

PROTECTION AND REGENERATION OF COMMON PROPERTY GRAZING RESOURCES: SOCIO-ECONOMIC ISSUES - THE INDIAN EXPERIENCE

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ABSTRACT

Grasslands and savannas which comprise about one-fourth of world's land surface are undergoing constant degradation. More than 200 million people use these grasslands worldwide for some form of pastoral production. The grazing resources are constantly shrinking mainly because of conversion to cropland leaving pastoralists vulnerable to environmental extremes. India with less than 2.5% of world's land mass supports 15% of its cattle, half the number of buffalo, 15% goat and 4% sheep. Due to heavy livestock and human population pressure, all types of grazing resources are fast degrading. This paper presents the existing condition of the common property grazing resources and its importance in the rural economy. It discusses the constraints in development and provides detailed strategies, including technological, policy and sociological packages for improvement of all types of common grazing resources. Development of people's participatory management in protection and sustained utilization of these resources is discussed with examples and the key elements of successful participation provided.

KEYWORDS

Grazing resource, carrying capacity, top feed, technology package, common property resource, social forestry, participatory resource management.

INTRODUCTION

Grasslands or rangelands provide forage for free ranging livestock and wild animals. Due to their physical limitation, these areas are unsuitable either for agriculture or intensive forestry. More than one third of the earth's surface is too dry for rainfed agriculture and is, therefore, used as grazing lands. Other areas are too rocky, or steep, poorly drained, or too cold (World Resource Institute, 1987).

More than 200 million people use range lands worldwide for some form of pastoral production. About 30-40 million (mostly nomadic) people wholly depend on livestock. The majority of world's pastoralists (about 55 percent) are in Africa, 29 percent in Asia, 15 percent in Americas and 1 percent in Australia. In a pastoral system, livestock is more than a source of meat and milk. Livestock is a popular means of accumulating capital and often the size of the herd is a symbol of social status. Range lands provide forage for about 2.9 billion heads of cattle, buffalo, sheep and goats. In many developing countries, livestock products account for a large proportion of total agricultural export. These rangelands also provide other products like wood for fuel, thatch, fencing material, medicinal plants, gums, fruits, berries, tubers, etc. used for daily life. The wildlife that roam many rangelands is often a major source of food for local people. In Ghana, for example, nearly 75% of the meat consumed is from wild animals. In Botswana, the figure is 40%. Livestock products are extremely important for farmers. It is estimated that without livestock, developing countries would have to spend an additional \$ 40 billion on mechanical power and \$ 6 billion on fertilizer. (WRI, 1987) With the increase of human population there is increasing pressure to convert grasslands into crop lands.

Despite their importance, knowledge of the extent of world's rangelands is incomplete; no comprehensive global assessments exist. Part of the problem in conducting such an assessment is the

overlapping definition of range, pasture, grasslands, and other types of lands that produce forage. The most comprehensive rangeland data available were compiled by FAO and are organized by type of vegetation. The total extent of rangeland in the world (Table 1) is estimated to be 6.7 billion ha. or about 50% of the total land (WRI, 1988-89).

In most developing countries, these rangelands, which are the major common property grazing resources (CPRs), make significant contribution to the economy and livelihood of the village community, particularly the rural poor. (Jodha, 1994; Magrath, 1986; Bromley and Cernea, 1989). However, in India, the role and contribution of the CPRs have been completely disregarded in the development planning of the country.

This paper emphasizes the importance of the CPRs in the rural economy and examines the impact of public policies on the society dependent on CPRs' for livelihood. It discusses the constraints on the development of grazing resources and enumerates the steps to be taken to effect improvement of the CPRs particularly through peoples' active participation in their protection and regeneration including the technological and sociological packages essential for sustained utilization.

DEFINITION, EXTENT AND ROLE OF COMMON PROPERTY GRAZING RESOURCES

Common lands as a grazing resource. Common property grazing resources or common property resources (CPRs) are the resources to which the whole community in a particular village or a group of villages have rights of use as against exclusive rights of any individual i.e. private property resources (PPR). These resources include village pastures or grazing grounds, revenue common lands and wastelands, community forests and other forests within a reasonable distance from the village, river banks, common threshing grounds, village ponds/tanks, rivers and river beds. In India, the total available grazing resource comprise 14.63 m ha of cultivable wastes, 11.3 m ha of permanent pastures, 23.5 m ha fallows and 3.66 m ha of miscellaneous tree crops and groves. (Source: Dte. of Economics and Statistics, Min. of Agril. Govt. of India). Besides, 50% of the 77 m ha of recorded forest area, i.e. about 38.5 m ha are also available for grazing. Thus a total area of over 91 m ha are available for grazing.

India with about 2.5% of total land mass of the world supports 15% of its cattle, half the number of buffaloes, 15% goat, and 4% sheep. The country supports 15% of the world's human population on 2.5% of land area. It is here that the natural living resource is under severest stress.

Forests land as a grazing resource. Of the recorded forest area of 77.008m ha, the actual forest cover based on 1989-91 imagery is only 64.01 m ha. It is recognized that almost half the recorded forest area is in various stages of degradation. While on paper, forest area is out of bounds for grazing animals and their owners, it is common knowledge that most forests are under open access grazing. According to one estimate (NCA, 1976) about 88% of the forest areas are subject to grazing. As such, along with traditional village grazing grounds or whatever is left over of this grazing resource, forests, particularly degraded forests have been one of the major source of grazing. In

our discussions of grazing resource, forest is considered as a major component.

Dependence of rural communities on CPRs. The extent of dependence of the rural communities on the CPRs in the drier areas of the country is shown in Table 2. The study covers 21 districts spread over 7 comparatively drier states in western and southern India. Households are categorized in two groups viz. 'poor' which includes landless labourers and small farmers with below 2 ha of dry land and 'others' which include large farmers only.

Between 84 to 100% of poor households gathered food, fuel, fodder and fibre items from the CPRs against only 10 to 28% of large farmers who dependent on the CPRs on these items. However, greater proportion of large farmers collected items like silt from CPRs ponds to enrich soils of their cultivated fields and timber for their private use. The number of CPR based activities as well as the number of CPR products collected (physically verified in most cases) were higher for poor households compared to rich households. The extraction cost or the cost of using CPR is quite low and the input required is only human labour which matches the surplus labour available in poor households. Thus these households are able to accept the low pay off activities possible through CPR.

Dependence of the poor section on CPRs for fuel as well as grazing is significant. The study showed that 66 to 84% of the fuel requirement of the poor is met from CPRs as against 8 to 13% of the large farmers. Where opportunity cost is higher, such as in some MP areas, the large farmers also gathered considerable amount of fuel from the CPRs.

After fuel, fodder is the major item for which practically all rural poor depend on CPRs. The landless farmers graze their animals as well as collect fodder from the CPRs. The poor also own more of sheep and goats which can survive in a degraded environment. The poor also earn by rearing dry and unproductive cattle on behalf of the rich farmers. The study showed that in the seven states, CPRs provided 128 (Maharashtra) to 196 (Gujrat) mandays of employment to the poor as against from 31 (Tamil Nadu) to 80 mandays only to the other farmers. As far as income is concerned, CPRs provided 14 (Maharashtra) to 22 (MP) percent of all income to the poor farmers as against only 1 to 2 percent to the rich. Thus CPRs contribute more than a fifth of incomes from these sources for the poor. Consequently, CPR based programmes should get proper recognition in the Government programmes directed towards reduction of rural poverty and inequality.

Decline in CPRs. In view of non-recognition of the importance of the CPRs in a subsistence economy, not only no action has been taken to sustain the CPRs but Government policies have actually been responsible for decline of CPRs. Depletion of CPRs has been both in terms of area and productivity. The land reform introduced in the early fifties encouraged privatization of CPRs. Programs of distribution of land to landless (a Government anti-poverty program) have resulted in curtailment of CPRs. The other major cause in the reduction of area is encroachment of common property by the influential villagers and subsequent regularisation of such encroachment by government. While on the one hand, area available have substantially gone down, the pressure on the available CPRs, on the other, increased with the growing population dependent on such CPRs. The percentage decline of CPR area in 21 study districts varied between 26 in Sholapur (Maharashtra) to 63 in Nagaur in (Rajasthan). While the availability of grazing land is greater in the arid and semi-arid region of the country, the area is declining fast

due to various biotic pressures. In the two most arid states viz. Rajasthan and Gujarat, a decrease of 24% has been reported between 1961-72 (Mann et al., 1977). Further more, a large part of these areas are threatened with desertification. The Indian situation is, however, not an isolated one. The decline in area and productivity of CPRs has been a part of the common scenario in most developing countries where these resources continue to be important. Range land degradation has taken place at a rapid pace (55-85%) in different countries resulting in heavy loss, US \$ 1.5 (Europe) to 20.9 (Asia) billion per year throughout the world (Annon. 1992)

As a side effect of these land reform programs, the traditional, formal and informal arrangements regulating the usage of CPRs have slackened and disappeared. For instance, the abolition of provision like grazing tax and levies, compulsory labour for maintenance of CPRs, including desilting of ponds which existed during the pre-land reform days has led to significant decline in the private cost of CPR use and resulted in over-use of CPRs. Similarly, the substitution of informal authority of village elders (or formal authority of zamindars or feudal lords in some areas) by formally elected village councils (*panchayats*) and replacement of conventional by formal laws relating to land have eroded the traditional, social and religious sanctions affecting CPRs. It has been seen that the members of the village *panchayat*, despite legal provisions, could not enforce the CPRs regulations. (Jodha 1994) So the "tragedy of the commons" (Hardin, 1968), a concept that received considerable currency in the developing world, is not a tragedy of commons but a tragedy of "open access" (Bromley and Cernea, 1989)

CONSTRAINTS IN IMPROVEMENT OF GRASSLAND PRODUCTIVITY

Climate. Climate, particularly, quantum of precipitation imposes the greatest limitation on productivity of grasslands specially in the arid and semi-arid regions. By and large grassland production declines with rainfall (Table 3). In tropical grazing eco-system, precipitation plays a vital role in production which ranges between 0.2 t/ha in 50 mm rain to 30 t/ha under 1850 mm rain. Improved management can further increase production. Grassland production is also related to use patterns, grazing intensity and soil factors.

Dwindling grazing resource. As mentioned earlier, more and more grasslands and marginal lands are being brought into cultivation throughout the tropics, which means lands not suitable for crop production are being put under cultivation. The result is more pressure on the remaining poorer lands to provide for increasing animal numbers. Thus both crop and livestock production suffers (Singh and Ghosh 1993). In Asia, whereas permanent crop land increased by 3.3% between 1970-85, the total area under permanent pastures declined by 2.8% (WRI, 1989). The highest loss of grazing lands is probably occurring in semi-arid zones of the sub-Saharan Africa because of increasing population, expansion of cultivation into range lands, development of government sponsored irrigation schemes and in some cases transfer of land from small holders and pastoralists to large scale private agri-business (WRI 1989). In more humid areas, where less land is available for crop expansion, farmers are forced to shorten fallow cycle thus reducing availability of fallow grazing.

Excessive livestock population. The other major constraint is the livestock number. The country's livestock population which was 292 million in 1951 rose to 445 million in 1987 and 470 million in 1992. In 40 years, the livestock population increased by 60%. However, the grazing potential both within and outside forests, have not only shrunk considerably due to indiscriminate heavy grazing, but in many areas the existing forests have actually disappeared. Besides

privatization's of the CPRs, the enormous cattle population and the practice of keeping large numbers of relatively unproductive cattle, particularly near the forests and the unlimited grazing rights have resulted in over-exploitation of the grazing resource.

Paucity of funds. Perhaps the most serious constraint is the low priority attached by the government to the improvement of livestock production in general and grazing and fodder resources in particular in the country's successive Five Year Plans. In spite of the Animal Husbandry sector contributing about 24% of the output of the Animal Husbandry and Agriculture sectors together, the outlays for Animal Husbandry development has remained extremely meager in the Plans. As small as 6% of the public sector outlays for Agriculture was provided for Animal Husbandry in the Sixth Plan. The share of Animal Husbandry in the outlay for Agriculture in the Seventh Plan was even less, a meager 4.8%. Allocation for development of feed and fodder resources come from within the allocation made to the Animal Husbandry sector. The allocation for fodder development varies from 0.5 to 5% of the resources of the Animal Husbandry sector. It is no wonder, therefore, fodder and grazing resources of the country have been dwindling leading to greater impoverishment of the people who depend upon the livestock for their livelihood.

Absence of pragmatic policy. It is surprising that no agency either in the government or outside has been made responsible for development of vast grazing resources available upon which over 90% of the livestock population depend for nourishment.

As a result of this neglect, improved production technologies that have been developed by research institutions like Central Arid Zone Research Institute, Indian Grassland and Fodder Research Institute and the various Agricultural Universities, remain unutilised. Agencies like National Wasteland Development Board (NWDB) and National Afforestation and Eco Development Board (NAEB) support projects in some selected areas. These are run as government programs and area covered is so low that they even do not serve as examples of technology demonstration. There is acute shortage of pasture grass and legume seed material, no agency having been made responsible for production of these seeds. The Ministry of Environment & Forests, during the Eighth Five Year Plan drew up a scheme for production of tree and pasture seeds with 100% grant from the center. While the states used the funds for setting up infrastructure for tree seed production, not enough attention was paid to production of seeds of grasses and legumes.

SOCIO-ECONOMIC IMPACT OF GRASSLAND DEGRADATION

Acute fodder shortage. Fodder shortages in the villages is a perennial problem. As the open access grazing lands are becoming more and more unproductive due to continuous and heavy use with no check of any kind, the traditional small dairy farmer and small holders are losing their livelihood. The village common lands which provided subsistence needs of the village animals, have been encroached upon by the influential elite of the village and privatized. Also much of the common land has been distributed to the landless in the name of welfare schemes. All these have increased pressure on the remaining land leading to their faster degradation. All the improvement schemes in the livestock sector are of no use without ensuring availability of proper feed.

Nomadic graziers - a neglected lot. Nomadic way of life in its combination with nomadic livestock management is a very ancient form of adaptation to arid and semi-arid as well as hill environment. The occurrence of nomadic pastoralism and grazing in both types of

environments have been discussed in detail (Ghosh 1991). India is unique in the world in terms of diversity of animals used with pastoral nomadism. While the main animals associated with nomadism are sheep, goat, cattle and buffalo, there are herders of camel in Rajasthan and Gujarat, donkeys in Maharashtra, pigs in Andhra Pradesh, Yaks in Ladakh and Arunachal Pradesh and even ducks in southern India. There are nearly 200 castes engaged in pastoral nomadism totaling nearly 6% of the Indian population (Agarwal, 1994). These migratory graziers are a neglected lot. The general neglect of the hill pastures in the country as also in the plains has resulted in accelerated degradation of the eco-system, particularly along the migratory routes which are used by both migratory and sedentary flocks

Social injustice. In a country like India, with high poverty level as well as high density of population, every habitable physical space is used by some human group or the other. Even the Thar desert is the most densely populated desert in the world. Therefore, in the name of development if any environment is transferred into something else for use by a different group of people, then the group earlier dependent on that environment would suffer. This leads to social injustice and conflict. The Rajasthan canal was meant to green the desert and bring thousands of ha under irrigation. In the process nomadic graziers who used the desert eco-system for grazing their animals had their grazing area severely cut down and they did not derive any benefit with the advent of the canal as outsiders were brought in and settled on these irrigated lands whereas the local graziers should have been given preference.

Degradation of CPRs and drudgery of women. A critical analysis of the so called rural development program would show that in most cases it is not the poor masses but the elite that have benefited. In the Indian rural setting, degradation of the CPRs automatically increase the drudgery of the women. It is the women who are responsible to procure fuel for the kitchen and fodder for the animals. With no source of fuel or fodder nearby, the women have to trudge miles to collect these items. In addition, they have to do household work, agriculture work and look after the animals. Consequently, vanishing bio-mass resource puts the greatest burden on the women of the poor particularly the landless and small farmer.

Forests and the people. Forests, which is major common property resource in most developing countries in the world needs special mention. One-third of world's tribal people live in India, the total number being next to only Africa (Sachchidanda and Prasad, 1996). Majority of India's 67.6 million tribals live inside or close to the forest and for centuries forests have been an integral part of tribal traditions, economy and culture. However, these are the people who have been in the receiving end of all so-called development programmes initiated during colonial rule and continued till recently. With their environment progressively dwindling due to degradation of forest resources, the tribal communities in most areas have become the nation's poorest community (Poffenberger, 1995). Beside the tribals, hundreds of millions of rural people depend on forest for their livelihood. They are dependent on the forest for numerous kinds of forest products which are either directly used or sold for cash. They are not interested in timber. To them, these intermediate forest products are of major importance. However, the major objective of the Forest Department has been to maximize production of a few valuable timber species, with complete disregard to the needs and requirements of the tribal people.

Attempts to stall or reverse the process of deforestation in the seventies and eighties with donor funds have not met with success for the simple reason that these projects did not or could not visualize

the peoples' requirements. Thus, a recent World Bank report (Ritchie, 1992) noted after spending \$ 1.5 billion on forestry projects in Asia between 1979 and 1990, it had negligible impact on borrowers forestry sector as a whole.

Failure of social forestry. The entire social forestry program which was a departmental imposition, could not or did not visualize the people's needs. By and large non-browsable trees were planted and as such the people had little or no interest in the program. As the program did not meet fodder or fuel needs, the people continued to depend on the forest which kept on degrading.

The government interventions by way of distribution of lands, tree *patta* (lease) schemes etc., with all the good intentions, only reduced the area of the commons without helping the target group. On the one hand the land so distributed was degraded and incapable of sustaining the livelihood of the people and on the other it was beyond their reach to make these lands productive. The only other option left is to develop these common resources as commons by involving the entire community.

PARTICIPATORY MOVEMENT: A HISTORICAL PERSPECTIVE

While the nation is reeling under the ever increasing livestock and human population pressure and the forests as well as other grazing resources are being lost at a fast pace, a revolution of sorts has been made at a little hamlet called Sukhomajri, near Chandigarh city. There is a large artificial lake near the city which serves as a major recreation spot for the city dwellers. The Sukhna lake, was built in 1958 in 180 ha area, with the deepest point being 14 m. By the year 1974, more than 60% of the lake got silted up and deepest part was less than 4 m. The authorities were spending millions of rupees on desilting and dredging the lake every year.

Participatory institution. Over 76% of the catchment area of the lake is forest land where the people from the surrounding villages have been grazing their animals for decades. Even after fencing the area, the department had not been able to keep the animals out. The Central Soil and Water Conservation Research and Training Institute (CSWCRTI) scientists found that 90% of the silt load was coming from the higher catchment area constituting only 25% of total catchment. In order to prevent silt from coming down, a check dam was constructed near the village Sukhomajri and trees were planted along with *Sabai grass* (*Eulaliopsis binata*) on contour trenches. A second check dam was constructed near the village in 1977. The same year the monsoon failed and the farmers saw their summer maize crop withering before their eyes. There was water in the dam and they realized there was life saving irrigation water in it for their crops. When the people approached the authorities, it was agreed that water could be made available provided they stop grazing animals in the catchment. After a series of talks with the villagers and much discussion all around, a Water Use Association (WUA) was constituted and a system established in which every member would be given equal share of water regardless of the land owned and the landless too could claim right to irrigation water which they could sell to others. The people agreed to keep the animals out of the watershed which the government had failed to do all these years (Anonymous, 1988).

Sukhomajri: a model of people's participation. Today Sukhomajri has three rainfed reservoirs. Previously, they were taking only one crop which depended on the monsoon. With supplemental irrigation, they can now raise two assured crops. As grazing was stopped, the catchment sprung back to life with grass, shrubs and trees growing

profusely. The Haryana Forest Department made a departure from normal practice and gave exclusive rights to manage fodder and *bubber grass* cutting, distribution and sales to the village society on contract basis. The villagers worked out rules for sharing grasses and payments to be made to the society. All the usual rules and procedures were made by the village society with no interference from the department. By early eighties, the system of people's participation in the management of their common property resources appeared so smooth, that it became a model to be adopted and emulated by other areas. By 1986, the extent of soil run off had come down to 1.6 ha m per year (from 40 ha meter in 1960). Between 1977 and 1986, wheat yield went up from 2.75 to 5.80 quintals per acre, average milk yield per buffalo went up from 2.32 litre to 3.01 litre. While the number of buffaloes increased from 136 in 1977 to 182 in 1986, the number of goats declined to nil (Chopra et al., 1989). The Sukhmajri model of developing natural resource base through peoples' participation has since replicated itself in the neighboring villages which were facing similar problem. One other innovation introduced in this project was the involvement of women, who are responsible for arranging fuel and fodder and, therefore, any regeneration of degraded commons or forest land can only be accomplished with their active involvement.

Holistic improvement of natural resource base. Another aspect which is notable in Sukhmajri is that while the entire exercise began with the use of stored water, ultimately the entire village eco-system was covered within the ambit of development i.e. the forests, the degraded grazing lands, the crop lands, the available water and its distribution, the animals, all aspects of the integrated agro-sylvo-pastoral system had to be tackled in order to bring about a sustainable improvement. Another outstanding example is Kharaya *nallah* watershed near Jhansi in Uttar Pradesh, where natural resource base of the common lands was developed through integrating it with village resource development (Hazra et al., 1996). This approach resulted in an increase of forage by 110% and reduction of firewood gap from 89% to 14%, besides increasing crop productivity of kharif (summer), rabi (winter) and zaid (autumn) crops by 66%, 36% and 80% respectively in a period of four to five years. Indian villages have a highly integrated land-livestock-crop-vegetation system. As such, any planning to develop village economy will ultimately have to tackle all the natural resources viz., land, water, crops, livestock, forest, grazing land etc. in an integrated manner by the villagers themselves. In Sukhomajri this holistic approach to improvement of the village eco-system had led to increased food production (village is now self-sufficient in foodgrains), improved milk production (sells more than Rs. 0.3 million worth of milk per annum), reduced fuel problems and drudgery for women folk. Sukhmajri villagers are now too rich to make ropes (*Sabai grass* is sold to paper mills) and this dramatic transformation has come only in 6-7 years.

The lesson to be learned from this is that if Sukhmajri, in Shivaliks, Chandigarh and Kharaya *nallah* watershed in the Vindhyan hills, Jhansi, can transform itself through rational use of its common property resources, most villages in India can do the same through appropriate participatory resource management.

Participatory management of degraded forest. *Arabari, West Bengal.* Arabari range in east Midnapur district is 30 kms. from Midnapur town and 200 kms. west of Calcutta. It has about 1272 ha of degraded forest. There are 11 villages comprising of 618 households who are dependent on the forest. Realizing that the forest could not be regenerated without the cooperation of the users, a Divisional Forest Officer started a dialogue with the villagers and found the villagers understood the devastating affect of deforestation

and that poverty was forcing them to over-exploit the forest. As there were no ready source of income in the lean periods, the landless labourers sold wood from the forest to generate cash. The officer promised to solve their problem of livelihood in the lean period provided they cooperate with him. He demarcated 1272 ha of wasteland for plantation and the work was taken up during the lean period. All the local people were assured equal employment opportunities. All the villages around this area were asked to form committee. The committee was given exclusive rights to collect all non-wood forest products (NWFP) free of cost. Their immediate needs of fuel and fodder were also taken care of. The committee arranged for 22 persons from 11 participating villages to guard the forest during day time. The committee also took measures for imposing fine any non-member individual spotted for cutting wood from the forest and disciplining members for any infringement.

Protection provided by the villagers allowed the forest to regenerate rapidly. The West Bengal government issued a special order entitling the committee 25% of the final yield from the sal pole timber at the end of 10 to 15 years rotation.

The project evaluation in 1986, revealed that over 699 ha had excellent growth of coppice sal and fully stocked plantation covered over 486 ha. The balance 86 ha is a refractory hard laterite area where tree species could not be grown. The growing stock was valued at Rs. 30 million (US \$ 0.88 million) capable of regenerating an annual income of Rs. 2.3 million (US \$ 67000) in perpetuity (at 1986 prices) by annual harvest at 10-15 year rotation (Bardhan Roy, 1988). There are now nearly 1300 forest protection committees active in south West Bengal protecting over 152,000 ha of degraded forests in the three districts, which is nearly 37% of the total forest area of the region. A comprehensive study of some of the operating FPCs concluded that the process of forest degradation can be reversed by such protection committees and that the local committees can act as effective care taker of the forest (Malhotra and Poffenberger, 1989).

Harda, Madhya Pradesh. In Harda forest division in Madhya Pradesh, at the initiative of the local forest official, the people of 155 villages are protecting 140000 ha of forest through protection committees (Bahuguna et al., 1994) In the initial stage the official was able to bring about the villagers to control grazing and forest fire. The success of this endeavor resulted in flowering of bamboo in over thousands of hectares, an event that occurs every 35-50 years. Without protection from heavy grazing and annual fires, bamboo regeneration after flowering is almost impossible. To allow the bamboo to become established, the communities developed a system of rotational grazing keeping the cattle out of the flowering areas. The community groups in Harda in collaboration with foresters are also beginning to develop improved management practices. Local villagers with specialized knowledge are now familiarizing forest guards and other community members with these silvicultural techniques.

Harda is an example where large forest areas can be successfully protected and managed to augment forage resource over extensive areas by the village community.

Significant aspect. The most significant aspect of participatory management of common grazing resources in the examples cited above is that the people kept their animals away from the protected area, resorted to stall feeding on their own and voluntarily got rid of the unproductive animals in favour of productive ones which brought them more cash. In some places, the forage available exceeded the requirement of the villagers which they sold. There are other examples where similar development took place once the availability of feed

for the animals was assured.

Bottom-up approach. In the initial phase of participatory movement, different people had different perceptions of peoples' participation. Some people understood (particularly departmental officials) participation as getting people agree to go along with the project already prepared for them. In fact, this approach was adopted in the social forestry program in the seventies and eighties. Any program which is forced down the people is doomed to failure. Participatory action succeeded because it was bottom up and not top down. Peoples' participation can be described "as the process by which the rural people are able to organize themselves and through their own organization, are able to identify their own needs, share in the design, implementation and evaluation of the participatory action"

With the success of people's participation in the development of CPRs and village eco-system, a great deal of interest has been generated both within India and outside and of late quite a bit has been written on the subject (Poffenberger and McGean, 1996; Chopra et al., 1989; Kurup, 1996). The Forest Department which now takes the credit for development of peoples' involvement in the forestry sector has given a name i.e. joint forest management (JFM). In fact, it would be most appropriate to call it Joint Resource Management, JRM. While there are many success stories and also some failures of protection of forest by the people, it is success of the improvement and management of the non-forest or degraded forest areas that have shown remarkable results as well as in the quantum of benefits accrued to the people and the improvement in their lifestyle.

Key elements for successful participation. A critical examination of the successful projects under peoples' participation indicates the following key elements of success:

- (a) Priorities of the people, particularly the poorer section, must be uppermost while developing CPRs and not those of the official machinery.
- (b) Priorities of the people are subsistence and income for their livelihood. For those living on the margin of subsistence, any change to a new system of land and livestock management can only be achieved if they can see the benefits which they will derive. Consequently, for forest and village lands to meet their livelihood must ensure sustainable multi-product availability through living trees, shrubs and grasses rather than a single product like timber, pole etc. People will protect only when they have a stake in the assets to be created
- (c) Equitable distribution of benefits to every member of the village community is crucial for the success of peoples' involvement. For example, in Sukhmajri the landless people stopped grazing their animals in the catchment only when they were given an equal share of the irrigation water which they could sell to the landholders or take a part of the produce instead.
- (d) The entire community must be associated right from the planning stage of development of CPRs and whatever type of village authority manages the CPRs should be given full responsibility to control and manage and take punitive action wherever necessary without any interference from any outside authority.
- (e) A suitable village level agency (institution) has to be created to manage the natural resources. The existing village *panchayats* have been found to be more of hindrance than help because these are too large (covering a number of villages) and ridden with politics, group rivalry and corruption. It is, therefore,

necessary to provide right institutional and legal framework for community action. The institution should be village or hamlet level like *gramsabha*, where all adults in a village will be members. However, no single pattern can be suggested regarding institution building. It has to take into consideration the diverse groups residing within a community and keep the institution as homogenous as possible. The most important factor is that there has to be complete unity within the community responsible for managing a resource.

- (f) Women's participation and involvement in developing CPRs will be crucial because it is the women folk in the village who have to toil for long hours for procuring fuel wood and fodder and other minor products and they, therefore, that have the greatest stake in protecting this resource.

Basically, the essential elements for ensuring people's involvement in community resource management are:

- Control by the community
- Unity within the community and
- Equity in distribution of usufructs

In case these three conditions (CUE) are fulfilled, people will be able to take a long term view and protect their assets and environment

Figure 1 depicts the existing and the ideal situation for development of commons. In the proposed system inter-community conflicts regarding use will be eliminated. The community having sole access will be able to take care of the common and discipline its erring members, if any. There are many instances where such a system succeeded in protecting the common.

POLICY CHANGES

The National Forest Policy (NFP) enacted in 1878 was first modified in 1952. Among the six vital needs which form the fundamental basis of the policy, is 'the need for ensuring sustained supplies of grazing'. Growing concern with the continued forest degradation had proved the futility of policing the forest and the 1988 revised NFP spoke of involvement of the people to minimize pressure on the forests. In a significant departure from the century old forest management policy, the Ministry of Environment and Forest, Government of India (GOI), issued guidelines on 1st June, 1990 concerning involvement of village communities and NGOs in protection and development of degraded forests on usufruct sharing basis.. As degraded forests constitute the largest common property grazing resource, the forest department could now officially undertake peoples' participation in developing this resource. Following the GOI circular, 16 state governments have issued notification/resolution regarding participatory management of these areas which account for 72% of the country's present 64 m ha of forest area. However, JFM will pick up momentum with attitudinal change of forest officials.

In a critical review of JFM, Kumar and Kaul (1996) have discussed the second generation issues which need to be resolved. They pointed out that the issue of share of the village communities in the final harvest is not very relevant to most JFM areas and should not be over emphasized. The production of fuel wood, fodder, NTFP to meet the subsistence needs of the village communities should be the first priority. The need for integration of JFM with other rural development programs was also emphasized.

Management approach. While the rural societies of India have shown that they are capable of managing their own land resources

given the correct attitude of the government, there are various issues that have to be tackled and initiative undertaken at the government level. First and foremost, the thrust should be in the involvement of the community towards adoption of appropriate land use along with judicious use of the presently available production systems and adopt new ones wherever necessary for sustained optimum return, be it agricultural holding, forests, pastures and other grazing lands, degraded lands of different types including degraded forests, lands affected with salinity, water logging etc. There is a close relationship between poverty and poor resource management. Unless the health and productivity of the natural resource base is restored, welfare of a Nation cannot be ensured.

Technology package. Any approach to developing an open access grassland management system for augmenting animal productivity and improving the living standards of the small land and stock holders will have to address the following issues:

- Reducing livestock number. There has to be a conscious policy thrust towards meeting the requirement of animal products as well as animal power with progressively lesser and lesser number of animals. In other words, both draught power and per capita productivity of animals will have to be increased. Breeding of better draught animals, on a large scale, by use of excellent draught and dual purpose breeds available in the country, through AI facilities and positioning of bulls where AI facilities cannot be provided, would go a long way in reducing the number of animals required. However, very little efforts have been made in this direction, The entire thrust of the government machinery is on cross-breeding of local animals with overseas milk breeds like Jersey, Holstein etc. for increasing milk production. In the process, there is genuine apprehension that the excellent Indian breeds of cattle will be lost.
- Cattle breeding strategy. Cattle breeding strategy needs a second look in terms of requirement of rural India where sophisticated animal care and feeding may not be possible. Breeding policy has to be delineated keeping in view the requirement of the different regions within the state and the possibility of raising quality feeds in the area.
- Drought proofing. In the arid and semi-arid areas herdsman tend to increase their stock as an insurance against fodder scarcity during drought which may kill some of the stock. Ensuring feed all round the year through proper management of grazing lands, preferably community managed, would bring confidence and instead of increasing they would keep lesser number of productive animals. That this can be done has been shown by a nomadic grazer in the Himalayas who was prompted to keep money in the bank instead of on hooves which was more risky. On return from Alpine pasture he sells off culled animals and within two years his bank pass book showed a balance of Rs. 0.25 million or US \$7,000 (Rizvi, 1994).
- Sheep and goats. Sheep and goats have been identified with degraded environment. In India, sheep and goats, particularly goats, are important livestock to the poorer section of the community who rear them for their livelihood as they find these animals most economical and suited to harsh environment where no other animal can be economically reared. Under a poverty alleviation program, government have distributed sheep and goats which has resulted in induction of many more animals in such ecologically fragile areas without making any effort to improve the fodder/grassland production potential. There has been over

40% increase in the goat population between the years 1972 and 1982 (95 million heads). Animal husbandry activities must be based on the carrying capacity of the land. Any increase will result in degradation of the grazing resource and eventually affect the eco-system. Here again, the answer lies in allowing the people to manage the grazing resource and by providing technological input and leadership in organizing themselves as was done in the case of Sukhomajiri. In many areas where people are managing the land resource and as assured fodder become available, themselves got rid of the non-descript cattle in preference to productive ones. In the case of Sukhomajri (Chopra et al., 1989), Aravalli (Srivastava & Kaul, 1994) and Jhansi (Hazara et al., 1996) the goat population was drastically reduced or completely eliminated.

- Development of degraded forests. Nearly 50% of the recorded forest area is under various stages of degradation. Hitherto, the Forest Department has been trying to reforest some of these areas at huge cost. Such attempts have largely failed as this did not meet the people's needs. Major portion of such areas should be developed under silvipasture system which will provide much needed source of fuel wood and fodder. This activity should be taken up in active collaboration and participation of village community. The government circular of 1st June, 1990 has paved the way for such participatory management.

The community, who should have a clearly demarcated area under its control, must be informed of the benefits that would accrue from protecting and developing this area. High yielding fodder grasses may be planted along with quick growing fodder and fuel trees, the choice of species should be left to the people. The grass will be available within one season yielding anywhere between 20 to 40 tonnes of green matter per ha depending on the location and rainfall. When properly protected, the produce will easily meet the requirement of the entire productive animals of the village in case a reasonable area is taken up for development.

- Grazing management in forest. In case the above mentioned system of development of degraded forests is followed and the community benefits from the fodder harvested from such areas, the department may regulate and/or prevent grazing in the main forest areas without any trouble. If development of degraded forests through peoples' participation becomes an important plank in forest management vis-a-vis cattle grazing henceforth, a rational and workable system of grazing management in the existing forests can be developed within the carrying capacity of each area as per the directive of the National Forest Policy, 1988.
- Increased productivity of all grazing resources. Productivity of degraded grasslands and other lands can be augmented through technology inputs provided these can be protected from overuse. Solution to this basic problem has been found in the people's participation in resource management discussed earlier. Provision of the following inputs would be essential:

(a) **Bush control**

Due to year round overgrazing, most grasslands in the arid and semiarid environment have been infested with unpalatable bushes like *Lantana*, *Zyziphus*, *Eupatorium* etc. These not only drastically reduce feed availability but prevent grass establishment and are troublesome to animals. As such, all efforts should be made to eradicate bushes and maintain a vigorous stand of grass and useful trees and shrubs.

(b) **Soil working**

Pasture productivity in arid and semiarid regions are directly

correlated with moisture availability. Consequently, water harvesting through different types of soil working as appropriate, depending on topography, slope etc. significantly improve productivity. Soil working like contour furrowing, contour bunding and contour trenching has been shown to increase productivity of the order of 638, 168, and 165 per cent respectively per year (Ahuja, 1977) on the basis of a ten year study.

(c) **Reseeding**

Most tropical grasslands in the old world countries are in poor, degraded condition. In India, 80% of the rangelands in the arid zone are in poor condition sustaining only annual species of low nutritive value (Ahuja, 1967). Natural succession, even if protection is provided, would be a slow process and use of ecologically suitable species for reseeding would considerably hasten the process and increase productivity. However, such a step should only be taken in areas where protection can be provided.

(d) **Legume introduction**

Legume introduction in grasslands increases production of nutritive herbage, extend the grazing period into dry seasons and significantly improves animal production. A review of experiments conducted in different countries revealed that liveweight gain varied from 250 to 550 kg/ha (with an average of 410kg/ha) with a vigorous grass-legume mixture (Crowder, 1985). Liveweight gain increased proportionally with the percentage of legume in the herbage and conception rate of cows increased and calf mortality decreased on grass-legume pasture as compared to grass alone. Advent of the legume *Stylosanthes*, with its various ecotypes, has been a real boon to the arid and semiarid tropical pastures of the world. However, large-scale use of *Stylos* in tropical grassland systems is still to catch up. Studies undertaken on introduction of *Stylos* in semi-arid, dry sub-humid and moist sub-humid conditions in natural grasslands have shown significant increase in dry matter and crude protein yield (Rai, 1988).

POLICY PACKAGE

Integration of livestock and forage development. India presents a paradox - so do probably most of the old world countries. There is not enough fodder or grazing available for existing stock and the stock can not be reduced except through voluntary culling. This the people will not do unless their income is secured through assured fodder/grazing availability. Consequently, on the one hand while the livestock population, particularly the cattle, will have to be limited to economically productive stock, without any reduction in total production, the problem of fodder and grazing on the other hand will have to be tackled in a manner that the minimum requirements are met. This can only be done through a coordinated and concerted approach by pooling resources of all the concerned departments e.g., Agriculture, Animal Husbandry, Forests, Revenue, Rural Development, Irrigation etc. The Forest Department as well as other agencies responsible for development of degraded lands, village common lands etc. should remain in close liaison with rural development programs. Under these programs, forestry related subjects such as pasture, silvi-pasture, agro-forestry etc. can provide gainful employment to the rural households and create real assets for the community, which, in the short and medium term can provide much needed fodder, grazing and fuel on a sustained basis.

Vigorous extension program needed. While the extension machinery for fodder development with the Animal Husbandry

Department is negligible or non-existent, the vast extension apparatus with the department of agriculture is not being utilized for this purpose as the department is not concerned with fodder. Farmers are not getting any advice regarding use of fodder crops in the rotation or short fallows to the extent desired. The village extension workers, school students and voluntary agencies should be properly involved and their appreciation continuously upgraded. The villages in the neighborhood of forests should receive special attention in fodder extension and production drive.

Augmentation of top feed resources. India is endowed with an astounding diversity of tree flora and this vast resource is yet to be fully utilized in a planned manner by the pastoral community. Excellent fast growing trees are available for all ecological conditions from arid to humid environments. Use of selected trees on a large scale is the best and easiest way of maintaining animal productivity during lean periods. Planting fast growing fodder tree species should be an essential component in the development of common grazing resources including degraded forest areas. Propagation of fodder trees has not been taken up seriously by the state Forest Departments. This lacuna needs to be rectified without further delay. For arid and semi-arid zones, Hocking (1993) has an excellent compilation of fodder and other trees for different situations. Subabul (*Leucaena leucocephala*) has been extensively studied and used under different rainfall and soil conditions in India and under different production systems including agri-silviculture, social forestry, alley cropping, silvipastoral and energy plantation etc. (Kaul, 1970; Pathak, 1988). This is, by far, the most popular and productive fodder tree species used in semi-arid to humid tropics in India. Under Jhansi conditions, maximum annual bio-mass production was found in *L.leucocephala* (20 t/ha) followed by *Acacia tortilis* (14.6 t/ha) and *Albizia amara* (9.5 t/ha) (Singh and Ghosh, 1993). For the arid and semi-arid zones, there are a number of other exotic and indigenous trees such as, *Prosopis cineraria*, *Colophosphermum mopane*, *Zizyphus numularia*, (Kaul & Ganguly, 1963) *Salvadora sp.* etc. Fodder trees should be extensively planted in homestead lands, field bunds etc. which will provide much needed nutritious fodder and would significantly contribute to the lowering of pressure on grazing resources, be it common grasslands or forests, particularly during dry season.

Straw treatment. Dry fodders such as crop residues and other cellulosic wastes are the primary source of feed presently available to majority of livestock. While simple methods of straw treatments are available, the same has not become popular and one hears about feeding treated straws only during the times of scarcity following failure of monsoon. In a review of the developments of chemical treatment of straws and its application, Owen and Jayasuriya (1989) found little evidence of farmer uptake of the technique in developing countries and suggested that there may be a case for centralized upgradation plants. The physical labor involved in the treatment process and risks of mortality through urea poisoning (though remote) are some of deterrents to large-scale adoption of the technique. Milk unions under the state federations and the Animal Husbandry departments of the states should undertake programs for centralized treatment at suitable locations so as to encourage feeding of enriched straws. Feeding enriched roughage, which can take care of the maintenance ration of bovines, would enable villagers to resort to stall feeding thus reducing grazing pressure on the commons and the forests.

SOCIOLOGICAL PACKAGE

In order to reduce the process of degradation of grazing resources, both within and outside forests, a certain amount of regulation and social restraint is essential. The types of regulation that are practicable

under the present circumstances are indicated below.

In most forest areas, there were certain amount of restrictions with regard to the number of animals and duration of grazing. Over the years, particularly after 1947, these have been done away with in complete disregard to NFP, 1952 and 1988. While such liberalization were resorted to at the times of drought and scarcity, the restrictions were never reimposed when conditions normalized.

Regulating grazing. Even though regulation of grazing is essential, it is perhaps the most difficult part under the present circumstances. Before regulation of grazing in the forests can be imposed, it must be ensured that sufficient area of common grazing land and/or degraded forests land have been brought under development through peoples' participation.

The 1952 NFP says 'cheap forest grazing has a demoralizing effect and leads to the vicious spiral of reckless increase in the number of cattle...'. This is exactly what has happened as grazing regulation was completely removed and made free by the state governments. It is, therefore, necessary that, while making adequate provision for grazing/fodder through people's participatory effort, the following general principles with regard to grazing may be enunciated:

- Natural resources must be used in a manner for sustained economic development. There will be no diversion of permanent pastures and other grazing lands to other uses and any encroachment of community grazing land should be appropriately dealt with under the law.
- Unrestricted grazing, if unchecked will result in environmental disaster. Consequently, gradual imposition of restraint in the extent of use of forest both in terms of number of animals as well as area and duration will have to be imposed.
- It is important that actual beneficiaries are identified. Only individuals/villagers in whose favour rights/concessions are recorded in the forest settlement only be allowed in the forest.
- Even for right holders, there has to be limitation on the number of cattle allowed access in forests. In this, the interests of the small farmers and laborers will have to be safeguarded.

The following order or priority for allowing cattle for grazing may be considered as a guide.

- (a) four cattle units of each individual family of laborers, rural artisan and per plough of agriculturist. This priority will cater to all agricultural operations as well as milk production.
 - (b) additional four cattle units per family of laborer, village artisan and per plough of agriculturist
- Grazing fee will be charged according to priority given above i.e. at concessional rate for category (a) and slightly higher for category (b). Commercial rates will be charged for cattle other than categories (a) & (b).

Grazing fees and regulatory measures could be taken after due publicity and informing the people why such measures become necessary in the national interest. The people may be suitably advised and helped to reduce the number of unproductive cattle and assisted in getting higher yielding animals.

While the above social package is suggested for the forest areas, it may not be necessary to impose such restriction in the long run once

the available commons and part of the degraded forests are developed under community management. No farmer would be willing to go a distant forest for grazing his animals in case feed is available close to the village.

Generation of alternative livelihood sources. Most landless and the rural poor due to compulsion resort to goat and sheep rearing as a source for their livelihood. In order to wean them away from goat rearing and thereby reducing livestock pressure on grazing lands, it is necessary that alternative sources of livelihood and the means to meet the needs of the population should be developed. Depending on the raw material available locally, forest departments have helped people to adopt alternative vocations such as basket weaving (from bamboo), furniture making (from canes), rope making (from grass, agave etc.) and even grinding and polishing semi-precious stones

CONCLUSION

In recent years India has taken a position of world leadership in exploring strategies in natural resource management through involvement of local communities as protectors as well as sustainable users of these valuable natural resource (Poffenberger, 1995). Evolution of this successful strategy has been made possible by realization of the fact that the traditional system of resource use by the people is not destructive and given responsibility, people can evolve their own system of protection as well as management. Over a million ha of regenerating degraded forest in the central India and hundreds of thousands of ha in other states in India bear ample testimony that given the right conditions the strategy works. While there is no doubt that NGOs, researchers and various other people have helped in clarification and evolution of this grass root eco-restoration movement, the credit, undoubtedly, goes to the resource starved people of the numerous villagers and hamlets.

It would be naive to suggest, however, that everywhere the people will immediately rise up and start protecting their environment or that a ready solution to over grazing has been discovered. There are numerous problems like social conflicts in a village community, caste barriers, exploitation by the elite and of course the ubiquitous politics. It would need understanding, patience, appropriate tactic to resolve conflicts and above all a firm resolve that all the steps taken will be for the benefit of the poorest in the community. Complete rapport will have to be established with the people and their confidence won before their cooperation can be expected. This would, therefore, require major shift in the departmental attitude, policy and procedures. With the issue of 1st June, 1990 circular of the Ministry of Environment and Forests, which undoubtedly was issued as a result of the success of people's participatory action, the first hurdle has been crossed. However, the second and more difficult hurdle is the change in the attitude and approach of the Forest Department functionaries. The younger generation of foresters are more amenable to change and it has been found that participatory management systems have been most successful with motivated and committed field staff who receive encouragement from their seniors.

The participatory institution should preferably be called resource management committees and not forest protection committees because the people are doing more than merely protecting the degraded forest. Further, all land resources should be covered within the ambit of development including the areas called revenue wastes and village grazing grounds. The Forest Department, in their own interest, should cover these areas as this will substantially reduce the pressure on forests.

The Indian experience may be of interest to many developing

countries facing similar problem of high population pressure and resource denudation. The approach and procedure may need modification depending upon the culture, customs and requirement of the communities.

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Table 1

Distribution of World's Rangeland (million ha) WRI 1988-89

Country/ Region	Area of Pasture	% of total R'land	Wooded & other land	Total Range	% of total land area
N.America	272	30	644	916	47
Europe	84	55	69	153	31
CIS	375	44	480	855	38
C.America	95	66	50	145	47
S.America	458	56	367	825	46
Africa	789	41	1155	1944	64
Asia	645	51	615	1260	46
Oceania	453	73	166	619	73
Total	3171	47	3546	6717	50

Table 2

Indicators of rural households' dependence on CPRs (From Jodha 1994)

Details	Andhra Pradesh (2,5)		Gujarat (3,6)		Karnataka (3,7)		Madhya Pradesh (3,7)		Maharastra (3,7)		Rajasthan (3,7)		Tamil Nadu (2,4)	
	Poor ¹	Others ¹	Poor	Others	Poor	Others	Poor	Others	Poor	Others	Poor	Others	Poor	Others
Category of households														
No. of households	65	41	84	62	64	33	98	72	102	64	72	64	48	23
Percent collecting CPR products: food	95	10	96	16	84	14	100	18	98	13	100	23	93	12
fuel, fodder, fibre	99	15	100	19	100	18	100	11	100	16	10	28	100	17
timber, silt, etc.	37	59	29	83	41	78	21	84	19	90	31	89	92	42
Per household average no. of CPR based activities ²	4	2	5	2	5	3	6	3	3	2	5	2	4	3
CPR items collected ³	7	4	8	3	7	4	12	5	7	3	10	5	6	3

Notes:

1. 'Poor' households include agricultural labourers and small farmers (<2ha of dry land equivalent). 'Others' include large households only.
2. Activities include product collection, grazing, processing and handicrafts based on CPR products and marketing of CPR products
3. Items include fuel, fodder, various wild fruits and flowers, roots, leaves and skin of plants and trees, honey, gum, fish, small game, silt, etc.

Table 3

Production of grasslands in different bioclimatic zones (from Patil, 1983)

Region/Country	Annual Rainfall (mm)	Dominant Species	Primary net prod. (gm/m ² /yr)
Africa			
Desert-Sahel	50		20
SW Africa	100-200		80-160
Same+Shrubs	450		400
Humid depression			260
SE Ethiopia	1080	<i>Themeda</i>	480
Sudan	560	<i>Themeda</i>	102
N. Sudan			360
			150-250 (open)
			300 (shade)
Tanzania		<i>Themeda</i>	50-300
Mali	800-1100	<i>Andropogon</i>	260-320
Upper Volta	1050	<i>Andropogon</i>	300 (open)
			550 (shade)
			800 (flooded savanna)
Guinea-Congolese			800-900 (grass savanna)
Ivory Coast		<i>Andropogonae</i>	1300-1600 (shrub-savanna)
Nigeria		<i>Pennisetum purpureum</i>	1500-2000
Zaire	1850	<i>Melinis Setaria</i>	600
	Brachiaria	1500 (lowland savanna)	
Zaire	1750	<i>Setaria sphacelata</i>	500 (Upland savanna)
America (Central)	700-1600	<i>Hyparrhenia rufa</i>	800
		<i>Hyparrhenia rufa</i>	2000 (managed)
		<i>Cynodon</i>	3000
El Salvador		<i>Pennisetum purpureum</i>	9500 (managed)
Venequela		<i>Trachypogon</i>	400
			910 (burned)
			700 (protected)
Brazil			
Asia			
Philippines		<i>Imperata cylindrica</i>	1000
N. India			
Jodhpur	400	<i>Cenchrus Aristida</i>	160
Ujjain	900	<i>Dichanthium</i>	520
Varanasi	1200	<i>Dichanthium</i>	504
Pilani	400	<i>Dactyloctenium</i>	260
Rajkot	590	<i>Sehima-Aristida</i>	400

Figure 1

Existing and Ideal situation for development of commons.

