

8.4.2 Objectives and Strategies

The objectives of this program are as follows:

- To strengthen the environment management capacity of the institutions (SCP, EMATER, Basin Management Committee, Municipality of Cangucu)
- To control the decrease of soil erosion and contamination by agricultural chemicals
- To introduce the environmental conservation oriented agriculture
- To sustain the agricultural productivity
- To consolidate the farmer's association for soil conservation

To accomplish above-mentioned objectives smoothly and effectively, the following strategies should be considered.

Participatory Approach

Farmers are the key persons in making decisions related to land use and management and therefore must always be taken into account in a land and water management and conservation program, through a “bottom-up” participatory approach, which elicits the participation of farmers in every step of program.

Phased Development and Implementation in Micro-basins

For the successful execution of this program, the phased development should be adopted and implemented in the units of micro-basin. The micro-basin is the ideal unit from technical and socio-economic point view for the execution of conservation actions. However, great part of the planning of activities and work itself must be carried out at the farm level.

8.4.3 Countermeasures and Improvement Area

Countermeasures for this program will be implemented as a combination of agronomic and mechanical measures. Proposed countermeasures for Cangucu region are summarized in **Table 8.4-2**. Considering the local conditions, the improvement areas by this program were anticipated 60 % of total arable land and 50 % of artificial pasture as shown in **Table 8.4-3**.

Table 8.4-2 Proposed Countermeasures for Cangucu Region

Crop	Zoning	ML	Essential alternatives			Ideal alternatives		
			TY	Measures	Effect	TY	Measures	Effect
All crop field and pasture	B, C		M	Improvement farm road	2	M	Diversion ditches	2
			M	Drainage along road side	2	M	Terrace channels	2
			M	Lining of steep gutter	2	M	Grassed waterway	2
			A	Proper spacing of crops	1&2			
			A	Proper crop calender	1&2			
			A	Proper plant selection	1&2			
			S	Maitenance of soil fertility	1&2			
Soybean Maize Beans	B	I	M	Terracing with contouring	2	M	Contour strip-cropping	2
			M	Buffer strip-cropping	2	A	No tillage	1&2
			S	Proper plowing or harrowing	1			
			S	Subsoiling to stir hard pan soil	2			
			A	Mulching by crop residue	1&2			
			A	Winter green manure crops	1&2			
Maize Tobacco Beans Potato Onion	B, C	II	M	Terracing with contouring	2	A	No tillage with animal	1&2
			M	Buffer strips with stones	2			
			M	Buffer strip-cropping	2			
			A	Mulching by crop residue	1&2			
			A	Winter green manure crops	1&2			
			A	Intercropping with green manure crops	1&2			
			M	Strip-cropping with spring & summer crops	1&2			
Peach Orange	B, C	II	M	Terracing with contouring	2	M	Contour strip-cropping	2
			A	Intercropping with green manure crops	1&2			
Pasture	B, C	I, II	M	Terracing	2	A	Crop rotation	1
			M	Water supply system for cattle	1&2	A	Perennial forage	2

Abbreviation: ML: Management level, I: Mechanical farming, II: Manpower or animal farming
 TY: Type of measures, M: Mechanical measures, A: Agronomic measure, S: Soil management
 1: Effect on rainsplash, 2: Effect on runoff

Table 8.4-3 Net Project Area

Land use	Existing total area (ha)	Implementation rate	Net project area (ha)
Arable land	67,250	0.6	40,000
Artificial pasture	39,200	0.5	20,000
Total	106,450		60,000

Source: JICA Study Team

8.4.4 Project Cost

Main measures which should be considered for the cost estimation, are terracing, no-tillage, and improvement of farm road. The costs of other measures are considered as small compared to that of main measures. The total cost would be 8.7 million US\$ as shown in **Table 8.4-4**.

Table 8.4-4 Cost Estimation

Countermeasures	Amount to Be covered	Unit cost	Cost (x 1,000US\$)
Terrace for arable land	40,000 ha	40 US\$/ha	1,600
No-tillage	20,000 ha	75 US\$/ha	1,500
Terrace for pasture	20,000 ha	40 US\$/ha	800
Farm road and drainage	1,200 km	4,000 US\$/km	4,800
Total			8,700
Annual O/M cost (3% of total cost)			227

Source: JICA Study Team

8.4.5 Effect and Benefit

This project is closely related to the agricultural production concerning stability of production and recovery of the productivity. The following effects and benefits are summarized in **Table 8.4-5**.

Table 8.4-5 Effects and Benefits

Item	With Project	Without Project	Improved value	Effect/Benefit
Terraced arable land (ha)	43,363	3,363	40,000	1) Sustaining of agricultural productivity
Terraced pasture (ha)	20,000	0	20,000	
Total soil loss (ton/year)	7.7×10^6	14.0×10^6	6.3×10^6	2) Improvement of water quality
Erosion in arable land (to/ha/yr)	7.7	122.4	114.7	
Erosion in pasture (to/ha/yr)	3.9	87.6	83.7	3) Reduction of production cost
Nutrient loss of nitrogen (kg/ha/yr)	0	20.0	20.0	
Nutrient loss of potassium (kg/ha/yr)	0	2.3	2.3	

Source: JICA Study Team and Parana Rural Program (SEAB, 1989)

8.5 Sutil and Duro Basins Erosion and Sediment Control Program

8.5.1 Background

Arr. Sutil and Duro basins are located in the left bank of Camaqua river. The steep slope land has widely distributed in this area, but the deforestation has being realized to tobacco cultivation and cattle breeding. Moreover, marginal area for agriculture had being deforested despite of its low productivity. Therefore, soil loss of this area causes the accumulation of sediments in the Camaqua river and Patos lake affecting negatively the fishing activities, navigation and wetland forest conservation.

As shown in **Fig. 8.5-1**, the project area consists of two (2) tributary basins of the Camaqua river namely Arr. Sutil and Arr. Duro. Actual land use in the project area is assumed as shown in **Table 8.5-1**.

Table 8.5-1 Actual Land Use

Land Use	Sutil Basin (ha)	Duro Basin (ha)	Total	
			(ha)	(%)
Artificial Pasture	3,160	1,090	4,250	3.8
Natural Pasture	32,910	11,360	44,270	39.2
Upland Crops	10,590	3,660	14,250	12.6
Forestation	5,070	1,750	6,820	6.0
Natural Forest	32,270	11,140	43,410	38.4
Total	84,000	29,000	113,000	

Source: JICA Study Team

8.5.2 Objectives and Strategies

The objectives of this program are as follows:

To promote erosion control and reforestation in order to recover environmental conditions in the Camaqua lower basin and to reduce the sediment flow in the Duro dam

To promote sustainable agricultural development in the sloped area with increasing the farmers' income

To accomplish above-mentioned objectives, the following strategies are considered.

Participatory Approach

The program will adopt the concept of “Participatory Approach”, which elicits the participation of farmers in every step of the planning of a program, and which accepts socio-economic factors as key-factors to solve land degradation problems together with the farmers.

Phased Development and Implementation in Micro-basins

Phased development and implementation in micro-basins is shown in **Table 8.5-2**.

Table 8.5-2 Phased Development and Implementation in Micro-basins

Phase	Stage	Activities
Federal	1	Establishment of responsible federal committee
	2	Feasibility study (selection of priority area)
Regional	3	Establishment of basin management committee
	4	Regional diagnosis and technological stock
	5	Establishment of the program and its action areas
Municipal	6	Constitution of the municipal committee
	7	Selection of micro-basins
	8	Participatory planning of micro-basins development
	9	Individual farm planning

Source: The Proposal of Integrated Land Management with Participatory Approach in Latin America (I) by H. Ago and K. C. Adriaan; 1998