4. PROBLEMS IN MODEL AREAS

4. PROBLEMS IN MODEL AREAS

4-1 Findings of Natural Conditions Survey

(1) Problems with Land Use

Using GIS land suitability classification for each Model Area was conducted. In general, as shown in Table 4-1, the land unsuitable for agriculture (Suitability Class 1) accounts for some 30% while land semi-suitable (Suitability Class 2) accounts for some 60%. The remaining 10% of land is suitable for agriculture (Suitability Class 3). Class 2 land is dominant in each Model Area, followed by Class 1 and Class 3 land.

Table 4-1 Land Suitability Classification by Model Area

(Unit: ha)

Class	Kaski North	Kaski East	Kaski West	Parbat North	Parbat South	Total (%)	
1 (Land unsuitable for agriculture)	3,752	1,086	3,121	2,484	1,440	11,883	(29)
2 (Land semi-suitable for agriculture)	7,911	3,650	5,744	4,706	2,029	24,040	(58)
3 (Land suitable for agriculture)	2,405	735	1,021	687	372	5,220	(13)
Total	14,068	5,471	9,886	7,877	3,841	41,143	(100)

Land suitability classification as presented in Table 4-2 shows that 25% of bari land and 10% of khet land is unsuitable for agriculture. The general picture is that most cultivable land is already cultivated and, therefore, there is little need to fundamentally change the existing land use except at some sites.

Accordingly, the best way to preserve/improve the land productivity, to improve the forest functions and to use grassland in an appropriate manner appears to be the diffusion of concrete management techniques to generally improve the present land use, taking the relationship between various types of land use and the soil characteristics into consideration.

Table 4-2 Area by Land Suitability Class and Land Use

(Unit: ha)

Land Suitability Class	Forest	Shrub	Grassland	Bari Land	Khet Land	Total
1 (Land unsuitable for agriculture)	7,046	314	1,305	2,499	714	11,878
2 (Land semi-suitable for agriculture)	10,926	161	802	8,251	3,889	24,029
3 (Land suitable for agriculture)	390	15	152	913	3,766	5,236
Total	18,362	490	2,259	11,663	8,369	41,143

Note: Alluvial fan and valley bottom flat land are included in Khet land.

(2) Problems with Forests

The general forest conditions have already been described in Chapter 3 under Land Use. Mixed broad-leaved forests account for most of the local forests, acting as supply sources of firewood and fodder, etc. High quality forests are observed in areas with a high elevation and in remote areas, greatly contributing to the water source conservation and erosion control. Table 4-3 classifies forests by the crown density, which is closely related to surface run-off and to soil erosion, for each forest type.

Table 4-3 Area by Crown Density for Each Forest Type

(Unit: ha)

Crown Density	Species					Total (%)	
	Pine	Sal	Mixed Broad-Leaved	Alder	Shrub		
0 - 10%	0	0	0	0	0	0	(0)
10 - 40%	0	0	2,396	37	0	2,433	(13)
40 - 70%	3	210	6,833	54	499	7,590	(40)
70% -	10	1,073	7,692	54	0	8,829	(47)
Total	13	1,283	16,921	145	499	18,852	(100)

Most stands are dense and have a high crown density (40% or more). But the scattered remains of grazing and burning which prevent natural regeneration and facilitate erosion were observed in some places. It is, therefore, necessary to improve the conditions of the existing stands through appropriate management rather than the creation of new forests. Therefore, to encourage forest management by

user's groups it is necessary to assure the groups of the utilization of forest products from the stands to be handed over to them for management.

(3) Problems with Resources Supply and Demand

The balance between the supply of timber, firewood and fodder, all of which are essential forest products for local life, and the demand by local inhabitants was examined using the Basic Guidelines for Sub Watershed Management Planning, 1994 issued by the Department of Soil Conservation as a reference. The results show that the supply exceeds the demand for timber while the opposite is true for firewood and fodder.

In regard to firewood supply, apart from the supplementation of resources by means of forest improvement and planting at degraded land, the use of such alternative energies as biogas and the introduction of improved furnaces will be necessary to prevent the further deterioration of the resources supply function of forests.

In the case of fodder, the demand may be exaggerated because of the lack of accurate data on the number of animals raised. It is possible to produce fodder through forest improvement as well as through planting fodder trees in farmlands. Tentative figures for the supply and demand of forest resources are given below.

< Resources Supply and Demand Balance - Mainly Featuring Forests >

① Timber

Supply		:	18,852 ha × 1.5 m^3 = 28,278 m^3/year
Demand		:	129,384 persons × 0.086 m^3 = 11,127 m^3/year
			→ supply surplus of 17,151 m^3/year

② Firewood

Supply	forests	:	18,852 ha × 3 tons = 56,556 tons/year
	shrub	:	490 ha × 0.5 tons = 245 tons/year
			total supply = 56,801 tons/year
Demand		:	129,384 persons × 0.588 tons = 76,077 tons/year
			→ supply shortage of 19,276 tons/year

③ Fodder

Supply	forests	:	18,852 ha × 0.66 = 12,442 tons/year
	shrub	:	490 ha × 1.00 = 490 tons/year
	grassland	:	2,295 ha × 2.0 = 4,590 tons/year
			total supply = 17,522 tons/year

Demand	cattle	:	14,704 × 0.8 × 2.35 = 27,643 tons/year
	water buffalo	:	36,138 × 0.9 × 2.35 = 76,432 tons/year
	goats	:	14,642 × 0.06 × 2.35 = 2,065 tons/year
			total demand = 106,140 tons/year
			→ supply shortage of 88,618 tons/year

The number of livestock is estimated on the basis of the socioeconomic baseline survey results.

(4) Problems with Soil

The results of the soil sample analysis are given in Table 4-4 and soil fertility is mentioned in ① ~ ④.

Table 4-4 Soil Properties of Model Areas

Item	Kaski North	Kaski East	Kaski West	Parbat North	Parbat South
Cation Exchange Capacity (CEC)	9 - 15	around 10	around 10	high	low
Soil Texture	loam/ sandy loam	loam	clay/silt/ loam	clayey loam	loam
Base Saturation (B-S)	around 10	5 - 40	low	low	low
pH	around 5.0	around 5.0	5.5 or less	alkaline/acid	around 5.0

From the results given in the table, the following observations can be made.

① The CEC value indicating the nutrition retaining capacity is low and, therefore, such slow effect fertiliser as compost should be more effective.

② The soil texture generally shows a high permeability, allowing sufficient groundwater supply.

③ The level of base saturation indicating the soil fertility is low.

④ The level of fertility may further decline without proper management as the soil fertility in the Model Areas is low to start with because of erosion.

(5) Problems of Erosion

① Surface Erosion

Heavy rain, the steep topography and inadequate farmland management have caused surface erosion at bari land and grassland in the Model Areas, seriously affecting the watershed. Although the level of erosion from forests and khet land is within the estimated tolerable soil loss of 10.0 tons/ha/year, the level of erosion from bari land and grassland of 10 - 20 times the tolerable amount is alarmingly high. It is, therefore, necessary to implement soil loss control measures, such as terrace improvement and agroforestry, at bari land and grassland.

② Landslides

The number of landslides by land use type per 100 ha is the largest at grassland with 6.98, followed by bari land with 1.90, shrub with 1.63, forest with 1.20 and khet land with 0.85 as shown in Table 4-5. In terms of slope, the number of landslides per 100 ha is 2.50 for slope of more than 60%, 1.93 for 30 - 60%, 0.32 for 15 - 30%, 0.10 for 3 - 15% and 0.0 for 0 - 3% (Table 4-6).

Table 4-5 Number of Landslides by Land Use Type

(Unit: sites/100 ha)

Land Use Category	Small Landslides	Large Landslides	Total
Forest	0.94	0.27	1.21
Shrub	1.45	0.18	1.63
Grassland	5.54	1.44	6.98
Bari Land	1.65	0.25	1.90
Khet Land	0.41	0.44	0.85

Table 4-6 Number of Landslides by Slope Category

(Unit: sites/100 ha)

Slope Category	Small Landslides	Large Landslides	Total
0 - 3%	0.00	0.00	0.00
3 - 15%	0.10	0.00	0.10
15 - 30%	0.32	0.00	0.32
30 - 60%	1.52	0.41	1.93
60% -	2.24	0.26	2.50

③ Erosion Hazard

Mass movement such as landslides, debris flow, river bank erosion and gully erosion occur in the Model Areas, mainly due to the fragile local geology and steep topography. External factors triggering mass movement, especially landslides, in the Model Areas are heavy monsoon rains and seismic activities.

Every year, houses, farmland, footpaths, bridges and livestock in the Model Areas suffer damage due to landslides, bank erosion and other forms of mass movement. This makes it desirable for local inhabitants as well as planners to have some knowledge of the location and level of mass movement hazards to enable them to decide on appropriate measures to mitigate damage. Consequently, hazard sites are predicted to indicate potential mass movement such as landslides and slope collapse.

The area of hazardous sites by land use type in each Model Area is shown in Table 4-7. According to the said table, high hazard sites, medium hazard sites and low hazard sites account for 5.7%, 37.7% and 57.6% respectively, suggesting that some 43% of the total land has a high hazard potential. In terms of the land use type, the proportions of high and medium hazard sites are recorded for bari land (9% for high hazard, 69% for medium hazard and 22% for low hazard) and grassland (35% for high hazard, 55% for medium hazard and 10% for low hazard), indicating that these land use types have a high slope collapse potential, particularly grassland where the medium and high hazard categories total 90%.

Table 4-7 Distribution of Hazard Sites by Land Use Type

(Units: ha, %)

Land Use Type	Low Hazard		Medium Hazard		High Hazard		Total	
Forest	15,147	(80)	3,654	(19)	24	(1)	18,825	(100)
Shrub	269	(51)	217	(42)	37	(7)	523	(100)
Khet Land	5,489	(70)	2,316	(30)	28	(0)	7,833	(100)
Bari Land	2,554	(22)	8,057	(69)	1,051	(9)	11,662	(100)
Grassland	225	(10)	1,263	(55)	812	(35)	2,300	(100)
Total	23,684	(58)	15,507	(38)	1,952	(5)	41,143	(100)

4-2 Findings of Socioeconomic Conditions Survey

Each Model Area faces a number of problems which affect the lives of local people to different degrees. The main problems are discussed below.

(1) Shortage of Food

People living in the Model Areas generally suffer from a food shortage. As shown in Table 4-8, a food shortage is a common problem for all mountainous and hilly areas in Nepal.

Table 4-8 Food Production/Consumption Balance

Ecological Zones	Food Production (1,000 MT)	Consumption Requirement (1,000 MT)	Surplus/Deficit (1,000 MT)	Surplus/Deficit (%)
Mountains	123	180	-57	-46.3
Hills	988	1,175	-157	-18.9
Terai/Plains	1,641	1,223	418	25.5
Nepal	2,752	2,578	74	2.7

Source: Issues of Mountain Development 97/1, ICIMOD (1996)

(2) Shortage of Firewood

People living in the Model Areas depend on firewood as their fuel but many find it difficult to obtain the required amount of firewood because of the great distance of firewood forests from their communities and/or the insufficient supply of firewood from these forests to meet the consumption requirement. In addition, firewood collection is such hard work that people give first priority to a reduction of this workload. Improved furnaces which are highly efficient in terms of reducing the firewood consumption volume are not yet widely used in the Model Areas.

(3) Shortage of Tree Fodder

Livestock are a crucial source of cash income, nutrition, pulling power and farm manure and tree fodder is the most important animal feed during the dry season when grass becomes scarce. As in the case of firewood, people in the Model Areas face difficulties in obtaining tree fodder.

(4) Shortage of Drinking Water

Most people in the Model Areas depend on piped water or springs for drinking water. Approximately 40%, however, face a supply shortage during the dry season. The problem of a drinking water shortage relates to both access (distance) to water sources and the water availability volume. Access to water sources is of crucial importance for women who are responsible for fetching drinking water. As good access to water sources directly reduces the burden of water fetching work for women, it is an important issue for local life.

(5) Damage by Landslides

There are many signs of landslides of various sizes in the Model Areas, indicating the occurrence of landslides in the past. The hazard prediction maps prepared by the Study suggests that many places in the Model Areas are associated with a medium or high landslide hazard. Some areas are particularly prone to landslides, causing strong concern on the part of local people. While the major causes of landslides are fragile geological conditions, high rainfall level with occasional downpours and insufficient vegetation cover of sloping land, the inadequate implementation of landslide prevention and rehabilitation measures constitutes another factor.

(6) Poverty

Many people in the Model Areas face such problems as ① difficulty of earning cash due to the scarce employment opportunities, ② lack of spare time to earn cash income due to the excessive workload, ③ inability to produce sufficient food due to the small farmland size, ④ low crop productivity due to the poor soil fertility and insufficient replenishment of nutrients and ⑤ shortage of essential resources for daily life such as water and firewood.

In addition to the above problems which affect local life, there also appear to be social problems, including ① inadequate public services, such as education, public health and hygiene, agricultural extension and soil conservation projects, ② a low level of education among adults (particularly women), ③ poor awareness of the importance of environmental conservation among local people, presumably because of inadequate educational activities and ④ poor access to water, land and forest resources for households of occupational castes. All of these problems are common problems in hilly areas in Nepal as well as in other mountainous countries and are closely related to the question of environmental conservation in watersheds.

4-3 Summarizing the Problems

Most bari land in the Model Area is located on steep slopes and the high rainfall level makes bari land vulnerable to soil erosion. Moreover, the soil fertility is generally poor and the nutrition retaining capacity (CEC) is also low. Given the likely increase of the impacts on farmland by demographic changes, inappropriate use of farmland and food deficit in the Model Areas, "the decline of land productivity" is another major problem affecting the watershed.

Forests provide various resources, including firewood, fodder, timber and fallen leaves, for local inhabitants and also contribute to the stabilisation of local life through the soil conservation and water source conservation. In the past several decades, even though the total forest area of the Model Areas has not substantially decreased, local inhabitants are now pointing out a shortage of all of the above-mentioned forest products. If the present situation continues, due to the population increase, non-participation in community forest schemes and excessive grazing in forests, forests will be further degraded which will have a negative effect on watershed environment. The frequent occurrence of landslides and other types of mass movement and erosion as well as the wide distribution of hazardous land in the Model Areas significantly affect local life. The importance of this problem is underlined by the frequent experience of and strong concern in regard to disasters among local inhabitants. In short, ① a decline of land productivity, ② forest degradation and ③ widespread erosion and related disasters have been identified as three key problems of watershed degradation.

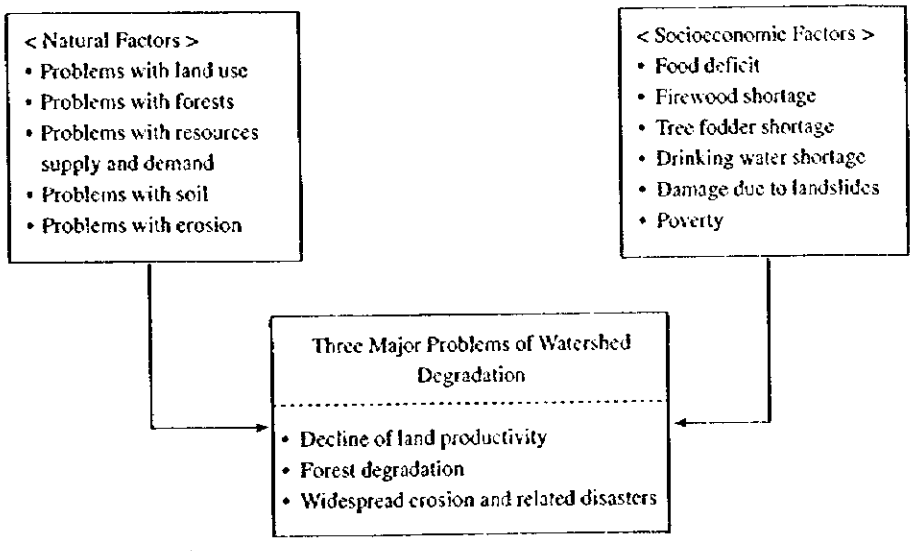

Fig. 4-1 Relationship Between Current State of Model Areas and Problems of Watershed Degradation

4-4 Problems and Their Impacts

Degradation of the watershed environment in the Model Areas has various impacts on the lives of the people living in the relevant watershed. Fig. 4-2 shows the major causes and impacts of degradation of the watershed environment.

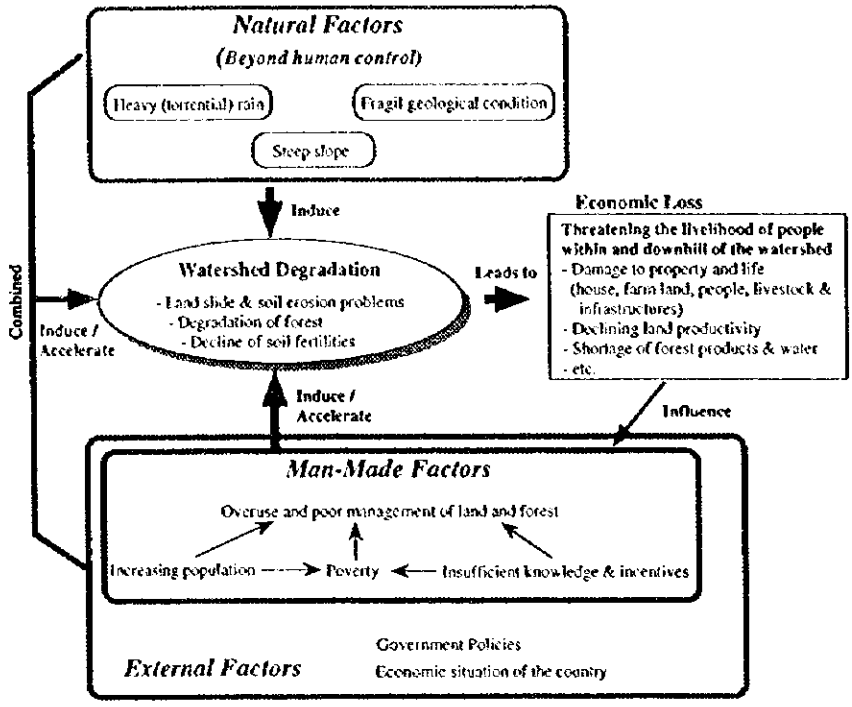

Fig. 4-2 Watershed Degradation and Its Implication

The causative factors of watershed degradation are largely classified into natural and socioeconomic (man-made factors). These factors independently, or often in combination, lead to watershed degradation and result in economic loss both within and downstream a particular watershed. This triggers a vicious cycle in which the economic loss causes adverse impacts on local life, worsening the socioeconomic factors, in turn further degrading the watershed environment.

Natural factors are characterised by the fact that they are normally beyond human control. For example, the topography of the Model Areas is dominated by steep slopes while a large part of the heavy annual rainfall is concentrated in the monsoon season. Localised downpours occur from time to time. Moreover, the presence of two major faults and

many minor faults in the Model Areas means that the bedrock has been fractured in various places.

In contrast, man-made factors can be improved. These factors can be summarised as "the excessive use and insufficient management of land and forest resources" originating from population increase, insufficient technical and financial assistance and poverty, etc. Many socioeconomic problems form the background for the excessive use and insufficient management of these resources.

4-5 Watershed Degradation and Hill Communities

People living in the Model Areas largely depend on the available resources in the watershed and their use of such resources has been partly responsible for the degradation of the watershed environment.

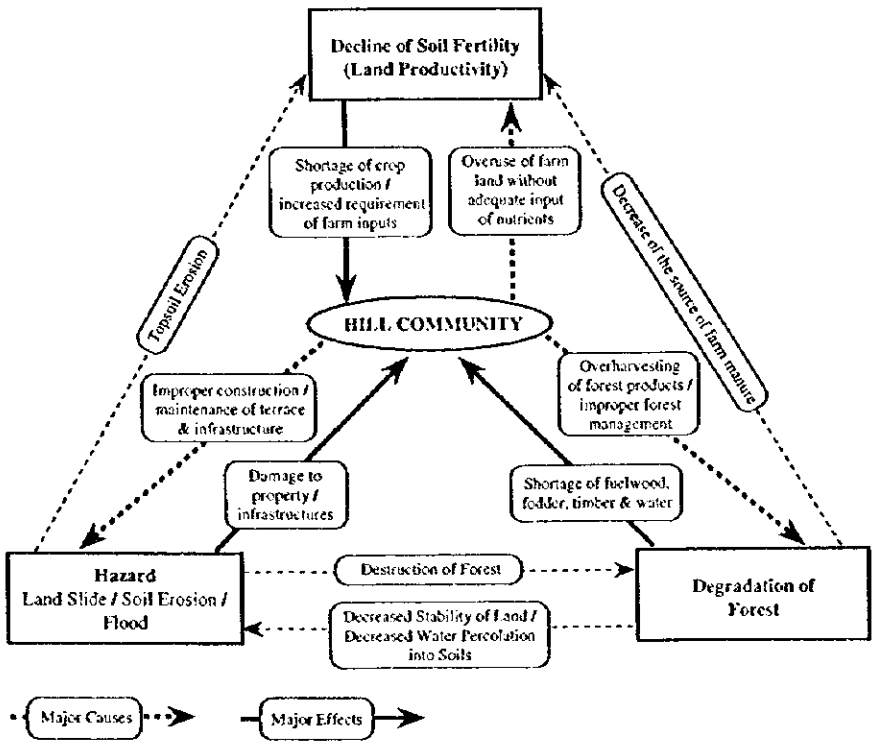

Fig. 4-3 Linkage Between Watershed Degradation and Hill Communities

(1) The main cause of the decline of land productivity on the part of local communities is the excessive use of farmland without sufficient replenishment of the soil nutrients. As a result, the crop productivity declines, forcing communities to implement measures to maintain productivity.

(2) The problem of forest degradation is caused by the excessive use of forests and inadequate forest management and local communities are facing a shortage of firewood, tree fodder and timber.

(3) The direct impacts of the activities of local communities on landslides, soil erosion and flooding include ① the use of geologically fragile steep slopes as farmland, ② the inadequate maintenance of terraces and ③ the lack of drainage facilities and the lack of treatment of cut and fill slope surfaces at roads and footpaths to prevent erosion.

As described above, these three problems of watershed degradation originate from the activities of local communities which, in turn, directly affect the living conditions of such communities. Moreover, there is also a causal relationship between these problems.

4-6 Causes of Watershed Degradation

4-6-1 Causes of Decline of Land Productivity

The household survey results indicate that local people show a high degree of interest in "crop productivity" which is largely determined by land productivity. In fact, their interest in crop productivity is third on the list after "cash income" and "roads". As the top two topics appear to represent people's wishes rather than interest, the problem of crop productivity which is closely related to land productivity could be described as the matter of highest concern among local people in regard to their everyday lives.

Fig. 4-4 shows the causal relationship between the problems and their causes based on an indepth analysis of the causes of the decline of land productivity. Here, the causes are largely classified into three categories, i.e. (1) over-use of farmland, (2) insufficient input of soil nutrients and (3) loss of nutrients through erosion of top soil.

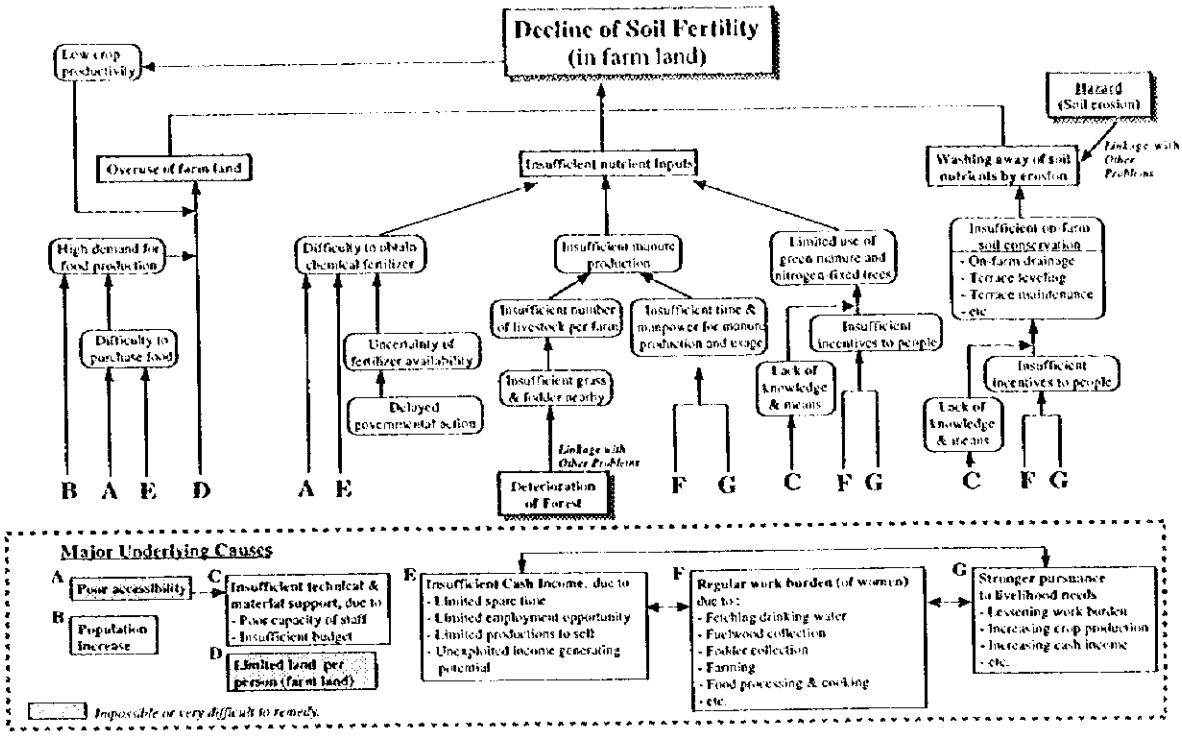

Fig. 4-4 Causes of Decline of Land Productivity

(1) Over-Use of Farmland

According to the household survey, the cropping intensity in the Model Areas is an average of 200% (185% and 224% for khet land and bari land respectively). This cropping intensity is the same level as that in the western hill area studied by the Land Resource Mapping Project (1986) but is higher than the national average cropping intensity (177%).[5] This high cropping intensity is presumably caused by the fact that the limited scope for farmland expansion, despite the increase of the population/households, makes the efficient use of the available land necessary for increased food production.

[5] Statistical Pocket Book of Nepal (1996), Central Bureau of Statistics

Table 4-9 Average Farming Area per Household and Cropping Intensity by Model Area

Item	Model Area					
	Parbat North	Parbat South	Kaski East	Kaski North	Kaski West	Total
Average Khet Land Area per HH (ha)	0.30	0.19	0.27	0.30	0.32	0.29
Cropping Intensity (%) at Khet Land	194	226	139	181	169	185
Average Bari Land Area per HH (ha)	0.19	0.19	0.21	0.15	0.15	0.17
Cropping Intensity (%) at Bari land	201	210	204	245	257	224

Note : The cropping intensity shows the frequency of farmland use for crop cultivation by percentage figure (intercropping is also included).
Source: JICA/Multi-Disciplinary Consultants (P) Ltd., Household Survey, 1996

The cropping intensity is largely affected by not only the degree of farmers' willingness to cultivate but also the natural conditions (temperature and rainfall) as well as the availability of irrigation facilities. As Table 4-9 indicates that the cropping intensity is high in areas with a smaller farmland area per household, it may be the case that farming households with a small area of farmland are responsible for the high cropping intensity through their efforts to use their farmland to the maximum in order to alleviate the food shortage as much as possible.

(2) Insufficient Input of Soil Nutrients

Although chemical fertilisers do not essentially improve the soil fertility as such, they are used to replenish the necessary nutrients for crops, particularly for high yield varieties of paddy rice and wheat, etc. In particular, the quantity of chemical fertiliser used for khet land is 35 kg/ha and 67 kg/ha for paddy rice and wheat respectively, showing a contrasting figure to bari land where fertiliser is hardly used. Nevertheless, it is currently unrealistic to rely mainly on chemical fertilisers to replenish soil nutrients because of the prohibitively high price for most farming households and the poor accessibility to the fertiliser market.

The application of farm manure to farmland is a traditional means of preserving the soil fertility and most farming households still raise livestock to use the manure as a fertiliser for their farmland. One reason for the insufficient production of farm manure lies with the situation in which the number of large livestock, such as cattle and water buffaloes, which are essential for the production of farm manure cannot be increased because of the limited supply of

tree fodder, in turn due to forest degradation and the shortage of forest area. Meanwhile, the insufficient application of farm manure can be partially explained by the fact that women, who are mainly responsible for the collection of fodder to produce farm manure and for the transportation of farm manure, lack the necessary time because of their engagement in more essential daily work, such as water fetching and firewood collection, and also in work which provides them with a cash income.

Green manure and nitrogen-fixing plants (such as leguminous plants) are currently seldom used in the Model Areas, mainly due to inadequate knowledge on the part of local people and insufficient external support. The higher priority of other daily work is also a contributory factor to the little use of green manure and nitrogen-fixing plants.

(3) Loss of Soil Nutrients

Another factor causing the decline of soil fertility is the loss of soil nutrients due to the erosion of the top soil of farmland. This type of soil erosion is caused by sloping terrace surfaces, lack of adequate drainage channels and insufficient terrace maintenance and repair. Behind the insufficient erosion control lies a lack of knowledge on erosion control measures, the absence of many men who are supposedly responsible for control work due to their working away from home and a lack of spare time due priority being given to other essential work (such as water fetching) which is directly linked to daily life and to work which produces a cash income.

4-6-2 Causes of Forest Degradation

Forest degradation in this Study is defined as the condition where forests cannot fully perform their essential functions (supply of various resources for local life and soil conservation) due to inadequate forest conservation and management. The survey has found that local people have medium or strong interest in issues related to forest degradation. The causes of forest degradation are largely classified into three categories, i.e. (1) over-use of forest resources, (2) insufficient forest management and (3) landslides and slope failures.

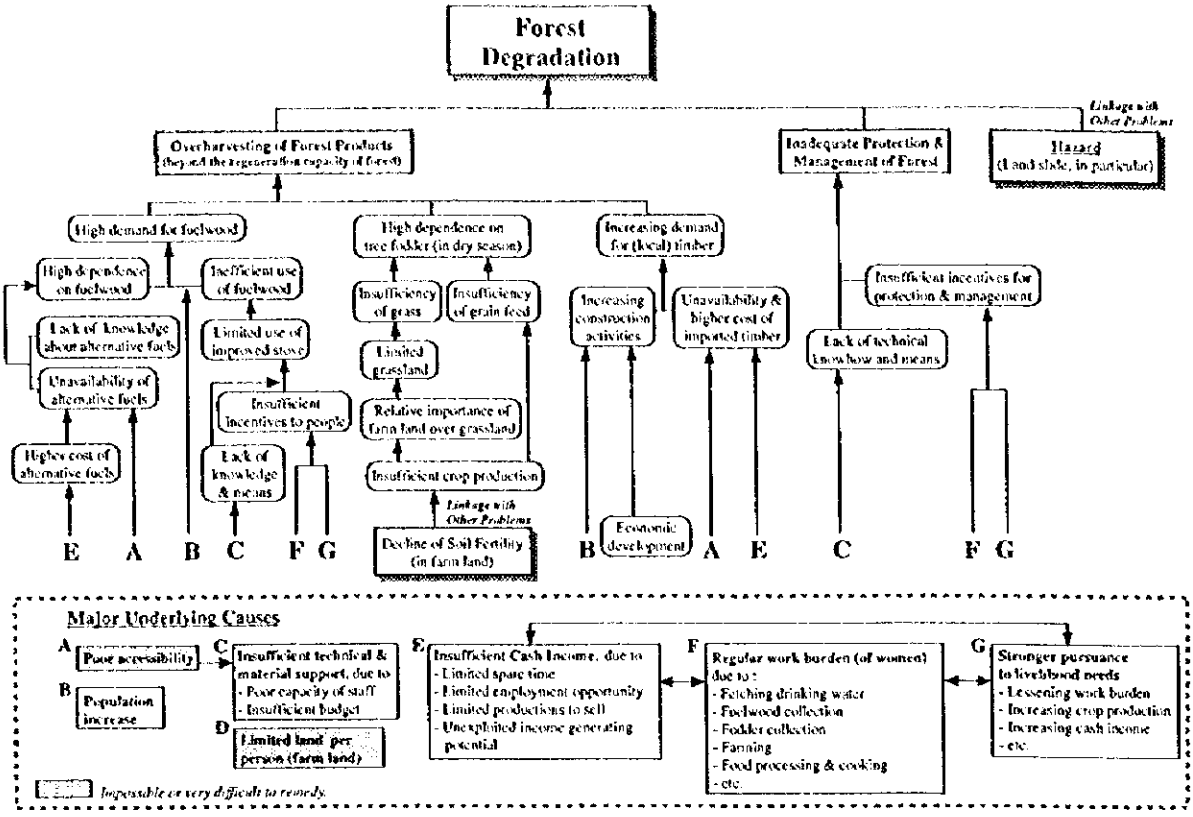

Fig. 4-5 Causes of Forest Degradation

(1) Over-Use of Forest Resources (Excessive Use Beyond Its Reproduction Capacity)

Forests function as sources of firewood, livestock feed, timber, fallen leaves for manure and bedding, medicinal plants and food. The key resources are firewood, livestock feed and timber and their excessive use beyond the reproduction capacity of forests causes forest degradation.

One of the reasons for the high level of firewood use is the necessity to almost entirely rely on firewood as a fuel source because of the impossibility of using alternative fuels (kerosene and biogas) due to the economic and natural conditions (access and temperature) as well as the lack of appropriate knowledge and technologies. Another reason is the slow progress of the use of improved furnaces which can achieve efficient firewood use. Behind this slow progress lie insufficient extension and educational activities, failing to extend knowledge and technologies of improved furnaces to local people.

Livestock are not only important as a source of pulling power, nutrients and cash income but are also essential to produce the farm manure required for the preservation of soil fertility. Livestock in the Model Areas are fed with tree fodder, grass, crop residuals and grain. During the dry season when the supply of grass is scarce, tree fodder is practically the only fresh feed, resulting in strong dependence on it (see Fig. 4-6), in turn leading to the over-use of forest resources.

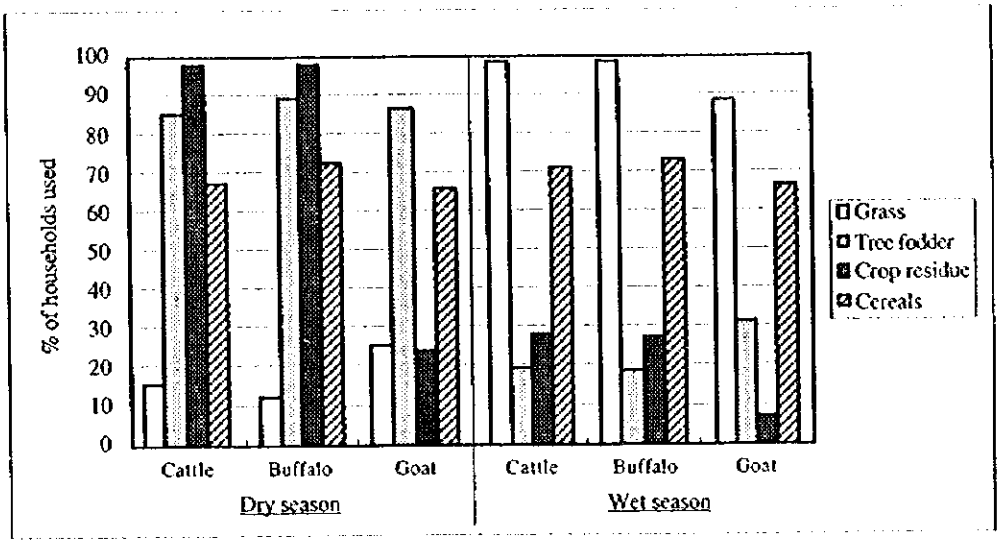

Fig. 4-6 Use of Livestock Feed by Season

The socioeconomic baseline survey results indicate the importance of the forest function of supplying timber for local people, after firewood and tree fodder. One reason for the over-use of forest resources could be that the demand for timber following an increase of the number of households and an increase of local economic activities is higher than the supply volume. Although timber can be supplied from other areas, the poor access to the Model Areas increases the price to a level which cannot be met by poor people in the Model Areas.

(2) Insufficient Forest Management and Forest Conservation

Insufficient forest management and forest conservation efforts on the part of local people is also a contributory factor of forest degradation. Table 4-10 shows the areas of forests/community forests by Model Area.

Table 4-10 Area of Forests and Community Forests by Model Area

	Model Area					
	Parbat North	Parbat South	Kaski East	Kaski North	Kaski West	Total
Total Area (ha) [1]	7,877	3,841	5,471	14,068	9,886	41,143
Forest Area (ha) [1]	2,298	651	2,904	7,674	5,325	18,852
Proportion of Forest Area (%)	29	17	53	55	54	46
Area of Community Forests (ha)[2]	878	207	100	833	938	2,956
Proportion of Community Forests in Total Forest Area (%)	38	32	3	11	18	16
Proportion of Households which are Members of Community Forests (%) [2]	28	17	22	68	81	47

Sources: 1) Measurement by GIS
2) Household & Administrative Surveys, JICA/Multi Disciplinary Consultants (P) Ltd. (1996)

Officially approved community forests in the Model Areas only cover some 16% of the total forest area. There are two reasons as described below why forest management is making slow progress despite the relatively strong interest in forest resources among local people.

① Insufficient External Support

The proportion of adults with experience of external support in relation to firewood production, tree fodder production and activities regarding general forest resources of 5.5%, 4.1% and 8.2% respectively is very low. It is believed that the lack of action in regard to the appropriate management of forest resources on the part of local people despite their strong interest can be partly attributed to insufficient external support.

② Lack of Incentives

The people in the Model Areas are generally poor and many young men work outside the Model Areas. The women who stay behind are too busy with daily essential work to sufficiently conduct forest management and conservation. Consequently, the voluntary involvement of local people in forest management without attractive incentives which are to their own benefit is difficult to achieve.

(3) Landslides

There are many traces of landslides of varying scales throughout the Model Areas.

4-6-3 Causes of Landslides, Soil Erosion and Floods

Such disasters as landslides, soil erosion and floods occur as a result of a degraded watershed environment, which in turn is caused not only by man-made factors, including forest degradation, inadequate prevention measures and a lack of implementation or rehabilitation measures, but also by natural causes beyond human control, such as localised downpours, fragile geology and steep slopes as described earlier.

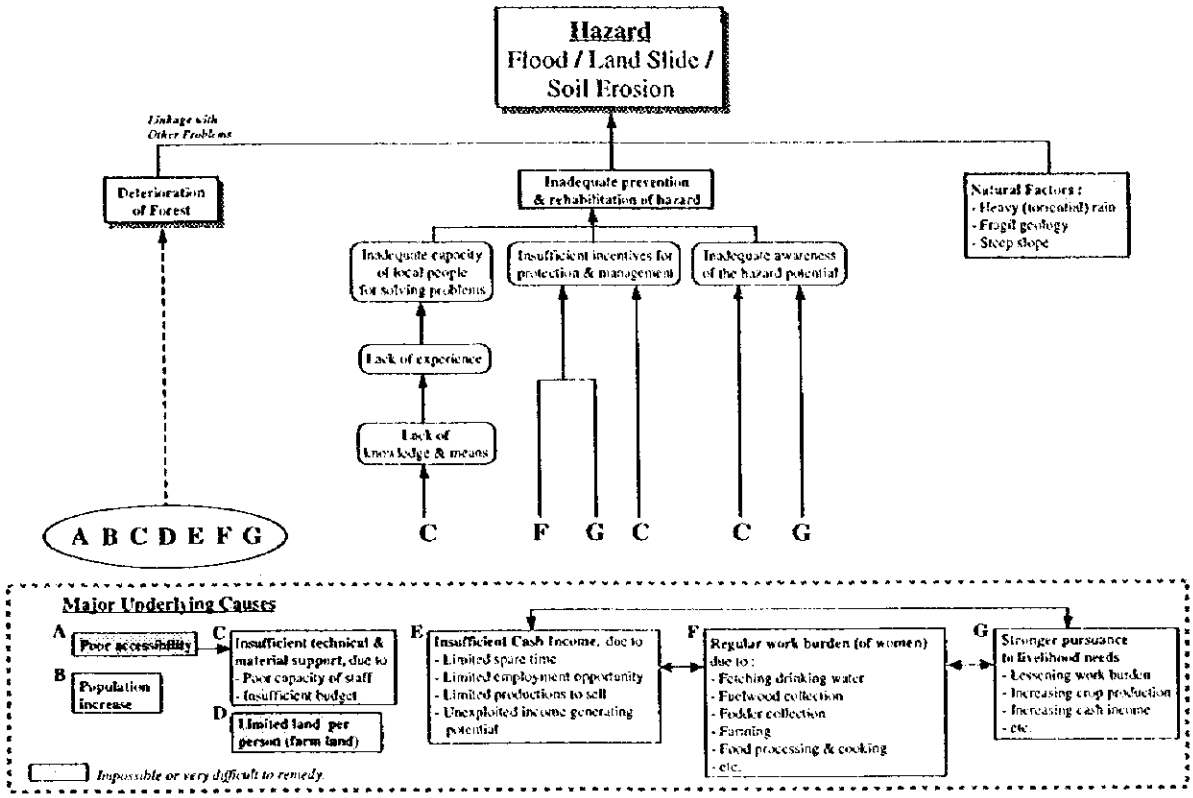

Fig. 4-7 Causes of Natural Disasters (Landslides/Soil Erosion/Floods)

(1) Forest Degradation

As described in 4-6-2, typical causes of forest degradation are the over-use of forest resources, inadequate management and conservation and landslides and slope failures. There are seven more fundamental causes behind these as shown in various figures (Figs. 4-4, 4-5 and 4-7).

(2) Inadequate Prevention Measures and Lack of Implementation of Rehabilitation Measures

The inadequate prevention measures and lack of implementation of rehabilitation measures are affected by the following three factors.

① Inadequate Ability or Lack of Ability of Local People to Implement Disaster Prevention Projects

The inadequate disaster prevention knowledge and technical expertise of local people and the difficulty of obtaining the necessary materials make it difficult for local people themselves to implement disaster prevention projects without external support. Table 4-11, which compiles the survey findings on disaster experience (frequency of disaster damage to farmland), degree of awareness (concern) and experience of participating in collective action, shows the extremely low experience level of participation in disaster prevention activities and external support despite experience of disasters (to farmland) and a fair degree of awareness.

Table 4-11 Baseline Survey Results on Disasters

Disaster	Item	Model Area					
		Parbat North	Parbat South	Kaski East	Kaski North	Kaski West	Total
Landslide/ Soil Erosion	Households whose farms are frequently affected by landslides*	33%	31%	9%	12%	12%	20%
	Households whose farms are frequently affected by soil erosion*	11%	15%	7%	3%	1%	7%
	Degree of awareness (score)	61	65	45	40	55	53
	Experience of participating in collective action	11%	11%	13%	11%	22%	13%
	Experience of receiving external support	1%	0%	2%	2%	6%	2%
	Proportion of those willing to participate	81%	84%	80%	67%	85%	78%
Flooding	Households whose farms are frequently affected by flooding*	10%	10%	30%	14%	12%	13%
	Degree of awareness*	42	46	55	41	52	45
	Experience of participating in collective action	5%	8%	23%	12%	18%	11%
	Experience of receiving external support	1%	1%	4%	2%	5%	2%
	Proportion of those willing to participate	70%	74%	82%	68%	82%	73%

* Includes households whose farms are "occasionally" or "regularly" affected.
Source: Household Survey and Household Member Survey, JICA/Multi-Disciplinary Consultants (P) Ltd. (1996)

② Insufficient or Lack of Incentives to Implement Prevention Measures

Even though people are aware of the necessity for disaster prevention activities, they are unlikely to take the initiative because of various reasons, including the high ratio of absence of local male adults who tend to work outside the Model Areas, the heavy burden of day-to-day work of women and the priority of work which provides a cash income to purchase food and other daily necessities, a reflection of the fact that people in the Model Areas are generally poor.

③ Insufficient Attention to Disaster Potential/Hazard on Part of Local People

The awareness of local people in some communities of the disaster potential/hazard is low despite the existence of a high potential/hazard. This is partly because of the lack of experience of a serious disaster and partly because of the lack of educational activities by government and other organizations.

4-6-4 Fundamental Causes of Watershed Degradation

The following seven fundamental causes are common to all problems of watershed degradation as shown in Figs. 4-4, 4-5 and 4-7.

(1) Poor Accessibility

Hardly any vehicle road exists in the Model Areas and access to these areas is extremely poor because of the steep topography. According to the socioeconomic baseline survey results, the average one-way travelling time on foot to the nearest vehicle road in the 307 wards in which the survey was conducted is approximately three hours. In 55 wards or 18% of the total number of wards, the travelling time is more than five hours.

(2) Population Increase

As mentioned in 3-3-1 (1), the figure is nearly the same as the national CWR figure for 1991 (Fig. 4-8). This finding suggests that while the birth-rate in the Model Areas is high, the outflow of adults seeking employment outside the Model Areas suppresses the population growth rate on the surface.

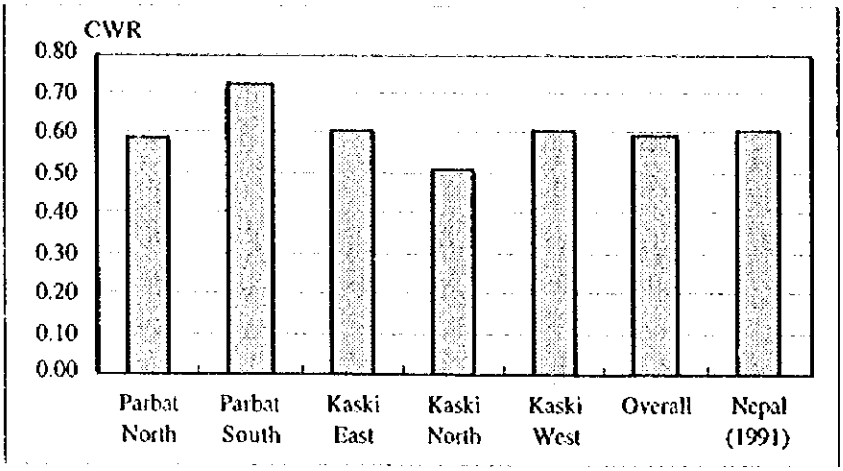

Fig. 4-8 CWR (Child-Woman Ratio) of Model Areas

(3) Insufficient External Support (Technical and Financial)

Table 4-12 shows the experience of external support of local people in different fields.

External support means the technical and financial assistance of government organizations and NGOs. The figures by Model Areas indicate that the Kaski District receives more external support than the Parbat District, presumably because of more vigorous support activities prompted by the better access to the Model Areas in the Kaski District.

In terms of the subject field, external support appears to be concentrated on "the supply of drinking water", "the supply of electricity", "education" and "health and hygiene" and little support is provided for the three major areas related to watershed degradation, i.e. "land productivity" (represented by the closely related cropping productivity), "forest resources management and conservation" and "disaster prevention".

Table 4-12 Ratio of Local People with Experience of External Support

(Unit: %)

Subject Field	Model Area					Average
	Parbat North	Parbat South	Kaski East	Kaski North	Kaski West	
Drinking Water Supply	24	43	74	76	55	52
Cropping Productivity Improvement (Agricultural Extension)	1	4	1	1	3	2
Vehicle Road Construction/Improvement	2	1	5	27	30	14
Footpath Construction/Improvement	8	5	20	19	35	17
Irrigation Facility Construction/ Improvement	6	2	9	13	9	7
Electricity Supply	2	0	0	65	52	29
Education of Children	26	34	14	23	3	21
Health and Hygiene	11	28	41	10	13	16
Family Planning	12	14	14	12	8	12
Forest Resources Management and Conservation	7	4	6	10	11	8
Disaster Prevention (Landslides and Erosion)	1	0	2	2	6	2
Disaster Prevention (Floods)	0	1	4	2	5	2

Note : The figures are the simple average of the ratios of men and women who have experience of receiving external support.

Source : JICA/Multi-Disciplinary Consultants (P) Ltd., Household Member Survey, 1996

(4) Shortage of Farmland (Compared to Population Size)

The present farmland in the Model Areas is believed to have taken shape over 100 hundred years. Most suitable land for farming has already been cultivated and even steep slopes which are generally unsuitable for farming have been made into terraced farmland. The farmland area per capita is less than 0.1 ha as shown in Table 4-13 and the figure for people of occupational castes of 0.03 ha is extremely small. More than 70% of the households surveyed mentioned a shortage of grain production for self-consumption and the period of the shortage is as long as 4.6 months which is more than one-third of a year.

Table 4-13 Farmland Area per Capita

(Unit: ha/person)

Farmland	Model Area						Households of Occupational Castes
	Parbat North	Parbat South	Kaski East	Kaski North	Kaski West	Total	
Khet Land	0.06	0.03	0.05	0.06	0.06	0.05	0.01
Bari Land	0.03	0.03	0.04	0.03	0.03	0.03	0.02
Total	0.09	0.06	0.09	0.09	0.09	0.08	0.03

Note : Long-term absentees are not included in the calculation of farmland area per capita.

Source : JICA/Multi-Disciplinary Consultants (P) Ltd., Household Member Survey, 1996

Although it is practically impossible to expand the present farmland area from the viewpoints of forest conservation and disaster prevention, the expected continuation of the population increase will further worsen the farmland shortage in the future.

(5) Insufficient Cash Income

At present, the main sources of cash income for local people are the remittances by family members working away from home, daily wages, salaries and pensions. The results of the interviews with a limited number of households suggests that the overall household cash income is very low. The fact that "cash income" is the item of the strongest interest of local people also illustrates the low level of local cash income.

(6) Regular Over-Working

The day-to-day over-working of women is a particularly serious matter. In addition to the traditionally heavier burden on women in the division of labour based on gender, there is also the social factor that the absence of many adult men due to their working away from home forces women to conduct almost all types of outside work, including farming, as well as the housework. Moreover, watershed degradation has caused adverse impacts, such as lengthening the walking distance to the available water sources and also that to forests where firewood and tree fodder are available and more involvement in waged labour to earn cash, aggravating the over-work situation of women. As women, who are the main support of the family, are hard pressed by their daily work, they find it extremely difficult to find the spare time to conduct work for improvement of the watershed environment.

(7) Priority of Day-to-Day Needs

People living in the Model Areas are facing a harsh reality characterised by a food deficit, shortage of cash income and over-work (water fetching and the collection of firewood and tree fodder. Their most pressing task at present is to improve this reality to better their standard of living in any way possible.

(8) Other Causes

In addition to the seven causes described above, there are also hidden socioeconomic causes of watershed degradation as described in Table 4-14.

Table 4-14 Hidden Causes of Watershed Degradation

Causes	Linkage with Watershed Degradation
1. Low Educational Level	- The planning and implementation of measures for watershed improvement may be obstructed by the acquisition, understanding and application of necessary technologies and information - Local people find it difficult to actively express their opinions at community meetings on watershed improvement activities
2. Emigration of People (particularly young men)	- The shortage of participants in watershed improvement activities makes it difficult to reduce the burden on women to allow them to participate in watershed improvement activities - Hinders the revitalisation of villages, resulting in delayed action to improve the watershed environment
3. Health Problems	- Worsens the shortage of labourers and participants in watershed improvement activities, increasing the burden on others - People have to use their spare time for paid work to pay the cost of medical treatment. As a result, the available time for watershed improvement activities is further decreased
4. Caste	- The organization of the community, important to implement watershed improvement activities, may be impeded