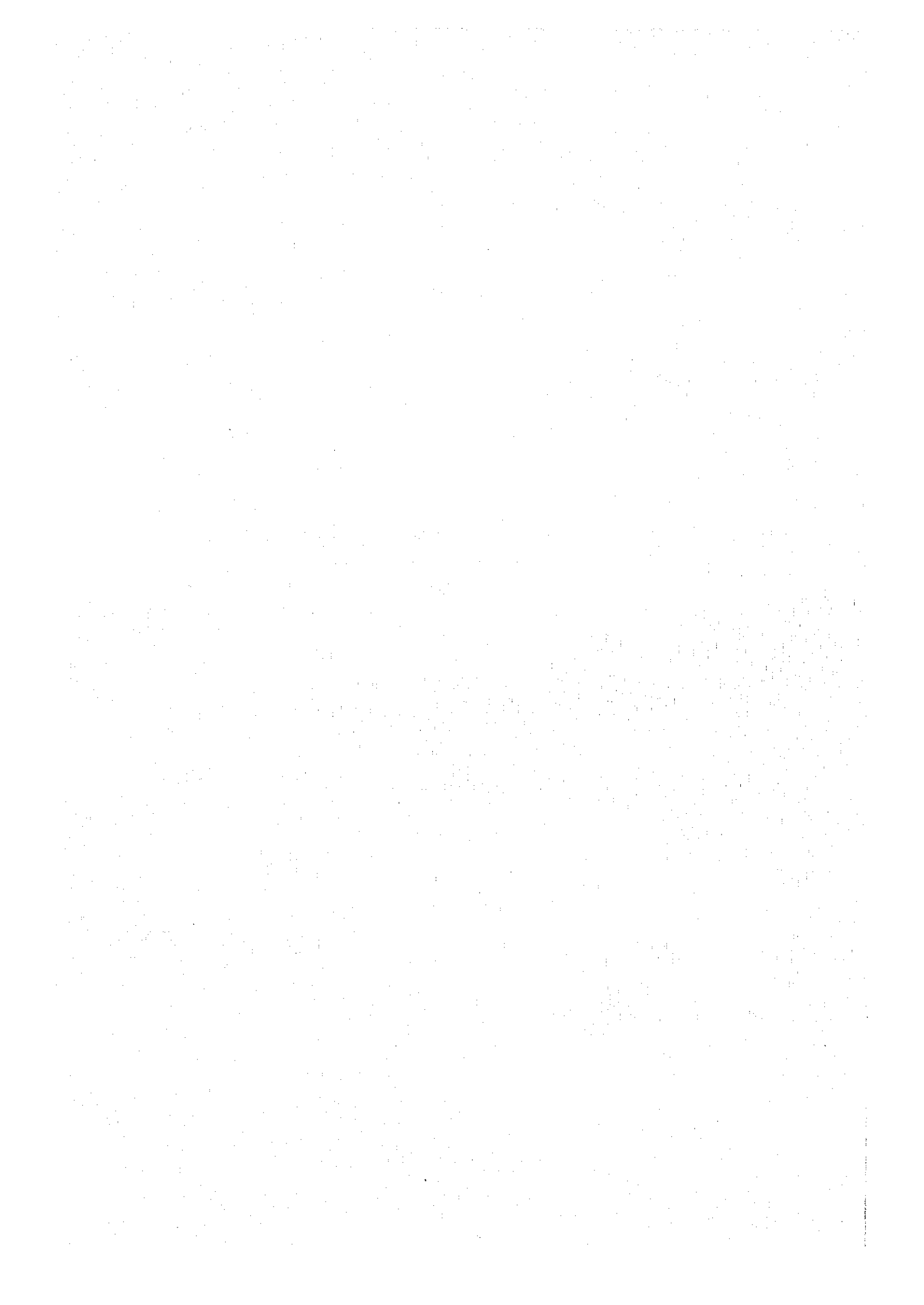


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SOIL AND WATER CONSERVATION PROJECT
IN NEPAL

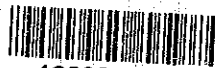
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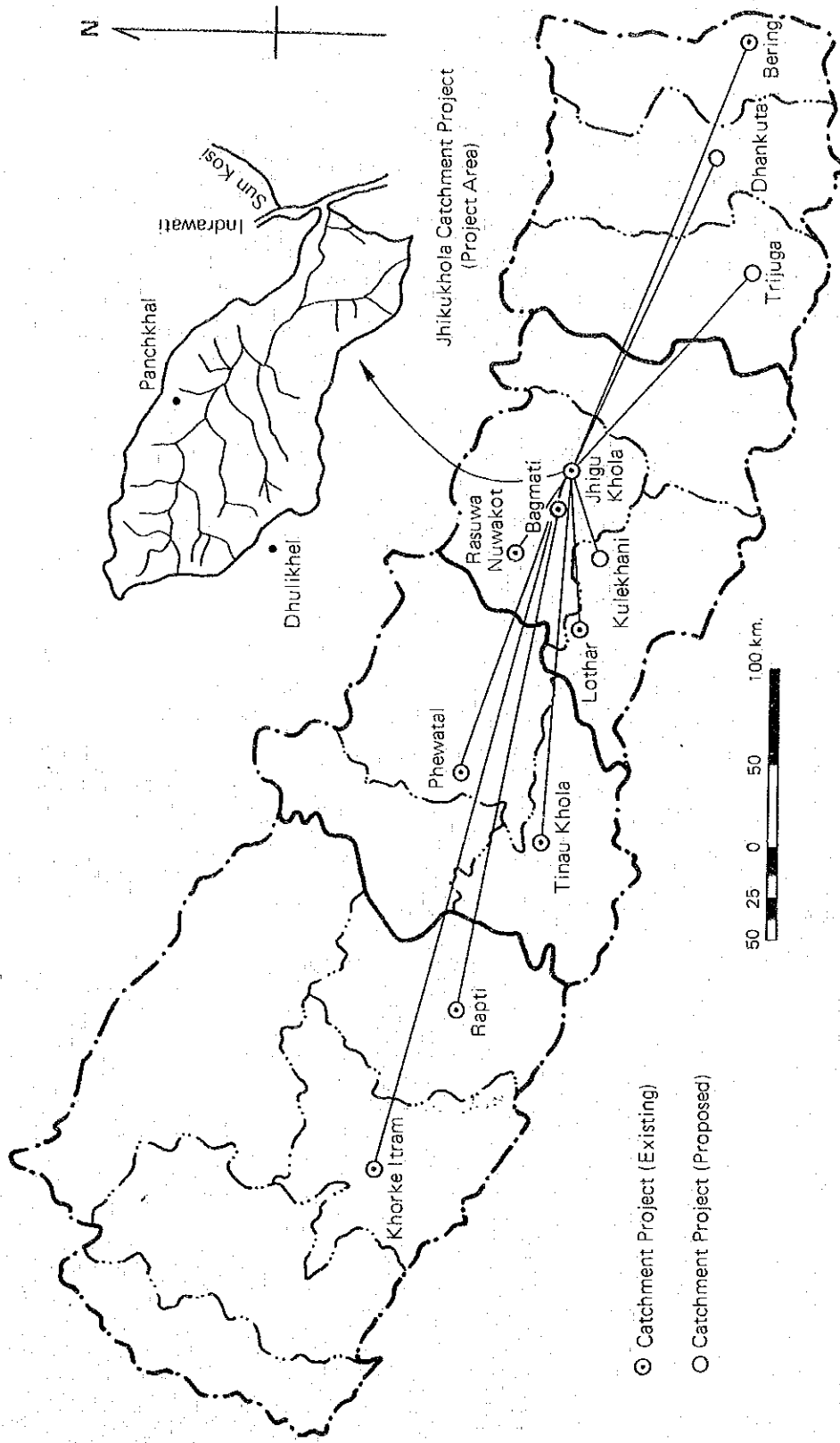
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Map of Nepal Showing Different Project Areas of DSWC



I.W.M. Cartographic Section

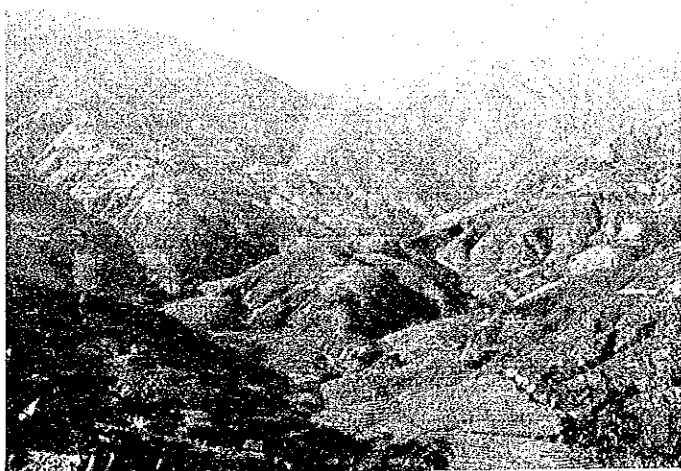
By:— Devendra Tiwari



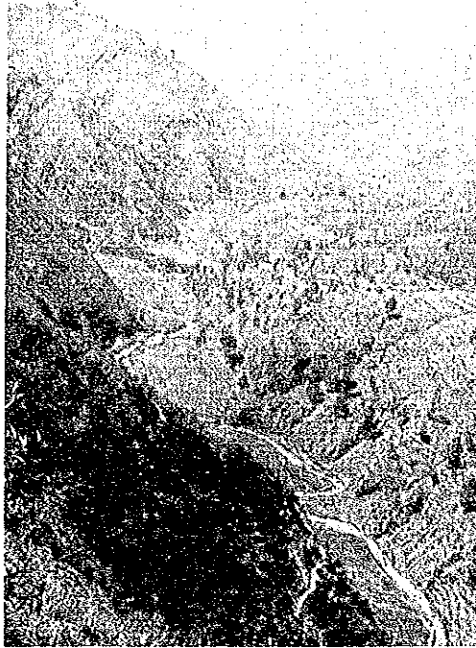
Dhulikhel, the administrative Center of Kabre district



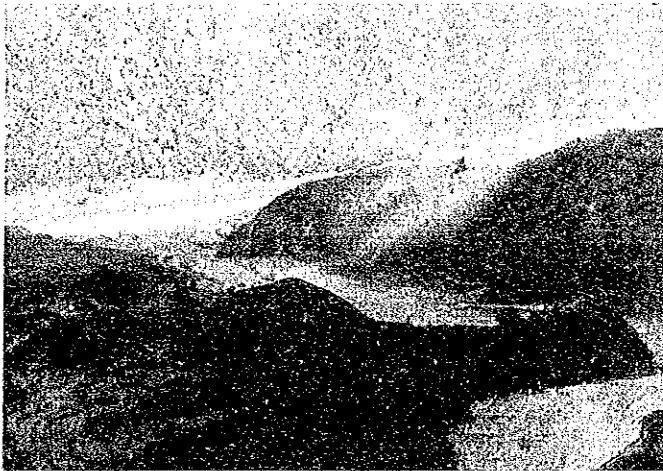
A view of Panchkhal from Rampur



Landuse Situation of Rabiwapi



Bohre tributary catchment.



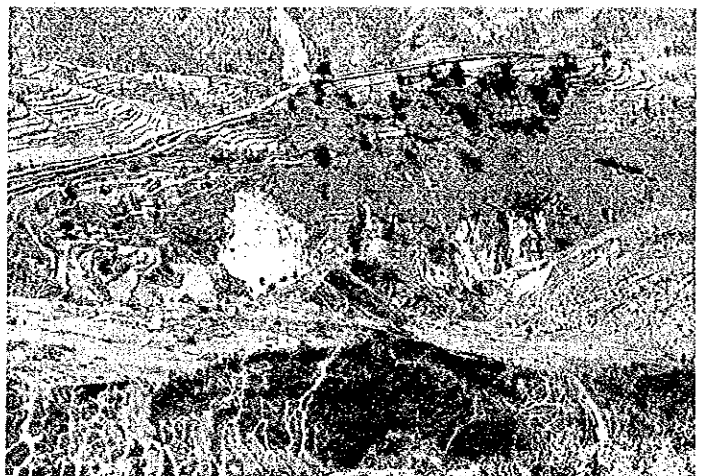
At this confluence, the water of Jhiku river flows as the water of Sunkoshi river



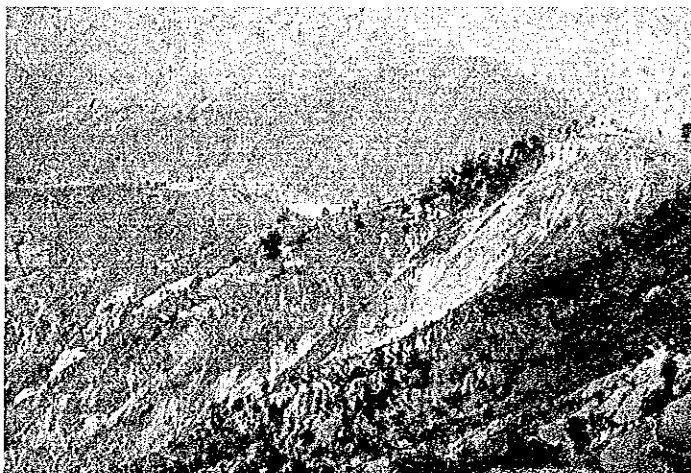
Gully erosion at Panchkhal



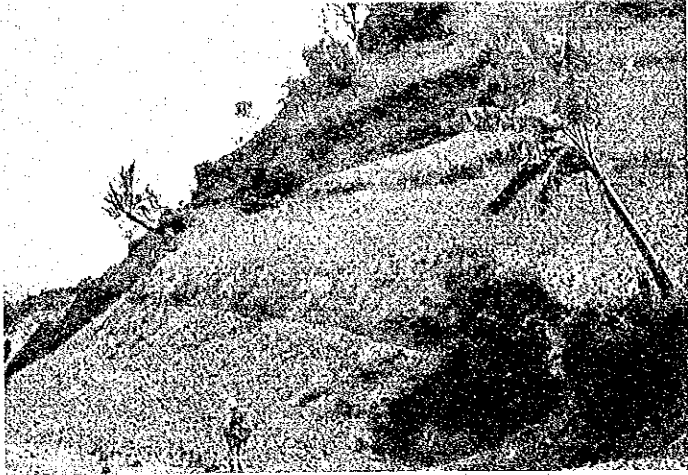
Erosion on the grass land of Adhabat



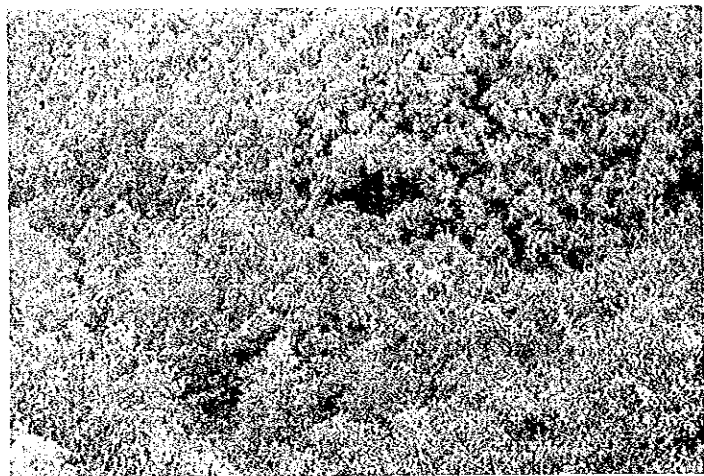
Continuous landslides caused by the water of Bohre tributary



Landslides caused by copper mining at Khanigaon



Erosion of terrace farmland near Patlekhet

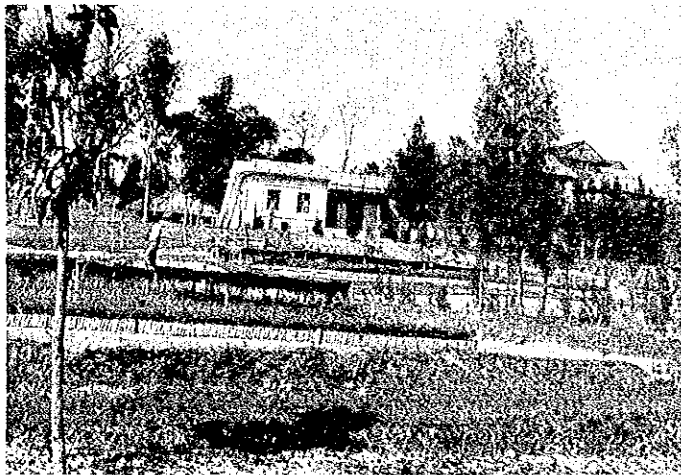


Preserved forest by the regulation of law at Patlekhet



Chilaune (*Schima wallichii*) at Dhulikhel

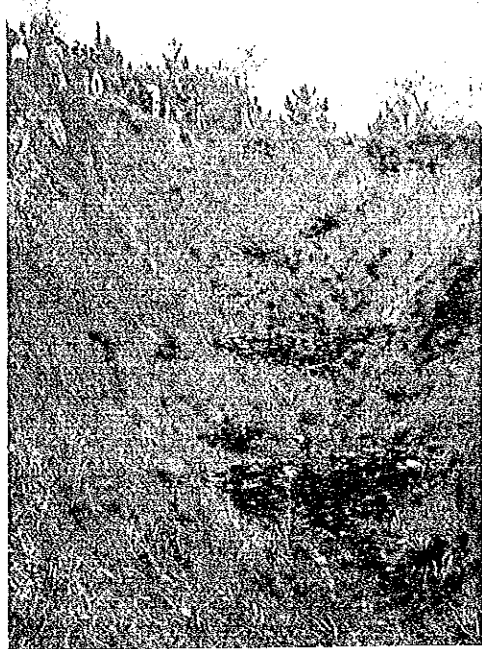
Pine forest by planting at Panchkhal



The nursery under the Ministry of Forest at Budol Bauepa

A weir for irrigation at Jaretar





Check dams at Panchkhal



A farmer using chemical fertilizer at the farmland near the Bohre tributary



Villagers of Adhabat carrying water from far distance



Bohre elementary school



Interview for getting local information

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February, 1979

Akira Hashimoto

Colombo Plan Expert
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from Sept. 1977 to Oct. 1978

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BASIC NEEDS OF THE PROJECTS

It has been felt world-wide that natural resources are no longer plentiful and that improved management of these resources is the need of the day.

Nepal is a country with diverse topography and climates – from tropical to alpine. There is, therefore, a corresponding diversity of vegetation in the Terai, hills and mountainous regions. The population has increased greatly in the last 2 to 3 decades (11.6 mill in 1971 census) without adequate job opportunities for the socio-economic development of the country and the people.

Nearly 93 % of the population depend upon agriculture. Natural calamities such as soil erosion, landslides and floods have adversely affected the agricultural production of the country, in addition to the lack of other necessities. The result of increasing incidences of soil erosion, landslides and floods in the country have compelled the people in the hills to migrate in the Terai Region encroaching on new forest lands for cultivation.

- The loss of top soil in the mountains raises the bed level of rivers in the plains by 15 to 30 cm every year,
- The World Bank estimates that 240 mill cubic meters of soil is transported by Nepal's major rivers every year, and
- Mr. M.E. Stevens & Mr. M.D. Joshi estimate that 10,000 sq.km of land is devoid of sufficient vegetation and can be considered as exhibiting the desertification process (Desertification in Nepal for U.N. Conference on Desertification, Delhi, India, April, 1977 pp. 9) are alarming features. Measures must be taken to determine the best technique and methodology to combat the deteriorating mountain environment in Nepal.

The establishment of the Department of Soil and Water Conservation in August, 1974 has shown the timely action taken by His Majesty's Government. Since its establishment, the Department is concentrating its activities in some project areas only. The need has already been felt for expanding its activities in wider portions of Nepal, during the sixth five-year plan period. Hence the necessity of establishing a project combining Research, Demonstration and Education has therefore been realized

- to determine the necessary scientific techniques and methodologies suitable for the extension of soil and water conservation activities all over the country.
- to educate the people by proper techniques and methods (soil and water conservation) so as to obtain their full participation and support in conservation activities.

The objective of Soil and Water Conservation Research described in the soil and water conservation system 1977 (Program planning and Budgetting for 25 years, HMG Department of Soil and Water Conservation) is presented as "Research provides information and a basis to apply sound practice to applied conservation practices." Most studies are not thorough enough and long-term investigations must be undertaken.

INTRODUCTION :

The report has been divided into three main chapters: RESEARCH, DEMONSTRATION and EDUCATION. The planning and budgeting has been estimated for 10 years. The report has been prepared on the basis of available local information, along with aerial photos (1 : 20,000) taken in 1967 and 1972 and 1 : 1 mile topo maps (1956). Assessment of the conservation work has been made by the comparison of aerial photographs and recent field observations.

The project area at Jhiku Khola catchment represents a part of the typical midlands of Nepal, and has been selected as a research center for the following reasons:

- Accessible - The project area is approachable by a one-hour drive by car (about 50 km) from Kathmandu.
- Representative - The project area is representative of the majority of the country.
- Public participation - There is a possibility of more public participation in conservation work.
- Improvement - There is a good natural potential for improvement.
- Supervision - The project area can be easily supervised from the department in Kathmandu.
- Labor - Labor is plentiful in the catchment area.
- Working materials available:
- Aerial photographs and maps of the area available.

The other project areas as shown in the map feed the data required for the research work.

The project will be directly implemented by DSWC (Department of Soil and Water Conservation)

A number of Nepalese institutions will be involved including Tribhuvan University for conservation education and research work. Some of the international agencies working in Nepal will be encouraged to co-ordinate their activities with those of the project, and to assist in the research work. A major share of the technical and financial assistance is desired from a donation country besides the HMG's input.

(A) CHAPTER— I . RESEARCH

1. PROBLEMS

The department is realizing the following problems while expanding its activities:

- (i) Lack of sufficient data, information and knowledge for planning, execution and management of the natural resources.
- (ii) Lack of proper knowledge on the choice of technology suitable for the natural conditions and the needs of the people in the country.
- (iii) Lack of co-ordination and contact with national and international agencies on the development of technologies and information on different experiences (foreign or local)

- (iv) Lack of adequate knowledge of integrated or multidisciplinary approach in the use and management of the natural resources.
- (v) Lack of trained personnel.
- (vi) Lack of public participation in conservation activities.

It is therefore necessary to establish a National Soil and Water Conservation Research center with necessary manpower, laboratory and other physical facilities in order to determine the necessary scientific techniques and methodologies suitable for the extension of soil and water conservation activities all over the country.

2. OBJECTIVES OF THE RESEARCH CENTER

The center will carry out research activities to : --

- Improve the existing land use and cropping techniques.
- Restore environmentally misused land areas by improving soil fertility and the quality of water.
- Improve the social and economic development of the local people by creating employment opportunities on Agro-Forest-Industries, without affecting the soil and water resource base.
- Improve pasture and fodder resources for the cattle.
- Improve timber and fuel resources.
- Minimize soil erosion through preservation and conservation of Soil and Water resources, thereby controlling the flood effects in the valley areas.
- Evaluate the local conservation techniques and provide guidelines for different conservation extension projects in different parts of the country.
- Protect human life and property from summer floods.
- Develop demonstration areas to educate the people on soil and water conservation techniques (local as well as foreign).

The location of the research center has been recommended for the Jhigu Khola Catchment Area.

3. FIELDS OF RESEARCH

Research and studies will be carried out in the following fields:

- a) Hydrology and Meteorology Research
 - Identification of flood zoning and measures to minimize damages
 - Flood frequency and extent, with identification of causative and contributory factors
 - Sediment flow, etc.
 - Studies on precipitation, temperature, evapo transpiration, runoff and discharge of rivers
- b) Geological Research
 - Types of erosion, its causes and effects
 - Landslides

- Landslide hazard frequency, etc.
- c) Vegetation Research
 - Forest Management techniques
 - Afforestation with particular emphasis on soil binding, fast growing and fodder species.
 - Nursery techniques.
 - Soil binding and palatable grasses on eroded hillslopes, etc.
- d) Structural research with low cost and local construction materials
 - Check dams (design)
 - Embankment (")
 - Spurs (")
 - Retaining walls
- e) Ecological Research
 - Inter action between man and vegetation
 - Relation between man and erosion, etc.
 - Ecological impact of various development schemes.
- f) Land use research
 - Present land use and its effects.
 - Land use changes
 - Cropping, tillage and other farming techniques, etc.
- g) Socio-Economic Research
 - Population
 - Existing economy and resource use and future economy after the project
 - Education, health and nutrition
 - Cattle population, etc.
 - Study on legal considerations on natural resources.
- h) Other Research
 - Relation between Road and Erosion
 - Technological research (foreign and local)

Research will not be duplicated and will utilize the facilities existing in other Governmental organizations. Available Research and Laboratory facilities are summarized in Annex 1.

The center will also study and propagate different experiences and knowledge gained by exchanging experiences with different organizations (in country and out side the country) dealing with resource conservation and utilization.

In order to set up the research center and help carry out the research work, provision for consultant services (foreign experts) have been mentioned in the report, see Annex 14 (Organization chart).

4. IMPLEMENTATION OF THE PROGRAM (physical targets)

S.No.	Items	Years										Total	
		1st Year	2	3	4	5	6	7	8	9	10		
1.	Building Construction of the Center	Land acquisition and planning	Construction work		Re-search lab fitting								
2.	Equipment Procurement: (a) Lab-equipment (b) Heavy equipment and vehicles	Planning and procurement of the equipment		Fitting and complete									
3.	Research Work and Study	Survey and planning	Establishment of research center		Data collection compilation and publishing of reports (time to time)								
4.	Manpower Development: (a) Difuta and new appointment (b) Consultants (Experts) (c) Training in local and foreign countries	Co-manager	H.M.G. Staff				Other experts			Through out the project period			

5. PHYSICAL FACILITIES

5.1 HMG Staff

The research unit in the department of soil and water conservation will act as a central research co-ordinator. This unit will co-ordinate with other projects undertaken by the department to feed data to this project and vice versa. This project will operate under the guidelines and supervision of the department. See Annex 14.

FOR THE PROJECT

- 1 Project Manager, gazetted I class (Forester)
- 1 Administrative Officer, gazetted III class (Adm. Service)
- 1 Senior Accountant, gazetted III class (Account Service)
- 3 Administrative Assistants, Non-gazetted class I
- 3 Junior Administrative Assistants, N.G. class II
- 2 Typist (English or Nepali), N.G. class I
- 4 Accountant, Non-gazetted class I
- 3 Storekeepers, Non-gazetted class I
- 3 Junior Storekeepers (Kharidars) Non. G. class II
- 1 Driver Cum. Mechanic – Non. Gaz. class I
- 4 Drivers Non. Gaz. class III
- 10 Laborers and Watchmen.

FOR RESEARCH

- 1 Senior Research Officer, Gazetted II
(Forest or Agri-Engineering or Civil Engineering)
- 2 Research Officers, Gazetted III (Forest)
- 1 Research Officer " " (Agri-Engineer)
- 1 Research Officer " " (Civil Engineer)
- 4 Research Assistants, Non. Gazetted I (Ranger)
- 4 Research Assistants, " " (Overseers)
- 3 Research Assistants, " " (Junior Technicians)
Agriculture or J.T.
- 2 Draftmen, " " (Draftman)
- 13 Field and Lab Assistants, Non. Gazetted III

FOR IMPLEMENTATION OF DEMONSTRATION AREA

- 1 Senior Soil Conservation Officer, Gazetted II (Forest or Agri. Engineering)
- 1 Assistant Soil Conservation Officer, Gazetted III (Forester)
- 1 " " " " " " (Agri-Engineer)
- 2 Conservation Assistants, Non Gazetted I (Rangers)
- 2 " " " " (Overseers)
- 2 Draftmen Non. Gazetted I (Draftman)
- 6 Field and Lab Assistants, Non. Gazetted III

FOR CONSERVATION EDUCATION

- 1 Senior Conservation Educator, Gazetted II (Forest or Agri-Engineer)
- 1 Conservation Educator, Gaz. III (Forester)
- 1 " " " " (Agri-Engineer)
- 2 Education Assistants, Non. Gaz. I (Rangers)
- 1 " " " " (Overseers)

- 1 Education Assistants, Non. Gaz. I (Junior Technician for Agriculture)
- 8 Field and Lab Assistants, Non. Gaz. III.

Note: Research Staff and Education Staff work jointly.

5.2 Accommodations

Since the project is to be set up outside Kathmandu valley, there are no proper accommodation facilities. The following accommodation requirements are necessary (for details see Table 1 and Annex 2) –

- 3 Office buildings (RESEARCH, IMPLEMENTATION AND CONSERVATION EDUCATION BUILDINGS)
- 1 Hostel for Trainees
- 1 Guest House
- 2 A – Type Residential Bungalows
- 16 B – Type " "
- 1 C – Type " " (30 flats)
- 1 D – Type " " (35 flats)
- 5 E – Type " " (Twin quarters ie. 2 flats in one building)
- 5 Garage for Bus, Pickup and Jeep, 1 workshop, 1 Building for Staff room and store room.
- 1 Hall for Engineering design and modelling.
- 1 Nursery shade including working space and storeroom to keep implements, tools, seeds, fertilizer, insecticides, etc.

Note: All the accommodation premises will be provided with a compound wall, connecting roads, water supply and sewerage facilities.

5.3 Equipment

The following equipment are essential for the project:–

- 1 Four-wheel drive pickup jeep – for transportation of planting materials and other light articles.
- 3 Four-wheel drive jeep – for movement in the project area.
- 6 Motorcycles for the project area.
- 1 Minibus (capacity about 15.20 persons) for trainees and guests, to move around Kathmandu valley and the project area.
- 10 Bicycles for the office clerical staff and laborers.
- 1 Pumps to supply water to the main overhead tank.
- 1 Overhead tank made of reinforced concrete capacity 50,000 liter, and required water supply pipes and other materials, to the residential quarters, nursery and office buildings.
 - Equipment for soil and water analysis laboratory.
 - Equipment for model room, library and auditorium cum lecture hall.
 - Implements and tools for the nursery, afforestation and grass plantation, construction of engineering structures, etc.

– Fara Equipment –

5.4 Consultants

- 1 Project Co-Manager or Advisor – Duration 6 years preferably a forester who has specialized in Watershed Management with at least 15 years experience in soil and water conservation research work.
- 1 Research Expert – Duration 5 years, preferably a forester with more than 10 years experience in soil and water conservation research work.
- 1 Research Expert – Duration 5 years, preferably a Civil Engineer with more than 10 years experience in soil and water conservation research work.
- 1 Watershed specialist or Rural Engineer for implementation work, Duration 5 years with more than 10 years experience in soil and water conservation or watershed management work.

5.5 Manpower Development

- 4 Volunteers – Graduates in different fields pertaining to Soil and water conservation activities.
- 8 One year training course for Officer level.
- 15 Six months training course for supervisor level, Overseers, Rangers and Draftsmen.
- 5 One to two month study tour for senior officer level.

6. COST ESTIMATE

6.1 Cost of accommodation Requirements in the Field

(includes all the three office buildings and other buildings required for the whole project, floor area for all types of accommodations is given in Table 1.)

– Land acquisition (about 4 ha.) = Rs 7,00,000.00 (Lump sum)

– Cost for 1 square meter housing area = Rs 1375.00.

Therefore cost for 9030 m² area construction.

= Rs 1,24,16,250.00 (i)

– Cost of Landscaping, compound wall, connecting roads, electrification, water supply, sanitary fittings and sewerage (or drainage)

= 25 % of the construction

= Rs 31,04,062.50 (ii)

Cost for interior necessities (ie. flooring and furnishings and required furniture)

= 50 % of the construction cost

= Rs 62,08,125.00 (iii)

Subtotal of the cost (i + ii) = Rs 1,55,20,312.50 (iv)

Cost of design, estimate and supervision (ie. Engineer services) is equal to 5 % of the subtotal cost (iv)

Rs 7,76,015.63 (v)

Hence the total cost required for accommodations is equal to the Cost of the land + iii+iv+v
= Rs 2,32,04,453.13 = 10 % contingencies (i.e. unforeseen expenses).
= Rs 2,55,24,898.44

Table 1. Floor Area and Types of Buildings

Type	Net Housing Area (m ²)	Housing Area with Compound (m ²)	No. of Houses	Total Area (m ²)	Remarks
Special type	1,700		3	6,000	OFFICE BUILDING See Annex 2 for detail.
Special type	600	2,000	1	2,000	Hostel for Trainees.
Special type	300	1,000	1	1,000	Guest House
A-type	200	600	2	1,200	For Project Manager and Co-managers.
B-type	100	500	16	4,800	For officers and consultants.
C-type (flat system)	75x30 =2,250	5,000	one 30 flat	5,000	For office assistants and supervisors.
D-type (flat-system)	70x35 =2,450	5,000	one 35 flat	5,000	For clerical staff, Field and Lab. Assts.
E-type (Twin-quarters)	50x10 =500	2,000	5	2,000	For Laborers & Watchmen.
Garage (total)	230	600	4	600	For Bus, Jeep and Pickup.
Hall	600	1,000	1	1,000	For engineering Design and Modeling.
Nursery shade and store	500	5,000	1	5,000	Includes nursery beds, shade and store room for implements and tools.
Training Area	—	5,400	—	5,400	For experimental plantation, Engineering structures, Meteo. and hydrological structures, survey, training, etc.
Total:—	9,030	30,600	37	39,500 (say 4 ha.)	

6.2 Cost of Planning and Designing the Research Work

The Dept. of Soil/Water Conservation cannot do all the work by itself, therefore, it is necessary to hire technicians or use consultant services for planning and designing the research work. A lump sum amount has been tentatively estimated as follows:--

6.2.(1) Survey, planning and design = Rs 3,00,000.00 (assuming the cost of hiring Nepalese experts for about 1,500 m. days at the rate of Rs 200 per m. day).

6.2.(2) Cost of preparing Land use maps and other expenses during the preparation of the report = Rs 6,00,000.00

Total cost = Rs 9,00,000.00

6.3 Cost of Implementation of All Types of Research

(i.e. total cost) in the five centers = Rs 40,00,000.00 (assuming average Rs 8,00,000.00 for each center).

6.4 Cost of HMG Staff (Project + Research Staff) for 10 years.

6.4.1 Pay--

Includes 30 % project allowance for gazetted officers
50 % " " " Non. gazetted staff.
Rs 300/- month as project Manager allowance.
5 % addition in cost for increment.

1	Project Manager	Rs 2,55,000/-	
1	Gaz. class II	Rs 1,64,000/-	
6	Gaz. class III	Rs 6,90,000/-	(i.e. 1,15,000 x 6)
26	Non. gaz. class I	Rs 26,00,000/-	(i.e. 1,00,000 x 26)
6	Non. gaz. class II	Rs 4,56,000/-	(i.e. 76,000 x 6)
17	Non. gaz. class III	Rs 9,69,000/-	(i.e. 57,000 x 17)
10	Laborers + Watchmen	Rs 3,20,000/-	(i.e. 32,000 x 10)
	Total	Rs 54,54,000/-	+ 10 % for Temporary staff = Rs 5,45,000/-

6.4.2 Allowance (TA & D.A) for the above staff--

15 % of the above cost (Rs 54,54,000/-)

= Rs 8,18,000/-

6.5 Cost of Procuring Scientific Equipment for All Projects
(Research, Implementation and Education).

S.No.	Items	Cost (Tentative) in Rs
1.	Survey equipment	3,00,000.00
2.	Hydrological-meteorological equipment	1,50,000.00
3.	Geological equipment	1,00,000.00
4.	Cartography equipment	1,00,000.00
5.	Research equipment	3,00,000.00
6.	Soil and water laboratory equipment	1,00,000.00
7.	Conservation education equipment	3,00,000.00
8.	Afforestation equipment	1,00,000.00
9.	Engineering equipment	1,00,000.00
10.	Other equipment for office such as ammonia printing and photocopying machines, typewriters, calculators, etc.	3,00,000.00
	Total:	Rs 18,50,000.00

6.6 Cost of Heavy Machinery and Vehicles:--

(A)

1. Machinery required for the cableway to transport construction materials	= Rs 10,00,000.00
2. Diesel generator and accessories for power	= Rs 5,00,000.00
3. Wireless set	= Rs 3,00,000.00
4. Pumping set to supply water to the main overhead tank for all buildings	= Rs 50,000.00
Total	= Rs 18,50,000.00

(B) Vehicles--

1. Bus for 50 Passengers (1)	= Rs 4,36,000.00
2. Pickup jeep (4 wheel drive) (1)	= Rs 1,50,000.00
3. Land cruiser jeep (4 wheel drive) (3)	= Rs 4,50,000.00
4. Motorcycles (6)	= Rs 1,80,000.00
5. Bicycles (10)	= Rs 10,000.00
Total	= Rs 12,26,000.00
Grand Total	= Rs 30,76,000.00

6.7 Cost of Training Personnel (for All Projects)

A tentative cost is shown with the following man months for training.

- 6.7.1 8 training sessions of 12-man month period for officer level = US\$96,000.00
(at the rate of \$1,000.00 per month including round trip tickets from Kathmandu to the Host country)
= Rs 11,42,400.00 (assuming 1 US\$ = 11.9 N.R.)
- 6.7.2 15 training sessions of 6-man month period for supervisor level = US\$ 72,000.00
(at the rate of \$800.00 per month including round trip ticket from Kathmandu to the Host country)
= Rs 8,56,800.00 (assuming 1 US\$ = 11.9 N.R.)
- 6.7.3 5 training sessions up to 2-man month period for Senior officer level = US\$20,000.00
(at the rate of \$2,000.00 per month including the fare from Kathmandu to the Host country and back Rs 2,38,000.00)
- 6.7.4 Other expenses for all the above trainees = US\$14,000.00
(at the rate of \$500.00 for each trainee) = Rs 1,66,600.00
Hence total cost for training personnel = Rs 24,03,800.00
- 6.8 Cost of Consultants and Volunteers (for All Projects)
- (A) 1 project co-Manager for 6 years = US\$ 2,16,000.00 (at the rate of US\$ 3000.00 per month)
= Rs 25,70,400.00.
- (B) 3 Experts for 5 years = US\$4,50,000.00 (at the rate of US\$2500.00 per month).
= Rs 53,55,000.00
- (C) 4 Volunteers graduate level for 3 years (preferably Japanese).
= US\$1,44,000.00 (at the rate of US\$1000.00 per month).
= Rs 17,13,600.00
- (D) Travel and daily allowances for all personnel
(i.e. 15 % of the total expense)
= US\$1,21,500
= N. Rs 14,45,850.00
- Therefore total cost for consultants and volunteers
= US\$9,31,500 = N.Rs 1,10,84,850.00

(B) CHAPTER— II .

IMPLEMENTATION OF DEMONSTRATION AREA

The Jhiku Khola catchment area has been selected as the center for the implementation of the demonstration area. Other project areas operated by the DSWC, will also have some demonstration areas to support the National project. As the major portion of the project activities are centered in this catchment area, a detailed study of the watershed is essential as well as the implementation work.

7. DESCRIPTION OF THE WATERSHED

7.1 Topography, Location and Size:—

The catchment area falls within the central midland zone and is east-west oriented. It extends from Sunkosi in the east to the villages of Rabiwapi, Andikot and Sashipani to the west. Palanchoak Bagwati forms the northern boundary and Dhulikhel the southern boundary. Jhiku Khola forms the main drainage, which originates from the western part of the catchment. The total watershed has an area of about 141.36 km² (i.e. 14136 ha.) Table 2 shows the situation of land use in 1967 and 1972 within the watershed and Table 3 shows the land use Category and status in Nepal.

The watershed lies in the Kabre Administrative District of Bagmatizone about 50 km. east from Kathmandu and consists of the following panchayats — Annex no. 9.

Table 2. Land Use Situation in 1967 and 1972 (hectares)

Land use Year	Forest	Scrub + Bushes	Grass	Erosion	Agriculture	Total
1967	2,786 19.7 %	3,427 24.2 %	2,367 46.7 %	— —	5,556 39.3 %	14,136 100.0 %
1972	841 5.9 %	3,407 24.1 %	2,131 15.1 %	1,201 8.5 %	6,556 46.4 %	14,136 100.0 %
Changes between the two periods	*1,945	*20	*236	1,201	1,000	

Aerial photographs taken in 1967 and 1972 were used to interpret different land use. A field check in 1978 has further helped to compare the extent and change in different usage of land. (Annex 3).

Table 3. Land Use Category and Status in Nepal

Land Use Category	Land Use Status in the Country (km ²)	Percent of the Total
1. Forest	47,915	34.25
2. Cultivated Area	23,051	16.48
3. Pasture and Meadows	17,612	12.59
4. Water bodies	3,885	2.79
5. Settlement and Roads	300	0.21
6. Barren (Rocky)	25,926	18.54
7. Area under perpetual snow	21,171	15.14
Total:	139,860 km ² (= 14.0 mill ha.)	100.00

Source: HMG of Nepal, National Planning Commission criteria for land use/erosion control policy Nepal, Draft Proposal, 1974.

7.2 Geology and Soil:

The geological formation is represented by very thick weakly metamorphosed sandy phyllites and schist which occupies almost the whole catchment area. The lower ends join the Sunkosi and in some areas pockets of limestone greissic schists and quartzites of Cambrian age can be found. The softness of the rock makes this region highly erodable. The slopes are moderate to steep.

The soil is sandy loam to sandy-claying loam. Presence of alluvium fans in the valley bottom. Two-thirds of the mountainous area consist of deep lateritic sandy clayey soil. Soil depth is shallow at the upper extremities and as deep as 6-meters in the lower plains and valleys.

Analysis of soil samples from the catchment area is given in Annex 4.

7.3 Climate—

Two-thirds of the area has a sub-tropical type of climate with summer temperatures rising to 40°C. The rest of the watershed has a mild sub-temperate climate.

There is more precipitation in the mountainous regions than in the valleys. The rainfall intensity is high and lasts for 2 to 3 hours. Snowfall is rare. Sashipani and Kothimal receives very little snowfall. Total annual rainfall varies from 1,000 to 1,500 mm. per year, see Annex No. 5. The watershed receives 80 % of the total precipitation in the form of monsoons which prevails from June to Sept. Very little winter rain prevails between Jan–March. The amount of rainfall increases with the rise in altitude.

Dew falls more in the valleys than in the hills. There are dew nights every month. The main dew period extends from November to the middle of March.

The degree of evaporation is considerably higher over barren soil than over ground covered by vegetation. The evaporation rate is still higher in the slopes, especially on the southern slopes.

The average maximum temperature ranges from 26°C to 40°C and the average minimum temperature is 1° to 7°C, see Annex 6.

Since vegetation generates a certain micro climate, the temperature curve below the vegetation is more stable than on unprotected and naked soil. The destruction of vegetation for grazing and firewood, cause the soil to warm up faster and deeper. The differences in temperature, maximum during the day and minimum during the night, have an adverse effect on the unprotected soil of this watershed, causing more erosion. This process has more adverse effects on slopes than in the plain regions.

Light frost is common in the valleys and is heavier in the hills above 2,000 m. The frost period is generally from December to January.

7.4 Hydrology and Drainage systems:—

Jhiku-Khola is the main river (or drainage) in this catchment. It is fed by many perennial rivers (Kuttal or Dhulikhel Khola, Danfe Khola, Buchakot Khola, Bohore Khola, Chenpur Khola, Subarna Khola, Dhap Khola, Dhod or Andikot Khola, Chharre Khola, Sashipani Khola) and by many other seasonal rivulets. These perennial rivers originating at certain altitudes, run their course through steep slopes carrying sediments to the lower plains and valleys. Kuttal, Dhod and Danfe Kholas bring sediment consisting of sand, gravel and silt to the valleys. The other Kholas bring mostly soil during the monsoon season. Frequent flooding and bank cuttings are quite common in the lower plains and valleys. Balua, Lamedehi (Jhorpati), Sigrampati and the lowland (khet) of Sikharpurbesi are mostly effected by Jhiku-Khola flooding. In the dry season (March--April--May) Jhiku-Khola has about one ghatta (ϕ 38 cm), which swells many times during the monsoon. The duration of the flood period lasts from 4 to 2 hour. No other records are available for this river. Annex 7 shows the gradient of the tributaries and the main river Jhiku Khola.

8. SETTLEMENTS, ECONOMY AND EDUCATION

8.1. Settlements:—

The present estimated total population of the watershed is about 37,325 with approximately 6,420 houses covering an area of 141.36 km². Average family size is about 5.8. The average density of population is 264 persons/km². Annex 9 shows the population distribution by Panchayats. Concentration of the people and villages in this watershed are mostly on the upper ridges of the surrounding hills. The distribution is nearly equal in the North and South. Very few people live in the valleys except for Panchkhal, where the population is increasing every day because of good communications. The distribution of class groups and castes are shown in Map No. III. The majority of the class groups are Brahmans and Chhetries, scattered all over the watershed. Tamangs occupy the higher regions and Danuars the lower flood plain. Few Newar classes occupy the vicinity near the Temple and Market areas. A group of Giri-Puri (Mahanta or Sanyashi group) are localized at the north-western part of Panchkhal. Besides the above class groups, Damai, Kami, Kusule, Nau, Magar, Sarki are also present in a minority.

8.2 Economy:—

Agriculture forms the main occupation of the people in this region. The agricultural system is very intensive and is beyond the ecological balance. The high population pressure, intensive livestock grazing and the great demand for firewood and fodder, has initiated the soil loss in the terraces of the hills. At the same time, the diminishing resources contribute to greater problems of economic and social development. The average land holding is about 1.00 ha./family.

About 46.4 % of the total land within the project area is under cultivation (for details see Table 2.) There are generally two crops in a year. Winter crops consist of wheat, barley, potatoes, mustard and sugarcane. Summer crops are maize, millet, rice and potatoes. Sugar cane is generally planted in the valley, one crop in one year. Phapar, vegetables, peanuts and soybeans are also grown as minor crops. Some industrial crops such as agave (hedge plant and also a source of fibre), Khar (for thatching purposes), cotton, jute and sugarcane (for molasses) are also planted in the project area. Jack fruit, mango, pine-apples, papayas and bananas are local fruits that are exported in small quantities to Dhulikhel and Banepa. There is a good opportunity for expanding this fruit industry. The horticulture station in Panchkhal is helping the local farmers by supplying plants such as Mango, Lichi, Pine-apple, Banana & others. There is also a possibility of extensive plantation of chiuri (*Madhuca lalifolia*) whose seed can be used as a source of vegetable butter and flowers as a good source of honey for the bee-keeping industry.

Farmers sell more than 50 % of their agriculture produce such as potatoes, rice and sugar cane, which generally grows on irrigated terraces and valley bottom. The cultivation of potatoes was started commercially in B.S. 2031. About 750 Quintal of Potatoes have been produced in the financial year 2033/34.

Animal husbandry is another progressive industry in this region. There are milk collection centers at Panchkhal (lamidanda) and Banepa. Farmers from the lower region bring milk to Panchkhal and from the upper region to Banepa. There is no fodder and pasture development programs. The pasture areas are overgrazed and progressively eroded. Panchkhal has become a good marketing center because of the good communication link to Dhulikhel-Banepa-Kathmandu.

Besides agriculture, a few people are in Government Service as teachers, JTAS, the Army and police, Many people are unskilled workers such as porters, laborers etc., who get daily wages up to Rs. 15 to 20 per diem.

Shoemaking is another cottage industry in the project area (Palanckoak and Panchkhal). A variety of shoes with the name Palanckokey is the speciality of this area. The price of a pair of shoes now is about Rs. 10 to 15.

There are some natural resources which can help the cottage and other industries. The copper are (Tamakhani) in Sarsaunkharka and different colored soils present in the project area could be best utilized.

8.3 Education:—

The majority of the people are illiterate. Very few people have a literacy level necessary to improve the quality of their life.

There are 16 primary schools (1st to 3rd grade) 8 middle schools (4th–7th grade) and 2 High Schools (8th–10th grades), in this project area.

The enrollment of female students is extremely low in comparison to males i.e. females 10 % and males 90 %. Similarly the enrollment of adult students in comparison to children is 15 % against 85 % for children.

The presence of girls as NDS staff in the village schools has a good impact on girls education in the villages.

Most of the schools have a very limited number of instructional materials. Very few teachers are trained to be able to handle the equipment and other instructional materials. There is virtually no library facility for the students. A girls education campaign and introduction of conservation education in all the school levels are necessary in this watershed.

A Samaj Kalyan kendra (i.e. a welfare center) was opened in the last two years in Panchkhal. About 40 ropanies (i.e. 2 hectares) of land has been allotted for this, which includes housing, gardens and paths. The objective of this center is to enable the disabled and poor people to be able to earn a living for themselves by providing them some training and education. There are about 40 to 50 people working at 6 weaving tables, 1 set of hosiery machines & 3 sets of cutting and stitching machines. About 150 boys and girls are learning in the primary vocational school. How to vegetables and horticultural species are also taught to the students and workers.

9. EXISTING LAND USE

The total amount of land of the project area is 141.36 hectares of which only 6556 hectares (46.4 %) is under cultivation. Forest, scrub + bush, grass land account for 841 ha. (5.9 %), 3407 ha. (24.1 %) and 2131 ha. (15.1 %) respectively. The eroded area accounts for 1201 hectares i.e. 8.5 % of the total area – see Table 1 and Map No. 1.

The project area consists of valleys, hills and mountains with an elevation ranging from 610 to 1867 meters.

The following villages suffer from minor to major erosion and landslides:— Andikot, Rabi, Dhulikhel, Keraghari, Timpiple, Belapuchhar, Danfekhola, Panchkhal, Sarsiunkharka, Koshidekha, Bhagwati, Hokshe, Dhapkhola & Sikharpurbeshi.

10. VEGETATION

Vegetation plays an important role in showing the degree of degradation by erosion, as plant succession changes in the course of progressively drying out and impoverishing the soil. Once the indigenous vegetation is disturbed by erosion and the ecological factors determining the location have changed, new dry resistant, fast growing plants replace the former flora. The presence of Banmara, Pithauli, Ainselu is the result of ecological change in the degraded soil.

The vegetation of the project area changes according to the altitude.

The valley and the lower hills (up to 1000 m. in elevation) have a sal type, dominated by sal, the most important timber species of Nepal. Very close associates of this type are Asha, Barro, Botdhayero, Banj, Semal, Shidhure, Kusum, Sandan, Amla and Jamum etc., – see Annex 11 for botanical names.

The mid-Himalayan region, above 1000 meters in elevation, has a lower slope mixed hardwood type of forest. In this type, sal is dominated by other species such as Chilaune, Dhalne-katus, Utis, Lakure, Harro, Dabdabe, Champ and Koiralo.

Very few places beyond the 1600 meter elevation have upper-slope mixed hardwood type, consisting of Chilaune, Banj, Angeri, Okhar, Paiyun, Guras, Kaphal and Bhojpatra, etc., as the main species.

Chirpine Type occurs in a scattered manner along with the lower slope mixed hardwood type, on the exposed south-Eastern and Western sides. The main species is Chirpine. This species is gregarious in nature and found in groups.

Bushes of Banmara are found all over the area, hindering the regeneration of important species. In some places, especially on barren slopes, it often acts as a soil binder. This plant is not easily grazed by cattle. The tender leaves are sometimes browsed by goats and sheep. At some places, especially on overgrazed and exposed hills, Satibeer or Pithauli plants are common. These plants also help to prevent soil erosion. Bushes and grass-like Bans, Nigalo, Babio, Khar, Amlisso, Neer, Chutro & Ainselu are also common in the watershed areas.

The existing forest on the slopes are heavily lopped, grazed and are in deteriorating condition. Considerable care and protection is needed for the forests especially near the settlement areas. There exists no reliable estimates of forest product consumption in the project area. However, local information points out the extensive use of forest products for fuel, fodder and timber, by the growing population. All the forests in the project area is owned by the Government. However, people are permitted to collect fire wood and fodder for their essential requirement. People have to obtain a permit and pay royalty of timber for household construction but virtually no timber is available from the forest. People in Panchkhal, however, bring timber from Kathmandu TCN (Timber Corporation of Nepal) depots. The forest area falls under the jurisdiction of the Chautara Forest Division, Dhulikhel Range, the office of which is located at Dhulikhel.

The people in Panchkhal collect Sal leaves (to make picnic plates and for other household use) to send to the Kathmandu market. This has produced a serious effect on Sal seedlings.

Sal, Chilaune & Jamun form the main source of firewood. Mango trees from the agricultural area supplement the need for firewood in some villages.

Kutmiro, Nimaro, Khanayo, Dabdabe and other Ficus spp. are utilized as fodder for the cattle. These species are found mostly on marginal lands (i.e. the land between agriculture and forest.)

11. WATER SUPPLY, IRRIGATION AND OTHER USE

Bohre village has the privilege of having a very good drinking water source (7 springs together made 5 taps). The water problems can be divided into three categories —

I Panchayats having severe water supply problems:—

Bagwati, Andikot, Sarshiunkharka, Maithankot, Kabre & Kanpur.

II Panchayats getting help from UNICEF for drinking water supply:—

Bhamarkot and Panchkhal.

III Panchayats having local water supply to some extent:— Phulbari, Dhulikhel and Balua.

Category I needs an urgent survey for water supply since 15 to 16 thousand people are suffering from severe drinking water problems. Irrigation facilities are common in Panchkhal and Bohre but very little in Balua villages. The need for irrigation has been noticed in Balua, Panchkhal, Palanchoak, Bagwati Panchayat, mostly for rice, potatoes, sugarcane, wheat and other crops. Even horticulture crops like mangoes, lichi and pineapples need irrigation in the above panchayats.

Fig. 1, 2 and 3 shows the present method of making a diversion channel at Jhigu Khola, Dhap Khola and Chhahare Khola.

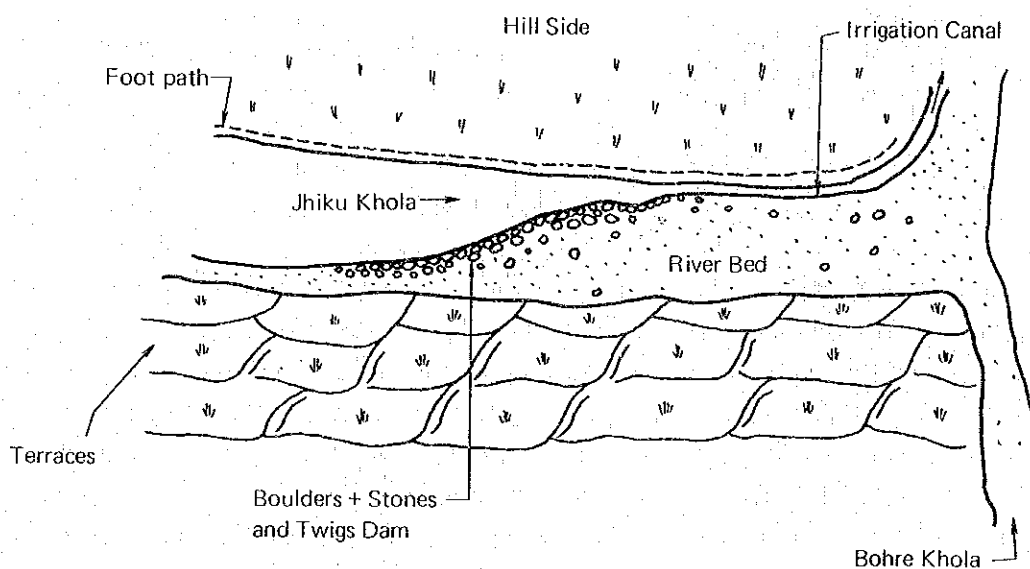


Fig. 1 Irrigation Dam Made by the Farmers at Jhiku Khola

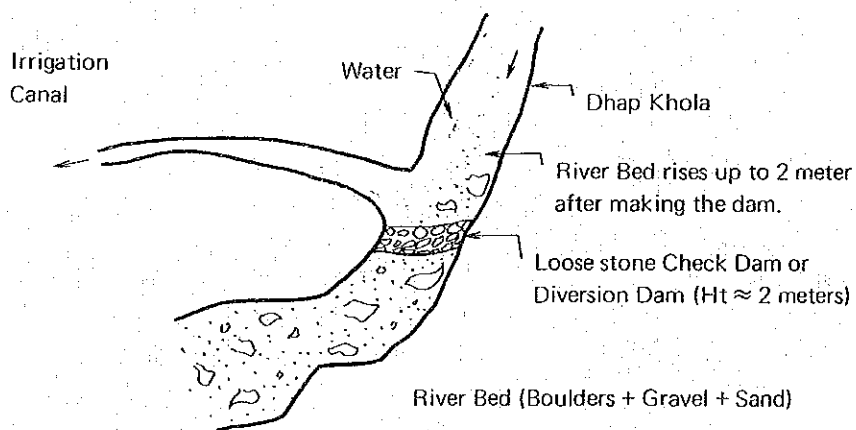


Fig. 2 Loose Stone Diversion Dam Made by the Farmers at Dhap Khola (near Sikharpurbesi)

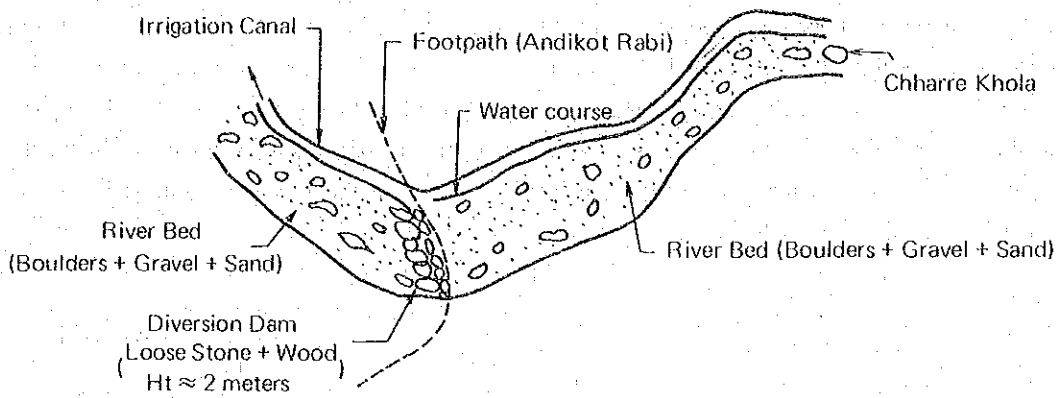


Fig. 3 Loose Stone Diversion Dam Made by the Farmers at Chhandare Khola (near Rabi)

There is very little difference on the technology of making irrigation channels in the above methods. The farmers dam up the water channels with 1 or 2 meter high walls of loosely filled stones or with branches (twigs) and stones and channel the river water into the irrigation channels to their fields. These structures are not permanent and are destroyed by the next flood, but can be reconstructed after the monsoon, with low cost and labor. These methods on technical improvement can be best utilized in other parts of the project area.

An example is shown in fig. 4, where farmers have tried to put a gate on the bottom of the structure from where a limited amount of water is passed to their fields. During flood season, the gate can be closed.

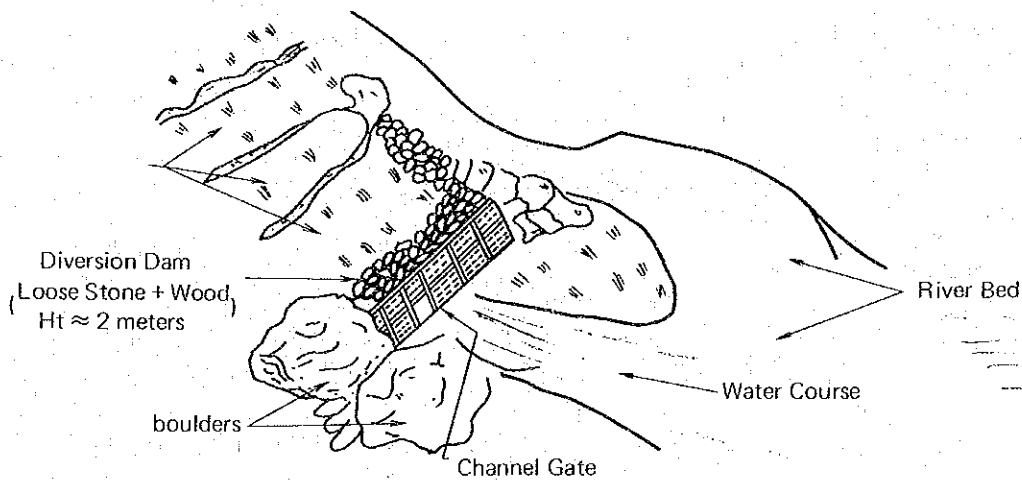


Fig. 4 Loose Stone Diversion Dam Made by the Farmers at Tinau-Khola Catchment

Besides drinking water and irrigation, in some places, people are utilizing water for flour milling and oil extracting, locally called ghatta. No electricity has been generated so far. There is a possibility of making a small powerplant at Maithankot besi by constructing a dam at the source of the Jhiku Khola (Panchkhal and Bhamarkot panchayat area) and mixing the water from Danpe Khola in the channel. But, an appropriate survey must be made to assess the project.

12. RECREATION

The project area has many scenic places and places of other importance —

Dhulikhel — One of the most important places to see the Himalayan Range. Mount Everest (Roof of the World) can be easily seen along with many other peaks. This area is accessible by car or local buses.

Phulbari — Also a good place to see the Himalayan Range, but difficult to reach by car. Can be reached by a walking 2 to 3 hours from Dhulikhel.

Namabuddha — A ancient Budhastupa lies south-east of Dhulikhel (outside the project area) and is within walking distance of 3 to 4 hours. There is an annual fair once in a year. Very famous as an ancient temple in Nepal.

Bhagwati — A very famous temple of Goddess Durga, about 7 to 8 hundred years old. Local information says this magnificent carved idol was brought by Mander, in 1200 B.S. This temple has archeological importance. From this place, Sunkosi and the Himalayan Range appear beautiful. This place is approachable by a fair weather jeep road (12 km) east of Arnico highway at Panchkhal (Lamidand) An annual fair takes place in May (Purnima i.e. full moon day)

Besides the above places of interest, the project area has other places such as Andikot, Chharre, Sashipani and Kothiwal from where a magnificent panoramic view of the Himalayan Range can be seen.

13. WILDLIFE AND FISHERY

The northern part of the watershed along with a portion of the Chakkhola Watershed (outside the project boundary) between Andikot to the west, Chisapani to the east, Chakkhole to the north and Panchkhal, Bagwati to the south, has an area of about 1750 hectares can be protected as a wildlife reserve (see map no. IV). This area consists of deer, pheasants and others. There is still a good forest which needs no additional investment, except to fence in the area and to hire some watchmen. An army firing camp has been observed on the southern part of this area. This will be stopped when the area is used for a wildlife reserve.

A fresh-water fishery is not possible in this area except for pond fishery. The soil is suitable for pond fishery in Panchkhal valley. Farmers have not yet started this industry.

14. AGRICULTURE

Much has been discussed while dealing with the economy of the people. Some more details are discussed below:—

The principal food crops grown are rice, wheat, maize and potatoes. Other crops are sugarcane, barley, phapar, soybeans, peanuts and other beans and pulses.

Rice is grown during the summer on irrigated terraces and in the valleys. Water for irrigation is brought from neighboring rivers and streams. Ghaiya (= upland paddy) is also grown on unirrigated terraces as rainfed crops. Very little fertilizer is used as compared to the traditional compost manure. Where farmers introduce new exotic varieties of rice, chemical fertilizer is used.

Wheat is grown as a winter crop in the irrigated fields after the rice is harvested. Seed origin-local as well as improved. Wheat as such is an introduced cereal crop in this project area.

Maize is the main staple food crop in this region. It is grown as a rainfed crop, planted in the dry season (Feb.—March) and harvested in the late summer (August—September). Seed origin is mostly local.

Potatoes are grown extensively on irrigated terraces, and valley fields, both in the winter and summer seasons. Seed origin is mostly local, but the growing techniques have been improved more. Potato cultivation has been found very popular among the farmers. The economical return is high as compare to other crops (yield 2.5 to 3 quintals/ha.) But the farmers do not fully depend upon this crop since disease called Daduwa, which causes considerable damage by drying the plants after two months of seeding i.e. after soil working. The technique of growing potato seeds as shown in Fig. 5, consists of —

The soil is worked first. Then a layer of chemical fertilizer Nitrogen, Phosphorus and Potash of the rate of 100 : 60 : 40 kg/ha. is made.

Above this is placed a layer of compost or dry grass or hay. Then on the top of it potato seeds are planted with proper spacing (about 10 cm x 10 cm) The potato seeds are covered with soft soil.

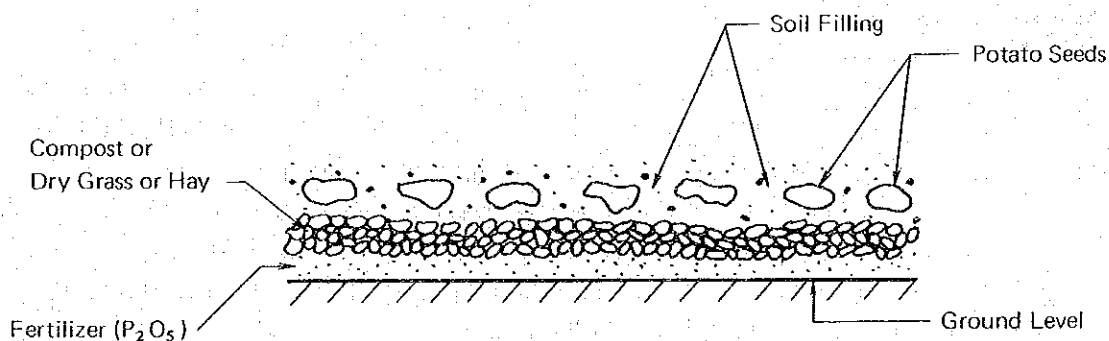


Fig. 5 Improved Method of Cultivating Potatoes in Panchkhal Valley

The production of potatoes with dry grass or hay is 4 bags, but with compost layer is 5 bags per ropani, which comes to 2.5 and 3.0 metric tons per hectare respectively. (c.f. 4.5 metric tons in Mahakali hills and 6.0 metric tons in Rapti zone). The growing production of potatoes now needs a storage facility (i.e. cold storage) at Panchkhal. Farmers at present bring the produce to the road side (Arnico Highway) at Panchkhal and Tinpile, where the produce is sold and brought to the Banepa and Kathmandu markets. Every year the seed potato is brought back to this region from Kathmandu and other places. This way the farmers have no guarantee of getting disease-free seeds.

Sugarcane is another important agricultural crop in this region. This is generally grown in irrigated terraces and valleys. The production in the form of raw sugar, known as gur, being consumed locally and a small portion is sold in the market.

Other agricultural crops like barley, Phapar, soybean, peanuts & pulses are grown as mono or mixed crops in different types of lands. They are mostly used for local consumption.

Industrial crops like cotton, hemp and jute are found in very little quantity. Ropes are made locally from agave (*Agave* sp.) and Babiyo, Khar. Rice and wheat straw are used for thatching of local houses and cattle sheds.

Main horticulture species found are mango, lichi, banana, papaya, guava, etc., which are generally consumed locally. A very small portion is sold in the market. Farmers seem very interested in the propagation of fruit trees. The Government Horticulture Station in Panchkhal is helping farmers in obtaining the above-mentioned horticulture plants.

15. LIVESTOCK AND GRAZING

Buffaloes, cattle, goats and sheep are raised for milk, meat and manure. Oxes or bullocks are the main animals for ploughing. Chickens and ducks are raised for eggs and meat.

A current livestock census of the project area is not available. A field survey estimate for the year 1978 is about 44,940, of which 25,680 or 57 per cent are goats and sheep, 12,840 or 29 per cent are cattle and 6,420 or 14 per cent are buffaloes. The average number of animals per household comes to about 4 goats and sheep, 2 cattle and 1 buffalo i.e. altogether 7 animals.

As the valley and plains area produce rice, farmers use Hay (Rice straw) as a principal source of fodder. However, grazing is generally done on forest lands and on community grazing grounds (= old Kharkas) at Tin piple, lamedehi, Palanchoak, Sikharpur and others. These grazing areas are heavily over-grazed and need proper management and maintenance.

Other sources of fodder are wheat, millet, bean or legumious straw, maize stover, sugarcane tops, vegetable waste and cut grasses. There are no silos, but farmers generally make hay (dry grass) for the winter and rainy season. This type of fodder and hay amounts to 12 percent of the total fodder needs. Besides fodder, farmers also prepare concentrated feed (= a mixture of rice bran, maize flour, pulses, oil cakes, salt and kitchen-left overs), which is boiled with water and fed to the animals in the morning. The quality is better (about 1 kg/day) for the milking cattle and buffalo as compared to others. This feed amounts to 5 to 7 percent of the total feed.

Veterinary services are very insignificant in this region. One Veterinary service in Dhulikhal is not sufficient for the whole watershed. The majority of the cattle are indigenous

and from a poor breed, therefore, the improvement of the cattle stock is essential.

16. INDUSTRY AND TRADE

There are no big industries in this project area. However, small sugarcane mills, (agri-based cottage industry) a total of 12 are operating in this area. These mills are mostly privately owned. The power source is bullocks. About 20 dharni gur (i.e. raw sugar) is being produced per day, working 4–5 hours. Therefore, the total capacity of gur production is $12 \times 20 = 240$ dharni (i.e. 576 kilo, taking 1 dharni = 2.4 kilos). The mills start operating from the beginning of Mansir (November) till the end of Falgoon (March) i.e. 4 months. These mills receive sugarcane from Mahadevsthan, Panchakanya, Bagwati, Bhamarkot, and Panchkhal Panchayats. One mill employs one bullock and two people plus 4 to 5 people for scaling the sugarcane.

Besides the sugar mills there are numerous Dhikki, Pani ghatta and Jato for rice and flour milling.

Palanchoak is famous for shoe making known by the name planchoke Jutta.

Other possible small scale industries in this area are –

- Dairy industry
- Jute cotton and hemp
- Fish farm
- Horticulture
- Agricultural processing and fruit canning
- Pottery
- Weaving- cotton, wool, linen, etc.
- Metal works and handicrafts, etc.

To operate the above industries, the following projects are important in the project are –

- development of infrastructures
- Encouragement in establishing plantation of raw materials required from a proper landuse basis.
- facilities and subsidies to the farmers.
- Storage facilities for the agri produce.
- facilities for sale and marketing of the produce.
- Improvement of agricultural lands, especially hill terraces for the improvement of agriculture produce.
- proper use of water resources for irrigation and power.

17. EROSION AND LANDSLIDES

Overpopulation, shortage of land, destruction of vegetation (forests), extension of arable land instead of intensive cultivation, overgrazing by cattle, under employment of the population are the main causes of erosion and landslides.

Geological erosion:— Erosion and landslides on under cut slopes in river valleys are a common phenomenon in mountainous regions of Nepal. Here in the Jhiku Khola Catchment the geological erosion has been initiated by human interference. Large quantities of soil disappear in the hill region every year. No data are available.

Because of the deforestation of the upper parts of the slopes and the cultivation on steep slopes at higher altitudes, the soil of the slopes does not conserve water and dries out quickly and becomes almost dry from November till March, despite the heavy monsoon rains. This effected the vegetation changing into a more xerophytic type. Example are Satibeer, Banmara, etc.

17.1 Erosion on Terraced Slopes —

Erosion and landslides on irrigated terrace slopes, due to the failure of terrace banks, are occasionally found. The continuous irrigation of terraces on steep slopes having underground rocks parallel to the slope leads to a damming up of the seeping water resulting in the whole slope sliding down.

More erosion has been noticed on unirrigated terraces and exposed barren slopes. Unirrigated agriculture fields have more than a 50 % slope. The changing angle of the slope and the inflow from the upper fields determine the zones of erosion and accumulation (Fig. 5). In this catchment farmers have made, in some places, a diversion or irrigation channel across the slope at every 8–10 terrace (approx) interval (terrace height about 1.5 meters). This has reduced the flow from the upper fields, thus creating less chance of erosion (Fig. 6).

Making diversion channels are very common to most of the villagers to protect their terraces and valley paddy fields from the runoff coming from the uphill side (Fig. 7). But sometimes a thin layer of sedimentation is allowed to settle on the fields, which fertilize the soil.

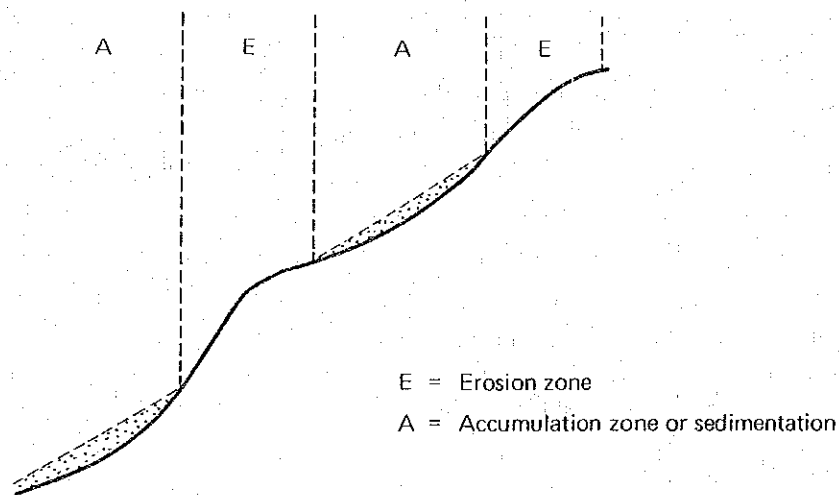


Fig. 6 Figure Shows the Erosion and Accumulation Zones on a Terraced Slope

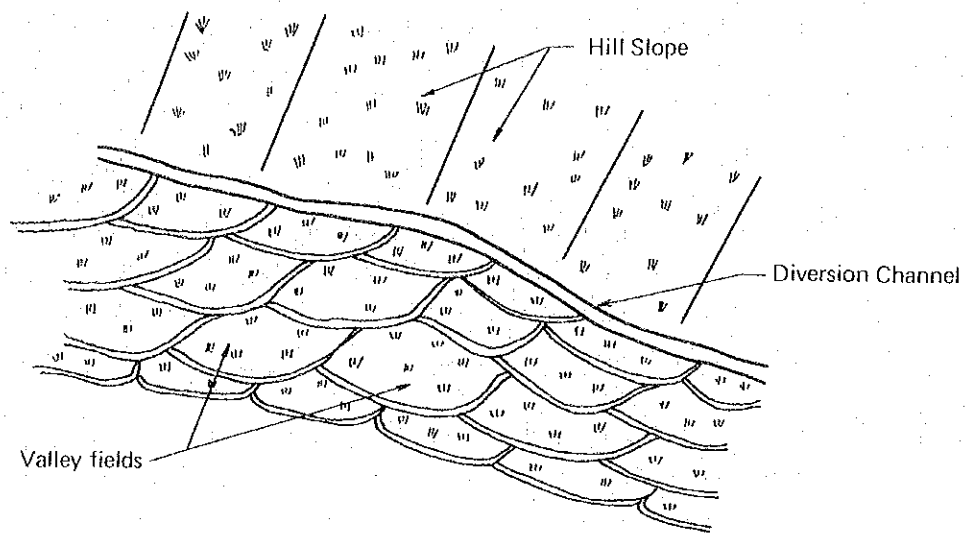


Fig. 7 Shows the Diversion Channel to Project the Valley Fields

17.2 Erosion on Forested Slopes –

Forested slopes generally do not have erosion problems. But the hunger for land of a fast growing rural population without any occupational diversity, forces the cultivation (forest encroachment) on steep forested slopes. The activities involve the felling of trees and cutting and burning of bushes, which consequently accelerate erosion. Another cause of erosion on forested slopes is the heavy grazing and collection of firewood. Due to such activities gullies are found, in some places, eroded during the monsoon.

17.3 Erosion on Deforested and Non-terraced Slopes –

Erosion on these areas are generally caused by heavy grazing which is easily marked by the presence of numerous cattle tracks. Such areas are generally found near the settlements. The area is devoid of vegetation due to heavy and repeated grazing, reduces the water conserving capacity of the soil and increases run-off. The run-off starts in the form of rills on cattle tracks which become larger and larger as it descends and starts cutting the slope. This ultimately joins the rivulets with abundant soil particles. In the Panchkhal area this has initiated the widening and deepening of gullies and ravines. In some places a group of xerophytic or hardy plant like Banmara and satiseev has taken its place. In some places, rocks & stones are left behind without any soil cover, as a beginning of a mountain desert. Erosion on such areas are generally found in the form of a V-shape.

17.4 Erosion on Roads & Tracks –

Generally faulty road drainage and foot paths are the source of erosion on mountainous regions. Another cause of erosion, is by cutting of slopes during road construction. The steeper the slope, the more will be the cut and greater danger of erosion. The road from Dhulikhel to Panchkhal has erosion problems in many places, due to the above reason. Some attempt has been made by the Dept. of Soil/Water Conservation to protect road side erosion near Tinpiple. The results are very promising. Methods to check further erosion were – gully-plugging, planting of

trees on the slopes, construction of check dams along with planting of Utis, Bamboo, Agave, vitex etc. in bigger gullies, construction of storage ponds and diversion channels etc. Thus, extreme caution must be taken when constructing a hill road in Nepal.

The following villages suffer from minor to major erosion and landslide problems --

Andikot, Rabi, Dhulikhel, Keraghari, Tinpipla, Belapuchhar, Danfekhola, Panchkhal, Sarsiunkharka, Koshidekha, Bhagwati, Hokshe, Sikharpurbesi, etc.

18. NATURAL DISASTERS

There are not many cases of natural disasters.

19. LOCAL NEEDS AND AWARENESS OF THE PROBLEM

Farmers show their awareness on the negative effects of deforestation and erosion. They generally have a strong desire to conserve and enlarge such areas with natural resources. But this awareness varies from area to area. Awareness is high on already deforested and severely erosion effected areas. Awareness of the people also differs on the availability of timber, fuel, grazing or fodder, drinking water and occurrence of erosion and landslides. In most of the areas, there is a strong need for fodder and fuel trees, fruit trees and methods to check erosion and landslides. Besides the above needs, farmers generally have the following needs such as irrigation, drinking water facilities, education, transportation, marketing, storage facilities for agriculture produce such as potatoes, and last but not the least, medical care.

The existing conservation activities by the local people have already been discussed in Part-I. The achievement of land using ethics which brings about the restoration poor soil and water resources and maintaining productivity of land now in production or capable of increasing production depends upon the involvement of the people. Everything depends on the local people contributing to community awareness of conservation practices while at the same time assisting in the lowering of conservation expenses.^{1/}

20. RECOMMENDED LAND USE IN THE DEMONSTRATION AREAS

The following are the main activities recommended for proper land use planning in the project area. See map No. II.

20.1 Forest Management Program --

Forest are to be managed mainly for:

1/ Soil and Water Conservation System (Program Planning and Budgeting, 25 yrs; HMG, Dept. of Soil/Water Conservation.

- Protection of erodable barren areas (conservation purpose)
- Production of timber and fire wood
- Production of fodder and developing grazing area for cattle.

The above items need a thorough survey (inventory) of the areas under forest cover and those which are likely to be converted into a forest area. About 1945 ha. of forest land have been decreased in the watershed by changing to agriculture, eroded area and grass land (mostly barren). The following activities are necessary –

- a) Plantation of eroded land (E) – 1200 ha.
- b) Improvement of shrubs and Bushes (SB) – 1000 ha.
- c) Improvement of grassland (G) – 640 ha.

The project will aim to develop plantations of fast growing local species as far as possible. A nursery must be established in the Watershed area (in a convenient place), to supply the necessary plants. Other details for a plantation will be dealt with separately when a detailed forest management program is made. The present forest area (841 ha.) will also be managed under this program.

20.2 Agriculture Management Program –

A separate detailed survey is necessary for this program. Some comments have already been made in Part I. The following items are necessary for the agriculture management program –

- improvement of cereals, oil seeds and legume production.
- improvement of mixed farming system.
- improvement of horticulture farming, fruit processing, etc.
- betterment of irrigation system, wherever possible.
- possibility of changes in present land use.
- introduction of cash crops.
- improvement of livestock and veterinary services.
- grassland and fodder improvement for cattle.
- increase in technical (agricultural) assistance services.
- credit facilities from banks.
- storage and marketing facilities for agricultural produce, etc.

About 33 % of the area is for agriculture i.e. 2000 ha. need proper management.

20.3 Improvement of Infrastructures:

The Kathmandu – Kodari Road (Arnico Rajmarg) linking Kathmandu to the Chinese border, Tatopani (Kodari) crosses the catchment from west to east at the Panchkhal from Bhagwati (total length: 12 km.) and Tinpiple from Balua (total length: 7 km) need improvements. A fair weather road from Dhulikhel to Kanpur (total length: 34 km) also needs improvement, repair and maintainance at several places. There are also several trails, in the catchment, that need immediate repair and improvement.

A detailed survey is necessary to determine the cost of the improvement of the infrastructures in this catchment.

The following targets are tentatively fixed:

- a) Repair and improvement of roads 55 km.
- b) New construction of roads (fair weather type) 30 km.
- c) Trail improvement 40 km.
- d) New trail construction 20 km.

20.4 Soil and Water Conservation Program

- a) Plantation of fodder cum fuel wood and soil binding palatable grasses will be done in (1200 + 1000 ha.) 2200 ha. of eroded and denuded grassland which has already been mentioned in the forestry management program.
- b) Improvement of small irrigation canals constructed by the local people – Many crude irrigation canals constructed by the farmers are in need of improvement. These canals are becoming the cause of erosion and landslides in many places. About 20 km of such canals require improvement.
- c) Terrace improvement – Most of the unirrigated terraces suffer from little to severe erosion. One of the regions utilizes unscientific terraces for cultivation. Such terraces covering about 400 hectares in area, require improvement.
- d) Rehabilitation of gullies with check dams and biological means – About 263 check dams of varied types and sizes must be constructed in different gullies. The size and types (Masonry, loose-stones, gabions, vegetative) can be identified by a detailed survey only.
- e) Stabilization of roadside slopes and trail slopes – The slopes of Arnico Rajmarg (at places) along with that of fair weather roads and trails in the watershed area, about 30 km in distance, will be taken up for stabilization work by different techniques.
- f) River training – To protect the fields in the valley bottom as well as on the hill slopes from summer flood (bank cutting and siltation), construction of embankments and other structures are necessary to control Jhikukhola and other tributaries. The total estimated length is approximately 28 km. A detailed survey is necessary to assess the exact length and suitable techniques for such work. Before making such structures, a detailed flood plain zoning map must also be compiled.

20.5 Miscellaneous Program

Other items of operation which do not fall in the above programs are included in the following paragraphs:

- a) Drinking water supply – The situation of drinking water supply has already been discussed. A detailed feasibility study must be carried out for the pipeline and identification of the drinking water source. About 10 km. of pipeline with necessary work are tentatively scheduled.
- b) Construction of a dam to generate electricity – Studies and surveys are necessary before planning this project. Because of the industrial nature of the local people and to help the existing small scale industries, utilization of the water from Jhiku-Khola for generating electricity is being considered. A tentative dam site has been indicated on the map No. II. The design for the dam can be done only by proper surveys and studies.

- c) Recreational area development -- Few recreational areas are within this catchment. By developing such areas, the local panchayats will be able to earn money after proper conservation work. This money could be utilized for different development projects within the panchayats. An appropriate management plan will be made after a proper survey. A lump sum amount will be fixed to develop the wildlife areas, viewing points for the Himalayan Range and Temple areas, etc.
- d) A certain amount of money would be set aside for other activities such as health services, education materials, farm equipment, Machinery for Cottage industries, etc. along with the project research works.

21. IMPLEMENTATION OF THE DEMONSTRATION PROGRAM (physical targets)

S.No.	Items	Years										Total							
		1st Year	2nd Year	3rd Year	4th Year	5th Year	6th Year	7th Year	8th Year	9th Year	10th Year								
1.	Forest Management Program:—																		
	(a) Improvement of Scrubs and Bushes																		841 ha.
	(b) Improvement of Grass Land																		1000 ha.
2.	(c) Plantation of Eroded Land																		640 ha.
	Agriculture Management Program:— (50% of the area under agriculture will be taken)																		1200 ha.
	3. Improvement of Infrastructures:— (a) Repair and Improvement of Roads																		2000 ha.
4.	(b) New Construction of Roads (Fair wheathers)																		55 km.
	(c) Trail Improvement																		30 km.
	(d) New Trail Construction																		40 km.
	Soil and Water Conservation:— (a) Improvement of Irrigation Channels																		20 km.
	(b) Terrace Improvement																		20 km.
	(c) Re-habilitation of Gullies (Construction of Checkdams + Plantation of Gallies with Soil Binding and Fast Growing Species)																		400 ha.
5.	(d) Stabilization of Road Side Slope																		263 Nos.
	(e) R. Training Works (Embankment Spures and Other Structure)																		30 km.
	Miscellaneous:— (a) Water Supply																		30 km.
	(b) Const. of Dam to Generate Electricity (Micro-hydro Electricity Project)																		10 km.
	(c) Recreation Area Development																		10 km.

Note:— For every item of work, observation, recording and study for the research work will be done.

22. COST ESTIMATE

22.1 Survey and Planning

As shown in the implementation chart (physical targets) page 31, a detailed survey will be done to identify the priority areas for research and demonstration sites and to prepare the comprehensive management plan of the watershed for carrying out the programs in subsequent years. Detailed design and survey work is also necessary for other programs as mentioned in the report.

For all these programs a sum of Rs. 1,50,000.00 is roughly estimated.

22.2 Forest Management Program

The 841 hectare forested area needs different silvicultural operations such as tending, thinning, clearing and improvement of the stock by the plantation of suitable species. Most of the forested areas remaining are especially on steep and unaccessible slopes and land not suitable for agriculture. Therefore protection of such forests is very essential. The total expense will come to about Rs 6,41,100.00. (Silvicultural operation 50 m. day/ha i.e. Rs 500.00 per hectare, which comes to Rs. 4,20,500.00 (assuming Rs. 10.00 per man)). Fencing – 6 strand barbed wire in 10 % of the area i.e. 84 hectares at a cost of Rs. 25.00 per r. meter, comes to Rs. 2,00,000.00. As an experiment, 10 % of the above area i.e. 8 hectares of the protected area will be supplemented by fertilizers (chemical as well as organic). Assuming the cost of fertilizer as Rs 700.00 per hectare, the total cost for 8 hectares is about Rs 5600.00.

About 10 forest guards or Watchmen are required, besides the regular staff, for this program. The cost comes to about Rs 30000.00, assuming Rs 300.00 per person per month, for years.

22.2.1 Plantation of Eroded Land – 1200 ha.

Here plantation is generally done with soil binding grasses and shrubs. Assuming Rs 1800.00 per hectare of plantation and Rs 50,000.00 for fencing 20 hectares of land, the cost of plantation comes to about Rs 36,60,000.00, taking only 50 per cent of the area to be fenced.

22.2.2 Improvement of Shrubs and Bushes – 1000 ha.

In this case 75 percent of the area i.e. 750 ha. will be planted with suitable species for fodder, firewood and Timber (as far as possible fast growing species). The other 20 percent i.e. 200 ha. will be fenced and weeding and cleaning operation will be carried out, also by removing the inferior species in favor of the superior kind. The remaining 5 percent i.e. 50 ha. will be fenced, and besides weeding and cleaning, application of fertilizer will also be tried on an experimental basis.

Cost of fencing for 1000 ha. of land = Rs 25,00,000.00.

Cost of plantation including land clearing, pitting, planting, cost of raising plants in the nursery and transportation of the plants to the planting site

= Rs. 2380.00 per hectare

= Rs. 17,85,000.00 for 750 ha. of land.

Plantation maintenance with two weedings a year in 750 ha., for 5 years at Rs. 500.00 per ha. per year

= Rs. 18,75,000.00 for 750 for 5 years.

Replacement of losses for the 1st year at the rate of 15 % (maximum).

= Rs. 280.00 per ha. (i.e. 28 m. day/ha.)

= Rs. 2,10,000.00 for 750 ha.

Therefore the sub total of expenditure for the improvement of shrubs and bushes in 1000 ha. of land

= Rs. 63,70,000.00.

22.2.3 Improvement of Grassland – 640 ha.

Most of the barren areas with degraded grass cover will be subject to grass plantation. This often includes over grazed areas near the villages. Deeprooted, soil binding and as far as possible palatable grasses will be selected for plantation. Assuming Rs 1800.00 per ha. of plantation and Rs 50,000.00 for fencing 20 hectares of land, the cost of grass plantation comes to be about Rs 19,52,000.00, taking only 50 percent of the area to be fenced.

22.3 Agriculture Management Program

The agricultural management program includes a variety of operations. The cost estimate has been done roughly for different operations, as follows:

- Cost of fertilizer for about 1500 hectares of land = Rs. 10,50,000.00
- Cost of seeds (cereals, legume, grass & others) for about 1300 hectares of land = Rs. 3,90,000.00
- Cost of fencing for horticulture plantation about 300 ha. = Rs. 7,50,000.00
- To improve the livestock for the dairy industry, the existing cattle needs improvement and proper veterinery care. Thus the cost of improved bulls and goats = Rs. 30,000.00 (approx)
- Cost of veterinary services including construction of two veterinary service centers and necessary medicine and equipment = Rs. 8,00,000.00 (approx)
- Improvement of small irrigation channels, about 5 km. in length = Rs. 1,00,000.00, taking Rs. 20,000.00 per km.
- Total No. of man days required for 200 hectares of land = 20,000 m. day at the rate of 100 m. days per hectare, which comes to Rs. 2,00,000.00.
- Construction of two storage godowns for agriculture products such as cereals, potatoes & pulses, etc. = Rs. 4,00,000.00

Therefore, the total estimated cost for agricultural program is equal to

= Rs. 37,20,000.00

22.4 Improvement of Infrastructures

22.4.1 Repair and Improvement of Roads – 55 km.

This includes the repair of the damaged portion of the roads (mainly fair weather roads) and improvement of roads by constructing drainage, breast walls, culverts, repaving the roads and other necessary tasks. Actual cost can be estimated after a detailed survey. Such fair weather roads need repair and maintenance every year. As these roads are constructed by the villagers, the 1st repair and improvement work will be costly and the repair work in subsequent years will be cheaper. A lump sum amount of Rs. 10,000 per kilometer which includes the cost of construction materials and labor is roughly estimated for the 1st time. Then in the future (for another

4 years) 10 laborers per kilometer 2 times a year (one just after the monsoon and the other during the winter season) will be enough.

Hence the cost of repair and maintenance of roads (fair weather 55 km for the 1st time
= $55 \times 10,000$. = Rs 5,50,000.00

Then in subsequent years (for 4 years) $55 \times 20 \times 4$
= 4400 m. days
= Rs 44,000.00

Therefore total cost = Rs 5,94,000.00

22.4.2 New Construction of Roads – 30 km.

This includes the construction of fair weather roads, necessary for project activities. In this program new alignments can be made or the continuation of an existing road can be done. For a road being constructed on a hillside, a lump sum amount of Rs 20,000.00 per km is estimated, which includes the cost of construction materials and labor for soil working, culvert or causeway construction, retaining wall or breast wall, drainage, etc. The type of structure depends upon the site condition and the purpose of the road. The road thus constructed requires repair and maintenance for several years (say 4 yrs) at the rate of 10 laborers per kilometer 2 times a year.

Hence the cost of construction of a 30 km Road

= $30 \times 20,000.00$
= Rs 6,00,000.00

Repair and maintenance for 4 years

= $30 \times 20 \times 4 = 2400$ m. days
= Rs 24,000.00

Therefore total cost = Rs 6,24,000.00

22.4.3 Trail Improvement – 40 km.

Most of the village trails are not properly made. They need repair and improvement for easy walking and free movement with working materials during project activities. Assuming 20 m. days/km for the 1st year and 5 m. days/km in subsequent years (about 4 years) the cost for 40 km of trail improvement comes to be about

Rs 8,000.00 for the 1st time or year and
Rs 8,000.00 for the other 4 years

Therefore total cost is Rs 16,000.00.

22.4.4 New Trail Construction – 20 km.

In order to facilitate the project activities and help the local people, it is necessary to construct additional trails. A tentative figure of 20 kms of trail construction has been estimated. If there is any public participation in the work, the length can be increased when required. A detailed survey with proper design and estimate is required before construction. A tentative cost figure is given as follows.

Cost for 1 km. of trail construction = 80 m. days
 = 1600 m. days
 = Rs 16,000.00
 Maintenance cost for 4 years = Rs 4,000.00 assuming 5 m. days/km
 Therefore total cost is Rs 20,000.00.
 Hence total cost for the Improvement of Infrastructures is
 Rs 12,54,000.00

22.5 Soil and Water Conservation Program

22.5.1 Stabilization of Roadside Slopes – 30 km.

Total cost Required = Rs 23,10,000.00

This amount also includes the stabilization work on the slopes of some of the existing trails.

22.5.2 River Training Work – 30 km.

Total cost required = Rs 3,00,00,000.00

22.5.3 Improvement of Irrigation Canals – 20 km.

(A) Cost for survey and planning = Rs 50,000.00 (lumpsum)

(B) Cost of improvement work = Rs 4,00,000.00, at the rate of Rs 20,000.00 per kilometer.

Therefore total cost is equal to Rs 4,50,000.00.

22.5.4 Terrace Improvement – 400 ha.

Total cost = Rs 20,00,000.00

22.5.5 Rehabilitation of Gullies (i.e. construction of check dams) – 263 No.

(A) Construction of cement concrete masonry check dams 79 Nos., i.e. 30 per of the total
 No. of check dams = Rs 59,25,000.00
 (Assuming average 250 m³ per check dam).

(B) Construction of loose stone filled gabion check dams 79 Nos., i.e. 30 percent of the total
 No. of check dams = Rs 29,62,500.00
 (Assuming average 250 m³ per check dam).

(C) Construction of loose stone check dams 105 Nos., i.e. 40 percent of the total No. of
 check dams = Rs 9,45,000.00
 (Assuming average 150 m³ per check dam).

(D) Rehabilitation of gullies with plantation of grass and other tree species (mostly deep
 rooted and fast growing) along with the construction of check dams in about 1000 ha. of
 land = Rs 15,00,000.00 (at the rate of Rs 1500/ha.) i.e. about 15 %
 of the total cost of construction of check dams.

Hence total cost required to rehabilitate the gullies

= Rs 1,13,32,500.00

22.6 Miscellaneous

22.6.1 Drinking Water Supply – 10 km.

(A) Survey, planning, design and supervision = Rs 25,000.00 i.e. 5 percent of the total cost

(B) Cost of water supply at the rate of Rs 50,000/km for 10 km to

= Rs 5,00,000.00

Therefore total cost = Rs 5,25,000.00

22.6.2 Micro-hydroelectricity Project

(A) Survey, planning, design and supervision = Rs 1,25,000.00 (i.e. 5 % of the total amount).

(B) Construction of a dam to generate electricity

= Rs 10,00,000.00 (1 mill), tentative.

(C) Cost of Machinery and power lines = Rs 10,00,000.00 (tentative).

(D) Cost of distribution = Rs 5,00,000.00 (lump sum).

Hence total cost is = Rs 26,25,000.00

22.6.3 Recreational Area Development

(A) Wild life reserve – 1750 ha.

Cost of fencing = Rs 44,00,000.00

Cost of trail improvement = Rs 8,00,000.00 for 1000 km.

(B) View points to see the Himalayan Ranges – about 6 in No. Dhulikhel, Phulbari, Andikot, Chharre, Sashipani and Kothimal view point areas, need development with approach roads and trails, view sheds, camping sites with water supply and other facilities.

A lump sum amount of = Rs 12,00,000.00 is estimated.

(C) Archeological monuments – Bagmati and Namabudha are famous religious and archeological sites. Besides an annual religious fair, many tourists visit these places.

A lump sum amount of = Rs 4,00,000.00 has been estimated for the protection and development of these monuments and sites.

Therefore the total cost required = Rs 68,00,000.00

22.7 Cost of HMG Staff (for implementation of demonstration area only) for 10 years

22.7.1 Pay includes 30 % project allowance for gazetted officers

50 % for Non-gazetted staff.

5 % addition in cost for increment

1 gazetted class II Rs 1,64,000/–

2 gazetted class III Rs 2,30,000/–

6 Non Gazetted class I Rs 6,00,000/–

6 Non. Gazetted class III Rs 3,42,000/–

Total Rs 13,36,000/–

22.7.2 Allowances (TA and DA) for the above staff

15 % of the above cost)

= Rs 2,00,400/–

(C) CHAPTER— III . CONSERVATION EDUCATION

The success of proper management and conservation of natural resources such as soil, water and forests depends on technical and professional persons trained and experienced in these fields. There is a timely need to develop such facilities within Nepal. The different institutions concerned of the Tribhuban University, Kathmandu, support the development of such persons. But persons developed from such institutions, have more theoretical and academic knowledge which is not adequate for actual work in the field. This proposed "Conservation Education" Center aims to help people with more practical knowledge based on the research of technology suitable for the country.

The primary objective of the Conservation Education Center is to educate the local people by proper techniques and methods in soil and water conservation, based on the research of technologies suitable for the country, so that their full participation and support in conservation activities are obtained.

Other objectives are –

- to train new appointees of the Department of Soil and Water Conservation
- to propagate and exchange the experience and knowledge gained from research and demonstration work in the project to different organizations in and outside the country.
- to extend educational services and information to different institutions concerned with nature conservation and utilization of the Tribhuban University.

23. IMPLEMENTATION OF THE PROGRAM (PHYSICAL TARGETS)

- a) Conservation education for Panchayats, progressive farmers, students and teachers of different institutions and inservice training for the concerned HMG staff.
- b) Printing and publishing of pamphlets, booklets, posters, handouts, etc., on soil and water conservation work.
- c) Conservation education campaigns in different parts of the country.
- d) Preparation, production and projection of documentary films on soil and water conservation.
- e) Carry out most of the publicity and extension work for the department.
- f) Training of personnel of DSWC (especially people working in the national soil and water conservation research, demonstration and education project) in foreign countries, preferably in Japan. 196 man months.
- g) Hiring of experts and volunteers to run the project, mentioned in No. 23 (f) – seven required for three to six years duration.

All the above activities will be carried out, according to the importance and yearly schedule throughout the length of the project.

24. PHYSICAL FACILITIES

Already mentioned in the Research Chapter (Chapter I).

25. COST ESTIMATE

25.1 Cost of HMG Staff (for Conservation Education Only)

25.1.1 Pay includes 30 % project allowance for gazetted offices
 50 % " " for Non-gazetted staff.
 5 % addition in cost for increment.

1	Gazetted class II	Rs	1,64,000/–
2	Gazetted class III	Rs	2,30,000/–
4	Non. Gazetted class I	Rs	4,00,000/–
8	Non-gazetted class III	Rs	4,56,000/–
	Total	Rs	12,50,000/–

25.1.2 Allowances (TA and DA) for the Above Staff

(15 % of the above cost)

= Rs 1,87,500/–

25.2 Cost of Conservation Education Activities:–

For Laboratory Cost and Heavy equipment, already dealt in Chapter I.

A Lump sum of Rs 50,00,000/– is estimated for this program.

26. Table 4 SUMMARY OF THE PROPOSED BUDGET FOR 10 YEARS
 ACCORDING TO HMG'S BUDGET HEADS
 (IN Rs 1000 NC)

Budget Heads	Particulars	Foreign (Rs)	HMG (Rs)	Clarification
1	Pay	4156	1245*	* Pay and Allowances according to HMG's Pay Scale, to Nepalese Staff.
2	Allowances	207	492*	
3	Travelling and Daily Allowances	1870	400	TA and DA for Technicians and Staff.
4	Services	625	175	Consultancy Services for Diff. Research Activities, Micro-Hydro Project and Other Services Required for the Office.
5	Rent	–	50	House Rent for 2 Years and Other Essential Works
6	Repair and Maintenance	1300	100	Repair of Vehicles, Other Machineries and Maintenance of Works Done in the Project Area.

Budget Heads	Particulars	Foreign (Rs)	HMG (Rs)	Clarification
7.	Perishable Goods (Not Lasting more than One Year)			
7.1	Office Goods	50	50	Daily Use Materials such as Paper, Pens and Others Reqd. for the Office.
7.2	Books, Magazines and Newspapers	950	50	To Purchase Technical Books, Magazines and some Newspapers.
7.3	Fuel (Gasoline)			
7.3.1	Gasoline for the Vehicles	200	100	Gasoline for Bus, Jeeps and Motorcycles
7.3.2	Fuel for Other Purpose	90	20	Diesel for Electric Motor, Kerosine, Candles and Torch Batteries for Office Use.
7.4	Clothes and Food-stuff	100	25	Apron for the Laboratory Staff and Field Dress for the Technicians, Peons Watchers and Drivers, etc.
7.5	Other Goods	900	100	Sleeping Bags, Tents, Utencils and Other Camping Equipments, Camera Films Reqd. for Research Works, Photocopy and Blue Print Papers, Maps, Photography Papers, Chemicals for Soil and Photo Lab and Other Materials Reqd. for the Project.
8	Financial Help and Prizes	100	20	To Panchayat and Village People for Good Soil and Water Conservation Works.
9	(A) Unforeseen Expenses	40	10	(A) For Inauguration Ceremonies, Refreshments and Other Unforeseen Expenses.
	(B) Training Expenses	1000	200	(B) To Provide Training Outside the Country for Project Technicians and in the Project Area for Farmers, Panchayat People and Others from Diff. Parts of the Country.
10	Lasting Equipments (Lasting more than One Yr.)			
10.1	Furniture	2295	574	For Flooring and Furnishing at the Time of Construction, also the Required Furnitures for Office Buildings and Residential Bungalows.
10.2	Vehicles and Other Means of Transport	800	—	To Purchase Bus, Pickup Jeep, Jeep, Motorcycles and Bicycles for the Project.
10.3	(A) Machinerics	1800	—	To Purchase Machinerics as Mentioned in Article No. 20.5 of the Report.
	(B) Equipments and Tools	1480	370	To Purchase Equipments and Tools as Mentioned in Article No. 20.4 of the Report.
11	Purchase of Land and Houses			

Budget Heads	Particulars	Foreign (Rs)	HMG (Rs)	Clarification
11.1	Land Purchase	—	500	Land Required for Project Buildings, Nursery and Training Area.
11.2	House Purchase	—	—	
12	Construction and Maintenance			
12.1	Building Construction and Maintenance	8376	84	Buildings Required for the Project as Shown in Table 1; Page 33 (Veterinary Services Centers) and Page 33 (Storage Godowns for Agriproducts). HMG Expense is Only for Maintenance (One Percent of the Total Cost of Construction)
12.2	Other Construction Repair and Maintenance	66189	16667	
	TOTAL COST:—	92528 =7.8 mill. US\$	21232 =1.8 mill. US\$	
TOTAL BUDGET = 9.6 mill. US\$ = N.Rs. 11 Crore 38 Lakhs				