, Scheduled Castes and Backward Castes was lower than the general caste. Institutional loans were not significant. The result is consistent for both AP and MP (in MP the coefficient of Backward Caste was not significant). The size of the coefficient of the migration and caste dummies were consistently higher in MP indicating that migration was more important and caste differences wider in MP.

Focusing on the results of the regression by quintile groups, we note that migration is more important to poorer households, both in AP and in MP. The size and significance level both is higher in the group without the topmost quintile.

Determinants of livestock ownership

The number of livestock owned was very low in the survey areas of AP and MP; about 1 SLU in AP with a range of 0–204 and about 2 SLU in MP with a range of 0–18.³ In AP, although the maximum number is much higher than in MP, only 0.1% of the households kept more than 18 SLU (6 households out of 4647). Thus almost all households are non-commercial owners. We specified the ownership equation taking SLU per adult equivalent as the dependent variables and most other variables defined in Table 9 as independent. Additionally, we have defined two other variables in this case: species is a dummy variable for the owner of single species (= 1 for the owner of a single species) and landless (= 1 for the landless households).⁴ Livestock ownership is a type of output variable, so that this equation should be a production function and should ideally include input variables such as feed, veterinary care, housing and extension services. These variables were omitted due to lack of data.

As we argued earlier whilst specifying the income equation, in the semi-subsistence setting income is more dependent on livestock than the other way round. This is shown by the poor performance of the income variable in the estimated equations reported in the appendix 3. In AP, income variable is insignificant in 3 equations out of 5 estimated; and in MP, the variable is insignificant in all 5 equations. The signs are consistent.

The important variables that determine livestock ownership are land, diversification and species in both AP and MP. Assets, landlessness and migration are important determinants in AP but they are insignificant in MP. Village specific factors are stronger in AP than MP. The status as Scheduled Caste strongly reduces the ownership in AP; on the other hand, the status as Scheduled Tribe reduces the ownership in MP.

Regarding the species, this is the variable responsible for the most of the explanatory power of the models. Households owning single species have lower numbers of livestock, suggesting that few have succeeded in specializing, and that the majority pursue risk aversion strategies of keeping several different types of livestock. Qualitative assessment in this study identified a number of barriers to specialization, including inadequate input supply. It is not possible to examine the reasons in more details or to quantify the relative importance of the barriers with the given data. The size of this coefficient is higher for the poorer households than the better-off, implying that the poorer are more risk averse.

The richer households respond relatively more with respect to land (Tables 16 and 17). Poorer households which have at least one migrant member have much lower ownership than the richer households with migration. The impact of livelihood diversification on livestock ownership is

3. SLU was defined as: bull = buffalo = 1, cow = 0.7, goat = sheep = 0.1, pig = 0.4, poultry = duck = 0.02. Age/size difference was not taken into account in this standardization due to lack of data.

4. Keeping of a single species may indicate specialization, especially where numbers are large. On the other hand, the tendency in semi-subsistence farming may be towards spreading risk by keeping several species.

higher for the poorer households. This is because poorer households rely more on livestock than the richer to increase local livelihood diversification, but for those migrating, livestock are required only in a few cases such as for hauling carts for sugar cane harvesting, and are otherwise more of a hindrance than a help in diversification through migration. Although poorer households respond less than the richer households with respect to resources under the current market conditions, the quantitative differences are very small. This may imply that any production enhancing policy would benefit the poor almost equally even if they are not targeted. However, targeted policies specifically designed for the poor could benefit them more as they are responding less to market conditions. One interpretation attributes this to higher levels of vulnerability (Ashley and Nanyeenya 2002). According to BAIF (2006a), a family maintaining three crossbred cows can enjoy gainful self-employment of 200 person days annually to come out of poverty. These types of private initiatives are to be encouraged to reduce poverty through livestock.

Table 16. *Elasticity of livestock ownership with respect to different variables by quintile groups, Andhra Pradesh, 2001–2002*

Elasticity with respect to ^a	Quintiles 1–4		Quintiles 2–5		Quintiles 2–4		Quintiles 3–5	
	Elasticity	Std. error	Elasticity	Std. error	Elasticity	Std. error	Elasticity	Std. error
Income	0.041	0.026	0.045	0.026	0.079*	0.053	0.017	0.032
Assets	0.009***	0.003	0.014***	0.004	0.011***	0.004	0.014***	0.005
Land	0.070***	0.024	0.086**	0.022	0.058***	0.028	0.106***	0.025
Education	–0.020	0.020	–0.022	0.020	–0.032	0.023	–0.014	0.022
Diversification	0.177***	0.034	0.166***	0.033	0.156***	0.039	0.157***	0.036

*** Significant at 1%, ** significant at 5%, * significant at 10%

a. Variable definition is given in Table 9, detail results are in Appendix 2.

Table 17. *Elasticity of livestock ownership with respect to different variables by quintile groups, Madhya Pradesh, 2001–2002*

Elasticity with respect to ^a	Quintiles 1–4		Quintiles 2–5		Quintiles 2–4		Quintiles 3–5	
	Elasticity	Std. error	Elasticity	Std. error	Elasticity	Std. error	Elasticity	Std. error
Income	0.048	0.059	0.077	0.056	0.123	0.098	0.039	0.067
Assets	0.037	0.031	0.009	0.014	0.031	0.035	0.002	0.017
Land	0.048	0.060	0.119**	0.049	0.085	0.064	0.106**	0.050
Education	–0.054	0.064	–0.036	0.057	–0.054	0.067	–0.104*	0.061
Diversification	0.369***	0.139	0.238***	0.090	0.335**	0.137	0.161*	0.090

*** Significant at 1%, ** significant at 5%, * significant at 10%

a. Variable definition is given in Table 9, detail results are in Appendix 2.

Conclusion regarding regression analysis

The analysis supports the view that livestock contribute to household income but, from the data available here, the contribution is proportionately higher among better-off groups.⁵ This may be partly attributable to their capacity to invest in fodder and veterinary inputs, but also to the fact that lower income households may not have the surplus labour needed for livestock rearing and caste discrimination means that lower income (predominantly SC and ST) households do not find

5. For MP especially, sample sizes are small and the limited degrees of freedom mean that differences between means do not appear significant in many cases. More comprehensive collection of data on income from livestock services and products remain to be analysed.

a ready market for livestock products among higher caste households, so that the incentive to keep livestock is reduced.

Assets, land, education and diversification are also important determinants of household welfare. Livelihood diversification appears to be the most important variable, bringing particular benefits to poorer households. The contribution of migration is also higher among poorer groups.

Land, diversification and species appear most important determining factors for livestock ownership. Village specific factors strongly influence livestock rearing decisions—for instance tribal villages in Mandla district of MP keep fewer of certain kinds of livestock because of the difficulties mentioned above of selling products to higher caste households. For many households, particularly the poorer, diversification among several types of livestock is a notable risk aversion strategy.

The technology like the stall-fed dairying and intensive poultry production are not affordable to poorer and at the same time the poorer respond less than the richer with respect to economic incentives. This implies that the poorer require support for the access to technology, capital and information. Without any support the poorer are not in a position to compete with richer households.

7 Study findings: Who keeps what and why?

Overview, Andhra Pradesh

A breakdown of income sources by landholding in AP shows that goat keeping among the poorest was notably higher compared to other groups accounting for 12.5% of the agri-allied income. The other important source of income for the poorest was dairy. Sheep on the other hand were more important for the better off groups with the second richest quintile deriving just over 6% of the agri-allied income from sheep and the richest quintile deriving over 4% from sheep. Backyard poultry was more prevalent among the middle quintiles and pig rearing was more prevalent among the second poorest quintile. The portfolio of the second poorest quintile was the most diversified with coconut mat weaving, basket weaving, pig rearing and hiring of bullock carts. Dairy was therefore not as important as in the case of the poorest, the middle quintile and the richest where it accounted for more than 87% of their agri-allied income.

Table 18. Shares (mean %) of agri-allied profits, by livestock type, in total agri-allied profit by Income Quintile (rabi season) in Andhra Pradesh

Livestock and other agri-allied type	Income quintiles				
	Richest	4	3	2	Poorest
Dairy	88.1(30)	78.6 (26)	87.6 (30)	69.3 (14)	87.5 (7)
Backyard poultry	0	8.9 (5)	4.3 (4)	0	0
Sheep	4.3 (3)	6.3 (2)	3 (1)	3.3 (1)	0
Goats	1.4 (1)	0	3 (1)	0	12.5 (1)
Pigs	0	0	0	5.9 (1)	0
Coconut mats	0	3.1(1)	0	9.8 (3)	0
Basket weaving	3.1 (1)	0	0	5.9 (1)	0
Bull cart hiring	3.1 (1)	3.1 (1)	2 (1)	5.9 (1)	0
Total	100 (32)	100 (32)	100 (33)	100 (17)	100 (8)

Note: Figures in parentheses are the numbers of households involved in the corresponding activity.
Data source: Sample survey 2001–02, ODI.

Overview, Madhya Pradesh

In MP allied and natural resources based income across the sample is made up of dairy (39%), goats (19%), other livestock (1%), natural resources and forest enterprises (17%), crop trading (16%) and hiring assets and money lending (8%). Livestock incomes are high in PT and SM but over 30 times higher in PR due to intensive dairy farming (more on this below under village reports). Only the richest and poorest groups earn significant amounts from livestock. While the richest groups earn twice the livestock income of the poorest groups, livestock income makes up almost 50% of mean household income whereas it only contributes 8% to the richest. While the richest earn the most from dairy (the intensive dairy in PR), the poorest earn the next largest amount, though twenty times less. Income from goats for the poorest is far more important (INR 2350 per household per annum on average) and twenty times the income from dairying. Goats are undeniably a crucial asset for the poorest.

Caste wise, dairying is dominated by BCs and goat income by SCs with tribals earning very little (ten times less) and FC nothing at all. These results are dominated by PR Livestock revenues are relatively most important to the landless (20% of total household income)—via goats—followed by the medium farmers (16%) and the large farmers (8%)—via dairy incomes. Dairy and pig incomes make a 2 and 0.6% contribution to the household income of the landless.

Goats—an increasingly popular accumulative option

Goat keeping appears to have increased, both in AP and MP. There are several reasons for this. Goats require very low investment for a unit return; a kid purchased for a few rupees can be sold for India Rupees (INR)¹ 1500 or more at maturity. Local demand for goat meat is high; almost 95% of the goat meat produced in the country is consumed locally. Goats are versatile eaters; they can be stall-fed or taken out to graze. They can be fed on rice, *ganji* (the starch water that is poured out of rice) and many other left-overs. Goats are less susceptible to diseases than sheep and they are suited to semi-arid conditions. They can be milked for small quantities of milk at any time of the day, unlike cattle. Due to these qualities, goats are ideal for additional source of income, meat and milk. In addition, poor women can easily raise them without forfeiting much time from their regular activities. Goat keeping appears a better option for the poor than backyard poultry, which also requires low investment, but people in the higher than the poorest quintile keep them, may be because poultry requires higher yard than goat. Several studies indicate that goat keeping and backyard poultry production are inversely related to socio-economic status and are largely the domains of women (Rangnekar 1998). From our survey data, it appears that most of the livestock related activities are done jointly by man, women and children, irrespective of types/species.

Box 2: Anti-goat legislation

The *Andhra Pradesh Water, Land and Trees Act, 2002* was enacted to promote water conservation and tree cover and regulate the exploitation of ground and surface water towards the ultimate goal of conservation of the environment. With respect to small ruminants, the Act says, 'It shall be competent for the Authority (constituted under the Act) to protect tree plantations by encouraging stall-fed goat rearing and by rehabilitating the goat rearers in a phased manner.' Some villagers felt that the above enactment has adversely affected goat rearers. However, the real impact the Act had on goats needs to be assessed through a primary investigation

Goats are believed to be sturdier. Long-term browsing experiments conducted by the Central Sheep and Wool Research Institute supported this claim due to the observed better performance of goats than sheep in both arid and semi arid conditions (Acharya et al. 1980). Often, sheep rearers keep one or two goats in their herd on the believe that goat is intelligent and capable to guide their sheep. Bhattacharya (1989) reported that goats provide significantly more meat and milk per unit of live weight per year compared to cattle and sheep. Goat milk is probably the single most nutritious component of a poor person's daily diet.² Goats may also allow rapid adjustments to stock numbers because of their fast reproduction rates (Sandford 1982)—they can produce one or two kids every six months.³ Goats are used in religious ceremonies by Muslims, some Hindus and some tribes. Sheep husbandry, on the other hand, is more difficult to tether and manage as sheep is not a versatile eater. Sheep reproduce less frequently and its meat is less preferred by the consumer.

It is a common sight to see a poor agricultural labourer with her lone goat tethered in the field eating crop residues and weeds that she pulls up while she gets through a day's work. Whereas the keeping

1. INR (India Rupees). In March 2008, USD 1 = INR 39.89.

2. The orotic acid content in goat milk prevents fatty liver syndrome, and the higher glycerol level makes it better for newborns (Devendra 1992).

3. However, feed scarcity in the dry season can be a constraint on the reproductive performance, particularly conception rates, of goats belonging to poor people (Conroy et al. 2001).

of larger animals is usually the business of men, goats and chickens are looked after by women in many parts of India.⁴ It should also be noted that goats are often share-reared by women, an important but under-recognized form of livestock management by the poor. The most prevalent form of this arrangement is for an employer/patron to hand over a female animal to a poor labourer. The labourer feeds the animal (sometimes on the patron's land) and gives it back with the first-born kid but has the right to keep the second born. The milk and dung of the animal are important benefits from this arrangement. This arrangement is also common in MP.

Box 3: Goat-keeping case study—Hiralal Chadhar

Hiralal's grandfather was a wage labourer and her father engaged in share cropping. Two goats were introduced into the family as part of her mother's dowry. The family has always been landless. They applied for land under the land ceiling act, but were excluded from the list for unknown reasons. The stock increased from 2 to 10. It is possible to earn INR 1000 from the sale of 1 goat in winter. Every year they sell three to four goats. If a goat dies they can get INR 50 for the leather. In addition they earn INR 360/annum from the sale of milk and INR 960 from herding other people's goats. Most people choose to look after their own animals; therefore it isn't possible to increase the business. The cost of goat rearing is increasing because they sometimes have to buy grass to feed the goats due to the depletion to buy goats from people who are keeping a larger stock so they are losing clients. Keeping goats is much easier than cattle rearing and much less work compared to wage labour or agriculture. These are the main reasons they have chosen it as their livelihood option. They have no interest in doing anything apart from goat rearing and participate in wage labour, when really necessary as it involves hard work.

Source: Samarra village report by Caroline Wilson (2004).

Box 4: Goat keeping as an activity for the elderly

SM came to PR in search of agricultural labouring work 30–35 years ago. He got a job as an attached farm labourer. When he became an old man he bought some goats with his savings. He now has 15 goats and makes a comfortable living from goat-keeping. There are markets nearby, so there is no problem of marketing.

Box 5: Goat keeping as an important safety net

A family in MB were given goats as a gift by an uncle. The family was able to herd the goats and now has 12 goats. For one goat the family receives between INR 500–800. Whenever the number of goats exceeds fifteen the family sells the goats, but the goats are also an important safety net in times of distress such as illness.

Source: Farrington et al. (2006).

4. In the survey data, most of the cases family members including men, women and some children jointly carry out the livestock-related activities irrespective of type/species. For example, out of 29 farms involved in dairying in MP, both men and women or other family members jointly shared the dairy activities in 21 farms.

8 Study findings: Does livestock provide a useful coping mechanism to vulnerable households and individuals?

Qualitative research conducted in Andhra Pradesh revealed that livestock was often sold for meeting expenses related to domestic emergencies and for meeting agricultural needs.¹ This appeared to be especially important in the remote and backward village of MD. Livestock is therefore an important liquid asset that is used to mobilize cash in emergency situations. Analysis by species shows that it was mainly cows and buffaloes that were sold to meet domestic needs.

In MP, the sale of livestock was mentioned as an important source of cash in the sample survey. Most of the lumpy expenditure was met by borrowing from moneylenders, on average, INR 18,500 per household over a period of three years. (This is compared to the average household income of INR 19 thousand per year). For other lumpy expenditures INR 4500 came from their own savings, INR 1500 were borrowed from family. The remainder (about INR 700 each) came quite equally from credit societies, selling land, selling livestock, or were borrowed from a friend.

By caste, more than 90% of the borrowing done by SCs is from money-lenders. The rest comes from selling livestock, a key productive asset. By land-holding, money-lending is central to all (though less for the largest) who make up the difference with own savings. Selling livestock is most common to the landless and medium farmers and selling land is common across most groups.

During focus group discussions and key informant interviews several examples were encountered of people selling animals during drought periods to buy essential items but it is difficult to put a figure on this. Livestock is an important form of collateral in MP and private moneylenders often take livestock wealth into account when lending. For example, one sample member borrowed money from a moneylender in LJ and could not repay it on time. He gave the moneylender his buffalo to clear the debt. Goats and poultry are also routinely used in this way.

In Tikamgarh district of MP, one better-off farmer, Khare, sold four buffaloes to cover the expenditure of his daughter's marriage.

Migration and livestock—case studies

Regression analyses show that migration contributes more to the income of the poorer but it is negatively associated with livestock (significant in AP but insignificant in MP). But this is by no means a universal trend. An illustration in Box 5 shows how livestock can be important to migrants (Deshingkar and Start 2003; Rao et al. 2006).

Another interesting qualitative observation is that in some villages both livestock and migration are higher. For example villages PT of Mandla district and MB in Tikamgarh district have high out migration villages along with more poultry. Survey data also supports that migration is higher here than other villages. Similar pattern was also observed in some AP villages.

Village accounts of livestock keeping patterns

The quantitative findings can be further elaborated with location-specific findings generated through focus group discussions and key informant interviews. A highly complex picture emerges

1. Thirty-eight per cent of the respondents who answer the question said that they had used livestock to generate capital for emergencies.

which shows that there are many cultural, social and historical factors in addition to other well known economic factors of access to credit, labour and markets that determine the exact mix of herd in different social groups and the functions that livestock fulfil. Chief amongst non-economic factors are caste-based propensities/social taboos and skills related to livestock keeping and access to veterinary support and migration.

Box 6: Importance of draught livestock to migrant sugarcane cutters from Medak district, Andhra Pradesh

Sugarcane cutting is said to have begun roughly 30 years ago from MD and surrounding villages, when contractors came to look for cheap labour to cut sugarcane in irrigated parts of the district. What started as a coping mechanism has now become an extremely well-paid alternative to local agricultural wage labour and is attracting more and more households who are able to mobilize the necessary contacts and resources. According to the villagers, more than 40% of the population migrated for this work in 2001. On average, a team of three adult workers along with a pair of working bullocks and a bullock cart bring back INR 15000 as savings from one season's work of about 4–6 months beginning from October/November. These people are certainly not the poorest of the poor although their older relatives may once have been. In fact, wealth ranking places many of them among the non-poor. Their large and well-maintained houses, together with the growing numbers of milch animals in their possession, are also evidence of this increasing wealth.

The main castes migrating are the *Mudiraj*, *Lambada* and *Madiga*. There are 141 pairs of bullocks and 47 bullock carts in the village. Some people migrate with one cart and two pairs of bullocks. Workers are paid INR140–60 for each tonne of sugarcane cut and transported to the crushing unit. The payment depends on the distance covered. One cart can transport up to two tonnes in a day.

This labour market is interlocked by an advance of cash-contract arrangement guarantying the employer with the required workforce at a predetermined rate. Many sugarcane cutters take an advance of roughly INR 5000 in the month of June, well before the cutting season. This is usually given by farmers to known parties, therefore social contacts and networks are important. Whether or not the labourer is disadvantaged by this arrangement depends on whether they are in a position to negotiate a good wage. That in turn depends on their access to information about the state of the labour market for that particular season.

The money from the advance is used to buy a new pair of bullocks or cart or other supplies and is repaid the following May after the cutting season is over. Farmers and labourers deal with each other directly, no formal negotiator is involved. There is no written agreement and the arrangement works on the basis of mutual trust from previous relationships. Some families have been doing this work for more than 20 years.

Andhra Pradesh: OP village in Chittoor district—Well connected, diversified

Nearly 74% of the households in the poorest quintile owned livestock as opposed to 64% in the richest quintile. In this village the curve of ownership against income was U shaped, with only half the households in the middle quintile owning livestock. Out of 214 households more than

42% kept 1–2 cows and a further 6.5% kept 3–4 cows. In line with the pattern in VP, *Yadavas* are the leading keepers of livestock of all types in OP as well. Several households keep local breeds of cows for ploughing because it is a tradition among the *Yadava* and *Kuruba* to use cows and not bulls for ploughing. Crossbred cows are also in evidence everywhere in the village. Even the smaller categories of farmer as well as the landless are able to own cows. A combination of milk cooperatives, government loans, effective backup and extension as well as promotion by NGOs has allowed this to happen. However, well-to-do farmers with relatively large land holdings possess better quality crossbreds with higher milk yields. While many Scheduled Caste households own animals nearly all of them also lease in animals from the *Gollas*.

Unlike VP, the livestock population of OP has not shown any significant variation over the years. However, goat keeping has gone up slightly among the poorer sections. Goat rearing is more equitable than sheep keeping as the latter is concentrated only among a few communities. As for commons, OP has a large patch of degraded forest, one small tank and a couple of hillocks in the vicinity. In addition to privatization, population pressure and ‘elite capture’ of the commons, restrictions by forest officials was also reported as a major constraint in accessing common pool resources (CPRs). Dependence on common pool resources for collecting and selling non-timber forest products (NTFPs) is still heavy, particularly during the lean work season.

Box 7: Saving Livestock through fodder camps

In the face of acute fodder scarcity and distress sales of livestock in the wake of severe drought conditions, the Andhra Pradesh government set up fodder camps in drought-affected districts in 2002. One such fodder camp was held near VP. Dry fodder (mainly paddy straw) was supplied free of cost to farmers and was procured mostly from the irrigated areas of coastal AP. Registered livestock farmers were required to stay at the camp for about two months during the peak summer season prior to the monsoon.

Each head of cattle was provided with 25 kg of dry fodder per day. In addition, each farmer was allocated one kg of rice a day for their subsistence. Hundreds of poor farmers of neighbouring villages used the facility. In other drought-affected parts of the state (e.g. Karimnagar district), government agencies launched such innovative programs as growing forage crops on village tank beds. In these interventions, 75% of seed cost was subsidized by the government.

Andhra Pradesh: VP village in Chittoor district—Remote, rainfed, new money from migration

VP, the other village in the same district, showed more livestock ownership amongst the rich compared to the poor with the 2nd, 3rd and 4th quintiles owning fewer livestock. Cows account for the largest number of large ruminant stock indicating the level of cow-based dairy. Cows are mostly Holstein-Frisian and Jersey crossbreds; indigenous breeds make up only a small proportion of the stock. Both cow and bull populations have declined, by 40 and 20%, respectively. More important, the sheep population has recorded the highest drop of 60%. Apart from drought, diseases are cited as a major cause of the sharp downward trend. Several sheep farmers reported a large number of deaths recently due to disease. Foot and mouth disease breaks out frequently in the area. Distress sales have also contributed to the overall decline in livestock numbers.

In conformity with the broader state-wide trend, small ruminants are mostly reared by the traditional sheep/goat keepers (i.e. *kurumas* here) and large ruminants by *Yadavas*. While goat distribution is more equitable, sheep are owned predominantly by *Yadavas*. And in contrast to cow keeping, buffalo rearing is concentrated among better off households.

VP lies in a drought-prone zone and during summer when water tanks run dry, livestock drink water from public hand pumps. To facilitate this, local authorities have recently constructed large concrete tubs at public hand pumps for the benefit of livestock keepers. In the face of frequent droughts and forage shortages, dairy farmers of the village have evolved an adaptive mechanism: they rely largely on stall-feeding during summer and open grazing during other seasons. Apart from crop residue such as paddy straw, farmers buy feed such as groundnut cake, paddy bran as well as concentrate feed from the local market (a 50 kg pack costs around INR 250).

During fodder-scarce periods, some farmers purchase crop residue, mainly paddy straw, from irrigated pockets of the district. Another major factor that has contributed to the overall decline in the livestock population in VP is the sharp decrease in acreage under sericulture. VP has been a sericulture village for a long time and mulberry cultivation had been a major source of fodder. Farmers have lost this principal source of fodder because many farmers gave up sericulture following price crashes for Indian silk in domestic and international markets. In this context, a new cropping pattern seems to be emerging with many dairy farmers growing rainfed sorghum mainly as a forage crop. The crop is stored and used as dry fodder round the year.

Tanks, scrub patches, grazing lots and small hillocks near the village comprise common grazing lands in VP. It was reported during participatory interactions that in addition to population pressure, privatization of the commons through encroachments and the regularization of these encroachments is a leading cause of deterioration and declining access to CPRs. Some poorer villagers contended that commons are controlled by the local elite. The only commons that have remained intact are the hillocks around the village.

The bull population of both Chittoor villages has shown a downward trend over the years and the decline is much sharper in VP. This is attributable, *inter alia*, to drought, migration and mechanization. Both migration and mechanization are taking place on a much larger scale in VP. There are ten tractors in VP as against six in OP and the former has higher migration rate than the latter.

Andhra Pradesh: KO village in Krishna district—Rich, highly diversified, well connected, unequal

In the coastal village of KO which is highly diversified, livestock keeping for dairy was definitely the prerogative of the rich but here overall livestock levels were lower than the poorer villages possibly because other sources of income were more remunerative. In KO livestock ownership amongst the SCs and BCs was higher than the higher castes. The bull population has decreased by almost 50%, because they have been replaced by farm machines and tractors in particular.

The virtual absence of CPRs in the village in the form of tanks and grazing areas is offset by irrigation canals and intensive cropping. Some rich farmers with relatively large landholdings grow forage crops. Land leasing is common in Krishna villages through which the landless and smallholder households have accessed land from which they obtain crop residues for their livestock. Half of those who lease in land are landless and marginal farmers. SC households said that a major reason for leasing in paddy land was for the straw which they used to feed their buffaloes.

Sheep and goat rearing is confined to only a few households and appear to have declined over time possibly due to government regulations and scarcity of common grazing land. There are 6 SC households in the village who rear goats on a shared basis. Female young goats are rented out on the arrangement of 50% kid sharing after giving birth; if two kids are born owner receives one kid as rent. Grazing around the village is done mainly on canal bunds and harvested plots. Small ruminant keepers of the area, mainly of the pastoralist *Yadava* community, have evolved a migratory coping mechanism to overcome the scarcity of common grazing land in the area. Groups of herders are on the move for greater part of the year grazing their goats and sheep on harvested patches and canal bunds. These male migrants travel as far as 200 kms and take turns to come back to visit their homes.

Andhra Pradesh: KA village in Krishna district—Rich, not much diversification outside agriculture, unequal

In contrast, livestock keeping was much higher in the prosperous but less diversified and more agrarian village of KA. But here livestock keeping was higher in the richer households. Livestock keeping is traditional; the larger landowners still earning most of their income through livestock and agriculture. Livestock keeping among the SCs and STs is low.

In the coastal villages dairy is well developed. About 24% of the households in KA keep two buffaloes; 17% keep one and 5% keep three; 19 households have five or more animals; 70–80% of SC households have milch animals, especially buffaloes which they obtained through IRDP loans. SC families meant that dairy plays a vital role during the lean season. There are 8–10 families which collect fallen dung from the roads and make this into cakes which they sell for INR 10–15 per 100. Veterinary services are good. Leasing in animals is also common. The arrangement is that the farmer gives the SC household a dairy animal. The farmer takes any calf that is born. If the farmer wants the mother back he gives 50% of the cost to the labourer. But due to a decline in the commons, green fodder availability for landless households becomes problematic between August and November.

Andhra Pradesh: GU village in Medak district—Industrialized, well connected, unequal

The lowest level of livestock keeping was recorded in GU, the industrialized, diversified village near Hyderabad. The results are slightly surprising given the trend towards more dairy activities in villages that are close to large metropolises. But, given its location near to urban areas, non-farm livelihood activities are more attractive.

In GU overall levels were low and lowest amongst the SCs with only 12% of the HH owning livestock. On the other hand, GU has seen a great increase in the numbers of buffaloes owing to the growing urban market for dairy products. But this has benefited mainly the *Reddy* and the *Golla* and *Kuruba*, (both BC) livestock keepers traditionally. In this peri-urban environment, only households having some land keep buffaloes, and they are fed on agricultural residues. The landless do not keep buffaloes in this village because of their limited access to government loans, extension services and common land.

Encroachments and privatization have led to a sharp decline in common lands. The government policy of land distribution to the poor and expansion of residential areas on to the common lands has reduced the area available for common grazing. Even agricultural land, which was used for grazing by the poor after the harvest, has been sold to industrialists and local rice millers, particularly those plots which lie close to the main road. The shrinkage of CPRs around the village is also due to the generous allotment of 'government land' including forest land near the village, to industrialists, as part of the government package of incentives to promote industrialization in this backward area. A few households have leased in land to ease their fodder problems: a landless household which leased in ten acres of land is keeping five buffaloes.

Bull and cow populations have declined considerably because of frequent droughts and pollution of water bodies by the industries located in the vicinity. The downward trend in cattle population is also attributable to mechanization (there are 25 tractors in the village).

Small ruminants are reared mainly by traditional livestock keeping communities such as *golla* (a.k.a. *yadava*) and *kuruma*. These animals are grazed on privately owned lands as well as hillocks near the village. But compared to sheep rearing which is essentially a *yadava-kuruma* preserve, there is diversity among goat keepers with several poor communities in the village such as Muslims and *Madigas* (Scheduled Castes) keeping goats. However, the overall goat population has declined steadily by around 20% over the last 7 years on account of sheep promotion policies and restrictions imposed on grazing goats in forest areas. By contrast, the sheep population has increased by 70% during the same period.

Some smallholder households set up small-scale poultry farms as the demand for poultry products has grown in nearby urban locations. Several poor households have given up backyard poultry owing to the availability of poultry products at farms (and at local meat shops) at reasonable prices.

Traditionally pig-rearing is pursued by the *Yerukala* tribals who are among the poorest groups in the village. Around half of the 50 *Yerukala* households of the village keep pigs. Pig-rearing is still looked upon as an unclean occupation by the upper castes. The pig population has dropped sharply by 80% over the last 5–6 years. This can be attributed to three major factors: shrinking CPR base following intensive vegetable cultivation for which pigs are considered pests, which damage the crop. There have also been drives against pigs by the government because they are carriers of *Japanese Encephalitis*. At the same time, the demand for pork continues to grow. The drop in pig population needs to be examined further to find out whether there are other factors contributing to the decline.

Andhra Pradesh: MD village in Medak district—Poor, rainfed, remote, backward

MD is the most backward, poor and remote village studied in AP. Here livestock keeping was lower than in the Chittoor villages but higher than GU because of fewer opportunities to diversify into modern/non-farm occupations. But STs have clearly taken on livestock based livelihood trajectories in MD with 63% households owning livestock. Livestock ownership among the SCs was lower here than the BCs and FCs.

As noted before bulls are important in seasonal migration for sugarcane harvesting. The bull population has seen steady rise, well over 40%, as migration for sugarcane cutting is a major livelihood option. Some poorer households of the village who cannot afford bulls used male buffaloes for ploughing and other draught purposes.

Goat keeping is more widespread in MD than in other areas with several households keeping large numbers. This village has large tracts of degraded fallows. Veterinary services are not well developed. Along with other advantages as mentioned earlier, goats serve the purpose of dowry for girls in some communities of Medak district.

The privatization of common land around the village (including forest land) over the last couple of decades is forcing poor households with small ruminants to go deeper into the forest for grazing. During the summer when water bodies go dry animals drink water from public hand pumps or private agricultural tube wells.

Over the years, goat population has gone up by almost 50% while at the same time sheep population has decreased by 56%. Interestingly backyard poultry has declined across the social spectrum over the years. Several households reported that attacks by predators and competition from intensive poultry production are two major causes of the decline.

Madhya Pradesh: PR village in Ujjain district—Well connected, rich, unequal, dairy

Commercial dairying has been practised in PR for a long time; a government farm operated business until the end of 1980s followed by private traders from Ujjain as well as large landowners getting involved in milk business. Modern technologies are used to examine milk quality and the price depends on the quality of milk. Traders use improved transportation, storage and processing equipments which make significant value addition to production. Large and medium farmers keep buffaloes and crossbred cows. Farming-cum-trading business appears a profitable enterprise. For example, one of the traders himself has a small dairy with 15 head of improved breed buffaloes and cows. In addition, he procures milk from other farmers. He separates cream from fresh milk to produce skimmed milk to sell in the local market at prices INR 5–6 per litre. The cream is processed to make *ghee* to sell in the local market at the price of INR 140 per kilogram.

Buffaloes, cows and bulls are bought from the nomadic *Gadulia* community. These people also buy old animals. Rich farmers go all the way to Punjab and Haryana to purchase superior breeds of cows (*Holstein*) and buffaloes (*Murra*).

Grazing is supervised by herders known as *gwals*, hired by landlords, the former generally being young boys or old people. Goat rearing is done by children within the household of around 10 years of age. *Gwals* are virtually bonded labourers who work hard without any prospect for improved earning and job progression. They are often 'given' to the landlord to repay a debt. Child *gwals* are usually of 9–14 years of age. The links between animal keeping and child labour deserve more attention.

There has been a decrease in buffaloes in the last three years because of shortage of labour, especially so-called 'attached' labour (locally known as *hali* and who work in near-bonded conditions). These labourers were responsible for dairy animals but since the state government began seriously implementing the ban on bonded and attached farm workers, large farmers have faced a labour crunch. By contrast buffalo keeping has increased among landless agricultural labourers in the village.

Goat keeping has increased among landless and lower caste farm workers who do not migrate (overall migration levels are low). Such households account for nearly 88% of the total goat population. Goats are the first diversification option chosen by *Halis* (bonded labourers). A common practice is for them to invest in goats as soon as they receive a lump sum from their employer; the purchase of goats from the village market is easy. They usually raise one or two by themselves and send the rest to their home villages which are usually very remote and rainfed (Isankhedi and Mahidpur blocks).

Box 8: Purchasing goats with the proceeds from migrant labour

Phoolsingh and his family live in village Isankhedi of Mahidpur block of Ujjain district. They own nearly 6 acres of rainfed land in the village. They were growing only one crop during the *khari* season, so they decided to dig a tube well by borrowing money from a private moneylender. But the tube well 'failed' and they could not pay back the money. In the following year, the crop failed due to drought which pushed Phoolsingh and his brothers along with their families to migrate to PR in search of work. Both of his brothers found work as attached farm labourers while the other adults of the house started working as casual agricultural labourers. In the first year, they bought household items such as a fan, utensils etc. with their earnings. Next year, all three brothers worked as attached labourers and collectively received INR 21 thousand. They spent INR 10 thousand on buying 19 goat kids and sent them back to their village to be reared. The following year, they changed jobs and each brother received an advance of INR 10 thousand. They sent INR 12 thousand to the village to repay the moneylender because by now they had an assured secondary income through rearing and selling goats.

In the past, people kept 1–2 goats but this has now increased to 8–10 goats mainly driven by growing demand as well as government loans that were provided 7 years ago (total loan of INR 30 thousand of which INR 10 thousand was subsidized). Earlier repayments were done through the sale of milk but now the sale of goats has picked up and this is the main product. Goat kids of 6 months sell for as much as INR 1000. Two goat varieties are reared: *desi* or local and *barbari*; an exotic breed. Goats are sold at the nearby Ujjain Budhawaria market or traders come to the village. Goats are usually purchased in June/July (*Shravan* and *Bhadro*) and sold after 7–8 months on the day of *Akha Teej* in April/May. This is the festive season and there is a great need for cash.

The main CPRs in the village are one grazing area and two water bodies—a river and a pond but there are also smaller patches of land where grazing takes place. The river banks are used for grazing goats in an open access manner without any kind of regulation.

Several tree species grow on the village commons such as roadside and riverside areas, field bunds and common pasture land. These trees, notably babool (*acacia nilotica*), khejda (*prosopis specigera*), ber (*zizypus mauritiana*) and imli (*tamarindus indica*) are the main sources of fodder for goats.

The riverside land is used for grazing large animals as well. In PR, apart from encroachments, common land is also used by government agencies for a variety of purposes such as housing schemes (e.g. Indira Awas Yojana), schools and roads. Cattle herders often cross village boundaries to graze their animals in neighbouring villages. The availability of fodder and drinking water from the village CPRs is normally seasonal lasting generally for about three months. All the owners of large ruminants store crop residues like wheat straw to be used during lean times. Besides they also purchase fodder from other villages during fodder-scarce periods.

In Madhya Pradesh, local government (the Gram Panchayat) is vested with powers to manage common property resources. The Gram Panchayats is meant to manage forest land and issue transit passes for forest produce. The management of all water bodies with an area of less than 2000 ha is also vested with the Gram Panchayat. In accordance with these policies, forest management committees and water users' committees have been formed, but the performance of these committees has not been very satisfactory.

In line with the trend in other parts of MP, share-rearing of livestock is in evidence in PR as well. The predominant form of this arrangement is one in which a livestock owner (usually employer/patron) lends a milch animal to a poor household. The first calf of the animal is given to the owner and the second one is retained by the borrower. In another type of arrangement, livestock traders from nearby towns enter into similar agreements with relatively poor households. In this compact, the receiving household takes goat(s) from the trader and retains half of the kids (i.e. one kid as goats normally give birth to two kids) and hands over the other kid to the trader. It may be mentioned here that in PR large ruminants are owned mostly by farmers with relatively large holdings while small ruminants (mostly goats) are kept by agricultural labourers and marginal farmers.

Madhya Pradesh: LJ village in Ujjain district—Poor

The village LJ is mainly rainfed and only 10% of the area has assured irrigation. It is highly drought prone and has been suffering from rainfall shortages the previous three years. Outmigration has increased with around 36% of the households migrating. The livestock economy has declined in numbers and productivity. Migrating households do not have buffaloes; a few keep one or two goats, bulls or indigenous cows. The Integrated Rural Development Programme was the first and only scheme under which poor people received loans for purchasing animals, but there was widespread dissatisfaction with the irregularities in the scheme: many households received only half of the total amount that they were entitled to. This led to several people defaulting on the loan

and now the entire village is a 'defaulter village' which will no doubt have implications for further loan-based programs.

The total available land of LJ measuring around 671 ha is classified into agricultural land and Panchayat land. During summer (the pre-monsoon dry season, i.e. March to May) the entire village land is available for grazing. Around 2% of village land, mostly on the village fringe, still remains as common land. The proportion of common land has dwindled sharply over the last 20 years—from nearly 20% of the total village land in 1980s to mere 2%. The steep reduction in common land is attributable mainly to encroachments and privatization. This land is basically an open grazing lot but the availability of grass is seasonal as the growing period lasts only for about a month.

Fodder is also obtained from a variety of trees that grow along the roadside. Important species are Palas (*Butea monosperma*), *Desi Babool* (*Acacia nilotica*), Imli (*Tamarindus indica*), Mango, Banyan (*Ficus benghalensis*), Peepal (*Ficus religiosa*) and Khejadi (*Prosopis cineraria*). Roadside trees also meet the fuelwood needs of the people; and the trees are pruned annually for better growth. Animal grazing on the commons starts immediately after the first monsoon showers. So the pressure on these patches peaks over the monsoons.

The village has a rather poor track record in managing common natural resources. In the past when grazing land was abundant the area was a notable source of fodder supplying fodder to Gwalior town every year. The number of tree species has also declined over the years. The steady expansion of area under second crop (*rabi*), facilitated by a growing number of dug-wells, coupled with drought conditions over the last couple of years has worsened groundwater availability. Some farmers with trees on their own fields fall back upon them as main sources of fodder for their livestock. The carrying capacity of the village pasture has declined as borne out by the fact that the grazing period has come down to only a month.

There are no formal or informal institutional arrangements at the village level to manage the pastures. There is a need for an institutional mechanism to manage the pasture on the lines of stakeholder groups covering areas such as irrigation, watershed, education etc. Pasture/common land programs need to be integrated into village natural resource development programs like water and soil conservation interventions. In the absence of a participatory management mechanism, it would be difficult to address the issues of equity and sustainability in CPR management.

The vegetation near the village is categorized as dry deciduous forest. Lopping is the main method of fodder collection for goats and is collected mainly from *Khejadi* and *Desi Babul* trees. The tree cover on the commons has shrunk over the years due to growing levels of wood consumption in the form of cooking fuel, construction material and farm implements. Children of school going age are engaged in grazing goats on pastures. The unsustainable exploitation of the vegetation has resulted in reduced availability of fodder for small ruminants.

Many households make animal dung cakes in winter to be used as cooking fuel over the rest of the year. It may be recalled here that the *Sarpanch* (elected head of the Gram Panchayat) and his associates came forward to grow fodder grass in the village. But no support from government agencies was forthcoming. As a consequence they had to give up their plans. The livestock

population of the village is nearly the same as that of humans. In the past people used to keep even more animals when they were required for traditional agriculture and common grazing land was abundant. At that time farmers kept separate plots for *kharif* and *rabi* crops. So during *kharif* cropping season *rabi* plots were available for grazing and vice versa.

With intensive cropping, farmers have begun to take two crops on the same plot of land thereby reducing the area available for grazing. Crop residue is used as a supplementary cooking fuel by many households. Focus group discussions in the village reveal that the per capita annual fuel requirement is around seven quintals. Farmers are now confronted with severe fodder and water scarcity following the drought in the previous year. Several households sold their weak and aging animals last year and around 25 animals died due to lack of fodder and water. The village has only one community tubewell catering to drinking water needs. So far the village has not had a common water facility such as a pond or well. This year villagers have built a pond in the village. This could meet livestock water requirements in the future. Table 19 shows the findings of a group discussion about the fodder and drinking water requirements of livestock in LJ.

Table 19. Fodder and drinking water requirements of livestock in LJ

Livestock type	Total Number	Daily fodder/ Unit (kg)	Total fodder requirement/ day (kg)	Water requirement/ unit (lts)	Total water requirement/ day (lts)
Buffalo	350	25	8750	100	43,750
Cow	500	15	7500	80	40,000
Goat	500	5	2500	15	7500
Bull	400	25	10,000	85	34,000
Total	1,750	70	28,750	280	125,250

Source: Group discussion with the villagers.

In LJ livestock are regarded as a form of liquid assets to be augmented during favourable times and liquidated during crises or emergencies. In this village agriculture is traditional and depends mostly on bulls for draught purposes. In the face of the recent drought many farmers sold their bulls and purchased calves or weak or inferior species of bulls. The possession of livestock distinctly improves the creditworthiness of a household. And the borrowed money can be repaid with livestock. This is illustrated by a case in the village where a poor borrower had to repay the money with their only buffalo when the local moneylender came to him for recovering the amount after the deadline. Moreover moneylenders also accept goats and poultry in lieu of cash.

Madhya Pradesh: GG village in Mandla district

GG Village is a part of the tribal district Mandla. This village has the lowest numbers of bovines. In fact livestock keeping in general has gone down in the village over the years. Once several Lodhis used to keep goats and cattle; now only a few Pradhans (SCs) are rearing goats on a share-rearing basis but a few Dongre families in the village are doing well with pig rearing. Most of the cultivating Lodhis have cattle for ploughing the land; and very few people sell milk.

The village has around 35 acres of common grazing land. However, this pasture has shrunk considerably over the last decade or so due to encroachment by several households (from all

caste groups) for residential purposes, in particular settlements on encroached land are found all along the village main road (on the northern side). The problem was exacerbated when some people started growing vegetables right in the middle of the common Kachar² land near the River Narmada. Due to these problems, livestock population (mainly kept by the Lodhi community) of the village, cattle in particular, has shown a perceptible downward trend over the years.

Encroachments on the commons have not only prevented livestock grazers from accessing the pasture but have also created difficulties for people who go to the river for bathing, washing and other purposes. Several meetings have been convened by the village Panchayat to discuss the issue and clear the encroachments but the exercise has proved to be ineffective. During focus group discussions several participants complained that the village Panchayat was corrupt and that the Sarpanch took bribes from the encroachers and turned a blind eye to the encroachments.

Madhya Pradesh: PT village in Mandla district

At one time livestock rearing was a major livelihood option in village PT as it was surrounded by forests. But the livestock population (large ruminants in particular) has dropped sharply over the years: per capita mean number of livestock has decreased from 25 to 2.5. This is probably due to the decrease in the extent of grazing land because of deforestation and the restrictions on free grazing imposed by the forest department. Bamboo grooves that once grew abundantly in the area have now vanished. Several NTFPs (Non-Timber Forest Products) are no longer available to the local people. Moreover, yields of crop residues (mostly paddy straw) have also declined with more and more farmers opting for high yielding paddy varieties which yield less straw. Thus although official records state that the village is encircled with reserve forest, in practice access to forests is very limited.

The village economy has shifted slowly away from livestock and forest resources to more intensive, settled agriculture, in response to increasing population pressure, diminishing natural resources and increasing returns to agriculture.

Box 9: Failed livestock enterprise

Forty-five year old Mangal Das belongs to Scheduled Caste got a buffalo in 1984 under government loan scheme against an amount of INR 9000. When he bought the animal he was promised that it would yield 5 litres of milk every day. But when he brought it home it was capable of producing only half a litre of milk per day. This was not sufficient to repay the monthly installments to the bank. Furthermore, the animal died a year later. He was not able to get any money through the insurance scheme and could not repay the loan.

Madhya Pradesh: SM village in Tikamgarh district

Village SM once had extensive forest cover and hence has a long history of forest based livelihood activities that depend on a variety of forest resources. Almost every community had access to forest resources either through direct collection or indirectly through purchase from the primary collector. But now forest based activities are no longer as important because hardly any forest is left except

2. *Kachar* is fertile riverbank soil suitable for vegetable cultivation. The *Dhimars* were the first to do the cultivation.

for a few patches of scrub around the village. These degraded patches are the only remaining village commons, the rest being encroached upon by wealthier villagers.

The decrease in the livestock population in SM can be attributed to the sharp shrinkage of the village *gochar* (grazing land), continuous and uncontrolled encroachments on the village commons, depletion of the village forest and the resultant loss of forest produce, and the policy of zero-tolerance on the part of farmers for protecting their crops from livestock. Fuelwood and timber for construction are now difficult to procure from these commons. Some farmers have begun stall-feeding their animals.

As the census data show livestock keeping has decreased substantially among the upper castes as well as the lower castes. While constraints related to livestock keeping like inadequate household labour (normally following livelihood diversification) are major factors contributing to the decline among upper castes, reduction in the extent of village *gochar* is strongly associated with the downslide in livestock numbers among lower castes. The traditional livestock rearing communities of the village like *Gadaria*, Muslims and *Pals* have given up this activity and have taken to non-farm activities. Earlier all three of these communities used to keep goats which could be easily sold in reduced circumstances or emergencies and purchased when the household had surplus money. Some Muslim families would keep as many as 30–40 goats each as a supplementary source of livelihood.

The situation these days is that most households do not keep large animals apart from cows or buffaloes for home consumption or 1–2 bulls for ploughing. Only a few BC farmers sell surplus milk. Goat keeping is more common but overall livestock levels are low in this village. Families drift into and out of animal herding, when other livelihood choices have failed. Many traditional goat herders have switched to cultivation and migration. The large scale herding of goats is no longer possible due to depletion of common grazing land, so that herders are only able to keep up to a maximum of 10 goats. The cost of rearing has increased because it is sometimes necessary to buy fodder. However, the selling price of goats has increased and during winter goats can fetch up to INR 1000. Small herders are losing clients, as traders prefer to buy animals from those with a large stock. There is little opportunity to look after the goats of others as most look after their own and few keep livestock in the village.

In the semi-feudal and status-conscious Tikamgarh district most upper caste households still do not buy dairy products from the lower castes, particularly from the Scheduled Castes who are still treated as untouchables despite the existence of laws providing for severe punishments for all practices of untouchability. In some villages, tribal households do not keep milch animals because of this factor.

Lower castes such as the *Ahirwars*, *Gadaria*, *Basod*, *Bunkar* (*Chadhar*) have livelihood systems that are closely linked with the livestock economy because they have traditional rights to dead animals as the table below indicates. There were detailed rules, rights and social taboos surrounding access to different parts of a carcass. *Ahirwars* were traditionally scavenging communities. They collect skin, flesh and bones from dead animals. Skins were basically used for making of leather shoes;

bags and other products, while bone was sold in the markets. Each kilogram of bones commands INR 50 in the market and the buyers send it to *Lalitpur* (Uttar Pradesh) for processing.

Madhya Pradesh: MB village in Tikamgarh district

Livestock economy was not historically important here, but created by government programs. However, livestock numbers remain low. Village census data show that the average (per household) large ruminant holding is 2.61. The per capita livestock of the village is 0.44 on average but the entire stock is held by the *Dhimar* community. Per capita bull and per capita milch animal population are almost equal indicating that both draught and milk animals are equally important to the village economy. Census data also reveal that bulls make up the single largest stock of animals in the village demonstrating the critical role played by animal traction. A few families are also involved in sharing of bulls for agricultural operations.

Table 20. *Traditional rights to carcasses among the lower castes in MP*

Caste	Ahirwar	Banskar (Basket making)	Zamadar (Mehentar)	Bunkar (Chadhar)
Traditional rights, rules, customs	<ol style="list-style-type: none"> 1. They have to take away the dead animal(s) from the house to far off places generally outside the village 2. Remove the skin of the dead animals 3. They could take one front leg of the animal 	<ol style="list-style-type: none"> 1. These people could take the other front leg, as a matter of right over the dead animals. Sometimes they were in conflict over deciding which leg to be taken by whom 	<ol style="list-style-type: none"> 1. One back leg of the dead animal 	<ol style="list-style-type: none"> 1. Other back leg of the animal

This picturesque village has forest cover on one side and a water body on the other. So it often gets cut off from the nearby villages during the monsoons. But the forest has now been reduced to degraded scrub. Despite that, forest resources play a crucial part in the village economy. Both landless and landed households depend on forest resources for fuel wood, fodder, minor forest produce etc.

Migration generally has a negative impact on livestock rearing as it tends to hinder migratory movements. Migrant households generally keep small ruminants because it is more convenient to manage them. However, some households with seasonal migrants also keep large animals. Backyard poultry is popular among migrants because chickens can easily be left to the care of old people and others who are left behind in migrant households.

In both these villages of Tikamgarh district most upper caste people do not purchase milk products from the lower caste people. In Khandwa district tribal people do not keep livestock due to such social taboos.

A typology of livestock keepers

Data from the LO study suggest that there are distinct patterns of livestock keeping by class and caste and this depends on customs, skills, access to resources and livelihood strategy. Five categories of livestock keeping according to wealth status are identified in Table 21, ranging from the poorest, which tends to keep a few goats, to the wealthiest, which undertakes intensive poultry and prawn production.

Table 21. *A typology of livestock keepers*

Poor survivors	One or two goats
Poor diversifiers	Share-reared cattle, chickens
Middle class—dairy farmers	2–4 buffaloes or cows, medium landholding
Rich—dairy industry	Large farm, >8 milch animals
Very rich	Poultry farm, prawns

Focus Group Discussions: Why have some farmers reduced their stocks over time?

Focus group discussions show that livestock keeping has been made difficult by drought in marginal areas. But the lack of access to grazing was also mentioned in the more developed and intensively farmed villages of AP. Pest/disease was also cited as a major reason by several respondents and it was not clear whether these were new pests and diseases or whether veterinary care had become less accessible.

Labour shortages are commonly cited problems in the rich and diversified villages of coastal Andhra Pradesh as well as the industrialized village (GU) near Hyderabad, obviously due to opportunities for more favourable employment. Labour shortages were also experienced by landed farmers in PR, the developed village in Ujjain in MP but there the reason was the enforcement of anti-bonded labour laws.

The policy context and its impact on livestock keeping

Despite the fact that livestock is critical to rural livelihoods and contributes an increasing proportion of agricultural GDP employing a large section of the workforce, it has a low profile in national priorities (apart from dairy), compared to agriculture.

The focus of policy has been to improve the productivity of animals by introducing improved breeds and rearing practices as concern amongst policymakers is the 'low productivity' of Indian livestock systems. These systems are characterized by local breeds that are valued for their resistance to local climatic variation and disease as well as the ability to survive on low quality and locally produced feed (Rao and Birthal 2002). While several attempts have been made to move people out of these systems by the production of crossbred cattle via artificial insemination, and upgrading to input-intensive systems such as stall feeding and zero grazing, uptake has been limited due to a number of constraints in backward and forward linkages notably, access to extension services, veterinary services and other support, credit and markets (Ravishankar and Birthal 1999).

An important dimension of the policy context that affects the poor is the effort to curtail environmentally destructive practices, especially free grazing. In fact programs aimed at environmental rehabilitation, such as watershed programs, often tend to limit free grazing in their areas of jurisdiction. Some species (e.g. goats) have been banned from time to time by certain governments (e.g. the former government of AP) in an effort to reduce environmental damage. This is arguably a highly anti-poor policy stance since goats are one of the few options for many poor people to diversify out of agricultural labour into the livestock economy. The case of Andhra Pradesh is illustrated in some detail below to highlight the potential implications of anti-goat policies for landless and lower caste people.

Anti-goat positions can be traced back to the National Commission for Agriculture in 1976 which recommended a reduction in goat numbers from the then existing 67 million to 40 million. Despite this, numbers increased rapidly in the 1980s and 1990s as more and more people switched to goats from larger animals due to a change in consumer tastes and deteriorating access to common property resources.

Goat keeping and contested access to resources

While concessions to forest-dependent communities have resulted from prolonged advocacy by NGOs and international rights organizations in the form of Joint Forest Management and Watershed Development Programmes, graziers have far fewer 'champions' for their cause. As a result, the Forest Department can easily override the rights of politically powerless and often illiterate goat-keepers, a feat achieved with the support of the local elite. Goats are not allowed into areas that are protected under Joint Forest Management and Watershed Development Programmes, even after temporary grazing bans are lifted. In some cases, when *panchayat* lands were brought under plantation by the Forest Department, poor tenant farmers and their goats were denied access to the land, thus actually adversely affecting their livelihoods rather than enhancing them (Kanda 2000). What the vast majority of small ruminant rearers do not realize is that there are three Government Orders that entitle Primary Sheep Breeders Co-operative Societies (associations of sheep and goat owners) and shepherds to government controlled natural resources for their own use (Personal Communication Rebecca Katticaren, Indo Swiss Programme on Natural Resource Management in Andhra Pradesh).

Goat and sheep rearers are rarely provided information about such GOs for a variety of reasons including the vested interest of some officials in restricting such information and the lack of a culture of openness. Most Collectors ignore these GOs (CRIDA/NRI 2001) either because they are unaware of them or because they do not place much importance on the livelihood constraints of these communities.

Most goat and sheep rearers are poor and illiterate belonging to the Scheduled Castes and Tribes. Not only are they unaware of their rights and entitlements, they would not even know where to begin accessing information. Formal organizations that control information are outside the sphere of social and economic interaction of goat and sheep rearers. Even educated urban citizens who may be interested in such legislation cannot get access to the information easily.

Conclusion and policy implications

Conclusion

The livestock economy has certainly gained in importance *vis-à-vis* crop cultivation in many locations and there has been a shift in the kinds of animals kept. Part of this shift has been induced by policy changes and technical support such as the decline in the number of indigenous cattle and increase in the number of cross bred cows. Where the performance of government credit schemes through the IRDP or the SC Corporation has been relatively better, SCs and the landless have benefited from milch animals. But access to fodder is key, and good access to grazing on the commons, or crop residues from own fields or the fields of employers, is essential. Access to markets and veterinary services is equally important: in MP, animal husbandry services are very weak; in PR, the closest MP village from district headquarters, people go to private veterinary doctors or use indigenous treatments. Other villages surveyed in MP are not visited by government veterinary doctors. In AP, services are better but are more accessible to rich people than the poor. Having to bribe veterinary doctors, or pay 'expenses', is commonplace.

On the other hand, for households in dry areas that are not well served by government extension or credit programs, goats appear to provide a more realistic diversification option. Goats are preferred by the poor because of the ease of feeding them even on degraded land, their resistance to disease, low maintenance, fast reproduction rate, low capital requirement and relatively higher demand in the local markets. Qualitative findings show that several agricultural labourers and attached farm servants have been able to exit poverty by rearing goats. Sheep herding appears a pro-poor option in some locations, but is limited by farmer preference towards goat, to some extent the preference is guided by belief. Backyard poultry is also an important source of income for the poor, nevertheless the poorest of the poor have access less than the relatively better poor.

In poor households, it is usually those families who have 'surplus' labour—children or old people—that are able to keep animals of any kind. However, what is noticeable is that the increasing risks in agriculture combined with remunerative opportunities in urban areas and manufacturing have led to an increase in migration. This is likely to be an important factor that militates against the growth of the livestock economy in marginal areas. However, some of the migrants find investment in goat in origin and destination an option for escaping poverty.

Labour shortages have adversely affected livestock keeping among the landed classes even in prosperous locations because of the enforcement of legislation against bonded labour.

Both quantitative and qualitative analyses support differences of livestock based livelihoods among social groups and location. For example, sugarcane is a profitable crop and shows a strong positive link between its production, bullock keeping and migration; nonetheless the sugarcane cutting market is interlocked and concentrated in specific location; the poor cannot afford the capital required in the form of bulls and carts.

The contribution of livestock income to household income appears proportionately higher among better-off groups. This may be partly attributable to higher investment capacity of the richer, but

partly attributable to caste discrimination, which means that lower income (predominantly SC and ST) households do not find a ready market for livestock products among higher caste households, so that the incentive to keep livestock is reduced.

Assets, land, education and livelihood diversification are strongly associated with household welfare. The contribution of migration is also higher among poorer groups.

Land, diversification and species appear strongly associated with livestock ownership. The richer households responded relatively more with respect to land. The impact of livelihood diversification on livestock ownership was higher for the poorer households. For many households, particularly the poorer, diversification among several types of livestock is a notable risk aversion strategy.

Village specific factors strongly influence livestock rearing decisions—for instance tribal villages in Mandla district of MP keep fewer of certain kinds of livestock because of the difficulties of selling products to higher caste households.

Policy implications

Given the kinds of structural constraints that are faced by poor farmers in marginal areas in adopting crossbred cows and buffaloes, policy should turn its attention to species that are preferred by the poor namely goats, sheep, pigs and country chickens. While there are undoubtedly research institutes and programs related to these species there is a need to raise their profile. There is also a need to find ways of addressing potentially negative environmental consequences of goat and pig rearing through pro-poor approaches that do not ban them but instead seek to provide accessible ways of feeding. Exactly how this can be achieved needs to be worked out through piloting and trials of various feeding regimes in different socio-economic contexts.

Anti-goat legislation to promote tree cover would result in an adverse effect on the welfare of the poor. A Task Force constituted by the government of India concluded that the contribution of goat to an ecologically fragile environment is only marginal. A BAIF study recommended to develop improved goat husbandry giving emphasis to breed improvement, micro-credit delivery, input procurement, sharing of technical knowledge and collective marketing through formation of user groups with a view to improve productivity without any threat to the environment (BAIF 2006b). A case study based analysis by Farm-Africa focused on the potential for goats to reduce poverty through goat development strategies such as credit programs, management and breeding improvements, value addition and linking of domestic and international markets (Peacock 2005). Similarly, sheep herding may be possible to make it more interesting through research and extension such as selection of preferable breeds of farmer's choice that produce more wool. Sheep require less grazing land than large ruminants and at the same time may contribute even less to fragile environment.

Another important factor to bear in mind while devising livestock policies is the increase in migration: here too smaller animals that are cheaper and easier to maintain such as goats and chickens appear to be the preferred choice. Poorer households also appear to be attracted by the 'divisibility' of small livestock units—one or two chickens can be sold to meet immediate cash needs.

Livestock are one of the few means of saving undertaken by the poor, even in the more remote rural areas. The 'divisibility' of especially small stock means that they play an important role in social protection. Government support to asset building and to the regulation of the livestock sector should recognize and build on this property.

Livestock keeping is also closely linked with the perpetuation of child labour and bonded labour and this points to the need for improving awareness on these dimensions into animal husbandry programs.

There is also a need for greater regulation of the private vet—medical supply outlet nexus which at present is loaded against the poor.

Livelihood diversification appears to be the most important variable, bringing particular benefits to poorer households. This indicates a need for increased attention to expand pro-poor livelihood options having strong linkages with livestock enterprises.

The technology like the stall-fed dairying and intensive poultry production are not affordable to poorer; however, these are considered the main engine of growth in Indian agriculture with further potential. This implies that the poorer require environment to get access to these technology, capital and information. Research institutes should be supported to develop poultry and dairy technology that poorer can afford. Targeted micro-credit programs linked with improved livestock production could be an attractive option in many locations. Any promotion of a particular type of livestock should consider location-specific characteristics that favour the particular type. Preparation of appropriate mapping would help. Promotion of several types of improved-bred livestock having strong linkages with other livelihood options like the sugarcane production could diversify livelihoods for the poor to escape from the hardship of poverty.

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Appendix 1

Table A1.1. Total number of livestock and poultry in India—1992—statewise (in thousands)

States	Total crossbred cattle	Total indigenous cattle	Total cattle	Total buffaloes	Total yaks	Total mithuns	Total sheep	Total goats	Total horses and ponies	Total mules	Total donkeys
Andhra Pradesh	484	10462	10946	9150	0	0	7788	4328	8	0	41
Arunachal Pradesh	19	305	324	5	9	105	32	125	5	0	0
Assam	325	9793	10118	959	0	0	149	3454	18	0	0
Bihar	191	21963	22154	5352	0	0	1689	17459	116	4	29
Goa	6	92	98	42	0	0	0	14	0	0	0
Gujarat	233	6571	6804	5268	0	0	2028	4241	13	0	79
Haryana	417	1719	2136	4372	0	0	1043	800	50	25	73
Himachal Pradesh	281	1884	2165	701	5	0	1076	1118	13	16	7
Jammu & Kashmir	793	2262	3055	729	33	0	2945	1767	122	19	19
Karnataka	626	12547	13173	4252	0	0	5430	6287	13	0	33
Kerala	1759	1765	3524	296	0	0	30	1848	0	0	0
Madhya Pradesh	208	28480	28688	7970	0	0	836	8370	73	8	58
Maharashtra	1773	15673	17446	5448	0	0	3077	9943	41	0	73
Manipur	71	648	719	114	0	22	14	38	0	0	0
Meghalaya	15	620	635	33	0	0	22	195	2	0	0
Mizoram	6	53	59	7	1	1	0	21	2	0	0
Nagaland	131	201	332	32	0	26	1	151	6	0	0
Orissa	600	13241	13841	1536	0	0	1838	4943	0	0	0
Punjab	1628	1281	2909	6008	0	0	527	544	39	16	36
Rajasthan	121	11578	11699	7708	0	0	12496	15309	24	3	200
Sikkim	45	153	198	2	10	0	15	114	2	0	0
Tamilnadu	1839	7439	9278	2814	0	0	5848	6343	9	0	43
Tripura	108	841	949	20	0	0	5	429	0	0	0
Uttar Pradesh	2498	23137	25635	20084	0	0	2403	13110	249	102	276
West Bengal	960	16493	17453	1012	0	0	1488	14170	12	0	0
Andaman & Nicobar	1	49	50	14	0	0	0	56	0	0	0
Chandigarh	5	0	5	23	0	0	0	0	0	0	0
Dadra & Nagar Haveli	0	49	49	3	0	0	0	19	0	0	0
Daman & Diu	0	8	8	0	0	0	0	5	0	0	0
Delhi	13	28	41	247	0	0	0	17	0	0	0
Lakshadweep	0	2	2	0	0	0	0	17	0	0	0
Pondicherry	60	30	90	5	0	0	3	44	0	0	0
Total	15215	189369	204584	84206	58	154	50783	115279	817	193	967

Note: The census work was not conducted in Bihar, Karnataka, Kerala, Punjab and Sikkim. In these cases projections have been used.

Table A1.2. Total number of livestock and poultry in India— 1997—statewise

States	Total crossbred cattle	Total ilndigenous cattle	Total cattle	Total buffaloes	Total yaks	Total mithuns	Total sheep	Total goats	Total horses and Ponies	Total mules	Total donkeys
Andhra Pradesh	751	9851	10602	9658	0	0	9743	5213	7	1	37
Arunachal Pradesh	11	441	451	12	14	124	27	154	6	0	0
Assam	369	7727	8097	728	0	0	84	2717	12	0	0
Bihar	232	24366	24598	5879	0	0	1956	20229	120	8	28
Chhatisgarh	105	8680	8786	1941	0	0	196	2154	9	0	1
Goa	7	81	88	40	0	0	0	13	0	0	0
Gujarat	342	6406	6749	6285	0	0	2158	4386	14	0	74
Haryana	848	1552	2401	4823	0	0	1275	968	49	34	63
Himachal Pradesh	368	1805	2174	748	7	0	1080	1168	13	18	8
Jammu & Kashmir	1083	2092	3175	787	33	0	3170	1864	141	21	23
Karnataka	1293	9539	10831	4367	0	0	8003	4875	16	0	28
Kerala	1957	533	2491	111	0	0	3	1598	0	0	0
Madhya Pradesh	177	19320	19497	6648	0	0	657	6470	55	7	49
Maharashtra	2457	15615	18072	6073	0	0	3368	11434	42	1	71
Manipur	69	439	508	95	0	17	8	33	2	0	0
Meghalaya	17	738	756	17	0	0	17	280	2	0	1
Mizoram	8	26	33	5	0	3	1	15	2	0	0
Nagaland	154	230	383	36	0	33	2	161	1	0	0
Orissa	912	12898	13810	1388	0	0	1765	5772	0	0	0
Punjab	1828	810	2638	6171	0	0	436	414	34	17	22
Rajasthan	211	11931	12141	9770	0	0	14585	16971	24	3	186
Sikkim	52	91	143	2	5	0	5	86	5	0	0
Tamilnadu	3506	5541	9046	2741	0	0	5259	6416	11	0	43
Tripura	73	1155	1228	18	0	0	6	639	2	0	0
Uttar Pradesh	2105	17911	20016	18996	0	0	1905	11784	216	84	245
Uttaranchal	103	1927	2031	1094	0	0	311	1070	23	24	1
West Bengal	936	16895	17832	1233	0	0	1462	15648	18	0	0
Andaman & Nicobar	6	54	60	14	0	0	0	71	0	0	0
Chandigarh	6	1	7	23	0	0	0	1	0	0	0
Dada & Nagar Haveli	1	59	60	4	0	0	0	20	0	0	0
Daman & Diu	0	5	5	1	0	0	0	5	0	0	0
Delhi	60	36	96	203	0	0	11	25	1	1	1
Lakshad-weep	1	3	3	0	0	0	0	26	0	0	0
Pondicherry	50	23	73	4	0	0	2	41	0	0	0
Total	20099	178782	198882	89918	59	177	57494	122721	826	220	881

Table A1.3. Total number of livestock and poultry—2003—statewise (provisional) (in thousands)

States/UTs	Cattle			Sheep	Goats	Pigs	Horses					Total livestock	
	Cross-bred	Indigenous	Total				and ponies	Mules	Donkeys	Camel	Yaks		Mithun
Andhra Pradesh	1107	8193	9300	21376	6277	570	9	–	33	–	0	0	38895
Arunachal Pradesh	13	445	458	19	231	330	7	0	0	0	9	192	799
Assam	440	7999	8440	170	2987	1543	12	0	0	0	0	0	5390
Bihar *	1274	9455	10729	382	9490	672	117	4	23	1	0	0	16432
Chhatisgarh	253	8629	8882	121	2336	552	4	–	–	–	0	0	4610
Goa	12	63	76	–	11	87	–	0	–	0	0	0	136
Gujarat	639	6785	7424	2062	4541	351	18	1	65	53	0	0	14231
Haryana	573	967	1540	633	460	120	25	14	8	50	0	0	7345
Himachal Pradesh	677	1559	2236	926	1125	3	18	24	9	–	2	0	2881
Jammu & Kashmir	1320	1764	3084	3411	2055	2	172	40	24	2	47	24	6816
Jharkhand	145	7513	7659	680	5031	1108	5	–	–	–	0	0	8167
Karnataka	1602	7936	9539	7256	4484	312	14	–	25	–	0	0	16082
Kerala	1735	387	2122	4	1213	76	–	–	–	0	0	0	1358
Madhya Pradesh	317	18595	18913	546	8142	358	32	4	39	8	0	0	16704
Maharashtra	2776	13527	16303	3094	10684	439	40	1	57	–	0	0	20460
Manipur	69	349	418	6	33	415	2	0	0	0	0	20	553
Meghalaya	23	744	767	18	327	419	2	0	0	0	0	0	785
Mizoram	9	27	36	1	17	218	2	–	0	0	0	2	245
Nagaland	243	208	451	4	175	644	1	–	0	0	0	40	898
Orissa	1063	12840	13903	1620	5803	662	–	–	9	–	0	0	9489
Punjab	1531	508	2039	220	278	29	29	9	5	3	0	0	6568
Rajasthan	464	10390	10854	10054	16809	338	25	3	143	498	–	0	38284
Sikkim	80	79	159	6	124	38	2	0	0	0	7	0	178
Tamilnadu	5140	4001	9141	5593	8177	321	25	0	26	–	0	0	15800
Tripura	57	702	759	3	472	209	0	0	0	0	0	0	698
Uttar Pradesh	1634	16917	18551	1437	12941	2284	154	52	182	16	0	0	39980
Uttaranchal	228	1961	2188	296	1158	33	17	22	1	0	0	0	2755
West Bengal	1119	17794	18913	1525	18774	1301	18	–	–	0	0	0	22704
A& Nicobar	13	51	64	0	64	52	0	0	–	0	0	0	132
Chandigarh	5	1	6	–	1	–	–	–	–	–	0	0	24
D & Nagar Haveli	1	49	50	–	21	3	–	0	0	–	0	0	28
Daman & Diu	0	4	4	–	4	–	–	0	0	–	0	0	5
Delhi	58	34	92	3	17	28	1	1	1	–	0	0	282
Lakshadweep	2	2	4	0	47	0	0	0	0	0	0	0	47
Pondicherry	63	16	78	3	48	1	–	0	–	0	0	0	56
All India	24686	160495	185181	61469	124358	13518	751	176	650	632	65	278	485002

Note: * Data from 2 districts are yet to be received from State Government. '–' denotes less than 500.
Source: Provisional census results received from State Governments

Appendix 2. Descriptive Tables

Table A2.1. Gender of household head and livestock and asset status

	Andhra Pradesh				Madhya Pradesh			
	Percent	Standard Livestock Units (mean)	Livestock Value (mean)	Asset Value (mean)	Percent	Standard Livestock Units (mean)	Livestock Value (mean)	Asset Value (mean)
Male	90.78 (4219)	2.40	14,956	13,507	88.40 (1147)	2.19	7,323	16,108
Female	9.21 (428)	2.27	13,770	12,839	11.60 (150)	1.23	3,742	8,251
All	100 (4647)	2.39	14,906	13,468	100 (1297)	2.08	6,909	15,199

* Based on census data; figures in brackets are frequencies; values are in Indian Rupees; assets exclusive of land.

Table A2.2. Gender of household head and livestock ownership

	Andhra Pradesh			Madhya Pradesh		
	Male	Female	All	Male	Female	All
With livestock	41.81 (1764)	18.00 (77)	39.6 (1841)	70.1 (804)	52.7 (79)	68.1 (883)
Without livestock	58.18 (2455)	82.00 (351)	60.4 (2806)	29.9 (343)	47.3 (71)	31.9 (414)
Total	100 (4219)	100 (428)	100 (4647)	100 (1147)	100 (150)	100 (1297)

* Based on census data; figures in brackets are frequencies.

Table A2.3. Household size and livestock and asset status

HH size groups	Andhra Pradesh				Madhya Pradesh			
	Percent	Standard Livestock Units (mean)	Livestock Value (mean)	Asset Value (mean)	Percent	Standard Livestock Units (mean)	Livestock Value (mean)	Asset Value (mean)
1	4.0 (185)	1.97	11,028	10,400	3.0 (39)	0.25	828	791
2–4	53.1 (2469)	1.97	13,393	12,040	36.9 (479)	1.38	3,935	3,670
5–6	30.1 (1401)	2.54	15,020	13,506	35.9 (465)	2.0	5,753	12,510
7–10	10.6 (494)	3.00	17,744	16,731	19.7 (255)	2.85	8,996	19,539
> 10	2.1 (98)	3.89	23,005	30,631	4.5 (59)	6.32	35,157	120,757
Total/All	100 (4647)	2.39	14,906	13,468	100 (1297)	2.08	6,909	15,199

* Based on census data; figures in brackets are frequencies; values are in Indian Rupees; assets exclusive of land.

Table A2.4. Household head age and livestock and asset status

Head age groups	Andhra Pradesh				Madhya Pradesh			
	Percent	Standard Livestock Units (mean)	Livestock Value (mean)	Asset Value (mean)	Percent	Standard Livestock Units (mean)	Livestock Value (mean)	Asset Value (mean)
20–30	21.5 (1001)	2.02	12,982	10,798	33.5 (434)	1.91	6,729	2,380
31–40	28.4 (1318)	2.35	13,710	11,363	30.4 (394)	2.06	7,117	2,764
41–50	21.9 (1020)	2.53	16,770	15,849	16.0 (207)	2.13	6,081	1,732
51–60	15.7 (729)	2.51	14,889	13,718	10.0 (130)	2.74	8,127	1,610
> 60	12.5 (580)	2.47	16,023	18,626	10.2 (132)	1.98	6,975	1,859
Total/All	100 (4647)	2.39	14,906	13,468	100 (1297)	2.08	6,909	2,263

* Based on census data; figures in brackets are frequencies; values are in Indian Rupees; assets exclusive of land.

Table A2.5. Household head education and livestock and asset status: Andhra Pradesh

Education in years	Percent	With livestock (%)	Without livestock (%)	Standard livestock units (mean)	Livestock value (mean)	Asset value (mean)
0 (Illiterate)	53.6 (2489)	40.0 (995)	60.0 (1494)	2.33	13,924	9,267
5	21.9 (1019)	47.2 (481)	52.8 (538)	2.34	14,617	15,170
8	16.9 (784)	36.0 (282)	64.0 (502)	2.59	15,631	17,129
12	3.5 (164)	25.6 (42)	74.4 (122)	2.66	28,369	20,866
15	2.0 (95)	22.1 (21)	77.9 (74)	2.66	31,161	16,155
> 15	2.1 (96)	20.8 (20)	79.2 (76)	2.73	15,127	15,713
Total/All	100 (4647)	39.6 (1841)	60.4 (2806)	2.39	14,906	13,468

* Based on census data; figures in brackets are frequencies; values are in Indian Rupees; assets exclusive of land.

Table A2.6. Percentage of literates in household and livestock and asset status: Madhya Pradesh

% of literates in HH	Percent	With livestock (%)	Without livestock (%)	Standard livestock units (mean)	Livestock value (mean)	Asset value (mean)
0	24.8 (322)	63.4 (204)	36.6 (118)	1.66	4,444	374
1–20	10.3 (133)	82.0 (109)	18.0 (24)	2.53	6,783	857
21–40	17.1 (222)	74.8 (166)	25.2 (56)	2.44	6,981	1,028
41–60	19.8 (257)	65.0 (167)	35.0 (90)	2.16	8,512	3,490
61–80	16.3 (212)	66.5 (141)	33.5 (71)	2.08	7,980	3,478
81–100	11.6 (151)	63.6 (96)	36.4 (55)	1.94	7,936	5,477
Total/All	100 (1297)	68.1 (883)	31.9 (414)	2.08	6,909	2,263

* Based on census data; figures in brackets are frequencies; values are in Indian Rupees; assets exclusive of land.
Note: Different categorization is used in column 1 as AP and MP data are not comparable in this regard.

Table A2.7. *Social/caste status and livestock and asset ownership*

Social/Caste status	Andhra Pradesh				Madhya Pradesh			
	Percent	Standard Livestock Units (mean)	Livestock Value (mean)	Asset Value (mean)	Percent	Standard Livestock Units (mean)	Livestock Value (mean)	Asset Value (mean)
Scheduled Tribe	3.2 (148)	2.97	15,693	13,982	11.5 (149)	1.87	3,885	451
Scheduled Caste	18.0 (838)	1.52	9,194	5,977	15.2 (197)	1.09	3,984	1,063
Backward Caste	47.4 (2202)	2.41	14,752	11,388	68.2 (885)	2.41	8,408	2,405
General/Upper Caste	31.4 (1459)	2.76	18,021	18,257	5.1 (66)	1.08	2,357	8,028
Total/All	100 (4647)	2.39	14,906	13,468	100 (1297)	2.08	6,909	2,263

* Based on census data; figures in brackets are frequencies; values are in Indian Rupees; assets exclusive of land.

Table A2.8. *Land ownership and livestock and asset status: Andhra Pradesh*

Land categories	Percent	With livestock (%)	Without livestock %	Land (mean) (acres)	Standard livestock units (mean)	Livestock value (mean)	Asset value (mean)
Landless	54.6 (2537)	22.9 (581)	77.1 (1956)	0	1.72	11,146	6,882
Submarginal	5.2 (242)	35.1 (85)	64.9 (157)	0.35	1.62	9,620	5,200
Semi-marginal	10.2 (472)	51.1 (241)	48.9 (231)	0.71	2.03	12,522	9,307
Marginal	10.6 (494)	62.3 (308)	37.7 (186)	1.29	2.35	14,351	11,720
Small	9.9 (458)	65.9 (302)	34.1 (156)	2.47	2.89	17,423	13,896
Semi-medium	5.3 (247)	66.0 (163)	34.0 (84)	4.44	3.36	19,404	25,891
Medium	3.6 (166)	79.5 (132)	20.5 (34)	9.47	3.74	26,944	55,305
Large	0.7 (31)	93.5 (29)	6.5 (2)	26.46	4.57	24,855	93,762
All/Total	100 (4647)	39.6 (1841)	60.4 (2806)	1.22	2.39	14,906	13,468

* Based on census data; figures in brackets are frequencies; values are in Indian Rupees; assets exclusive of land.

Table A2.9. Land ownership and livestock and asset status: Madhya Pradesh

Land categories	Percent	With livestock (%)	Without livestock (%)	Land (mean) (acres)	Standard livestock units (mean)	Livestock value (mean)	Asset value (mean)
Landless	22.7 (295)	31.5 (93)	68.5 (202)	0	0.45	1,681	5,503
Submarginal	4.3 (56)	62.5 (35)	37.5 (21)	0.75	1.19	1,766	2,680
Semi-marginal	11.3 (147)	63.3 (93)	36.7 (54)	0.78	1.43	2,738	2,396
Marginal	15.7 (203)	70.9 (144)	29.1 (59)	1.46	1.63	3,412	1,712
Small	17.5 (227)	80.2 (182)	19.8 (45)	2.58	2.19	5,531	1,962
Semi-medium	14.4 (187)	87.2 (163)	12.8 (24)	4.68	2.77	7,494	3,069
Medium	10.6 (138)	94.9 (131)	5.1 (7)	8.76	4.34	15,375	5,604
Large	3.4 (44)	95.5 (42)	4.5 (2)	26.36	8.04	56,634	30,125
All/Total	100 (1297)	68.1 (883)	31.9 (414)	3.30	2.09	6,909	5,907

* Based on census data; figures in brackets are frequencies; values are in Indian Rupees; assets exclusive of land.

Table A2.10. Household income quartiles and livestock and asset status: Andhra Pradesh

Income Quartiles	With livestock (%)	Without livestock (%)	Land (mean) (acres)	Standard livestock units (mean)	Livestock value (mean)	Asset value (mean)
Quartile 1	72.5 (971)	27.5 (369)	0.50	2.00	11,413	8,023
Quartile 2	59.7 (636)	40.3 (429)	0.71	2.00	11,897	7,846
Quartile 3	55.8 (668)	44.2 (530)	1.10	2.35	14,383	10,109
Quartile 4	50.9 (531)	49.1 (513)	2.81	3.04	20,488	23,823
All	60.4 (2806)	39.6 (1841)	1.22	2.39	14,906	13,468

* Based on census data; figures in brackets are frequencies; values are in Indian Rupees; assets exclusive of land.

Table A2.11. Household income quartiles and livestock and asset status: Madhya Pradesh

Income quartiles	With livestock (%)	Without livestock (%)	Land (mean) (acres)	Standard livestock units (mean)	Livestock value (mean)	Asset value (mean)
Quartile 1	50.7 (38)	49.3 (37)	1.20	0.99	2,648	3,253
Quartile 2	61.0 (47)	39.0 (30)	1.62	1.67	3,299	4,721
Quartile 3	70.7 (53)	29.3 (22)	2.09	2.00	5,109	7,770
Quartile 4	74.7 (56)	25.3 (19)	7.15	2.83	22,091	77,467
All	64.2 (194)	35.8 (108)	3.00	1.87	8,253	23,179

* Quartiles are based on seasonal survey data; figures in brackets are frequencies; values are in Indian Rupees; assets exclusive of land.

Table A2.12. Income quartiles and land and livestock status by village: Madhya Pradesh

Village	Quartile 1		Quartile 2		Quartile 3		Quartile 4		All	
	Land owned (mean)	Standard livestock units (mean)	Land owned (mean)	Standard livestock units (mean)	Land owned (mean)	Standard livestock units (mean)	Land owned (mean)	Standard livestock units (mean)	Land owned (mean)	Standard livestock units (mean)
PR	0.5	0.55	0	0.02	0	1.05	17	5.36	8.16	2.85
LJ	2.08	1.14	3.07	2.04	2.81	2.04	7.21	3.28	3.6	2.03
GG	0.23	0.22	1.04	1.12	1.09	0.8	0.9	1.4	0.69	0.72
PT	1.87	1.32	1.87	1.96	3.47	4.23	5.5	1.42	2.99	2.39
SM	1.5	1.8	1.49	1.01	2.3	1.35	2.87	1.75	2.23	1.5
MB	0.47	1.03	1.29	2.51	1.28	2.08	0	0	1.1	2.03
All	1.2	0.99	1.62	1.68	2.09	2.01	7.15	2.83	3	1.88

Table A2.13. Income quartiles and land and livestock status by village: Andhra Pradesh

Village	Quartile 1		Quartile 2		Quartile 3		Quartile 4		All	
	Land owned mean	Standard Livestock Units mean	Land owned mean	Standard livestock Units mean	Land owned mean	Standard livestock Units mean	Land owned mean	Standard livestock Units mean	Land owned mean	Standard livestock Units mean
OP	0.76	1.21	0.92	1.61	1.04	1.66	2.65	2.60	1.29	1.78
VP	0.67	1.56	1.00	1.59	1.53	1.96	3.41	3.66	1.61	2.25
KO	0.20	1.48	0.30	1.65	0.54	1.84	2.42	2.61	0.92	2.01
KA	0.31	1.21	0.83	1.82	1.61	2.25	4.42	2.78	1.95	2.16
GU	0.48	2.61	0.71	2.98	1.10	3.73	2.16	4.09	1.03	3.40
MD	1.06	2.91	1.19	2.89	1.96	3.04	5.12	3.33	1.60	2.97
All	0.50	2.00	0.71	2.00	1.10	2.35	2.81	3.04	1.22	2.40

Table A2.14. Land categories and mean standard livestock units (SLUs) by village: Andhra Pradesh

Village	Landless	Submarginal	Semi-marginal	Marginal	Small	Semi-medium	Medium	Large	All
OP	1.40	0.58	1.64	1.97	1.87	2.61	3.46	2.20	1.78
VP	0.87	1.20	1.91	2.15	2.74	3.75	4.53	3.60	2.25
KO	1.62	1.09	2.13	2.11	2.63	3.10	2.70	4.07	2.01
KA	1.33	1.55	1.55	2.09	2.68	2.78	2.86	4.66	2.16
GU	2.35	3.25	2.03	2.49	4.34	4.15	5.58	4.97	3.40
MD	3.46	2.41	2.55	3.24	2.81	3.70	1.75	7.80	2.97
All	1.72	1.62	2.03	2.35	2.89	3.36	3.74	4.57	2.39

Table A2.15. Land categories and mean standard livestock units (SLUs) by village: Madhya Pradesh

Village	Landless	Submarginal	Semi-marginal	Marginal	Small	Semi-medium	Medium	Large	All
PR	0.54	00	0.20	0.40	3.00	2.96	4.80	8.75	3.17
LJ	0.46	0.33	1.01	1.12	1.98	2.85	5.88	7.27	1.96
GG	0.27	00	1.18	1.57	1.78	2.05	3.24	00	1.12
PT	0.97	0.82	1.80	2.15	2.82	3.15	4.44	00	2.14
SM	0.30	1.87	1.17	1.59	2.04	2.67	3.74	5.15	2.22
MB	0.39	1.62	1.91	2.54	2.95	3.18	3.93	10.60	2.12
All	0.45	1.19	1.43	1.63	2.19	2.77	4.34	8.04	2.09

Appendix 3. Detailed results of regression analysis

Table A3.1. *Determinants of household income in Andhra Pradesh, 2001–2002*

Variables	All sample	Quintiles 1–4	Quintiles 2–5	Quintiles 2–4	Quintiles 3–5
Constant	8.549(.00)	8.253(.00)	8.669(.00)	8.370(.00)	8.824(.00)
SLU	0.027(.01)	0.010(.24)	0.032 (.00)	0.011(.06)	0.019(.06)
Assets	0.042(.00)	0.019(.00)	0.036(.00)	0.010(.00)	0.028(.00)
Land	0.171(.00)	0.069(.00)	0.144(.00)	0.024(.01)	0.161(.00)
WetL	0.097(.00)	0.074(.00)	0.071(.01)	0.040(.02)	0.044(.15)
Schooling	0.121(.00)	0.026(.04)	0.125(.00)	0.031(.00)	0.144(.00)
Diversity	0.367(.00)	0.229(.00)	0.248(.00)	0.103(.00)	0.170(.00)
D1	0.071(.03)	0.057(.05)	0.028(.34)	0.009(.62)	0.030(.35)
D2	0.340(.00)	0.239(.00)	0.260(.00)	0.154(.00)	0.122(.01)
D3	–0.060(.01)	0.018(.35)	–0.080(.00)	0.001(.97)	–0.091(.00)
D4	0.031(.28)	–0.013(.63)	0.062(.02)	0.023(.21)	0.026(.34)
D5	–0.118(.06)	0.033(.53)	–0.100(.09)	0.019(.60)	–0.086(.20)
D6	–0.147(.00)	0.004(.89)	–0.144(.00)	0.012(.53)	–0.156(.00)
D7	–0.096(.00)	0.015(.52)	–0.093(.00)	0.016(.32)	–0.105(.00)
V1	0.201(.00)	0.190(.00)	0.089(.09)	0.065(.05)	0.083(.17)
V2	0.213(.00)	0.189(.00)	0.099(.04)	0.066(.03)	0.074(.18)
V3	0.004(.94)	0.143(.01)	–0.080(.14)	0.059(.09)	–0.163(.01)
V4	–0.137(.01)	–0.119(.01)	0.016(.75)	0.049(.12)	–0.020(.72)
V5	–0.154(.02)	–0.178(.00)	0.039(.55)	0.003(.93)	0.017(.82)
Number of obs	4556	3644	3645	2733	2734
F value (Prob > F)	96.80 (.00)	40.19(.00)	64.76(.00)	10.31(.00)	50.19(.00)
R-squared	0.28	0.17	0.24	0.06	0.25
Adj R-squared	0.28	0.16	0.24	0.06	0.25

Dependent variable = Log of household total income per adult equivalent.

Figures in parentheses are p-values (prob > t).

Variables other than dummy variables are normalized by adult equivalent. The first six variables are expressed in log. The last 12 variables are dummy variables. Ds and Vs are defined in Table 9; D1-migration, D2-remittance, D3-money lender loan, D4-bank loan, D5-Scheduled Tribes, D6-Scheduled Caste, D7-Backward Caste and Vs are village dummies.

Table A3.2. *Determinants of household income in Madhya Pradesh, 2001–2002.*

Variables	All sample	Quintiles 1–4	Quintiles 2–5	Quintiles 2–4	Quintiles 3–5
Constant	8.571(.00)	7.319(.00)	9.270(.00)	8.348(.00)	8.942(.00)
SLU	0.138(.03)	0.083(.13)	0.077(.20)	0.019(.68)	0.105(.08)
Assets	0.043(.02)	0.022(.17)	0.032(.04)	0.020(.08)	0.032(.07)
Land	0.228(.00)	0.138(.02)	0.167(.01)	0.080(.05)	0.145(.02)
Schooling	0.090(.27)	0.041(.54)	0.066(.38)		0.087(.23)
Diversity	0.371(.01)	0.182(.22)	0.221(.07)		0.323(.01)
D1	0.413(.00)	0.558(.00)	0.073(.53)	0.200(.02)	
D2	0.748(.00)	0.456(.05)	0.687(.00)	0.344(.04)	0.442(.01)
D4	0.215(.16)		0.250(.07)		0.309(.04)
D5	–0.652(.07)	–0.150(.35)	–0.738(.02)	–0.655(.02)	–0.345(.11)
D6	–0.963(.25)	–0.222(.11)	–0.821(.01)	–0.503(.07)	–0.545(.00)
D7	–0.332(.25)		–0.419(.12)	–0.458(.08)	
V1	–0.795(.00)		–0.858(.00)		–0.663(.00)
V2	–0.653(.02)	0.131(.46)	–0.928(.00)		–0.730(.00)
V3	–0.815(.00)		–1.038(.00)	–0.146(.24)	–0.790(.00)
V4	–0.225(.28)	0.655(.00)	–0.624(.00)	0.232(.02)	–0.441(.01)
V5	–0.798(.00)	0.181(.26)	–1.013		–0.948(.00)
Number of obs	283	225	238	180	177
F value (Prob > F)	8.49(.00)	6.59(.00)	7.88(.00)	4.14(.00)	7.76(.00)
R-squared	0.34	0.27	0.36	0.20	0.40
Adj R-squared	0.30	0.23	0.32	0.15	0.35

Dependent variable = Log of household total income per adult equivalent.

Figures in parentheses are p-values (prob > t).

Variables other than dummy variables are normalized by adult equivalent. The first four variables are expressed in log. The last 12 variables are dummy variables. Ds and Vs are defined in Table 9; D1-migration, D2-remittance, D3-money lender loan, D4-bank loan, D5-Scheduled Tribes, D6-Scheduled Caste, D7-Backward Caste and Vs are village dummies.

Table A3.3. *Determinants of livestock ownership in Andhra Pradesh, 2001–2002*

Variables	All sample		Quintiles 1–4		Quintiles 2–5		Quintiles 2–4		Quintiles 3–5	
	Coefficient	P value	Coefficient	P value	Coefficient	P value	Coefficient	P value	Coefficient	P value
Constant	–0.458	0.009	–0.520	0.027	–0.549	0.069	–0.826	0.025	–0.280	0.354
Income	0.033	0.087	0.041	0.119	0.045	0.133	0.079	0.085	0.017	0.592
Assets	0.000	0.001	0.000	0.006	0.000	0.005	0.000	0.001	0.000	0.008
Land	0.094	0.000	0.070	0.004	0.086	0.043	0.058	0.000	0.106	0.000
Schooling	–0.016	0.762	–0.020	0.313	–0.022	0.164	–0.032	0.260	–0.014	0.528
Diversity	0.181	0.000	0.177	0.000	0.166	0.000	0.156	0.000	0.157	0.000
Species	–1.520	0.000	–1.650	0.000	–1.467	0.000	–1.618	0.000	–1.355	0.000
Landless	–0.141	0.000	–0.123	0.005	–0.137	0.014	–0.125	0.000	–0.168	0.000
D1	–0.156	0.000	–0.189	0.000	–0.131	0.001	–0.176	0.005	–0.150	0.005
D2	0.057	0.420	0.036	0.687	0.109	0.282	0.105	0.158	0.113	0.159
D5	–0.059	0.500	–0.023	0.784	–0.134	0.343	–0.097	0.149	–0.057	0.609
D6	–0.192	0.000	–0.170	0.000	–0.233	0.000	–0.208	0.000	–0.263	0.000
D7	–0.021	0.595	–0.033	0.380	–0.027	0.268	–0.049	0.454	–0.013	0.739
V1	0.273	0.000	0.318	0.000	0.233	0.002	0.286	0.005	0.204	0.042
V2	0.506	0.000	0.503	0.000	0.473	0.000	0.477	0.000	0.438	0.000
V3	0.197	0.006	0.215	0.008	0.144	0.089	0.160	0.081	0.130	0.184
V4	0.530	0.000	0.545	0.000	0.474	0.000	0.483	0.000	0.452	0.000
V5	0.551	0.000	0.590	0.000	0.585	0.000	0.627	0.000	0.483	0.000
No. of obs	4556		3644		3645		2733		2734	
F value (Prob> F)	157.27 (.00)		138.96 (.00)		118.54 (.00)		99.19 (.00)		79.43 (.00)	
R ²	0.40		0.42		0.38		0.41		0.36	
Adj R ²	0.40		0.42		0.38		0.41		0.35	

Dependent variable = Log of total livestock unit per adult equivalent.

Variables other than dummy variables are normalized by adult equivalent. Income, land, schooling and diversity are expressed in log. The last 12 variables are dummy variables. Ds and Vs are defined in Table 9; D1-migration, D2-remittance, D3-money lender loan, D4-bank loan, D5-Scheduled Tribes, D6-Scheduled Caste, D7-Backward Caste and Vs are village dummies.

Table A3.4. *Determinants of livestock ownership in Madhya Pradesh, 2001–2002.*

Variables	All sample		Quintiles 1–4		Quintiles 2–5		Quintiles 2–4		Quintiles 3–5	
	Coefficient	P value	Coefficient	P value	Coefficient	P value	Coefficient	P value	Coefficient	P value
Constant	–0.911	0.056	–1.192	0.057	–0.795	0.180	–1.387	0.142	–0.028	0.967
Income	0.061	0.168	0.048	0.422	0.077	0.170	0.123	0.215	0.039	0.561
Assets	0.000	0.188	0.000	0.234	0.000	0.555	0.000	0.374	0.000	0.928
Land	0.092	0.058	0.048	0.429	0.119	0.015	0.085	0.187	0.106	0.036
Schooling	–0.025	0.656	–0.054	0.401	–0.036	0.523	–0.054	0.423	–0.104	0.091
Diversity	0.282	0.003	0.369	0.009	0.238	0.009	0.335	0.016	0.161	0.076
Species	–1.442	0.000	–1.442	0.000	–1.386	0.000	–1.393	0.000	–1.379	0.000
Landless	–0.131	0.210	–0.005	0.970	–0.134	0.202	–0.063	0.654	–0.136	0.239
D1	–0.108	0.226	–0.106	0.305	–0.122	0.170	–0.150	0.152	–0.092	0.353
D2	0.207	0.174	0.210	0.291	0.189	0.186	0.205	0.285	0.175	0.211
D4	–0.181	0.089	–0.166	0.203	–0.178	0.087	–0.145	0.274	–0.118	0.272
D5	–0.610	0.014	–0.523	0.168	–0.452	0.074	–0.376	0.375	–0.566	0.029
D7	–0.076	0.701	0.045	0.897	–0.124	0.517	–0.034	0.928	–0.235	0.221
V1	0.213	0.179	0.407	0.037	–0.043	0.802	0.061	0.793	–0.335	0.062
V2	0.597	0.001	0.725	0.002	0.478	0.012	0.489	0.053	0.276	0.170
V3	0.534	0.007	0.741	0.003	0.235	0.256	0.332	0.237	–0.029	0.893
V4	0.377	0.012	0.508	0.011	0.165	0.299	0.174	0.450	–0.061	0.704
V5	0.421	0.027	0.543	0.017	0.267	0.174	0.299	0.232	0.023	0.914
Number	283		225		238		180		177	
of obs										
F value	21.00 (.00)		15.64 (.00)		18.31 (.00)		12.09 (.00)		16.98 (.00)	
(Prob > F)										
R-squared	0.59		0.58		0.60		0.56		0.66	
Adj R-squared	0.56		0.54		0.57		0.53		0.62	

Dependent variable = Log of household total income per adult equivalent.

Variables other than dummy variables are normalized by adult equivalent. Income, land, schooling and diversity are expressed in log. The last 12 variables are dummy variables. Ds and Vs are defined in Table 9; D1-migration, D2-remittance, D3-money lender loan, D4-bank loan, D5-Scheduled Tribes, D6-Scheduled Caste, D7-Backward Caste and Vs are village dummies.