POPULATION, ENVIRONMENT, AND THE DEVELOPMENT PROCESS

Land resources are the resources par excellence in the Arun watershed. The population dynamics are, therefore, inextricably linked with land resources. In such a context, the best indicator of development is the state of land resources, their use, and utilisation. Development is a relative concept. From an environmental point of view, development is positive to the extent that the given pattern of land use, institutions regulating its use and productivity, and internal and external linkages together contribute to enhance the environmental capability of sustaining a given population without impinging or otherwise impairing the regenerative capacity of the environment; by implication development has a negative bearing on the environment to the extent that it is not so.

Some of the facets of this relationship in the Arun watershed will be explored in this section.

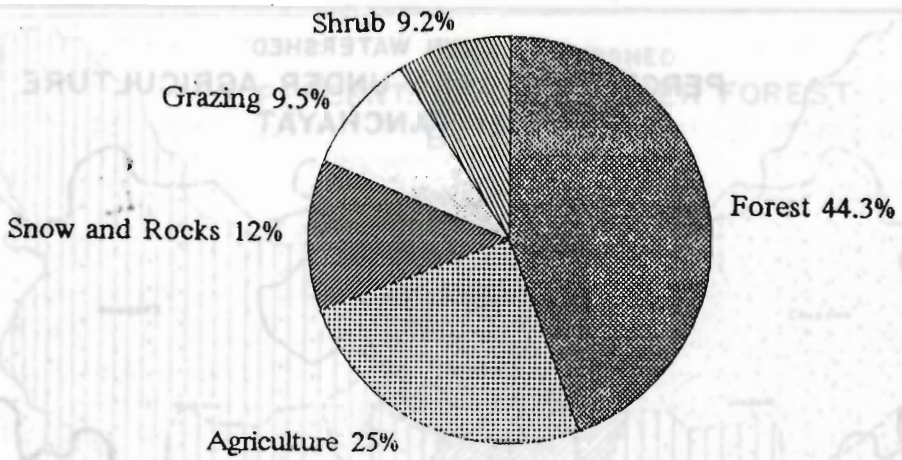
Land Use

A generalised picture of land use patterns in the Arun watershed can be derived from LRMP maps. The gross land use pattern in the Arun watershed appears as follows: forest and agricultural uses account for 44.3 and 25.0 per cent of the total area; and grazing land, shrubs, and snow-fields cover 9.5, 9.2, and 12.0 per cent of the total area respectively (Table 9).

Table 9: Land Use in the Arun Watershed, 1978/79

Land Use Category	Dhankuta		Bhojpur		Sankhuwa Sabha		Total	
	Area (km^2)	(%)	Area (km^2)	(%)	Area (km^2)	(%)	Area (km^2)	(%)
Agriculture	222.7	(55.6)	585.3	(43.8)	496.4	(14.3)	1309.4	(25.0)
Forest	150.3	(36.7)	634.1	(47.4)	1531.3	(44.0)	2315.7	(44.3)
Grazing	23.3	(5.7)	60.2	(4.5)	411.1	(11.8)	494.6	(9.5)
Shrub	7.9	(1.9)	57.6	(4.3)	415.5	(11.9)	481.0	(9.2)
Snow & Rocks	-	-	-	-	625.5	(17.9)	625.5	(12.0)
Total	(409.2)	(100.0)	1337.2	(100.0)	3479.8	(100.0)	5226.2	(100.0)

Sources: Computed from LRMP maps



Note: Chart based on Table 9.

Land uses differ markedly between the northern and southern areas of the watershed. Agricultural uses account for a larger proportion of the area in Dhankuta (55.6 per cent) and Bhojpur (43.8 per cent) than in Sankhuwa Sabha (14.3 per cent). About 83 per cent of the grazing land is concentrated in Sankhuwa Sabha alone. Much of it is in the northern *panchayats*. Also, two-thirds of the forest area in the watershed lie in Sankhuwa Sabha.

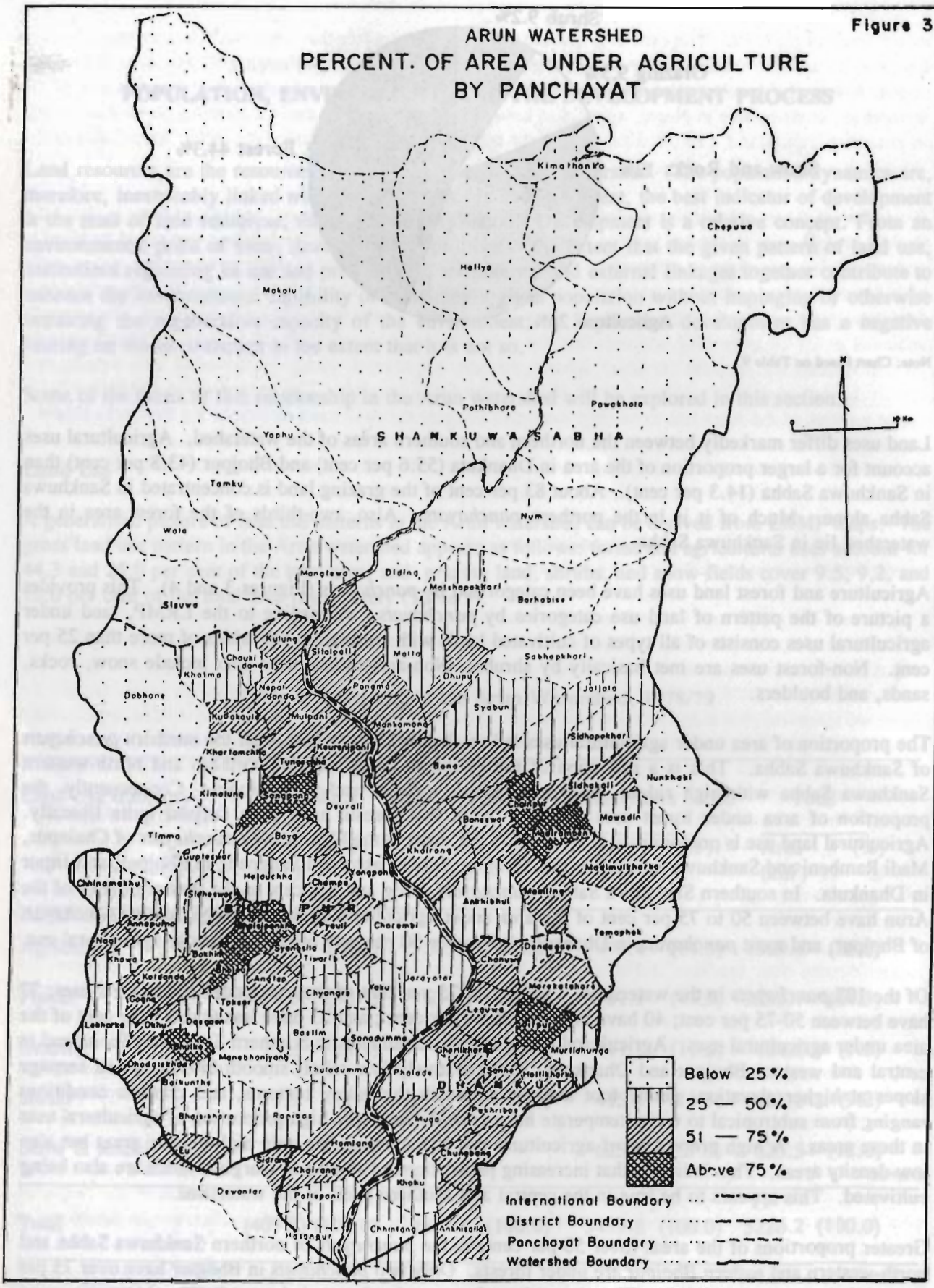
Agriculture and forest land uses have been categorised by *panchayats* (Figures 3 and 4). This provides a picture of the pattern of land use categories by *panchayats*. According to the LRMP, land under agricultural uses consists of all types of cultivated lands with cultivation intensities of more than 25 per cent. Non-forest uses are met basically by shrubs. Non-agricultural uses also include snow, rocks, sands, and boulders.

The proportion of area under agricultural uses is low (below 25 per cent) in all the northern *panchayats* of Sankhuwa Sabha. This is a reflection of the dissected topography of northern and north-western Sankhuwa Sabha with high ridges, deep and narrow valleys, and steep slopes. Consequently, the proportion of area under forest uses is high. Note that forests have been defined quite liberally. Agricultural land use is predominant (i.e., over 75 per cent) in the high density *panchayats* of Chainpur, Madi Rambeni and Sankhuwa Sabha, Bhulke, Bhojpur, Bhaisipakha and Sangpang in Bhojpur, and Jitpur in Dhankuta. In southern Sankhuwa Sabha, *panchayats* along and adjacent to the western banks of the Arun have between 50 to 75 per cent of the area under agricultural uses. The high density *panchayats* of Bhojpur, and most *panchayats* in Dhankuta, have over 50 per cent of the area under agricultural use.

Of the 107 *panchayats* in the watershed, 7 have over 75 per cent of the area under agricultural uses; 37 have between 50-75 per cent; 40 have between 25-50 per cent ; and 23 have less than 25 per cent of the area under agricultural uses. Agricultural use of land predominates in Southern Sankhuwa Sabha and in central and western Bhojpur and Dhankuta. Comparatively low relief, smooth interfluve and seepage slopes at higher elevation, gentle foot and toe slopes in the valley bottoms, and climatic conditions ranging from subtropical to warm temperate have contributed to the high proportion of agricultural uses in these areas. A high proportion of agricultural use characterises not only high-density areas but also low-density areas. This indicates that increasing proportions of slope and marginal lands are also being cultivated. This appears to be true in the central and southern parts of the watershed.

Greater proportions of the areas (over 50 per cent) in the *panchayats* of northern Sankhuwa Sabha and north-western and eastern Bhojpur are under forests. Only two *panchayats* in Bhojpur have over 75 per cent of their area under forests. The proportion of area under forests is lowest in Dhankuta.

Figure 3


ARUN WATERSHED
PERCENT. OF AREA UNDER AGRICULTURE
BY PANCHAYAT
SHANKUWASABHA
Kimathanka
Chepuwa
Hellya
Makalu
Pothibhara
Pawakhola
Yaphu
Tamku
Wata
Num
Mangtewa
Diding
Matshapokhari
Barhabise
Siauwa
Kulung
Sitalpati
Chauki danda
Khatma
Nepal danda
Dobhane
Kuwakauli
Mulpani
Matta
Dhupu
Pangma
Sabhapkhari
Jollate
Syabun
Mankamana
Sidhapokhari
Kharkamchha
Kauripani
Tungrupha
Bana
Nunkhola
Kimatung
Sanggang
Deurali
Sidhakali
Chainpur
Bansewar
Mawadin
Timma
Boyo
Khairang
Maimulikharka
Chhinamekhu
Helauchha
Changma
Yangpon
Siddheswor
Ankhibhui
Maamling
Tyauli
Charambi
Tamaphok
Chanuwa
Dandagaon
Khawa
Kalsanga
Anglap
Jorayotar
Yaku
Chyangra
Gogne
Taksar
Legawa
Lashkhe
Dagagaon
Basilim
Sanadumma
Murlidhunga
Ghorikharka
Manebhanjyang
Thulodumma
Phalaka
Sanne
Hattikharka
Bhojpokhara
Ranibas
Pokharibas
Muga
Eu
Hamlang
Chumbang
Sidrang
Khairang
Khoku
Dewantar
Pottepani
Chhintang
Ankhisalla
Hasangur
Below 25 %
25 — 50 %
51 — 75 %
Above 75 %
International Boundary
District Boundary
Panchayat Boundary
Watershed Boundary

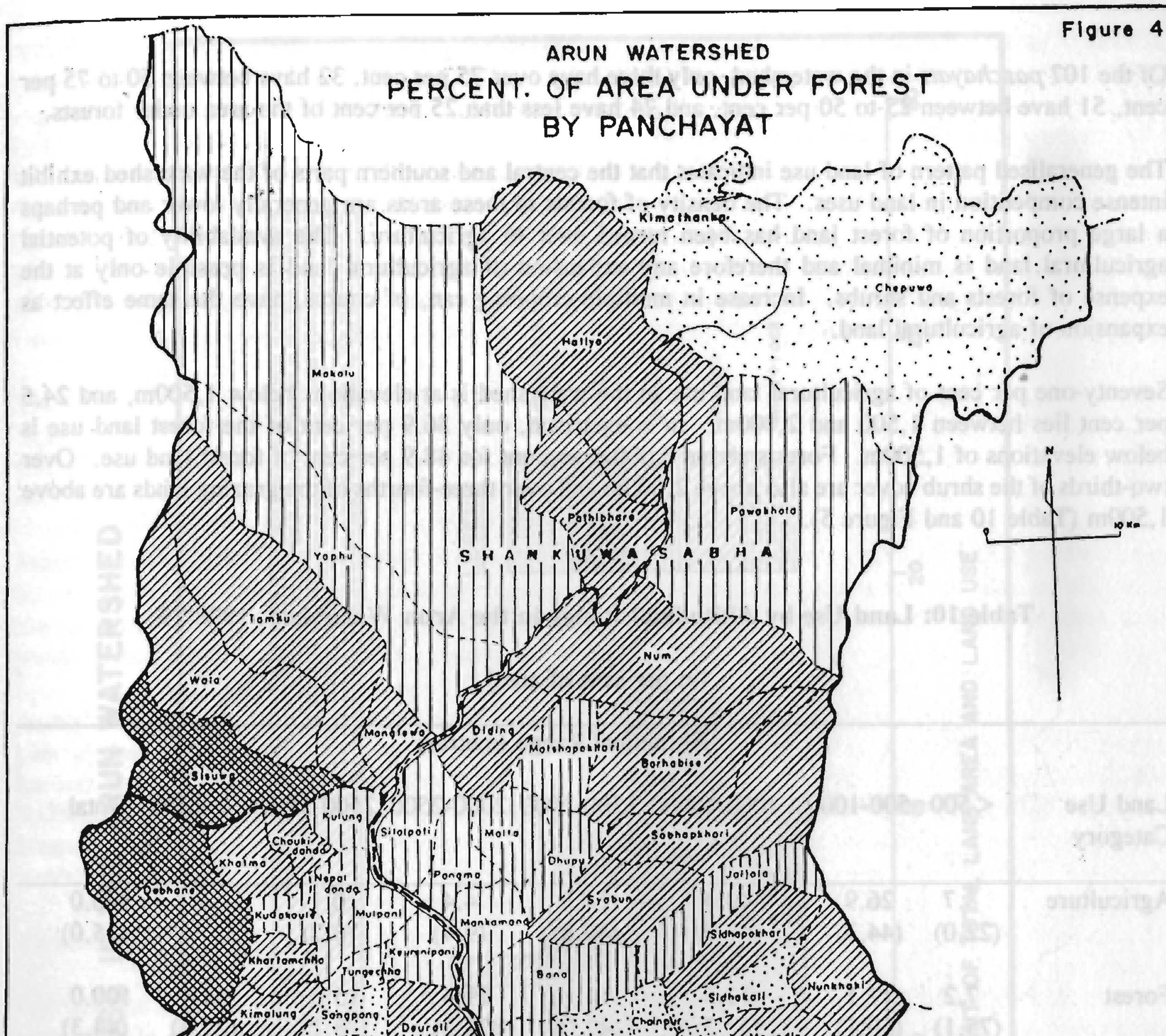


Figure 4
ARUN WATERSHED
PERCENT. OF AREA UNDER FOREST
BY PANCHAYAT
Kimathanka
Chepuwa
Hatiya
Makalu
Pathibhara
Pawakhola
SHANKUWASABHA
Yaphu
Tamku
Num
Wala
Mangtewa
Diding
Matshapokhari
Barhabise
Sisuwa
Kulung
Sitalpati
Maita
Sabhapokhari
Chaukidanda
Khalma
Nepaldanda
Dhupu
Jaljala
Pangma
Syabun
Dobhane
Kudakauli
Mulpani
Mankamana
Sidhapokhari
Kharlamchha
Keurenipani
Tungechha
Bana
Nunkhaki
Kimalung
Sangpang
Deurali
Sidhakali
Chainpur
Baneswar
Mawadin
Madrambeni
Timma
Boya
Khairang
Guptesvar
Chinamakhu
Helauchha
Champe
Yangpang
Madimulkharka
Sidheswor
Mamling
BHOJPUR
Annapurna
Ankhibhui
Bhaisipankha
Pyauli
Charambi
Tamaphok
Nagi
Khawa
Bokhim
Syadhapola
Bhojpur
Tiwarib
Dandagaon
Chanuwa
Kotdanda
Angtep
Yaku
Jarayotar
Marekatahare
Gogne
Taksar
Chyangre
Leguwa
Lekharka
Oshu
Dasgaon
Bastim
Jitpur
Sanadumma
Bhulke
Manebhanjyang
Ghortikharka
Murtidhunga
Dhodalekhani
Thulodumma
Phalade
Sanne
Hatikharka
Baikuntha
DHANKUTA
Bhaisikhora
Ranibas
Mugo
Pakhribas
Hamtang
Chungbang
Eu
Sidrang
Khairang
Khoku
Dewantar
Pattepani
Chhintang
Ankhisalla
Hasanpur
Below 25%
25 — 50%
51 — 75%
Above 75%
International Boundary
District Boundary
Panchayat Boundary
Watershed Boundary
N
10 Km

Of the 107 *panchayats* in the watershed, only three have over 75 per cent, 32 have between 50 to 75 per cent, 51 have between 25 to 50 per cent, and 24 have less than 25 per cent of the area under forests.

The generalised pattern of land use indicates that the central and southern parts of the watershed exhibit intense competition in land uses. The density of forests in these areas are generally lower and perhaps a large proportion of forest land has been turned over to agriculture. The availability of potential agricultural land is minimal and therefore any expansion of agricultural land is possible only at the expense of forests and shrubs. Increase in multiple cropping can, of course, have the same effect as expansion of agricultural land.

Seventy-one per cent of agricultural land use in the watershed is at elevations below 1,500m, and 24.5 per cent lies between 1,500 and 2,000m. In comparison, only 36.9 per cent of the forest land use is below elevations of 1,500m. Forests above 2,000m account for 48.9 per cent of forest land use. Over two-thirds of the shrub cover are also above 2,000m and over three-fourths of the grazing lands are above 1,500m (Table 10 and Figure 5).

Table 10: Land Use by Altitudinal Range in the Arun Watershed, 1978/79

(in per cent of area)

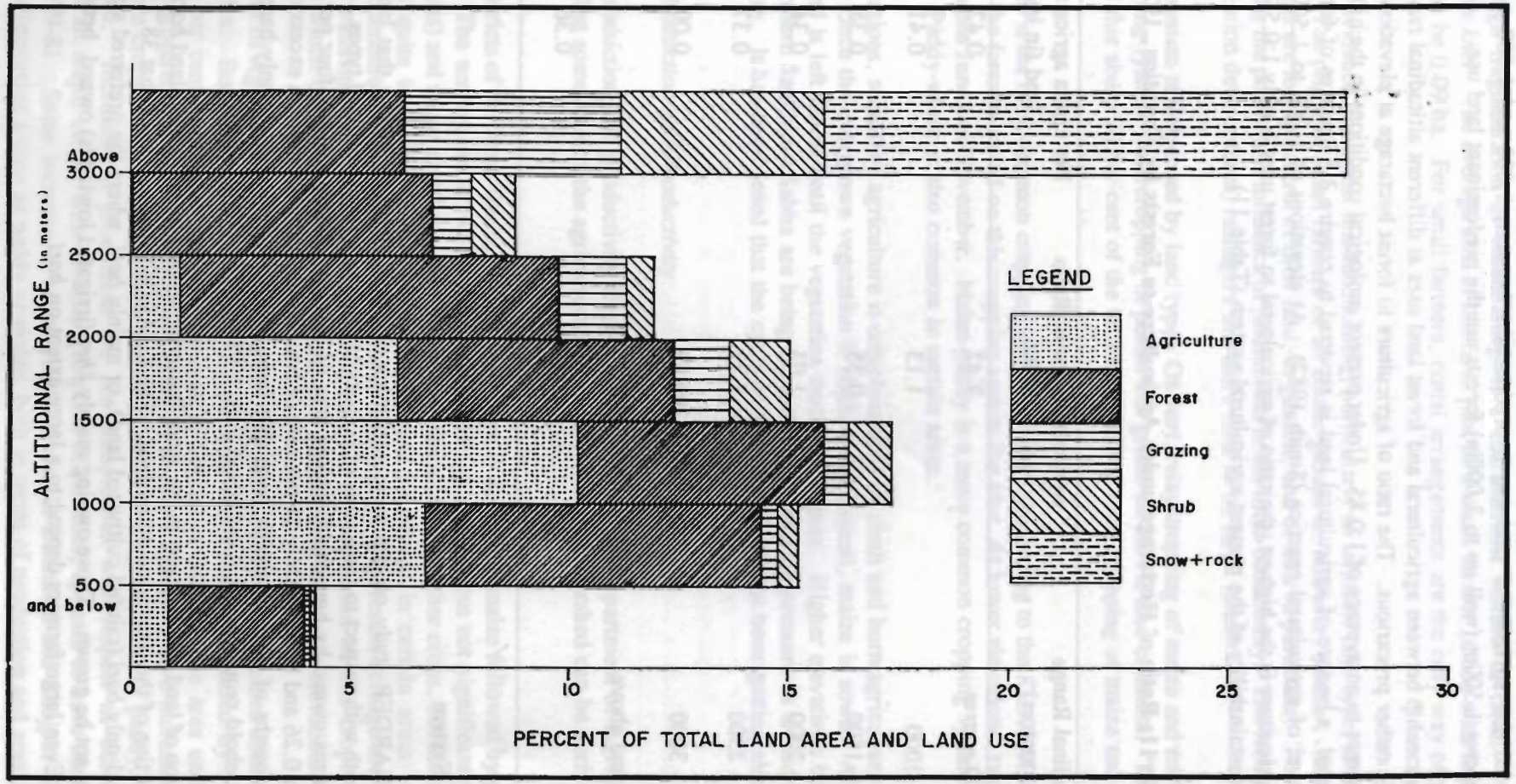
	Altitudinal Range (metres)							
Land Use Category	<500	500-1000	1000-1500	1500-2000	2000-2500	2500-3000	>3000	Total
Agriculture	3.7	26.9	40.4	24.5	4.4	0.1	-	100.0
	(22.0)	(44.3)	(58.8)	(40.8)	(9.4)	(0.2)		(25.0)
Forest	7.2	17.1	12.5	14.1	19.4	15.6	14.1	100.0
	(75.1)	(50.1)	(32.2)	(42.0)	(72.3)	(78.1)	(22.5)	(44.3)
Grazing	7.2	17.1	12.6	14.2	19.3	15.5	14.1	100.0
	(1.5)	(2.3)	(3.4)	(7.9)	(12.8)	(9.9)	(17.7)	(9.5)
Shrub	0.7	5.4	10.4	15.4	7.27	11.4	49.6	100.0
	(1.5)	(3.3)	(5.5)	(9.4)	(5.6)	(11.9)	(16.5)	(9.2)
Snow & Rocks	-	-	-	-	-	-	100.0	100.0
							(93.3)	(12.0)
Total	4.2	15.3	17.3	15.0	11.9	8.8	27.6	100.0
	(100.0)	(100.0)	(100.0)	(100.0)	(100.0)	(100.0)	(100.0)	(100.0)

Source: Computed from LRMP maps

Note: Percentages may not add up to 100 because of rounding.
Figures in parentheses are column percentages.

Figure 5

LAND USE IN THE ARUN WATERSHED



It may be noted that agricultural land use is predominant between 1,000 and 1,500 metres. Below 1,000m and above 1,500m (well up to 3,000m) forests are the predominant land use.

The inter-relationship between agricultural and forest land uses at different altitudinal ranges shows that the situation is rather precarious. The ratio of agriculture to forest hectarage at elevations between 500 and 2,000m comes to an average of 1:0.85. Under present ecological conditions in the hill and mountain regions of Nepal, a hectare of agricultural land is reported to require 3.5 hectares of forests to sustain the present level of agricultural practice (Smith 1982). At elevations of 1,000 to 1,500m, where the intensity of agriculture is the highest, the ratio of agricultural to forest uses is only 1:0.55. This clearly shows the unsustainability of the present agricultural system (Table 11).

Table 11: Ratio of Hectarage under Agriculture to Forests by Elevation, 1978/79

Altitudinal Range (in metres)	Agriculture Forest Ratio (in ha)	Per capita agricultural land (in ha)
< 500 metres	3.42	0.42
500 - 1000	1.13	0.41
1000 - 1500	0.55	0.35
1500 - 2000	1.03	0.34
2000 - 2500	7.71	0.37
2500 - 3000	399.53	0.00
3000 and above	-	-
Total	1.77	0.36

Agricultural System

The 1979 KHARDEP study on the socioeconomics of the Koshi hills shows that land is unevenly distributed, both with respect to farm sizes of households and with respect to land types. Around 20 per cent of the farms owned by households had an area of less than 0.25 ha. Fifty-four per cent had farm sizes between 0.26 and 0.5 ha. Only 26 per cent of households had farm sizes in excess of one ha. For almost three-fourths of the households, available farm size was inadequate or only barely adequate to meet the household requirements (Conlin and Falk 1979: 60-78).

The distribution of land by land type in the Arun Basin shows that unirrigated upland *bari* accounted for a large proportion of the total agricultural land. The KHARDEP study showed that 38.7 per cent of the farmers owned only *bari* (rainfed cultivated land), or mainly *bari*, where the preferred staple crop - wet paddy - could not be grown. Those owning mainly *khet* (irrigated lowlands) owned between 40-69 per cent of *bari*. Even large farmers depend to a large extent on *bari*.

A relatively high fragmentation of landholdings is a characteristic feature of farms. *Bari* are less fragmented than *khet*. The average size of the farm plot of a small farmer (those with less than 0.5 ha) was reported to be 0.09 ha. For small farmers, rental arrangements are the only way of getting access to *khet*.

There is some evidence to suggest that landholding, particularly in terms of land type, is related to caste and ethnicity. The plight of small farmers of all ethnic groups is, however, similar. Small farmers of all ethnic groups are losing control of their land, in general, and of *khet* in particular. The accumulation of *khet* increases the power and influence of households in the local community. The local level political (and by implication development) managers therefore tend to be large farmers.

The cropping system is influenced by land type. On *bari*, relay cropping of maize and millet is the most common cropping system. Intercropping of pulses and grams on *bari* is also common. The KHARDEP study reported that about 70 per cent of the farmers practised relay cropping of maize and millet in *bari* land.

Monsoon paddy is the most common cropping system on *khet*. According to the KHARDEP study, about 60 per cent of the farmers relied on this cropping system for *khet*. At lower elevations, two paddy crops are raised between June and November. Maize-paddy is a more common cropping system on *khet* than paddy-paddy. Paddy-wheat is also common in certain areas.

At higher elevations, sedentary agriculture is complemented by slash and burn agriculture in four to 10 year cycles . Once the overgrown vegetation is slashed and burned, maize is sown. After the maize harvest the land is left fallow until the vegetation reaches a climax. Higher elevations between 2,500-3,000m in northern Sankhuwa Sabha are being subjected to increasing pressure as a result of slash and burn agriculture. It has been noted that the cycle of slash and burn has been getting shorter in recent years.

Agricultural Production and Productivity

Agricultural production and productivity figures available from the Department of Agriculture are not very reliable, but some idea of the agricultural development in the watershed can be derived from these sources.

In the three districts of the Arun Basin, the largest acreage is devoted to maize followed by paddy, millet, and potatoes. The acreage under wheat has risen in the last decade, but not significantly. Barley (at higher elevations) and sugar cane and oilseed (at lower elevations) are other crops, but the acreage under these crops is quite low. Large cardamoms have been introduced in certain areas (notably Madi Mulkharka in Sankhuwa Sabha) and are cultivated as a cash crop. Figures on acreage are not available, but the Arun watershed provides reasonable prospects for the expansion of this crop. Potatoes are cultivated as a winter crop at lower elevations and as a summer crop at higher elevations.

The Department of Agriculture figures show that the area under paddy has increased considerably in the last few decades. Between 1969-71 and 1979-81 the area under paddy increased by 91 per cent in Dhankuta, 21 per cent in Bhojpur, and 61 per cent in Sankhuwa Sabha. The area under maize and potatoes also registered increases. The area under millet does not appear to have increased. Production figures for these crops indicate that between 1969-71 and 1979-81 production of paddy, potatoes, and wheat increased. Increases in production are not conspicuous with respect to other crops. The productivity of all major crops, with the sole exception of potatoes, appears to have declined between 1969-71 to 1979-81. Some increase in wheat yields is seen in Dhankuta and Bhojpur (Table 12) but wheat is not as important a crop as paddy or maize, both in terms of production and area. More recent

figures (1987-89) show that the productivity of paddy has been on the decline in all districts; the productivity of maize and millet has not shown clear declines since 1979-81. Even wheat yields show signs of instability. Potatoes are the only crop clearly showing increasing yields.

The land use and agricultural use situations in the watershed reveal that, although potential land has been gradually brought under relatively intensive agricultural use, the agricultural productivity has not increased. Agricultural production has not kept pace with the "intrinsic" growth of the population. Although the extent to which increases in agricultural inputs can, under existing agro-ecological conditions, bring about increases in agricultural productivity remains a moot point, it is clear, however, that agricultural inputs have not backed up the agricultural production regime of the watershed. The sensitive and complex relationships between population, land use, livestock, and agricultural production and productivity do not seem to be positively affected by the ongoing development process. Studies (Shrestha 1989) indicate that the number of persons and the number of cattle per household are almost equal in the Arun area. This would suggest that the livestock population in the watershed is perhaps larger than the capability of the grazing land to support them. In the absence of grazing land and cheap fodder supplies to support livestock, many small farmers are not in a position to maintain appropriate numbers and types of livestock. The quality of livestock is low and the contribution of livestock to increases in productivity is also low.

Table 12: Yield of Major Crops, 1969-1989
(tons/ha)

	Dhankuta			Bhojpur			Sankhuwa Sabha		
	1969-71	1979-81	1987-89	1969-71	1979-81	1987-89	1969-71	1979-81	1987-89
Paddy	2.35	2.05	2.04	2.22	1.90	1.62	2.35	2.25	2.10
Maize	2.08	1.40	1.47	1.97	1.50	1.41	1.89	1.34	1.53
Millet	1.19	0.89	0.95	1.21	1.00	0.90	1.21	1.06	0.95
Wheat	1.09	1.38	1.35	1.08	1.14	1.13	1.07	1.15	1.41
Potatoes	5.19	6.11	6.83	4.44	5.74	6.08	4.64	5.25	6.75

Source: DFAMS. Agricultural Statistics of Nepal, 1983
Agricultural Statistics of Nepal, 1990

Available information indicates that the agricultural extension services are thinly spread; the use of fertilisers and improved seeds is very low, although all feasible irrigation schemes under existing technological conditions have been taken advantage of. The predominance of *bari* suggests that, under given capital and technology constraints, the land that could be brought under irrigation has already been brought under it. Any expansion in irrigation would, therefore, require external inputs.

The linkages of the Arun watershed with the outside world are mainly expressed in the form of export of forest products (mainly herbs to the southern markets) and import of manufactured goods and other necessities from markets in the *Terai* and India. The administrative centres and market settlements at transportation nodes partially function as centres for the exchange of goods. This exchange network is predominantly south-north oriented. The construction of the Dharan-Dhankuta road has contributed to the expansion of market facilities for import as well as export of goods. It is evident, however, that imports have grown, and have the potential to grow, much faster than exports.

By far the most important linkages of the Arun watershed with the outside world are expressed in the form of migration. Migration of family members, on a seasonal or semi-permanent basis to the *Terai* or India, is a source of income to a large proportion of small farmers. A large part of this income goes to meet household requirements. There is, however, little evidence to suggest that the migration linkage has positively affected the agricultural scenario of the watershed.

Development Infrastructure and Institutions - the KHARDEP Effort

Since 1976, the districts comprising the Arun Basin have been beneficiaries of the Koshi Hill Area Rural Development Programme (KHARDEP) - a U.K. supported attempt at integrated rural development in the Nepalese hills. The primary objective of the programme during its early stages was to increase agricultural production. Subsequently, the scope of the programme was expanded to cover the major sectoral development activities of the Government. The programme was intended to support the overall development process in the Koshi hills in the four districts of Dhankuta, Bhojpur, Sankhuwa Sabha, and Tehrathum. The main objectives of the programme were "to strengthen local services and build up local institutions".

During its first and second phase the programme was multisectoral in character and focussed on eight major areas or sectors. The land use sector included agricultural extension, crop, livestock, and community forestry development programmes. The road sector involved the extension of the Dharan-Dhankuta road beyond Dhankuta. Drinking water, irrigation, trail improvement, and bridge construction were the activities under the local development sector. Training, marketing, and overall support to traditional as well as new crafts were the main focuses of the programme under the cottage industry sector. Agricultural education and teachers' training programmes were activities undertaken in the education sector. Expansion of the training of health-related personnel and integration of health services at the village level were activities pursued in the health sector. Women's development and the development of a system for programme coordination and management were the two final areas of particular concern.

Although the achievements of KHARDEP in terms of the impact made on households and population remain open to conjecture, some of the quantitative achievements may be noted (Dunsmore 1987).

In the land use sector, by 1985, 12 agricultural service centres and 18 livestock clinics had been established. The agricultural service centres were developed as bases for agricultural extension in surrounding *panchayats*. The Pakhribas Agricultural Centre (PAC) was developed as the base for field

trials, resource development, and training to provide backup for the needs of the agricultural sector programmes in general.

PAC has taken the lead in developing a farming system's approach to agricultural research and extension. Field research problems are addressed by working groups dealing with Alternative Technology, Fodder, Farming Systems, and Women. PAC's approach is community-based, and group effort and involvement are given considerable importance. PAC has met with some success in the diffusion of technology to farmers and in bringing about changes in the attitudes of the majority of farmers towards improved and sustainable farming. Wheat and maize crops appear to have increased significantly due to PAC's efforts (Chand and Thapa 1990).

Under the community forestry programme, attention was focussed on the development of *panchayat* forests and the management of *panchayat* protected forests. As of 1985, 42 nurseries were established and *panchayat* protected forests were established in 36 areas.

The Dharan-Dhankuta road was opened to traffic in early 1980. Under the road sector a 22.5 km long road from Dhankuta to Sidhuwa was completed and a further 9.5 km extension from Sidhuwa to Basantpur was approaching completion.

In the area of local development, 52 drinking water projects, servicing around 30,000 people, had been completed by 1984. Eleven irrigation schemes were fully operational and 14 partially operational by 1985. Four suspension bridges were also completed.

Training and support to existing crafts remained the major activity in the cottage industry sector. Dhaka cloth weaving, production of cloth from *allo* (nettle), production of embroidery, bamboo, and pine needle items have been the cottage crafts supported by the programme.

In the educational sector an Agricultural Technical School was established at Uttarpani. Training of Junior Technical Assistants (JTA) or agricultural technical personnel to support agricultural extension work has been the main objective of the school. The Education Resource Centre in Dhankuta was established to train in-service teachers in formal schools. But the Centre was closed in 1985.

In the health sector, a regional centre was established to train village health workers. The overall aim of the programme is to support integrated health posts and expand health extension work, including immunisation.

In the women's development sector, the effort has been to support the Women's Training Centre in Dhankuta through the establishment of field extension services in seven areas.

The KHARDEP effort has been instrumental in creating or supporting development infrastructure and institutions. However, many of the programmes under KHARDEP have relied heavily on outside technical, as well as management, support, and the role of local institutions (with perhaps the sole exception of the Pakhribas Agricultural Centre) has been minimal. The key development actors, in most cases, have not been from within but from outside. People's participation, except in a few instances, has remained limited. The coordination between the line agencies of the Government and expatriate assistance has by and large remained tenuous. The development of institutions has not been complemented by the creation of an effective and workable management system. As a result, while the apparent manifestations of development (such as physical structures) are in place, the conditions for their use by the target population are largely lacking. The programme, as a whole, has neither brought about a change in the system or manner of the delivery of development services nor has it been influential in alleviating poverty or creating conditions for meeting the basic needs of the population that do not have

the resources to do so. The programmes, by their very nature, have not contributed to the expansion of access to or control over resources of a large proportion of the subsistence or below subsistence population.

Although the cottage industry programmes appear to have contributed to the creation of some off-farm employment opportunities, the occupational structure of the population remains unaffected. The establishment of nurseries and afforestation programmes may indicate the potential of better environmental management, but the structural conditions impinging on the environment in the KHARDEP area remain essentially unchanged. Therefore, the conditions leading to out-migration remain as compelling and as operative as ever.

The population parameter (of growth and distribution) appears to have been least affected by the development process brought about through KHARDEP. Indeed, the implications of the programmes on population growth and distribution are neither explicitly stated nor adequately addressed at the field level. The mobility of the population increased after the construction of the Dharan-Dhankuta road. The highway has been instrumental in channelling the flow of goods and services into the region, but the nature of the flow does not seem to have been substantially affected.

In terms of the objectives with which KHARDEP was established, the range of local services has been expanded, but the system for sustaining the services is weak. Local institutions (in the sense of institutions being responsive to the local decision-making process) have not been built up to the extent that they play a major role in the management and support of services that such institutions are expected to provide.

The environmental aspect of the programme was expressed in the implementation of the community forestry programme. The limited nature of the programme's success has been due primarily to the limited participation by local communities. The programme has been largely unsuccessful in creating conditions that would bring about the participation of local communities. This means that issues other than those directly related to afforestation have to be addressed to facilitate afforestation.

The major problem with KHARDEP, as with all integrated rural development programmes, has been one of integration and coordination. The operational processes through which programmes from different sectors can be "integrated" remain largely conjectural. Integration has to be defined in terms of operational complementarity of sectoral activities at the field level, on the one hand, and in terms of the relevance of the programme to the household economy of the poorest segment of the population (i.e., the large majority of small farmers) on the other. Integration has also to be defined in terms of shared management responsibilities between development agencies and local level institutions and communities. These aspects of development do not seem to have been given the attention and importance they deserve in the KHARDEP.

Issues Related to Population and Development

Land resources are and will remain the resources par excellence in the Arun watershed. The issues of development in the Arun Basin have, therefore, to be appreciated in the context of the existing and potential use and productivity of land resources in the face of a growing population.

Development in the Arun, as in the Nepalese hills in general, has been contingent on the flow of external resources. Under KHARDEP, a multi-sectoral development approach has been pursued for almost a decade now. This approach has neither enlarged nor expanded the resource base nor altered the *status quo* with regard to the access to or control over resources for the large majority of the population.

Development efforts have had very little bearing on the parameters of population growth and distribution. The inexorable process of an increasingly poor and growing population, encroaching upon land resources for its mere survival, has been the story of the Arun. Under the existing rural technology and land management system, it is doubtful whether the acreage under agriculture can be substantially increased to bring about increases in output. The environmental implications of further expansion of the existing agricultural system, on to hill slopes, on forested land, and at higher altitudes, in any case are bound to be serious, in any case, if not disastrous.

The key development issues in the Arun watershed are mainly three: How can agricultural productivity be raised? How can the pressure of population on agriculture and land resources be reduced? How can development be managed in a sustainable manner?

The question of raising agricultural productivity is vital because, due to the lack of increase in agricultural productivity, more and more marginal lands will be brought under cultivation, and this will have serious repercussions on the environment and economy of the watershed. At the spatial level, programmes need to focus on specific high-density pockets in the watershed where the environmental impacts of agricultural land use are already serious. Sustainable changes in land use should remain the key concern of development in the Arun Basin. It will become necessary to give priority to activities in terms of environmental hazard areas. At the sectoral level, the key points for intervention to bring about increases in productivity have to be discreetly identified. This is an area where the "integrated" approach can be of great relevance.

The link between environmental quality and the production regime is an often ignored but extremely important link. Therefore programmes and activities designed to bring about increases in productivity have to be tied into programmes and activities to enhance the quality of the environment. The link between environment and productivity-related programmes can be meaningful only when local institutions are nurtured to identify, coordinate, and integrate such activities. External agencies can play a leading role during the initial stages in supporting local institutions, but the programmes and activities can be sustained only when local institutions develop their own capabilities and a management system suited to local needs. It is only through such efforts that public support and participation in development can be generated.

The question of raising agricultural productivity has also to be seen in the context of the existing potentials for specialisation in crops other than cereals. Large cardamom cultivation and horticulture appear to be the two potential areas of exploitation in the Arun watershed. Identification of areas suited to the expansion of large cardamom cultivation and horticulture in the land use context of the watershed would therefore require attention. Diversification of agricultural production in specific localities requires the creation of local marketing channels that can take advantage of the existing infrastructure and assure a stable income to the farmers.

Emphasis on raising agricultural productivity has to be complemented by a concern for the existing disparities in the access to or control over resources. Increases in productivity would disproportionately favour those households which have a higher share in existing resources. By implication the benefit accruing to the large majority of small farmers would be disproportionately less. This would mean that programmes have to be prioritised from the point of view of distribution also.

Insofar as the parameters of population growth and distribution are concerned, the emphasis on programmes to increase agricultural productivity will, in the short and the medium run, have little impact on existing patterns unless diversification of agriculture and specialisation lead to the growth of employment in the secondary and tertiary sectors.

Population pressure on land resources cannot be reduced through an increase in productivity alone. Potential opportunities and a potential resource base for expanding off-farm employment have to be explored. Such income-generating opportunities are presently limited to and dependent upon the agricultural and forestry sectors. Cottage crafts and forest products (mainly herbs) seem to be the two avenues for off-farm employment that exist at present. In the event that construction of the Arun III hydro-electric project is completed and essential electric power provided to major settlements, other off-farm employment opportunities could well become possible. Early exploration of such opportunities would become essential in such an event.

A major thrust towards generating off-farm employment opportunities in environmentally sensitive areas will have the advantage of reorienting the pattern of settlements in addition to reducing the pressure on agriculture. This will make the provision of essential services to far-flung populations easier.

Population pressure on existing land resources is a direct function of the number of people as well as the nature of their demands on environmental resources. The present rate of population growth is clearly not sustainable. While attempts need to be made to bring a larger proportion of the households into the family planning fold, more focussed human resource development policies and programmes need to be pursued. Literacy, particularly female literacy, basic health care, and skill development programmes, vis-a-vis available resources and needs, have to be given priority.

The KHARDEP effort exemplified that the flow of external resources and the creation of institutions at local levels are not sufficient conditions for the success and sustainability of development programmes. Local level institutions have to be made responsive to local needs and encouraged to develop (or capitalise on existing) mechanisms that give the community a sense of shared responsibility in development. In societies such as those in the Arun, traditional mechanisms of social control over the exploitation and use of common resources are fast disintegrating. External influences, rising expectations, and the rise of individualism have all contributed to the demise of traditional mechanisms of social control.

Going back to traditional mechanisms of social control may not be feasible, for the social, economic, and political conditions needed for those mechanisms to be operative no longer exist. Clearly then, development managers and local level institutions have to infuse a sense of shared responsibility among the majority - among the small farmers in particular. A management system responsive to the needs and aspirations of small farmers has to be evolved therefore.