Document 015 (July 2008)

Learning Event 2: 'Common Property Resources - Livestock' (CPR)

15th - 17th July 2008

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READER

SOUTH ASIA
Pro Poor Livestock Policy Programme
A joint initiative of NDDB and FAO

READER

Learning Event (LE) two:

- **Theme:** 'Common Property Resources - Livestock' (CPR),
- **Period:** 15th – 17th July '08; post LE: 3rd Quarter 2008

[1] These three articles provide excellent background information to our theme 'CPR-Livestock'.

[2] These two articles bring in a pronounced livestock perspective.

Introduction to the theme

- why SA PPLPP is focusing on the theme common property resources in relation to livestock and the boundaries of the theme,

Common property refers to some form of shared resource tenure – usually involving a group that uses and manages the resources. Common property resources constitute all such resources which are meant for common use of the villagers without any individual ownership right (Jodha, 1986). These resources can broadly be categorized into common property **land** resources, common **forest** resources and common **water** resources.

In addition and referring to the agrarian society in South Asia especially, there are also a range of private lands which are seasonally open for grazing; livestock can normally freely graze on crop land after the crop is harvested providing animals access to stubbles, crop residues and grasses on boundaries while available fodder trees are lopped; private pasture lands too are normally open to all when the grass crops have been harvested. The Good Practices identified primarily refer to the former; i.e. Common Property Resources (CPR[3]) namely grazing lands, forested areas, and other community lands under **common property regimes**.

In the context of SA PPLPP, where we focus on livestock developments in the interest of poor livestock keepers, the interest is towards CPR as an important source of **feed and fodder**; i.e. grasses, tubers, creepers, flowers, leaves and pods of shrubs and trees. **Water** is in addition an important source.

The main source of feed and fodder for small and large ruminants as well as camels is not planted fodder and/or manufactured feed (dairy meal etc.), but first crop by products and – residues and secondly feed and fodder from CPR. In general, the poorer the livestock keepers are, the more their animals depend on CPR; whether there is a correlation between increasing number of poor livestock keepers (agricultural labours, marginal and small farmers, pastoralist/nomadic communities) and decrease in quantity and quality of CPR is difficult to prove due to lack of data but there is a high probability as per Jabir, 2007.

Animal husbandry departments in the region (Bhutan being an exception to some extent), related research institutions/centres (e.g. Indian Grassland and Fodder Research Institute, Fodder production farms, Forest Research Institutions), other Government entities such as National Dairy Development Board as well as the traditional dairy development oriented NGOs/cooperatives (BAIF, primary cooperatives, BRAC[4] etc) have primarily focussed upon crop by products/residues and secondarily on planted forages/fodder crops. In addition, an overemphasis on breed improvement (cross breeding) has not sufficiently taken into account the corresponding nutritional

[3] The seasonal access to fodder of private owned land will be addressed through another series of Good Practices focusing on typical this form of partial public access.

[4] BRAC is not a typical dairy oriented institution but a micro financing oriented and famous for its small holder poultry models, it is currently active in dairy development and follows the pattern of crossbreeding and promotion of fodder crops.

requirements and made these efforts turning economically unviable especially in the resource poor areas and farms.

In case of forest related institutions the focus has been on forest land use/protection and **hardly on managing grass land and fodder trees/shrubs**; the component of grasses and tree fodder falls under the category of non-timber-forest-products (NTFP) but these are not quantified while fuel, timber and others are (Tejwani, 2007).

It is definitely a constraint that **feed and fodder deriving from CPR is not quantified while its monetary value is not assessed** ((Tejwani, 2007), (Brara, 1992)) and access to these fodder and feed resources for the villagers interested in grazing their animals, lopping the trees and harvesting the pods, is constrained in many ways.

The multitude of institutions involved in watershed development too have not significantly addressed the impact of soil and water conservation measures in terms of **increase in type of biomass and who has access to it**; although increase in cropping area and intensified cropping of existing crop land leads to more crop by products these are not automatically available to landless livestock keepers while the existing CPR are reduced (diverted towards crop lands) and/or put under rigid protection including ban on grazing[5].

In many ways, Common Property Resources are under **threat** and the **main causes** are as follows:

a) Traditional institutions managing CPR have broken down for various reasons among others due to tenure being taking over by Government Institutions,

b) CPR are allocated for other purposes such as Special Economic Zones (Industrial Development Areas with attractive tax exemptions), Bio fuel production (e.g. Jatropha), Infrastructural development (roads, dams etc), Mining, Clean Development Mechanism (carbon sequestration), distribution of plots to landless families etc,

c) Increasing number of livestock and decreasing grazing areas[6] and thus overstretching[7] of and high competition among users[8] of these resources,

d) Others such as various types of encroachment.

However, the **primary source** of **feed and fodder** for poor livestock keepers is derived from **CPR**.

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[5] Studies show that increased cropping area has resulted in reducing the availability of and access to common grazing lands.

[6] Over the period 1966 to 1997, the livestock units per hectare of grazing land has increased from 1.83 to 2.9 as per Tejwani, K.G., 2007 who uses the Ministry of Agriculture data of 2000.

[7] As a result degradation of the CPR is widespread.

[8] As a result conflicts among users of these resources can be severe.

SA PPLPP's interest in identifying and documenting Good Practices in managing CPR is **threefold** namely:

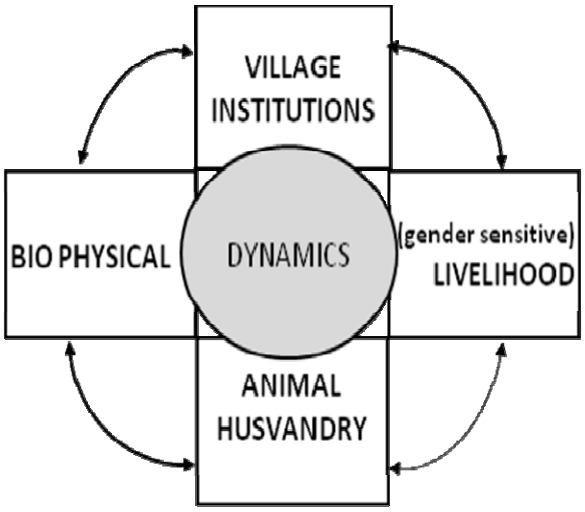
i. arriving at **concrete evidence** that investing in development and management of CPR in a holistic manner can be an effective and efficient means to contribute to poverty reduction[9];

ii. **to anticipate current strength of the livestock sector** in South Asia which is not in direct competition with agriculture (non-grain based systems; non-planted fodder systems) but **synergetic** (integration of animals in crop, food and forest production systems) **and/or pastoralism oriented**; it is about the relative extensive systems of keeping animals which efficiently convert the non-food produce –often called "waste"- from crop, food, forest and pasture systems,

iii. while providing evidence for the former two, have a multitude of GPs at hand for dissemination.

As can be learnt from the Good Practices identified, the more livelihood and poverty oriented NGOs are those which have facilitated the evolution of Good Practices. Next, there are also some communities who managed to adjust traditional systems with time and kept the CPR productive and ecologically sound.

The diagram 'Holistic Development of CPR: four window perspectives and its dynamics' presented on the right visualises holistic development and management of CPR.



Holistic Development of Common Property Resources
- four window perspectives and its dynamics -

Introduction to the theme

- the process of how SA PPLPP makes use of GPs is highlighted

The process of identifying, documenting and analysing Good Practices concerns a **learning path**; it does lead, for instance, to better understanding of the requirements for effective pro-poor livestock policies and programs as well as institutional arrangements just by working with the five parameters spelt out for the filtering process[10], namely i.) successful adoption, ii.) sustainable benefits, iii.) sustainability, iv.) strengthening of livelihoods and v.) community empowerment (Maarse et al., 2007).

[9] The below poverty line people in South Asia are those depending on livestock in particular small animals.

[10] Important step in documenting GPs.

Therefore, the learning initiated allows the actors (whoever is involved in the identification and documentation) to be better equipped to contribute to influencing policies, overall change in direction for the sector; i.e. they can thus function as '**champions**'.

Another term applied is **Good Practice 'owner'**; it concerns a person, a team, a group, a department or shortly institution who/which has facilitated and/or substantially contributed to the development of the Good Practice. A GP owner knows all the ins and outs of the concerned GP and normally contributes to the documentation process by providing information, facilitating field visits, etc. In certain situations a GP owner might be requested to take the lead in documenting the GP.

The lessons learnt and evidences obtained in this process of identifying, documenting and analyzing Good Practices target two pronounced groups namely the Promoters (public sector authorities, trainers / capacity building entities, advocacy groups, research and development etc.) and Practitioners (fe/male farmers and their organizations, service providers, fe/male community workers, input suppliers etc.).
For instance, **the GPs on 'CPR - Livestock' should lead towards the safeguarding of common property resources in the interests of fe/male farmers, with a special focus on the poor, the ecological value of CPR and the economic importance of CPR to livestock keepers**.

Apart from these concrete outcomes, it is equally important to develop interactive and participatory instruments, as well as knowledge to apply them and learn from their application. One could call it a kind of policy laboratory.

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SPECIAL ARTICLES

Are Grazing Lands 'Wastelands'?
Some Evidence from Rajasthan

Rita Brara

Economic & Political Weekly, February 22, 1992

The dominant view contends that vast tracts of common grazing land are wastelands to be greened in the wake of the environmental crisis confronting the country's arid and semi-arid zones. Clearly there can be no definition of wasteland other than that which draws attention to its defining feature of uselessness. What is to be investigated then, is whether this land and its produce, if any, has a use value at all.

This article, based on a study in the Sikar district of Rajasthan, juxtaposes the state's view (incorporating the scientists' definition) of wastelands to the vi1lagers' perception of the commons which draws its characteristics and validity from the shared context of local inhabitants.

The language that characterises the debate on environment in the country offers a mode of classification worthy of study by itself. The very description of the environmental problem leads to alternative directions for its resolution.

The dominant view contends that vast tracts of common grazing land are waste-lands to be greened in the wake of the environmental crisis confronting the country's arid and semi-arid zones. It is apparent that there can be no definition of wasteland other than that which draws attention to its defining feature of uselessness. What is to be investigated, then, is whether this land and its produce, if any, has a use value at all.

Often, the land revenue record has been taken as the basis for identifying wastelands (classified as non-revenue-yielding lands) and the legacy of land settlements under the British government /princely states as carried over into the present. For some purposes, lands producing less than one-fifth of their potential have been regarded as wastes (see Bhumbla and Khare, ud) without explaining how estimates of either the potential or the actual were obtained. Wastelands have also been described by focusing upon the physical characteristics of' the terrain, such as the lack of top soil and toxicity toward plant growth [Bhumbla and Khare, ud) or its sandy, stony, gravelly or saline qualities (Ram et al, 1983; Yadav 1986). But then these lands, as Ram et al observe, were nevertheless used for grazing.

The modalities of redressing wastelands have often been proposed and planned by the government in concurrence with the natural scientists. The latter have been associated with the government for their technical expertise on growing trees, expeditiously checking the onset of bare, vegetation-less stretches, countering desertions threats and in working out subsistence-oriented afforestation schemes.

In the area of this study, viz, the Lachhmangarh 'tehsil' the Sikar district of Rajasthan, the schemes approved by the scientists were far removed from the contexts of users dependent upon the still-existing natural diversity of vegetation on the common lands and the monsoonal resurgence of pastoral grasses.[1] Often, the government had, inadvertently perhaps,

[1] Krishnamurthy (1978) and Patil et al (1979) corroborate the view that pastoral grasses in India reach their peak value during the monsoons.

jeopardised the interests of users by centrally determining what constituted subsistence from the commons in diverse, ecological contests over-looking their present use value. Often, the losses from these schemes exceeded the gains that were presumed.

Against the depiction of the commons as waste was another view that drew its characteristics and validity from the shared local context of village inhabitants, even though it often ran counter to the enacted laws of the state. From this perspective the commons (i) offered a regenerative vegetation that supported the livelihoods of the small holder; (ii) when seen along seasonal dimensions, over the course of a year, this vegetation of the commons appeared at critical junctures in the fodder cycle of small who were also livestock rearers; and (iii) the produce of the commons was valued by village inhabitants as epitomised in the regulations that governed its use and sale in the interests of the villagers as a collectivity. Village inhabitants defined their own commons and differentiated them from the commons of other villages, irrespective of whether these lands were classified in the land revenue records as 'charagah' (permanent pasture), 'gairmumkin' (revenue-free state government lands), 'siwai-chak' (lands vesting in the state government) or as lands falling under the jurisdiction of the forest department. The actual extent of the commons and the quantum of commons' produce at their disposal was evidently understated in the official land records and in the estimates that relied upon the latter.

Tracts of land identified by the villagers as their commons had multiple uses that coexisted with grazing. The forages afforded by the commons too were a part of the natural vegetation that offered other uses as well. It was the less well-to-do inhabitants of the dryland tracts who even now utilised the natural vegetation for meeting their fodder, timber and fuel needs; for their thatching requirements and raw materials from which they crafted articles of daily use such as baskets and ropes; for the supply of wild fruits and vegetables that were both consumed and sold and as the source of herbal remedies that cured or alleviated locally prevalent ai1ments. While we identified about 70 plant types in the common lands of two villages taken up for detailed study, we have somewhat arbitrarily limited this paper to what seemed to be the principal flora from the point of their use by the residents (Table l), especially as fodder.

Secondly, the symbiotic relation between agriculture and livestock-rearing for the majority of small holders in dryland tracts was an ecological adaptation made viable by the existence of private farms and common grazing tracts. An annual cycle of fodder provisioning that relied upon the produce of this combination could be discerned in the practice of livestock-rearers though it was often overlooked by those who regarded village commons as wastes.

From the onset of the rainy season, when the farms had to be cultivated, the animals were grazed mainly on the newly-sprouted vegetation of the village commons. The livestock were reared as long as possible upon the monsoon-enriched pastoral grasses and shrubs. It was during this period that the livestock showed an appreciable gain in weight [cf Ahuja and Vishwanathan, 1976]. A favourable winter rain encouraged a renewed growth of the perennial grasses and herbs on the commons. The leaves of the 'khejri' (Prospis cineraria) and 'kair' (Capparis decidua) trees that grew on this land also afforded forage in winter.

The scarcity of fodder was at its zenith in the four months of summer. Supplements of green fodder during this period were obtained through tree loppings from the commons. The larger perennial species were a significant resource in furnishing the supply of greens during the lean season. The dearth of fodder was especially acute for small holders dependent on the forage resources of the commons while the large landholders could either use their private fallows and trees / shrubs growing on their farms or raise irrigated fodder crops to meet their requirements.

Third, far from being characterised by unrestricted access, the use of grazing resources was situated within a territorial framework that comprised the residents of a village. Regulations regarding the rights were the produce of the commons and sanctions against their contravention were decided by a village committee of 'mukhias' (heads). This informal committee of mukhias was a characteristic feature of villages in Lachhmangarh tehsil.

Residents in most villages regulated the use of grazing lands by conventions that were accepted by the majority. As a first principle, residents of the village alone were considered to be the rightful users and decision takers in regard to the produce of the commons. The access of itinerant professionals and migrating shepherds was restricted to a few days only. The lopping of whole trees and shrubs war forbidden and defaulters were penalised. Decisions about the auctioning of the natural produce of the commons – what was to be auctioned and when, who was to be entrusted with the money raised in this manner and the common purpose to which it would be put – were matters specifically resolved by the village-level committees.

Far from being apathetic to their environs, village inhabitants were alive to the dangers of ecological degradation. By contrast with the physical, and often uni-dimensional, indicators of denudation put forth by the scientists in their efforts to identify wastelands, the villagers perceived the environment by including its human and social dimensions as well. The first section of this paper attempts a short appraisal of the, afforestation efforts that we encountered in Lachhmangarh tehsil. The villagers' perceptions of diminishing vegetation are documented in the second section and compared with the thinking of' the natural scientists and the interventions that have been proposed. The third section investigates living tradition of afforestation in the village. Section IV concludes this enquiry by suggesting that plans for augmenting livelihoods based on the commons should provide for wages and allow the definition and design of public works to be determined by the inhabitants themselves.

Table 1: Uses of Principal Plant Types on Common Land
(Villages Khedi and Banai)

Local Name	Botanical Name	Fuel	Fodder	Timber	Fibre	Medicine
I *Grasses: Annual*						
Bharoot	Cechrus biflorus	-	x	-	-	-
Koori	Brachiaria ramose	-	x	-	-	-
Lampalio	Aristida adscensionis	-	x	-	-	-
Makro	Dactyloctenium barbarum	-	x	-	-	-
Seetiyo	Eragrostis ciliaris	-	x	-	-	-
Sedges/Grasses: Perennial						
Dab	Desmostachya bippinnata	-	x	-	x	-
Doob	Cynodon dactylon	-	x	-	-	-
Jichhabari	Cyperus arenarius	-	x	-	-	-
Jirneo	Digitaria adsendens	-	x	-	-	-
Kans	Saccharum spontaneum	-	x	-	x	-
Kooncha	Saccharum bengalense	-	x	-	x	-
Motho	Cyperus compressus	-	x	-	-	-
Tantia	Dacttyloctenium	-	x	-	-	-
II *Herbs: Annual*						
Aagyo	Borreria pusilla	-	x	-	-	-
Bhakri	Tribulus terrestris	-	x	-	-	x
Kagler	Corchorus tridens	-	x	-	-	x
Ramsario	Arnebia hispidissima	-	x	-	-	-
Sureli	Gisekia pharnaceoides	-	x	-	-	-
Herbs: Perennial						
Bekaria	Indigofera cordifolia	-	x	-	-	-
Kharsana	Crotolaria burhia	x	x	-	x	x
Mansa	Tephrosia hamiltoniana	-	x	-	-	x
III *Shrubs: Perennial*						
Akra	Calatropis procera	x	x	-	x	x
Alay	Mimosa hamata	x	x	-	-	-
Babul	Acacia jacquemontii	x	x	x	-	-
Bordi	Zizyphus nummularia	-x	x	x	-	-
Bui	Aerva persica	-	x	-	-	-
Erni	Clerodendrum phlomoides	x	x	-	-	-
Kheemp	Leptadenia pyrotechnica	x	x	-	x	x
Murali	Lycium barbarum	x	x	x	-	-
Phog	Calligonum polygonoides	x	x	-	-	x
III *Trees: Perennial*						
Hingota	Balanites aegyptiaca	x	x	x	-	x
Kair	Capparis decidua	x	x	x	-	x
Kankera	Maytenus emarginata	x	x	x	-	x
Khairi	Acacia senegal	x	x	x	-	x
Khejri	Prosopis cineraria	x	x	x	-	x
Kikar	Acacia nilotica	x	x	x	-	x

Note: x indicates presence of trait
Source: Field Survey

I
Constraining Framework of Afforestation Schemes

There was a characteristic set of' problems associated with the functioning of the government schemes for rural development that impinged on afforestation schemes as well. The implementors were not accountable to the local people; the knowledge of the inhabitants for whom the schemes were intended was ignored [cf Caufield, 1982] and the rationale for such pursuits was not debated with those who were presumed to

benefit through such action. These problems were especially constraining in relation to the nurture of living resources.

RESISTANCE TO ENCLOSURES

The survival rate of saplings planted on village commons was low. The villagers did not share the government's approach to afforestation by enclosure or fencing ('tarbandi'). Such enclosure was seen as an act of encroachment by the state. The common lands that were deployed for growing grass/ trees were perceived as belonging to the residents by a conventional right. The curtailment of the right to tree loppings and grazing on such tracts was regarded as a deprivation by the majority, irrespective of the scheme that was being pursued.

The economic value of the existing forage on what were classified as wastelands was easily overlooked since, by and large, tree loppings, grasses and sedges were, not a traded commodity or a part of the monetized sector. Yet the present output of such forages was considered significant for the animal enterprise by the residents of this tehsil. The villagers resisted schemes for afforestation upon such lands on the grounds that there was already an acute scarcity of pasturage.

Where the government persisted with its strategies for grass/tree plantations, a deflection of priorities envisaged in the scheme occurred to orient it to what the villagers desired but was not the official intention [cf Blair, 1986; Chambers and Leach, 1987].

In this area of' one-crop agriculture the demand for work was unrelenting during the eight months of the agricultural off-season. Employment on daily wages ('dhyanki') was the paramount concern of the majority of rural inhabitants in Lachhmangarh tehsil and the only recognised gain from afforestation schemes pursued by the government. This perception was quite regardless of apparent differences in the official focus of these schemes – whether these were forest department nurseries, shelter-belt plantations, silvi-pastoral schemes, village fuel-wood and fodder-plot programmes or sand-dune stabilization efforts.

Though restricted to a few village sites, the afforestation schemes afforded an avenue of employment to the villagers. Employment through these schemes was considered to be the claim of, at least, one member in every village household that sought such work but in fact, tilted in favour of the faction that aligned with the 'sarpanch'. Generally viewed as light work, employment on government schemes was acceptable to the relatively better off villagers as well who eschewed other types of wage labour.

Often, the sarpanches persuaded village residents to accept afforestation schemes by reasoning that a few inhabitants would secure daily wages in the process. It was agreed that the restrictions on grazing would not be enforced. Or else it was clarified that since the expenditure on watering the saplings was underrated by the government, in any case, the plants would naturally die out. The pasturage on these tracts would then be theirs to utilise much as before.

Rural inhabitants, too, engaged in a continuous evaluation of the government's interventions from their vantage position. While the scope for employment was lauded, the majority of residents was convinced that the government's fodder and tree-planting schemes did not augment their resources but, instead, curtailed the use of what was already available.

The choice of tree species for the past and ongoing afforestation schemes in Lachhmangarh tehsil had almost exclusively fallen on Acacia tortilis ('buli'). This tree was fast-growing and had a remarkable survival capacity under drought conditions. Its role in sand-dune stabilisation was attested by natural scientists [Muthana and Arora 1979; Jindal et al, 1985]. For the local residents of this tehsil, however, the Acacia tortilis had scarce use as fodder, fuel or timber. Yet its singular propagation under state auspices continued unabated since it dovetailed well with the targeting at quick and certain results.[2]

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[2] The director, desert afforestation and pasture development, Rajasthan noted

Again both under the silvi-pastoral and the village fuel-wood-and-fodder-plot schemes, the only grass seeded was an improved variety of Cenchrus ciliaris recommended by CAZRI [Paroda and Jatasra, 1985]. This perennial species was acclaimed by the inhabitants as palatable for all types of livestock. In their view, however, the provision of water alone could make a striking difference to the output of this grass, a fact confirmed by natural scientists [see for instance, Ahuja et al, 1978, Pressland 1984].

WHO BENEFITS?

The benefits from afforestation-linked programmes were more easily appropriated by those who had the wherewithal when the inputs required were over and above time and labour and the individual returns greater than daily wages.

For instance, the 'kisaan' nursery scheme offered free bag, fertilizer, seed and pesticide for the nurture of the saplings that were to be sold to the government by prior contract at 30 paisa each. Since the costs were envisaged as mainly labour, the disadvantaged sections were to be given a preference in this selection. The scheme envisaged that the government would save the expenses incurred and establishment costs of the saplings, thus combining thrift and social justice.

But the disadvantaged rural residents had little information about the scheme's existence and could not have coped easily with the paper work entailed in securing the contract. Nor was it possible to raise saplings in this irrigation-scarce zone on a mass scale for those without irrigation facilities – evidently, labour was not the only input required for participation in this scheme as had been assumed. The contracts for the supply of saplings on favourable terms, in fact, found their way to those privileged with access to irrigation sources. Since the contractors, too, had to meet targets, moreover, they raised saplings of the diehard Acacia tortilis.

The results of most afforestation schemes were disappointing and sooner or later the planners conceded that the goals were not adequately met [see, for instance, Negi, 1986]. Time and again the inhabitants were reinforced in their view that the government was wasteful while they remained unemployed. Villagers questioned the benefits presumed to accrue to the residents, especially to the smallholders[3], the choice of species, the location of the site and the disdain for local know-how. The silver lining was employment for the privileged few.

There are alternative ways of harmonising the good intent of the government and the interests of the villagers. It seems to med that the afforesation effort can be enhanced by meeting the demand of the villagers for employment on a sustained basis and by associating the user groups and the informal, village-level committees (which are presently the de facto custodians of the commons) as partners in this quest.

The interests of the relatively disadvantaged sections in the village – the aged, women and children – who are the actual users of the commons have not been addressed in state interventions for afforestation / pasture development in this area. The future direction, in fact, should question the exclusion of aged men and women from employment in afforesation - related interventions when the quality of their labour is adequate for the tasks envisaged. The type of support required by children who are employed in grazing and common-produce collection, too, needs to be planned in concurrence with the users of the commons. Finally, the view 'that the commons are wastelands should be reviewed since it

that the department did not opt for slow-growing species since the plantations had to be established in the shortest possible time. For details, see Mathur (1983:79).

[3] An evaluation of pasture development under the DPAP programmes in the Jodhpur and Jaisalmer districts of Rajasthan, too, concluded that the membership of the sheep cooperative based on the number of sheep owned virtually excluded the small farmers from benefitting. For details see Sewak and Purohit [1977].

militates against the villagers' perceptions of the present worth of its pasturage and other vegetative produce. There is a perceived threat to the customary rights of the inhabitants in the commons and fear of the state's taking over these lands and its produce by initiating afforestation schemes.

The local evaluation of the problems posed to farmers-cum-livestock-rearers in their pursuit of a livelihood and the context of diminishing vegetation can provide the grounds for the type of intervention to be undertaken. This subject is investigated in the following section before evaluating the recommendations put forth by scientists for augmenting forage production.

II
Local Understandings of Diminishing Vegetation

The residents' recognition of the village level environment bore the impress of in situ knowledge. The depth at which water was available, the floral indicators of soil fertility, the means of provisioning against wind erosion and shifting sand-dunes were commonly attested phenomena. Striking, for our purposes, was what the villagers described as a 'johada' (a pond and its catchment area) that was conventionally used for grazing animals.

Every depression in the village had been deployed to catch the natural run-off of rain-water. During the 'chaumasa' (the four months of the rainy season) especially, the johada provided a convergence of watering and grazing facilities for livestock. The johadas, the Assessment Report of Thikana Sikar [1940:12] noted, were "a blessing in several ways to the village people". Here the khejri (Prosopis cineraria) trees grew in a natural abundance.

The predominance of khejri trees and bordi (Zizyphus nummularia) bushes was taken to be a positive indicator of soil productivity. The land of the johadas was evidently fertile. Yet, it was not brought under the plough but set apart as a sacred tract. Khejri trees growing in the fields were utilised for the more profane purposes of fire-wood and forage.

The first threat to the expression of cultural ecology as it had evolved till this point came from the continuous increase in the human population after the 1920s. On the one hand, the grazing lands in the village were increasingly restricted to the johadas as uncultivated lands and old fallows came to be tilted. The unceasing demand for fodder, moreover, gradually loosened the injunction against the coppicing of khejri trees growing in the johadas.

On the other hand, the rise in the human population occurred in a context that enabled the 'jagirdars'[4]/chiefs to limit the cultivators' prior access to the forage and other natural produce of the uncultivated areas. The competition for arable land encouraged the jagirdars to make over the former grazing lands to cultivators for a monetary consideration. Their agents and revenue contractors, increasingly, staked their claims to the forage and timber of uncultivated areas. This landmark in the inhabitants' history found an expression in the protest movements that were launched by the peasants in the period 1924-47 [Joshi, ud; Ram, 1986]. At Sikar, the renewed agreement between the cultivators and the chiefs took the shape of the 1940 land settlement.

Significant for our study was the tussle over who had the right to the now-scarce natural produce of the grazing lands – the jagirdars, 'thikanedars[5]', 'ijaredars[6]' and 'patels[7]' of the village or the villagers as a collectivity. A diversity of arrangements for sharing was in evidence but the frequent agitations by the cultivators kept the situation restive until independence in 1947.

Shortly after, in 1952, the abolition of jagirdari and taxes of diverse nature, including grazing taxes, was legislated

[4] Jagirdar: The holder of a jagir or estate who was assigned the revenue by the ruler.

[5] Thinkanedar: The holder of a thikana or estate whose position was subordinate to the chief of the state itself but who had considerable autonomy and powers of revenue utilisation in the tract.

[6] Ijaredar: Revenue contractor

[7] Patel: The hereditary title of a revenue intermediary

and acted upon by the state. This was recognised as a positive measure by the cultivators. On the negative side, however, the onslaught on tracts reserved by the inhabitants as johadas came with the force of a sledge-hammer in the post-independence period.

While every villager knew that the johadas in Lachhmangarh tehsil (as in the rest of the Shekhawati region) were synonymous with grazing lands, administrative expediency, the private stakes of village notables and laws that were questionable in themselves created a virtually lawless situation as far as the grazing lands and their users were concerned. The grazing lands of the tehsil came to be diversely classified as de jure pasture (charagah), unoccupied government lands (siwai-chak), both culturable and unculturable as well as 'banjar' johada (pasture declared as much by a former settlement). Forest lands, too, were carved out of the johadas. Such lands bore the same natural characteristics as lands that had elsewhere in the tehsil been classified as tracts suitable for agriculture or for grazing.

The picture of grazing lands was complex from the point of view of the record and ironically simple from the villagers' perspective. Regardless of the official classification, the forest department's lands and 'unoccupied' state government lands were regarded by the inhabitants as a part and parcel of their village johadas or grazing lands.

Soon after independence, the modus operandi in the management of village johadas, crystallised in what was, more or less, its contemporary form. Irrespective of the official classification of such land and rights to its use and alienation by the state, regulations regarding the common pastoral produce and sanctions against their contravention were decided and implemented by village-level committees of mukhias. Proceeds from the yearly auctioning of 'loong' (the valuable fodder of dried khejri leaves) from grazing lands were utilised for the interests of the village as a whole and especially for the maintenance of the village 'sandh' (stud-bull). The uncompromising protection of the khejri was later limited to the portions of the johadas earmarked as land consecrated to a deity. Many villages in the tehsil had a tree-rich tract conserved in this manner.

Meanwhile, the pressure of men and livestock on the grazing lands of Lachhmangarh tehsil had increased. The population of livestock showed a nearly five-fold rise

Table 2: Consumption Pattern of Green Fodder by Different Livestock Species (Villages Khedi and Banai)

Local Name	Camel	Cow	Goat	Sheep
I *Grasses: Annual*				
Bharoot	x	x	-	x
Koori	x	x	x	x
Lampalio	x	x	x	x
Makro	x	x	x	x
Seetiyo	x	x	x	x
Sedges/Grasses: Perennial				
Dab	x	x	x	-
Doob	-	x	x	-
Jichhabari	-	x	x	x
Jirneo	x	x	x	x
Kans	x	x	-	-
Kooncha	x	x	x	-
Motho	-	x	x	x
Tantia	x	-	x	-
II *Herbs: Annual*				
Aagyo	x	x	x	x
Bhakri	x	x	x	x
Kagler	x	x	x	x
Ramsario	x	x	x	x
Sureli	x	x	x	x
Herbs: Perennial				
Bekaria	x	-	x	x
Kharsana	x	-	x	x
Mansa	x	-	-	-
III *Shrubs: Perennial*				
Alay	x	-	x	-
Akra	-	-	x	x
Babul	x	x	x	x
Bordi	x	x	x	x
Bui	x	-	x	-
Erni	x	-	x	x
Kheemp	x	-	x	-
Murali	x	-	x	-
Phog	x	x	x	x
III *Trees: Perennial*				
Hingota	x	-	x	-
Kair	x	-	x	-
Kankera	x	-	x	-
Khairi	x	-	x	-
Khejri	x	x	x	x
Kikar	x	x	x	x

Notes: 1 x indicates presence of the characteristic
2 The buffalo, too, could eat all types of green fodder that was consumed by the cow but it was not considered to be a 'grazing' animal
Source: Village residents

from 1940-1977. The reliance on tree tops and shrubs for forage continued to be critical during summer and winter when other vegetation was scarce. For smallholders, the annual and perennial grasses and herbs of the commons were still vital forage resources in the rainly season. The natural diversity of the pasture's vegetation was even now utilised in its seasonal manifestation of renewed greens.[8]

Since the 1950s, however, the vegetation cover and the density of the perennial species in the lands of the village had diminished in the recall of the inhabitants. This was a consequence of the conjoined impact of the demands for agriculture, timber, fire-wood and livestock-grazing upon the flora of the region. It had not led to the extinction of plant species in the area, as seen from a botanical viewpoint. Nor had large-scale commercial exploitation been responsible for the destruction of natural vegetation as in the forest regions of the country, even though a few herbs were sought out for their distinctive medicinal and fuel properties. Rather, it was the cumulative depletion of shrubs and trees and the threat to the viability of a few species in the not-so-distant future that fairly described the present situation.

At the same time, there was considerable overlap in the types of green fodder consumed by the different types of livestock [of Lusigi et al, 1984] so that no single animal species could be singled out for its vegetation-devouring capacity (Table 2). The goat seems to have been arbitrarily assailed for its role in desertification[9] by the National Commission of Agriculture [Government of India, 1974:120].

DECLINE OF VEGETATION

The divergence of tree and grass types on private lands and grazing lands grew out of the farmer's intervention aimed at optimising returns from crop output, forage produce and timber.

Primarily, trees which conceded the nurture of an under storey crop survived on private farms – mainly the khejri, and less often the babul (Acacia jacquemontii) and bordi. Trees with dense low-yielding canopies that precluded the penetration of light and the growth of underlying crops, for instance, the 'hingota' (Balanites aegyptiaca) and shrubs such as 'erni' (clerodendrum phlomoides) and 'murali' (Lycium barbarum), were increasingly confined to field boundaries where they served as shelter-belts or found in the grazing lands.

The boundaries of private fields were, florally, the richest stretches in the village. The area's native shrubs and trees – the 'kankera' (Maytenus emarginata) erni, murali, 'khairi' (Acacia Senegal), hingota – rarely encountered in the cropped areas were preserved in these live fences. Field boundaries were also planted with grasses such as 'kooncha' (Saccharum bengalense) which along with the basal cover of shrubs checked the ravages of wind erosion.

The farmers were, in fact, practising agro-foresters. They often trained the on-farm trees, vital for their fodder and wood to grow a single trunk in order to ensure the minimal reduction of cropped area. They had invested in tree species that were attractive for their timber, both indigenous species such as the 'rohirra' (Tecomella undulate) and 'seesham' (Dalbergia sissoo) and exotic species – for instance, the 'safeda' (eucalyptus).

The density of trees on cultivated lands now stood at 10 per cent hectare. It was, more or less, akin to the nine trees per hectare noted by the Settlement Officer of Lachhmangarh tehsil in 1940. It suggested a balance that the farmers had struck in the viable proportion of crop-land to tree cover – in other words, a ratio that was optimal for food, fodder and timber production from the standpoint of a farmer's household.

The expansion of cultivation had restricted the perennial herbs and grasses to the pastures and private fallows. Their underground roots were dug out in the process of ploughing and especially so, when this activity was undertaken by tractors. On private fallows, however, the indigenous

[8] For a discussion of the issue, see Shankarnarayan et al [1985]

[9] For details, see Singh [1985]

perennial grasses were nurtured. The rooting of perennial grasses took about three years to establish and yield an optimal, aerial growth under local, unirrigated conditions.

The 'khejri' was the most frequently occurring tree in the Shekhawati region on both private farms and grazing lands. The density of trees on grazing lands, at 11-13 per hectare, was higher than that of the cultivated areas. Yet, most old inhabitants attested that the number of trees on the pastures had decreased over the last 50 years.

Old khejri trees stood out on the grazing tracts. There were few young trees discernible by contrast with the private fields that showed the khejri tree in varying stages of growth. A search for other tree species on grazing lands revealed an occasional kankera, kair or khairi. Some trees were dwarfed to stumps (khejri) or had assumed a shrub-like appearance (Kair). The evergreen erni had lost its green appearance and mostly wore a wooden look.

The natural vegetation of the village pastures varied with the topography. The density of khejri trees was highest in the catchment areas of the pond, less on flat, sandy plans and the tree passed out of sight on the upper reaches of the sand-dunes. The sand-binding grasses and herbs such as kooncha, 'kheemp' (Leptadenia pyrotechnica) and 'phog' (Calligonum polygonoides) could be seen at distant intervals on high sand ridges though during the rainy season they were more evident.

The trees and shrubs of the commons even in their present state augmented the supply of firewood, fodder, and less often, of timber and fencing material. The rate of their consumption, however, was much higher than that of the flora's regeneration. The effects of current consumption were especially discernible on the less-frequent species. Again, species that were slow-growing (kankera, kair) and those that had low seed viability (such as phog) were particularly affected.

The annual lopping the khejris growing in the commons was not detrimental to their forage yield. However, the reduced canopy cover may have slowed the infiltration of water in the soil. Moreover, these trees did not produce seed-pods so that their natural regeneration over time was threatened even while, as at present, the khejri remained the predominant species of the commons in this area.

The grazing of animals on tender, young, perennials, too, curtailed their regeneration on the commons since the green, aerial parts were quickly devoured and their growth stunted by the trampling of hooves. The effects of grazing, however, varied with the age of the plant, species type and distance from the 'abadi' (habitation) area. Trees with spiny branches (kankera, murali) or those that had grown beyond animal reach (kair, khejri) were more tolerant of the grazing pressure but species with low-yielding canopies (erni, kair) were extremely vulnerable.

It was the ephemeral vegetation of the pasture that presently constituted a dependable and nutritious source of green fodder for about two months of the rainy season. Less predictably, it reappeared in the wake of a winter rain. The value of this produce was considerable for those with less forage resources.

The annual grasses and herbs were not threatened by grazing since they had short life span (10-60 days). Seed setting in annual grasses was prolific and enabled by even two showers of rain. Yet, their optimal growth on the commons was precluded by the immediate utilisation by livestock while on the private fallows these annuals were encouraged to reach their forage potentials.

The perennial grasses and sedges came to life a little after the annuals. Often, their shoot development and root viability was adversely affected by the constant grazing of animals [see, Shankarnarayanan, 1977, Mishra, 1982]. Towards the second half of the rainy reason, the unpalatable 'mansa' (Tephrosia hamiltoniana) dominated the low-lying vegetation. It was promoted as the more desirable species were exhausted in the commons. A winter shower, however, could usher in the green state of perennial grasses and herbs, again, but their

dominance in the pastoral system had been severely affected.

These trends were acknowledged by the inhabitants in what may be described as the local indicators of scarcity and denudation. The ephemeral vegetation of the grasses lasted for only two months now against the four months of the *chaumasa* (the rainy season) for which it had formerly sufficed in this area. Second, the predominance of the less-palatable mansa stood witness to the reduction of perennial grasses in the total biomass of the low-lying vegetation. Third, the near-absence of healthy, young trees and shrubs on the pastures testified that the threshold of their natural regeneration was rapidly being crossed, even while some species were affected less than others.

A comparison of the perennial vegetation in a relatively protected grazing expanse (that formed a part of a nearby sheep breeding farm) and the pastoral vegetation of two villages confirmed some of the village-level findings. There was perceptibly more foliage (including perennial herbs and grasses) per quadrat of land. The higher incidence of all trees and all types of young plants was striking. Eight indigenous tree species dominated the quadrat in the protected area against a maximum of three species on village grazing lands (Table 3). The distance between the trees was shorter in the less utilised quadrat though the topographic and soil environments were comparable. By contrast, the tall, single-trunked trees in the village pasture were old. The younger trees that were browsed heavily tended to spread laterally, if at all. What were shrubs in the village often reached three times their height in the protected stretches. Their canopy cover, too, was more extensive since it was rarely coppiced.

RE-THINKING IMPLICATIONS

By botanical criteria, the pastures at Khedi and Banai were overstocked 'poor condition' rangelands with a preponderance of the 'undesirable' annual grasses such as Arictidas and Cenchrus biflorus [Gupta and Saxena, 1972, Shankarnarayan, 1977, Ahuja, 1977]. The climax grass for this region was Cenchrus ciliaris which was rarely encountered in the villages of our enquiry.

This botanical engagement with ecological successions and the climax vegetation of grasslands in Rajasthan was important in elucidating what may be termed as epochal shifts. However, the pastoral problem from such studies has been inferred as the restoration of the climax grass. Cenchrus ciliaris. An improved strain of the latter was the only grass species being promoted by the state government under its fodder plantation schemes in the area of our study. Its seeds were reported to be in short supply (NCAER 1980).

From the perspective of the farmer the considerable demand for diverse forages leads to the question whether climax compositions that once existed can be an adequate goal for the current users of this resource. The development of climax vegetation in the 'moderately' grazed tracts of arid areas is estimated to take at least 60'years [Dormaar and Smoliak, 19RS] even while I acknowledge that pristine conditions may provide an idea of site potential [Herbel, 1983]. Secondly, there is a contending school that views vegetation regimes as dynamic entities revealing poly-climax patterns. This leads to alternative implications for what constitutes a desirable pastoral vegetation but has not been the subject of enquiry in the context of the Indian arid zone.

At the grassroots level, the palatability of annual grasses for livestock was not considered less than that of the perennials though this perception may have been influenced by current availability and not nutritive value alone [cf Lusigi et al, 1984]. Rather, the nutritional properties of both perennials and annuals at different stages of growth were known and utilised by the livestock-rearers. Apart from the grasses, what featured as equally important in the pastoral forages were both perennial and annual herbs and shrubs that have been, more or less neglected in conventional pastoral studies. The whole range of pastoral resources in the region has

still to be investigated in an integrated manner.

The strategies for augmenting pastoral produce have included rotational grazing and re-seeding. The recommendations for rotational grazing that advocated a division of the pasture into four blocks and monthly closures over the year [Ahuja, I982], fail to take the annua1 contribution of ephemerals that have a cycle of a few weeks into account. The closure of the other blocks of the pasture results in an under-utilisation of the ephemerals and does not, in contrast to the short-duration rotations practised by the farmers during the rainy season alone, reckon with the seasonal aspect of the pasture's vegetation. Reinforcing this argument is the finding that the current proportion of annual ephemerals in Western Rajasthan is nearly three times more than their distribution in the normal spectrum {Pandey et al, 1985}. The reasons for the rejection of rotational grazing patterns that were proposed are still to be probed by scientists. Similarly, the rain-dependent re-seeding of forage grasses has proved to be chancy and vulnerable to wind erosion. The survival of grass slips, too, is contingent on timely rains.

Finally, natural scientists commended 50 Prosopis cineraria trees per hectare [Shah. 1957] as the best land-use for the desert and later 30 trees per hectare [Ahuja et al. 1978] on grasslands. These recommendations have been made without reckoning with the near constant ratio of trees on private lands at 9-10 trees per hectare considering the necessity of year-round food and fodder production by the farmer. Again the carrying capacity of the pastures has often been specified in terms of animal species (for instance, Das et al, 1963, suggest 2.5 sheep per hectare on 'poor' quality range lands) disregarding the fact that in village conditions diverse animal species graze on the same tract (Table 2). From the perspective of checking desertification alone in the commons it may be possible to work out a goal for a desirable vegetation cover but the costs entailed in realizing it must then be borne by those who consider the problem of desertification paramount. The means have to be oriented to the residents' demand for wage employment in afforesting the commons based on their appraisal of hydrologic, soil and topographic conditions and without jeopardising the residents' rights over its regenerative produce. For both natural and social scientists, it may be useful to posit the farmer's indicators of scarcity and ecological degradation for initiating interventions that would be valued by those who are dependent on the vegetation of the commons. The inhabitants' intimacy with the environment enables them to gauge the utility of diverse plant species, including their multiple uses, as well as to discern ecological benchmarks that are sensitive to prior spatial and temporal variations. Obtaining such indicators from varying ecological regimes would facilitate our macro understanding of the changing, natural environment and its consequences for the inhabitants.

III
Ecological Traditions

There were elements of ecological sensitivity in the living tradition of the villagers which are outlined below. The interests of women and men in relation to the ecology of the commons and its produce were often disparate within this tradition. It is likely that any activity pertaining to the commons would draw on their traditional orientations. This is an area where a critical appraisal of the dominant male tradition has to be undertaken so that the women who related to a more extensive range of vegetation in the commons as users could benefit equally with the men who were more intimately linked with the commercial produce of the commons.

Villagers had protected/planted trees that had been perceived as valuable both collectively and individually. The lopping of khejri and other trees on the village pastures had been restricted though it was tempered by the forage/fuel/wild fruit/fibre requirements of those with less private land.

The residents as a group co-operated in the tending of

trees in common tracts when such cooperation was seen as advancing their individual and collective interests. On common lands, trees had been raised for their shade-giving and medicinal properties and for their religious associations.

In the centre of the residential area, the villagers had tended a 'bar' (Ficus bengha-lensis) or a 'peepal' (Ficus religiosa), in a pattern characteristic of the tehsil. Under its shade, rope-makers hammered on raw fibre, shoe-smiths carried out their craft, village animals were parked and resident's meetings occurred.

Near the entrance to the village temple the peepal tree was strikingly common. Even where the main temple was located on the top of a sand hillock with relatively scant natural vegetation, there was evidence of young trees being protected by the residents in this tract. The khejri trees here were not lopped.

Trees had also been fostered for food and shade in private courtyards-'sehjna' (Morringa olifera) seesham, 'neem' (Azadirachta, indica) and planted near wells. On farms the inhabitants had preferred to raise/preserve shrubs and trees on the boundaries where they functioned as shelter-belts. The crop-land was retained as such and this practice was likely to continue as long as the farmers cultivated food crops.

That the trees planted were exotics to this area ('bar, neem 'sirrifs' – Alibizia lebbeck – eucalyptus, 'arru-Ailanthus excelsa) or slow-growing (bar, peepal) had scarcely proved to be a detriment to their nurture. The villagers in fact, appreciated the exotic flowering trees as well both for offering flowers to gods and for the aesthetic delight of seeing them bloom.

Typically the women identified with the under storey of the pasture, as it were – the low-lying herbs and grasses, the fallen twigs and branches – that is, the produce that had not been commercialised. The women were concerned with supporting a whole range of naturally occurring grasses and herbs as well as shrubs and trees that were useful to them as forage fuel and vegetable in their daily lives. The majority of men, by contrast were keener to invest in trees that had a market value on the village's pastures.

The women were not enthusiastic about the nurture of the khejri in the commons because its leaf-fodder was auctioned, as they saw it, by the men and had been excluded from the available forage resources in the commons for three months of the year. Moreover, the annual lopping precluded the crop of khejri pods that constituted a popular vegetable. The lopping of khejri branches for fuel was gradually being disallowed as well. Yet, even for the women these khejris were still useful for the green fodder that they afforded for the livestock in the months prior to their coppicing in December and for the re-growth that was generated by March.

The diverging species' preferences of men and women underscored the fact that the species desirable for meeting the subsistence needs of the residents could not be a matter of their objective and physical forage and fuel characteristics alone.

Secondly, the women encompassed the interests of children as well while evaluating plant species or contemplating what was worth pursuing on the commons. The nurture of the bordi, as they saw it, along with its fodder value would provide children with a popular fruit. Again since the village pastures were grazed primarily in the rainy season, a shelter for the grazing (often children) was considered desirable especially where the grazing lands lay at a considerable distance from the main habitation.

Table 3: Comparison of Vegetation in Two Quadrats: Protected and Unprotected (Khedi, Banai and Protected Areas)

S. No.	Dominant Tree Type/Shrub	Botanical Name	Protected Area	Unprotected Area	
				Khedi	Banai
1	Kair	Capparis decidua	x	x	-
2	Kankera	Maytenus emarginata	x	-	-
3	Khejri	Prosopis cineraria	x	x	x
4	Bordi	Zizyphus nummularia	x	-	-
5	Hingota	Balanites aegyptiaca	x	-	-
6	Murali	Lycium barbarum	x	-	-
7	Khairi	Acacia senegal	x	x	-
8	Babul	Acacia jacquemontii	x	-	-

Notes: x indicates presence of trait
Source: Field Survey

Third, certain qualities of the flora in the commons were the distinctive concern of women. They commended the shrubby 'akra' (Calatropis procera) and the dense kair as plant species of the grazing lands because they could conveniently defecate under the cover of the ample foliage that these species provided in local conditions.

The villagers knew which species were locally threatened and the potential of individual species as sand-binders and windbreakers. The technology of tree protection too, was familiar to the villagers.

The digging of a trench around the sapling and the laying out of a circular tree guard, made of locally available thorny twigs/branches, prevented the sapling from being grazed off. This method was adopted for protecting trees on temple tracts. It was preferred to strip enclosures because it allowed the utilization of browse and pasturage growing in the interstitial spaces between saplings. The protection of naturally regenerating shrubs and trees in this manner offered the advantage of dispersing the afforestation effort in the grazing tracts. This would tend towards a more balanced regeneration of the vegetation.

The fences to private farms in the village effectively kept grzing animals at bay. Live fences also helped the struggle against soil and wind erosion. Scientists have now begun to commend such fences for their biodegradable and 'visually unobtrusive' characteristics as well [Mitchell et al, 1982].

On private lands, the farmers practiced checks against wind ravages that were built into the practice of agriculture itself. For instance, the 'bajra' (Pennisetum americanum) stalks were lopped after leaving about 10 cm of the main stem above the ground. This reduced the flight of top soil. Again, the farm was ploughed after the crop stubble was exhausted since the furrows arrested soil erosion. The laying out of khejri branches flat on the fields and the planting of grasses such as kooncha and perennial shrubs, too, reduced the ill-effects of gusty winds. In the past the residue, of the bajra crop were also mixed with the soil to augment its organic content. The escalating fodder prices, however, had confined this practice to crop residues that had been damaged beyond use by livestock.

How to conserve water in the village ponds by lining the bottom with a nonporous clay was a technological skill which, along with de-silting, had been rendered obsolete by the supply of water from energized wells in the village. Yet, some of these location-specific, water conserving strategies may still afford significant adaptations that could augment fuel and forage yields.

IV
Outcomes

We can now briefly contrast the residents' approach to afforestation and the state's efforts. The lack of correspondence between the two led the villagers to conclude that the government was not acting in their interests, despite claims to the contrary.

The villagers recognised that the indigenous flora can be propagated by vegetative means or by seeds that were available in the village itself. The propagation of indigenous floral species that were popularly recognized as suitable fodder species, sand-binders or wind-breakers was overlooked, even when the only input necessary for their regeneration was human labour. The diverse grasses and herbs that offered green pasturage at different points of the grazing calendar, too, had not been considered.

The government, on the contrary, lent support to the production of the seeds of improved varieties, raising plants in nurseries and transporting them to the afforestation sites. .The preference for angle-iron and barbed-wire fencing, too, was seen as facilitating the interests of the sellers.

From the villagers' perspective, tree guards of local material were adequate to protect newly sprouted or planted saplings from grazing animals. At the same time, the pasturage was utilisable and the protected trees dispersed over a significant expanse of

land. The government, by contrast, undertook strip plantations and spent a high proportion of its forestry budget on fencing. The ecologically redundant barbed wire fences that were the current norm in government schemes for afforestation by enclosure had been commended by the scientists (Bhimaya et al, 1966; Kanodia and Patil, 1983) even though the villagers had a wealth of know-how on the construction of fences, replete with the core-wall and the area's indigenous flora.

The residents, in fact, also relied on social fencing not only in the temple tracts but in keeping a collective vigil over the trees growing on the village pastures and the activities of transhumant herders *en route.* Even engaging a 'chowkidar' from the village for keeping out thieves as well as grazing and wild animals, in their view, would have been a better alternative to the expenditure on the ineffective barbed fencing.

Again, shelter-belts raised by the forest department had been confined to the roadsides. Such plantations kept the dust from flying on to the roads, were highly visible to inspectors and could easily be watered by mobile vans. The correct site for shelter-belts in the villagers' reckoning, however, was field boundaries not necessarily alongside roads but depending on the direction of the wind [cf Government of India, NCA, 1976].

Nurseries supported by the state had a role to play only in the provisioning of exotics including fruit and flowering trees. The latter saplings were largely availed by the better-off farmers with irrigation facilities while villagers with less land gained only if they could be employed on daily wages at the forest department's nurseries.

The controversy over exotic add indigenous species was not important in itself for the villager – the addition of a few, exotic species to the already existing spectrum was unobjectionable and had been a process recurring over millennia. What was questionable, however, was the subtle process through which the benefits from the exotic tree species (as also in the case of the high - yielding varieties of forage and crop species) tilted in favour of the already better - off farmers. The interventions of the government, thus, reinforced doubts about the intentions of benefiting the smallholders.

We shall now return to the question posed at the beginning of this article; are grazing lands, wastelands? To a large extent the answer depends on who defines the issue. Obviously, for the villagers, grazing lands still met their requirements for a livelihood despite their diminution and degraded conditions. On the other hand, defined by the government as wastelands with the support of physical indicators such as ravines, sand dunes saline soil quality or tank-beds facilitated the privatisation of such tracts for agriculture/tree culture by a few or appropriation by the state. These lands, exceptionally, could be allotted to farmers who already had private lands as well[10]. Whose definition prevailed however, varied with the local configurations of power and leadership.

The government and the scientists acted in consonance while schemes for afforestation / pasture development were proposed. The challenge of identifying a fast-growing tree species (such as the Acacia tortilis) and a spectacular pastoral grass (the improved variety of Cenchrus ciliaris) was taken up by the scientists, for instance. But the villager related to the vegetation in the entirety of an eco-system for his subsistence. While the solutions put forward by the scientists may have been valid within formal, scientific parameters, they were not necessarily relevant to the subsistence interests of the user in her commons.

The appropriate technology for the user of the commons on the other hand, as the smallholder saw it could meet the need for employment and maximize on what the marginalised sections have in plenty – time and labour; cut costs on seeds, fencing and saplings; be oriented to the self-

[10] For details see the rules framed for the allotment of ravine lands, tank beds, saline areas and wastelands under the Rajasthan Land Revenue Act, 1956.

provisioning of those who currently derive a living from grazing lands; have a vision extending beyond two or three generations, like the native khejri tree, countering the mobile scientist's tendency to research on short-duration projects or the forest department's occupational prompting towards fast growing trees and draw, in addition, upon the intellectual resources of the local users.

While the prescriptions of the representatives of the state and the scientists in research institutes often harmonized, the tripartite interest that encompasses village inhabitants obtains with difficulty. Relating the environmental concerns of those who subsist on small holdings and common resources seems to be an ever-widening gyre rendering just and determinate solutions to asymmetrical relationships less possible at each rise in the level of centralization. Yes the association of scientists and users can facilitate the harnessing of science for ends defined by the latter as well. This is important where the language of scientific discourse precludes a dialogue with farmers in professional journals. The responsibility vests with social scientists, too, for establishing that the tendencies towards desertification lie in the means through which smallholders and livestock-rearers obtain their subsistence and therefore partake of a social design rather than a physical nature.

Perhaps science in the interests of the disadvantaged has to begin with *their* categories – grazing lands or commons, not wastelands – in the wake of evident epistemological disjunctions.

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COMMON PROPERTY RESOURCES AND LIVESTOCK SECTOR IN INDIA: IMPLICATIONS FOR SMALLHOLDERS,

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Abstract

Common property resources (CPRs) play an important role in sustaining and enhancing the livelihoods of rural poor by providing wide variety of essential items such as food, fuel, fodder, fibre, timber, manure, medicinal herbs and so on. As majority of livestock rearing households belong to landless, marginal and small categories, deriving major portion of their feed & fodder requirement from the CPRs, sufficient availability of common property resources quantitatively and qualitatively, becomes essential. This paper analyses the implication of common property resources for sustainable livestock sector development with special reference to landless and smallholders.

Introduction

Livestock sector plays a multi-faceted role in socio-economic development of rural households. It contributes about 6 percent to the Gross Domestic Product and 25 percent to the Agricultural Gross Domestic Product. Over the last two decades, livestock sector has grown at an annual rate of 5.6 percent, which is higher than the growth of the agricultural sector (3.3 percent). At the household level, the contribution of livestock activities is more significant as it generates a continuous stream of income and employment and reduces seasonality in livelihood patterns, particularly of the poor (Birthal and Ali 2005). Several empirical studies indicate that livestock rearing has significant positive impact on equity in terms of income & employment and poverty reduction in rural areas (Singh and Hazell 1993; Adams and He 1995; Birthal and Singh 1995; Rao *et al* 2003; Birthal and Ali 2005) as distribution of livestock is more egalitarian as compared to land (Taneja and Birthal 2004; Ali 2004). In India, over 70 percent of the rural households own livestock and a majority of livestock owning households are small, marginal and landless households. Small animals like sheep, goats, pigs and poultry are largely kept by the land scarce poor households for commercial purposes because of their low initial investment and operational costs (Birthal and Rao 2002).

The challenges for redressing poverty in rural areas is mainly related with expansion of economic opportunities, empowerment of poor to take advantage of new opportunities and an effective safety net to reduce vulnerability and protect poorer of the poor (Kozel and Parker, 2003). Poverty is primarily caused by low level of assets holding, coupled with low and uncertain returns. Land and livestock are considered to be the major assets of rural households for livelihood support in general and small and marginal households in particular. As distribution of land holdings in rural India is highly skewed towards medium and large farmers, rearing of livestock particularly small ruminants, pigs and poultry are considered to be the potential options for poor landless and small farming households to earn their livelihood on sustainable basis.

Common property refers to some form of shared resource tenure – usually involving a group that uses and manages the resources. Common property resources constitute all such resources which are meant for common use of the villagers without any individual ownership right (Jodha 1986; NSSO 1999). These resources can broadly be categorized into common property land resources, common forest resources and common water resources. Various studies demonstrate the significance of common property resources in sustaining and enhancing the livelihoods of the rural poor (Jodha, 1986; Jodha, 1992; Pasha, 1992; Beck and Nesmith, 2001; Adhikari, 2005; Dasgupta 2005; Ghate 2005; Fuys et al, 2006). A wide variety of essential items are gathered by rural households from the village commons and forests, for personal use and sale: food, fuel, fodder, fiber, small timber, manure, bamboo, medicinal herbs, oils, materials for house building and handicrafts, resin, gum, honey, spices and so on (Agrawal, 1995). In India for example,

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community forests contribute upto 29 percent of the income of poorer households, which is close to US $5 billion a year (Adhikari, 2005).

A number of studies indicate that the area under common property resources has declined in most part of the country due to various reasons such as encroachment and land reform policy of government to re-distribute land (Jodha, 1986; Iyengar, 1989; Chopra et al, 1990; Jodha, 1990; Arnold and Stewart, 1991; Jodha, 1992; Karanth, 1992). On the other hand, the pressure on the remaining common property resources has rapidly increased due to reduced area under CPRs and population growth causing quality deterioration. Several studies also point out denial of access to poor families by dominant households in the villages (Iyenger, 1989; McKean 1992; Beck, 1994; Iyenger, 1997; Beck 1998; Beck and Ghosh 2000; Cavendish 2000). Therefore, sustainable management of these resources by ensuring access to all, becomes essential. Studies indicate that various steps have been taken by the government and non-government agencies in several parts of the country to manage these poor centric resources through government interventions and collective action by the community (Wade, 1987; Bromley and Cernea, 1989; Chopra et al, 1989; Gibbs and Bromley, 1989; Tang, 1991; Bromley et al 1992; McKean, 1992; Iyenger and Shukla, 1999; Singh and Singh, 1999; Agrawal, 2001; Chopra and Dasgupta, 2002; Dasgupta, 2005).

The recent trend in livestock sector growth suggests that in order to meet the emerging demand for livestock based products both in domestic and global markets, there is a need to reorient the production system with greater efficiency and quality consciousness. The major challenge before Indian livestock sector is to ensure sufficient supply of livestock inputs i.e. feed, fodder and concentrate. As land scarce poor households are unable to meet feed and fodder scarcity, they tend to give up livestock rearing, particularly that of large ruminants. Therefore, structural change in livestock distribution is significantly visible. Though major share of livestock is still reared by marginal and small landholders, the holding of livestock among landless households has significantly declined in 2002-03 (NSSO 2006). The shrinking of common pool resources as well as fodder shortage accounted for the drop in livestock holdings (Rao *et al* 2003). With the emergence of market economy and increased demand for livestock products, the livestock production system in India is moving towards specialization where big farmers and investors are getting involved in livestock production and processing. Small dairy herds are moving towards big dairy farms with capital intensive production technologies. Likewise, backyard poultry is converging itself towards integrated capital intensive poultry farms (Conroy *et al* 2005). Therefore, the recent phase of livestock sector development does not favour landless and smallholder producers. In this paper, an attempt has been made to examine the issues related to common property resources and their implications for sustainable livestock sector development with special reference to landless and smallholders.

Livestock Population Dynamics

India has a huge livestock population with 185 million cattle, 98 million buffaloes, 124 million goats, 61 million sheep, 14 million pigs and 489 million poultry birds. Out of the total livestock in the country, around 38.2 percent are cattle, 20.2 percent are buffaloes, 12.7 percent are sheep, 25.6 percent are goats and only 2.8 percent are pigs. All other animals account for less than 0.50 percent of the total livestock population. The composition of livestock population in broad groups like bovine (cattle and buffaloes), ovine (sheep and goats), pigs and poultry has changed over the last two decades. Cattle population that had been increasing until 1992 has started declining and between 1992 and 2003, it declined by 9 percent. The decline in the cattle population is confined to indigenous stock that was about 87 percent of the total cattle population in 2003. The number of indigenous cattle declined by 15 percent, while that of the crossbred increased by 62 percent. Within the indigenous stock, decline was drastic in males (22%). The main reasons for this decline in indigenous cattle population are increasing substitution of draught animals with mechanical power and low milk yield (Birthal and Taneja 2006). Buffalo population has increased from 70

million in 1982 to 98 million in 2003. There has been a small decrease in total bovines in the country by 1.9% between 1997 and 2003.

Table 1: Livestock population in India (millions)

Year	Cattle	Buffalo	Sheep	Goat	Pig	Poultry
			Million numbers			
1982	192.5	69.8	48.8	95.3	10.0	207.7
1992	204.6	84.2	50.8	115.3	13.0	307.1
1997	198.9	89.9	57.5	122.7	13.3	347.6
2003	185.2	97.9	61.5	124.4	13.6	489.0
			Annual growth (%)			
1982-1992	0.6	1.9	0.4	1.9	2.4	4.0
1992-1997	-0.6	1.3	2.5	1.3	0.8	2.5
1997-2003	-1.0	1.2	1.2	0.2	1.0	7.0

Source: Livestock Census (various issues), Ministry of Agriculture, Government of India

Total ovine population has increased from 144 million in 1982 to 186 million in 2003. The number of goats increased from 95 million in 1982 to 124 million in 2003, but at a decelerating rate throughout. During 1997-2003, the growth in goat population remained almost stagnant. Sheep population has been increasing but with considerable variations in the trend. Poultry is gaining importance in India due to growth and availability of poultry feed at reasonable prices. Between 1982 and 2003, poultry population increased more than double, from 207 million to 489 million. Except during 1992-97, poultry population has maintained a steady growth of above 4 percent a year. Between 1997 and 2003, poultry witnessed an all time high growth of 7 percent a year. Pig population has increased from 10 million in 1982 to 14 million in 2003. Growth in pig population, however, has decelerated sharply since 1992 due to lack of widespread demand for pork (Birthal and Taneja 2006).

Livestock Sector and Smallholders

Livestock sector is an important source of income and employment for landless, marginal and small households. The potential of livestock to reduce poverty is enormous. If the poor households without livestock can acquire animals, their livestock can help them to come out of poverty (Holmann *et al* 2005). In some situations, the "livestock ladder" may allow the poor to progress from modest livestock holdings such as a few poultry, to acquiring sheep, goats and pigs, or even cattle/ buffalo (ILRI 2003). Hence, livestock production provides a constant flow of income and reduces the vulnerability of livelihood support especially among the poor.

Table 2: Distribution of livestock holdings in India, 1991-92

Category	Landless (<0.002ha)	Marginal (0.002-1.0 ha)	Small (1.0-2.0 ha)	Medium (2.0-4.0 ha)	Large (>4.0 ha)	All
% households	21.8	48.3	14.2	9.7	6.0	100.0
Distribution of livestock (%)						
Bovine	2.5	43.8	23.3	17.7	12.7	100.0
Ovine	5.1	46.2	19.3	15.0	14.4	100.0
Poultry	6.4	54.9	19.0	14.4	5.3	100.0
Pigs	7.7	49.9	20.4	13.9	8.1	100.0
Size of livestock holdings (no/100 households)						
Bovine	23	180	324	361	418	198
Ovine	20	81	115	131	203	85
Poultry	49	190	223	247	147	166
Pigs	2	4	6	6	5	4

Source: NSS Report No. 408, Livestock & Agricultural Implements in Household Operational Holdings, 1991-92, Ministry of Statistics and Program Implementation, GOI.

Tables 2 & 3 show distribution of livestock production across different size groups of rural households during 1991-92 and 2002-03. About 22 percent of the households did not

have access to land for crop production in 1991-92 which has increased to 32 percent in 2002-03. About 48 percent of the households have less than one hectare of land holdings. The size of land holding, particularly of the marginal landholders, is too small to provide an adequate livelihood. These households seek supplementary livelihood opportunities from livestock and allied activities. Livestock being less capital-intensive is an important option for them, because of less land requirement, low initial investment and low operational cost (Birthal and Ali 2005).

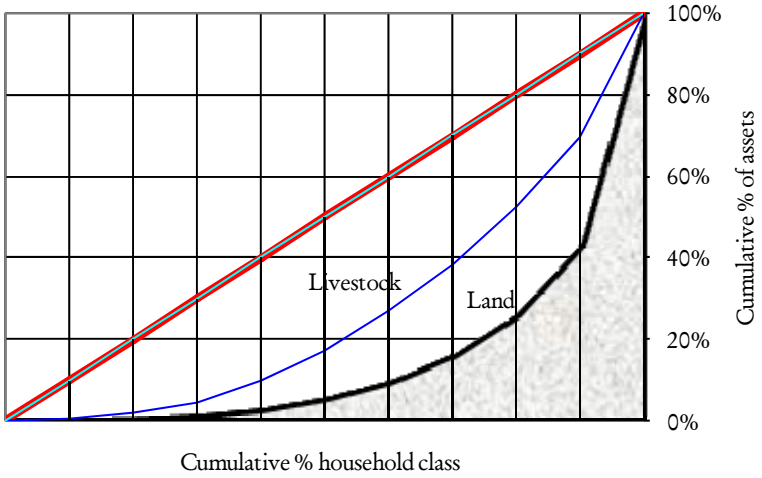
Table 3: Distribution of livestock holdings in India, 2002-03

Category	Landless (<0.002ha)	Marginal (0.002-1.0 ha)	Small (1.0-2.0 ha)	Medium (2.0-4.0 ha)	Large (>4.0 ha)	All
% households	31.9	47.1	11.2	6.2	3.4	100.0
Distribution of livestock (%)						
Bovine	0.6	51.3	21.2	15.0	11.9	100.0
Ovine	2.1	61.5	15.7	9.6	11.0	100.0
Poultry	4.4	62.7	17.4	6.8	8.6	100.0
Pigs	3.2	76.2	12.0	5.5	3.0	100.0
Size of livestock holdings (no/100 households)						
Bovine	3	169	293	374	535	156
Ovine	4	84	90	99	203	64
Poultry	17	164	191	136	306	123
Pigs	0.3	5.3	3.5	2.9	2.9	3.3

Source: NSS Report No. 493, Livestock Ownership Across Operational Land Holding Classes in India, 2002-03, Ministry of Statistics and Program Implementation, GOI.

A comparison of livestock holdings of landless households between 1991-92 and 2002-03, shows that landless households significantly increased during the period whereas share of livestock holding among landless households declined for all type of livestock. Livestock rearing amongst landless households largely depends on common property resources such as common grazing lands, common water resources, forests, wastelands, fallow lands and roadsides for feed and fodder. The decline in availability of these resources has affected the landless households to quit livestock rearing. In case of marginal households, the share of livestock holding has substantially increased in 2002-03 for all types of livestock. Therefore, minimum availability of land for feed and fodder is an important determinant of size of livestock holding. But, given the resources with the land scarce households, the utility of livestock as provider of livelihood opportunities is far greater (Birthal and Ali, 2005).

Figure 1: Lorenz Curve for Distribution of Land and Livestock Assets by household classes, 2002-03



The distribution of land and livestock is more explicitly shown by the Lorenz curves (Figure 1) which plots cumulative percentage of total value assets against cumulative percentage of number of households[22] (Birthal and Ali 2005). The diagonal line represents zero inequality, while the area under the curve as proportion of total area under the diagonal line represents degree of inequality. It is clear from Figure 4 that livestock is closer to the diagonal line, compared to the Lorenz curve for land, indicating that livestock is more equitably distributed than land. Thus, the flow of income from livestock is also expected to be more favourable to low income groups comprising the landless, marginal and small landholders.

Livestock Sector and Common Property Resources

Majority of households in rural India belong to landless, marginal and small categories with very limited resources of livelihood. These households directly or indirectly derive some portion of their livelihood from common property resources subject to availability and accessibility of the same. CPRs play an important role in the rural economy and benefit its population in a number of ways. The fuelwood and shrubs available from them are used for cooking and heating; grass, leaves and shrubs are used as animal fodder; bamboo, small timber and palm leaves for housing and a variety of fruits, vegetables and fish, for sustenance, particularly during the lean seasons. CPRs also contribute significantly to private-property based farming as well as to the household enterprises. These provide irrigation water, mulch and manure for cultivation, raw material and common pastures for grazing (NSSO 1999).

Feed and fodder scarcity has been the major constraints to livestock production in India. The decelerating growth in livestock numbers, especially of ruminants and increasing number of high-producing animals, indicates that livestock population is gradually heading towards optimization in conformity with feed resources (Birthal and Taneja 2006). Therefore, adequate supply of feed and fodders is crucial for improving livestock productivity. Livestock in India is fed largely on crop residues and byproducts and grazing lands. India is chronically deficit in feed and fodders, largely on account of huge livestock population. The National Commission on Agriculture (1976) estimated deficit in dry fodder, green fodder and concentrates to the extent of 13, 53 and 43 percent respectively for the year 1972-73. In 1991, while the deficit in dry fodder increased to 31 percent and in concentrates to 47 percent, deficit in green fodders narrowed down to 23 percent (Singh and Muzumdar 1992). Recent estimates of demand, supply and requirement of different animal feedstuffs by Birthal *et al.* (2005) show significant reduction of deficit in dry fodder. However, the deficit in green fodder and concentrates is still a serious problem (Table 4).

Table 4: Livestock feed and fodder deficit (%)

Feed & Fodder	1972-73*	1991-92**	2002-03***
Dry Fodder	13	31	9
Green Fodder	53	23	24
Concentrate	43	47	29

Source: *NCA, 1976; ** Singh and Muzumdar 1992; and ***Birthal et al, 2005

[22] The data on value of assets were taken from NSS Report No. 500, Household Assets and Liabilities in India, 2002, National Sample Survey Organization, Ministry of Statistics and Program Implementation, Govt. of India.

Cultivated fodder and gathered grasses are two important sources of green fodder supply and each accounts for about half of the green fodder consumed in the country (Birthal *et al.* 2005). About 5 percent of the gross cropped area in the country is allocated to fodder crops. This, however, has not increased much over the last two decades (Table 5).

Table 5: Grazing resources in India (million ha)

Type of resource	1980-81	1990-91	2002-03
Geographical area	328.7	328.7	328.7
Forests	67.5	67.8	69.1
Permanent pastures and grazing lands	12	11.4	10.6
Culturable wastelands	16.7	15	13.5
Fallow other than current fallows	9.9	9.7	11.7
Barren and uncultrable wastelands	20	19.4	19.3
Total CPRs (excluding forests)	58.6	55.5	55.1
CPR as % of geographical area	17.8	16.9	16.8
Permanent pastures and grazing land as % of geographical area	3.6	3.5	3.2
Area under fodder crops (% of GCA)	4.6	4.6	5.2
Livestock units (million)	295	327	485
Livestock units/ha of CPR	5.0	5.9	8.8

Source: Ministry of Agriculture, Government of India

Common grazing lands (permanent pastures and grazing lands, wastelands, fallows excluding current fallows) occupied nearly 17 percent of the geographical area in 2002-03. The area under permanent pastures and grazing lands alone comprises a mere 3.2 percent of the area, which has declined by 18 percent between 1980-81 and 2002-03. Livestock units per hectare of CPR have increased from 5.0 in 1980-81 to 8.8 in 2002-03. The declining trends in CPR with increasing trends in livestock population raises further pressure and sustainability issues for development of livestock sector. Apart from this, CPRs are not only declining quantitatively but also qualitatively (Jodha 1992). The qualitative deterioration of grazing lands is attributed to increasing population pressure and over-grazing (Saxena 1993; Ramanathan 2002). Promotion of stall feeding and retention of only high quality productive livestock seems to be a viable option to protection common grazing lands (Ramanathan 2002). But resource poor household who largely depends on CPRs and livestock rearing, may not be able to meet high cost of feed and fodder for their animals.

The recent 54th Round report of the National Sample Survey Organization (NSSO) confirms the Ministry of Agriculture Data and estimates that India has about 15 percent of total geographical area under common property land resources with an average of 0.31 hectare per household. Out of total common property land resources, 23 percent are community pastures and grazing grounds (Table 6). The major chunk of common property land resources are constituted by the area under cultivable wastelands and fallow lands other than current fallows.

Table 6: Availability of Common Property land resources in rural India

Item	Estimate
Percentage of common property land resources in total geographical area	15

Common property land resources per household (ha)	0.31
Common property land resources per capita (ha)	0.06
Components of common property land resources (%)	
Community pastures and grazing grounds	23
Village forests and woodlots	16
Other	61

Source: Report No. 452, Common Property Resources in India (1999), NSS 54th Round, Ministry of Statistics and Program Implementation, Govt. of India.

About 48 percent households in the country are reporting the collection of any kinds of material from CRP with average value of Rs. 693 per annum (Table 7).

Table 7: Use of common property resources

Item	Estimate
Households reporting collection of any material from CPRs	48%
Average value of annual collections per household	Rs 693
Ratio of average value of collection to average value of consumption	3.02%
Households reporting grazing of livestock on CPRs	20%
Households reporting use of common water resources for:	
(i) Irrigation	23%
(ii) Livestock rearing	30%
(iii) Household enterprise	3%

Source: Report No. 452, Common Property Resources in India (1999), NSS 54th Round, Ministry of Statistics and Program Implementation, Govt. of India.

About 20 percent households use CPR for grazing livestock, whereas 30 percent households use common water resources for livestock rearing. The possession of livestock is positively influenced by land ownership (Table 8). On an average 13 percent households are reporting the collection of fodder from CPR with average quantity of 275 kg per annum. The access of CPR is reported by 63 percent of households. About 30 percent of the households are using common water resources for rearing livestock in the country. Thus, the livestock sector development largely depends on CPRs in a number of ways such as grazing, supply of green fodder and water requirement particularly for smallholders who have major share of livestock population.

Table 8: Use of CPRs for livestock rearing by category of households

Category of households	Percentage possessing livestock	Percentage reporting collection of fodder	Avg. quantity of fodder collected (kg)	Percentages of households reporting use of water resources for livestock rearing
Rural labour	42	13	294	24
Other with land possessed (ha)				
less than 0.20	25	8	200	12
0.20-0.50	66	17	305	34
0.50-1.00	80	18	338	42
1.00-more	88	11	251	47
Other: all	66	12	261	34
All	56	13	275	30

Source: Report No. 452, Common Property Resources in India (1999), NSS 54th Round, Ministry of Statistics and Program Implementation, Govt. of India.

Summary and Conclusions

Livestock sector in India has experienced remarkable growth during the last two decades due to increased demand for livestock based products. This sector contributes nearly one-fourth of the gross value of agricultural output at the national level. At the household level, its contribution is much more in the case of the smallholders who comprise a sizeable proportion of rural households and control bulk of the livestock resources. These households derive large amount of animal feed & fodder and water requirements from common property resources, which have been deteriorating quantitatively as well qualitatively, largely due to distribution of common lands to the landless under the government policy of land redistribution, encroachment by the influential rural rich and lack of proper management. The structural changes in livestock distribution among various categories of households show that livestock is becoming an specialized commercial activity which is sidelining the marginal and smallholders as these groups lack resources in terms of land, feed & fodder and water to maintain livestock herds. Therefore, proper management of common property resources is quite essential for development of livestock sector on one hand and providing livelihood support to large portion of rural households on the other.

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INDIA-60: GRASS & TREE LEAF FODDER: A NEGLECTED NTFP*
(A Review in the 60th Year of Independence of India)

KG. Tejwani**

Abstract

Grasslands in India are deteriorated and their production is very poor. Increasing livestock members and uncontrolled grazing contribute to the poor health of grasslands. While lots of technology for the restoration of grazing lands has been developed, their application and judicious management is lacking. The role of Indian Council of Agricultural Research (ICAR) and the Indian Council of Forestry Research and Education (ICFRE) is discussed. Paper proposes an anthropocentric framework for solving the problems of grasslands where people policy and institution have to work in tandem to achieve the objectives.

Keywords: Rangeland management, Forage production, Technology development, Grazing policy, Grassland, Tree leaf fodder.

1. PREAMBLE

I started my work on natural resources in Australia in 1951, being involved in land use survey in the wheat and sheep raising farms. The farms were very big, the sheep stations (therefore the grazing lands) were very large and the water resources very limited. A very small dry mini rivulet would, be called a river!

In India, when I started work on erosion control and reclamation in ravine lands, even the ravine beds were reclaimed, irrigated and cultivated; the holdings were very small, and though water was limited it was not a constraint.

The ravines are classed as uncultivable waste land, yet though severely eroded/eroding they supported naturally growing trees, bushes grasses. Ravines are grazed by goats, sheep and village cattle. Apart from the non-anthropocentric causes of erosion, anthropocentric causes (more specifically very small holdings for cultivation, faulty cultivation practices, severe grazing, and lopping/cutting of trees were also responsible for land degradation. The socio-economic causes of land degradation (namely uncertainty of tenure, landless labour, lack of inputs, etc) were also well known. This scenario was true in forest land use and do not focus much on managing the grass/grazing land in the forests. They treat grass as a sort of "minor" or "non-wood forest product to be

lands and also other land resource regions/agroecological regions (such as deserts, hills, Himalayas, plains, alpine lands) of India. The problems of land erosion/degradation and efforts to ameliorate the degraded lands were made even by the British colonials (e.g dry farming schemes, management of *chos*/*raos*/torrents, ravine lands etc.).

Soon after independence of India, we started planned development programmes. The Government of India/Indian Council of Agricultural Research/Indian Council of Forestry Research & Education/Centres dealing with natural resources management, agriculture, livestock, forestry, grasslands etc. Some Institutes more directly concerned with grassland and silvopastoral land use were (Indian Grassland & Fodder Research Institute; Central Arid Zone Research Institute; Central Soil & Water Conservation Research Institute; National Research Centre for Agroforestry, ICAR Research Complex for NEH Region etc.). All these research institutes/centres had a very wide spread through their regional centres, State Agricultural Universities, and All India Coordinated Research Projects.

The Forest Research Institute and its Regional Centres are more concerned with grazed/extracted. The purpose of this paper is to review, in very brief, the issues of technology development, technology transfer, results achieved and some policy

issues, with special reference to grasslands and tree fodders.

2. TECHNOLOGY DEVELOPMENT

Since India is an agrarian society all its crop, food and forest production systems combine and integrate livestock and animals. For example crop production on agricultural lands, strictly peaking is an agro-pastoral systems. When the crops are grown there is a social-fencing and the
cattle and other animals don't graze there. The moment the crop is harvested and taken away, the social fence doest not exist, and the cattle and other live stock freely graze on crop residues and grasses (on farm boundaries & waste lands), and the tree fodders are lopped. The village common lands are similarly grazed. The forest land grazing is regulated. Many of the agro-pastoral, silvo-pastoral, agrosilvo-pastoral systems are described by Tejwani (1994). Unfortunately, all these systems (e.g. desert ecology, alpine pastures, forest grazing lands in the hills and plains etc.) are under dense livestock and animal population pressures. The village common lands and forests have been encroached and degraded. Even the ravine lands have been overgrazed and fodder trees over lopped and further degraded.

Almost within 2-3 years of starting research on waste(d) lands non-culturable lands, grazing lands, it was realized that closure to biotic interference restored grass cover and allowed the bush and tree species, whose stock was already existing in the area, to shoot up. There was succession of annuals grasses, to perennial grasses (both in quality and quantity), to dominance of bushes and trees, to reduction in grasses (quantity), and finally a jungle/forest cover was achieved. This was observed in arid/semi arid/sub-humid/shivalik/Himalaya/ shola/ DVC etc. regions. (Kaul, 1962 a.b; Pandey, *et al,* 1967; Pradhan and Vasava, 1980; Prajapati, 1979, 1995; Sharma *et al,* 1981; Singh and Verma, 1971; Tejwani, 2001, 1991; Tejwani e*t al,* 1961, Verma e*t al,* 1986, 1967). There was nothing new in these observations but a confirmation of what was already known to the practitioners/ managers of such lands. If the land could be closed to biotic interference the problem of fodder was easily solved.

The other piece of technology which was developed was rotational grazing in paddocks created at and by the research stations. While this piece of technology is useful, yet it had no takers for application in India due to the small size of holdings or social problems to manage the system. In fact even the practice of grassed water ways in broad based soil conservation terraces technology did not succeed as there was no means to control free ranging over grazing.

With regard to improved varieties of grasses, irrigated crop fodders, multi purpose tree species (yielding leaf fodder) there has been considerable progress. Yet apart from the irrigated crop fodder there - has not been much spread of these varieties.

3. THE PROBLEM AND POLICY ISSUES

The problem of insufficient grasses and fodders for cattle and other livestock has been talked / written about *ad infinitum.* Raghavaiyengar (1893) reported acute shortage of fodder for livestock in the Madras Presidency (then comprising parts of the present Tamil Nadu, Andhra Pradesh & Karnataka States). The problem was addressed by the Royal Commission on: Agriculture (1928), National Commission on Agriculture (1976), National Wasteland Development Board (1986). The problem does not appear to be resolving itself. Why? The technology is available but it is not transferred / transferable. The cattle and live stock are increasing; the land area per cattle unit is decreasing, there is no estimate available how much fodder is produced/needed (Table 1).

Table 1. : Population of livestock in cattle units and related statistics*

	1966	1977	1987	1992	1997
Cattle units (millions)#	286.5	30.5	356.7	375.6	392.6
Total grazing land (million ha) ##	156.0	145.0	143.9	137.7	136.8
Agricultural labour (millions)	39.5	51.5	65.0	74.6	-
Cattle units/ha of grazing land	1.83	2.1	2.5	2.7	2.9
Cattle units/Agri. Labour	7.2	5.1	5.5	5.0	-

Total grazing land includes wastelands, forests, pastures, cultivable wastelands, and fallow lands
** 1995 Value
# Cattle Unit = One cattle/horse/pony/mule/donkey/4 goats/ 4 sheep/0.67 buffalo/0.67 camel
* Source: MoA (2000)

The situation is like six blind men describing an elephant. In 1976, NCA estimated availability of 300.54, 691.00 and 20.51 million tonnes of dry fodder, green herbage and concentrates respectively. In another estimate 478.00 **m** tonnes (air dry) or dry grass from grazing lands, sub-marginal lands, degraded forest lands, cultivated fodder, crop residues, top feed, edible weeds are reported (NWDB, 1986). *Nowhere an interrelationship between the grazing land, the fodder yield, the number of cattle units, the carrying capacity of the grazing land, the sufficiency / insufficiency of fodder is addressed.* If one refers to the animal husbandry component of the Indian Economy the information available is about the livestock population/census, animal husbandry products (milk, eggs) but there is no reference on the fodder and water requirements of livestock (incidentally apart from the domesticated live stock there are other herbivores which also need fodder)

Livestock is a very important component of agrarian Indian economy, yet while the economy counts its products and its contribution to the GDP, the issues of the inputs of fodder, grasses and water and the impact of the sufficiency/ insufficiency of these resources remains in the realm of unknown.

If one looks to the forestry statistics, they refer to the area under forests, outturn and value of forest produce and employment of labour. The component of grasses and tree leaf fodder and grazing is extremely insignificant in rupee value, yet it is silent on how much area is grazed and how many animals graze there. On the other hand we continue to complain that forests are degraded/destroyed by over grazing! Is it not possible to quantify these elements while we are quantifying timber and fuel wood? As far as National Forest Policy (1988) is concerned, fortunately it has adequately focused on fodder, grasses and grazing (as in basic objectives, essentials of forest management strategy: MOEF, 1988) yet it would appear that grass, grazing and tree fodder leaf are of no importance to the forests and forest research. In a recent workshop on non-timber-forest-products Table 2 Poverty reduction in India organized by a National NGO, while many issues and strategies were discussed, the issue of forest grasses and leaf fodder was not even mentioned. It is at the conclusion of the Workshop that I had to bring this glaring omission to the organisers of the Workshop. National Water Policy takes note of providing drinking water to human being arid animals (MOWR, 2002). However, neither the Forest Departments nor the Animal Husbandry Departments focus on the increasing water requirements for increasing number of livestock and other animals and the increasing demand for fodder.

Livestock and Poverty Reduction

The goal of economic development in the agrarian society in India has been to reduce the poverty and the number of poverty affected people. While the number of persons percentage wise has decreased, yet in absolute terms the number of persons below the poverty line has increased (Table 2).

Table 2: Poverty reduction in India

	Year			
	1950	1980	1990	2000
Population (million)	361	685	-	1027
Rate of population increase (%)	1.26	2.4	2.3	1.9
Poverty incidence (%)	50*	44.5	36.5	26.1
Number of poor (million)	180	305	-	269

* Estimate by author

As compared to 1950, the total number of landless and agriculture labour maintain poor has been increasing continuously. This has occurred due to the exponentially expanding population of India. The increase in the number of agricultural labour, and small and marginal farmers is a direct consequence of this (Table **1).** The landless and agricultural labour maintain some animals mostly goats/sheep to survive. Thus even though the total number of cattle units has increased, yet the number of animals which an agricultural labour & small/marginal farmer can maintain has gradually decreased (mainly due to decrease in the area for grazing). Thus the poverty/the agricultural labour/small and marginal farmers/national resources of land-water-grass- fodder/number of livestock are related (positively or negatively) to the total human population.

4. PROBLEM RESOLUTION-CONCLUSIONS

It would appear that the problem of livestock management vis-à-vis grassland/fodder management not only has not been resolved but has become more complex and acute, and may be most of the production systems are at **a** breaking point. It is suggested that we address various components of policy-institutions-operations frame work which are anthropocentric (Fig. 1)

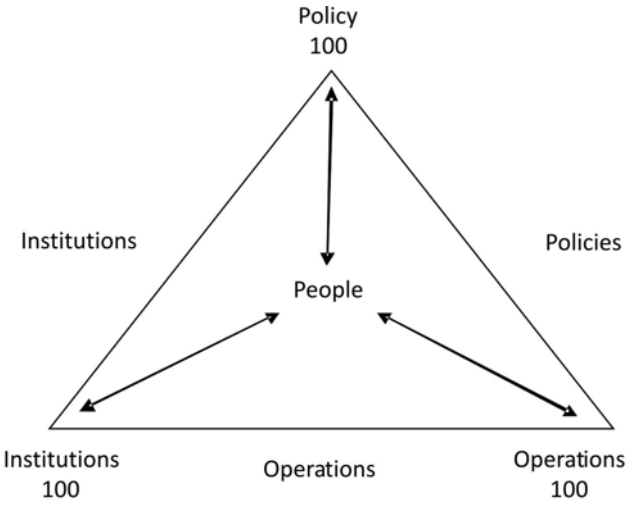

Fig 1: Anthropocentric framework of policy institutions operations

Policy: It would appear that the National Policy on Agriculture (NCA, 1976), Forest Policy (MOEF, 19881, Water Policy (MOWR 2002) have addressed the issue of livestock and fodder fairly well. In fact the National Commission on Agriculture (1976) is very comprehensive. In spite of this, the problem is becoming more acute day by day. One can therefore presume that it is either a failure of the policy itself or the failure of the institutions to properly implement them and deliver the goods and services.

It is suggested for consideration that the Indian Grassland & Fodder Research Institute (ICAR), Jhansi may undertake a

critical review of the recommendations of the NCA (1976) and any other subsequent reviews/reports as to what recommendations were implemented/ modified/ not implemented etc. IGFRI(1CAR) may be the lead institute. It will have to work with/carry along ICFRE/Animal Husbandry Departments and relevant NGO's.

Institutions: Provide the implementation tools by research, technology development and its transfer. Technology has to be practical, easy to transfer, cost effective and socially acceptable. Without going into many details it may suffice to say that research institutions must critically appraise themselves (with the help of the users of technology) whether they have addressed all the components of technology, whether the technologies developed by them fulfill the criteria mentioned in this para, and whether if the technologies so developed have been transferred to the development agencies. For example, ICAR says that we develop the technology and give it to the states. It needs to be examined whether this system is actually working. With respect to the
Grazing lands in the forest there is neither a technology nor a mechanism to transfer it. Once again may be IGFRI (ICAR) may undertake the review in association with the Animal Husbandry Departments of the States and Indian Council of Forestry Research and Education. **A** cooperation and complementary/supplementary mode of working is needed.

Programmes: If one looks at the programmes and statistics one is surprised to note the lack of focus on grazing lands/grasses/fodder and livestock in general (except the buffaloes & cows). This is a very serious lacuna. There is a mis-match between the poor man's/agricultural labour's/small marginal farmer's fodder and grass needs and the livestock. There is no estimate as to how much fodder is needed/how much fodder is produced/whether the natural resources of land, forest, water are sufficient/sustainably used/degraded etc. If we produce high quality goats/sheep/cattle they need higher input of fodder and feed. Feed may be forthcoming at present but availability of fodder and grass is a question mark. It has to be examined whether there is any mis-match or synchronization of the technology developed and technology being actually transferred. If it is actually transferred how extensive it is?

People: All the policies, institutions and programmes are anthropocentric i.e. they are of the people, by the people and for the people. In an agrarian society like that of India the livestock is an important resource. Thus the numbers of people and the numbers of livestock maintained by them determine the sustainability of natural resources and production systems. With increasing numbers of human population, consequently increasing number of poor people, increasing number of livestock maintained by them there by resulting in decreasing land area and grass and fodder for livestock, the production systems are breaking down. What is the solution'? Do we agree as a matter of policy to the increasing numbers of poor people/increasing & increasing numbers of livestock/increasing area of degraded forest and other lands/increasing poor quality of life and environment? The question or the solution is obvious. Are we willing to address it? We may ignore these issues at a very grave risk to all for which we profess to be working for!

Thus, a synergy is required between policy, institutions, programmes and people so that the desired results are obtained. Institutionaility, common resources and people's participation for their improvement and management are called for to up-scale forage production and supply. Many examples in past have shown the success of such endeavors. The issue also requires t o b e examined by natural resource accounting and ecological economics methodologies so that proper price tags are provided and users at every level are sensitized. The sustenance of grasslands of Kangeyam-Dhamapuram tract in Tamil Nadu should be understood to modify technology, policy and it proper implementation

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Of cows and men, and grazing lands

Unequal distribution of resources has resulted in a shortage of land available for grazing. **Anthra** develops sustainable alternatives in consultation with affected groups.

January 2003 - Common lands and public lands have played a significant and key role in the life and economy of rural communities, particularly the poor and the women amongst the poor, as sources of food, fuel wood, energy, fodder and grazing for livestock, medicinal plants, irrigation and drinking water. Unlike rich farmers who have considerable private property, poor farmers are particularly dependent on these common property resources (CPRs). Their access to CPRs, to some extent, ameliorates the inequalities of their small holdings. Since women are primarily responsible for collecting fuel, fodder, and water, and play critical roles in the livelihood production activities of their households, their dependence on CPRs exceeds that of men. Between the 1950s and 1980s, the area under CPRs declined drastically by 26-63 per cent. Large-scale privatisation of CPRs took place during this 30-year period (Jodha, 1986) - the key reason for the decline in common lands.

Laws enacted in the 1950s to redistribute land to the landless invariably got operationalised as distributing common lands. Afraid to touch the big landlords, the State took the soft option of distributing common grazing lands as private land pattas/landholdings to the landless. In this manner, millions of hectares of lands classified as common lands, which were largely sub-marginal lands unsuitable for cultivation, were distributed and became privatised. However, in the process of privatisation of common lands, 49-86 per cent of the privatised CPR ended up in the hands of the non-poor.

The decline of the commons has burdened the poor in dramatic ways. While farmers with larger land holdings are able to meet their grazing, fuel wood and water needs from their own private resources, the poor do not have this option, and this becomes a question of survival. Their animals can no longer graze on common lands, their own fields are too small to be able to allocate grazing areas, and the loss of common watering sources becomes a critical factor for both them and their livestock. Besides this, there is the issue of shifting status of a resource between being "private" at certain points in time and common at others. Typically, in dry and semi-arid regions of India, private agriculture holdings that are private property at the time of cultivation, shift to becoming common grazing lands available to all livestock in the village, post-harvest. They shift back to becoming private property at the onset of the next sowing season.

Contradictions within approaches

A fundamental flaw in the development and management of wastelands, whether in forest or non-forest areas, has been the lack of recognition of the criticality of these "wastelands" for the livestock of millions of farmers. These livestock are indispensable to the livelihoods of the landless, small and marginal farmers. Typically, these animals' fodder requirements are met through a combination of crop-residues, and grazing on common lands, private grazing lands, forests, near tanks, fallow agricultural lands and on harvested agricultural lands. Green fodder composed of naturally

available grasses, herbs and creepers, are also cut and fed to the animals.

However, in planning and implementing programmes aimed at developing these degraded lands, whether under joint forest management or watershed development, livestock are perceived as a hindrance to development, and the primary cause of wastelands. Plans are conceived and implemented with total disregard to the presence of these animals. Official policies, whether forest agriculture or livestock, perceive local breeds to be unproductive and an environmental burden. Policies and plans thus attempt to reduce these local animals and advocate their replacement with crossbred varieties for higher productivity and environmental rejuvenation. Despite massive state and financial backing, this "replacement" technology has failed over the past 40 years. The focus, unfortunately, is on breed-replacement and there are minimal comprehensive attempts to address the real issue of fodder and water crisis.

Livestock population in India increased from 280 million in 1947 to an estimated 467 million in 1997; permanent pasture and grazing land has decreased from 70 million hectares in 1947 to 38 million hectares. Simultaneously, the loss of forests has resulted in the loss of innumerable valuable species of both fodder and medicinal plants that form an important part of the diet of animals. On the other hand there has been a dramatic shift in cropping patterns from diverse food crops (millets, pulses, oilseeds, legumes), which were rich in crop-residue fodder value, to cash crops (cotton, tobacco) and hybrid crops with decreased or no fodder value. It has also resulted in tremendous pressure on resources, overgrazing of more palatable grass species such as Sehima and Dicanthium, and proliferation of hardier inedible species like Heteropogon contortus.

Afforestation and biomass-enhancing interventions on degraded lands, by and large, have focussed on growing plantation crops such as Eucalyptus, glyricidia, Australian acacia and teak which seldom meet the diverse requirements of farming communities. Besides, the idea behind growing these trees is that animals do not graze them, so the trees do not need much protection. Occasionally, when a few fruit and medicinal trees like tamarind, neem and awla have been grown, they have been insufficient to meet the multiple requirements of food, fodder, fuel wood, building materials and medicines.

In programmes to regenerate lands, the policy of 'zero-grazing' or a complete ban on grazing coupled with a complete ban on goats has regrettably become the pre-dominant formula of "success". All over the country today there is growing resistance by poor livestock rearers to "regeneration programmes" that are forcing them off the land and forcing them out of their livelihood. In addition, there are negative environmental consequences of "zero-grazing" - the absence of livestock manure to re-inoculate the bacteria in the soil at the onset of the rains, excessive growth of grass that often catches fire in summer, etc.

An alternate approach

For some years now, the non-governmental organization Anthra has been working closely with farmers in different parts of Andhra Pradesh and Maharashtra on the above concerns. Anthra is an organisation started by

women veterinarians, working predominantly in the field of livestock development. Keeping these factors in mind it have been working with different communities, farmers organisations and NGOs to evolve a more holistic approach that places people's livelihoods, bio-diversity and equity at the centre of any natural resource management and regeneration effort.

Anthra's work includes using a range of participatory approaches to work with farmers to collectively analyse and understand their resources and problems before planning any intervention. Anthra has encouraged communities to document their indigenous knowledge related to livestock production, feeding, fodder, watering resources, agriculture, health-care practices, grazing systems, etc. The result is a wealth of information that is critically integrated into subsequent "development strategies". Documenting traditional species, for example, resulted in area-specific inventories of important local species of fodders, medicinal and fuel varieties that have disappeared, but can be re-introduced through interventions. Many communities have been encouraged to propagate these varieties through community nurseries.

Another key area of work has been the mobilisation and organisation of traditionally unorganised marginalised groups such as goat- and sheep-rearers to enable them to voice their concerns and negotiate usufruct rights, such as grazing and lopping rights, within mainstream watershed and joint forest programmes. Their concerns have to be built into the evolvement of any development plan. Documenting traditional practices has evolved into participatory farmer experiments or farmer-led research, on evaluating "best fodders", grazing management systems and lopping systems, which has helped the organisation and concerned stakeholders to integrate sustainable practices. Best practices on lopping and grazing management are, for instance, being widely disseminated to other rearers. This is necessary to sensitise other organisations, scientists and government functionaries as well.

At the micro-level, Anthra's work has been to respond and lobby on critical policy issues. Since the past year it has been actively campaigning against repressive and unfavourable grazing policies which the State wanted to impose in Andhra Pradesh. It was successful as part of a wider coalition of farmers' organisations and other non-government organisations to halt the introduction of the proposals.

Sagari R Ramdas and Nitya S Ghotge
January 2003. India Together.

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Roles and functions of livestock in the livelihoods of the underprivileged families [23]

Most of the reports on this subject relate to generation of income and employment amongst rural families in general and very few specifically on the underprivileged families and on evaluating different roles played by livestock. Extremely few studies are reported from Central, Eastern and North-Eastern regions although these regions have high proportions of underprivileged families. The roles and functions of livestock can be classified broadly into four major categories (based on reports and observations) as shown below.

Roles, functions and contributions of livestock

1. **Output function**: related to producing food and non-food products.
   - milk, meat, wool, hair and eggs
2. **Input function**: related to providing inputs for crop production, transport etc.
   - Livestock provide inputs (manure, urine, grazing fallow land/stubble fields) for crop production, transport (drought power) of produce and people and fuel (manure / dung cakes; urine/goat milk ➔ medical value, etc.) needs of the families.
3. **Risk coverage or asset function**: related to raising moneys in times of need.
   - 'asset building: in the form of animal/bird. This forms often the priority function among poor livestock keepers.
4. **Socio-cultural functions**: related to social status, culture etc.
   - livestock are a part of the family. Their importance in Indian rural society is evident from the fact that livestock are still indicators of social status, many festivals and fairs are based on livestock, and many songs related to livestock are sung by women while cleaning, feeding or grazing and milking the animals. Possessing an animal of their choice gives women considerable satisfaction. The choice of an animal, kept by a family, and management practices are influenced by socio-cultural factors

The output function

This is the most commonly studied and reported function of livestock. It relates to the production of food and non-food products (milk, meat, wool, hair and eggs) used for home consumption as well as for sale and generate employment and income for the family. While using food products like milk from cattle and buffaloes is well studied, there is dearth of information on non-food products and products from small animals. Home consumption of food products is affected by factors like food habits, economic status of the family, market conditions, crop performance and drought. During droughts, almost 90% of milk and all surplus/unproductive animals may be sold, being the only commodities available for sale. Home consumption of eggs and poultry meat from backyard poultry is very limited (mostly used for sick members or for entertaining guests). Tribal families are more interested in sale of birds rather than eggs. Surplus goat milk for sale is available only with pastoralists or big farmers while most underprivileged families consume all the milk produced. The availability of good quality and fresh food products for the family, at low cost, makes even a low producing cow or goat or fowl an important asset for the women from underprivileged families and there is need to understand this function when assessing the productivity of livestock.

The income and employment generated from the production of food and non-food products are well studied for large dairy animals and to some extent for small ruminants (in a few states); however,

[23] Source: Rangnekar D.V. 2006. "Livestock in the Livelihoods of the underprivileged communities in India: A review",. ILRI, Nairobi, Kenya. 72 pp. Full Document available on ILRI website.

there are very few reports on pigs and backyard poultry. In mixed crop–livestock systems, dairy production contributes 20 to 50% of family income; the extent of the contribution is influenced by factors like type of animal, market condition, economic status of the family and crop condition. The share of income from milk in the total income of underprivileged family is as high as 75 to 80% during drought. Dairy production is labour intensive and the employment generated is relatively high. Labour is invariably provided by family members with low opportunity cost. Small ruminants are a major source of income for the underprivileged families and their contribution ranges between 17 to 24% of family income.

Additional aspects worth noting about output functions of livestock are:

1. Very few comprehensive studies on contribution of all livestock owned by a family.
2. Indigenous livestock is reported to make a negative financial contribution to family income, yet the majority of families continue to keep them and consider them important. Farmers' perceptions of benefit from livestock (key non-market functions) are probably not well understood and not assessed in the published Indian studies.
3. Data on the economics of livestock are often incomplete or are inadequately analysed and hence comprehensive understanding of these livelihood systems is not possible.
4. Reports and data are very scanty for Central, Eastern and North-Eastern India.

The input function

Livestock provide inputs for crop production, transport of produce and people and fuel needs of the families. While some studies have assessed the input functions of large ruminants (though only in a few states), there are hardly any studies specifically on underprivileged families and on inputs provided by small stock (sheep, goats, pigs, backyard poultry). Large ruminants provide two major inputs for crop production, viz. draft power and organic manure from their excreta. Precise data on use of dung as manure and for other uses like fuel and for plastering of walls and flooring of houses are not available. Estimates indicate that 40 to 60% of dung is used as manure and the rest as fuel. The extent of use for different purposes depends on land holding, herd size, economic status of the family and alternate material available as fuel and fertiliser. Valuing cattle and buffalo dung as manure is done only on the basis of its NPK value and the beneficial effect on properties of soils is ignored. Using dung as fuel is criticised by many, but has some positive aspects such as saving fuel wood and oil, low cost, traditional preference for cooking, convenience and low dependency on fuel suppliers. Surplus dung cakes are sold and are a good source of income for women from underprivileged families (income is mostly used for purchase of jewellery). Biogas system is an efficient alternative for use of dung as manure and fuel; however, its adoption is limited to a few pockets of the country. Very few resource poor families have adopted biogas, despite the subsidies provided by the Government, due to some constraints (initial investment, small herds, maintenance needs). The excreta from small ruminants is widely recognised as good quality manure and is used through an innovative and well-knit system of penning animals in harvested fields during migration by pastoralists. The system enables pastoralists to get fodder and resting place for their animals as well as the opportunity to sell animals and the farmers' fields get fertilised. However, this system is breaking down with changes in farming systems (cropping intensification, adoption of cash crops). There is lack of comprehensive studies on contribution of animal excreta for soil enrichment and meeting fuel needs of the underprivileged families.

A few decades ago draft power for crop production and transport (of produce and people in remote rural areas) was the major function of large ruminants and particularly cattle, as is evident from the fact that majority of Indian cattle breeds are draft type. The share of animal power in farming and hence the demand for bullocks and their population has now gone down substantially except in states like Andhra, Orissa and Rajasthan, indicating their continuing use. Only a small percentage of

underprivileged families keep bullocks and mostly depend on others for meeting draft needs. While there is preference for bullocks for transporting material in most parts of the country, buffalo males are preferred in western Uttar Pradesh. The reasons for this variation have not been studied. The use of animals for draft purposes results in saving of fossil fuel and thus saving of precious foreign exchange. Social benefit–cost analyses show that the estimated value of contribution of livestock through use of crop by-products, draft power and dung for manure and fuel far exceeds the value of livestock products (Mishra and Dixit 2004).

Risk coverage or asset function

Participatory studies on reasons for keeping livestock show that 'asset building', in the form of animal/bird, is one of the top four objectives along with income generation, meeting family needs and tradition. For resource poor families, any kind of animal is an asset since it can be easily encashed in times of need. There are several examples of resource poor farmers using income, from sale of animals, for improving their farms, irrigation facility, houses, as well as for meeting marriage expenses or paying school fees of the children etc. During drought, sale of animals is a major source of income for resource poor farmers to sustain the family. However, there are very few studies to assess the contribution of animals and birds as assets in times of need and giving due credit for it while working out economics of livestock production.

Social function

This is an aspect usually ignored or undervalued even though it is now well known that livestock have strong socio-cultural linkage. For most rural families and particularly for women, livestock are a part of the family. Their importance in Indian rural society is evident from the fact that livestock are still indicators of social status, many festivals and fairs are based on livestock, and many songs related to livestock are sung by women while cleaning, feeding or grazing and milking the animals. Possessing an animal of their choice gives women considerable satisfaction. The choice of an animal, kept by a family, and management practices are influenced by socio-cultural factors. These factors have to be borne in mind while studying production systems and suggesting interventions for increasing productivity and profitability with underprivileged families.

These roles and functions of livestock therefore suggest four hypotheses:

1. Generating and analysing economic data on the multiple roles of livestock will give a better understanding of their contribution to the livelihood systems of the underprivileged and will provide information from which to design more effective livestock development programmes
2. An outcome of livestock development will be generating employment and income through increasing demand for livestock-related services
3. Another outcome from livestock development would be producing energy and organic fertiliser from livestock waste—an area hitherto neglected but gaining importance for environmental reasons and due to increasing oil prices and depleting soil fertility; and
4. Improving productivity of livestock with the underprivileged would further reduce malnutrition in their families besides improving income.

SOUTH ASIA Pro Poor Livestock Policy Programme

A joint initiative of NDDB and FAO

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*"development of **healthy environments** in which **healthy animals** are reared by **healthy people**"*

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