

Basic Principles of the Plan

Here, basic principles of the plan and plan contents are mentioned from the standpoint of existing problems in the Study Area.

(1) Flow of Basic Principles

Flow of basic principles is shown in Fig. 17.

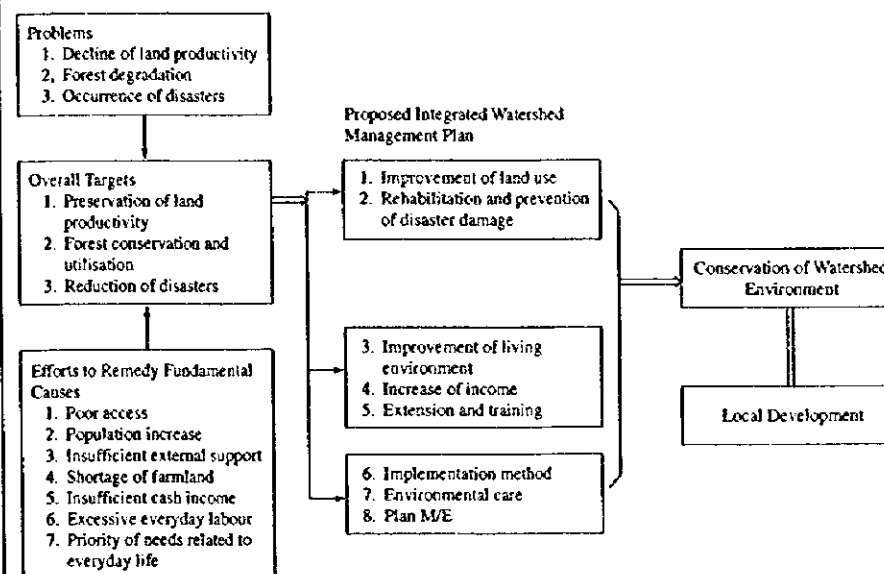


Fig. 17 Overall Targets and Proposed Integrated Watershed Management Plan

(2) Contents of the Basic Plan Principles

- ① Establishment of overall targets
- ② Efforts to remedy the fundamental causes
- ③ Showing the most appropriate measures for achieving the targets
- ④ Proposals for use of the plan at implementation stage

(3) Establishment of Overall Targets

Overall targets are established by taking up the related problems;

In Model Areas, for example, the related problems were:

- ① Decline of land productivity
- ② Forest degradation
- ③ Occurrence of widespread erosion and disasters

The following targets could be established vis-a-vis the 3 problems mentioned above.

- a. Preservation of land productivity
- b. Conservation and utilization of forest resources
- c. Disaster mitigation

(4) Examination of Measures to Remedy the Fundamental Causes

To fulfill the targets, it is necessary to tackle the fundamental causes.

The following 7 fundamental causes, for example, were recognized in the Model Areas and measures to solve them were proposed.

- ① Poor access
- ② Population increase
- ③ Insufficient external support
- ④ Shortage of farmland
- ⑤ Insufficient cash income
- ⑥ Excessive everyday labour
- ⑦ Priority of needs related to everyday life

The same 7 fundamental causes could also exist in the Study Area. However, necessary adjustments have to be made based on actual investigation results.

(5) Measures are Formulated for Achieving the Targets

Measures related to soil conservation and watershed conservation are proposed to achieve the 3 targets. Community development programmes are necessary to support the measures.

The following measures, for example, were proposed in the Model Areas

① Appropriate land use and management

- a. Balance between utilization and conservation is attempted
- b. People's needs are taken up
- c. Improvement of land productivity and soil and water conservation functions of forests
- d. Land use improvement programme

② Erosion control and disaster prevention measures

- a. Classification of erosion types is carried out
- b. Proposed control measures will be those applicable by people at the community level
- c. Objects to be protected will be taken into consideration
- d. Erosion control programme

③ Improvement of lives of local inhabitants

- a. Tackling of fundamental causes
- b. Understanding and cooperation of local inhabitants
- c. Living environment improvement programme
- d. Income generation programme

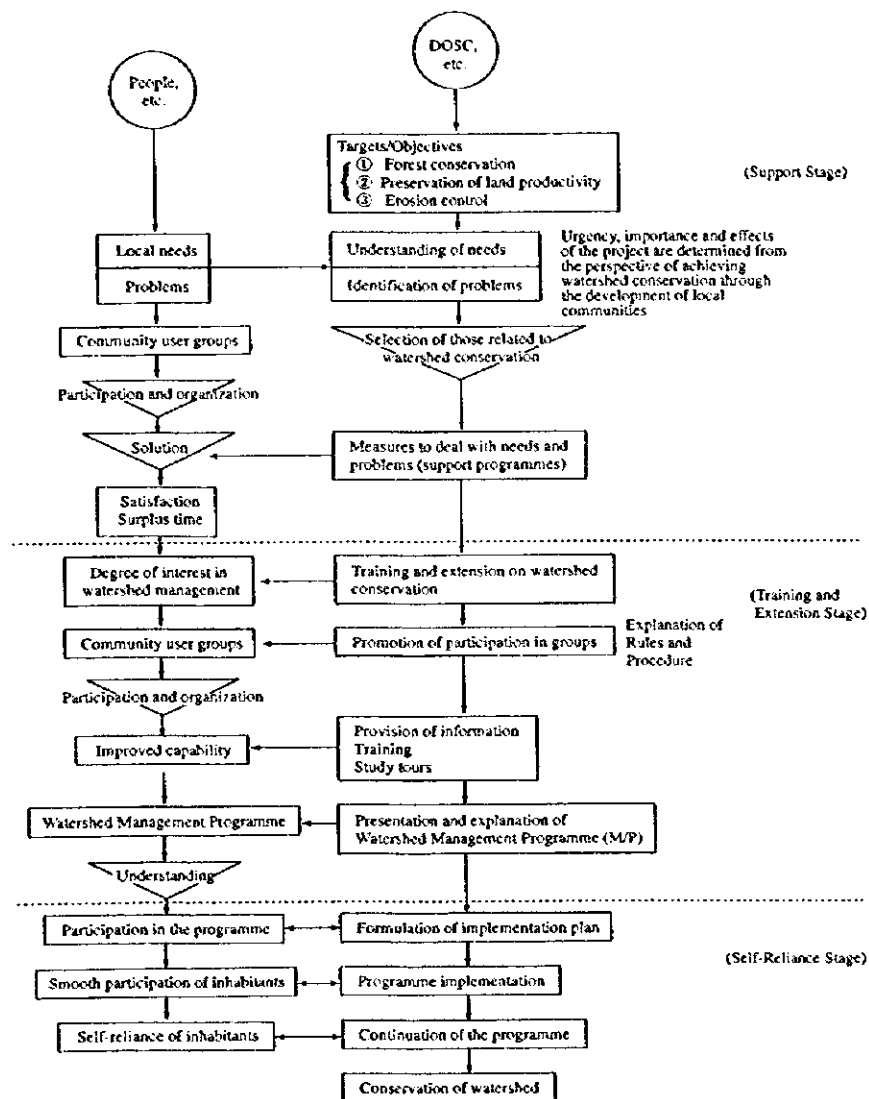


Fig. 18 Process of People's Participation in Watershed Management (An Example)

- ④ Empowerment of women and occupational casts
 - a. Income generation is taken up
 - b. Extension and training are promoted
- ⑤ Promotion of people's participation
 - a. The meaning and importance of people's participation are described.
 - b. The participatory process is clearly indicated.
 - c. Measures for smooth organization and maintenance are proposed.
 - d. Extension and education are promoted.
- ⑥ Strengthening of support system
 - a. The roles within the project team are clarified.
 - b. Extension and education by staff members of the Department of Soil Conservation are promoted.
 - c. The significance of the involvement of NGOs is clearly indicated and the quality of the staff members is improved.

An example of the process of people's participation in Watershed Management is shown in Fig. 18.

(6) Presentation of Actual Use at Implementation Level

The implementation method of proposed programmes at field level is shown.

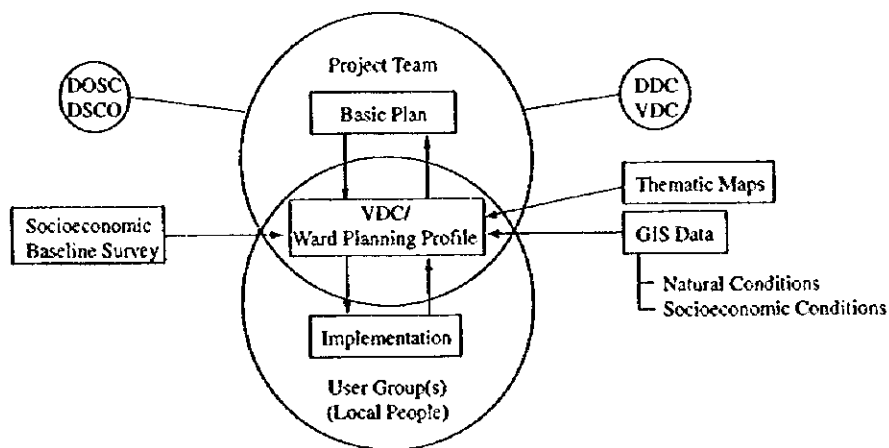


Fig. 19 Use of the Plan at Implementation Level

In Model Areas use of the plan at implementation level was proposed as mentioned below (Fig.19).

① Utilisation of Master Plan

- Presents a plan encompassing the entire Model Areas (Master Plan)
- Corresponds to the implementation level (flexibility)
- Use of the master plan at the project, DDC and DOSC levels

② Utilisation of VDC Planning Profile

- Presents the socioeconomic baseline survey results for each VDC/ward
- Use of the ranking as a reference for judgement on the urgency and importance levels
- Use at the project, VDC and DOSC levels
- Presents the profile used for a Model Area as an example

③ Utilisation of Ward Planning Profile

- Acts as a reference material for planning by local people
- Assists the understanding of local people of the actual conditions and problems of a ward and the necessity for the planned items
- Helps to establish the priority order of projects
- Use at the project, VDC and DOSC levels
- Presents the profile (Case Study) used for a Model Area as an example

VDC Planning Profile (Ward Selection): An Example

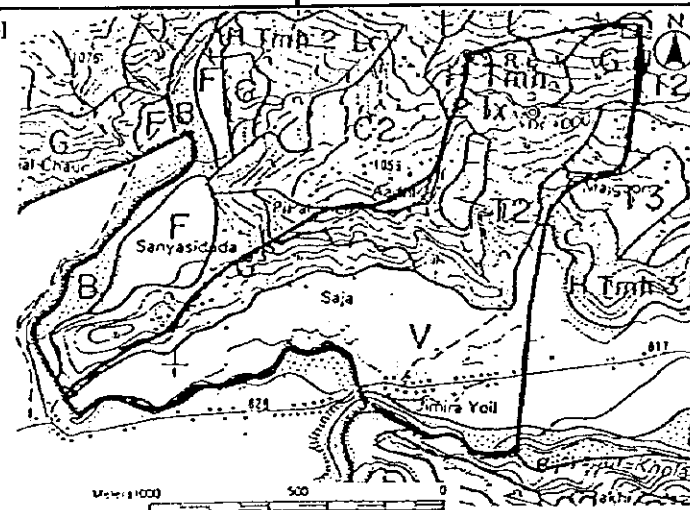
Kaski North Model Area

Items	Sub-items	Data No.	Data items	4. Arba Vijaya (KN)									
				Overall	Ward-1	Ward-2	Ward-3	Ward-4	Ward-5	Ward-6	Ward-7	Ward-8	Ward-9
Present Condition	Demography & Others	1	Total HH	638	100	80	53	74	79	111	48	65	28
		2	Total Pop.	3,683	631	392	322	377	430	630	377	351	173
		3	Occupational caste HH	3	2	2	1	2	3	3	3	4	2
		4	Absent pop.	2	2	2	2	1	2	1	4	2	1
		5	Pop. w/o education	3	3	3	2	3	4	4	4	5	2
		6	Org. member	4	4	4	3	3	3	4	5	5	4
		7	Distance to road (hrs)		0.7	0.5	0.5	0.5	0.75	0.83	3	1.15	1
		8	HH w/o Toilet	4	4	3	2	3	4	4	4	4	5
	Forestry, Agriculture, & Livestock	9	Member of FUG	3	3	5	4	3	3	2	1	1	2
		10	Farm size per person	4	4	3	3	5	3	5	4	5	4
		11	Pop. of Cow per HH	0.9	1.4	0.6	0.7	0.7	1.6	0.5	1.2	0.5	1.0
		12	Pop. of Buffalo per HH	1.9	2.6	1.6	2.0	2.0	2.0	2.1	1.6	1.3	1.6
		13	Pop. of Goat per HH	1.2	1.6	0.9	1.0	0.6	1.8	2.0	0.1	0.5	0.2
	State of Resource Shortage	14	Drinking water	1	1	1	1	1	1	1	1	1	1
		15	Fuelwood	3	2	6	4	4	3	3	1	1	2
		16	Fodder	3	2	2	1	2	2	4	1	4	1
		17	Food (cereals)	3	3	3	2	2	3	4	4	5	5
		18	Cereal deficit period	4	4	3	1	3	3	6	4	6	6
	Damage to Farm by	19	Flood	5	5	6	6	6	6	4	5	2	4
		20	Land slide	2	2	2	4	1	1	2	4	4	1
		21	Soil erosion	4	4	3	6	4	3	4	3	1	1
	Degree of Concern & Interest about	22	Food	3	4	2	1	2	3	4	5	6	5
		23	Fodder	3	4	2	2	3	3	3	4	4	3
		24	Fuelwood	4	4	4	2	3	4	4	3	4	4
		25	Drinking Water	1	1	1	1	1	1	1	1	3	1
		26	Irrigation	2	2	1	2	1	2	1	2	3	2
		27	Land slide / erosion	1	3	1	2	1	1	1	1	1	1
		28	Flood	2	3	3	4	2	3	2	1	1	3
		29	Cash income	5	5	5	5	5	6	6	6	6	6
		30	Motorable road	5	5	5	5	5	6	6	6	6	6
		31	Child education	1	1	2	1	1	1	1	1	1	1
		32	Health	3	4	4	2	3	4	4	3	3	5
		33	Community meeting	1	1	1	1	1	1	1	1	1	1

Ward Planning Profile – Case Study (Kaski North)

Ward Planning Profile				[Prepared by]		[Date of preparation]	
(Case Study I)							
Model Area	Kaski North	VDC	Arba Vijaya	[Proposed Programmes] 1. Living environment improvement programme Improvement of roads 2. Income generation programme Introduction of cash crops into forests 3. Erosion control programme Gully erosion control Stream bank erosion control 4. Forest improvement programme Forest management to boost production of firewood 5. Grassland improvement programme There is currently no problem regarding fodder trees, but the introduction of silvopasture is needed to prevent sediment runoff to downstream areas		[Program Priority Level] A B C	
Ward No.2		Settlement	Jimira Yoil, Saja Latabari				
[Current Conditions]							
Population	392	Male	206	Female	186		
Households	80	Ratio of female householders		5%			
Ratio of occupational castes	0%	Female non-education rate		48%			
Participation in organizations	Male 8%	Participation in community forests		6%			
	Female 5%	Community forests: 2 sites (10 ha)					
Per person farmland area (ha)	0.09-0.12	Toilet establishment		40-60%			
Distance from the nearest road (h)	0.5	Distribution of erosion type: 2 small landslides					
Past disasters	Landslide (1994)	2 gullies, stream bank erosion 1 km					
Land use	Forest	82.2	Shrub land	0	Grassland	21.1	
(113.9ha)	Bari land	6.1	Khet land	2.9	Others	1.7	
Soil:	Ach, Rgd, Fle/c/d, LPd, CMd	Water resources (exist • not exist)					
Slope classes	(flat to nearly flat • gentle • moderately steep • steep • very steep)						
Hazard	(Large • Medium • Small)						
Public facilities	VDC office						
Infrastructure	Roads	4.6km	Footpaths	0.5km	Irrigation facility	9.0km	
[Problems]				[Necessity of Countermeasures]			
Firewood shortage (L, M, S)	Flooding	(L, M, S)	Maintenance of land productivity	(H, M, L)			
Fodder shortage (L, M, S)	Concern for road construction	(L, M, S)	Forest preservation and utilization	(H, M, L)			
Water shortage (L, M, S)	Concern for sanitation	(L, M, S)	Control of erosion	(H, M, L)			
Food shortage (L, M, S)	Concern for insufficient income	(L, M, S)	Improvement of living environment	(H, M, L)			
Landslides (L, M, S)	People participation	(L, M, S)	Income generation	(H, M, L)			
Soil erosion (L, M, S)			Promotion of extension and training	(H, M, L)			
[People's Needs] Reduction of time needed to obtain firewood and fodder trees and reduced haulage of compost				[Items of Special Note] Immediate countermeasures are required to counter gully erosion in the lower reaches of Kabu Khola. It is desirable to use this area as a project demonstration plot. Before introducing an income generation programme, it is necessary to carry out a market survey and take measures that are accepted by people. JICA has already supervised the construction of footpaths by user groups in some areas.			

[Ward Planning Map]



Plan Items and Contents

Here, based on the plan principles, items and contents of the proposed plans are explained.

(1) Plan Component

Depending on the actual site condition, adjustment of the components may be needed.

Components of the plans proposed for the Model Areas, for example, were as mentioned below.

Land use improvement plan	Land use improvement programme	Soil and water conservation forest Timber, etc. production forest Grassland improvement Introduction of silvopasture Farmland improvement Introduction of agroforestry Khet land maintenance
	Seedling production programme	Seedling production Nursery establishment
	Proposed plant species	
Erosion control plan	Erosion control programme	Landslide Gully erosion Bank erosion, etc.
Living environment improvement plan	Living environment improvement programme	Infrastructure improvement Suspension bridge improvement Drinking water supply Maintenance and construction of ponds Joint rice polishing mills irrigation facilities Improved furnaces
	Health and hygiene programme	Health centres Toilets
	Educational programme	Maintenance of school buildings
Income generation plan	Income generation programme	Agriculture products/livestock Small scale processing industries Creation of employment opportunities
Extension plan	Extension programme	People NGO Field staff

(2) Land Use Improvement Plan

① Principles of the plan

This plan attempts suitable land use and conservation of forest/ environment of the watersheds through people's participation.

Plan formulation process is as mentioned in Fig. 20.

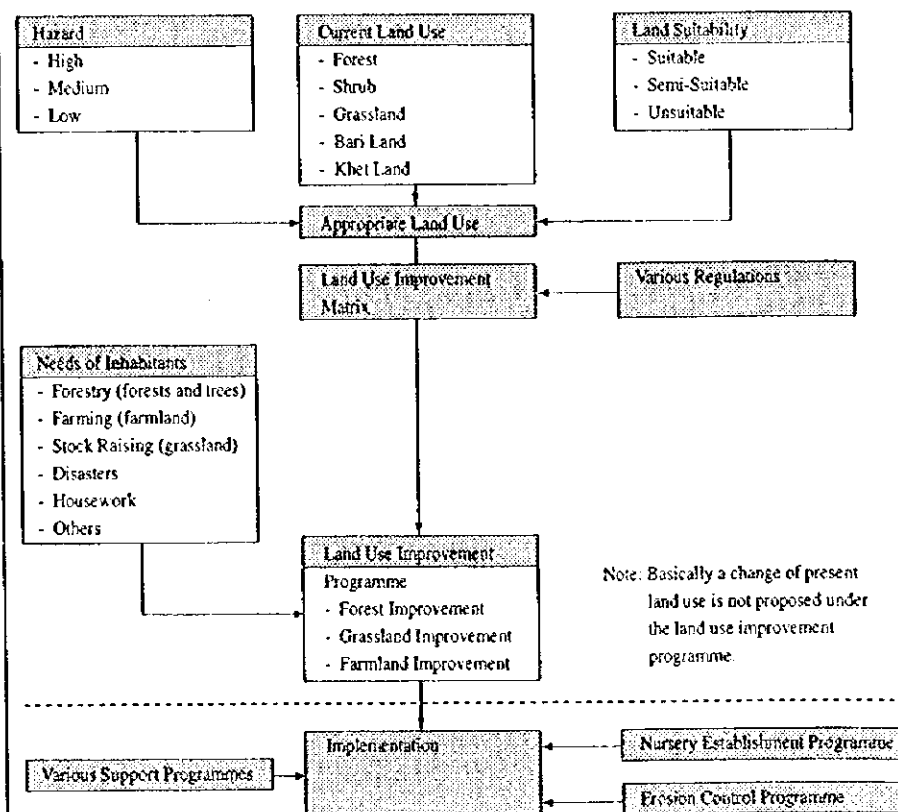


Fig. 20 Land Use Improvement Programme Flow

② Hazard

Appropriate land use to mitigate hazard by present land use type.

Appropriate Land Use in View of Hazard Category

Land Use	Hazard	Appropriate Land Use
Forest	High	Preservation as a forest with the aim of facilitating rainwater infiltration and slowing down of the speed of surface run-off
	Medium	As above
	Low	Use as an all-purpose forest for the production of timber, firewood and fodder, etc.
Shrub	High	Creation of a forest for water and land conservation
	Medium	As above
	Low	Creation of a forest to produce firewood and fodder, etc.
Grassland	High	Conversion to a forest to facilitate rainwater infiltration and slowing down of the speed of surface water flow
	Medium	Creation of a grazing forest to allow continuous grazing and to conserve the soil
	Low	Maintenance of the present state for use as grassland
Bari Land	High	Conservation as farmland by means of the greening of slopes, planting of new trees and improvement of terraces as conversion to a forest is desirable but difficult
	Medium	Conservation as farmland by means of the greening of slopes and improvement of terraces
	Low	Conservation as farmland by means of preservation of the present condition

③ Suitable land classes

Appropriate land use type based on land suitability classification.

Appropriate Land Use in View of Land Suitability

Land Use	Land Suitability	Appropriate Land Use
Forest	Suitable	While conversion to farmland is desirable, it is difficult to change the national policy of preserving national forests. Crops which can be planted without affecting the status of forest will be introduced to improve the income of local people.
	Medium	As above
	Unsuitable	Maintenance as a forest
Shrub	Suitable	It is possible to opt for either forest or farmland. Conversion of site suitable for farming to farmland is desirable.
	Medium	As above
	Unsuitable	Maintenance as shrub land
Grassland	Suitable	If necessary, conversion to farmland is possible but coordination with stock raising is required.
	Medium	Maintenance as grassland with the planting of trees if necessary
	Unsuitable	Improvement of the soil conditions through tree planting to increase the land productivity
Bari Land	Suitable	Maintenance of the present state to produce farming crops (terrace improvement if necessary)
	Medium	Maintenance of the present state or introduction of terrace improvement and tree planting to maintain the land fertility
	Unsuitable	Maintenance of the land fertility by means of terrace improvement and tree planting

④ Appropriate land use

- a. It is desirable to maintain forests or conduct reforestation in high hazard sites.
- b. It is desirable to use the land suitable for farming as farmland.
- c. The concept of appropriate land use (land use improvement) is summarized in Fig. 21.

Land Suitability Classification \ Hazard	High	Medium	Low
	High	Medium	Low
Unsuitable	Forest Use (Conservation)		Forest Use (Production)
Semi-Suitable			
Suitable	Agricultural Use (Conservation)		Agricultural Use (Production)

Fig. 21 Concept of Land Use Improvement

⑤ Restrictive factors or limitations

Restrictive factors or limitations in connection with land ownership are mentioned in Table 21.

In the case of land use change in national lands government permission is needed, and when private lands are involved owner's agreement is necessary. Also, existing forests are owned by the government and is impossible to convert them to other uses. Farmland are owned by private persons and their conversion require owner's agreement.

Table 21 Present Land Use and Restrictive Factors

Land Use	Land Ownership	Restrictive Factors
Forests	In principle, owned by the government although there is some privately owned forest land	It is difficult to convert forests to other types of land use. Private land can be converted at the owner's discretion
Shrub	As above	As above
Grassland	As above but some grassland is described as communal grassland	It is possible to convert grassland to forests. Private land as well as community land can be converted at the owner's discretion
Bari Land	Private land	There are no legal restrictions on the change of the type of land use
Khet Land	As above	As above

⑥ Land use improvement matrix

Land use improvement matrix shows the desirable use of the present lands from view point of hazard, land suitability classification as well as restrictive factors.

Table 22 Land Use Improvement Matrix

Hazard Land Suitability Present Land Use	High			Medium			Low		
	Suitable	Semi-Suitable	Unsuitable	Suitable	Semi-Suitable	Unsuitable	Suitable	Semi-Suitable	Unsuitable
Forest	F1	F1	F1	F2	F1	F1	F2	F2	F1
Shrub	F1	F1	F1	F2	F1	F1	F2	F2	F1
Grassland	G3	G3	G3	G1	G2	G2	G1	G1	G2
Bari Land	A2	A2	A2	A1	A2	A2	A1	A1	A2
Khet Land	A3	A3	A3	A3	A3	A3	A3	A3	A3

Note: F = forest use; G = grassland use; A = agricultural use

⑦ People's needs

People's needs and interests are investigated through socioeconomic baseline survey to collect basic data for plan formulation.

Table 23 People's Needs and Concerns Vis-a-vis Land Use in Model Areas (An Example)

Existing Land Use	Needs and Interests
Forest (including shrub)	<ul style="list-style-type: none"> - Sufficient supply of firewood, fodder and compost (fallen leaves) - Timber supply - Sale of firewood - Water supply - Improved furnaces - Landslides and erosion - Managed grazing, organizing user's groups
Grassland	<ul style="list-style-type: none"> - Sufficient supply of fodder - Alleviation of labour - Shed management - Grazing control - Landslides and erosion
Bari land	<ul style="list-style-type: none"> - Cash income - Terrace improvement - Introduction of irrigation - Alleviation of ploughing work - Alleviation of compost transportation work - Landslides and erosion
Khet land	

⑧ Land use improvement programme

Land use improvement programme is formulated by adding people's needs to the results of the matrix.

Contents of land use improvement programme in Model Areas, for example, are shown in the table below.

Table 24 Contents of Land Use Improvement Programme
(An Example from Model Areas)

Existing Land Use	Programme Type	Contents
Forest (including shrub)	FIP1 (F1)	<ul style="list-style-type: none"> - Preservation and improvement of soil and water conservation functions - Forest-oriented land use by means of conservation of present forests and forest improvement through enrichment, etc. - Production of firewood considered depending on local needs - Participation in communal forestry
	FIP2 (F2)	<ul style="list-style-type: none"> - Preservation and management of production forests - Forest-oriented land use by means of productive forest use and management of present forests to produce firewood, fodder and timber, etc. and introduction of fodder trees and firewood trees through enrichment - Introduction of cash crops to land classified as cultivable land to improve local life - Participation in community forestry - Introduction of improved furnaces
Grassland	GIP1 (G1)	<ul style="list-style-type: none"> - Grassland improvement, introduction of high yield varieties - Managed grazing, organizing user's groups
	GIP2 (G2)	<ul style="list-style-type: none"> - Introduction of silviculture - Managed grazing, Organizing user's groups
	GIP3 (G3)	<ul style="list-style-type: none"> - Conversion to forests to preserve/improve soil and water conservation functions - Phased planting required, taking necessary grazing control and scale of planting into consideration - Introduction of fodder trees and possible employment of stall feeding
Bari land	AIP1 (A1)	<ul style="list-style-type: none"> - Improvement of bari land - Increase of yield - Introduction of cash crops - Appropriate water control - Terrace maintenance
	AIP2 (A2)	<ul style="list-style-type: none"> - Introduction of agroforestry techniques to bari land - Introduction of fodder trees - Introduction of cash crops - Appropriate run-off control - Terrace maintenance
Khet land	AIP3 (A3)	<ul style="list-style-type: none"> - Maintenance of present khet land - Terrace improvement - Maintenance of irrigation channels

- ⑨ Land use improvement programme in terms of subject land area
- Land use improvement programmes in Model Areas were as shown in Table 25. Subject land areas of the plan were determined based on the matrix through GIS data compilation.

Table 25 Land Use Improvement Programme by Model Area
(An Example)

(Unit: ha)

Model Area	FIP1	FIP2	GIP1	GIP2	GIP3	AIP1	AIP2	AIP3	Total
Kaski North	4,055	3,852	105	299	405	447	1,616	3,252	14,031
Kaski East	1,096	1,928	1	8	17	288	1,162	944	5,444
Kaski West	5,142	249	54	274	73	128	2,176	1,743	9,839
Parbat North	1,444	1,069	28	243	90	631	3,039	1,534	8,078
Parbat South	430	218	17	448	221	291	1,848	342	3,815
Total	12,167	7,316	205	1,272	806	1,785	9,841	7,815	41,207

The expected changes (in land area) of the present land use of these areas due to the implementation of the land use improvement programme are shown in Table 26.

Table 26 Changes of Areas Due to Implementation of Land Use Improvement Programme (An Example)

(Unit: ha)

Current Land Use	Land Use by Improvement Plan				
	Forest (including Shrub)	Grassland	Bari Land	Khet Land	Total
Forest	F1: 19,483 F2: 7,316				19,483
Grassland	G3: 806	G1: 205 G2: 1,272			2,283
Bari Land			A1: 1,785 A2: 9,841		11,626
Khet Land				A3: 7,815	7,815
Total	20,289	1,477	11,626	7,815	41,207

(3) Seedling Production Plan

In preparing the nursery plan, it is important to select seeds of the species requested by local inhabitants, to fully consult with local inhabitants on the nursery sites and nursing schedule and to improve the awareness of local inhabitants of their responsibility for nursery management.

① Nursery practice

The method of seedling raising to be adopted varies with the species of trees, and here the essential points of seedling raising for the case of forest trees will be described. Seedlings will be raised in polyethylene bags, as a rule.

- a. Selection of seeds: Seeds of good quality will be selected. The method of selection varies with the species of trees.
- b. Sowing: Selected seeds will be sowed on the germination bed. The method of sowing varies with the species of trees.
- c. Preparation of polyethylene bags: 10 cm × 17.8 cm bags will be used, as a standard.
- d. Preparation of the soil: The soil to be put in the polyethylene bags will be prepared. Varying with the species of trees, usually a mixture of soil, sand and compost will be used.
- e. Transplanting of young seedlings: Young seedlings will be transplanted in soil-filled polyethylene bags.

In addition, shading, watering, weeding, root cutting, insect killing and prevention, hardening and other operations are necessary.

② Number of required seedlings

The number of required seedlings to be used is calculated on the following basis. An example from Model Areas is given below.

Land use improvement program	Calculating basis
Forest Improvement Programmes 1 and 2	10% of planned area for enrichment planting and planting distance of 2m × 2m
Grass land Improvement Programme 3	100% of planned area and planting distance of 2m × 2m
Grassland Improvement Programme 2	100% of planned area and planting distance of 10m × 10m
Farmland Improvement Programme 2	30% of planned area and planting distance of 5m × 4m

③ Nursery

In establishing the nursery the following points should be considered.

- a. Water availability, topography, accessibility, etc.
- b. The nursery of a large scale need not be considered, and the nursery of a small scale in the vicinity of the farmhouse is favorable.
- c. For obtainment of the site, the best suited one will be selected through discussion with the inhabitants.
- d. The nursery will be designed to meet at least the following conditions.
 - (a) Fences: To prevent ingress of animals.
 - (b) Working paths: Used for transportation of seeds and seedlings, watering, weeding and other management and maintenance operations.
 - (c) Water tank: For water make-up in the dry season. Simple

one is desirable.

(d) Seedbed: $1\text{m} \times 10\text{m}$, as a standard, to be adjusted as necessary.

- e. In addition, soil storage yard, working yard, etc. are also required.
- f. Moreover, seedbeds, etc. should be well drained, and care should be taken to avoid root rotting, etc.

(4) Proposed Plant Species List

A list of the species of trees and grasses to be used in the land use improvement plan and erosion control plan is prepared based on available information and interviews conducted in the field. Adjustments have to be made by taking into consideration the specific site conditions when introducing plants as mentioned in Table 27 into the Study Area.

Table 27 Proposed Plant Species List

A. Grasses and small legumes

Local name	Botanical name	Altitude (m)	Propagation method	Main use
Amliso	<i>Thysanolaena maxima</i>	up to 2,000	cuttings	E (good in moist sites)
Babiyo	<i>Eulaliopsis binata</i>	up to 1,500	cuttings/seeds	E (also for rope & paper making)
Banso ghans	<i>Eragrostis tenella</i>	500-1,800	cuttings/seeds	E
Clover (legume, exotic)	<i>Trifolium</i> sp.	up to 2,000	cuttings/seeds	Fo, S, E
Dangre khar	<i>Cymbopogon pendulus</i>	up to 1,200	seeds	E
Desmodium (legume, exotic)	<i>Desmodium distortum</i>	up to 1,800	cuttings	Fo, S, E
Dhonde	<i>Neyraudia reynaudiana</i>	up to 1,500	cuttings/seeds	E
Kans	<i>Saccharum spontaneum</i>	up to 2,000	cuttings	E (good for dry & severe sites)
Katara khar	<i>Themeda</i> sp.	up to 2,000	cuttings	E
khar	<i>Cymbopogon microtheca</i>	up to 2,000	cuttings/seeds	E (also for roofing)
khus	<i>Vetiver zizanioides</i>	up to 1,500	cuttings	E

Note : ① Sources : -Agroforestry Systems and Practice in Nepal, Forest Research & Survey Centre.
 -Bio-engineering Information (Lists of Species), Dept. of Roads, HMG Government, 1996.
 -Interview with DOSC staff and local inhabitants.
 -Lists of "Recommended Species for Vegetative Measures in Soil Conservation" provided by CDFWCP.

② Main Use : (E:Erosion control)(Fu:Fuelwood)(Fo:Fodder)(S:Soil improvement)(T:Timber)

Grasses and small legumes

Local name	Botanical name	Altitude (m)	Propagation method	Main use
Kudzu (legume, exotic)	<i>Pueraria lobata</i>	500-1,500	cuttings	Fo, S
Molasses (exotic)	<i>Melini minutiflora</i>	up to 1,800	cuttings/seeds	Fo
Musekharuki	<i>Pogonatherum</i> sp.	up to 2,500	cuttings	E
Napier (exotic)	<i>Pennisetum purpureum</i>	up to 1,750	cuttings	E, Fo
Narkat	<i>Arundo donax</i>	up to 1,500	cuttings	Fencing
Padang bans (small size bamboo)	<i>Himalayacalamus hookerianus</i>	1,500-2,500	cuttings	E (also for making baskets & roofing)
Phurke	<i>Arundeuella nepalensis</i>	700-2,000	cuttings/seeds	E
Rato Kans	<i>Friarthus rufipilus</i>	900-2,200	cuttings/seeds	E
Salimo Khar	<i>Chrysopogon gryllus</i>	800-2,000	cuttings/seeds	E
Setaria (exotic)	<i>Setaria anceps</i>	500-2,500	cuttings/seeds	Fo, E
Sito	<i>Neyraudia arundinacea</i>	up to 1,500	cuttings/seeds	E
Stylo (legume, exotic)	<i>Stylosanthes guianensis</i>	500-1,500	cuttings	Fo
Tite nigalo bans (small size bamboo)	<i>Drepanostachyum intermedium</i>	1,000-2,500	cuttings	E (also for making baskets, etc)

B. Shrubs and small trees

Local name	Botanical name	Altitude (m)	Propagation method	Main use
Ainselu (thorny)	<i>Rubus ellipticus</i>	1,000-2,500	seeds/cuttings	E
Alainchi	<i>Blettaria cardonum</i>	1,000-2,000	seeds	cash crop
Amala	<i>Phyllanthus emblica</i>	up to 1,500	seeds	E (also fruits are edible)
Amba/ambak	<i>Psidium guyava</i>	up to 2,000	seeds	Fruit producing
Areri (thorny tree up to 5m high)	<i>Acacia pennata</i>	500-1,500	seeds	E
Assuro	<i>Adhatoda vasica</i>	up to 1,000	cuttings	E (leaves good for compost making)
Bainsh	<i>Salix tetrasperma</i>	up to 2,700	cuttings	E (specially good in wet sites)
Ban chutro (thorny shrub up to 5m high)	<i>Berberis aristata</i>	1,500-3,000	seeds	E
Bhui katahar (Pineapple)	<i>Ananas comosus</i>	up to 1,800	cuttings	E (especially for planting along terraces)
Bhujetro	<i>Butea minor</i>	500-1,500	Direct seeding	E
Dhanyero	<i>Woodfordia fruticosa</i>	up to 1,500	seeds	E
Dhusun	<i>Colebrookea oppositifolia</i>	up to 1,000	seeds	E
Changaru	<i>Pyracantha crenulata</i>	1,500-2,500	cuttings	E
Kera (Banana)	<i>Musa paradisiaca</i>	up to 1,300	Root suckers	Fruit producing, (specially good for planting in gullies). E

Shrubs and small trees

Kottuke (large cactus)	<i>Agave americana</i>	up to 2,000	Root suckers	E (widely used for fencing)
Keraukose	<i>Indigofera atropurpurea</i>	up to 2,000	seeds	E, S
Kimbu	<i>Morus alba</i>	up to 2,000	cuttings/seeds	F o
Kunyelo	<i>Trema orientalis</i>	up to 1,500	cuttings/seeds	E (good on stony & dry sites)
Mesquite (thorny, exotic)	<i>Prosopis juliflora</i>	up to 1,000	seeds	E (good on calcareous soils)
NilKanda	<i>Duranta plumier</i>	up to 1,500	cuttings/seeds	E (used for making hedges)
Rahar (fast growing legume)	<i>Cajanus cajan</i>	up to 1,500	seeds	S
Saruwa/bihaya	<i>Ipomoea fistulosa</i>	up to 1,500	cuttings	E (Fill slopes only)
Simati	<i>Vitex negundo</i>	up to 1,750	cuttings	E, F u
Tilka	<i>Wendlandia puberula</i>	up to 1,500	seeds	E, F u

C. Bamboos

Local name	Botanical name	Altitude (m)	Propagation method	Main use
Choya/tama bans (heavy branching)	<i>Dendrocalamus hamiltonii</i>	300-2,000	clum cuttings	E, construction, basket making, etc.
Dhanu bans (heavy branching)	<i>Bambusa balcooa</i>	up to 1,600	"	"
Kalo bans (heavy branching)	<i>Dendrocalamus hookeri</i>	1,200-2,500	"	"
Mal bans	<i>Bambusa nutans</i>	up to 1,500	"	"
Nibha/ghopi/lyas bans	<i>Ampelocalamus patellaris</i>	1,200-2,000	"	"
Tharu bans	<i>Bambusa nutans</i>	up to 1,500	"	"

D. Large trees

Local name	Botanical name	Altitude (m)	Propagation method	Main use
Acacia (exotic)	<i>Acacia auriculiformis</i>	up to 1,000	seeds	E, F o, S (grows well in severe sites)
Amp/aap (Mango)	<i>Mangifera indica</i>	up to 1,200	seeds	Fruits, F u
Ashare phul	<i>Lagerstroemia parviflora</i>	up to 1,200	seeds	E
Bakeno	<i>Melia azedarach</i>	up to 1,800	seeds	E (grows fast in deep soils)
Bange kath	<i>Populus ciliata</i>	2,000-3,000	cuttings	T, F u
Champ	<i>Michelia champaca</i>	500-1,500	seeds	T, E
Chilaune	<i>Schima wallichii</i>	900-2,000	seeds	T, E
Dabdabe	<i>Garuga pinnata</i>	up to 1,300	seeds/cuttings	F o
Dhale Katus	<i>Castanopsis indica</i>	900-2,900	seeds	E (also seeds are edible)
Dudhilo	<i>Ficus neriifolia</i>	900-2,200	seeds	F o
Ipil ipil (prone to pest attack. Mixed planting preferred)	<i>Leucaena leucocephala</i>	up to 1,500	seeds	F o, E
Jamun	<i>Syzygium cumini</i>	up to 1,600	seeds	T, F u
Kadam	<i>Anthocephalus cadauba</i>	up to 1,000	seeds	T, F u

Large trees

Kagati	<i>Citrus aurantifolia</i>	500- 1,500	cuttings	Fruit
Kalo seris	<i>Albizia lebeck</i>	up to 1,200	seeds	T. Fu
Kaura	<i>Ficus lacor</i>	up to 1,600	cuttings	Fo, T
Khanyu (khosro)	<i>Ficus cunia</i>	up to 2,000	seeds	Fo
Khari	<i>Celtis australis</i>	700- 2,400	seeds	T, Fo
Khashru	<i>Quercus semecarpifolia</i>	1,700- 3,800	seeds	T, Fu
Koiralo	<i>Bauhinia variegata</i>	up to 1,900	seeds	Fo
Kulmero	<i>Litsea monopetala</i>	up to 1,600	seeds	Fo
Lankuri	<i>Fraxinus floribunda</i>	1,200- 2,700	seeds	T, Fu, E
Musure Katus	<i>Castanopsis tribuloides</i>	500- 2,300	seeds	T, Fu
Nebharo	<i>Ficus roxburghii</i>	up to 2,000	seeds/cuttings	Fo
Okhar (walnut)	<i>Juglans regia</i>	1,200- 2,800	seeds/grafting	fruit
Paiyu	<i>Prunus cerasoides</i>	500- 2,400	seeds	ornamental, E
Palle kalus	<i>Castanopsis hystrix</i>	1,000- 2,500	seeds	Fo

Large trees

Phalant	<i>Quercus lamellosa</i>	1,600- 2,800	seeds	T, Fu
Phaledo	<i>Erythrina sp.</i>	900- 3,000	seeds/cuttings	Fo
Rani(khotay) Salla	<i>Pinus roxburghii</i>	500- 1,950	seeds	T, Fu
Rato siris	<i>Albizia julibrissin</i>	800- 3,000	seeds	T, Fu
Sal	<i>Shorea robusta</i>	up to 1,000	seeds	T
Sissau	<i>Dalbergia sissoo</i>	up to 1,400	seeds/cuttings	T, Fu
Suntala	<i>Citrus chyracarpa</i>	500- 1,500	cuttings	Fruit
Tanki	<i>Bauhinia purpuria</i>	up to 1,600	seeds	Fo
Tooni	<i>Toona ciliata</i>	up to 1,700	seeds	T, Fu
Ulish	<i>Alnus nepalensis</i>	900- 2,700	seeds	E, Fu

(5) Erosion Control Plan

(Objectives)

To mitigate erosion hazard, reduce the damage from sediment disasters and improve land productivity.

① Plan principles

- a. Landslide, gully erosion and bank erosion sites with conservation objects nearby should be the plan targets.
- b. Conservation objects could be mainly farmlands, roads, footpath and houses.
- c. Priority for treatment should be given to those sites that are located on high and medium hazard zones.
- d. Simple and low cost structural measures, the material for construction of which is available in the community and can be constructed using simple techniques, should be planned. Also regarding the treatment plan of large landslides, possible options have to be explored.
- e. Structural measures have to be accompanied with bioengineering measures to improve the site environment and to produce plant material for use by local inhabitants.

② Countermeasures for landslide control and prevention

Generally, practicality of treating a landslide is based on identification of causes, depth of failure, environment of the site (including presence or absence of conservation objects and their value) and the availability of human and financial resources.

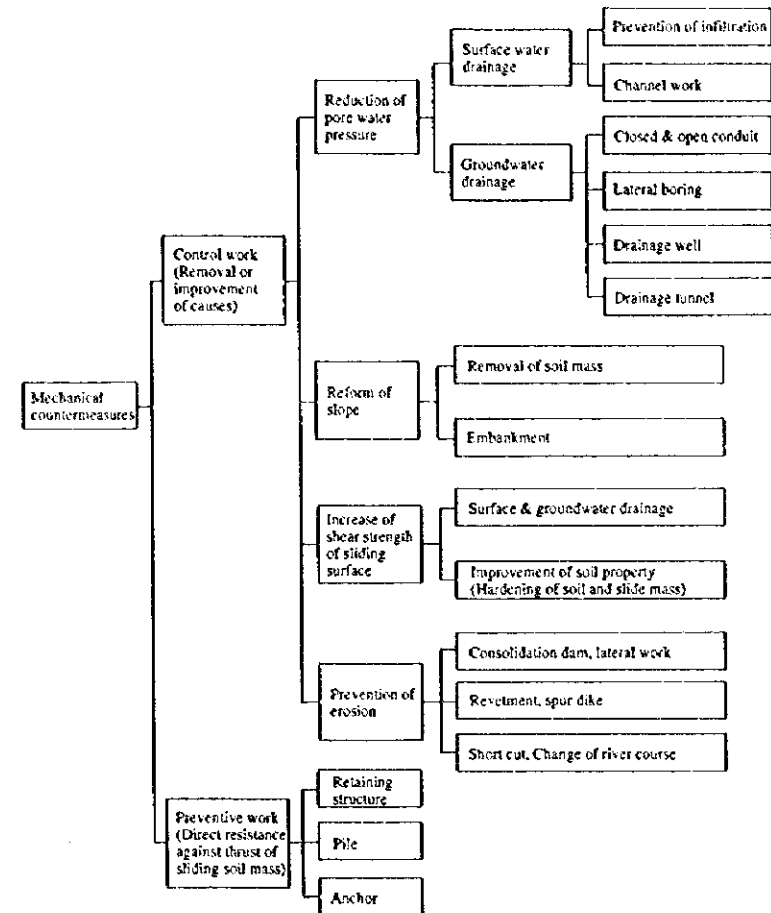
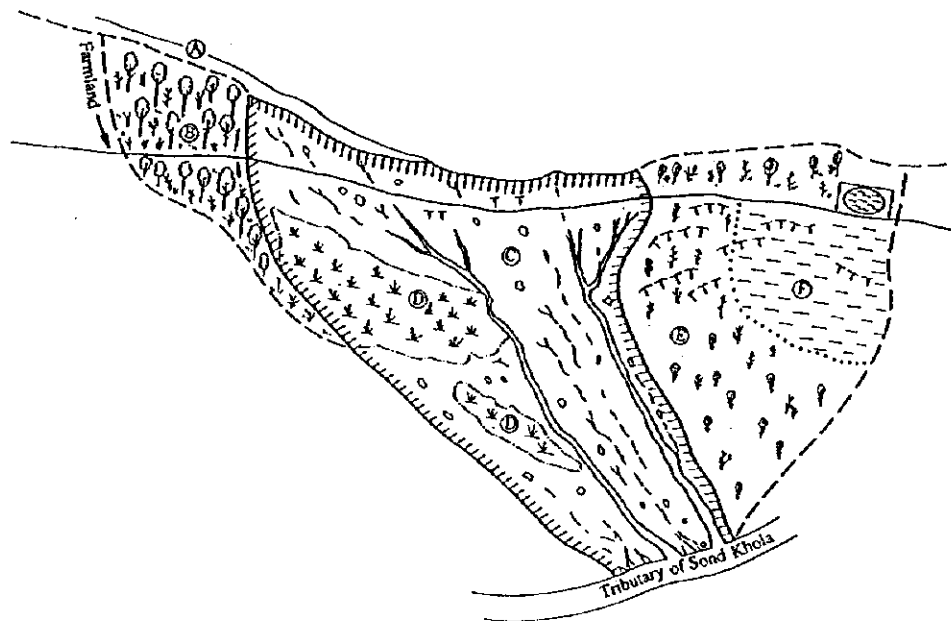


Fig. 21 Types of Mechanical or Structural Countermeasures for Landslide Control and Prevention

- a. Considering the immediate causes of small scale landslides, which are mainly a weak geology, concentration of surface run-off from upper fields, steep slope, etc., a mixture of

structural measures to divert surface run-off and stabilize the landslides, and bio-engineering measures to control secondary erosion of the scar, improve the site environment and provide a source of income for inhabitants have to be planned.

- b. In view of the causes of the large landslides, which are mainly geological structures and groundwater, their prevention and rehabilitation will require major engineering undertakings such as construction of large structures, treatment of groundwater, etc. the implementation of which will require special skills and large investments. Therefore, simple mitigation and monitoring measures, applicable at the community level have to be planned to prevent further enlargement and expansion of these landslides. Mechanical or structural countermeasures will be adopted from what is mentioned in Fig. 21.
- c. Taking into consideration the financial and human resources conditions of the local inhabitants affected by landslides, condition of conservation objects and inaccessibility of affected sites, from among the structural countermeasures of Fig. 21, those items the application of which is judged to be practical in Study Area are:
 - (a) control works such as prevention of infiltration and channel work for surface water drainage and
 - (b) prevention works such as construction of retaining structures made of loose stones or stone-filled gabion check dams.



Legend	
---	Landslide area (approx. L. 400m, W. 250m)
TTTTT	Scar
TTTTT	Tension cracks
---	Foot trail
---	Active gully
---	Pond
②	Bail land
③	Old part of landslide (Alnus trees 8-10m H.)
④	Slided area (bare and active)
⑤	Slided area (some vegetation due to natural regeneration)
⑥	Steep bushland containing tension cracks
⑦	Abandoned bail land

Symbol	Proposed treatment measures
TTTTT	Fencing of the scar.
①	Terrace improvement and diversion channel construction to control run-off.
②	Protection against cutting, grazing and fire and utilization of tree branches as fuel wood.
③	Protection to encourage natural regeneration of plants.
④	Bioengineering work (grass and tree planting) and protection.
⑤	Filling of tension cracks and protection.
⑥	Filling of tension cracks and protection.
⑦	Improvement to prevent overflow.
⑧	Foot trail re-routing or improvement.

Fig. 22 Mauja VDC Ward No.8 Large Landslide
An Example of Zoning and Treatment
of a Large Landslide

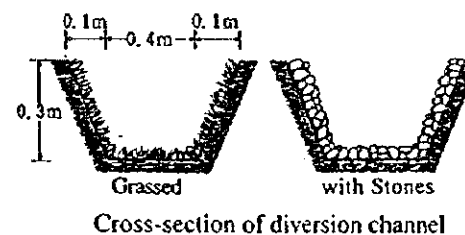
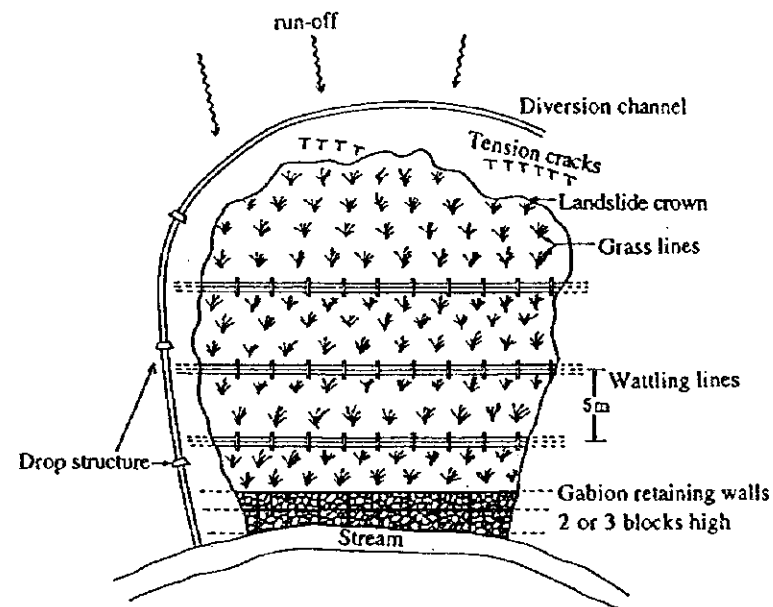


Fig. 23 Example of Small Landslide Treatment

② Gully erosion

- a. In principle, for effective control of gully erosion in areas which have heavy rains, such as Study Area, the following 3 methods could be applied.

- b. Criteria applied for selection of control measures for various portions of a gully could be those established by the FAO (Conservation Guide 13/2, 1986) for continuous gullies of up to 20 ha watershed area, up to 1,000m channel length and less than 35 degrees channel gradient.

- (a) Improvement of gully watershed to reduce and to regulate the surface run-off.
- (b) Diversion of surface water above the gully area to direct surface run-off away from gully head and discharge it safely into natural and stable streams.
- (c) Stabilization by a combination of structural and bio-engineering measures.

- (a) Diversion ditches are established above the gully heads. The ditch cross-section could be decided after survey of discharge and topographic condition at the implementation stage but should be designed to have sufficient capacity to drain maximum run-off. To prevent scouring of the bed and sides, the channel should be stone-paved or grassed.
- (b) The upper portions of the main gully channel and branch gullies could be controlled by constructing bamboo or log check dams (depending on the availability of material) and loose stone check dam. Bamboo or log check dams are temporary structures and are estimated to have a life-span of 3-4 years under the climatic conditions of Study Area, are less expensive and easy to built and maintain by local user's group. They are

- c. The lower parts are treated with loose stone or boulder check dams.

intended to stop channel and lateral erosion of gullies by reducing the original gradient of the gully channel, diminish the velocity of water flow and the erosive power of run-off. Also these structures hold soil and moisture in the bottom of the gully and therefore tree seedlings as well as shrubs and grass cuttings can grow in gullies without being washed away by flowing water. This will help the establishment of a permanent vegetation cover in a short period of time.

At a stable point in the lowest section of the main gully channel, a gabion or cement masonry check dam could be constructed. Spacing between the check dams and therefore their number is determined according to the compensation gradient of the gully channel and effective height (minus foundation depth) of the check dam.

All structural measures should be accompanied with bio-engineering measures such as planting of grasses, shrubs and trees which will begin after structural works are completed. Choice of fodder trees have to be left with the user groups.

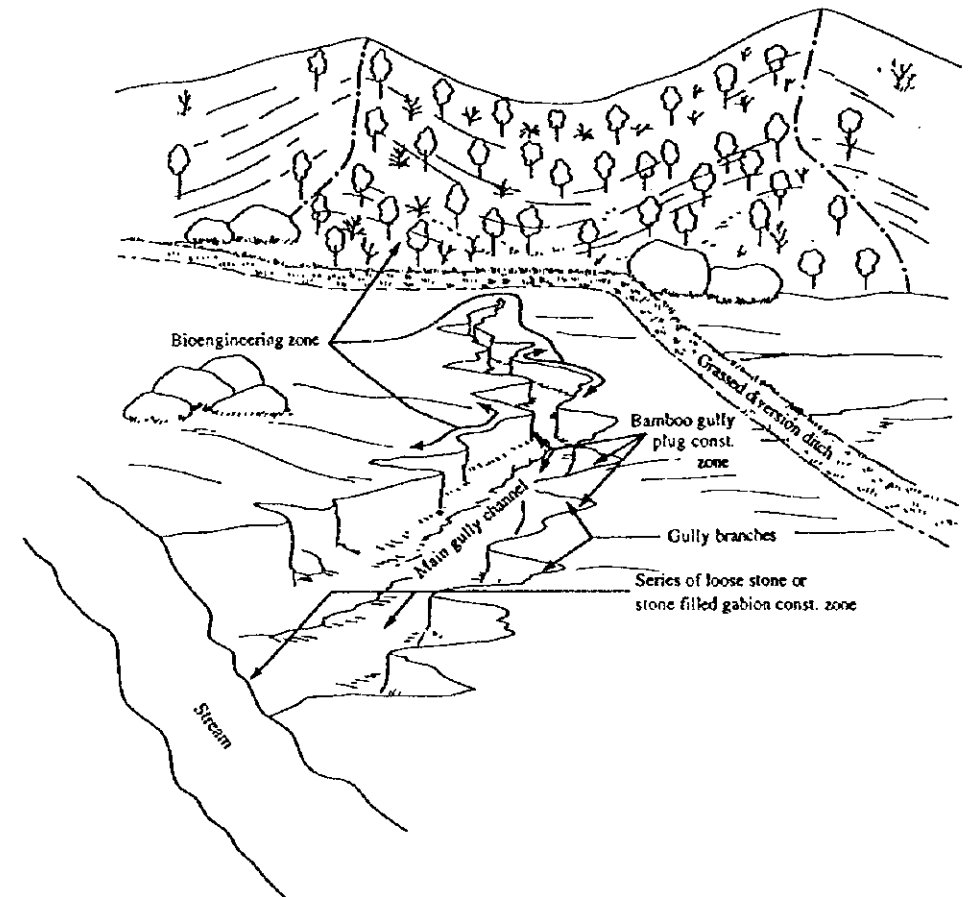


Fig. 24 Gully Control with Bioengineering Work and Simple Structural Work (An Example)

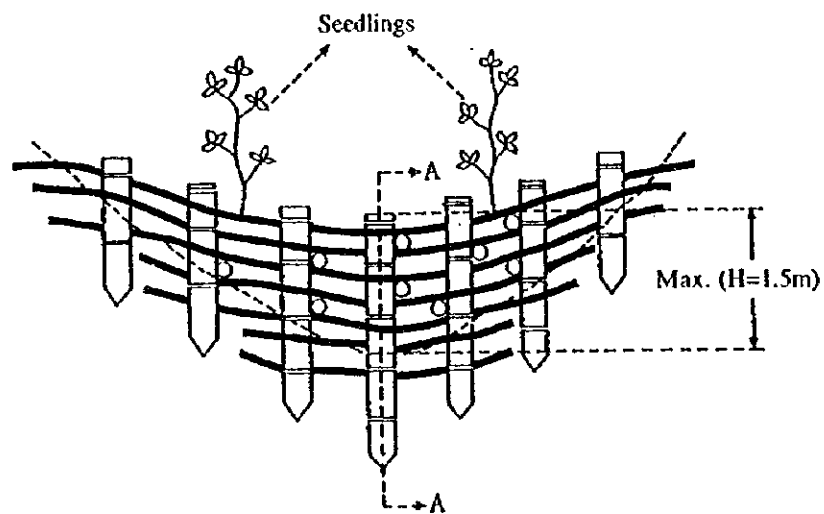


Fig. 25 Front View of Bamboo Gully Plug
(An Example)

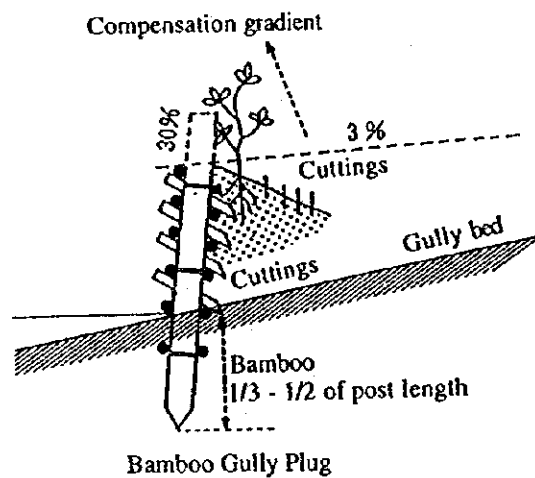


Fig. 26 Cross-section of Bamboo Gully Plug
(An Example)

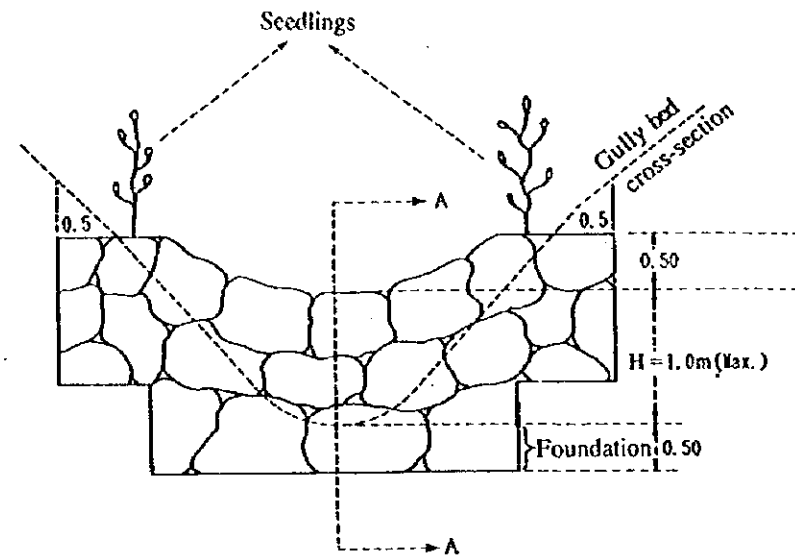


Fig. 27 Front View of Stone Check Dana
(An Example)

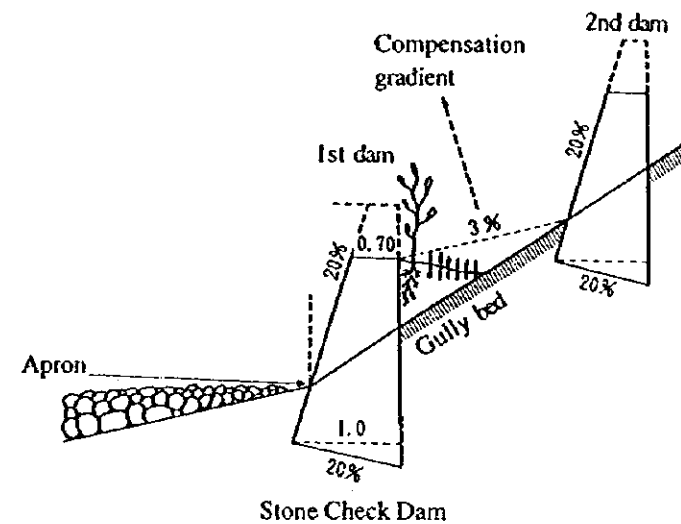


Fig. 28 Cross-section of Stone Check Oaw
(An Example)

③ Bank erosion

Revetments and spurs, built using stone-filled gabions, are usually the main countermeasures applied for bank erosion control. Riparian vegetation belt as a bio-engineering measure should be introduced along the affected streams for bank protection.

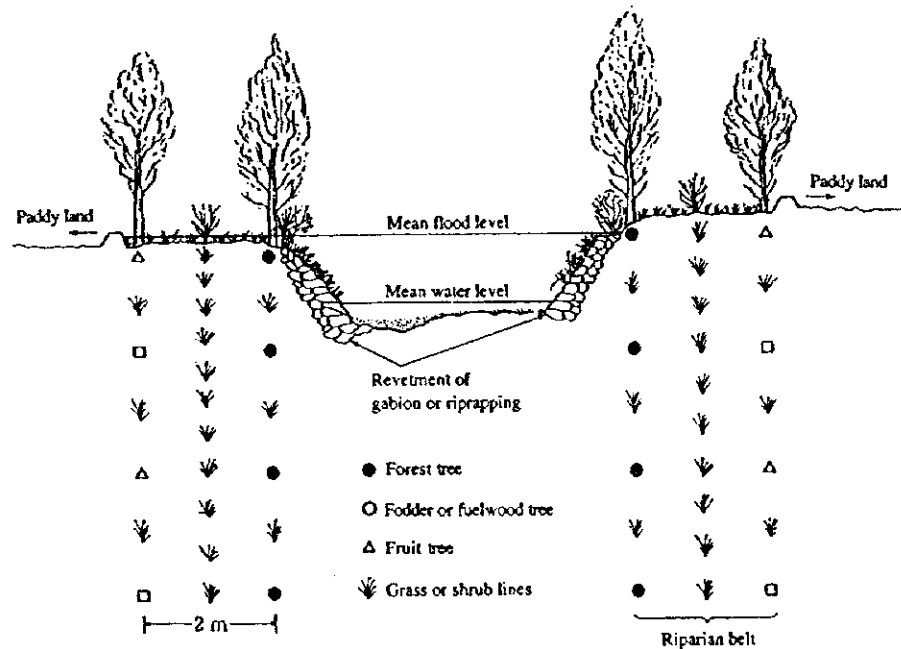


Fig. 29 Revetment and Riparian Belt Design for Bank Protection
(An Example)

- (a) The riparian belt will be effective in adjusting and improving the river environment as well as binding the soil by means of root system. Moreover, the riparian vegetation will assist local life by providing fodder, firewood, etc. Also the presence of the belt along streambanks will reduce the velocity of overflowing flood, thereby reducing the damage to crops.
- (b) A 4m wide strip of land on both sides of the banks (2m along each bank) could be planted with forest, fodder, fuel, and where possible, fruit trees. The forest trees could be Delbergia Sissoo for low elevation (under 1,000m) areas and Alnus nepalensis for high elevation (over 1,000m) areas.
- (c) As an incentive, all seedlings could be provided and the choice of fodder, fuelwood and fruit trees should be given to farmers on whose land the riparian belt is going to be established. Actually a riparian belt should be more wider, for example, 50m or 100m to be effective, but considering the scarcity of land in the Study Area it's highly unlikely that local farmers will agree to the establishment of a belt wider than a few meters. Thus a belt 2 meters wide in one side have to be a beginning step and in the future it could be expanded with the agreement of local inhabitants.
- (d) Bio-engineering measures such as the creation of riparian belts alone may not be enough for bank erosion control because the plants may not be firmly established before the time a strong flood occurs. Therefore, for an effective bank erosion control and prevention structures have to be constructed but in combination with bio-engineering measures such as riparian belts.

(6) Improvement of Living Environment Plan

The most important issue from the viewpoint of ensuring the development and continuity of programmes designed to achieve watershed management is an accurate understanding of and voluntary and active participation of people in the projects. For this purpose, first the living environment of the people have to be improved according to their needs, and based on it, watershed conservation could be conducted.

In Model Areas, the following improvement measures were proposed for issues which were of strong concern or for which there was a strong need among local people.

- The construction or improvement of roads and footpaths was examined from the viewpoint of soil conservation. A proposal was made in regard to the possibility of constructing new roads.
- The construction of suspension bridges is important to improve the access of local people. Coordination between communities will, however, be essential.
- As the supply of drinking water (installation of water tanks and pipes) involves the question of local water rights, proper surveys and coordination are necessary.
- In the case of the repairing of ponds, proposals have to be made from the viewpoints of run-off conservation and their use as drinking places for livestock.
- In regard to community rice polishing and flour milling facilities, careful examination of the question of the distribution of operation profits will be necessary.
- Planning of the construction or rehabilitation of irrigation facilities have to be conducted in the form of conservation measures around irrigation channels.
- The use of improved furnaces and biogas will not only contribute to the conservation of forest resources but will also lead to a reduction of the firewood collection time and the cooking time of women.
- Health and hygiene, etc.

① Trail improvement programme

a. Target sites

Improvements in terms of stone paving as well as provision of drainage facilities are necessary to control surface run-off, and therefore, erosion of the trails and their surrounding areas, which will facilitate a smooth use of the trails by local inhabitants. As the potential of occurrence of slope failure and erosion is high in high hazard areas, trails running in these areas as well as trails having steep gradients of 15 degrees or more (could be measured on topographic maps) will have to be the subjects of improvement.

b. Contents

Cross-drains 15-20cm wide and 10-12cm deep could be constructed every 30-50m. Stone paved side drains 30-40cm wide and 20-25cm deep with drop structures in every 30-50m could be constructed, specially where a trail crosses heads of streams. The trails should be paved with stones.

② Road improvement programme

Improvement of feeder roads is necessary for the smooth implementation of a plan and for the promotion of local economy.

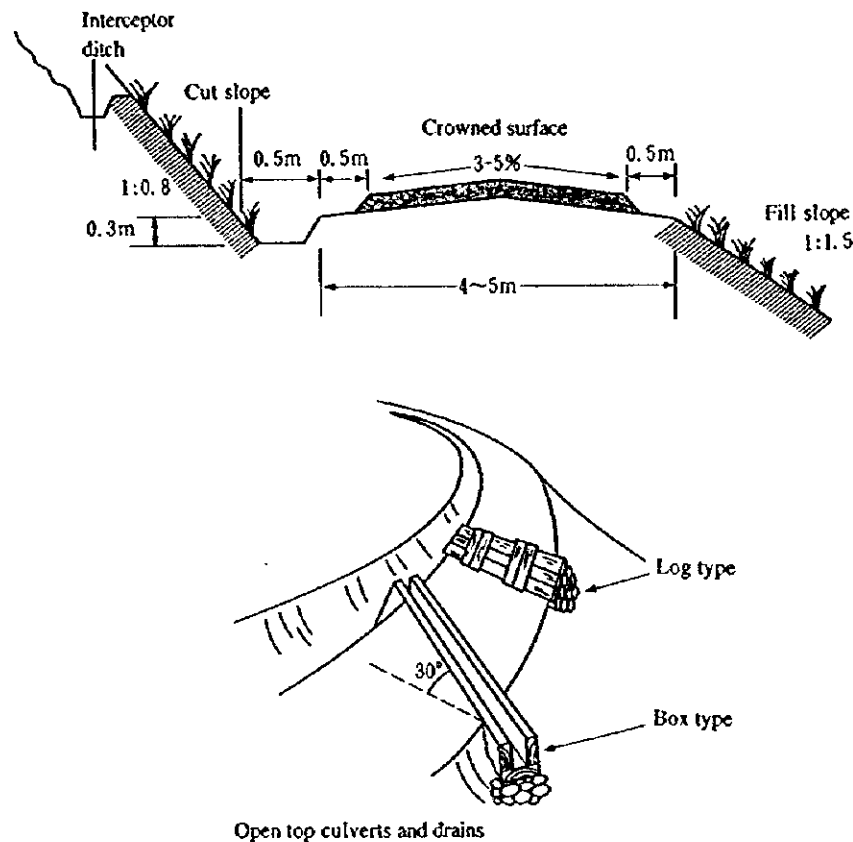


Fig. 30 A Typical Mountain Road Cross-section and Run-off Draining Facilities

a. Targets sites

Roads running on steep hillslopes where gullies and rills developed on their surfaces, and roads the cut and fill slopes of which are unprotected. Also the roads requiring drainage facilities and surface improvements.

b. Improvement contents

(a) In feeder roads located in valley floors or relatively flat areas

- i The existing drainage ditches have to be improved by clearing them of deposited material to prevent plugging and to facilitate the flow of run-off water.
- ii Where drainage ditches do not exist, ditches 0.5m wide and 0.3m deep have to be built on both sides of the roads.
- iii The roads have to be paved with 10cm to 15cm deep layer of gravel and maintenance have to be carried out regularly.

(b) Roads running on steep hillsides

- i These roads could be improved according to the specifications of mountain roads (4-5m wide and 20-30 km/hour vehicle speed) as mentioned below.
- ii In case of a lack or insufficiency of gravel paving traffic will cause ruts to form, channelling run-off water longitudinally down the road.
- iii In mountain roads water flowing in ruts could easily obtain high velocities, causing erosion of the road

surfaces. To prevent this to happen, road surfaces have to be paved with gravel 10-15cm thick.

- iv Lateral drainage have to be conducted by crowning or by in-or out-sloping (3-5%) of road surfaces. longitudinal drainage have to be conducted by constructing side ditches and cross-drains. Side ditches could be 0.5m wide, 0.3m deep and stone paved with drop structures every 20-50m.
 - v Cross-drains 0.3m wide and 0.3m deep have to be constructed. Either logs or stones could be used or open culverts could be built. Culverts could be slanted at 30° downslope to help prevent plugging. The gradient in order for cross-drains to be self-cleaning should be 4% or more. Spacing of cross drains depend on road grade, surfacing material, rain intensity and slope. Here a spacing of 10-50m is proposed, depending on actual field situation.
 - vi Road surface grade have to be 8% and the maximum could be 12-14%. Curve radius have to be more than 12m to facilitate a smooth flow of the traffic.
- c. To carry out the above activities user's groups have to be organized.
 - d. Cut and fill slope stabilization (planting activities).
 - e. Examination of possibility of construction of new roads.
 - (a) When examining the possibility of construction of new roads in the Study Area, special attention should be paid to the existence of severe natural conditions such as fragile geology, high rainfall and mass movements such as landslides, etc. as well as to construction cost, post construction maintenance, etc.

③ Construction of suspension bridges

As the lack of access hinders the transportation of fertiliser and farming products, suspension bridge construction will have important meaning for local life.

- (b) Local inhabitants indicate a strong desire for the improvement of the existing roads as well as for the construction of new roads which can function in all seasons.
- (c) The construction of new roads should be undertaken after careful and detailed surveys and evaluation of a road's impact on social as well as natural environments.

a. Target sites and improvement measures

Sites to establish suspension bridges are selected based on people's needs.

- (a) There is a possibility that the construction of new suspension bridges will cause a clash of interests between communities and a socioeconomic gap between areas enjoying such bridges and other areas. There are, therefore, many problems to be solved prior to the implementation of such a project.
- (b) Accordingly, a careful approach is required to the construction of suspension bridges with the coordination of local people and the relevant VDC and district authorities and examination of the problems between communities, the project cost and other relevant issues.
- (c) From the viewpoint of the construction cost, small bridges can be constructed by local people themselves while the construction of large bridges requires the form of a district or even national project.
- (d) For design and planning standards established by Dept. of Roads are used.

b. User's groups are organized.

④ Improvement of water source areas of permanent springs

To ensure a continued and sustainable supply of water from permanent springs, measures should be taken to improve the forest conditions in the water source areas of the springs and to protect the source areas against fire, grazing and cutting.

a. Target sites and improvement measures

- (a) Where a spring is located in non-forest areas such as paddy land, sloping terraced land, grassland, etc., from the spring source an area 50m in radius (approx. 0.8ha) could be fenced and planted with a mix of forest, fodder and fuelwood trees. This area should be protected against fire, grazing, grass cutting and tree cutting. After the trees grow and the crown is closed, utilization of branches as fuelwood and fodder could be allowed.
- (b) Where a spring is located in a forest having a crown density of 10-40%, or in a shrub land, from the spring source an area 100m in radius (approx. 3 ha) could be fenced and protected against fire, grazing, selective as well as clear cuttings. After a period of 5-8 years—depending on the forest and site conditions this period could be shortened or prolonged—when the canopy cover of over 40% is achieved, utilization of tree branches as fuelwood and fodder could be allowed.
- (c) Where a spring is located in a forest having a crown cover of 40-70% or >70%, an area of the same size as in b. could be protected against fire, grazing and selective and clear cuttings.

⑤ Supply of drinking water

Some 60% (65% in the rainy season) of the population, for example, in the Model Areas receive drinking water through piped supply and local people show strong interest in the supply of drinking water. A piped water supply is convenient in that people can obtain water near home, resulting in a reduction of the women's water fetching workload. As such, all communities indicate a strong need for this type of water supply.

b. Incentives, management and maintenance

- (a) As an incentive for local inhabitants to cooperate in water source area protection, pipes could be extended to their communities to provide drinking water or irrigation water for small size farmlands.
- (b) User's groups have to be formed and protection, planting and all forestry operations have to be conducted under community forestry. The activities could be carried out for at least a period of 10 years, after which they will be reviewed and with the cooperation of local inhabitants protection area sizes could be increased.

a. Target sites and improvement measures

- (a) When the laying of clean water supply pipes in response to the needs of local people is planned, it is necessary to determine the priority among similar projects based on a precise understanding of the local conditions, including the state of water use, etc.
- (b) Target sites for water supply installation will commence in those places with a serious water shortage in areas where there is strong interest in watershed conservation on the part of local people.

⑥ Repair and new construction of conservation ponds

Conservation ponds play the dual functions of conservation to prevent soil loss and the provision of drinking places for livestock. The design conditions and drainage requirements for the repair or construction of the ponds from the viewpoint of conservation have already been described.

Conservation ponds play a significant role in controlling harmful insects for livestock, particularly water buffalo, while they are used as drinking places for other livestock.

b. User's groups and maintenance

In addition, the following conditions should be set for local people and user groups.

- Compulsory conservation of the headwater area
- Compulsory maintenance of pipes and water tanks by users
- Establishment of user groups to establish rules, etc.

c. Meanwhile, to avoid conflict between communities living in upstream water source area and those living downstream, it is necessary to obtain their full understanding regarding drinking water supply programme. In addition to assistance for the programme, coordination with the VDC, DDC and Department of Water Supply will be required.

a. Targets

The target could be to establish one reservoir in each ward, the final decision however have to be made in accordance with the needs of local people and the level of stock raising.

b. Improvement contents

The followings are proposed as guides when choosing sites for construction of new ponds and pond dimension.

- (a) Avoid the site on a slope where tension cracks, subsidence, deformities, old or new landslides and active gullies exist;
- (b) Avoid the site on a slope containing unconsolidated soils and highly weathered rocks;
- (c) Sites where there is a break in slope and the land is relatively flat and contain clayey soil are preferred for constructing a new pond. The sizes could be considered.
- (d) For rectangle shaped pond:
Depth : 1.0-1.5m

⑦ Joint rice polishing and flour milling facilities

It is one item which is high on the local inhabitants needs list.

⑧ Construction and Rehabilitation of Irrigation Facilities

The existing irrigation facilities are fairly well maintained, showing a positive attitude towards khet land by farmers.

Width : 5.0-10.0m

Length : 15.0-20.0m

(e) For circular shaped ponds:

Depth : 1.0-1.5m

Radius : 3.0-6.0m

(f) The ponds could be constructed using wet masonry (stones and cement) and their bottoms will not be sealed off to facilitate gradual infiltration. However, since infiltrating water may increase pore water, which in turn increases slope failure hazard, careful attention should be paid when selecting the site.

(g) As a number of ponds built by local inhabitants or related organizations already exist in the area and these could be used for storing run-off. In Model Areas construction of approximately 1 new pond per ward was proposed.

- a. Reduction of working hours and cost of flour milling.
- b. User groups have to be established to operate and maintain these facilities.
- c. Coordination with the related organizations is required.

- a. The relevant programme must be prepared after careful examination of the site conditions and the question of water rights, etc. regarding the subject sites. Proper coordination with the agricultural office and irrigation office is essential.

⑨ Improved furnaces and biogas

It is hoped that improved furnaces and biogas will be widely used in the future.

⑩ Health/Hygiene

Poor health leads to the stagnation of local people's participation as it can reduce not only the efficiency of the workforce conducting watershed conservation improvement work but also the level of local income.

- b. In regard to the DOSC, conservation around channels will be the main issue.
- c. Planting near new irrigation facilities and conservation measures near intake points should be conducted on the initiative of user groups.
- d. Local people, who will be responsible for the implementation of the programme, should be made constantly aware of the importance of watershed management upstream.

- a. Introduction of improved furnaces are attempted based on the examination of people's needs and customs.
- b. In regard to biogas, its use at high altitudes is not particularly efficient and, therefore, its use in the Study Area should be carefully examined.

- a. The present health centre buildings should be repaired through the establishment of user groups with a view to improving the living environment.
- b. Compulsory planting around these buildings will also help to improve the awareness of local people of the importance of watershed and forest conservation.

⑪ Toilets

The construction of toilet facilities will improve the sanitation conditions for local people and remove the causes of various diseases, resulting in an improved sanitation level for the whole community.

- a. While it is normally preferable to locate toilets near houses, the drainage conditions in the surrounding area and possible adverse impacts downstream should be taken into consideration when deciding the sites. In the future, the needs of local people and environmental impacts should be carefully considered when constructing new toilets.
- b. The understanding of local people that the construction of toilets has important implications vis-a-vis not only public hygiene but also the water quality in the entire watershed is essential.

⑫ Education

As the level of education is closely related to the level of understanding and the level of cooperation for watershed conservation projects, appropriate improvement measures should be examined.

- a. Literacy education for women have to be thoroughly implemented to improve the status of women (requiring a positive understanding on the part of men).
- b. The local level of education should be improved through the proper maintenance of school buildings and the distribution of teaching materials. User groups have to be established for building maintenance and their active participation in school nursery and forest conservation schemes have to be encouraged.
- c. Environmental education should be provided to facilitate understanding of the importance of watershed management among local people.

(7) Income Generation Plan

The income generation programme intends to improve the income of local people to enable the purchase of foodstuffs, a sufficient supply of nutrients for farmland, the purchase of alternative energy and the alleviation of the excessive workload of women, etc., all of which should have a positive effect on forest and watershed conservation.

Another aim of the programme is improvement of the living environment for women and occupational castes in view of development throughout the area. Improved income will empower local people in terms of their efforts to improve their living environment and their involvement in soil conservation projects. It will become possible for local people to set up a fund to assist the continuous implementation of programmes.

① Farming products/livestock

The cultivation of cash crops is the quickest and most effective method of improving the income of local people and obtaining the understanding of local people.

- a. At present, the following crops are cultivated to generate income.

Kaski District	Parbat District
ginger, potatoes, cauliflowers, cabbages, pulses, apples, peaches, plums, tangerines, tea, coffee, vegetable seeds, Lapsi	ginger, rocta (<i>Edgeworthia chrysantha</i>), coffee, napier grass, tangerines

- b. The cooperation of the agricultural office is required with a view to facilitating the understanding of local people,
- c. It is essential to conduct a full market survey and a survey on the intentions of local people.

② Small-scale processing industries

One way of obtaining cash income for local inhabitants is through small-scale processing industries. Generally, currently, there is little demand for processed foodstuffs. However, the situation could change with progress in marketing in such areas as Pokhara.

- d. In regard to improving the awareness of local people of the importance of watershed conservation through income generation, it is important to improve the understanding of local people of the following connections.
 - (a) Cultivation of potatoes → supply of compost → livestock fodder → conservation of forest resources
 - (b) Bee-keeping → preservation of honey resources → growth of flower-bearing plants and trees → conservation of forest resources
 - (c) Cultivation of rocta in forests → forest conservation
- e. Although the raising of goats is said to have adverse implications vis-a-vis conservation, appropriate breeding control can prevent forest degradation. Moreover, the problem of feeding goats can be presented to local people to improve their awareness of the importance of forest conservation. It will be necessary to obtain data on fodder required for goat raising.
 - a. As bamboo is observed in many locations in the Study Area, there should be a sufficient supply of bamboo for bamboo work. If bamboo work is to be conducted for self-consumption, the training of technicians, etc. will be required for the proper selection of materials and the improvement of processing techniques.
 - b. Local woodworking includes handicrafts, furniture making and sawing.

③ Creation of employment opportunities

Full-time farmers dominate the population in both Kaski and Parbat districts. Creation of local employment will hopefully improve the situation of a population outflow to seek jobs outside home areas.

- c. For the expansion of sales outlets in this field, it will be necessary to improve access to and to develop the markets in Pokhara (particularly souvenir shops).
 - d. Further requirements are the establishment of producer groups of bamboo work and handicrafts, i.e. user groups of forest resources, to provide marketing information and to organize technical training courses. In this regard, it will be essential to remind producers (users) of the importance of forests as a supply source of raw materials and also to prepare programmes, including a programme which makes planting after the felling of trees to obtain raw materials compulsory.
-
- a. The active development of the small-scale processing industries will possibly lead to an expansion of communal forests, producing new jobs for watchmen. Further employment opportunities will include those for engineers specialising in erosion control work and for the transportation of cash crops.
 - b. The day-to-day exchange of information with related organizations is necessary for the creation of employment opportunities, treating this issue as not only one which affects local people but one which also relates to forests and environmental conservation through local development.

(8) Extension Plan

Extension activities are intended to provide incentives for local people to take the initiative in watershed and forest conservation and should not be simply the top-down conveyance of the importance of environmental conservation. The mutual exchange of information between extension agents and beneficiaries must be ingredients of the plan and implementation processes. In fact, extension activities and plan implementation cannot be separated in the field. The extension and training programme for local people, NGOs and field agents is described below.

① Local people

The emphasis of the programme should be placed on the socially weak, women and the poor who are in fact the most closely related to the use of forests.

- a. As local people have a strong interest in cash income and road improvement, these needs should be incorporated in reforestation and soil conservation programmes.
- b. Extension activities should avoid the busy farming season and any period with a high concentration of other necessary work as much as possible.
- c. The benefits for local people participating should be clearly established together with the benefits for other communities.
- d. Key persons should be selected from among local people and these persons should be used to encourage the active participation of farmers in various programmes.
- e. Literacy education and environmental education in schools should be actively promoted to enable local people to understand the objectives and significance of programmes.
- f. The participation method should be clearly shown to create the opportunity for free participation.

② NGOs

The present manpower of the DOSC, which is responsible for watershed conservation and soil conservation activities, will find it difficult to ensure the smooth implementation and maintenance of projects. The role of NGOs as partners of DOSC is expected to increase in the future.

③ Field agents (DSCO Staff)

In regard to the number of agents, it appears difficult to increase the present manpower level of soil conservation offices given the national policies of administrative rationalisation and decentralisation. It will, therefore, be necessary to improve the technical abilities of agents even if their number remains small.

- g. Any extension activity should always incorporate an element of reminding local people of the necessity to try to be independent based on self-help efforts instead of relying on external assistance.
- a. The involvement of NGOs in national projects and foreign aid projects has been very active and NGOs have rich experience of projects with strong implications for local inhabitants, including watershed management and local development projects.
- b. When the mobilisation of NGOs, which have members with various backgrounds, is intended, know-how on watershed conservation, local development and the organization of people is necessary.
- c. To ensure the building up of such know-how, NGO staff members should be encouraged to participate in technical training courses and seminars and to learn socioeconomic analysis techniques as in the case of DOSC staff members.

- a. It is necessary to improve the level of technical expertise of agents and, therefore, their active participation in seminars and workshops should be encouraged together with the learning of administrative and technical skills and socioeconomic analysis techniques at the Extension and Training Centre of the Department of Forestry.
- b. As the Plan will be implemented using an integrated approach, cooperation with other fields should be sought to ensure a swift and effective response to the diverse needs of local people.
- c. It is true to say that the present means of extension are insufficient as there is an inadequate number of vehicles and motorbikes providing a means of transport for agents. However, in view of the inadequate access in the area, the frequency of use of these means of transport should be reviewed in order to improve efficiency.

(9) Integrated Watershed Management Plan Maps

- To present a basic plan covering the entire Study Area
- To show measures to solve problems in the Study Area
- To provide objective materials for judgement by the administration and local people in relation to the needs of the latter

① Contents

Based on the principles described above, contents of the plan maps should be as mentioned below.

- a. Land use improvement programme for "forest conservation" and "preservation of land productivity"
- b. Erosion control programme for "mitigation of disasters, such as landslides, etc."
- c. Footpath and road improvement programme among the planned infrastructure development

② Use of the Maps

- a. The maps will provide basic material for policy decisions at the VDC level.
- b. The maps will present measures to solve problems in the subject areas and will be used to coordinate these measures with the VDC authorities.
- c. The maps will be used to prepare the ward planning profile which will be described later.
- d. In view of the participation of local people in not only plan implementation but also in planning, the contents of the maps should not be treated as fixed contents but as a reference for the planning of programmes with the participation of local people.

Plan Implementation Method

It is necessary to examine items ① to ③, etc. in connection with the implementation of each programme of the integrated watershed management plan.

- 1 Implementation system
- 2 Plan procedure
- 3 Cost

(1) People Involved in Plan Implementation and Their Roles

For the implementation of the Plan, the project implementation body (hereinafter referred to as the Project Team) will be established, in which related organizations, including the Department of Soil Conservation (hereinafter referred to as the Department of Soil Conservation, etc.) and people involved in the implementation of the Plan locally, including local people (hereinafter referred to as local people, etc.), will cooperate and liaise with each other. While the Project Team will mainly be composed of the Department of Soil Conservation, etc. and local people, etc., NGOs and donor organizations will join the Project Team when necessary.

The following organizations and people, etc. will be involved in the implementation of the Plan.

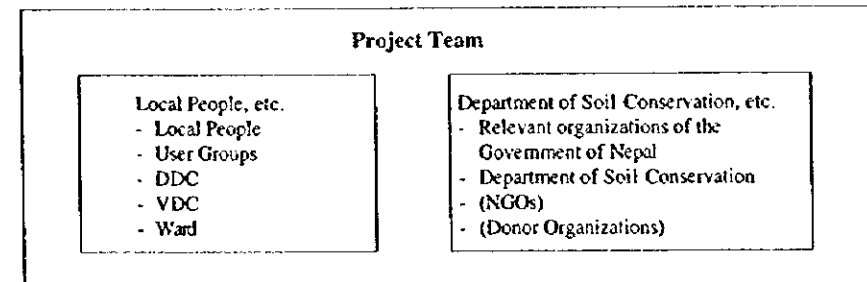


Fig. 31 Roles of Various Participants in the Plan Implementation

- ① Local People, etc.
 - a. Raise local problems
 - b. Request the implementation of a programme(s)
 - c. Formulation and implementation of the implementation plan for each approved programme
 - d. Provision of manpower and bearing of the costs required for plan implementation
- ② Department of Soil Conservation, etc.
 - a. Dispatch of staff members, etc. to establish a project team
 - b. Provision of policy advice necessary for plan implementation and payment of the necessary expenses
 - c. Coordination with other related organizations for plan implementation
- ③ Local people, etc. and the Department of Soil Conservation, etc. will consult with each other on plan implementation mainly through the Project Team.
- ④ At present, the Department of Soil Conservation has local soil conservation offices in Pokhara and Kusma and also has local ranger posts. To ensure efficient plan implementation and appropriate communication with local people, it will be necessary for the local soil conservation offices located in the subject area of the Plan to dispatch staff members to join or assist the Project Team.

(2) Organizational Structure of Project Team

For the smooth implementation of the Plan, the Project Team will consist of a team leader and those responsible for land use management, watershed conservation, women in development, local development and general affairs as well as village extension officers who will directly deal with local people, etc. on site. The organizational structure of the Project Team is given in Fig. 32 and the role of each team member is described below.

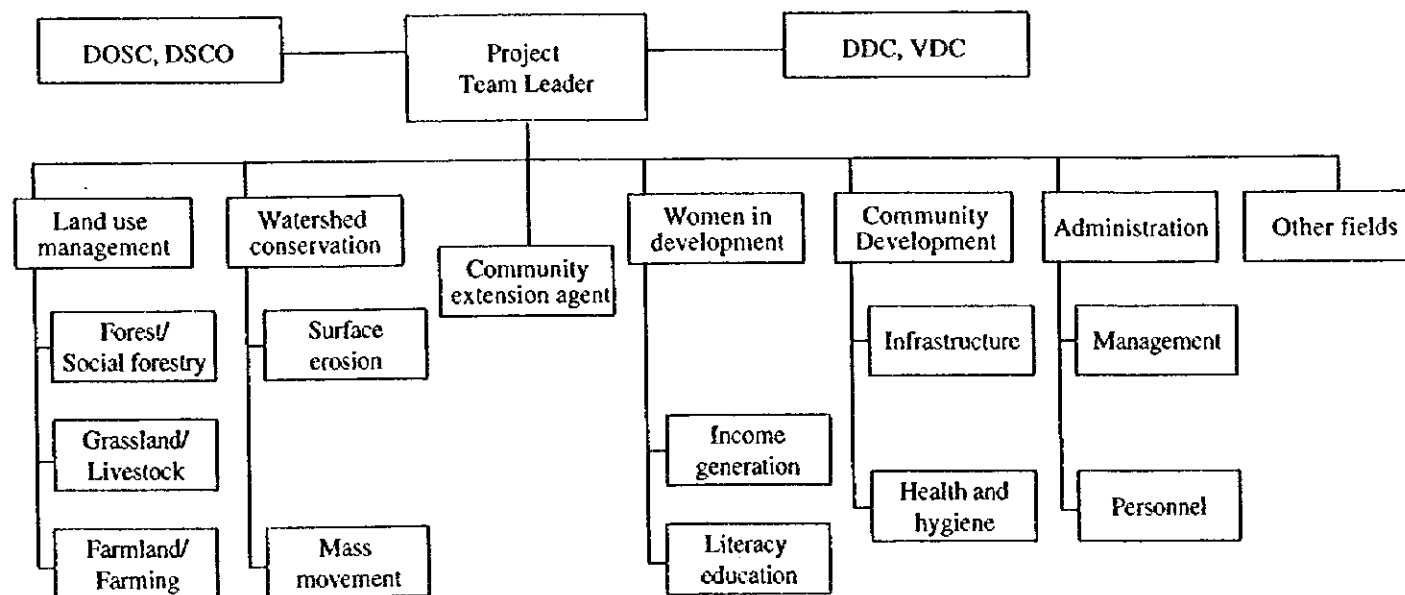


Fig. 32 Project Implementation System (an example)

(3) Planning Unit

Although for watershed management planning a watershed is the planning unit, in fact the Study Area boundaries do not necessarily correspond with those of natural watershed boundaries. Thus it will be preferable for the plan to be implemented in an administrative unit (VDC, etc.) in view of the smooth organization of local people, budgetary execution and management and maintenance issues. Considering these matters, an administrative unit may be considered as the planning unit. Moreover, careful attention should be paid to implementation duration, cost, etc., by taking into consideration the scale of a plan.

(4) Plan Implementation Period

The plan period is established taking the plan size and its implementation system, etc. into consideration.

(5) Cost Estimation

Cost estimation have to be based on the standards established by DOSC and related organizations.

Initial Environmental Survey

(Objectives)

The initial environmental survey is conducted in accordance with the flow shown below 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.).

(1) Principles

Environmental care is examined in accordance with Nepal's Environmental Impact Assessment Guidelines for the Forestry Sector issued in 1995.

(2) Survey Flow

Survey flow is as shown in Fig. 33.

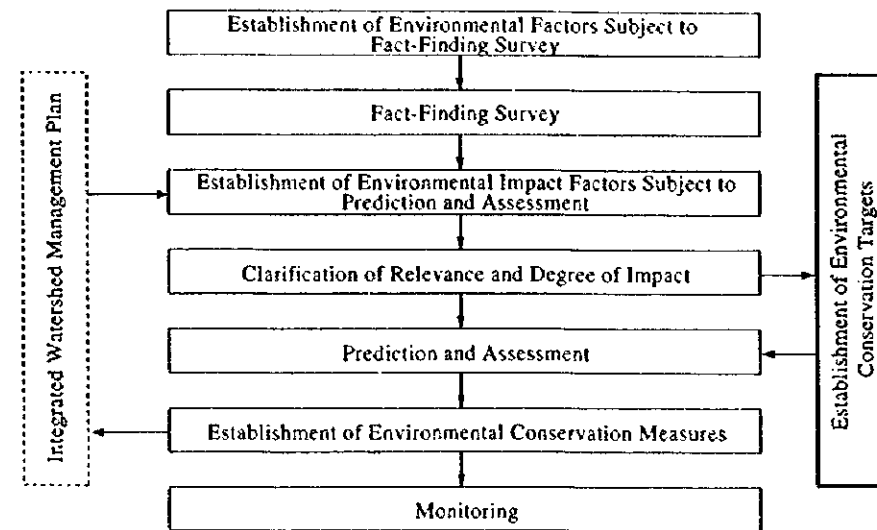


Fig. 33 Flow of Environmental Survey

① Selection of environmental factors

Environmental factors selected in Model Areas are as mentioned in the table below.

Table 28 Environmental Factors

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 Field Survey

For factors in the Study Area, actual surveys have to be conducted.

See an example from Model Areas.

Table 29 Actual Field Survey: An Example

Model Area		Parbat North
Item		
Natural Factors		
Climate	The mean annual temperature and annual rainfall at the Kusma Station are 22.0°C and 2,540mm 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.	
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.	
Soil	Dystic cambisols are distributed on gentle slopes. Dystic regosols are dominant at steep slopes while dystic leptosols are dominant at cliff and rocky sites. Haplic luvisols and haplic alisols are distributed at old river terraces.	
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.	
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.	

Model Area		Parbat North
Item		
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.	
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	
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.	
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%	

③ Establishment of environmental impact factors

The factors believed to affect the environment and watershed are identified based on the contents of the integrated watershed management plan.

Table 30 Environmental Impact Factors in Model Areas: An Example

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 Prevention and Rehabilitation 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
Life 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	Training/extension vis-a-vis local people, NGOs and DOSC staff

④ Establishment of environmental conservation targets

- a. Impact on the environment by each programme is evaluated using scoping check lists.

Evaluation standards could be:

◎ : has a strong adverse impact

○ : has some adverse impact

△ : may have an adverse impact

+ : has a positive impact, no symbol: irrelevant

Table 31 Scoping Check List of Model Areas: An Example

Environment Impact Factors	Land Use Improvement Plan							
	Forest Improvement Plan		Grassland Improvement Plan			Farmland Improvement Plan		
Environmental Factors (Natural Environment)	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	+	+		+	+		+	
Environmental Factors (Social Environment)								
1. Social Life								
(1) Living								
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 Beautiful View, etc.								
1. Damage to and/or destruction of historic remains and cultural heritage								
2. Loss of rare view								
3. Impact on archaeological objects								

b. Environmental conservation target

Based on the scoping check list, items evaluated as "having a strong impact" are examined and environmental conservation targets set.

⑤ Prediction and assessment

Regarding the established environmental conservation targets, evaluation and assessment are carried out on the possible impacts.

⑥ Environmental conservation measures

Environmental conservation measures are established for a plan if prediction and evaluation show any environmental impacts of the plan.

⑦ Monitoring

Monitoring will be conducted when necessary.

Monitoring and Evaluation

(Objectives)

Once the Plan is implemented, it is important to monitor its effects with a view to making the necessary improvements.

(1) Monitoring and Evaluation

Monitoring and evaluation items, objectives and method for Model Areas are as shown in Table 32.

**Table 32 Monitoring and Evaluation Items and Methods Under the Plan
(Example of Model Areas)**

Planning Item	Index	Evaluation Item	Monitoring Method
Land Use Improvement Programme			
Forest Improvement	<ul style="list-style-type: none"> Forest area Soil erosion Firewood, fodder and timber production volumes Participation in community forest 	<ul style="list-style-type: none"> Water supply Erosion control Firewood, fodder and timber supply Income generation 	<ul style="list-style-type: none"> 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	<ul style="list-style-type: none"> Grassland area Soil erosion Fodder production volume 	<ul style="list-style-type: none"> Decline of eroded land Erosion control Firewood, fodder and timber supply Livestock increase Income generation 	<ul style="list-style-type: none"> 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	<ul style="list-style-type: none"> Farmland area Area of improved terraces Growth of planted trees Food production 	<ul style="list-style-type: none"> Sufficient food supply Erosion control Firewood, fodder and timber supply Income generation 	<ul style="list-style-type: none"> 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
Seedling Production	<ul style="list-style-type: none"> Nurseries Seedling production volume Seedling supply volume 	<ul style="list-style-type: none"> Contribution to improved land use Stable supply of seedlings 	<ul style="list-style-type: none"> 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	<ul style="list-style-type: none"> Landslide sites and their areas subject to treatment Progress of work to construction of treatment facilities 	<ul style="list-style-type: none"> 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 	<ul style="list-style-type: none"> 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	<ul style="list-style-type: none"> Gully sites and their areas subject to control Progress of work to construct control facilities (including vegetation works) 	<ul style="list-style-type: none"> Stabilisation of gullies Protection of farmland and roads, etc. Organization of user groups and their participation in control work Firewood, fodder, etc. supply 	<ul style="list-style-type: none"> 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	<ul style="list-style-type: none"> Bank sites and their length subject to conservation Progress of work to construct control facilities (including vegetation works) 	<ul style="list-style-type: none"> Stabilisation of banks Decline of flood and landslide occurrences Organization of user groups and their participation in rehabilitation work Firewood, fodder, etc. supply 	<ul style="list-style-type: none"> 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)	<ul style="list-style-type: none"> Total length of footpaths and roads subject to improvement Slope protection 	<ul style="list-style-type: none"> Erosion control Protection of farmland and roads, etc. Access improvement Income improvement 	<ul style="list-style-type: none"> 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	<ul style="list-style-type: none"> Headwater sites and their areas Scope of use 	<ul style="list-style-type: none"> Water supply in dry season Water quality improvement Alleviation of water fetching work 	<ul style="list-style-type: none"> 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)	<ul style="list-style-type: none"> Subject reservoirs 	<ul style="list-style-type: none"> Erosion control Water supply for livestock 	<ul style="list-style-type: none"> Use of socioeconomic baseline survey results (degree of satisfaction of local people; organization of user groups) Reservoir improvement survey
Improved Ovens and Biomass	<ul style="list-style-type: none"> Installation site and quantity 	<ul style="list-style-type: none"> Forest conservation Alleviation of firewood collection work Reduction of cooking time 	<ul style="list-style-type: none"> Use of socioeconomic baseline survey results (degree of satisfaction of local people; organization of user groups) Actual usage survey
Public Health	<ul style="list-style-type: none"> Health centre sites and details Public toilet sites and quantity 	<ul style="list-style-type: none"> Decrease of number of ill persons Understanding of watershed conservation 	<ul style="list-style-type: none"> Use of socioeconomic baseline survey results (degree of satisfaction of local people; organization of user groups; change of awareness) Sewage treatment survey
Education	<ul style="list-style-type: none"> Building maintenance Educational effects 	<ul style="list-style-type: none"> Empowerment of women through literacy education Interest in environment Participation in tree planting and forest conservation 	<ul style="list-style-type: none"> 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	<ul style="list-style-type: none"> Type and area of planted crops Number of heads, etc. raised 	<ul style="list-style-type: none"> Empowerment of local people Income generation Participation in tree planting and forest conservation 	<ul style="list-style-type: none"> Use of socioeconomic baseline survey results (degree of satisfaction of local people; organization of user groups) Market survey on products
Small-Scale Processing	<ul style="list-style-type: none"> Processed products Small-scale processing facilities 	<ul style="list-style-type: none"> Empowerment of local people Income generation Participation in tree planting and forest conservation 	<ul style="list-style-type: none"> 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
Creation of Employment Opportunities	<ul style="list-style-type: none"> Types of employment and number employed 	<ul style="list-style-type: none"> Empowerment of local people Income generation Participation in tree planting and forest conservation 	<ul style="list-style-type: none"> 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	<ul style="list-style-type: none"> Number of user groups Training contents and frequency 	<ul style="list-style-type: none"> People's participation Learning of conservation techniques 	<ul style="list-style-type: none"> Use of socioeconomic baseline survey results (degree of satisfaction of local people; organization of user groups)
NGOs	<ul style="list-style-type: none"> Training contents and frequency 	<ul style="list-style-type: none"> Management capability to facilitate people's participation Learning of conservation techniques 	<ul style="list-style-type: none"> Management and technical evaluation survey
Department of Soil Conservation	<ul style="list-style-type: none"> Training contents and frequency 	<ul style="list-style-type: none"> Management capability to facilitate people's participation Learning of conservation techniques 	<ul style="list-style-type: none"> Implementation of intensified staff training

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