4. ENVIRONMENTAL CARE

4. ENVIRONMENTAL CARE

4-1 Initial Environmental Survey

4-1-1 Principles

As the Study is a development study in the forestry sector in Nepal, environmental care under the Study is examined in accordance with Nepal's Environmental Impact Assessment Guidelines for the Forestry Sector issued in 1995. The survey process is decided through consultations with the Ministry of Environment and Population and the check items is based on JICA's Environmental Care Guidelines for Development Studies (XV Forestry) issued in January, 1994.

4-1-2 Survey Flow

The initial environmental survey is conducted in accordance with the flow shown in Fig. 4-1 to determine the degree of impacts by development actions (felling, construction of forest roads and afforestation, etc.) on social environment (lives of local people and population, etc.) as well as natural environment (topography, flora and fauna, etc.). The survey will be based on the scoping check list shown in Table 4-1.

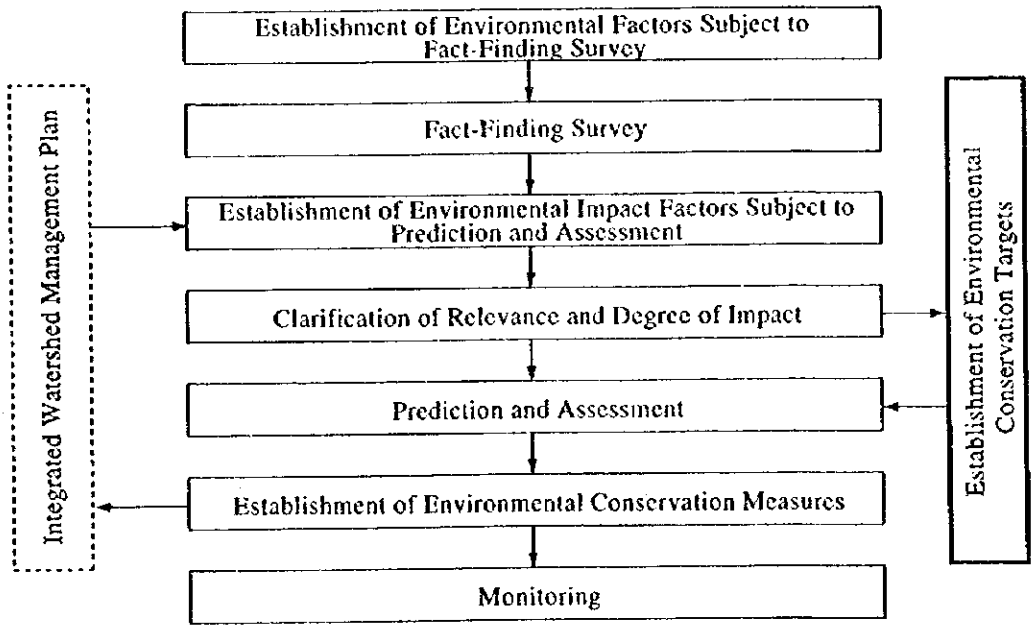

Fig. 4-1 Flow of Initial Environmental Survey

Table 4-1 (1) Check List for Scoping (Social Environment)

Environmental Element \ Environmental Factor	Development Action							Remarks
1. Social Life								
(1) People's Lives								
1. Planned Resettlement								
2. Involuntary Resettlement								
3. Changes in Lifestyle								
4. Friction Between People								
5. Original Inhabitants, Ethnic Minorities and Nomads								
(2) Population Increase								
1. Population Increase								
2. Sudden Changes of Demographic Structure								
(3) Local Economic Activities								
1. Relocation of Economic Base								
2. Changes of Economic Activities and Job Losses (Unemployment)								
3. Widening Income Gap								
(4) Systems and Customs								
1. Readjustment of Right to Use Forests								
2. Changes of Social Structure through Organization, etc.								
3. Reform of Existing System and Customs								
2. Health and Hygiene								
1. Increased Use of Agrochemicals								
2. Outbreak of Local Diseases								
3. Propagation of Infectious Diseases								
4. Accumulation of Residual Toxicity (Agrochemicals)								
5. Increase Waste and Body Waste								
3. Historic Sites, Cultural Heritage and Attractive Views								
1. Damage to or Destruction of Historic Sites or Cultural Heritage								
2. Loss of Valuable Views								
3. Impacts on Underground Resources								

Evaluation Categories

A: Requiring a field survey to examine more detailed information, etc. as negative impacts are anticipated.
B: Unknown (requiring a field survey for clarification as a judgement cannot be made based on the preparatory work in Japan).
C: No impact worthy of note is anticipated.
P: Requiring a field survey to examine more detailed information, etc. as positive impacts are anticipated.

Table 4-1 (2) Check List for Scoping (Natural Environment)

Environmental Element \ Environmental Factor	Development Action								Remarks
4. Rare Wildlife and Ecosystem									
1. Changes of Vegetation									
2. Impacts on Rare Species and Indigenous Flora and Fauna									
3. Decrease of Biodiversity									
4. Invasion and Propagation of Harmful Species									
5. Disappearance of Wet Land and and Peat Moors									
6. Degradation of Natural Forests									
5. Soil and Land									
(1) Soil									
1. Soil Erosion									
2. Excessive Salt Content in Soil									
3. Decline of Soil Fertility									
4. Soil Contamination									
(2) Land									
1. Land Devastation (including Desertification)									
2. Landslide/Slope Failure									
3. Decline of Wind-Breaking, Sand-Breaking, Fire-Breaking Functions									
4. Subsidence									
6. Hydrology and Water Quality, etc.									
(1) Hydrology									
1. Changes of Hydrological Regime of Surface Water									
2. Changes of Hydrological Regime and Level of Groundwater									
3. Occurrence of Droughts or Floods									
4. Sedimentation									
5. Lowering of Riverbed									
6. Impacts on River Shipping									
(2) Water Quality and Water Temperature									
1. Water Pollution and Decline of Water Quality									
2. Eutrophication									
3. Invasion of Salt Water									
4. Changes of Water Temperature									
(3) Air									
1. Air Pollution									
2. Emission of CO_2									
3. Minute Changes of Climate									
4. Generation of Noise									
7. Sustainability of Forest Resources and Functions									
1. Disruption of Sustainability of Forest Resources									
2. Disruption of Sustainability of Environmental Conservation Function of Forests									

Evaluation Categories

A: Requiring a field survey to examine more detailed information, etc. as negative impacts are anticipated.
B: Unknown (requiring a field survey for clarification as a judgement cannot be made based on the preparatory work in Japan).
C: No impact worthy of note is anticipated.
P: Requiring a field survey to examine more detailed information, etc. as positive impacts are anticipated.

4-1-3 Survey Results

(1) Environmental Factors Subject to Fact-Finding Survey

The environmental factors subject to the fact-finding survey (initial environmental survey) have been identified by examining the results of the field surveys (on climate, topography and geology, soil, land use and vegetation, erosion control and infrastructure improvement and socioeconomic conditions) and the socioeconomic baseline surveys (household survey, household member survey and VDC/Ward profile preparation survey) which have hitherto been conducted. The finalised environmental factors subject to the survey based on the said examination are such natural factors as climate, topography, geology, soil, land use and vegetation and state of erosion and such social factors as the number of households, population, industries, local social institutions/customs and water use as shown in Table 4-2.

Table 4-2 Reasons for Selection

Item		Reason for Selection
Natural Factors	Climate	It is necessary to establish the rainfall amount, etc. to estimate the erosion level, etc. due to the Plan.
	Topography and Geology	Changes of the local topography due to the implementation of the Plan could cause landslides, etc.
	Soil	The implementation of the Plan could cause sediment discharge.
	Land Use and Vegetation	Changes of the vegetation due to the implementation of the Plan could cause sediment discharge and landslides, etc.
	State of Erosion	It is necessary to reflect the current state of erosion on the Plan.
Social Factors	Number of Households and Population	It is necessary to establish whether or not any resettlement of households is caused by the Plan or was conducted prior to the Plan.
	Industries	The implementation of the Plan could affect local industrial base.
	Local Social Institutions/Customs	The implementation of the Plan could affect the local right to utilize forest (forest products).
	Water Use	The implementation of the Plan could affect the existing water use.

(2) Fact-Finding Survey

The results of the various already completed surveys have been compiled for each Model Area is shown in Table 4-3 instead of conducting a new fact-finding survey.

Table 4-3 Survey Findings on Natural and Social Factors in the Model Areas

(1/4)

Item	Model Area				
	Parbat North	Parbat South	Kaski East	Kaski North	Kaski West
[Natural Factors]					
Climate	The mean annual temperature and annual rainfall at the Kusma Station are 22.0°C and 2,540mm respectively.	As left.	The mean annual temperature and annual rainfall at the Pokhara Airport Station are 20.7°C and 3,755mm respectively.	As left; the annual rainfall at the Lamachaur Station is 4,347mm.	The mean annual temperature and annual rainfall at the Lumle Station are 15.7°C and 5,337mm respectively.
Topography	Hazard in Parbat North is mainly linked to the geological structure and soil properties. The hazard frequency is high at north-facing gentle slopes covered by colluvial deposits. Many hazardous sites are located at the dip slopes. At these slopes, many plane rock landslides and debris landslides are observed.	A large part of Parbat South consists of counter dip slopes. At Argaudi, Bhorle and Hile, major rock landslides are associated with dip slopes.	Compared to the other model areas, Kaski East is the least hazardous area. Dip slopes, erosion fronts, active gullies and landslide sites are the common geomorphological features.	Long erosion fronts, reactivated old landslide sites, ongoing gully erosion sites and large-scale landslide sites are frequently found in Kaski North.	Areas along the vehicle road between Chhorepatan and Phusre Khola are the most hazardous areas in Kaski West. The factors responsible for hazard are dip slope and loose colluvial deposits.
Geology	North facing gentle slopes in Parbat North are covered by colluvial materials. Many hazardous sites are located at the dip slopes and show many plane rock and debris landslide sites. A strongly sheared zone is located along the Phalebas thrust fault and an anticlinal axis passes through Malyangdi Khola.	Geologically speaking, Parbat South mainly consists of intercalations of quartzite, phylite and slate. Minor plane rock landslides are seen at moderately weathered slate slopes. Wedge failures are observed at counter dip slopes of dolomite.	Dip slopes, erosion fronts and colluvial slopes are frequently seen in Kaski East. Plane rock landslides are seen along the foliated structure of phylite and meta-sandstone. The prominent dip slopes are seen in Mulpani, Ghonguwa and Pelunga areas.	The bedrock in Kaski North is weathered to a medium degree. The main garnet schist unit and kuncha formation unit are predominantly distributed in the southern part.	Kaski West is dominated by dip slopes and loose colluvial cover, resulting in many landslide sites and active gullies.

Item	Model Area				
	Parbat North	Parbat South	Kaski East	Kaski North	Kaski West
Soil	Dystric cambisols are distributed on gentle slopes. Dystric regosols are dominant at steep slopes while dystric leptosols are dominant at cliff and rocky sites. Haplic luvisols and haplic alisols are distributed at old river terraces.	Haplic luvisols and haplic alisols are distributed in areas where dolomite is the parent material. Eutric cambisols dominate mountainous slopes. Haplic acrisols, humic cambisols and dystric cambisols are distributed in areas where slate or schist is the parent material.	The main soil unit of slopes in mountain areas is dystric cambisols. Fluvisols are also distributed in the lowland along rivers.	Humic cambisols are distributed above an elevation of 1,300 m in mountain areas while dystric cambisols are dominant in areas around an elevation of 1,200 m or less. Eutric cambisols and dystric cambisols are distributed at terraces and fluvisols are found in lowland.	Most soil in mountain areas consists of either humic cambisols or dystric cambisols. Calcaric / eutric / dystric fluvisols are distributed in river sedimentation areas.
Land Use and Vegetation	Sloping terrace land is the most prominent land use category accounting for 46%, followed by forests (29%), paddy fields (17%), grassland (5%) and alluvial fans (3%). The area of medium cultivation ratio (42%) is extremely high.	The sloping terrace land ratio of 56% is the highest of all the model areas while paddy fields only account for a mere 1%. The forest ratio of 17% is relatively low. The ratio of grassland is as high as 18% which is much higher than the other model areas. Alluvial fans account for 8%.	Forests are dominant with 53%, followed by sloping terrace land (27%), paddy fields (6%) and valley bottom lowland and alluvial fans (6%). The area of medium cultivation ratio (26%) is much higher than the other model areas in Kaski.	Forests are dominant with 55%, followed by sloping terrace land (15%), alluvial fans (13%) and paddy fields (10%). Abandoned farmland, landslide sites and water bodies are large enough for separate classification only in Kaski North.	Forests are dominant with 54%, followed by sloping terrace land (23%) and paddy fields (14%). Minor grassland, valley bottom lowland and alluvial fans are also observed.
State of Erosion	Major landslides are the Kamere landslide at Thulipokhari (complex landslide with a length of some 200 m, a width of 150 m and a depth (estimate) of 10 - 15 m) and the Khalte landslide (some 10-12 m deep; originally occurred some 40 years ago). Other small landslides are also observed.	There is a major landslide site at Argaudi which is a complex type landslide of some 200 m in width and 300 m in length. This landslide is still active and many tension cracks can be observed throughout the village of Argaudi.	No large landslide site is observed in Kaski East.	The major landslides in this Model Area are a complex landslide (some 350 m long, 200 m wide and 10-15 m deep) located in the upperstream of Sand Khola, a tributary of Bijaipur Khola, running through the 8th Ward of Mauja VDC and a debris landslide (some 100 m long, 40 m wide and 4 - 6 m deep) at Jumleti in the 1st Ward of Armala VDC. Several minor landslides are also observed.	A major landslide at Bamdi in the 6th Ward of Chapakot VDC originally occurred some 30 years ago and is some 70 m long, 50 m wide and 5 m deep. The affected area extends much more to 800 m long, 200 - 300 m wide and 15 - 30 m deep. Several small landslide sites are also observed.

Item	Model Area				
	Parbat North	Parbat South	Kaski East	Kaski North	Kaski West
Social Factors					
Number of Households and Population	There are 6,051 households with a total population of 38,718 (19,128 males and 19,590 females). 122 households (2.0%) have moved out while 43 households (0.7%) have moved in.	There are 2,823 households with a total population of 18,619 (9,057 males and 9,544 females). 96 households (3.4%) have moved out while two households (0.1%) have moved in.	There are 2,026 households with a total population of 12,680 (6,270 males and 6,410 females). 48 households (2.4%) have moved out while six households (0.3%) have moved in.	There are 5,958 households with a total population of 34,687 (17,134 males and 17,553 females). 107 households (1.8%) have moved out while 78 households (1.3%) have moved in.	There are 3,901 households with a total population of 24,680 (12,349 males and 12,331 females). 61 households (1.6%) have moved out while 25 households (0.6%) have moved in.
Industries	The scoring of the relative importance of household cash income sources gives remittance from family members working outside the area the highest score of 23.6 points. Other sources are as follows. Crops : 5.7 Livestock : 11.6 Forest products : 0.7 Salary : 17.7 Wages : 21.2 Pension : 7.3 Private business : 10.4	The situation is similar to that of Parbat North. Remittance : 28.9 Crops : 2.2 Livestock : 10.0 Forest products : 0.9 Salary : 13.4 Wages : 16.4 Pension : 19.5 Private business : 6.2	The situation is similar to that of Parbat North. Remittance : 21.8 Crops : 3.9 Livestock : 8.7 Forest products : 0.4 Salary : 18.5 Wages : 6.3 Pension : 18.4 Private business : 6.1	The situation is similar to that of Parbat North. Remittance : 26.9 Crops : 9.8 Livestock : 10.5 Forest products : 1.2 Salary : 15.2 Wages : 20.0 Pension : 12.6 Private business : 7.9	The situation is similar to that of Parbat North. Remittance : 28.7 Crops : 4.8 Livestock : 16.4 Forest products : 0.5 Salary : 13.6 Wages : 5.8 Pension : 13.7 Private business : 8.6
Local Social Institutions/ Customs	There are 41 official community forests of 844 ha in the total area involving 5,836 households, 15 forests of 317 ha in the total area involving 1,172 households under application for official status and 12 unofficial forests of 1,156 ha in the total area involving 2,621 households.	There are 7 official community forests of 207 ha in the total area involving 961 households, 3 forests of 12 ha in the total area involving 480 households under application for official status and 10 unofficial forests of 232 ha in the total area involving 1,383 households.	There is one official community forest of 100 ha in the total area involving 212 households, 5 forests of 158 ha in the total area involving 363 households under application for official status and 20 unofficial forests of 783 ha in the total area involving 1,576 households.	There are 23 official community forests of 833 ha in the total area involving 3,668 households, 28 forests of 971 ha in the total area involving 3,753 households under application for official status and 14 unofficial forests of 914 ha in the total area involving 1,153 households.	There are 24 official community forests of 938 ha in the total area involving 2,725 households, 10 forests of 302 ha in the total area involving 997 households under application for official status and 10 unofficial forests of 2,260 ha in the total area involving 3,410 households.

Item	Model Area				
	Parbat North	Parbat South	Kaski East	Kaski North	Kaski West
Water Use	The drinking water supply sources in the dry season are as follows. Piped supply : 50.4% Springs : 38.6% River : 3.8% The drinking water supply sources in the rainy season are as follows. Piped supply : 47.6% Springs : 41.0% Rivers : 4.4%	The drinking water supply sources in the dry season are as follows. Piped supply : 55.7% Springs : 41.2% Rivers : 3.0% The drinking water supply sources in the rainy season are as follows. Piped supply : 54.3% Springs : 42.3% Rivers : 3.3%	The drinking water supply sources in the dry season are as follows. Piped supply : 47.2% Springs : 50.6% Rivers : 2.1% The drinking water supply sources in the rainy season are as follows. Piped supply : 50.7% Springs : 47.3% Rivers : 1.7%	The drinking water supply sources in the dry season are as follows. Piped supply : 79.9% Springs : 16.9% Rivers : 3.0% The drinking water supply sources in the rainy season are as follows. Piped supply : 86.0% Springs : 12.0% Rivers : 1.7%	The drinking water supply sources in the dry season are as follows. Piped supply : 56.0% Springs : 39.5% Rivers : 4.4% The drinking water supply sources in the rainy season are as follows. Piped supply : 74.4% Springs : 24.4% Rivers : 1.2%

(3) Establishment of Environmental Impact Factors

The factors believed to affect the environment and watershed have been identified based on the contents of the integrated watershed management plan and the results are shown in Table 4-4.

Table 4-4 Environmental Impact Factors

Programme	Environmental Impact Factors (Planned)	Description
Land Use Improvement Programme	Forest Improvement Plan 1 Forest Improvement Plan 2 Grassland Improvement Plan 1 Grassland Improvement Plan 2 Grassland Improvement Plan 3 Farmland Improvement Plan 1 Farmland Improvement Plan 2 Farmland Improvement Plan 3	Forest improvement, grassland improvement and farmland improvement
Seedling Production Programme	Nursery Operation Plan	Establishment of nurseries and nursery practices
Erosion Control Plan	Landslide Treatment Programme Gully Erosion Control Programme Bank Erosion Control Programme Surface Erosion Control Programme	Low cost structure plan; plan for materials used to construct structures with simple skills
Living Environment Improvement Programme	Footpath Improvement Programme Road Improvement Programme Headwater Area Improvement Programme Public Health Programme Education Programme	Infrastructure improvement; construction of suspension bridges; supply of drinking water; repair and construction of reservoirs; joint rice polishing and flowering facilities; construction and rehabilitation of irrigation channels; construction of health centers and toilets
Income Generation Programme	Farm and Stock Raising Programme Small-Scale Processing Programme Employment Opportunities Promotion Programme	Crop cultivation; stock raising; improvement and market development of processing technologies; creation of employment opportunities
Extension and Training Programme	Extension Plan	Extension and training vis-a-vis NGOs, local inhabitants and DOSC staff

(4) Relevance and Degree of Possible Environmental Impacts

Using the scoping check list, the possible impacts and the degree of impact of the planned items under the Integrated Watershed Management Plan have been examined and the results are given in Table 4-5. Most of the planned items of the Plan are judged to be either irrelevant or positive impact items in terms of possible environmental impact as shown in Table 4-5. Accordingly, no environmental conservation targets have been established, no prediction and assessment have been carried out and no environmental conservation measures or monitoring have been formulated.

4-2 Necessary Environmental Care at Implementation Stage

At the stage of the initial environmental survey, it is concluded that neither conservation measure nor monitoring will be necessary. However, the following points should be noted at the programme implementation stage.

(1) Land Use Improvement Programme

① Forest Improvement Programme

a. The rules governing community forests should be observed to avoid over-felling.

b. The invasion of forests by domestic animals should be efficiently controlled to prevent degradation of the forest floor and erosion.

c. When a programme involves more than one ward or VDC, the rights of all parties should be mutually respected. Sufficient discussions should be conducted to reach an agreement.

② Grassland Improvement Programme

a. Grazing by domestic animals should be properly controlled to protect the planted grasses and trees.

b. The stones required to create grazing areas should be collected from multiple locations instead of one location.

c. The agreement of local people to the creation of forests should be obtained through consultations while providing local people with a substitute for the loss of grassland.

Table 4-5 (1) Degree of Environmental Impact (Scoping Check List)

(1/2)

Environmental Factors \ Environment Impact Factors	Land Use Improvement Plan									Erosion Control Plan				Infrastructure Improvement Plan				People
	Forest Improvement Plan		Grassland Improvement Plan			Farmland Improvement Plan			Nursery Plan	Land-slide Control Plan	Gully Erosion Control Plan	Bank Erosion Control Plan	Surface Erosion Control Plan	Road Improve-ment Plan	Trail Improve-ment Plan	Head-water Protec-tion Plan	Living Improve-ment Plan	Participa-tion and Exten-sion Plan
	F1	F2	G1	G2	G3	Fa1	Fa2	Fa3										
1. Rare Wildlife and Ecosystem																		
1. Change of vegetation																		
2. Impacts on rare species and indigenous flora and fauna	+	+	+															
3. Decline of biodiversity																		
4. Invasion and propagation of harmful species																		
5. Degradation of natural forests																		
2. Soil and Land																		
(1) Soil																		
1. Soil erosion	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
2. Decline of soil fertility						+	+	+										
(2) Land																		
1. Degradation of land	+	+	+	+	+	+	+	+		+	+	+	+	+	+	+	+	+
2. Landslides	+	+	+	+	+	+	+	+		+	+	+	+	+	+	+	+	+
3. Decline of protection functions of forest (windbreak, erosion control, etc.)	+	+			+						+	+				+		
4. Subsidence																		
3. Hydrology and Water Quality, etc.																		
(1) Hydrology																		
1. Change of surface water flow regime				+	+		+											
2. Change of groundwater flow regime and/or level																		
3. Occurrence of drought or flood	+	+	+	+	+	+	+	+		+	+	+	+	+	+	+	+	+
4. Sedimentation	+	+	+	+	+	+	+	+		+	+	+	+	+	+	+	+	+
(2) Water Quality and Water Temperature	+	+														+		
1. Water pollution and lowering of water quality																		
2. Change of water temperature																		
4. Sustainability of Forest Resources and Functions																		
1. Interruption of sustainability of raw materials	+	+		+	+		+									+		
2. Interruption of sustainability of environmental conservation function	+	+		+	+		+									+		

Notes 1) ◎: has a strong adverse impact, ○: has some adverse impact, △: may have an adverse impact, +: has a positive impact, no symbol: irrelevant

2) F1 or 2: forest improvement programme 1 or 2, G1, 2 or 3: grassland improvement programme 1, 2 or 3, Fa1, 2 or 3: farmland improvement programme 1, 2 or 3

Table 4-5 (2) Degree of Environmental Impact (Scoping Check List)

(2/2)

Environmental Factors \ Environment Impact Factors	Land Use Improvement Plan								Erosion Control Plan				Infrastructure Improvement Plan				People
	Forest Improvement Plan		Grassland Improvement Plan			Farmland Improvement Plan			Nursery Plan	Land-slide Control Plan	Gully Erosion Control Plan	Bank Erosion Control Plan	Surface Erosion Control Plan	Road Improve-ment Plan	Trail Improve-ment Plan	Head-water Protec-tion Plan	Living Improve-ment Plan	Participa-tion and Exten-sion Plan
	F1	F2	G1	G2	G3	Fa1	Fa2	Fa3										
1. Social Life																		
(1) Lives of local population																		
1. Systematic resettlement																		
2. Non-voluntary resettlement																		
3. Change of lifestyle	+	+	+	+	+	+	+	+		+	+	+	+	+	+	+	+	+
4. Conflict among local inhabitants																		
5. Indigenous people; minority groups; nomadic people																		
(2) Population Increase																		
1. Population increase																		
2. Sudden change of demographic structure																		
(3) Local Economic Activities																		
1. Transfer of base of economic activities																		
2. Change of economic activities and job losses																	+	
3. Widening of income gap																	+	
(4) Social Institutions/Customs																		
1. Readjustment of right to use forests																		
2. Change of social structure through grouping, etc.																	+	
3. Reform of existing institutions/customs																	+	
2. Health and Hygiene																		
1. Increased use of agrochemicals																		
2. Breakout of local disease																		
3. Spread of contagious disease																		
4. Accumulation of residual toxins (agrochemicals)																		
5. Increase of solid waste and night soil																		
3. Historic Remains, Cultural Heritage and Scenic View, etc.																		
1. Damage to and/or destruction of historic remains and cultural heritage																		
2. Loss of rare view																		
3. Impact on archaeological objects																		

Notes 1) ◎: has a strong adverse impact, ○: has some adverse impact, △: may have an adverse impact, +: has a positive impact, no symbol: irrelevant

2) F1 or 2: forest improvement programme 1 or 2, G1, 2 or 3: grassland improvement programme 1, 2 or 3, Fa1, 2 or 3: farmland improvement programme 1, 2 or 3

③ Farmland Improvement Programme

a. Proper examination should be conducted prior to the introduction of an exotic species.

b. When the purchase of fertiliser by local people is facilitated due to an increase of their income, fertiliser application methods should be carefully examined. Proper attention should be paid to water use at farmland, including leakage prevention, as part of terrace maintenance.

④ Seedling Production Programme

a. In the establishment of nurseries, crucial issues will be drainage and water supply. Proper drainage downstream should be arranged. Water supply will be essential for the growth of seedlings.

b. Although the scale of the planned nurseries is not large, a system to control diseases and harmful insects should be established.

(2) Erosion Control Programme

① Landslide Control Measures

a. Sufficient attention should be paid to surface run-off to prevent repeated inflow to groundwater in the same place.

b. Grazing should be properly controlled by means of erecting stone walls (fencing) and posting watchmen. It will also be necessary to protect the constructed structures and naturally generated trees.

c. A simple method of detecting the occurrence of landslides will be spread among local people.

② Gully Erosion Control Measures

a. It will be necessary to establish a system which is capable of fully supervising the construction work involving gabions, etc.

b. Various planting techniques should be fully examined to select a technique which can be adopted by local people.

③ Bank Erosion Control Measures

a. Work designed to achieve bank erosion control should be conducted to minimise sediment discharge to the lower reaches.

b. The possible introduction of exotic species should be fully examined.

(3) Living Environment Improvement Programme

① Footpath Improvement

a. The wasteful excavation of soil should be avoided during the step improvement work and the installation of drainage ditches.

b. The materials used to construct steps should be collected from more than one location.

c. Local people should be consulted as much as possible when determining the work blocks, etc. to avoid problems in advance.

② Road Improvement

a. An apron to receive the discharge of collected water should be appropriately located to ensure sufficient drainage.

b. Prior coordination with local people will be required as in the case of footpath improvement.

③ Possibility of New Road Construction

a. Detailed surveying and design will be required to ensure the avoidance of environmental damage due to new roads.

b. The geological map, etc. should be carefully examined prior to deciding any new road route.

④ Headwater Area Protection and Establishment of Water Supply System

a. Newly planted trees in headwater areas should be properly protected.

b. The laying of water supply pipes should avoid the displacement of sediment as much as possible.

c. Sufficient consultations with all parties involved should be conducted prior to the creation of a water supply system with a view to avoiding any conflict with local people.

⑤ Public Health and Hygiene

As the construction of toilet facilities has the inherent risk of deteriorating the water quality downstream, proper preventative care should be taken.

(4) Income Generation Programme

① Farming Products

a. The excessive digging of planted crops in forests, particularly during the harvesting season, should be avoided to protect the forest floor.

b. Adequate knowledge of new crops and their cultivation techniques, etc. should be acquired through agricultural extension agents.

② Livestock

a. Excessive grazing in forests or on grassland should be controlled to prevent subsequent soil loss.

b. Proper care should be taken in regard to the discharge of dirt produced in the compost making process downstream.

③ Small-Scale Processing

The excessive utilisation of various raw materials should be avoided as it could lead to the depletion of resources, making sustainable operation impossible.

(5) Extension and Training Programme

The following care should be taken in regard to the participation of local people.

① When the establishment of a user group is intended, the details of the group should be clearly established.

② The participation of local people should be facilitated through clarification of the objectives of user groups.

③ Sufficient attention should be paid to women and those belonging to occupational castes.

5. MONITORING AND EVALUATION

5. MONITORING AND EVALUATION

5. Monitoring and Evaluation

The present Plan is a master plan showing various measures to achieve the targets. As the implementation of the Plan is based on the readiness of local people to participate, it does not propose concrete subject areas for plan implementation. Once the Plan is implemented, it is important to monitor its effects with a view to making the necessary improvements. Because of the importance of monitoring and evaluation, monitoring items and methods, etc. which are believed to be necessary for the smooth and successful implementation of the Plan are shown in Table 5-1.

Table 5-1 Monitoring and Evaluation Items and Methods Under the Plan

(1/4)

Planning Item	Index	Evaluation Item	Monitoring Method
Land Use Improvement Programme			
Forest Improvement	- Forest area - Soil erosion - Firewood, fodder and timber production volumes - Participation in community forest	- Water supply - Erosion control - Firewood, fodder and timber supply - Income generation	- Use of socioeconomic baseline survey results (degree of satisfaction of local people; change of income level; organization of user groups) - Change of forest area using aerial photographs - Forest inventory and land surface conditions survey (including soil erosion) using fixed point observation method
Grassland Improvement	- Grassland area - Soil erosion - Fodder production volume	- Decline of eroded land - Erosion control - Firewood, fodder and timber supply - Livestock increase - Income generation	- Use of socioeconomic baseline survey results (degree of satisfaction of local people; change of income level; organization of user groups) - Change of grassland area using aerial photographs - Grassland survey (including soil erosion) using fixed point observation method
Farmland Improvement	- Farmland area - Area of improved terraces - Growth of planted trees - Food production	- Sufficient food supply - Erosion control - Firewood, fodder and timber supply - Income generation	- Use of socioeconomic baseline survey results (degree of satisfaction of local people; change of income level; organization of user groups) - Soil erosion survey using fixed point observation method - Planted tree growth survey - Production volume survey using fixed point observation method

Planning Item	Index	Evaluation Item	Monitoring Method
Land Use Improvement Programme			
Seedling Production	- Nurseries - Seedling production volume - Seedling supply volume	- Contribution to improved land use - Stable supply of seedlings	- Use of socioeconomic baseline survey results (degree of satisfaction of local people; organization of user groups) - Production and supply volume survey
Erosion Control Programme			
Landslide Treatment	- Landslide sites and their areas subject to treatment - Progress of work to construction of treatment facilities	- Stabilisation of landslides - Protection of conservation objects (houses; roads; public facilities; farmland) - Organization of user groups and their participation in treatment work - Firewood, fodder, etc. supply	- Use of socioeconomic baseline survey results (change of disaster awareness; degree of satisfaction of local people; organization of user groups) - Landslide survey and vegetation restoration survey using fixed point observation method - Introduction of landslide monitoring system
Gully Erosion Control	- Gully sites and their areas subject to control - Progress of work to construct control facilities (including vegetation works)	- Stabilisation of gullies - Protection of farmland and roads, etc. - Organization of user groups and their participation in control work - Firewood, fodder, etc. supply	- Use of socioeconomic baseline survey results (change of disaster awareness; degree of satisfaction of local people; organization of user groups) - Gully survey using fixed point observation method - Vegetation restoration survey
Bank Erosion Control	- Bank sites and their length subject to conservation - Progress of work to construct control facilities (including vegetation works)	- Stabilisation of banks - Decline of flood and landslide occurrences - Organization of user groups and their participation in rehabilitation work - Firewood, fodder, etc. supply	- Use of socioeconomic baseline survey results (change of disaster awareness; degree of satisfaction of local people; organization of user groups) - Bank survey using fixed point observation method - Vegetation restoration survey
Living Environment Improvement Programme			
Improvement of Footpaths and Roads (including Suspension Bridges)	- Total length of footpaths and roads subject to improvement - Slope protection	- Erosion control - Protection of farmland and roads, etc. - Access improvement - Income improvement	- Use of socioeconomic baseline survey results (change of awareness; degree of satisfaction of local people; organization of user groups) - Erosion survey

Planning Item	Index	Evaluation Item	Monitoring Method
Living Environment Improvement Programme			
Headwater Site Improvement	- Headwater sites and their areas - Scope of use	- Water supply in dry season - Water quality improvement - Alleviation of water fetching work	- Use of socioeconomic baseline survey results (degree of satisfaction of local people; organization of user groups) - Water volume and quality survey at fixed points
Repair of Reservoirs (Ponds)	- Subject reservoirs	- Erosion control - Water supply for livestock	- Use of socioeconomic baseline survey results (degree of satisfaction of local people; organization of user groups) - Reservoir improvement survey
Improved Ovens and Biomass	- Installation site and quantity	- Forest conservation - Alleviation of firewood collection work - Reduction of cooking time	- Use of socioeconomic baseline survey results (degree of satisfaction of local people; organization of user groups) - Actual usage survey
Public Health	- Health centre sites and details - Public toilet sites and quantity	- Decrease of number of ill persons - Understanding of watershed conservation	- Use of socioeconomic baseline survey results (degree of satisfaction of local people; organization of user groups; change of awareness) - Sewage treatment survey
Education	- Building maintenance - Educational effects	- Empowerment of women through literacy education - Interest in environment - Participation in tree planting and forest conservation	- Use of socioeconomic baseline survey results (degree of satisfaction of local people; organization of user groups; change of awareness)
Income Generation Programme			
Farm Products/ Livestock	- Type and area of planted crops - Number of heads, etc. raised	- Empowerment of local people - Income generation - Participation in tree planting and forest conservation	- Use of socioeconomic baseline survey results (degree of satisfaction of local people; organization of user groups) - Market survey on products
Small-Scale Processing	- Processed products - Small-scale processing facilities	- Empowerment of local people - Income generation - Participation in tree planting and forest conservation	- Use of socioeconomic baseline survey results (degree of satisfaction of local people; organization of user groups) - Market survey on processed products - Business operation fact-finding survey

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Planning Item	Index	Evaluation Item	Monitoring Method
Income Generation Programme			
Creation of Employment Opportunities	- Types of employment and number employed	- Empowerment of local people - Income generation - Participation in tree planting and forest conservation	- Use of socioeconomic baseline survey results (degree of satisfaction of local people; organization of user groups) - Employment fact-finding survey
Extension and Training Programme			
Local People	- Number of user groups - Training contents and frequency	- People's participation - Learning of conservation techniques	- Use of socioeconomic baseline survey results (degree of satisfaction of local people; organization of user groups)
NGOs	- Training contents and frequency	- Management capability to facilitate people's participation - Learning of conservation techniques	- Management and technical evaluation survey
Department of Soil Conservation	- Training contents and frequency	- Management capability to facilitate people's participation - Learning of conservation techniques	- Implementation of intensified staff training

6. PLAN JUSTIFICATION

6. PLAN JUSTIFICATION

(1) Expected benefits and effects

The proposed Integrated Watershed Management Plan aims at improving forest and land resources as well as controlling erosion. The plan has two distinctive characteristics: it addresses socio-economic problems and needs that underlie watershed problems; and it proposes a participatory approach for the detailed planning and implementation at the implementation stage. Therefore the plan does not specify the precise location of the subject sites (for example, within a Ward) for programme implementation but merely explains the general features of programme components to be included.

Considering the objectives of the plan and the conceivable programme components, it is expected that the implementation of the plan would generate the following benefits and effects:

① conservation of forest resources
② mitigation of landslide, control of flooding and conservation of soil
③ increase of fuelwood, fodder and timber production
④ increase of food production
⑤ improvement of the living condition in villages
⑥ improvement of the livelihood of hill communities
⑦ improvement of water source areas
⑧ protection of public and private assets from sediment disasters
⑨ increase of employment opportunity
⑩ Improvement of the knowledge, technical expertise and ability to slove problems on the part of local inhabitnts
⑪ protection of environment in the downstream area

As mentioned above, the plan does not specify the precise location of the subject sites for programme implementation. Accordingly the benefits and effects can not be quantified at this stage.

(2) Some advantages of participatory approach

The plan proposes people's participation in planning and implementation and the formulation of users' group in each programme component. Such approach could offer the following advantages:

① Sustainability

Participatory planning and implementation leads to increased self-reliance among hill communities and the establishment of a network of self-sustaining rural organization. This would enhance the efficiency of project activities and also provide them the opportunities to contribute constructively to development activities.

② Reduced costs

The people's contribution to planning and implementation generally leads to the reduction of costs because such plans tend to utilize locally available materials as much as possible, be easy to implement with the skill of people and receive labor contribution from the participants.

③ Increased efficiency

Through the participation, people can contribute their knowledge of local condition, facilitating the diagnosis of environmental, social and institutional constraints, as well as the search for better solution. The plan formulated like this could be implemented efficiently.

④ Building of community organization

Formulation of users group with limited size is suited to people's scarce organizational experience and low literacy level. Moreover, the small user group is ideal for the diffusion of collective decision-making and leadership skills.

(3) Empowerment of women and underprivileged people

The plan promotes the participation of women and underprivileged people (i.e., occupational castes) from the outset of the planning activities. This would empower them in the following way:

① They can have equal access to project information.

② They can express their concerns and opinion and participate in decisionmaking.

③ Activities that address their needs and concerns would allow them the opportunity to improve their living condition, develop their own skills and actively participate in community development programmes and watershed management activities.