1 Title

Impact of irrigation-led agricultural development on use of common lands in dry regions of Karnataka, India

2 Subtitle

3 Abstract

The currently popular notion of ‘community management’ of rural common-property resources such as forests and grazing lands is based upon an assumption of a heavy dependence of the rural community on the commons. While the pioneering work of Jodha and others provided an empirical basis for such an assertion, this and subsequent work has also flagged the possibility of a decline in this dependence over time due to various factors. Understanding whether and why such a decline might occur is crucial to understanding the practical limits to and redesign of the community management approaches. We seek to contribute to this literature by exploring the impact of canal irrigation-led agricultural transformation on the relationship between rural households and common lands both spatial and temporally. We have attempted this through a case study approach that compares two villages in the eastern plains region of Karnataka, both well-endowed with common lands but one of them having been brought under canal irrigation over the last two decades. Both villages were also brought under the Joint Forest Planning and Management (JFPM) programme of the state forest department in the past few years. Our comparisons indicate a major difference between the two villages in terms of the use of common lands for fuelwood collection and grazing and it is higher in unirrigated case study village. This difference is seen across all the economic classes, but it is noteworthy that the poorest economic class in the irrigated village continues to have a significant dependence. Enquiring into the history of the case study villages showed that the dependence on common lands decreased with the advent of irrigation in the irrigated village, but the links between irrigation and common land use are complex and context-specific. The unexpected link between irrigation and proliferation of the exotic weed *Prosopis juliflora*, the increasing pressure on the commons for conversion to cultivable land even by the poor, and increased labour demands also play a role in reducing dependence. Our findings underline the dangers of simplistic assumptions about the link between villagers and their common lands and therefore about their interest in undertaking ‘community’ management. We point out the need to redesign official policies such as joint forest management that are currently based upon such assumptions.

4 Keywords

Common property resources, Common lands, irrigation, dependence, fodder, fuelwood

5 Background and Objectives

5.1 Debates about CPR dependence and agricultural development

In last few decades, the role of common property land resources (CPRs for short)[1] for the livelihood of rural households has been researched quite extensively (e.g., Jodha, 1986; Nadkarni, 1990; Arnold and Stewart, 1991). Most of the earlier literature dealt with status and use of CPRs by rural communities. Rural communities were shown to be dependent upon CPRs for meeting their own fuelwood, grazing and small timber needs (as well as food and medicinal needs to some extent). In many situations, they were also extracting and selling fuelwood and non-timber forest products for generating income. However, over the nearly six decades years since India's independence, there has been a significant decline in CPR dependence amongst rural communities across the country. The first reason for such a decrease in dependence is the degradation of the CPRs themselves (Beck and Ghosh, 2000; Iyengar, 1989; Jodha, 1986; Nadkarni, 1990). A variant of this has been the rapid privatisation of many CPRs for cultivation by rich and poor households alike, with strong encouragement from the state. Second, various transformations in the rural economy resulting from state and market interventions have either reduced the importance of CPRs in the livelihood pattern or completely shifted their dependence elsewhere (Jodha, 1985;1995; Freese, 1998; Beck and Ghosh, 2000; Vedeld *et al.*, 2004; Sengupta, 2004). For, e.g., in the Western Ghats of Karnataka, it has been shown that where coffee or tea plantations have become important land-uses, the traditional link between forests, agriculture and livelihoods has been lost (Lélé, 2001).[2]

Amongst the various processes of rural transformation, irrigation-induced changes are clearly one of the most important, and they have been studied using both macro- and micro-level data. The macro-level analysis by Chopra and Dasgupta (2003) using data for four states out of the dataset from the 54th round survey conducted by the National Sample Survey Organisation (NSSO) showed that villagers in irrigated areas derive a larger fraction of their fuel and fodder use from agricultural residues as compared to unirrigated villages. Another analysis of the entire NSSO 54th round dataset Menon and Vadivelu (2006) showed that states based on agriculture economies show a lower dependence on CPRs. Micro-level studies reinforce these observations and provide some more detail. Iyengar's study in Gujarat compared groups of irrigated and unirrigated

[1] Admittedly, the term CPR (common property resource) encompasses non-land resources such as water and fisheries. Some authors (such as Iyengar, 1989) have used the term CPLRs to indicate the focus on common lands. Although our study is indeed focused only on common lands, we prefer to use the more widely recognized acronym CPRs. Two more clarifications are in order. First, although strictly speaking 'common property' refers to resources that are fully owned by a group, in the Indian context very few common lands are actually controlled by local communities. Hence the convention has been to include all lands that are 'accessible' to the village community as a whole, even though they may not have complete management rights over these lands. Second, we use the term 'common lands' to include both forest lands and other types of publicly accessible lands such as grazing lands.

[2] Whereas traditional agricultural or horticultural systems (i.e., paddy or areca cultivation) occupy the valley lands only and depend upon forests for substantial inputs of organic matter and nutrients in order to maintain productivity under heavy rainfall conditions, coffee and tea plantations directly compete with forests for the same ecological niche, i.e., the hill slopes and ridges, and use chemical fertilizers extensively to maintain fertility. The shade trees in the plantations also yield substantial amounts of fuelwood. Thus, farmers cultivating coffee and tea are no longer dependent upon the commons for any of their domestic or agricultural inputs; instead, they prefer to convert the commons to such plantations.

villages located in different geo-physical regions in terms of their dependence on CPR (Iyengar, 1989). The study showed that the dependence was lower in agriculturally developed villages with better irrigation facility, as the agricultural residues available from the irrigated agricultural land were higher. Beck and Ghosh (2000), in their study in Bengal, showed that overall dependence on common lands by villages with better agriculture infrastructure was low. Although the dependence of the poor classes continued to be higher than that of the better-off, the dependence of the poor on the commons was also dramatically lower in the well-developed village. Note that the inferences in both these studies are based upon a cross-sectional (spatial) comparison of irrigated and unirrigated villages and there was no information of how the villagers in irrigated villages used to obtain firewood and fodder before the advent of irrigation.

The above review of the literature suggests that there is a fairly clear correlation between increased economic development and decreased common land dependence. But there is room to augment our understanding of the specific pathway through which this decline occurs, particularly in the context of one mechanism of economic development, viz., canal irrigation.[3] There is also a need to better understand the differential impact of such changes across economic classes. Karnataka's eastern plains region, particularly the northern part is well-suited for this purpose, as it has a high incidence of canal irrigation (and more canal irrigation schemes are under construction). In the present study we intend to compare the CPR dependence in irrigated and unirrigated village using spatial comparison and later support the results by looking at the dependence in irrigated village before the advent of irrigation.

5.2 Policy relevance of the CPR dependence question

Since about the 1990s, the governments of most states in India have attempted to shift towards more participatory forms of natural resource management. The 'joint forest management' (JFM) initiatives in various states have been particularly targeted at forests and often including other common lands. The core assumptions of all such initiatives are that a) rural communities are heavily dependent upon such common lands for key livelihood needs of fuelwood, fodder, etc; b) hence the degradation of these lands is of great concern to them, and c) hence, given a chance, they would willingly cooperate amongst themselves to manage and regenerate these lands (see, e.g., Agarwal and Narain, 1989). But if the rural community is *not* dependent upon common lands in this manner, the incentive for them to get involved in any collective management of these lands in general and JFM in particular would be seriously reduced. Given that the state governments are borrowing and spending vast sums of money on implementing such programmes,[4] it is urgent that policy makers and programme implementers be aware of the variation in dependence on the commons that they are supposedly trying to regenerate.

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[3] Today, the percentage of net irrigated area (including all types of irrigation) to the net sown area is 40 % in India and about 25% in Karnataka and the percentage of canal irrigated area within all types of irrigation is 40%.

[4] For instance, the Karnataka Forest Department implemented an "Eastern Plains Forestry and Environment Project" during 1997-2002 with a loan of more than Rs.500 crores from the Japanese Bank for International Cooperation (Principal Chief Conservator of Forests, 1996). And it has taken a fresh loan of Rs. 573 crores as a 2nd phase of this project file (see www.jbic.go.jp/english/oec/project/yen_loan_list.php).

5.3 Objectives and framework

The objective of the study is to understand the changes in the pattern of dependence on common lands induced by the introduction of canal irrigation using both temporal and spatial comparisons within a case study approach. For the spatial comparison, two villages both well endowed with common lands but one village with irrigation and another without irrigation are compared for their dependence on CPR. The results of spatial comparison are confirmed by looking at the pattern on dependence on CPR in the irrigated village before and after the advent of canal irrigation. We hypothesized that in villages with large amount of cultivated area under canal irrigation, an increase in the number of crops and the area cultivated would substantially increase the availability of crop residues that could be used as fodder and fuelwood by the villagers. Consequently, the dependence on common lands for these products would be expected to reduce substantially. Note that we define dependence simply in terms of the extent to which households go to common lands at all for these products, and the physical quantities of these products extracted or, in the case of grazing, the time spent by livestock units in grazing.

6 Methodology

6.1 Choice of sample villages

This study is a part of larger study we had carried out to understand the quality of Joint Forest Planning and Management (JFPM) in the eastern plains region (Lélé *et al.*, 2005). We assumed that availability of common lands is a pre-requisite to meaningful JFPM. We further hypothesized that actual response of the villagers to the JFPM programme in villages with adequate common lands would be influenced by the level of dependence of the villagers on those lands, and this dependence in turn would be influenced by the presence or absence of canal irrigation. We sought to identify JFPM villages with significant extent of common lands and within this subset, selected one village each with and without canal irrigation.

Given the focus on JFPM, we perforce looked only at villages where Village Forest Committees (VFCs) had been formed. This made the population of villages that we could chose from quite small. The macro-level dataset on JFPM implementation in Eastern Plains Forestry and Environment Project (EPFEP) provided by Karnataka Forest Department (KFD) was combined with the Census 1991 village-wise dataset. The KFD dataset contained a list of 1722 VFCs in all, listed as of 31st December 2001, of which 1036 could be matched with the Census 1991 village list. Of these, only 233 belonged to the northern maidan[5] region. From this subset, we identified 12 JFPM villages with more than 50 % total irrigated area and 30 % of land under common lands[6]. Even amongst

5 Since micro level case studies are done for only two villages it would be difficult to compare studies carried under different agro-climatic and socio-economic conditions. Also since most of the studies are conducted within Southern Karnataka, it was decided to conduct the present study in Northern Karnataka (northern maidan).

6 Population Census datasets of Primary Census Abstract (PCA) and Village Amenities was combined together for selecting the sample villages (Census of India, 1991). Irrigated area quoted above is related to only canal irrigated area. We did not consider other type of irrigation sources, viz., bore wells, open wells, tanks, rivers and streams

these, most were very large (i.e., with a population of more than 2000). Covering such large villages would have been difficult, given our limited resources. Eventually, we selected Benkanahalli in Shorapur taluka of Gulbarga district as the irrigated village. However, identifying JFPM villages without canal irrigation was easy. There were 58 such villages in northern maidan of which we chose Kanvihalli in Harappanahalli taluka of Davangere district (see Figure 2).[7] Both southern and northern maidan together contain 16969 villages of which 325 villages had more than 80 ha common land and 25 percent canal irrigated area;[8] Benkanahalli falls within this subset. Similarly Kanvihalli falls within the subset of 776 villages where more than 50 percent of total geographical area is under common lands and less than 25 percent of net sown area is irrigated. Note, however, that presence of canal irrigation and the presence of common lands were significantly negatively correlated, because topography dictates that canals can only irrigate villages in the lower parts of valleys, whereas forests and common lands occur much more in villages in the upper reaches[9].

6.2 Method of data collection within sample villages

In each of the case study villages, we collected available secondary data from the Village Accountant, the village cadastral map from the Land Records office, and historical information from the taluka-level archives and village elders. We then conducted social mapping, focus group discussions (FGDs) and key informant interviews. The above process helped us in developing a broad understanding of agriculture, land distribution and common lands with a historical perspective. To prepare the temporal write up of the case study villages, information on common lands management was collected in detail using recall method from the knowledgeable village elders and particularly those who had been involved in village common land management in the past. During FGDs, cadastral maps were used to understand the location of common lands and distances travelled for fuel and fodder collection, and to identify parcels that have been encroached for cultivation. Once a broad understanding of the village with respect to use of common lands was developed, we designed and implemented a questionnaire survey for about 67 households stratified by landholding (27 households in Benkanahalli and 39 households in Kanvihalli) and other assets. We also sampled the vegetation in the common lands. Point sampling method was used to assess the tree density on the common lands. The above process took more than three weeks for two researchers to complete one village. To have a better rapport with the villagers, the researchers stayed in the village throughout the study. In one of the case study village (Kanvihalli), an NGO (REACH,

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because the extent of such irrigation was low. The common land area is sum of cultivable wasteland and forest area. Percentage of canal irrigated area was calculated by dividing canal irrigated area by sum of total irrigated area and unirrigated area, whereas percentage of common land was calculated by dividing sum of forest area and cultivable wastelands by total geographical area of the village.

7 In 1953, following the reorganisation of states, Bellary district became part of Karnataka State. In 1998, with the reorganisation of districts within Karnataka, Harpanahalli taluka became part of Davangere district and earlier it was part of Bellary district.

8 In fact, the first hand information collected during field visit and recent satellite imagery indicated that irrigated area has increased significantly since the 1991 census.

9 This seems to be the case elsewhere also. E.g., the study in Gujarat by Iyengar (1989) showed that CPR land in irrigated villages is very small, ranging from 0.4 % to 27.9 % of the total geographical area. On the other hand, villages with low or no irrigation facility had 9.6 % to 72.9 % CPR area.

Harpanahalli) involved in various development process of the village helped in collecting the information and easy understanding of the village. In other village, there was no NGO working in the village, but we took the help of an NGO (Abhiyan) working the neighbouring village.

7 Description

7.1 Description of the study region

Karnataka lies between latitudes 11.33 and 18.27 degrees north and longitudes 74.02 and 78.33 degrees east on the western part of Deccan plateau of India. Karnataka's total geographical area is 191,791 sq.kms. As per the 2001 Census, the total State's population was 527 lakhs and density of population was 275 persons per sq. km.

Several different ways of classifying Karnataka into agro-climatic or eco-climatic zones have been proposed. We follow the zonation adopted by Nadkarni (1990).[10] The state has been divided into four regions *viz.*, Coastal and Ghat, Mixed and transitional, Northern maidan and Southern maidan. The broad outlines of each region are indicated in Figure 2. Both of our case study villages are located in the Northern maidan, although one of them is at the very southern edge. As such, our study villages may be said to be representative of the entire northern and southern maidan regions, which together are conventionally called the 'eastern plains' of Karnataka.

In eco-climatic terms, the northern maidan is a dry region, with rainfall ranging from 350 to 900 mm annually. The region is an extensive plateau with mostly deep black soils. The Krishna and its tributaries—the Malaprabha, Ghataprabha, Tungabhadra and Bheema—are the principal rivers of the northern maidan. Forest cover is low but low however there are many pockets (Chincholi, Sandur, Ramdurg) with significant forest cover (although in various stages of degradation). The southern maidan region has slightly more rainfall (500-900mm per year), is slightly higher in elevation than the northern maidan, and has predominantly red soils. The forest cover in this region is also low and degraded, but there are larger areas of other common lands in this region. Overall, due to a combination of climatic and administrative factors, the extent of forests and grazing lands is generally much higher in the southern maidan (ranging from 5% to 40% of the geographical area of a taluka) than in the northern maidan (where it ranges from 0% to 15% at most).

The economies of both the northern and southern maidan regions are heavily agrarian. The cropping pattern depends upon the soil type and the presence or absence of irrigation. The unirrigated areas in the northern maidan support jowar, cotton, oilseeds and pulses, whereas ragi, mulberry and groundnut dominate the unirrigated areas in the southern maidan. Over the past few decades, large areas of the northern maidan have been brought under canal irrigation, whereas the irrigated area in the southern maidan is largely from tanks, open wells and bore wells. A map of the percentage of net sown area

10 Several different ways of classifying Karnataka into agro-climatic or eco-climatic zones have been proposed. It should be noted that there often is substantial variation in agro-climatic conditions within a district, especially those districts that straddle the transition between Western Ghats and the eastern maidan areas (Shimoga, Chickmagalur, Belgaum, Hassan, Mysore). So the district-level categorisation is necessarily a crude one.

that is under irrigation in difference talukas of these regions is given in Figure 1.[11] Paddy and sugarcane are the main irrigated crops in both regions.

In terms of economic development status, the eastern plains in general and the northern maidan region in particular are quite distinct from (poorer than) the other regions of Karnataka on many dimensions. Hanstad *et al.* (2001) presented a comparison of eco-climatic regions in Karnataka along various socio-economic characteristics using a representative district for each region. The level of socio-economic stratification within the village communities in northern and southern maidan is higher as also overall poverty levels when compared to the average for the state. He found male and female literacy to be the lowest (68% and 46%) in northern maidan. Similarly agricultural labourers as percentage of main rural workers[12] were highest 50% in northern maidan while it was 30 % in southern maidan. The land distribution (percentage of land holdings) was also more skewed in the maidan region. Large land holders of more than 10 ha were highest (8%) in northern maidan and a uniform 1% in all other regions. While the fraction of farmers with less than 1 ha land holding was highest (63%) in coastal region and lowest (4%) in northern maidan. The state average of land holding more than 10 ha was 2% and those less than 1 ha was 39 %.

7.2 Description of study villages

The description of the study villages is done in two main sections. The physical geography section includes geographical area, soil type, land use pattern, forest plantation details. While the social geography section would provide details with respect population, caste composition and land holding variation. The key characteristics of the case study villages are summarised in Table 1.

[11] Our field visits and examination of satellite imagery indicate that our map is an underestimate because irrigated area has increased significantly since the 1991 census.

12 “Main workers” are defined by Census of India, 1991 as those who work at least 183 days per year in an economically productive activity.

Table 1. Basic characteristics of the villages studied

Feature	Details	Benkanahalli	Kanvihalli
Rainfall	Average annual	680 mm	740 mm
Population 1991	SC	208	256
	ST	0	0
	Others	571 (Valmiki, Kuraba, Lingayat)	1592 (Valmiki, Kuraba, Lingayat, Harijan)
	Total	779	1848
Literacy	Male literacy	43%	40%
	Female literacy	15%	25%
	Total literacy	28%	33%
Households (year)		144 (1991), 187 (2001)	273 (1991), 330 (2001)
Total Geographical Area (ha)		548	1716
Common Land (TCL)	Forest land	51	781
	Other	42	0
	Total	93	781
TCL per capita		0.12	0.36
Forest type		Southern tropical thorn forests	Southern tropical thorn forests
Forest composition	Main species	*Prosopis juliflora, Albizia amara, Carissa carandas, Dodonia viscosa, Chloroxylon switenia, Randia uliginosa, Cassia auriculata, Santalum album*	*Diospyros melanoxylon, Acacia catechu, Soymida febrifuga, Eucalyptus globulus, Dolichandrone crispa, Hardwickia binata, Pongamia pinnata, Chrysopogon fulvus*
Density		62 trees/ha	182 trees/ha
Regeneration potential		Medium: few coppice stumps and many patches devoid of any vegetation	High: lots of coppice stumps present, hill tops and common land close to village are devoid of trees
Agricultural land (1991: ha)	Irrigated	346	10
	Unirrigated	92	826
	Main crops	Paddy, Groundnut, Jowar, and Bajra	Hybrid sorghum, Maize, Groundnut, Tobacco, Tur, Horse gram,
Livestock	Large ruminants	459	600
	Small ruminants	220	1400
	TCL per animal unit (ha)	0.18	0.88

Sources:

A. Rainfall data were collected from Directorate of Economics and Statistics, 2004.

B. Population, number of households, total geographical area, common lands, and agricultural land was collected from Census of India (1991).

C. Forest type, main tree species, density of trees, and livestock population data were collected during field visit through personal communication and field checks.

D. Other common lands in Kanvihalli were more than 102 ha. However, much of this has been encroached for cultivation..

7.2.1 Physical Geography

As mentioned earlier, both villages have a dry climate with average rainfall around 700mm and large interannual variability. The terrain in Benkanahalli is somewhat rolling while in Kanvihalli there are two major hillocks. The soils in Benkanahalli vary widely, ranging from black cotton soil near the village habitation and on the either side of the streams to red sandy loam in the agricultural fields around the hillocks. The latter soils contain lot of stones and boulders and are relatively less fertile. In Kanvihalli, the flat agricultural lands have red sandy soils. The surface soil is a thin layer of sandy loam and subsoils are more gravelly with lot of boulders.

7.2.2 Area of common lands and their status

Benkanahalli has approximately around 93 ha of public lands of which Karnataka Forest Department owns 51 ha and 42 ha belong to revenue department defined as village grazing lands. The latter are not a contiguous patch; some of them are close to the village and others are away from the village. The ratio of common land to the total geographical area is 17% and per capita common land available is 0.12 ha. But in reality the common land area is higher than that indicated by the current official records in the village. There are small parcels of private land that had been encroached and regularised, that are not being currently cultivated of the presence of rocks and boulders. Furthermore, public lands, such as those on either sides of irrigation canals, village roads, state highway and streams, are also used for grazing and fuelwood collection. Therefore, it can be said that per capita common land available in the village is slightly more than 0.12 ha.

Kanvihalli has hills on either side (north and south). These hillocks are part of a continuous stretch of hills that were declared as Reserve Forest back in 1890 under the British regime. The total area of Reserve Forest within the village boundary is around 781 ha. During 1960s village had wastelands controlled by Revenue Department to a tune of 102 ha. Today, the official area of such lands is 0, although villagers claim that there is about 9 ha of public land still present. The ratio of common land to the total geographical area is 45% in Kanvihalli and per capita common land available is 0.36 ha.

The forest type in both the villages could be broadly classified as Southern Tropical Thorn Forests (sub-group 6A) according to the Champion and Seth (1968) classification. When one walks through the forest area it looks more like a scrub thorn forest with average height about 3 to 5 meters in Benkanahalli and 4 to 6 meters in Kanvihalli. In both the villages the distribution of trees is highly scattered and most of the saplings, shrubs and plants present are coppiced shoots from root stocks of the indiscriminately hacked trees over last few decades. Most of existing tree species are good coppicers, very hardy and come up well even under harsh growth conditions. High biotic pressure on the common lands, has led to total degradation of the forest area. However in both the villages major part of the common lands consists of palatable grass growth. The density of trees estimated using point sampling method is 62/ha in Benkanahalli but much more in Kanvihalli (182/ha). However, it should be noted that the forest vegetation in Kanvihalli is much more heterogeneous, with the density ranging from 0/ha in some parts and above 440/ha in others.

7.2.3 Social geography

The study village Benkanahalli (548 ha) is three times smaller in its geographical area than Kanvihalli (1716 ha). Nevertheless, the number of households and village total population of Benkanahalli are three times lower than that of Kanvihalli. The caste composition is, however, similar in both the villages. There is no Schedule Tribe (ST) population in both the villages and fraction of dalit (Schedule Caste or SC) population to the total population is 0.26 in Benkanahalli and 0.14 in Kanvihalli. Livestock holding in both the villages is relatively same. However, the number of small ruminants in Benkanahalli is very low (220), when compared to Kanvihalli (1400). More than 700 sheeps are reared by just two families in Kanvihalli and therefore the number of small ruminants is abnormally high.[13]

The total agricultural area in Benkanahalli is 438 ha and in Kanvihalli it is 836 ha. The fraction of Net Sown Area (NSA) is 0.80 in Benkanahalli and 0.48 in Kanvihalli. While in Benkanahalli two third of the agricultural land is under irrigation, it is just around 10 ha in Kanvihalli. Paddy is the main crop in Benkanahalli both during the kharif and rabi season. The other crops grown during kharif are bajra, green gram, groundnut and cotton. While the crops grown during rabi season are jowar, groundnut and cotton. The cropping pattern in Kanvihalli during the kharif season is maize, pearl millet, sunflower, safflower, lentils, greengram, tur, groundnuts, hybrid jowar, horse gram and other millets, in the rabi season the main crop is jowar and in few hectares wheat is grown.

Both the villages are by no means are homogeneous. Apart from having a range of caste groups, there is significant difference in landholding and wealth. An indication of vertical economic difference can be obtained from the distribution of agricultural land holdings given in Table 2.[14] 20% of the households in each village are landless and around 50% hold very small areas (< 1 ha) of agricultural land. While the large farmers (>4 ha) are less than 5% in both the villages. Although landholding size does not exactly correlate with wealth, nevertheless it is clear that both the villages have high degree of internal inequality in economic condition.

[13] The FGD revealed that Kanvihalli has the highest number of sheep in the entire neighbourhood of about ten village.

[14] The landholding figures in this table have not been adjusted for the difference in economic productivity of irrigated versus dry lands. The data was not collected at household level, instead collected in FGD in the villages and later cross checked randomly with the Village Accountant.

Table 2. Differences in land holdings within the case study villages

Land holdings	No. of households	
	Benkanahalli	**Kanvihalli**
Large farmers [> 4 ha]	7 (3.5%)	15 (5%)
Medium farmers [2-4 ha]	15 (8%)	42 (13%)
Small farmers [1-2 ha]	31 (16.5%)	57 (17%)
Marginal farmers [<1 ha]	93 (50%)	150 (45%)
Landless households	41 (22%)	66 (20%)
Total	**187 (100%)**	**330 (100%)**

Note: Figures in brackets represent percentage of total households in the village that belong to a particular class.

In choosing sample households for the questionnaire survey, we followed a stratified random sampling method using the 5 landholding classes in Table 2 as the basis. Subsequently, however, the surveyed households were regrouped into four economic classes based on the total income and assets of the family from all the sources.[15] Economic class 1 consists of the large landholders with highest income (>Rs.100,000 per year) and those in class 4 are the landless and some marginal farmers with very low income (<Rs.20,000 per year). A better understanding of the land holding in the villages, divided into irrigated and unirrigated agricultural holdings for the sample households, can be obtained from Table 3. The average land holding of the lowest economic class is 0.1 ha in Benkanahalli and 0.9 ha in Kanvihalli, whereas in the highest economic class average land holding is 7.8 ha in Benkanahalli and 12.7 ha in Kanvihalli. It can also be clearly seen that all the (borewell) irrigated area in Kanvihalli is managed by the elite farmers in the village. However, the land holding of small farmers (economic class 3 and 4) is around 2.5 and 1.5 ha. Table 3 also provides the number of households considered for questionnaire survey and the population characteristics of those households in each economic class.

The main occupation in both villages is agriculture and livestock rearing. The number of small ruminants in Benkanahalli is much lower (220) than that in Kanvihalli (1400); however, this difference is exaggerated because just two families in Kanvihalli own more than 700 sheep.[16] In Benkanahalli, livestock are grazed by individual household or groups of two or three households, while in Kanvihalli livestock are grazed by two hired labours for the whole village, one managing cows and the other buffaloes. The landless and small farmers in both the villages are mainly dependent on agriculture labour work within the village. However, outmigration is also significant in Kanvihalli, with people going for labour work such as coffee estates in Western Ghats, construction work in Bangalore, and road work across the state. In both villages, women do the household work, while the women in landless and marginal farming households also engage in agricultural wage labour. Fuelwood collection in landless and small farmer households is done mainly by women in the form of headloads, while the elite households hire

[15] Classifying households based on landholding alone was found to be somewhat misleading. Many of the households get significant income from other sources, viz., salaried members of the family, shops, business, renting vehicles, labour work outside the village or artisanal work.

[16] The FGD revealed that Kanvihalli has the highest number of sheep in the entire neighbourhood of about ten village.

labourers or send male family members with bullock carts.

Table 3. Difference in average irrigated and unirrigated land holding of both the villages across economic class (in hectares)

Village	Type of landholding	Economic class				Total
		1	2	3	4	
Benkanahalli	Total no. of households	18	60	52	57	187
	Dry land per household	1.5	1.7	1.0	0.1	0.1
	Irrigated land per household	6.4	1.2	0.4	0.0	1.2
	Total land holdings per household	7.8	3.0	1.4	0.1	1.1
	No. of adult members	10	40	28	15	93
	No. of children	12	45	31	15	103
	No. of households surveyed	**3**	**10**	**9**	**5**	**27**
Kanvihalli	Total number of households	15	70	95	150	330
	Dry land per household	10.4	2.3	1.6	0.8	0.8
	Irrigated land per household	2.2	0.0	0.0	0.1	0.2
	Total land holdings per household	12.7	2.3	1.6	0.9	2.7
	No. of adult members	34	39	43	47	163
	No. of children	28	34	27	46	135
	No. of households surveyed	**4**	**11**	**11**	**13**	**39**

Note: Class 1 contains the largest landholders and 4 the poorest.

7.2.4 Use and management of common lands

Generally speaking, the forest and other common lands are used for collection of firewood, grazing of livestock and some amount of small timber collection. The dependence for timber and commercial non-timber forest products is very low in both the villages. In Kanvihalli, during the British period, a multi-village *Forest Panchayat*[17] in the village controlled illegal felling of trees, encroachment of common lands and control of fire. This *Forest Panchayat* was dissolved by the state during mid-1960s and currently (even after the advent of JFPM) there was no system of collective management of these lands. Benkanahalli did not have any institutionalised system of common land management, except for one small patch of grazing land that was reserved for grazing by bullocks. Currently, the common lands in both villages are heavily degraded.

Starting the 1970s, the state forest department carried out a number of plantation activities. In Benkanahalli, KFD has raised four plantations over the last 30 years, including mostly eucalyptus and recently a mixed species plantation. In the case of

[17] The Forest Panchayat area consisted of a contiguous set of hills covered with dense forest and surrounded by four villages (Kanvihalli, Konganahosuru, Kodihalli, Kulahalli). A *Forest Panchayat* consisting of eight *panchanami's*, two members from each village and Tahsildar (Revenue Officer) as the head was formed to protect, conserve and sustainable use the forest resources. In most of cases the *panchanamis* would be from a particular caste group (Talwar) in these villages. They would be responsible for the protection of the village forests and required cooperation was provided by the village head (typically from the Gowda<<Vokkaliga? caste).

Kanvihalli, although there was no information on plantations raised before 1990, we found that three plantations had been raised after 1990, including eucalyptus and tamarind. In all cases, the plantations were protected by Forest Department for initial three years and later the watchers were shifted to the next new plantation. Once the watchers are withdrawn from the plantation area villagers allow their livestock into the plantation and most of the seedlings were destroyed.

The status of common lands in both villages is also partly the outcome of the process of land encroachment that has gone on in both villages over the past few decades. In Benkanahalli, encroachments in 65 ha of erstwhile common land have been 'regularised' and applications for another 10 ha are pending with the government. Note that not all encroached lands are actually cultivated. Particularly in Benkanahalli, some farmers have given up cultivation since the quality of the encroached land is very poor. This in effect makes the land still available as common land for grazing.

8 Results: Pattern of dependence on common lands

We present here the results of the comparison across the two villages in terms of current CPR dependence, followed by a description of the temporal change in CPR dependence in the irrigated village. Major part of the spatial comparison is based on the household questionnaire survey, whereas the information for temporal comparison came from the FGDs conducted in the village.

8.1 Fuelwood

We first present the overall pattern of current fuelwood use from the commons. The key differences across villages are summarised in Table 4. In the unirrigated village (Kanvihalli), nearly 92% of sample households use the commons (exclusively or in addition to some other sources) for gathering fuelwood. In contrast, in the irrigated village (Benkanahalli), almost all (96%) sample households get fuelwood entirely from other sources. Since the forest lands in both villages are in degraded condition, the difference cannot be attributed to the condition of these lands. This clearly shows that the overall tendency to go at all to common lands is substantially lower in Benkanahalli.

Table 4. Variation in use of forest and other common lands for fuelwood

Village	Does household gather fuelwood from forest or other common lands at any time during the year?		
	Yes	No	Total
Benkanahalli	1 (4%)	26 (96%)	27 (100%)
Kanvihalli	36 (92%)	3 (8%)	39 (100%)
Total	37 (56%)	29 (44%)	66 (100%)

Note:

1. "Other common lands" includes gomaals and other revenue lands, but not roadsides, canal sides and streambeds.

2. The answer' Yes' means the villager goes to forest atleast once in year or more. While 'No' means they have never been to forest for fuelwood in a year.

Understanding the differences in terms of quantities of firewood obtained from different sources by villagers helps understand where the fuel is coming from. The quantities of fuel collection from different sources across the economic classes is presented in Table 5. From this, it appears that 81% of the fuel consumption in the irrigated village is contributed by *Prosopis juliflora,*[18] which grows abundantly on either sides of the canal and village roads and tank bed. Whereas, the contribution of common lands is less than 2%. Whereas, in the unirrigated village, 66% of fuelwood is collected from common lands.

Table 5. Source-wise distribution of fuel collection by households in different economic classes and total fuel collected from different sources

Village	Fuel source	Economic class				Total headloads per hh per week	Total no. of headloads collected from each fuel source
		1	2	3	4		
Benkana-halli	Forest + Gomaal	0.0	0.2	0.0	0.0	0.1	**2 (1%)**
	Canal + roadside + tank bed	6.0	5.5	4.6	8.0	5.7	**154 (81%)**
	Agricultural land	7.3	0.8	0.4	0.0	1.3	**35 (18%)**
	Total consumption	**13.3**	**6.5**	**5.0**	**8.0**	**7.1**	**191 (100%)**
Kanvi-halli	Forest + Gomaal	7.0	2.7	2.4	3.7	3.4	**131 (66%)**
	Canal + roadside + tank bed	0.0	0.0	0.0	0.0	0.0	**0 (0%)**
	Agricultural land	10.0	1.2	1.2	0.2	1.7	**68 (34%)**
	Total consumption	**17.0**	**3.9**	**3.5**	**3.8**	**5.1**	**199 (100%)**

Note Units are 'standardised' headloads per household per week in each class (1 headload = 20 kg); agricultural waste details were collected in number of bullock cart loads and then converted into headloads of 20kgs. The average weight of bullock cartload of different kind of agricultural waste was collected in the FGD discussion in the village. It is assumed that 20 kg of agricultural waste is equivalent to 20kg firewood from CPRs.

Our original hypothesis was that irrigation would directly increase the availability of agricultural waste as an alternative fuel source. However, the fuel contribution of agricultural land is nearly double (34%) in unirrigated village when compared to irrigated village (18%). It turns out that the changes in cropping patterns that irrigation introduces are very location-specific and complex. In most of canal irrigated areas in India and Karnataka, most of the cropped area is under paddy and sugarcane (Ray, 1992; Dhawan, 1994; Vaidyanathan *et al.*, 1994; Vaidyanathan, 1999), which is true in Benkanahalli as well. However if the village had grown irrigated dry crops *viz.*, cotton, tur and sunflower then the availability of fuelwood from agricultural lands would be significant.

[18] Prosopis juliflora (locally known as Ballary jali) is an exotic shrub, and its spread across the country is primarily a result of its physiological characteristics (high rate of growth, regrowth from coppice, thorny nature preventing browsing, etc.) that make it an excellent invasive species. Since this is a very hardy thorny plant, it is able to establish in any type of soil, terrain or climatic condition, colonizing open lands rapidly through seeds and root suckers (METRIC, 2001; Goel and Behl, 1995).

Figure 3. *Prosopis juliflora* grown on either sides of the stream in Benkanahalli

Thus, the declining dependence in Benkanahalli on common lands for firewood is not due to the increased availability of agricultural waste as fuel, but due to the abundant availability of Prosopis as an alternative source of fuel. The presence of Prosopis cannot be directly attributed to the presence of canal irrigation. However, canal irrigation and perennial stream passing beside the village results in increased soil moisture levels, which is essential for the rapid growth and regeneration of Prosopis (see Figure 3).[19] Thus, irrigation does have an indirect role to play in increasing the availability of fuel. This can also be inferred from the fact that people from the neighbouring village of Siddapur, which does not have canal irrigation, come to Benkanahalli to cut Prosopis.

The data presented in Table 5 also show that there is significant variation across economic classes in both villages. Across both villages, poorer households collect less of their fuel from agricultural lands, depending upon either common lands or other public lands (roadsides). In contrast, large landholders in both villages get significant amount of fuel from their own agricultural lands. It should also be noted that the elite households in both villages burn more fuelwood compared to poorer households.

An exploration of the history of fuel collection in Benkanahalli suggests that the impact of irrigation on fuel availability is intertwined with the role played by population growth

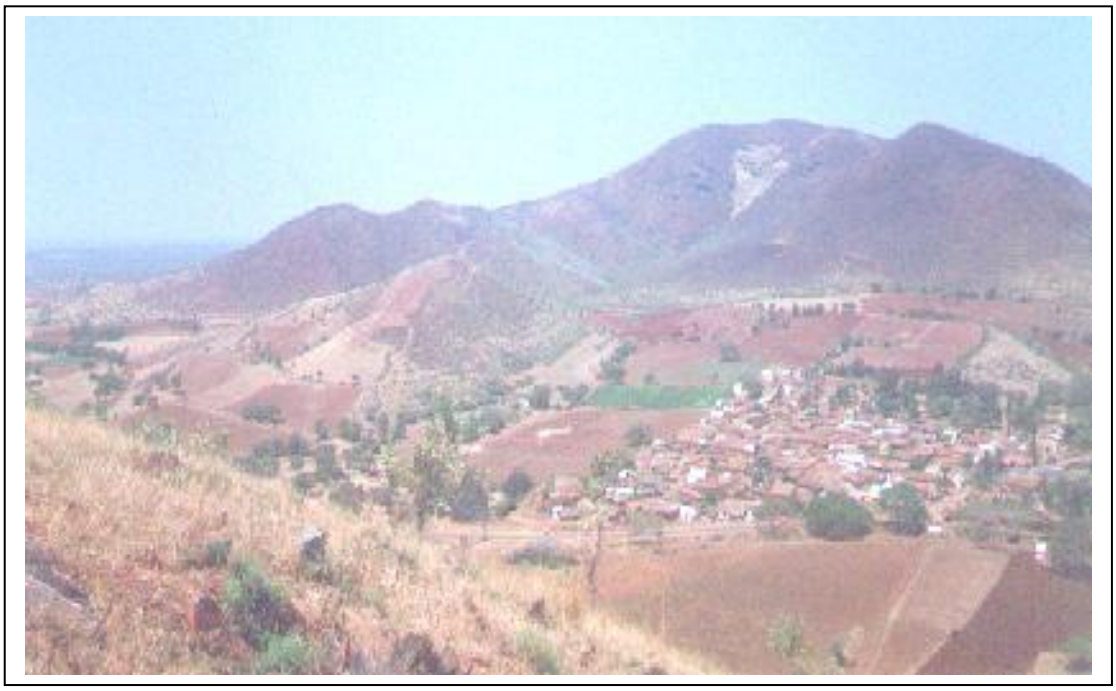
[19] We have observed that Prosopis stands grow preferentially on irrigation tank foreshores and in tankbeds. Discussions with various botanists have confirmed that the rapid growth of Prosopis requires adequate soil moisture.

and the decline of traditions of common lands management. Fuelwood was being collected from the common lands since generations till the mid-1980s and common lands were in a good condition compared to the existing ones. While the neighbouring village (Siddapur) people were also self-sufficient with the agricultural wastes and fuelwood collected from the common lands (< 35 ha) within the village and also the village population was very low. However during early 1980s farmers in neighbouring Siddapur village started facing severe shortage of the fuelwood and started collecting fuelwood from the common lands of Benkanahalli. The road going to Siddapur village passes through the forest area of the Benkanahalli and it is very easy for them to collect the fuelwood. Most of the households carried fuelwood on their bullock cart from Benkanahalli. This was the main reason for the degradation of the Benkanahalli commons. During mid 1980s farmers started planting *Prosopis juliflora* as live fencing material which immensely helped for its expansion and able to establish very well with the advent of canal irrigation in Benkanahalli. In the initial years of canal irrigation, farmers grew irrigated dry crops (as per the rules governing the irrigation scheme) such as cotton, chilly, sunflower, maize, hybrid jowar and this increased the amount of agricultural waste available as fuel very substantially. However, starting the early 1990s, most of the farmers shifted to irrigated paddy cultivation, the waste from which can be used as fodder but not as fuel. This resulted in dependence of people on Prosopis for fuel. . Thus, although degradation of the commons due to their open-access nature triggered the adoption of Prosopis in the village, irrigated dry crops contributed fuel in the initial phase of irrigation and it was the shift to paddy cultivation that resulted in a greater dependence on Prosopis, just as the canal banks provided the sites for its rapid growth.

The history of Kanvihalli is similar in terms of the decline of the commons, but different in terms of its impact, due to the absence of irrigation. Kanvihalli historically managed its common lands under the *Forest Panchayat* system, wherein villagers were allowed to collect only dead and fallen dry wood and also available in plenty within 1 km radius of village because forest was in good condition. According to the villagers, agricultural waste was not being used because the availability of fuelwood was ample. After the *Forest Panchayat* system was dismantled by the state in the 1960s and the Forest Department took over the management of the RFs, the above restrictions of fuelwood collection started withering. Starting the early 1980s, fuelwood began to be extracted for commercial purposes, i.e., for sale in nearby towns (Hospet, Hagari Bomanahlli and Harpanahalli) as well as to better off households in neighbouring villages that did not have common lands. This was one of the principal reasons for the heavy degradation of the village common lands. By the late 1990s, the decline in fuelwood availability and stricted protection measures by a dedicated Range Forest Officer brought an end to the hacking of the Kanvihalli forests for fuelwood sale. Even today, in its partially denuded state, the common lands yield significant quantities of fuelwood, but this collection process is arduous and time consuming. Hence, many of the middle and large farmers have tried to use agricultural waste to the maximum extent possible. The fact that they cultivate non-irrigated crops such as jowar, tur, maize, sunflower and tobacco helps the people to use it as alternative for fuelwood. Presently it is the rural poor (landless, small and marginal farmers) who are collecting the much of the total fuelwood from the degraded common land for day to day consumption (see Figure 4). This clearly shows that in an unirrigated village people dependence on forest common lands for fuelwood is

high, since they are not having any other alternative source.

Figure 4. View of forest area in Kanvihalli used for grazing and fuelwood collection



8.2 Fodder and grazing

We examined the dependence on common lands for grazing in a manner similar to the analysis for fuelwood dependence. We first examined whether forests and other common lands were used for grazing at all by the sample households in each village. We then examined the source-wise consumption in a quantitative manner and also broke it down by class. An added complication in this case is that the livestock holding itself can evolve over time to reflect both the demand for livestock products and the supply of fodder and grazing material. We therefore examined the differences in livestock holding across the villages. Finally, we placed the current patterns of grazing and livestock holding in a historical perspective.

The dependence on common lands for grazing is similar to the case of fuelwood, although the difference is less stark (see Table 6). In the irrigated village, 78% households do not go to the commons for grazing at all, whereas in the unirrigated village this fraction is 59%. This clearly shows that livestock in irrigated village are less dependent and those in unirrigated village are more dependent on common lands. The reasons for overall difference in dependence are discussed below.

Table 6. Variation in the use of forest/common lands for grazing

Village	Does the household graze its livestock in the forest or other common lands at any time during the year?		
	Yes	No	Total
Benkanahalli	6 (22%)	21 (78%)	27 (100%)
Kanvihalli	16 (41%)	23 (59%)	39 (100%)
Total	22 (33%)	44 (67%)	66 (100%)

Note:

1. "Other common lands" includes gomaals and other revenue lands, but not roadsides and streambeds.
2. The number of households in category "No" includes households not rearing livestock at all. There are 11 such households in Kanvihalli and 6 in Benkanahalli.
3. There are 3 households owning just bullocks and no other livestock in Kanvihalli and bullocks are usually not grazed on common lands and instead staff fed.

To understand the use of different sources of grazing material or fodder in a quantitative and integrated manner, we converted the grazing pressure into a common unit, viz., "animal-unit months". This involved converting small ruminants into equivalent large ruminant units (5 small ruminants=1 large ruminant). We also combined numbers of animal-unit months of stall-feeding with numbers of animal-unit months of grazing on private agricultural lands, because the biomass for stall feeding comes largely from agricultural lands anyway. Differences in pattern of grazing across different sources and for different classes are summarized in Table 7 below for the two villages.

We see that the overall dependence on the forests and common lands is lower in the irrigated village (31% of total animal unit months) as compared to the unirrigated village (52%). Thus, the quantitative difference is stronger than the difference we observed in a yes/no sense above. Since the common lands in both villages are in degraded condition, the difference cannot be attributed to the condition of these lands and so it is likely to be related to the fact that Benkanahalli is an irrigated village. But examining the contribution of the other sources presents a different picture, just as in the case of fuelwood. Canal sides, roadsides and tank bed lands seem to play a more significant role in the irrigated village than fodder production from agricultural lands themselves. This is partly because the sides of the irrigation canal are a rich source of fodder in the irrigated village, and partly because irrigation also seems to have a 'spillover' effect in terms of increased productivity on roadsides.

It should also be noted that the use of 'animal-unit-months' as the unit for estimating the contribution of a source has its own limitations, because it hides the significant variation in quantity of fodder/grazing material available per unit time per animal from different sources. In particular, the quantities of biomass fed in the form of agricultural wastes during stall-feeding in Benkanahalli are much higher than those obtained through grazing. On the other hand, the quantity of feed provided by the typical farmer in Kanvihalli to his livestock during 'stall-feeding' in the dry season is much lower than that provided by a farmer in Benkanahalli.

The continued dependence on the common lands for grazing in Benkanahalli is mainly because all of the households prefer to send their livestock to the forest land for grazing

after one or two months of rainy season because the grass growth immediately after the rains would be better on common land. Therefore, the overall 31% of livestock depend on the forest area for grazing in Benkanahalli. This suggests that at least in the context of livestock management, common lands continue to fill an important gap in the livelihoods of households in an irrigated village.

Table 7. Source-wise distribution of grazing by households in different economic classes

Village	Grazing Source	Economic class					
		1	2	3	4	Total animal unit months per hh per year	Total animal unit months grazed on each source
Benkanahalli	Total no. of livestock	35	31	6	10	-	**82**
	Avg. no. of livestock per hh	11.7	3.1	0.7	2.1	3.1	-
	Forest and grazing land	39	9	3	15	12	**311 (31%)**
	Canal + roadside + tank bed	55	18	4	10	16	**430 (43%)**
	Agricultural land and stall feeding	46	10	1	0	9	**248 (25%)**
	Total months	**140**	**37**	**8**	**25**	**37**	**989 (100%)**
Kanvihalli	Total no. of livestock	24	28	17	12	-	**80**
	Avg. no. of livestock per hh	6.0	2.5	1.5	0.9	2.1	-
	Forest and grazing land	35	17	10	5	13	**499 (52%)**
	Canal + roadside + tank bed	0	4	1	3	3	**100 (10%)**
	Agricultural land and stall feeding	37	9	7	3	9	**362 (38%)**
	Total months	**72**	**30**	**18**	**11**	**25**	**961 (100%)**

Note: 1 animal unit months = 1 month grazing period of single large ruminant

We specifically examined the availability of agricultural waste as fodder in the two villages. The area under paddy cultivation in irrigated village has increased from 0 ha in 1980 to 167 ha in 2001, which has resulted in a very substantial increase in the availability of paddy straw as fodder. But large quantities of paddy straw produced was sold to neighbouring villages without irrigation facility and depended more on open grazing. This clearly shows that there is an excess of agricultural fodder being generated in the irrigated village. But it also demonstrates the villagers' preference: when common lands do yield green grazing material, they prefer that over dry paddy straw, which they sell to villages where the livestock owners do not have access to common lands.

A class-wise analysis of grazing patterns indicates less variation than in the case of fuel. In Benkanahalli, the landless and marginal farmers have to depend upon the common lands for grazing, as they do not have agricultural waste as a fodder source. But even the elite do send their livestock to the common lands for grazing during particular periods, as mentioned above. This is also partly because the elite have much higher livestock holding than the poorer classes.

Finally, an examination of the livestock holding pattern itself reveals other facets of the impact of irrigation and the consequent implications for common land dependence. Table 8 shows that the overall livestock holding per household is higher in Benkanahalli, the irrigated village, as compared to Kanvihalli, the unirrigated village. Note that this is so even though the per household availability of forest and gomaal land area is much higher in the latter. This is a reflection as much of the degraded status of the common lands in the unirrigated village as it is of the increased availability of fodder in the irrigated village.

Furthermore, there is an interesting shift in the composition of livestock, with the irrigated village showing an increase in cows and decrease in bullocks. The number of cows per household in irrigated village was nearly 2 and less than 1 in unirrigated village, while the number of livestock holding in Benkanahalli is 3 per household in irrigated village and 2 in unirrigated village. The reason for higher number of livestock in irrigated village is mainly due easy access of grazing area, when compared to unirrigated village, whereas, number of bullocks per household was less than 1 in irrigated village and nearly 1 in unirrigated village. This is related to the mechanization of agricultural operations with the advent of canal irrigation. While in the unirrigated village even today most agricultural practices are done using draught energy.

On the other hand, the population of small ruminants does not show a major difference across villages. This is explained when one looks at the class-wise livestock holding pattern. The small ruminants are held by the lower economic classes, who do not benefit as much from irrigation (because they do not have much land and most of it is not irrigated) and hence continue to depend upon the commons. With the commons being degraded, they resort to small ruminants that can better graze on degraded lands as compared to large ruminants.

Table 8. Livestock holding by animal type by sample households in different economic classes

Village	Type of livestock	Economic class				No. of livestock per hh	Total no. of livestock
		1	2	3	4		
Benkanahalli	Cows	8.0	1.8	0.2	0.6	1.7	47 (57.0%)
	Bullocks	1.3	0.6	0.0	0.4	0.4	12 (14.6%)
	Buffalos	2.3	0.7	0.1	0.2	0.6	16 (19.4%)
	Total large ruminants	**11.7**	**3.1**	**0.3**	**1.2**	**2.8**	**75 (91.0%)**
	Sheeps	0.0	0.0	0.0	0.4	0.1	2 (0.5%)
	Goats	0.0	0.0	1.7	4.0	1.3	35 (8.5%)
	Total small ruminants	0.0	0.0	1.7	4.4	1.4	37 (9.0%)
	Total livestock	**11.7**	**3.1**	**0.7**	**2.1**	**3.1**	**82 (100.0%)**
Kanvihalli	Cows	2.0	0.1	0.4	0.3	0.4	17 (20.4%)
	Bullocks	2.5	1.1	1.0	0.3	0.9	37 (44.4%)
	Buffalos	1.5	0.8	0.1	0.2	0.5	19 (22.8%)
	Total large ruminants	**6.0**	**2.0**	**1.5**	**0.8**	**1.9**	**73 (87.5%)**
	Sheeps	0.0	0.4	0.2	1.5	0.7	26 (6.2%)
	Goats	0.0	2.3	0.1	0.0	0.7	26 (6.2%)
	Total small ruminants	0.0	2.6	0.3	1.5	1.3	52 (12.5%)
	Total livestock	**6.0**	**2.5**	**1.5**	**1.2**	**2.1**	**83(100.0%)**

Note:

1. In Kanvihalli village one household is left out of the analysis to prepare the above table, since he has very large sheep herd. In the surrounding ten villages he is only person having highest number of sheeps. Also during most of the year sheeps are taken to far away places for grazing. For more than six months they are grazed on the Tungabhadra dam storage area once the dam water recedes during dry season.
2. 1 animal unit = 1 cow/buffaloe/bullock = 5 sheep/goats (following Jodha, 1986; Nadkarni, 1990).
3. Figures in brackets are percentages.

Does the history of the livestock sector in each village support the observations emerging from the spatial comparison? Till the late 1980s, villagers in Benkanahalli had restrictions of grazing animals on the common lands. One of the restraints was from the elite farmers of the village who had bullocks. They hired a person to protect a patch of common land (~10 ha) from the start of rainy season for about 4 months against grazing by stray cattle. After two months of protection, only bullocks were allowed to graze on this piece of land till the end of rainy season. Other animals were allowed graze on this land after the end of the rainy season. However, the other livestock were allowed to graze on remaining common lands in the village during monsoon season. Though villagers carried out open grazing on common lands, roadsides and stream banks for the whole year but maximum grazing was done on common lands. They also grazed on agricultural fields after the harvest of crops. During rabi season main crop was jowar on black cotton soils and livestock were grazed on it for less than a month after the harvest. However, the agricultural residue was used to stall feed the livestock during summer because of the very low grazing material on the common lands. Table 9 illustrates the dependence of livestock mainly on forest area for grazing along with other sources till early 1980s

(before the advent of canal irrigation).

Table 9. Calendar of livestock grazing till early 1980's in Benkanahalli

Type of area	Jan	Feb	Mar	April	May	June	July	Aug	Sept	Oct	Nov	Dec
Common lands	*	*	*	*	*	*	*	*	*[1]	*[1]	*	*
Roadsides and stream banks	*	*	*	*	*	*					*	*
Grazing supported by Agricultural fields (AF)		*		*[2]	*[2]	*[2]				*	*	

[1] Only bullocks were allowed to graze in small patch of protected common land from July to October.

[2] Agricultural residue collected from agricultural fields is used for stall feeding during summer because livestock could not get sufficient fodder from open grazing.

Table 10. Calendar of livestock grazing after the advent of canal irrigation in Benkanahalli (early 1990s onwards)

Type of area	Jan	Feb	Mar	April	May	June	July	Aug	Sept	Oct	Nov	Dec
Common lands[1]							*	*	*	*	*	
Roadsides, steams banks, canal sides	*	*	*	*	*	*	*	*	*	*	*	*
Grazing supported by Agricultural fields (AF) [2]			*	*	*				*	*	*	

[1] Common lands include a small patch of forest plantation raised by KFD, which was banned for grazing.

[2] All types of grazing supported by agricultural lands

The pattern of grazing and availability of fodder changed dramatically after the village started receiving canal irrigation from the Upper Krishna Irrigation Project in the mid-1980s. During the initial years of irrigation, farmers cultivated irrigated dry crops, *viz.*, cotton, chilly, groundnut, sunflower, maize and hybrid jowar. With this the availability of green fodder from agricultural fields—both from the bunds and from the weeding operations—increased substantially, while still keeping the lands available for stubble grazing for 4 months in a year as before. However, this system was followed for few years and was stopped by 1990. Later, starting the early 1990s, most of the farmers started taking two crops of paddy every year and therefore the grazing support provided by the agricultural fields dropped, although the amount of paddy straw increased.

Figure 5. Green grass collected from the bunds of paddy field in Benkanahalli

The grazing pattern followed from the early 1990s onwards is provided in Table 10. Presently the main source of grazing area for livestock is along the roadsides, canal, stream and other barren lands. These areas are able to support grazing to a great extent, for all around the year because of the moisture provided by canal irrigation water supporting luxuriantly growth of grazing material. For a short period (July to November) during rainy season livestock are grazed on forest common lands. While the irrigated agricultural fields provide significant support with grazing material with stubble after the harvest of crops, grass on the bunds and weeding (see Figure 5). Overall agricultural fields support livestock for more than five months along with open grazing. Thus, the pattern of dependence on common lands for grazing changes as the nature of irrigated cultivation changes, and is really low now because two crops of paddy are being in cultivated, to the extent that extra paddy straw is being sold to neighbouring villages. Note, however, that such double cropping of paddy is in violation of the prescribed cropping pattern in the command area of the irrigation project, and cannot be followed by farmers in the tail-end region of the canal.

8.3 Differences in employment patterns and out migration

We had hypothesized that, with the advent of irrigation, one would see an increase in the agricultural labour opportunities (as the cropping intensity would increase) and a decline in the level of unemployment faced by landless labourers. A comparison of the agricultural wage labour employment across the two villages and across classes within each village, however, does not reveal such a pattern (see **Table 11**). Indeed, the landless

labour class in Benkanahalli (the irrigated village) do less labour work when compared to those in Kanvihalli.

Table 11. Extent of wage labour employment in each village

Labour days per adult per year	Village	Economic class			
		1	2	3	4
Agricultural non-local + Non-agricultural labour	Benkanahalli	0	69	139	114
	Kanvihalli	0	36	174	241
Agricultural local labour	Benkanahalli	0	40	78	114
	Kanvihalli	0	7	95	199

Note: *Class 1 is the wealthiest class, Class 4 are landless and marginal farmers.*

The trend across the two villages is not as expected seems to be related to two confounding factors which make the villages not actually similar. The first one is the inequality of landholding is much higher in Kanvihalli, with one landlord alone controlling more than 40 ha of cultivated land. This creates significant potential for wage labour work for the landless households. The second reason for reduction in labour work for small and marginal farmers in irrigated village is due to the increase in mechanization of agriculture practices of paddy crops.

On the other hand, the impact of irrigation on outmigration has been positive. In Kanvihalli, out migration was 33 person days per adult of the village whereas that in Benkanahalli was only 8 person days (see Table 12). Within the economic classes it was higher in the lower classes and very high within the landless and small farmers of Kanvihalli. They migrated to various locations in Karnataka for all kinds of labour, including coffee estates, construction work in Bangalore, and road work across the state. In Benkanahalli it was only two families in the sample out migrated for labour work and they worked as supervisors of house construction. Whereas the poor households in Benkanahalli did not wish to go out of the village for labour work because they had sufficient labour work within the village itself, some on their own landholdings and some on that of others

Table 12. Extent of out migration in each village

Village	Employment obtained through out migration (average labour days per adult per year) in different economic classes				
	Class 1	Class 2	Class 3	Class4	All classes
Benkanahalli	0	10	13	0	8
Kanvihalli	0	15	58	49	33

9 Response to JFPM

Did this difference in dependence on common lands show up in the villager's response to JFPM? Certainly the response of the villagers was consistent with the hypothesis that villagers in Benkanahalli were much less concerned about the state of their common

lands than those in Kanvihalli. In Benkanahalli, firstly, the VFC was formed with the help of a few villagers who were sitting near tea shop on the roadside. Secondly, the plantation was done without the involvement of the VFC. In neither case did the villagers bother to enquire about the correct procedure or protest about their non-involvement. On the other hand, in Kanvihalli VFC members fought for their rights with the KFD officials on several occasions and took up various activities such as raising plantation and tried stopping illegal felling and encroachments. Overall people in Kanvihalli are very enthusiastic upon formation of VFC and interested in protecting and conserving the common lands.

It should be noted, however, that there could be other location-specific factors responsible for this difference. In particular, our observation was that the implementation of JFPM in Gulbarga Division (of which Benkanahalli is a part), was perhaps the most lackadaisical of the divisions in the Eastern Plains region (see, Lélé *et al.*, 2005). Furthermore, the villagers of Kanvihalli were certainly mobilized and made aware of the possibilities under JFPM by an NGO called REACH which was quite keen on ensuring better implementation of JFPM in that region. Nevertheless, our observations in Benkanahalli suggest that the villagers there would simply not have responded to the JFPM programme due to lack of interest.

10 Summary of findings, conclusions, and policy recommendations

The key findings of the study are as follows.

- The overall dependence on common lands for fuelwood and grazing was found to be lower in the irrigated village as compared to the unirrigated village.
- In the case of fuelwood use, the decline in dependence on common lands seems to be more an indirect outcome of the introduction of canal irrigation, which coincided with and has clearly supported the spread of Prosopis juliflora, an invasive woody shrub.
- In the case of grazing, the decline in dependence on common lands is clearly the outcome of irrigation, which has dramatically increased fodder and grazing material availability from agricultural lands.
- The impact of irrigation has also shifted over time. In the initial years, when farmers followed the recommended cropping pattern under the irrigation scheme, the irrigated dry crops yielded residues that could be used as fuel and fodder. The shift to paddy cultivation has meant no augmentation of fuel resources and a poorer quality of fodder, although a quantitative increase.
- In terms of class-wise impacts, in both villages large land holders get significant amount of fuelwood and fodder from the agricultural fields, while the small and landless depend on the common lands. The advent of irrigation seems to sharpen this difference to some extent, as the increased agricultural residues are available only to the landed classes. However, some spillover benefit does seem to reach the landless and marginal farming households, in the form of increased productivity of canal side and road side lands.

The effects of irrigation-induced agrarian change are thus complex and context-

dependent. Nevertheless, there appear to be significant direct and indirect effects on the *overall* availability of alternative sources of fuel and fodder and hence on the importance of common lands in the livelihood strategies of most villagers, except perhaps of the poorest classes. It should be noted, however, that the poorer economic classes in the irrigated village continue to be significantly dependent upon the commons, especially for grazing their livestock. Since rearing of small ruminants is an important survival strategy of the landless and marginal farmers, the commons provide an important resource for these groups. Equally important, the commons continue to have some importance as a grazing resource even for the higher economic classes in the irrigated village. There may thus be a significant interest in the community to regenerate the commons for grazing purposes, but not as a source of fuel.

In terms of policy recommendations, our study leads to two suggestions. Firstly, in the short-run, programmes of community management of forests and common lands (such as JFPM) that are based on an assumption of strong (and generally uniform) dependence of the villagers on common lands should concentrate on non-irrigated villages where this assumption is more likely to hold. Secondly, in the long run, these programmes will have to think of more innovative ways of mobilising local involvement in such areas. Two possibilities come to mind: involving only the lower economic classes (which continue to be somewhat dependent), or handing over the lands to neighbouring villages which might not have irrigation. Our observations also reinforce the point that JFPM should not focus exclusively on tree planting, as villagers, especially where Prosopis has already spread, might be more interested in the grazing/fodder benefits of the regenerated common lands.

11 Acknowledgements

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13 Key people and institutions

- G N Simha, REACH, Pattankere, R D Ismail Sab Bldng, 4th Ward, Harappanahalli, Davangere, Karnataka.

- Bhat M. K., Development Support Initiative (DSI) (No.680, 38th Cross, 15th Main, Jayanagar 4th T Block, Bangalore 560 042) and co-founder of the *Jana Aranya Vedike* (People's Forest Forum), an initiative set up in 2002 to act as a platform for pushing for a more participatory form of forest management in Karnataka.

- Director, FEVORD-K, No.44, New Bamboo Bazar Street, Cantonment, Bangalore-560 051

14 Publications and websites

15 Map

Figure 1. Variation in extent of irrigated land across different talukas

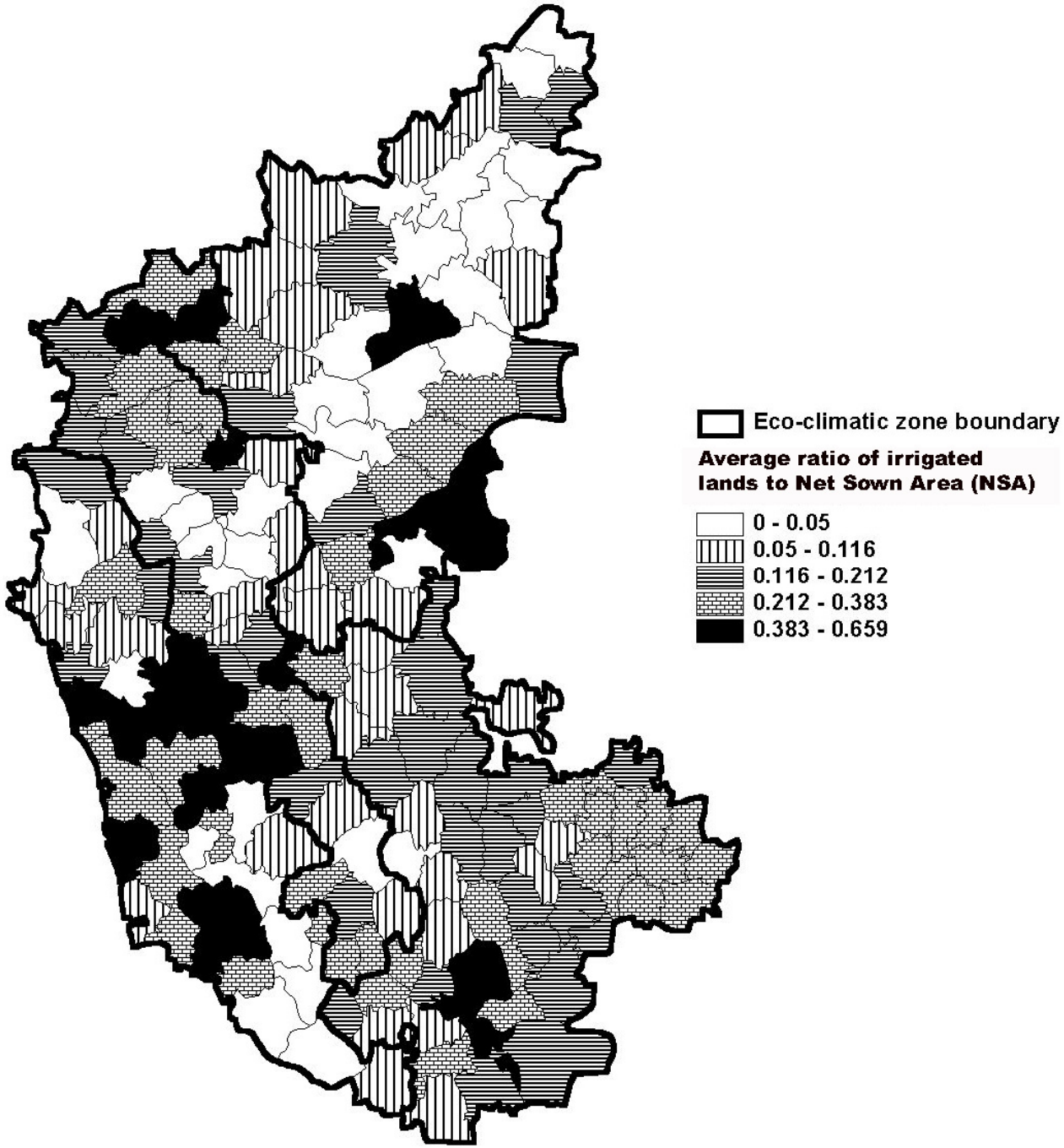
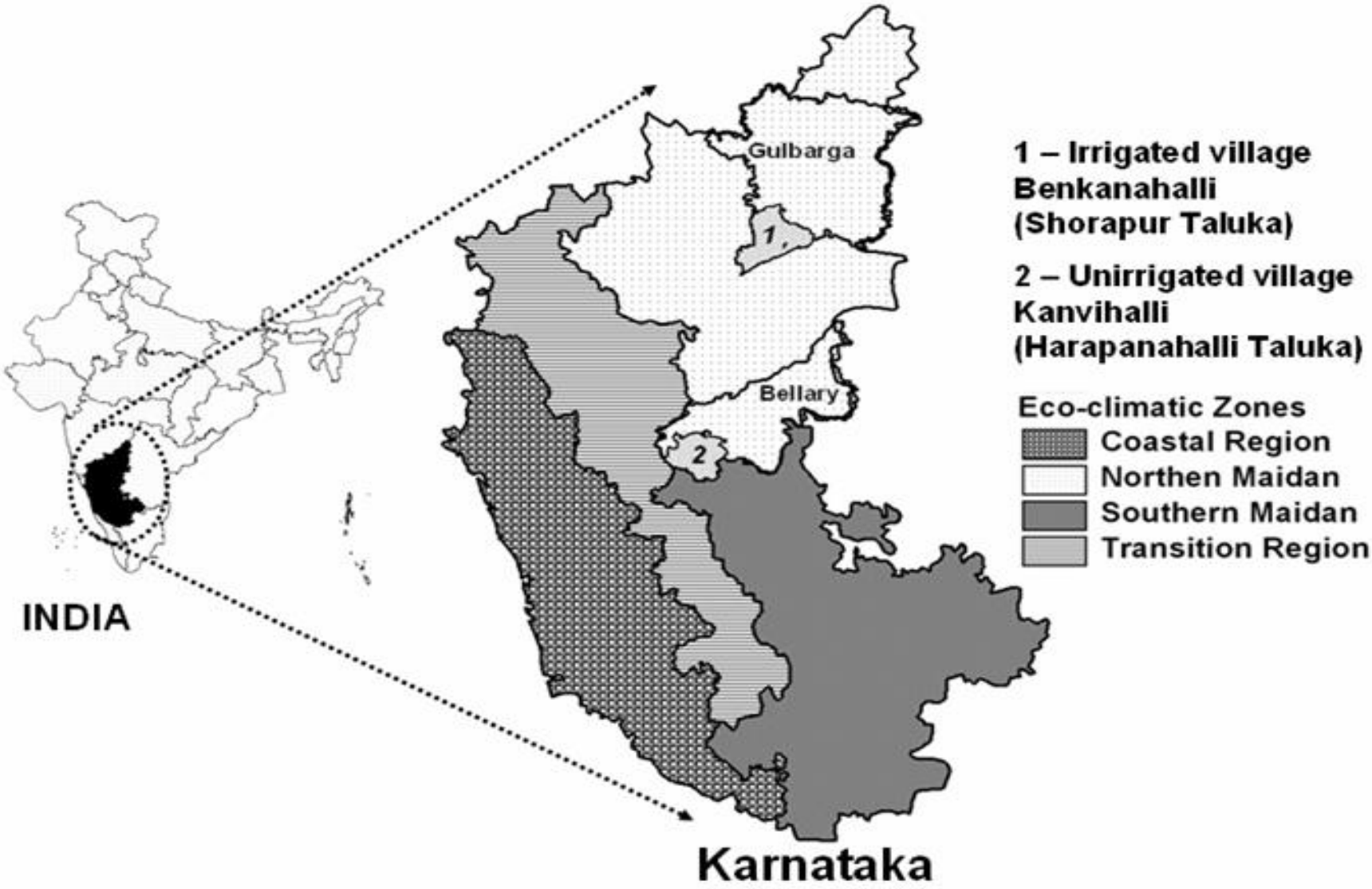


Figure 2. Location of study villages in Karnataka



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17 Brief description of association

The authors were involved in a larger study on JFPM in the eastern plains region of Karnataka, on which this paper is based. The study involved eight months of intense field work and secondary data analysis during 2002, and extensive with the state forest department as well as activist groups in Karnataka working on questions of forests and common land management. Kiran Kumar has recently moved to University of Canterbury, New Zealand to do a PhD on the hydrological effect of forest cover change. Sharachchandra Lele has been involved in research on forest and common land management for the past 15 years, including questions of ecological impact of forest use, forest rights and institutional issues in forest management. Pravin is interested in issues of social justice, and is presently working with CRY Bangalore.