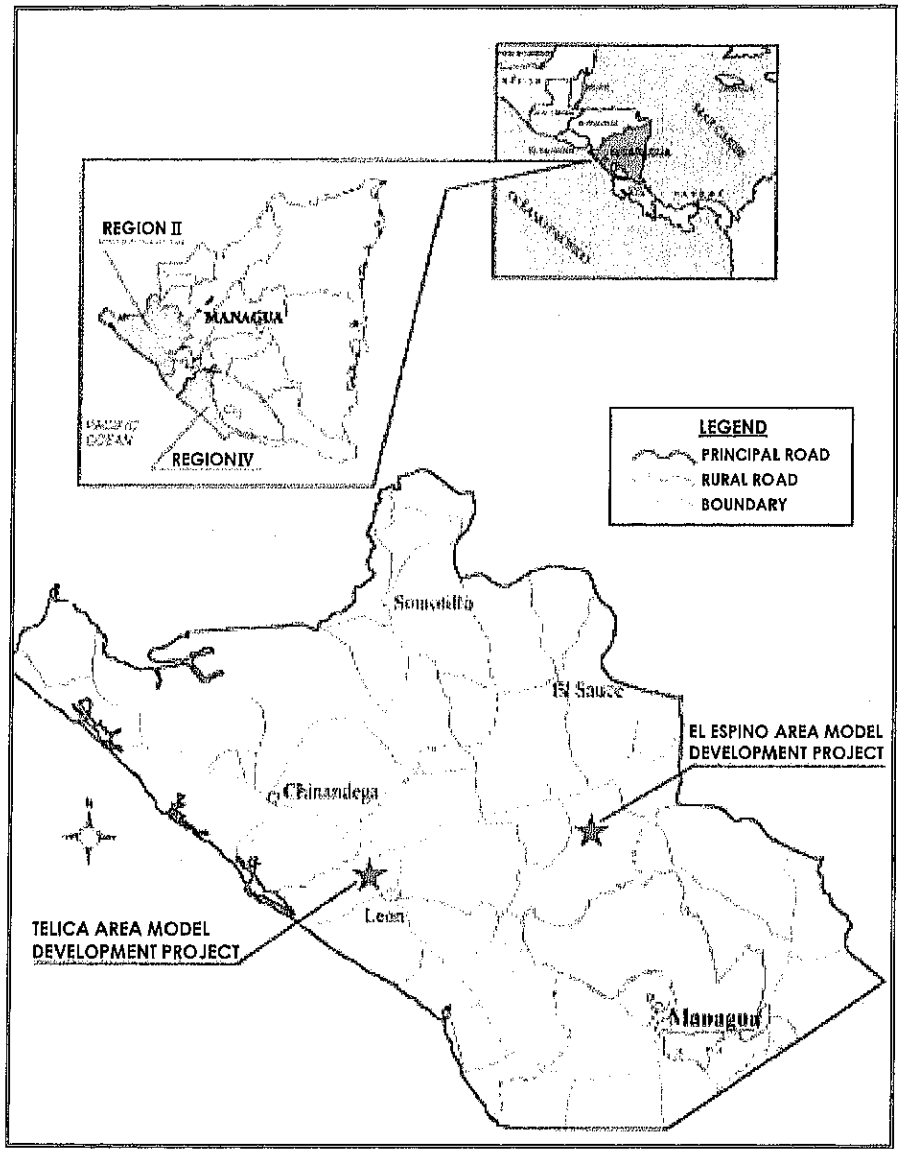


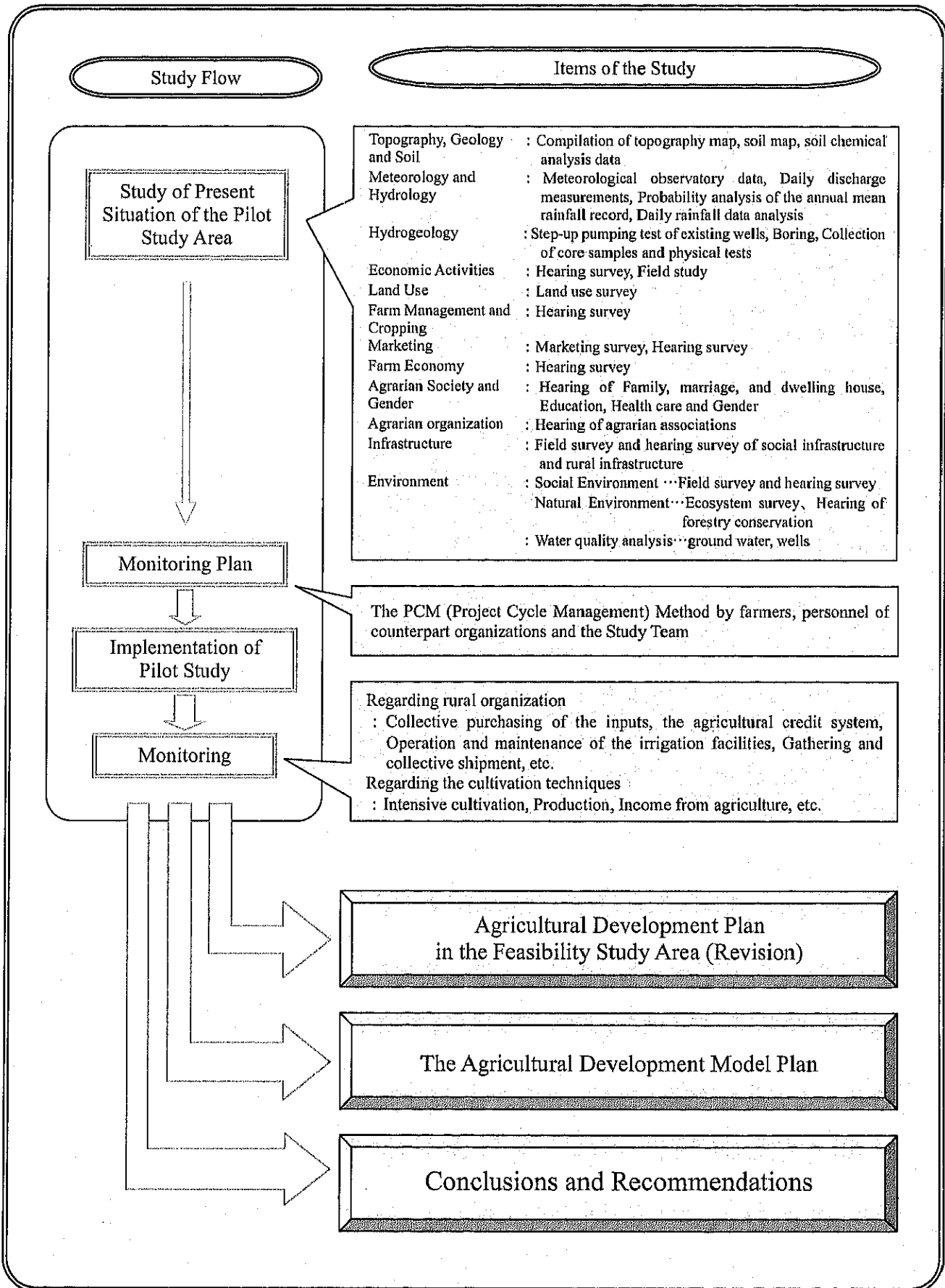
**Study Area**

- The study area of Pilot study comprises of two, the Telica and El Espino areas. These two areas belong to the Region II.
- The Telica area is situated about 10 km from the city of Leon and has not only good access to markets but also has flat and fertile lands suitable for agriculture.
- The El Espino area is located about 8 km from the main road linking Telica with El Jicaral.
- The two P/S areas, each of which covers about 20 to 30 ha will be selected in Telica and in El Espino.

**Location Map**



**Study Items and Flow**



### Summary of the Plan (Pilot Study)

- |  |  |
|--|--|
| (1) Target group                       | Farmers of the study area  |
| (2) Overall Goal                       | To improve the living standard of the farm families  |
| (3) Objective of the Plan              | Increased income of farm families  |
| (4) Proposed Projects<br>(Master Plan) | Development model plan, Irrigation plan, Roads rehabilitation plan, Seeds production plan, Experimental farm plan, Strengthening of extension services plan, Livestock plan, Commercialization plan, Agricultural credit plan, Farmers organizations plan, Environmental conservation plan |
| (5) Main Projects                      | Farm Management Plan, / Irrigation Facilities Development Plan, / Agrarian Organization Strengthening Plan, / Agricultural Credit Plan   |
| (6) Expected Results                   | 1) Making the rural organizations operational<br>2) Implementation of intensive cultivation  |

### Pilot Study

#### Target Areas

- Telica : 20~30ha (The participant 14 families)
- El Espino : 20~30ha (The participant 13 families)

#### Evaluation Items

- Effectiveness
- Efficiency
- Impact
- Relevance
- Sustainability

#### Summary of the Evaluation Results

##### Rural Organization :

The factors blocking the formation and the normal development of the organization functions

- The small-scale farmers are not ambitious to be self-sufficient.
- The small-scale farmers do not want to pay their debts.
- Dominance of individualism to protect their own interests.

##### Provision

- The farmers should decide on the plan even if planning process could be slow.
- For the member to learn the social rules, the members should define the regulations.
- With the purpose of motivating the debtors to return the debt, it is necessary to take as mortgage their properties, etc.
- For the selection of the project areas, priority should be given to the socially mature communities.

##### Cultivation :

(1) Selection of new crops and the capacity of the farmers

: New crops should be selected to begin the production by farmers' own initiative.

(2) Technical level and the service method of the support organizations

: Farm management plan should be based on the conventional crops and on the initiative of the farmers.

The support services for beneficiaries should be planned systematically.

### Problems improved through the Pilot Study

Characters	Activities	Previous problems	Improvement
Farmers	Collective purchase (agrochemicals and fertilizers)	The purchase was made by coordinating with the agricultural credit. The farmers knew the warehouses but they could not make the purchase by themselves since they did not know how to present an estimate nor the payment conditions.	Through experience, the farmers were acquiring knowledge on the mechanisms for the agricultural credit and now they can make their own purchases. But they don't understand yet whether they need to buy something.
	Collective purchase (gasoline and services)	Previously, the farmers could not contract the sale and purchase of gasoline because the transaction was through a credit, hence the first purchase required the support of a third party.	The farmers are already qualified to make purchases on their own without the support from C/P, except when a serious problem arises.
	Crop	For lack of experiences, the behavior of the farmers was very passive, depending too much on the extension workers.	The producers are relatively more active after P/S-1. The difference of the aggressiveness of the participants was reflected in the intensity of the cultivation control and, therefore, in the yield.
C/P	Purchase of goods and services	Initially, a purchase process was designed and adopted by the Study Team and C/P that lined the purchase with the credit. However, the support to the farmers regarding this topic has not been sufficient because of time limitations, etc.	Presently, the support is provided through the initiative of C/P.
	Technical assistance in the crops	A great communication gap existed between the supporting organizations and the beneficiaries regarding the service of technical assistance in cultivation.	There was less dissatisfaction from the farmers regarding technical support, and the communication among both parties was also improved.
	Selling the crop	The participating producers insisted on marketing their products individually, and the necessary quantity of crop for the commercialization in big lots would be hardly prepared.	The C/P can look for and propose the favorable commercialization routes for the farmers. However, the proposal does not always guarantee the expected results.
	Payment of the debts	At the beginning the C/P personnel did not have a deep knowledge on the cost-benefit relation, agricultural credit procedures, etc. which hindered them to carry out the necessary analyses.	Now they are qualified to calculate and analyze the amount of the debt that the farmers can return from the earnings obtained in the sale of products.

### Lessons through the Pilot Study for the Revision of the Feasibility Study

- Rural organization : It is necessary that farmers understand needs, objectives and activities of the projects.
- Cultivation techniques for the producers : It is not proper to introduce new crops for which the farmers don't have any experience.
- Extension on the cultivation techniques : It is necessary to establish a framework regarding extension cultivation techniques relationship between INTA\*, NGO and farmers.
- : It is necessary to outline the importance and the meaning of keeping the control records of the cultivation.
- : It is necessary to execute a systematic training plan oriented to the farmers according to their needs.
- Irrigation facilities : It is necessary to demand the farmers to bear the cost when building the irrigation facilities.
- : It is important to carry out the training of the farmers in preventive and periodic maintenance.
- Distribution of goods : It is important not to incorporate this component at the initial phase.
- Agricultural loans : Support plan should be formulated with enough flexibility because it is difficult for farmers to understand immediately.
- \* I INTA ... Nicaraguan Institute for Agricultural Technology

### Agricultural Development Plan in the Feasibility Study Area (Revised)

Target Areas	Study Area	Characteristic	Area
	Telica Area	Telica Area is located near Leon City and has a good traffic condition and it is easy to use public transport. The zones present a plain topography and fertile soils and good for agricultural production. The water resource for irrigation is mainly groundwater. The Telica river which runs along the area border flows with stability between rainy and dry season.	Total population of farming families → 250 Total area of land holding → 1,151.4ha (4.6ha per family)
	El Espino Area	The accessibility to Leon City as the closest market is bad. It is about 8 km to the closest national highway, where public transportation is available. The topography of the land is characterized by undulations. The agricultural producing area is threatened with the soil erosion due to deforestation. There are three irrigation wells but these are not in use now because the pumps are removed.	Total population of farming families → 57 Total area of land holding → 947.3ha (16.6ha per family)

Farm Management Plan	Telica Area	El Espino Area
	<ul style="list-style-type: none"> <li>• Production system is directed from self-supported production to market oriented farming system.</li> <li>• Cash crops should be gradually introduced by training the beneficiaries to get an eagerness and receptive capacity.</li> <li>• With establishment of self-supply system, the system of farming practice toward market-oriented farming is introduced.</li> <li>• New farm management plan enables the farmers to work in their own farm throughout the year by introducing irrigation technology.</li> <li>• Sustainable farming is directed by taking the measures of soil conservation, agronomic method to build soil fertility, and a farming system to expand farming scale is premised.</li> </ul>	<ul style="list-style-type: none"> <li>• Production system is directed from self-support production to market oriented farming system.</li> <li>• Cash crops should be gradually introduced by training the beneficiaries to get an eagerness and receptive capacity.</li> <li>• New farm management plan enables the farmers to work in their own farm through the year by introducing irrigation technology.</li> <li>• Sustainable farming by introducing the leguminous crop is directed by adopting soil conservation measures, agronomic method to build soil fertility, and a farming system to expand farming scale is premised.</li> </ul>

Irrigation Facilities Implementation Plan	Telica Area	El Espino Area
	River water flowing near the beneficial area should be utilized to the maximum and the groundwater shall be used as supplementary water.	The groundwater is used as the irrigation water source.
	Irrigation Area	Irrigation Area
	Case 1 : 1,160.7ha      Case 2 : 798.3ha	99.75ha can be brought under irrigation by 2 existing wells and 1 new well.
	Irrigation method : furrow irrigation	No. of water source : 3 wells
	Intake Facilities : fixed dam, floating (with Fish passing)	Intake volume : 42 l/sec~53 l/sec
	Pumping plant : Rotating and aspirating pump, simple stage with horizontal axle...3 units.	Pump type : turbo pump of multiple stages and vertical axle
	Irrigation canal : Main canal 4,670m, Secondary canal 13,940m	Installation of water supply : PVC 5.8km

### Plan to Strengthen the Farmers' Organization

	Telica Area	El Espino Area
Formulation of Organization	To form groups of 10 to 20 properties that are located along the same side of the channel. This way, 15 to 20 rural groups would be formed in the whole area. It is expected that these groups of farmers will be matured and strengthened in cooperative bond with other groups, and that a rural organization that covers the entire area will be formed. The institutional support for the farmers' organization should be established on this viewpoint.	To form groups of 10 to 20 properties that are located along the same a well.
Functions of Organization	<p><u>Collective purchasing</u> : To reduce the unit cost of purchased goods by ordering in large quantities.</p> <p><u>Collective gathering and forwarding activities</u> : According to the maturity of the organizations and the condition of progress, if the farmers recognize their needs, they will start to gather the agricultural products in a collective manner.</p> <p><u>Operation and management of irrigation facilities</u> : The management of the irrigation water in the terminals will be carried out by each group of farmers. Each rural group should know the item and area of each member's crops, and distribute the necessary amount of water to operate the water intake of each parcel. According to the intake plan, the person in charge of managing the water will operate the water intake of each rural group.</p>	<p><u>Collective purchasing</u> : To reduce the unit cost of purchased goods by ordering in large quantities.</p> <p><u>Collective gathering and forwarding activities</u> : According to the maturity of the organizations and the condition of progress, if the farmers recognize their needs, they will start to gather the agricultural products in a collective manner.</p> <p><u>Operation and management of irrigation facilities</u> : The management of irrigation water is carried out based on the cropping plan of members. The unit cost of irrigation water (in this case per hectare) is calculated as the operation cost of irrigation facilities divided by the total irrigated area.</p>

### Agricultural Credit Plan

	Telica Area	El Espino Area
Basic focus on fund for the agricultural loan	The beneficiaries almost depend on the agricultural credit in the initial stage of the project. For the first year of the project only 50% of the proposed yield is expected and on the fifth year onwards 100% will be achieved. The amount not collected (unrecoverable debt) from each property will be taken as a long term loan, forcing the debtors to pay in a planned manner up to the fifth year when the administration of each property will already have been stabilized.	The system for the agricultural credit will be the same as described for Telica. However it is necessary to take into account that it is only during P/S that the farmers of this area had the experience of agriculture utilizing the funds from the agricultural credit, and that there were quite many farmers here who refused to return the debt. Executing organization for the project should offer a strong support to the farmers for the canalization procedures and refund of credit.
Credit Mechanism	The credit system must be managed under the premise that the farmers understand and agree on the mechanism. The executing organization of the project or the NGOs in charge of administering the resources will instruct the requesting farmers of the most adequate method to manage the resources and financing. The farmers should participate actively in the training organized by the executing organizations of the project or by NGOs and be completely responsible for operating the loan system.	

### Project Costs

Unit : US\$1,000

Cost of the Project	Telica Area						El Espino Area		
	Case 1			Case 2			Irrigation area : 99.75ha		
	Local Currency	Foreign Currency	Total	Local Currency	Foreign Currency	Total	Local Currency	Foreign Currency	Total
	Irrigation area : 1,160.7ha			Irrigation area : 798.3ha			No. of beneficiaries : 43 properties		
	No. of beneficiaries : 250 properties			No. of beneficiaries : 250 properties					
Construction works	859.8	1,918.1	2,777.9	711.5	1,771.6	2,483.1			
* Irrigation facilities	(850.8)	(1,770.9)	(2,621.7)	(702.5)	(1,624.4)	(2,326.9)	127.7	433.6	561.3
Road improvement	(9.0)	(147.2)	(156.2)	(9.0)	(147.2)	(156.2)			
Land Acquisition	21.2	0.0	21.2	19.6	0.0	19.6	0.1	0.0	0.1
Administrative Expenses	215.0	479.6	694.6	177.9	442.9	620.8	19.2	65.0	84.2
Technical Administration	60.2	134.3	194.5	49.9	124.1	174.0	11.5	39.0	50.5
Contingencies	115.7	253.2	368.9	95.9	233.9	329.8	12.8	43.4	56.2
Total Cost of the Project	1,271.9	2,785.2	4,057.1	1,054.8	2,572.5	3,627.3	171.2	581.0	752.2
	(31.3%)	(68.7%)	(100%)	(29.1%)	(70.9%)	(100%)	(22.8%)	(77.2%)	(100%)
Cost per ha	3.5			4.5			7.5		
Cost per beneficiary	16.2			14.5			17.5		

Note : \*The cost of the preparation works and the temporary works are included in the implementation cost of the irrigation facilities.

### Economic Evaluation

(Discount Rate : 15%)	Telica Area				El Espino Area		
	Case	EIRR(%)	B/C	NPV(US\$1,000)	EIRR(%)	B/C	NPV(US\$1,000)
	Case 1	18.3	1.25	875	9.1	0.72	-293
Case 2	16.2	1.08	280				
Income-Expenditure Analysis of the Properties	<ul style="list-style-type: none"> <li>In both cases that the initial investments for the implementation of the irrigation facilities are C\$10,000 and C\$2,700, the analysis provides good results. However, the surplus on the twentieth year in both cases has been higher than the reinvestment requirement. Still when the resources are reserved for reinvestment on the twentieth year, the farmers will be able to enjoy enough resources to improve their living standard.</li> <li>If the beneficiaries have to finance the entire implementation cost of the irrigation facilities, the corresponding debt would be paid in 13 or 16 years depending on the case. However, the surplus on the twentieth year is lower than the reinvestment requirement, and the farmers will not be able to enjoy the remaining resources to improve their living standard.</li> </ul>				<ul style="list-style-type: none"> <li>Should the beneficiaries contribute C\$10,000 and C\$5,000, respectively, for the construction of the irrigation facilities as initial investment, cumulative deficit is dissolved for 7 years. However, the surplus in the 20th year is lower than those required for reinvestment in both cases. It is necessary to make more efforts to increase the value added of the products not only in the production base but also in commercialization.</li> <li>If the beneficiaries have to cover the entire implementation cost of the irrigation facilities, there will not be any surplus at the 20th year. On the other hand, the initial investment should be as small as possible because when it is too high, it can have adverse effects on the management of the properties.</li> </ul>		

## Agricultural Development Model Plan

### Introduction

As the P/S of the Telica Area and the El Espino Area was implemented, the technical level of the small scale farmers concerning farm management, locational characteristics of the zones, implementing capacity of the institutions, were identified and it was felt that there was a need for a more feasible plan to substitute the two agricultural development plans implemented. There are a great number of zones suitable for the implementation of the Agricultural Development Model Plan if the study area scale is small. Therefore, concrete policies for the selection of priority areas of the Agricultural Development Model Plan as well as methods for their implementation are presented.

### Background

- ① Low level of agricultural technology
- ② Lack of agricultural infrastructure
- ③ Inadequate market administration
- ④ Little access to agricultural credit for the small and medium scale farmers
- ⑤ Bad operation of the farmers' organization
- ⑥ There is no thought or action coming on their own impulse

### Objectives

- ① Improvement of the living conditions of the targeted people in the Project Area
- ② To "accumulate technical skills" and "strengthen the advisory capabilities" of the executing agencies of the Project.
- ③ To apply the experiences accumulated during the process of providing assistance to the small and medium scale farmers of the whole country through the execution of the Agricultural Development Model Plan.

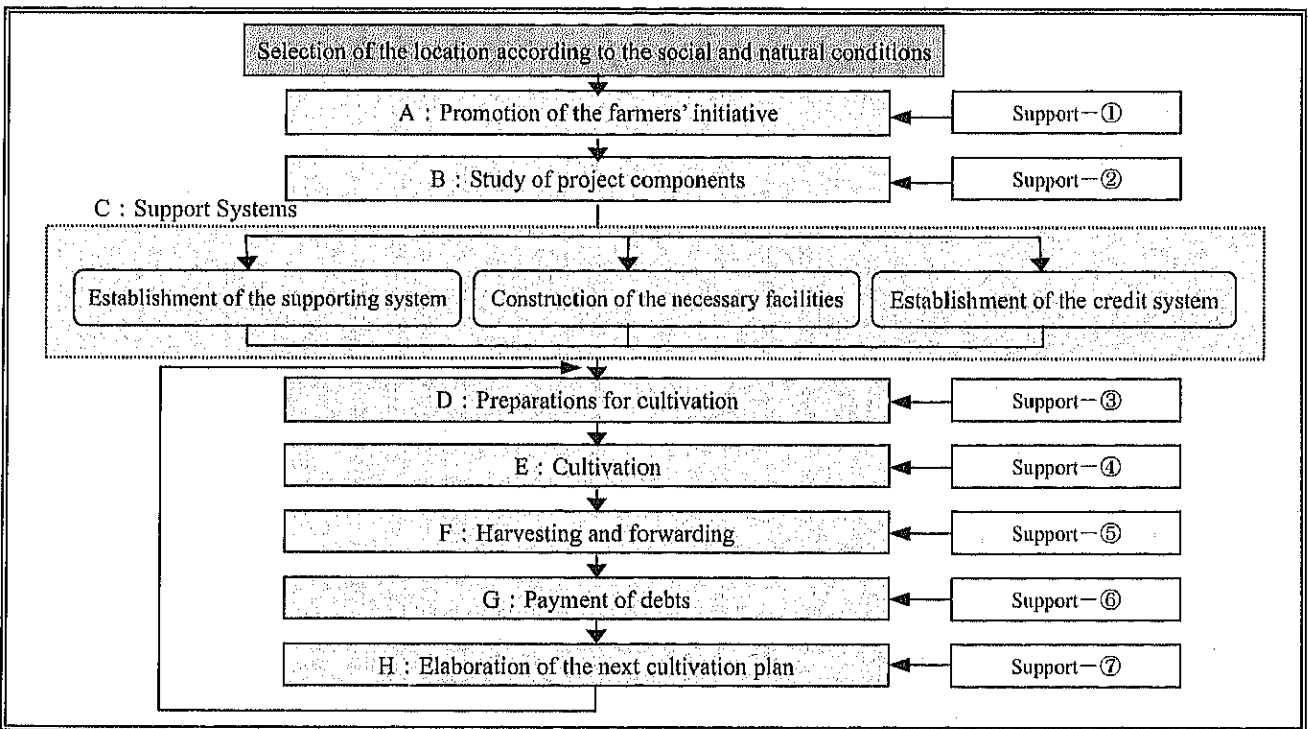
### Strategy

**Project Formulation**  
 : It is important to support those farmers who understand and fully recognize the conditions of their farms; the incentives provided by the Project must be clearly explained to these farmers using a participatory approach.

**Concept for Improvement of the Facilities**  
 : The concept must have a future perspective. The size of the facilities should be basically that to secure adequate income level for the farmers, taking into accounts the farm management system and the availability of water and soil resources. Also, it is important to define the appropriate irrigation area which will make it possible to carry out a stable and intensive agriculture, and in this way, improve the living conditions of those who are vulnerable to fall into poverty with the lowest unit cost (per farm) for the facilities.

**Effect on other zones**  
 : Implementing institutions will have to work taking into consideration the need to possibility to expand the effects of projects all through the country. These accumulated experiences will be very valuable in the future and these must be compiled in a manual for the development of the small and medium scale farmers of Nicaragua.

## Flow of the Model Development Plan



### Criteria for Selection of Location of Project Area

Selection of location through the screening

- (1) Social conditions that fit the framework for the agricultural development model
- (2) Availability of water resources for irrigation
- (3) Availability of clustered cultivation lands with good quality
- (4) Establishment of an adequate linkage of land renting
- (5) Good access to the market

Selection of location through detailed study

- (1) Willingness of the farmers (hopes and perspectives for the future)
- (2) Attitude of the farmers towards agriculture
- (3) Structure of the communal society and the role of the communal organizations
- (4) Identification of the leader of the community and his role
- (5) Presence or absence of conflicts among community or within the community
- (6) Existence of the custom of renting farms and its respective method
- (7) Size and distribution of the farms

### Plan for Implementation of the Project

	Stage ①	Stage ②
Tasks to be performed	<ul style="list-style-type: none"> <li>• Selection of the location</li> <li>• Fulfilling the organizational requirements</li> <li>• Organization of the farmers by themselves</li> <li>• Preparations for the implementation of the Project</li> <li>• Establishment of the supporting systems</li> </ul>	<ul style="list-style-type: none"> <li>• Crop preparations</li> <li>• Cultivation</li> <li>• Harvesting and selling</li> <li>• Distribution of the profits</li> <li>• Repayment of debts</li> <li>• Elaboration of the next cultivation plan</li> </ul>

### Estimated cost of the Project

#### Implementation cost of the irrigation facilities :

Items	Amount (US\$1,000)	Remarks
Construction cost: Wells, perforation, installation of pumps, Pipes, Sprinkler sets, Rural roads	222	Wells with a 100m depth, Pumps and engines
Administrative expenditures, etc.	71	32% of the costs of the works
Total improvement of the irrigation facilities	293	
Cost of the Project for each hectare	10.5	

### Project Evaluation

The third year	The farms will have a surplus.
The fifth year	The debt will be totally repaid.
From the sixth year	This surplus become C\$11,700
The tenth year	This surplus become C\$55,100
The twentieth year	This surplus become C\$171,000

The farmers that own a parcel of 1.75ha will need about C\$2,000,000 to renovate the facilities in the 20th years.

#### Requirements for the funds by agricultural credit :

By assuming that a zone under the Development Model is 28 ha and that the Plan will be implemented in five zones per year, the total area would be 140 ha  
 The requirement for the funds C\$2,360,000 per year in the first year  
 C\$5,310,000 per year in the fifth year

#### Expenditures for activities of the supporting organization :

Office expenditures	C\$58,000	C\$1.0=US\$0.08
Fuel for vehicles	C\$36,000	
Others	C\$20,000	
Total	C\$114,000	

### Conclusion

As of projects for supporting the small and medium scale farmers in Nicaragua, the Agricultural Development Model Plans must be implemented as it is easier to implement. The agricultural development plans for Telica and El Espino should be implemented after the supporting institutions have accumulated enough experience.

### Recommendations

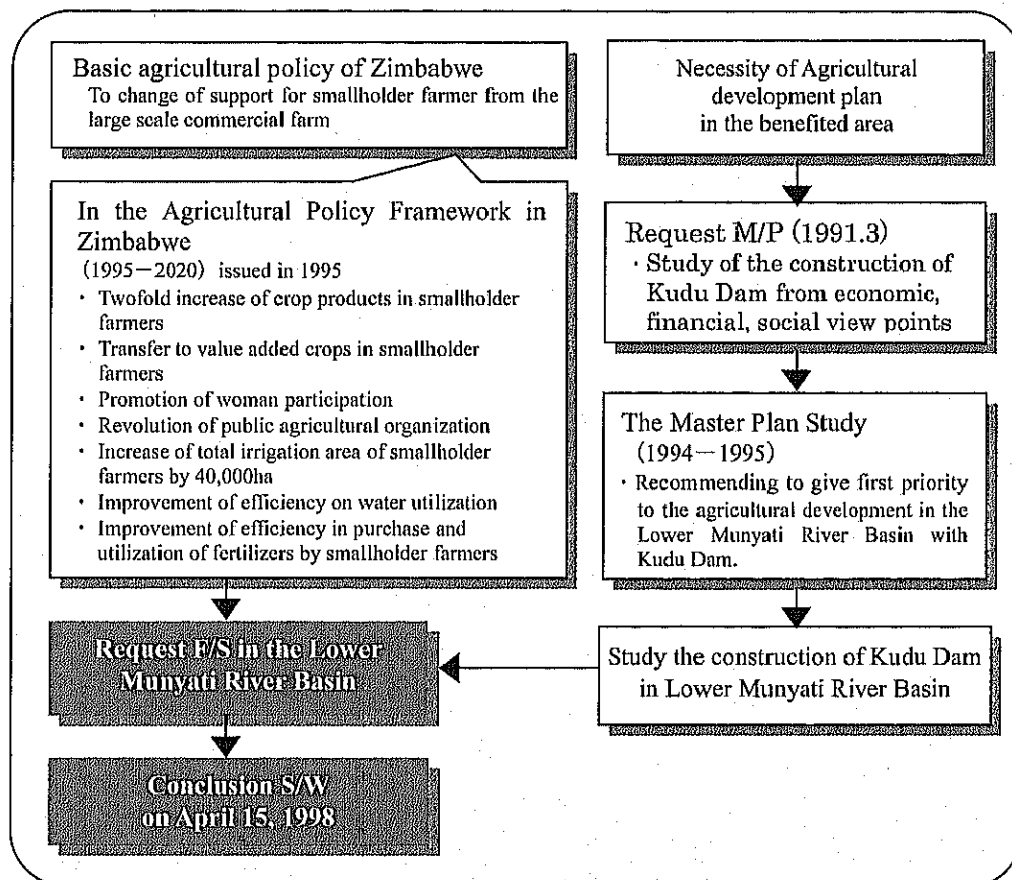
- (1) Agricultural development plan for the Telica Area  
 The great number of the small and medium scale farms in this zone makes difficult the proper service by the supporting institutions. Therefore, it is strongly recommended to carry out the agricultural development model plan and raise the efficiency of the institutional support before implementing the other development projects.
- (2) Agricultural development plan for the El Espino Area  
 It is recommended that El Espino and other areas facing unfavorable conditions for agriculture must be considered as candidate areas for the last stages of the Agricultural Development Model Plans.
- (3) Implementation of the Agricultural Development Model Plan
  - 1) The Agricultural Development Model Plan proposes to limit the scale of development and select the prioritized areas that offer good conditions in terms of soils, water resources, markets, etc. in order to secure determined agricultural productivity, and commercialize the crops under fair conditions.
  - 2) The selections of these areas must be implemented under the initiative of Nicaraguan public institutions, so that they could get a sense of ownership of the projects and encourage the farmers to participate in the projects.
  - 3) The Agricultural Development Model Plan must be implemented in a participatory process inviting the beneficiaries in each stage of the development process.
  - 4) It is necessary to request technical assistance about methodology of participatory development from the donors.

## The Lower Munyati River Basin Agricultural Development Project

Counterpart Agency	Ministry of Lands and Agriculture
Consultant Company	Nippon Koei Co., Ltd. Kokusai Kogyo Co., Ltd.
Team Leader	Takeshi KAWAGUCHI
Study Term	1998.10 - 2000.10
Study Type	Feasibility Study

### Background of the Study

In the agricultural sector in Zimbabwe, the government had been giving support to the large scale commercial farms through development of water resources, etc. However, the government has started to change its basic agricultural policy in which smallholder farmers get more support than large-scale commercial farms. Targets in the Agricultural Policy Framework in Zimbabwe (1995-2020) issued in 1995 are increase in crop production and intensification of value added crops by small farms. While the government of Zimbabwe (GOZ) studied the construction of Kudu Dam for agricultural development in the Munyati River including a design of the dam. However, study of agricultural development in the benefited area of the Kudu Dam Irrigation Project has not materialized. In response to the request of GOZ to carry out the M/P study in March 1991, the Government of Japan (GOJ) conducted its study of the construction of Kudu Dam from economic, financial, social view points from 1994- to 1995. As the result, the M/P study gave top priority to the agricultural development in the Lower Munyati River Basin with Kudu Dam. Considering the result of the M/P, GOZ requested technical cooperation for the F/S of the Project by the GOJ in November 1998. In response to this request, GOJ concluded the S/W in April 1998.



### Objective of the Study

- Objectives :** Development of small scale agriculture in the Communal Area and Resettlement Area in the Lower Munyati River Basin.
- Studies :**
- : To conduct additional studies of the dam of the Lower Munyati River Basin and to make preliminary design of the main canals.
  - : To select priority project areas and to formulate the agricultural development plan for the priority project areas including irrigation canal construction plans below main canals.
  - : To carry out, in the course of the Study, technology transfer to counterpart personnel in AGRITEX\*1 and DWD\*2 about study methods on study items and procedures and ways of thinking in planning.

\*1 AGRITEX : Department of Agricultural, Technical and Extension Services

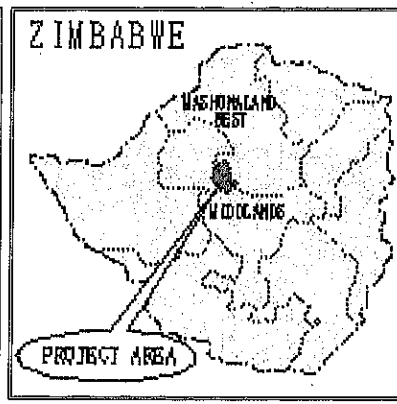
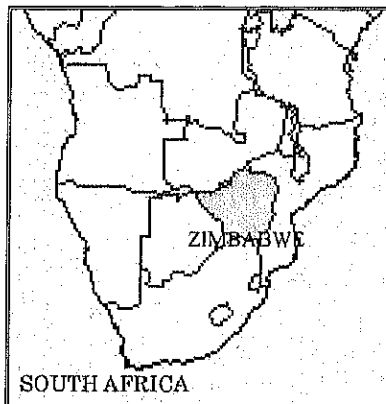
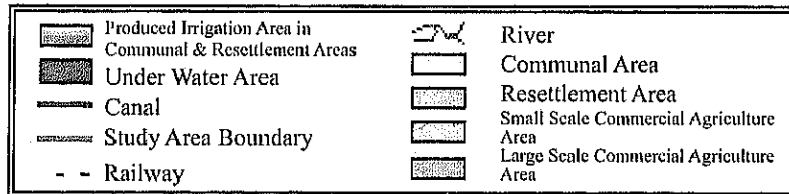
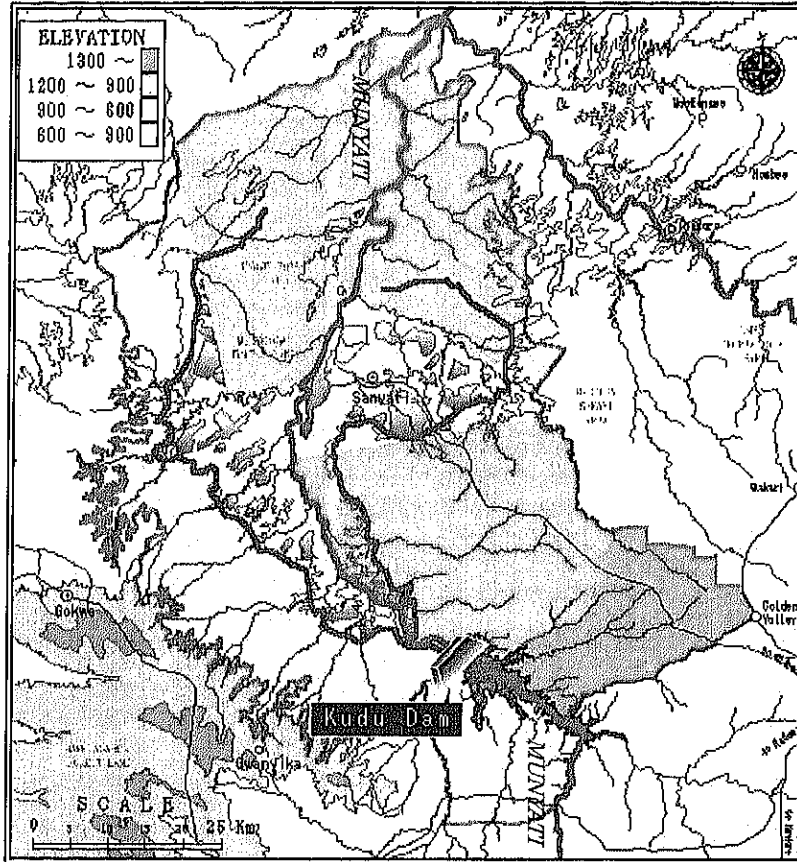
\*2 DWD : Department of Water Development



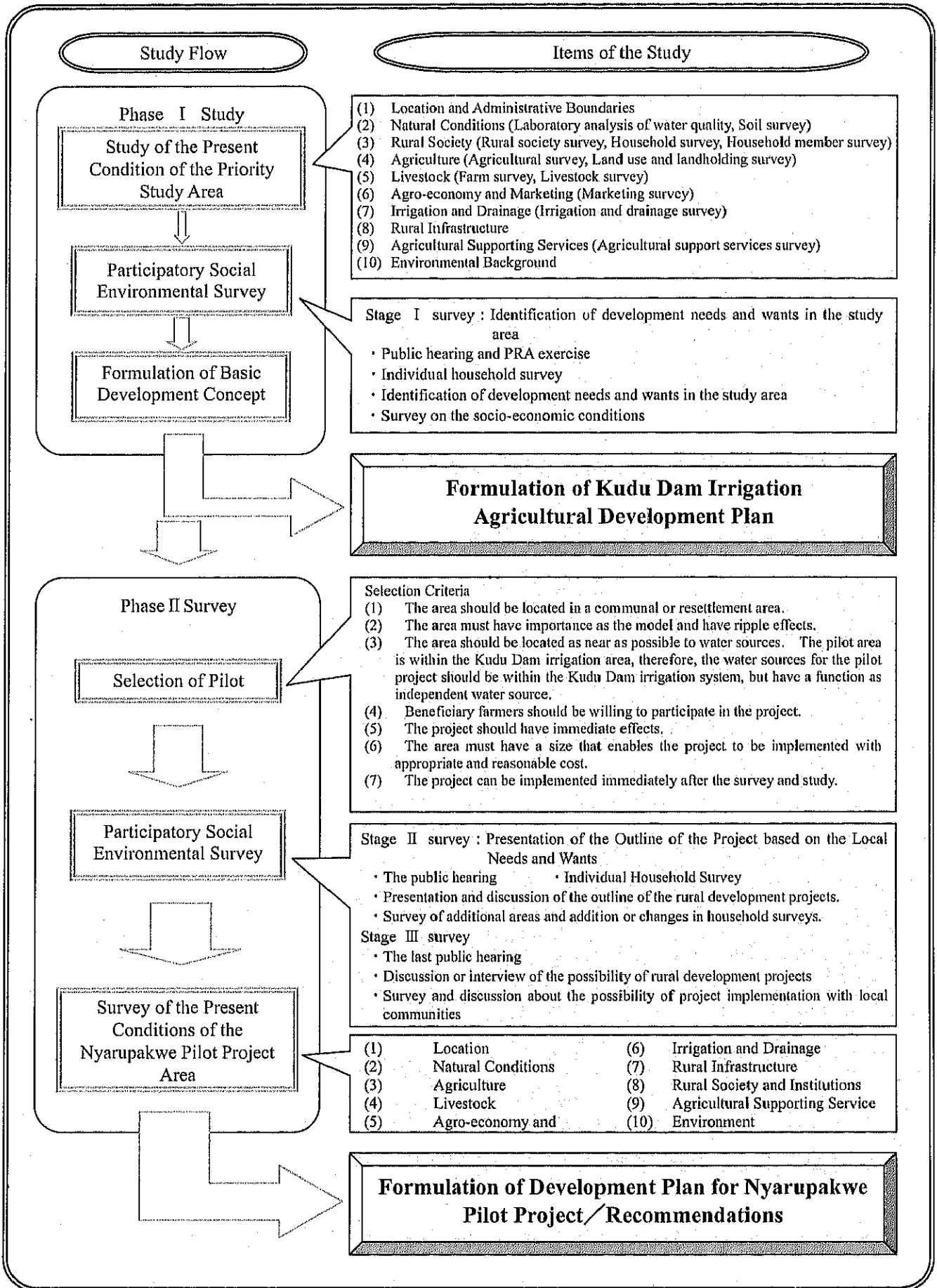
**Study Area**

- Kudu Dam and two main irrigation canals
- Approximately 14,700ha of proposed irrigation land in the Communal Area and Resettlement Area in the lower Munyati River Basin.

**Location Map**



**Study Items and Study Flow**





### Environmental management and conservation plans

- Resettlement Plan  
: Resettlement for the dam construction and for the creation of a supply reservoir.
- Land Re-Allocation in Irrigation Area  
: Those women and men who are cultivating in the project areas should be given priority in land allocation.
- Management of the reservoir : Management of the reservoir and its surrounding areas.
- Catchment Management : Monitoring of siltation to the dam
- Health Program : Prevention of malaria and bilharzia.
- Project Environmental Monitoring and Control  
: Implementation of environmental monitoring by the Environmental Management and Monitoring Section (EMMS) of LMADA
- Post-Implementation Monitoring  
: Monitoring of water quality, ecology, management of land and the reservoir and of beneficiary health and welfare conditions.

### Implementation Plan

#### Water Resources Development (Construction of Kudu Dam)

<b>(1) Main Dam</b>		
(a) Dam Type	Zoned Fill Type	
(b) Dam Height (m)	72.7	
(c) Dam Crest Length (m)	860.0	
(d) Dam Crest Width (m)	8.0	
(e) Embankment Volume (m <sup>3</sup> )	7,003,000	
<b>(2) Saddle Dam</b>		
(a) Dam Type	Zoned Fill Type	
(b) Dam Height (m)	30.0	
(c) Dam Crest Length (m)	875.0	
(d) Dam Crest Width (m)	8.0	
(e) Embankment Volume (m <sup>3</sup> )	2,554,000	
<b>(3) Spillway</b>		
(a) Design Flood Discharge		
- For Services Spillway (m <sup>3</sup> /s)	6,000	
- For Emergency Spillway (m <sup>3</sup> /s)	12,122	
(b) Type of Spillway	Ungated Ogee Type	
(c) Overflow Crest Length (m)	300.0	
(d) Overflow Depth (m)	6.12	
<b>(4) Outlet Works</b>		
(a) Type	Intake Tower	
(b) Outlet Capacity (m <sup>3</sup> /s)	31.5	
(c) Tunnel Diameter (m)	2.5	
(d) Tunnel Length (m)	560.0	

#### Livestock Development Plan

(1) Water Trough (unit)	72
(2) Fully Fenced Gazing Blocks (Block)	10

#### Agricultural Support Services Strengthening Plan

(1) Agricultural Extension Center (unit)	2
(2) Agricultural Support Services Program	L.S

#### Irrigation Development Plan

<b>(1) Irrigation Area</b>	25,000
(a) Communal & Resettlement Areas (ha)	14,500
(b) Small Scale Commercial Farms (ha)	6,000
(c) Large Scale Commercial Farms (ha)	4,500
<b>(2) Main Irrigation Canal</b>	
(a) Canal Type	Trapezoidal Concrete Lined Canal
(b) Canal Length (km)	177.9
<b>(3) Secondary Irrigation Canal</b>	
(a) Canal Type	Trapezoidal Concrete Lined Canal
(b) Canal Length (km)	100.0
<b>(4) Related Structures</b>	
(a) Diversion Structure (nos.)	363
(b) Siphon (nos.)	3
(c) Aqueduct (nos.)	25
(d) Cross Drain (nos.)	317
(e) Bridge (nos.)	39
(f) Pump Station (nos.)	88

#### Rural Infrastructure Improvement Plan

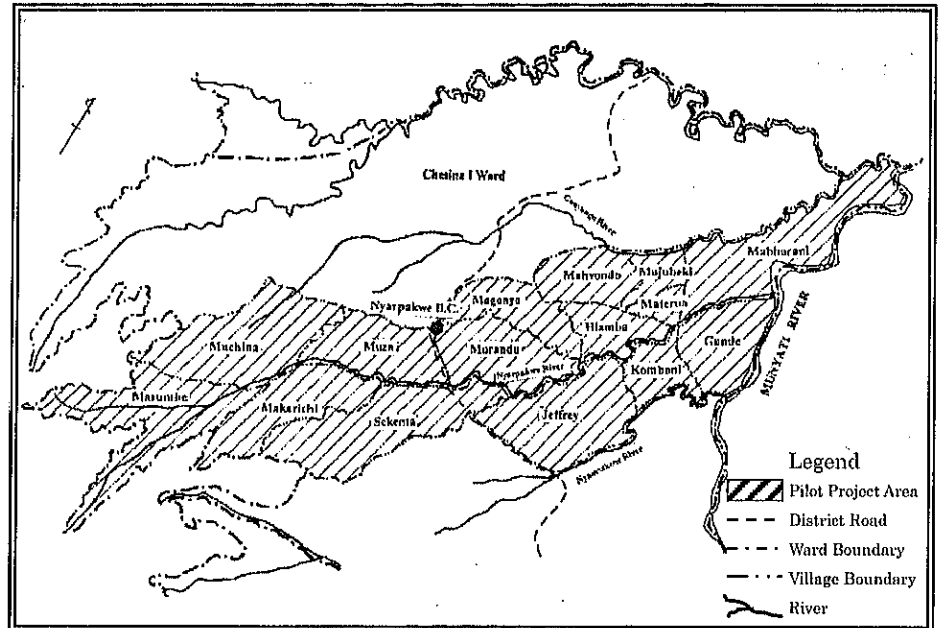
(1) Rural Road Improvement (km)	279
(2) Borehole Improvement	
(a) Rehabilitation (nos.)	90
(b) New Construction (nos.)	101
(3) Improvement of Communication system	L.S

#### Pilot Project

(1) Water Resources Development	Nyarupalwe Dam
(2) Irrigation Development	Magonyo, Hlanba
(3) Livestock Development	Grazing Area Development, Livestock Water Development
(4) Rural Infrastructure Improvement	Road Improvement, Rehabilitation and Installation of Boreholes, Construction of a Community Development Center
(5) Institutional Strengthening	Strengthening of Farmers Organization
(6) Agricultural support Services Strengthening	Strengthening of Agricultural Extension Service

### Nyarupakwe Pilot Project

- Located in the middle of Chisina I ward of Gokwe South District, Midlands Province.
- The pilot study area is 14,900ha.



### Water Resources Development

<b>(1) Nyarupakwe Dam</b>	
(a) Dam Type	Combined Type of Concrete Gravity Dam and Fill Dam
(b) Dam Height (m)	15.5
(c) Dam Crest Length	
- Concrete Dam Portion (m)	226.0
- Fill Dam Portion (m)	356.0
(d) Dam Crest Width (m)	8.0
(e) Concrete Volume (m <sup>3</sup> )	29,500
(f) Embankment Volume (m <sup>3</sup> )	87,500
(g) Spillway	
- Design Flood Discharge (m <sup>3</sup> /s)	400
- Type	Ungated Ogee Type at Concrete Dam Portion
(h) Intake Discharge (m <sup>3</sup> /s)	0.074
<b>(2) Upstream Small Scale Dam</b>	
(a) Dam Type	Concrete Gravity Dam
(b) Dam Height (m)	7.2
(c) Dam Crest Length	61.0
(d) Dam Crest Width (m)	2.0
(e) Concrete Volume (m <sup>3</sup> )	1,120
(f) Overflow Section	W20m × H11m at the Center of Dam Wall

### Irrigation Development

(1) Irrigation Area (ha)	60
<b>(2) Main Irrigation Canal</b>	
(a) Design Discharge (l/s)	72
(b) Canal Length	
- Pipeline, Dia.=500mm (m)	770
- Open Canal (m)	4,883
(3) On-farm Facilities	L.S
(Tertiary canals, Watercourses, Farm Drains and Farm Roads)	

### Livestock Development

(1) Fully Fenced Grazing Area (ha)	860
(2) Water Trough (nos.)	2
(3) Fish Farming in the Nyarupakwe Reservoir (ha)	20

### Rural Infrastructure

<b>(1) Rural Road Improvement</b>	
(a) Nyarupakwe to Gokwe Road (km)	24
(b) Farm to Market Link Road (km)	22
<b>(2) Borehole Improvement</b>	
(1) Rehabilitation (nos.)	13
(2) New Construction (nos.)	6
(3) Community Development Center (place)	1

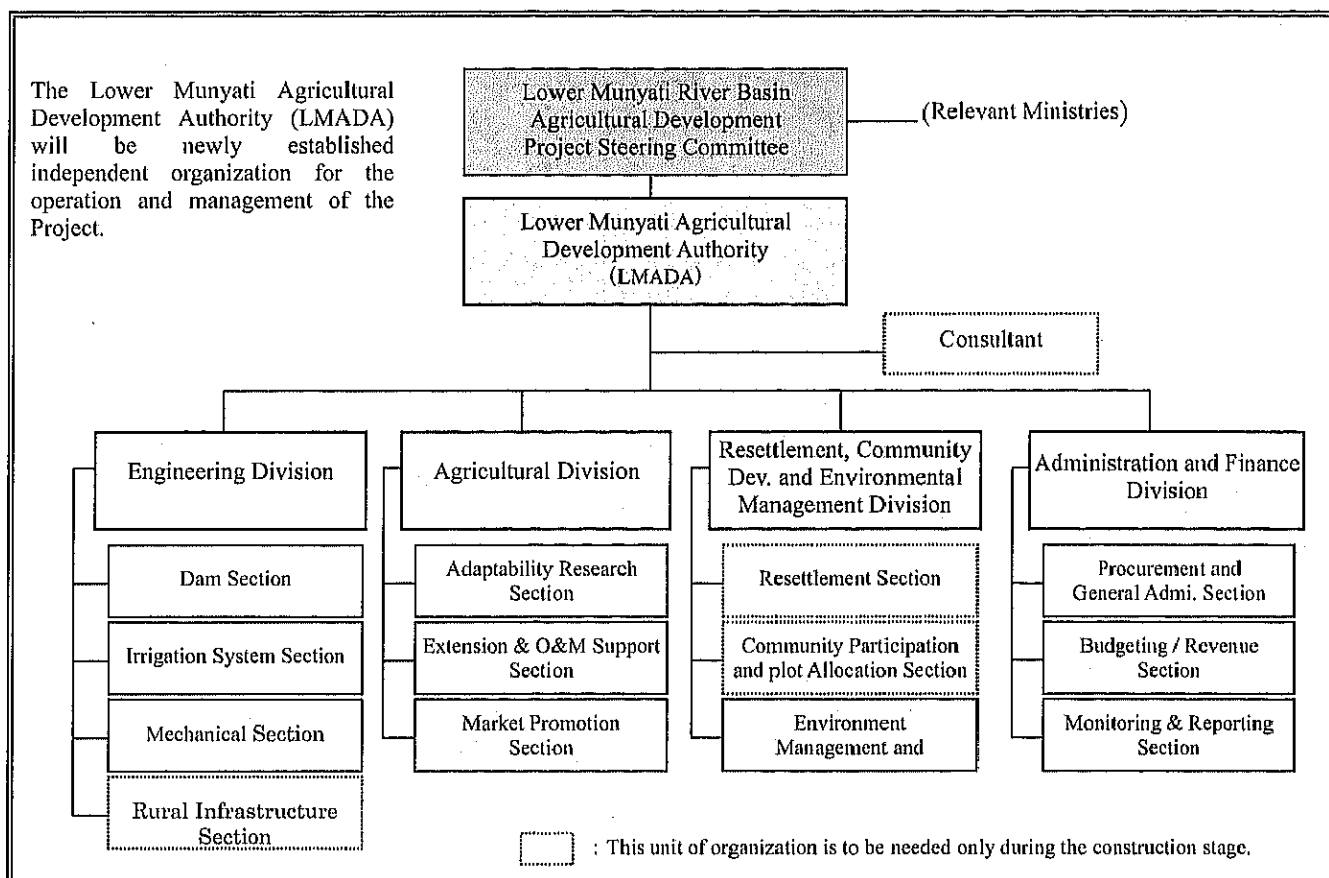
### Institutional Strengthening

Agricultural Extension Center (place)	1
Institutional Strengthening Program	L.S

### Agricultural Support Services

Agricultural Support Services Program	L.S
Open Market (unit)	1

### Organization Structure



### Implementation Schedule

Work Items	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
	1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th	11th	12th
1. Feasibility Study												
2. Detailed Design & Pre-construction Work												
3. Environmental Management Components												
4. Pilot Project												
5. Kudu Dam Irrigation System												
6. Livestock												
7. Rural Infrastructures												
8. Agricultural Support Services												

**Project  
Construction Costs  
and  
Operation and  
Maintenance Costs**

Item	Construction Cost (Z \$ 1,000)	O&M Cost (Z \$ 1,000)
Kudu Dam	3,640,574	25,100
Irrigation and Drainage Development	5,707,680	75,500
Livestock Development	5,544	50
Rural Infrastructure Improvement	286,017	2,260
Agricultural Support Strengthening	21,797	—
Pilot Project	257,653	1,945
Total Amount	9,919,265	104,915

US \$ 1.0 = Z\$38.0

The replacement cost : 1.0% of the total project cost for every ten years for the replacement of various equipment with shorter life than the project evaluation term.

**Project Evaluation**

Economic Evaluation		Financial Evaluation		
Economic Benefits	(Z \$ 1,000)	Household Budget (Unit : Z \$)		
		Particulars	Without Project Condition	With Project Condition
Irrigation Development	1,386,892	Total Net Income	16,609	53,688
Urban/Industrial and Domestic Water	63,779	Living Expenditure	13,615	15,657
Maize Stalk/Residues	31,062	Net reserve	2,994	38,031
Road Rehabilitation	17,833	The total amount of water charge and O&M cost become Z\$3,960/ha/year, for which the beneficiary farmers will have enough capacity to pay.		
Livestock Development	5,590			
<b>Socio-Economic Impact</b>				
(1)Improvement in Farm Roads in the Project Area		(5)Food Availability throughout the Year		
(2)Improvement in Living Condition		(6)Foreign Exchange Saving		
(3)Improvement in Domestic Water Supply Condition		(7)Empowerment of Women		
(4)Increase in Employment Opportunity		(8)Demonstration Effects to Other Similar Projects		



- (1) The Project has justified technically sound and economically viable.
- (2) The Project will contribute to a large extent to the improvement in income and living standards of the local people in the Project Area.
- (3) The Project will contribute to supply stable food and to attain the development target of the national agricultural policy.
- (4) The Nyarupakwe Pilot Project is essential for successful implementation of the Kudu Dam Irrigation Project.

**Recommendations**

- (1) The Project should be started as early as possible.
- (2) Early Establishment of Resettlement Program by the construction of Kudu Dam  
The Government should have detailed discussions on the resettlement with the local people. It is preferable to employ a reliable NGO with international accreditation for facilitating the resettlement process.
- (3) Consensus of farmers on the Land Re-allocation in Irrigation Areas  
In Zimbabwe, farmers have to surrender their land to the Government when their land become irrigable. This system is to reduce impartiality in income caused by the introduction of irrigation water. The land re-allocation in the proposed irrigation areas should be made based on the consensus of beneficiary farmers taking the existing land holding conditions into consideration.
- (4) Establishment of the Lower Munyati Agricultural Development Authority (LMADA)  
It is proposed to set up a Steering Committee for dealing with important policy matters relating to the operation or financing of LMADA.
- (5) Early Completion of Seke Dam Irrigation Project  
The Seke Irrigation Project on the right bank of the Nyarupakwe River should be completed as soon as possible.
- (6) Further Study in the Kudu Dam Design Stage  
It is recommended to conduct the further studies of (a) Dam axis (b) Permeability test at dam foundation (c) Spillway (d) Diversion work during the construction.

<h2 style="margin: 0;">Watershed Rehabilitation in Middle Shire in Malawi</h2>	Counterpart Agency	Ministry of Natural Resources and Environmental Affairs, Department of Forestry
	Consultant Company	Sanyu Consultants Inc. and Nippon Koei Co., Ltd.
	Team Leader	Toshihide SHIBATA
	Study Period	1999.8.14~2001.3.20
	Study Type	Master Plan Study (M/P)

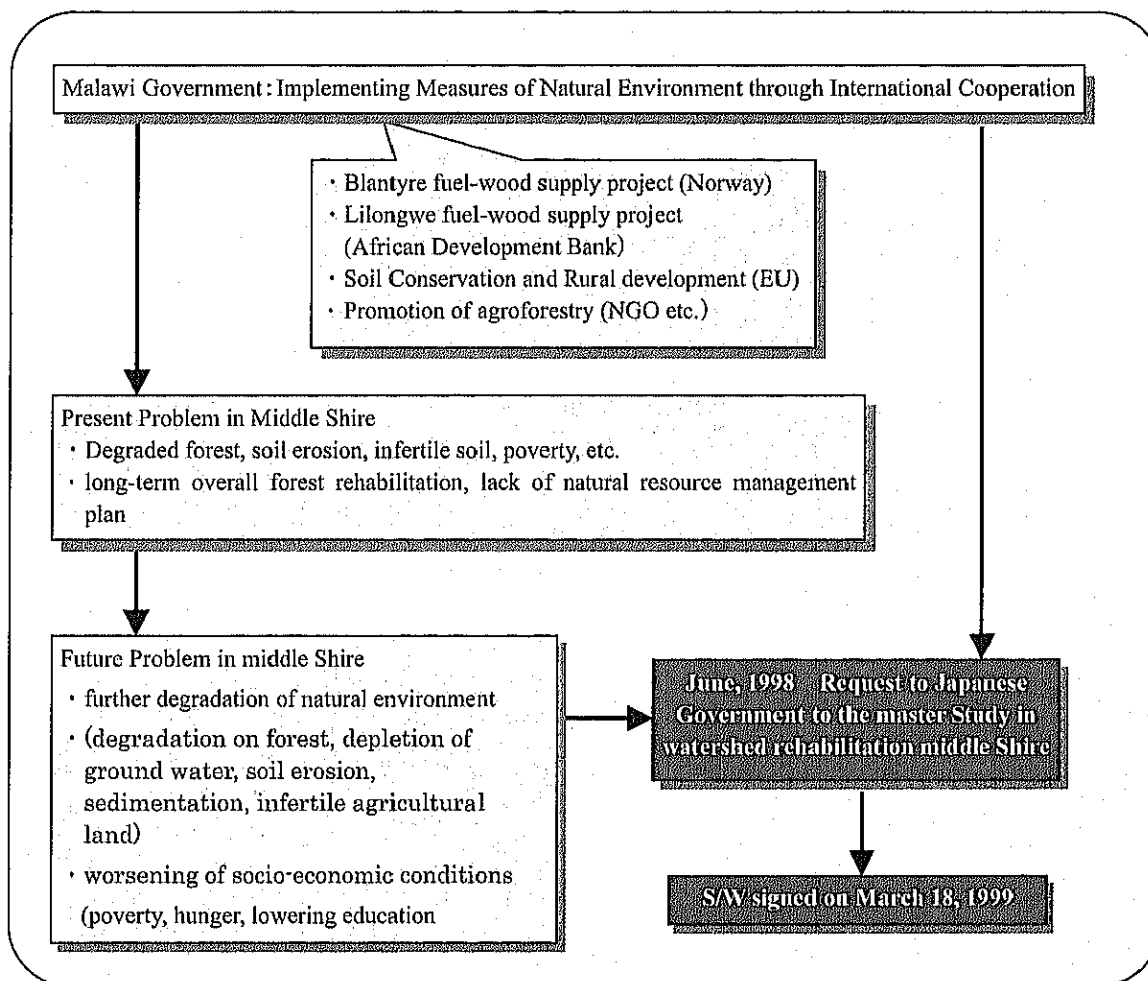
### Background of the Study

Shire river, originating Lake Malawi, flows southward through northwest of the Blantyre City. At the midstream of the Shire river, the Nkra Dam for hydropower plant is situated, which generates 80 % of electricity of the country. Due to the degradation of the natural environment within such as deforestation, soil erosion, etc., within the catchment area of the dam, massive sediment deposition occurs at the reservoir, thus reducing effective storage capacity of the dam to half of the original capacity.

Middle Shire Watershed is also the poverty area characterized by a high population density (290 per sq. kilometers), and chronic starvation. Increased population pressure, improper cultivation sustaining life of the population, triggers the vicious cycle of degradation of natural environment.

The Government of Malawi (GOM) has been implementing, with the aid of foreign donors, projects such as fuel-wood supply, community forestry and agroforestry. However, long-term measure to rehabilitate forest has not been taken.

Under such circumstance alleviation project, regional development plan, etc. GOM requested Government of Japan to carry out a development study for the formulation of Watershed Rehabilitation Plan in Middle Shire, in June 1998. Acting on the request, JICA dispatched a preparatory study team (as S/W mission) in March 1999, and it signed the S/W for the Master Plan in March 1999.



### Objectives of the Study

- (1) To carry out a M/P study over the forest rehabilitation plan formulation in the middle Shire
- (2) To conduct a detailed survey over a model area selected within the Study area in order to formulate village natural resource management plan
- (3) To transfer to the counterparts, through a course of the Study, techniques concerning the methodology of the study, procedure and concept of formulation plan

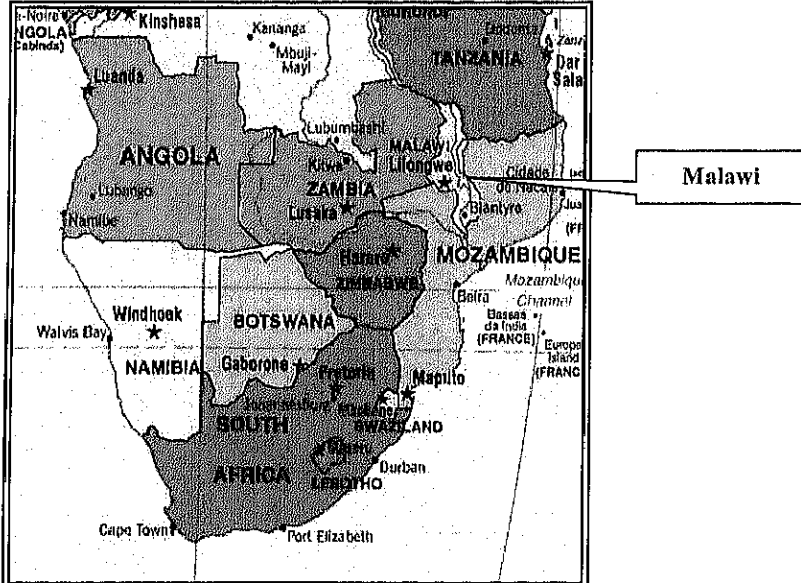
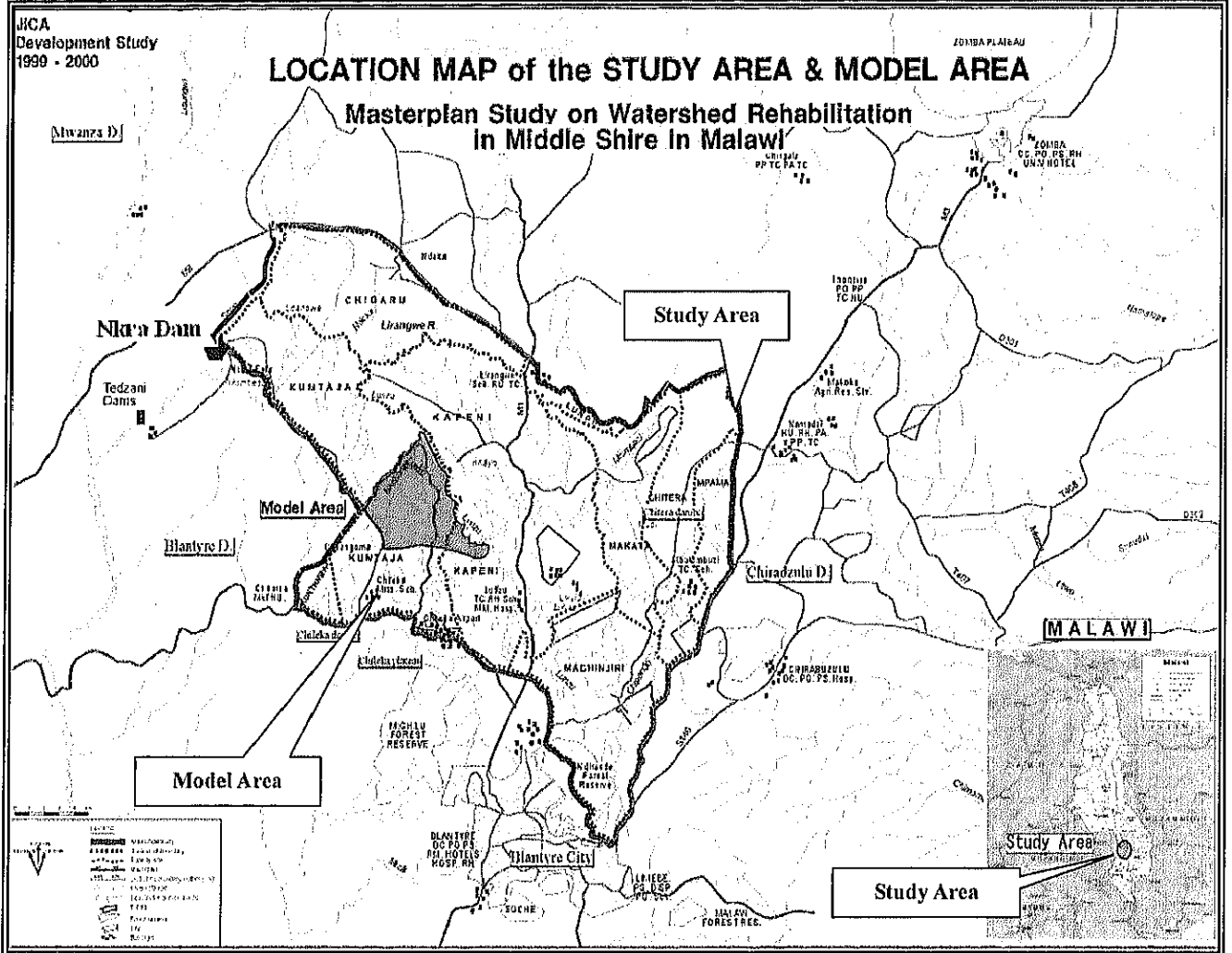


**Study Area**

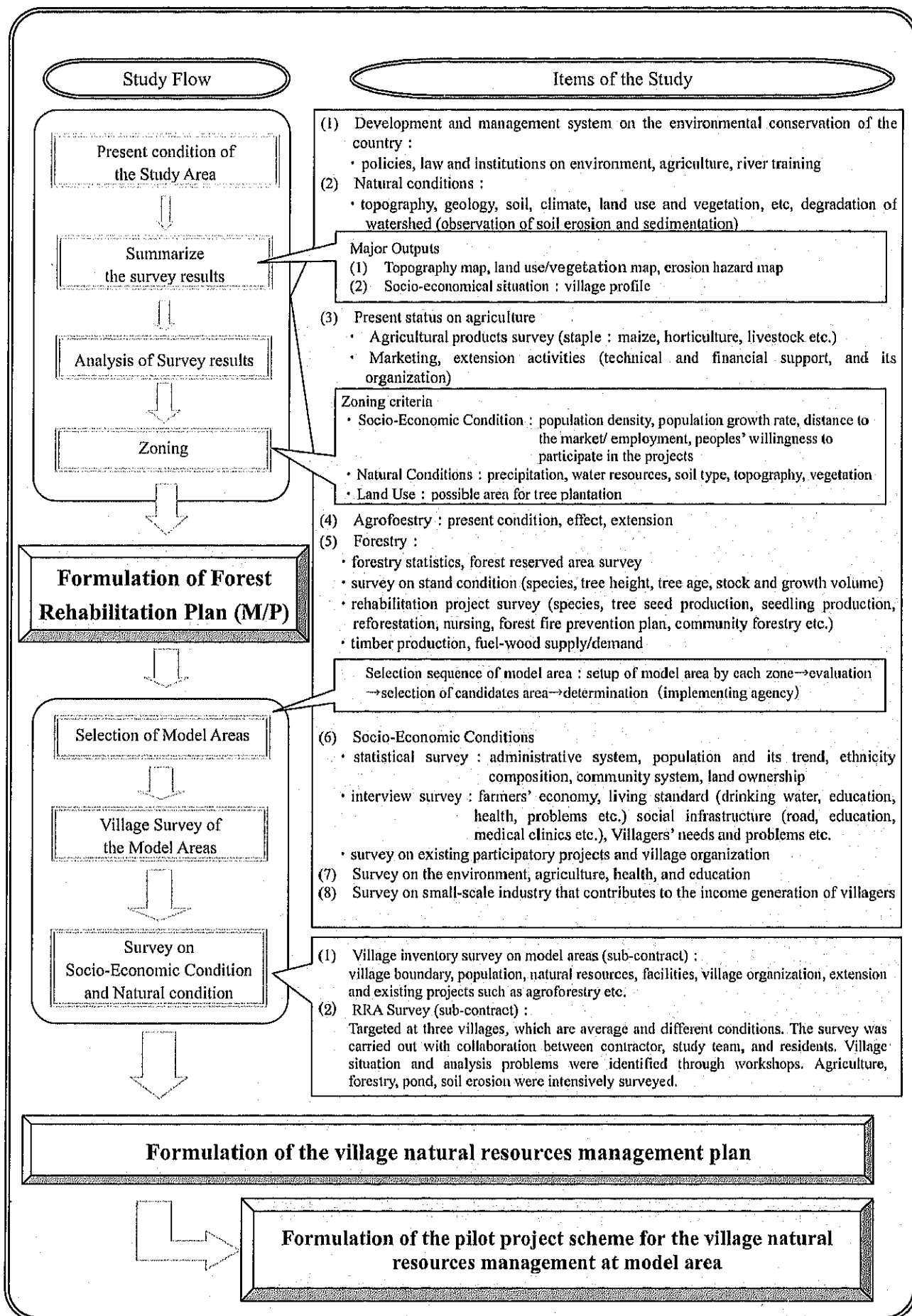
- (1) Middle Shire (tributaries :Lunzu and Lirangwe catchment) , Area: 6,7000 hectare
- (2) Admini : Blantyre (TA\* Chigaru, TA Kuntaja, TA Kunthembwe, TA Kapeni, TA Lundu, TA Makata, TA Machinjiri), Chiradzulu (TA Chitera, TA Mpama)

\* :TA: Traditional Authority. An administrative unit, which has a traditional, governs the village under the control of

**Location Map**



## Study Items and Flow



## Outline of the master plan on watershed Rehabilitation in middle Shire

### Summary of the Plan

- (1) Target Group : inhabitants and extension worker in the Study area
- (2) Overall Goal : forest rehabilitation in middle Shire
- (3) Objectives of the Plan :
  - short-term objective : fuel-wood supply, self-sustaining in fuel wood supply, soil conservation and fertilization
  - long-term objective : ground water conservation, self-sustaining in timber supply for house construction/repair, flood prevention
- (4) Proposed Plan :
  - short-term plan (within 5 years) : agricultural development project, participatory small-scale agricultural development project
  - mid-term plan (6 to 10 years) : promotion of reforestation
  - long-term plan (11 to 20 years) : expansion of reforestation, forest rehabilitation and conservation
- (5) Main Projects : forest related project, software related project, and public works project
- (6) Expected Results : environmental conservation and improvement of quality of living of local people
- (7) Implementation : period short-term plan : 5 yrs, mid-term plan : 10 yrs, long-term plan : 15yrs

### Target Area & Plan

- (1) middle Shire : 6,7000 ha
- (2) Contents of plan :
  - major projects (refer to the outline mentioned below)
  - participatory organization plan (refer to the organization chart mentioned below)

### Project Components by Zone

Proposed Project Component	Related zone					Project objectives	Priority	Project span
	A	B	C	D	E			
<b>Components related to Forestry</b>								
Creation of nurseries and seedling raising	-	⊙	○	-	△	Supply of seedlings	1	S - MT
Demonstration plot for hedge-row <sup>*3</sup>	-	○	⊙	△	-	Diffusion of AF	2	MT
Establishment of agroforestry nursery center	-	⊙	-	⊙	-	Diffusion of AF	3	S- MT
Expansion/creation of individual woodlot	-	⊙	○	△	-	Fuelwood supply	4	M- LT
Reforestation of river side forests	-	⊙	○	-	△	Soil/water conserve.	5	S-MT
Reforestation of hill-side/hill-top forests <sup>*4</sup>	-	△	⊙	-	○	Soil/water conserve.	6	S-MT
Restoration of denuded Forest Reserve <sup>*4</sup>	⊙	-	-	-	⊙	Soil/water conserve.	7	M-LT
<b>Components of Software Activities</b>								
Assistance/training for income generation	-	⊙	○	-	△	Assisting the poor	1	M-LT
Improvement of reservoirs	-	⊙	○	△	-	W.C., flood control	2	MT
Adult education for environment conservation	-	⊙	○	-	△	Concept implantation	3	LT
<b>Components related to Public Works</b>								
Soil conservation by gavion net	⊙	○	-	△	-	Ground stabilization	1	MT
Construction of weirs in the streams	△	⊙	○	-	-	Runoff prevention	2	LT
Intensive utilization of dambos	-	⊙	-	⊙	-	Higher land use	3	M- LT
Vaccination against livestock epidemy	△	○	-	⊙	-	Knowledge diffusion	4	MT

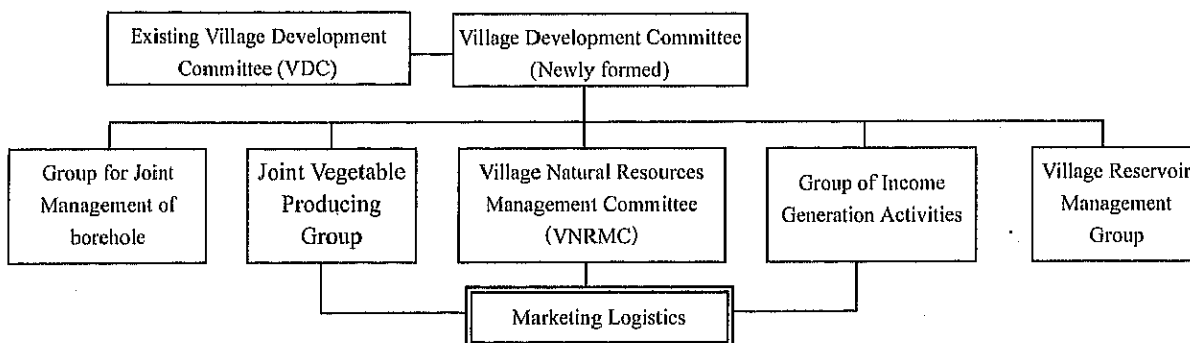
Note<sup>\*1</sup> : A: urbanized area, with reforestation of reserved forests needed, B: reforestation of village forests needed, higher potential of tapping water resources, C: Semi-arid, heavily reclaimed zone with reforestation on undulated hills needed, D: Eco-system conserved by estates, but land in TA has been barren and narrow, E: Semi-arid, reforestation on degraded TA land with aridity tolerant tree species

<sup>\*2</sup> : ⊙:major applying zone, ○: the next important zone, △: applicable but the third important zone, -: no data

<sup>\*3</sup> : ST; short term, S-MT; short-medium term, MT; medium term; M- LT; medium - long term, LT; long term.

<sup>\*4</sup> : Including boundary planting, AF; agro-forestry, conserv.; conservation, W.C.; water conservation

### Organization Chart of Participatory Organization Plan



## An Overview at Village Natural Resources management Plan (Pilot Projects Plan)

### Summary

- (1) Target Group : residents and extension officer in model areas
- (2) Overall Goal : forest rehabilitation in middle Shire
- (3) Objectives of the Plan :
  - short-term (5years) : upgrading income generating and agricultural productivity
  - mid-term (10years) : forest rehabilitation and reduction of soil erosion in model areas
- (4) Proposed Plan : pilot projects
- (5) Main Projects : utilization of agro-forestry (AF), forestry promotion measures, IGA promotion measures, social infrastructure and water use, village organization, enlightenment, capacity building, extension activities
- (6) Expected Results : income generation of villagers and natural resources management
- (7) Implementation Period : 5 years

### Target Area and Plan

#### Target Area

#### Target Area

- Model area in middle Shire (Area: 3,864 hectare)
- Number of villages : 33 Villages (TA Kapeni : 8 villages, TA Kuntaja : 25 villages)
- 1<sup>st</sup> year : 3 average villages that has different natural and socio-economic conditions (Kaumbata, Nanjiwa and Ndemanje)
- 2<sup>nd</sup> to 5<sup>th</sup> year : village adjacent to the village of 1<sup>st</sup> year implementation

**Proposed Target Villages for the Scheme by Year**

Year	Village Name	Area (ha)	Population	Year	Village Name	Area (ha)	Population
1 <sup>st</sup>	1. Kaumbata	316	489	4 <sup>th</sup>	15. M. Ngondo	107	493
	2. Nanjiwa	234	714		16. Lemu	349	2,316
	3. Ndemanje	144	235		17. Teula	127	493
	Subtotal	694	1,438		18. Manjelo	69	408
2 <sup>nd</sup>	4. Kam'mata	171	1,513		19. Kamwendo	315	353
	5. Kumanda	127	258		Subtotal	967	4,063
	6. Tamvekenji	36	501	5 <sup>th</sup>	20. Peter Bilila	129	435
	7. Daniel Mbedza	70	154		21. S.Mpombe	54	327
	8. Chilangali	51	258		22. K. Chigumula	102	782
	Subtotal	455	2,684		23. Kumponda	190	1,584
3 <sup>rd</sup>	9. Chakana	49	200		24. Kateyo	15	92
	10. Mdala	801	1,289		Subtotal	490	3,220
	11. Siyamdimba	119	899				
	12. Makanokaya	164	251				
	13. Chikoja	233	748				
	14. Maluwa	45	376				
	Subtotal	1411	3,763				
				Total		4,017	15,168

### Contents of the Plan

- (1) Projects  
Project Component will be determined through Participatory Rural Appraisal (PRA) by each village.
- (2) 1<sup>st</sup> year project plan (draft)
  - Utilization of AF/ Forestry Promotion measures
    - Utilization of agroforestry : Construction of AF nursery, equipment and materials supply for nursery and tree plantation.
    - Forestry promotion plan : Establishment of individual woodlot along riverbank forest, or water resource conserving forest. ; creation of village forests with trial of promising, fast-growing tree species. ; Indigenous forest rehabilitation, environmental reforestation in public land
  - IGAs promotion measures  
sales of vegetables, small-scale fowl rearing, bee-keeping
  - Social Infrastructure and water use  
weirs(Gabion net), road crossing culvert, Milala dam rehabilitation
  - Village organization  
following the needs analysis through the PRA (Participatory Rural Appraisal) and the PCM, formation of the VNRMP (Village Natural Resources Management Plan) and sensitization of the community, the community organization expert, leadership training, study tour
  - Enlightenment, capacity building, and extension activities  
capacity building for extension staff, monitoring activities (self-monitoring, extended monitoring between villages of project implementation, extended monitoring target for village in project preparation phase), environmental education for children

## Detailed Contents of the Plan (1<sup>st</sup> year)

### 1. Major Flow on AF Exploitation Activities

	Subject	Reference
(1)	Formation of AF Farmers Group by village	Sub-contract to NGO
(2)	Enlightenment activities to villagers' group of the target villages	Bus tour for successful AF farm
(3)	Confirmation of AF exploitation plan of the AF farmers' group	Land with intention to adopt AF, species to be employed, etc.
(4)	Survey: AF nursery land, farm land planned to practice AF, soil and other natural condition, socio-economic condition	Delineation of village border and planned AF practice farmland by GPS, etc. bench mark survey
(5)	Survey on water resources to AF nursery	Water resource survey
(6)	Planning	AF nursery construction plan, AF nursery seedling production plan, AF practicing plan, etc.
(7)	Procurement	Construction equipment and materials, AF nursery and AF operation equipment and materials, etc.
(8)	Implementation	AF nursery construction: construction by AF farmers' group and other villagers' groups that will produce seedling at the nursery, Production seedling: AF farmers group, Land preparation for AF: ridging, weeding, etc.
(9)	Monitoring	Seedling production at AF nursery by species, Land area practicing AF by farmers, Number of transplanted AF seedling by farmer and species, etc.
(10)	Evaluation and Analysis	Seedling production, AF practicing, Agricultural production in farm land practicing AF, Sales of farm production

### 2. Tree Planting Plan (hectare) : Summary of Forest Target Area at 1st Year Vatch Village

(Unit : ha)

Type of reforestation / Village Name		Kaumbata	Nanjiwa	Ndemanje
Individual woodlot	Total target area	80 (10)	54 (7)	26 (4)
Rapid growth trial village forest	Total target area	20 (3.2)	5 (0.8)	30 (4.7)
Reforestation at public space	Total target area	- (3.0)	- (0.4)	- (1.0)
Rehabilitation degraded natural vegetation	Total target area	-	30 (5)	-
Total (annual target area)		16.2	13.2	9.7

※Target Area of 1st Year : Kaumbata, Nanjiwa, Ndemanje, ( ) : annual target area

### 3. Income Generating Activities (selected items)

Items	Required equipment and materials
Sales of Vegetables	(1) Farm inputs (seed, chemical fertilizer, agricultural chemicals) (2) Farm implements (Hoes, Sickles, Treadle pumps, Watering can) (3) Harvesting and carriage containers (Bamboo basket, Cargo basket, Bicycles) (4) Retail stall (Pole and roofing material, Material for wall and displaying stall table, mat)
Storage/ primary processing	(1) Implements and equipment (Hoes, Sickles, Shovels, Drying mats, Peeling knives, High pressure boiling pans, etc.) (2) Tools for harvesting and carrying (Baskets made of bamboo, Cage baskets, Bicycle) (3) Building materials for retail stall (Supporting poles, Wooden board for wall/table, Mat for covering table)
Bee-keeping	(1) Input materials (beehive boxes, honey harvesting wears, harvesting knives, wax cable wire) (2) Box assembling kits (Wood cutting saw, Metal scale, Wooden ink containers, Plumb, Hand borer, Metal Hammer, Nail Chisels, Measuring tapes)

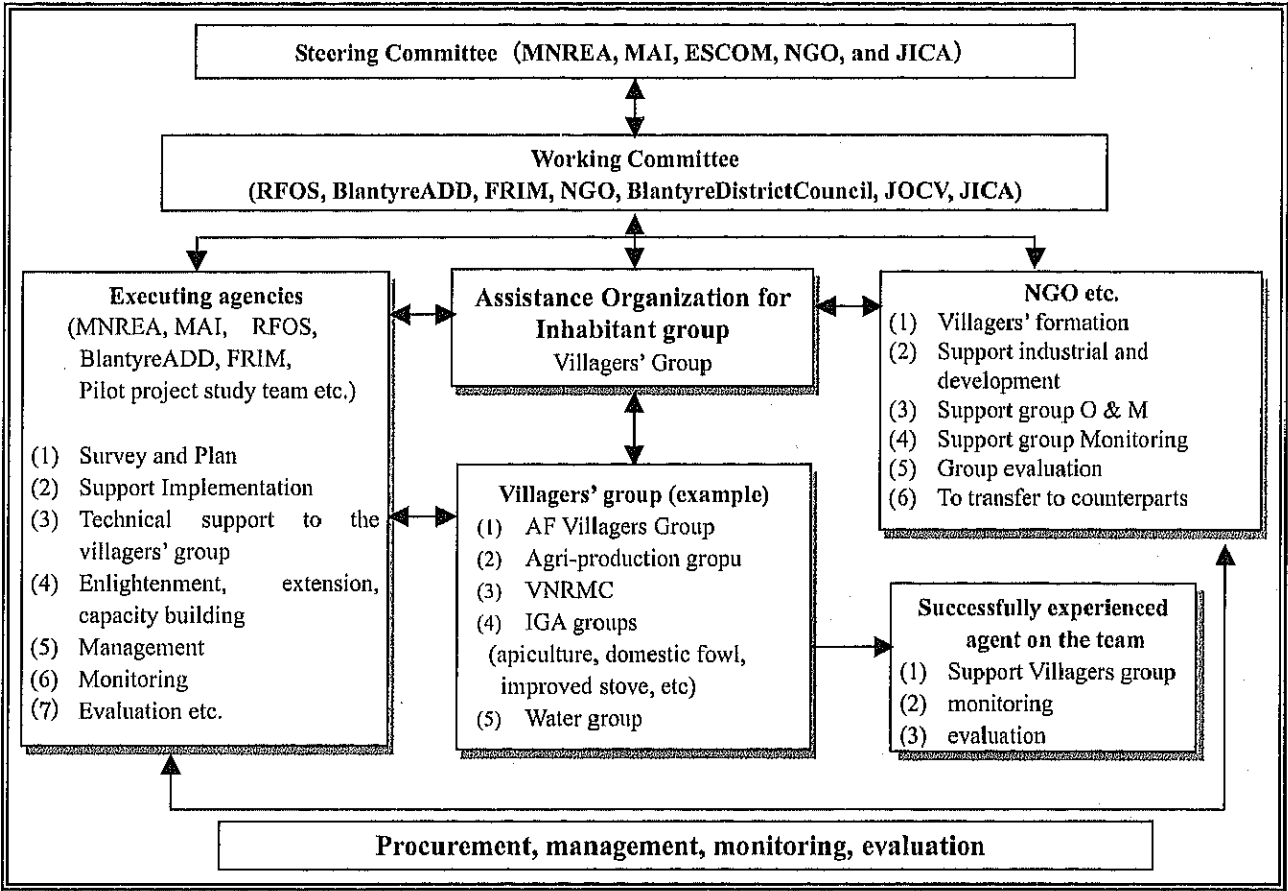
### 4. Social Infrastructure

Weirs (Gabion Net), Road Crossing Culvert, Rehabilitation of Milala Dam (Increase of Dike etc.)

### 5. Candidate Subjects for Community Sensitization (An example of community sensitization)

Subject	Candidate Expert
Usage and management of natural resources	Forest extension staff
Benefit and techniques of AF	FA, NGO
Agriculture (Crop diversification, Promotion of local products, Rotation cropping, etc.)	NGO
IGA (poultry, bee-keeping, food processing, etc.)	NGO
Improved fireplace	Expert in introducing improved fireplace

**Organization Structure**



**Implementation Schedule**

activities/year (month)	1 <sup>st</sup> year	2 <sup>nd</sup> year	3 <sup>rd</sup> year	4 <sup>th</sup> year	5 <sup>th</sup> year
(1) Improvement and maintenance of infrastructure	█	█	█	█	█
(2) agroforestry nursery construction, production, maintenance	█	█	█	█	█
(3) agroforestry, plantation, increase agricultural production	█	Landpreparation / plantation	█	█	█
(4) Village reforestation	Landpreparation/ plantation	nursing	█	█	█
(5) IGA	█	█	█	█	█
(6) Village Organization	█	█	█	█	█
(7) education, extension, enlightenment technology transfer environmental education for children	█	█	█	█	█
(8) Monitoring & Evaluation	█	evaluation	█	█	█

Survey, planning
  Design, procurement
  Implementation
  Evaluation

### Project Cost (approximate estimate)

(Unit:US\$)

	1 <sup>st</sup> year	2 <sup>nd</sup> year	3 <sup>rd</sup> year	4 <sup>th</sup> year	5 <sup>th</sup> year	Total
Utilization of AF/Forestry Promotion Measures	55,900	54,700	50,400	36,000	21,800	218,000
IGAs promotion measures	22,300	38,900	22,900	28,600	30,000	142,700
Social Infrastructure and water use	40,300	8,100	32,300	79,500	8,100	168,300
Village Organization	25,800	62,100	53,600	-	-	141,500
Enlightenment, capacity building, extension activities	43,300	8,200	10,500	10,500	10,500	83,000
Total	187,600	172,000	169,700	154,600	70,400	754,300

Remarks: figure represents the estimates based on the pilot project cost at 1<sup>st</sup> year.

### Indicators for project evaluation

Component	Proposed Indicators
<b>Technical Items</b>	
(1) Utilization of Agroforestry	Production, marketing and margin of Agroforestry seedlings Number of households practicing Agroforestry, quantity of farm produce and yields, number of varieties thereof
(2) Forestry Promotion Measures	Number of trees, planted area, volume of stock by woodlots, number of households engaged in forestry
(3) IGAs promotion measures	Amounts sold of such products as honey and farm-processed foods by cooperative Number of fowls reared and of households by species Number of households using improved fireplace
(4) Social Infra. and water use	Number of households using dam and river water, area under irrigated farming
<b>Socio-economic Items</b>	
(5) Village Organization	General indicators for socio-economic assessment
(6) Enlightenment, capacity building, and extension activities	General indicators for socio-economic assessment

※Project evaluation at implementation plan phase was not carried out in this pilot project plan.

### Recommendations

(1) **Provision of a framework of environmental measures chaired by MNREA**

The report recommends to involve domestic groups assisting the environmental care, international organizations concerned, domestic and international NGOs, so that these members can contribute by exchanging views, ideas and tactics in technical and financial dimension in a wider range, strategic methodology.

(2) **Closer coordination among government agencies concerned**

For instance, liaison committee for area rehabilitation measures constituting of representatives from the ministries and agencies concerned.

(3) **Review and implementation of long-term demographic measures**

The population density in the Study Area has already exceeded the carrying capacity of land resources. From long-term viewpoint, it is desirable to review and implement a long term, nation-wide strategy to balance density distribution among regions.

(4) **Exploration of substitute energy resources**

A study on the substitution of traditional thermal and light energy source with modern sources, by making use of domestically available lignite resources.

(5) **Stable supply of agricultural inputs at reasonable unit price**

Rational processing of domestically available apatite deposit into phosphate fertilizers coupled with organic nitrogen supply through the proper practice of agroforestry.

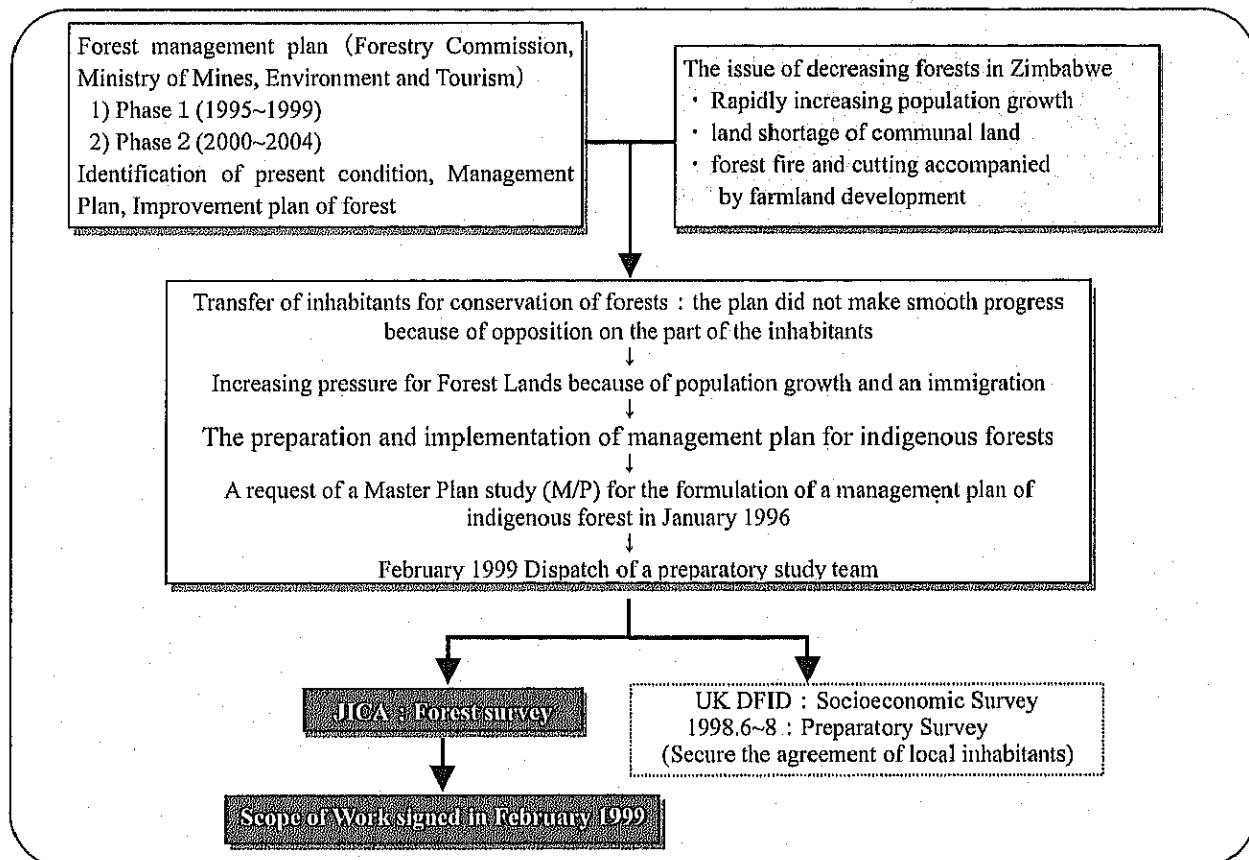
<b>The Forest Survey in The Gwaai and Bembesi Areas in The Republic of Zimbabwe</b>	Counterpart Agency	Forestry Commission (FC) of the Zimbabwe Ministry of Mines, Environment and Tourism
	Consultant Company	Japan Forest Technical Association / KOKUSAI KOGYO CO., LTD.
	Team Leader	Takao FUJIMORI
	Study Period	1999.11~2001.3
	Study Type	Forest Resources Survey

## Background of the Study

In recent years, forests of Zimbabwe have been faced with severe pressure and decrease in area (approximately 60,000 ha every year) due to rapid population growth and shortages of communal land. The Gwaai Forest land and the Bembesi Forest Land, located in the western part of the country, are the largest designated forest conservation areas for preservation of indigenous vegetation. Currently, the area faces serious environmental degradation due to population growth in the area. The forests are felled for farmland development, and many forest fires and/or land erosions are breaking out damaging environmental conditions. The Forestry commission, Ministry of Mine, Environment and Tourism, established a "Forest Management Plan" for the purpose of forest conservation intending to relocate all inhabitants in the forestland. The plan was not making smooth progress because of the inhabitants' opposition to the plan. Due to such pressure, the Government of Zimbabwe made a request to the Government of Japan in January, 1996 for a development study (master plan study: M/P) for the formulation of a management plan for the indigenous forests.

In response to the request, and against this back ground, a preparatory study team (for discussions on the S/W) was dispatched to Zimbabwe by JICA in February, 1999 which held discussions with the Forestry Commission (FC). As a result, it was agreed that the JICA and DFID would conduct a forest survey and a socioeconomic survey respectively and that the Forestry Commission would formulate a forest management plan based on the findings of these two surveys. Based on this agreement, the scope of work (S/W) describing details of the forest survey under the JICA study was concluded on 18 February 1999.

Meanwhile, the Department for International Development (DFID) of the UK conducted the preparatory phase of a project designed to secure the agreement of local inhabitants through the shared forest management (SFM) approach in the period from June to August, 1998.



## Objectives of the Study

- (1) A forest survey and other necessary surveys to identify the extent of forest resources and other information such as soil condition and existing woody coverage necessary for the formulation of a forest management plan.
- (2) To transfer relevant technologies to the counterpart personal through the study.



### Study Area

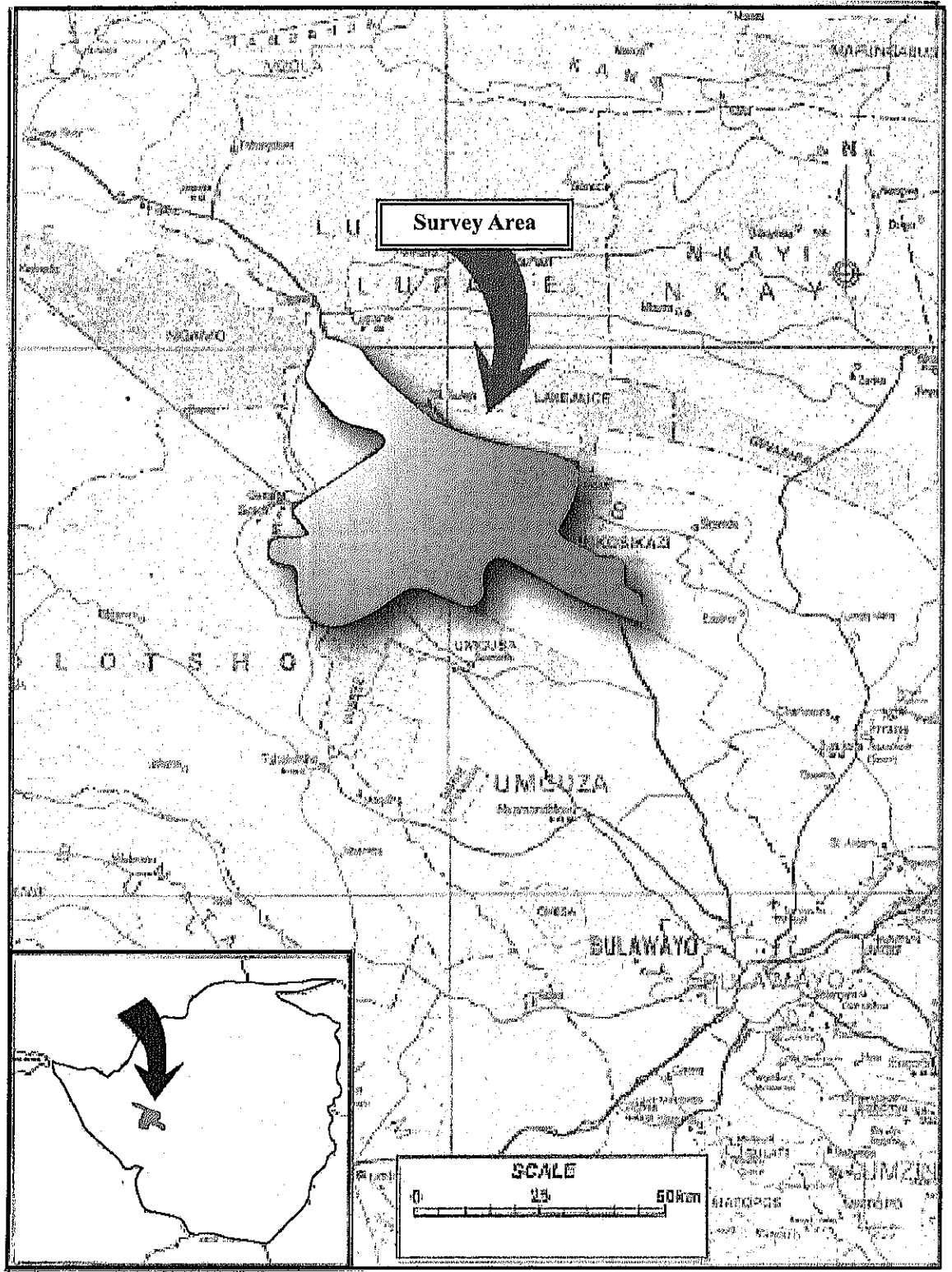
(1) Survey Area

The study targeting survey areas are the Gwaai Forest Land (144,000ha) and the Bembesi Forest Land (55,100ha), both of which are located about 150-200km northwest of Bulawayo City.

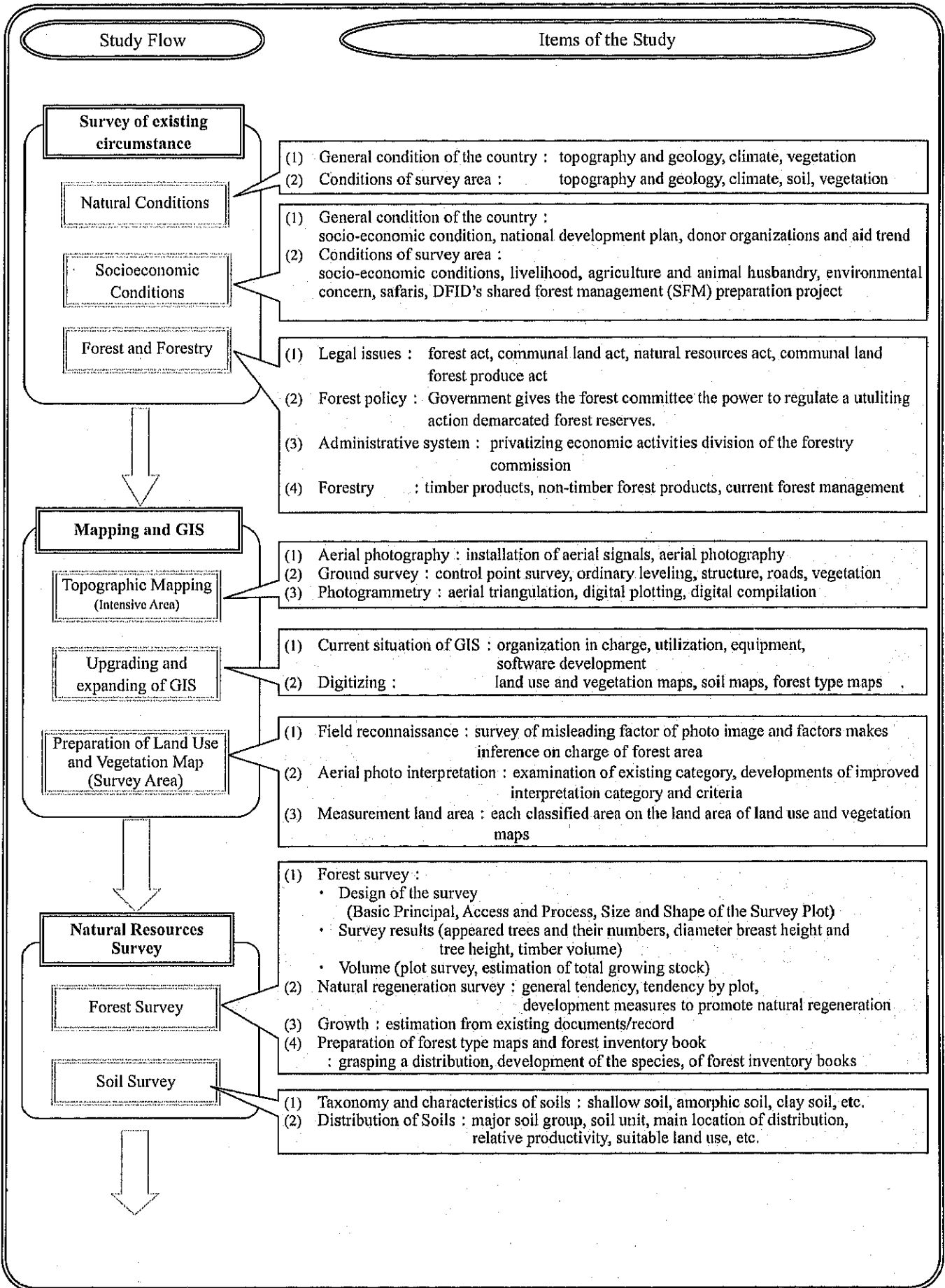
(2) Intensive Area

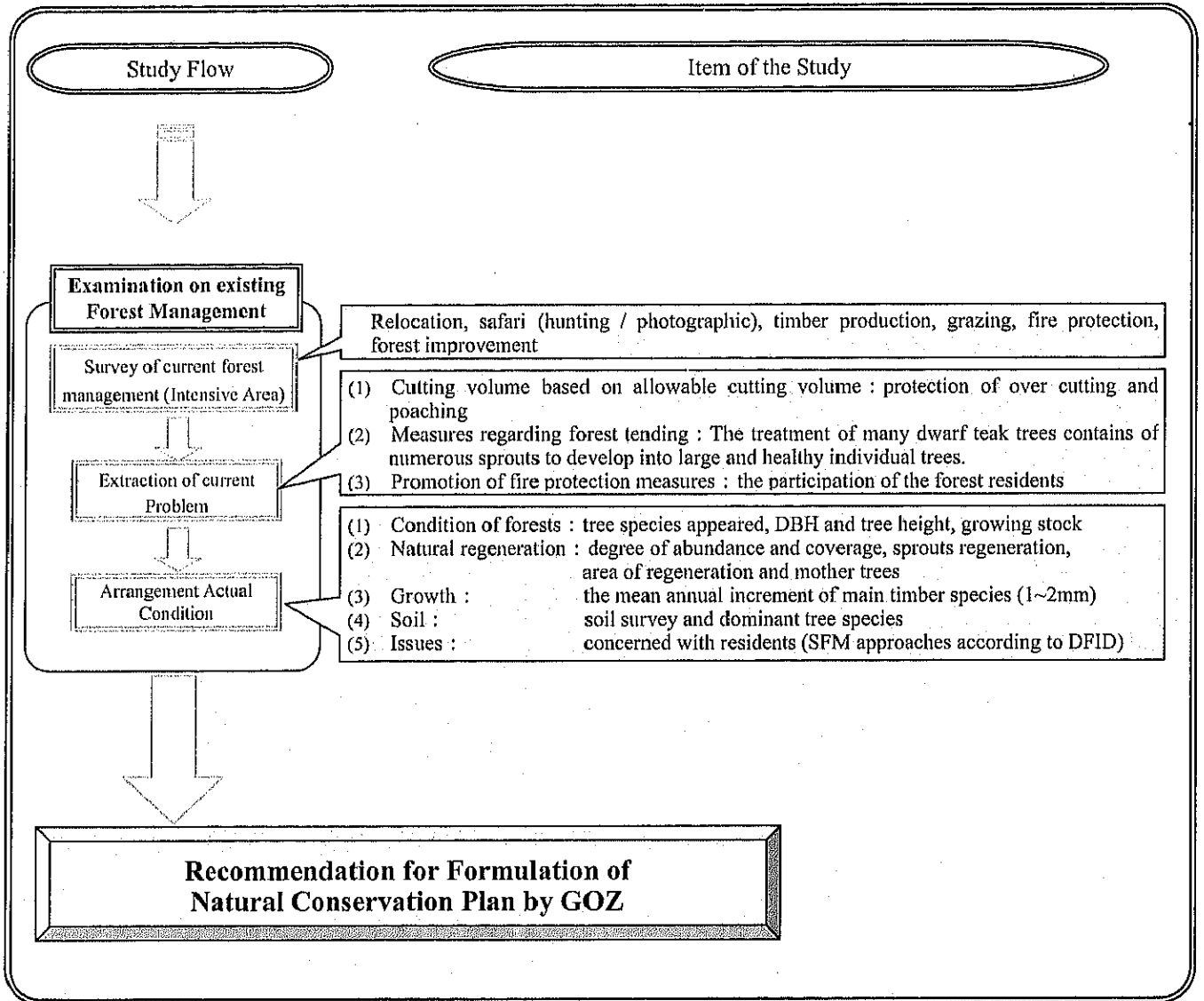
The Forestry Commission has established the Intensive area of 50,000 ha along the Victoria Falls Road and inside the Survey Area.

### Location Map



**Study Items and Flow**





## Major component of Existing Forest Management Plan

By Zone or General	Main Plan Content by Zone	Results of Phase 1 (1994 ~ 1999)	Plan for Phase2 (2000~2004)
<b>Bembesi Forest Land</b>			
A	a. Relocation	Moderate achievement.	The activities of Phase 1 will continue. Relocation is key issue
B	a. Consumptive safari* <sup>1</sup> (Hunting) b. Non-Consumptive safari * <sup>2</sup> (Photo)	Approximately 80% achievement.	The activities of Phase 1 will continue.
C	a. Timber production b. Grazing lease	Cutting targets were achieved, but only fences and boreholes were constructed for grazing lease.	Timber production had ended. Grazing lease will continue for relocated people.
General	Fire protection	Planned fire prevention and fire control activities were implemented.	Planned fire prevention and fire control activities will be improved.
General	Forest improvement	Planted area for 5 years total to 5 ha which is less than 2% of the planned planting area. Arboretum was not established. No research was conducted.	The activities of Phase 1 will continue. Research on thinning and regeneration will restart.
<b>Gwaii Forest Land</b>			
A	a. Hunting b. Photographic safari	Improved targets regarding bridges, game viewing platforms were achieved.	The activities of Phase 1 will continue.
B	a. Relocation	Plan contents are being implemented.	The activities of Phase 1 will continue.
C	a. Improvement of hunting safari site	Plan contents are being implemented. (The improvement work will start after finishing the end of relocation.).	The activities of Phase 1 will continue.
D	a. Grazing	Targets not achieved.	The activities of Phase 1 will continue.
E	a. Timber Production	Cutting was conducted in G, C and E blocks, amounting to some 27,000 m <sup>3</sup> more than the planned amount of 25,000 m <sup>3</sup> for 5years.	Grazing lease will be arranged for the people relocated. Additional planting or enrichment planting will be conducted.
F	a. Hunting	Targets almost achieved.	The activities of Phase 1 will continue. Incorporating grazing especially along the railway.
General	Fire protection	Planned fire prevention and fire control activities were implemented.	Planned fire prevention and fire control activities will be implemented.
General	Forest improvement	Arboretum was established. But research and seed count were not conducted.	Maintenance of arboretum Research plots will be established and surveyed. Implementation of seed counting

Note) \*<sup>1</sup> Consumptive safari : Hunting

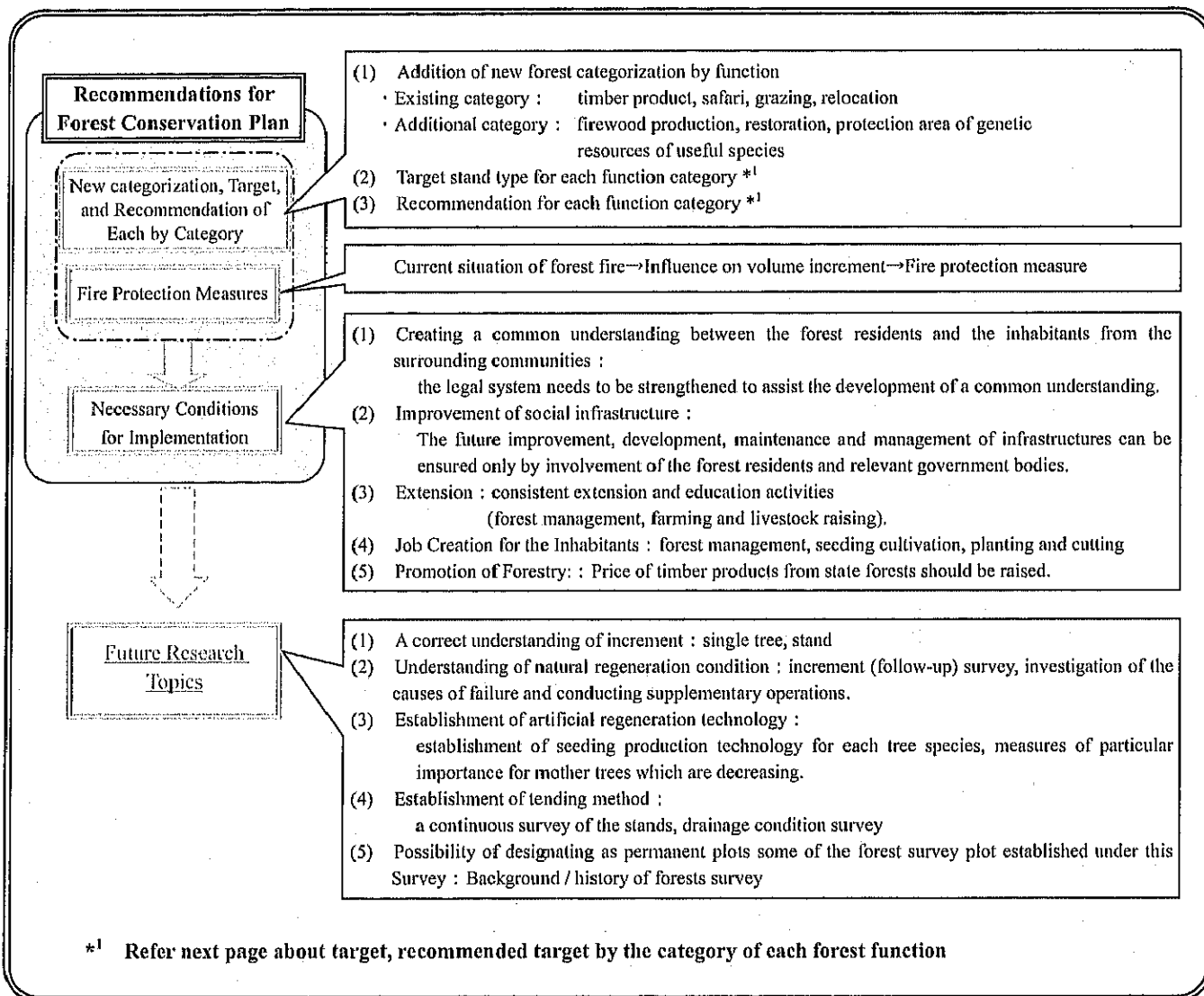
\*<sup>2</sup> Non-consumptive safari : Animal observation

## Recommendation for Formulation of Natural Conservation

### Summary of the Plan

- (1) Target Group : local inhabitants in intensive and survey areas
- (2) Overall Goal : formulation of natural conservation plan of Zimbabwe
- (3) Objectives of Support : sustainable exercitation of each forest facilities
- (4) Proposed of Support : target stand type for each function category, recommendation of forest management, setting of forest category
- (5) Expected Results : support and recommendation involving formulation of natural conservation plan
- (6) Implementation Period : modification of the period (5 years to 10 years, and review in every 5 year)

### Summary of the Recommendation and its Flow



## Recommended Target by the Category of each Forest Function

### Production Area

#### Timber production area

- (1) Content : Forests to be used for timber production
- (2) Target stand type : The stand will be uneven aged, will consist of useful tree species and will have a high ratio of good quality trees. The upper story trees will comprise trees reaching to usable DBH or of similar sizes. The stand will have good quality trees of DBH of at least 30cm or more.
- (3) Recommendation
- 1) **Prohibits cutting of good quality trees having a DBH of 30 cm or less**  
In order to conserve the total growing stock and to prevent the number of good quality trees have been from decreasing, formulation of guidelines to show duration of cutting cycle and cutting volume for each compartment will be indispensable for the forest conservation plan.
  - 2) **Clear marking and a strict supervision system for prevention of cutting mother trees, supplementary method for the natural regeneration**  
It is essential to preserve the stands containing a sizable number of mother trees of a high quality as protection area of genetic resources of useful species by demarcating such areas as compartments and to implement supplementary method for the natural regeneration.
  - 3) **Prohibits inhabitant and cultivation at Timber production forests**  
In order to prevent a factor to degrade and decrease those trees by elephant damage, it is necessary to create the comfortable living environment for elephants in the wildlife area, to restrict the range of activities within the wildlife area.

#### Grazing area

- (1) Content : Forests to be used for timber production and grazing.
- (2) Target stand type : The same stand type as timber production area besides grazing.
- (3) Recommendation :
- 1) **Prevention of cattle poisoning**  
Though there is a poisonous grass species that kills the cattle when eaten, it is possible to prevent cattle poisoning by advising the persons involved to remove the poisonous grass species before grazing.
  - 2) **Mitigating the spread of fire by grazing**  
If cattle are grazed in the forests, it will have certain positive effects such as reducing the fuel load and thus mitigating the spread of fire. Additionally, the cattleman may discover fire accidents and participate in fire fighting.
  - 3) **Providing livestock drinking water facilities**  
In order to promote grazing in the forest, it is necessary to provide livestock drinking water facilities.

#### Firewood production area

- (1) Content : Forests to be used mainly for firewood production. Grazing and farming will be allowed to some extent.
- (2) Target stand type : The stand where selective coppice system will be applied to firewood trees. A coppice stand having a DBH of 10cm or more would be preferred. To the certain extent, grazing and farming will be allowed within the area.
- (3) Recommendation :
- 1) **Calculation of cutting interval**  
Many trees of DBH less than 10cm are cut for firewood. To maintain a high level of biological productivity and to promote energy efficiency, it would be desirable to grow stands to be cut at DBH of some 10 cm.
  - 2) **Clearly demarcated**  
This area of firewood production stand should be calculated by considering factors such as the history of land use, soil condition and population of approved inhabitants, and should be clearly demarcated.

Restoration area
------------------

- (1) Content : Targeted forests composed by Dwarf teak stands, which will be incorporated into the timber production area after developing to woodland.
- (2) Target stand type : After restoration, the target stand type will be the same as the timber production area.
- (3) Recommendation :
  - **Restoration of the original stands**

It is said that the low height of dwarf teak forest is evidently a result of repeated forest fires. So as to restore the original stands, it is essential to prune low quality sprouts and to leave only a few sprouts of good quality.

Safari area
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- (1) Contents : Forests to protect wild life and to be used for recreation hunting and photographic safari purposes.
- (2) Target stand type : The stand will be kept under the natural condition unless there is a specific reason to act otherwise.
- (3) Recommendation :
  - **Establishment of core zone & buffer zone**

In principal the safari area should be protected as for conservation of indigenous forest. It is important to protect the subject area as a core zone while taking the vicinities into account as buffer zone. In the buffer zone arrangements to minimize cutting activities will be required when the timber production is undertaken. From the viewpoints of both humans and wild animals settlement and farming should be prohibited in the buffer zone.

Protection area of genetic resources of useful species
--

- (1) Contents : Areas to protect genetic resources of useful but scarce tree species.
- (2) Target stand type : The high trees with good quality and their young regeneration should grow together.
- (3) Recommendation :
  - 1) **Protection of Good quality mother trees & Designation as protection area**

A high quality tree had been cut preferentially. This has resulted in a significant decrease in the number of these trees species and their young tree for regeneration. Areas where these decreases significantly occur should be preserved as protection area in order to preserve useful species and prevent genetic degradation. In the protection area, area where good quality mother trees are remaining should be demarcated and designated as protection area.

  - 2) **Removing trees of undesirable phenotype & Prohibition of needless and commercial cutting**

An operation to leave individual trees having better phenotype by removing the trees of undesirable phenotype would conform to the consideration of good genetic qualities. A commercial cutting (including needless cutting) should be prohibited.

Soil and water conservation area
----------------------------------

- (1) Contents : Area to conserve the headwaters and drainage systems from soil erosion and water discharge.
- (2) Target stand type : The stand will be kept under the natural condition unless there is a specific reason to act otherwise.
- (3) Recommendation :
  - **Principal of prohibiting cutting of forest along rivers in principal**

Riverside forests are designated as Water and Soil Conservation area. Further careful consideration is recommended regarding the riverside forests to determine whether to adopt special long narrow forest compartment along with river or prepar riverside forest compartment in the block.

Notes) It is important to organize the functions to coexist or tune without detriment to each function by taking mutual relationships between them into account.

<h2 style="margin: 0;">The Study on car Cartography, Inventory and Management of Classified Forest in Northern Area</h2>	Counterpart Agency	National Center for Remote Sensing and Forest Cover Monitoring, Department of Forest and Natural Resources, Ministry of Rural Development, the Republic of Benin
	Consultant Company	Japan Forest Technical Association / Aero Asahi Corporation / Sanyu Consultants INC.
	Team Leader	Yutaka TAGUCHI
	Study Period	1998.10~2000.11
	Study Type	Master Plan

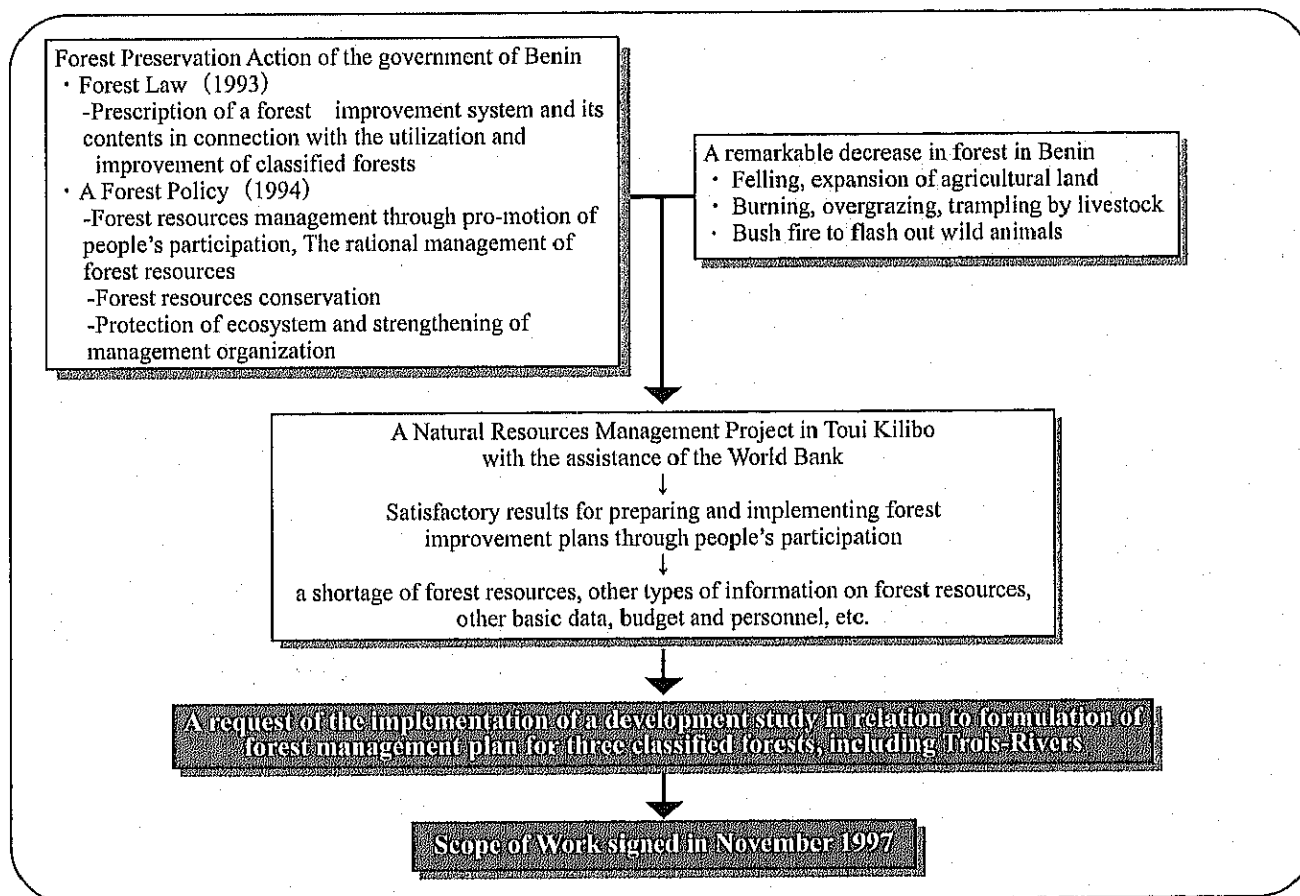
### Background of the Study

In Benin, a remarkable decrease in forest is conspicuous in recent years due to the main causes of which are said to be felling, expansion of agricultural land, burning, overgrazing, trampling by livestock, bush fire to flush out wild animals, etc., has been carried out under the pressure of an increasing population.

To deal with this situation, the government of Benin enacted the Forest Law in 1993, which prescribes a forest improvement system and its contents in connection with the utilization and improvement of classified forests. Subsequently, the government adopted a forest policy in 1994 the main pillars of which are forest resources management through promotion of people's participation, the rational management of forest resources, forest resources conservation, protection of ecosystem and strengthening of management organization.

In order to implement the policy, a Natural Resources Management Project (PGRN) with the assistance of the World Bank is being implemented in Toui Kilibo classified forest with satisfactory results for preparing and implementing forest improvement plants through people's participation.

Under the above background, the Government of Benin requested the assistance of the Government of Japan for the implementation of a development study in relation to formulation of forest management plan for three classified forests, including Trois-Rivers. In response to the request, the Government of Japan sent the Preparatory Study Team (S/W discussion) to Benin. This Study had been implemented based on the Scope of Work (S/W) signed between the Preparatory Study Team and Government of Benin in November 1997.



### Objective(s) of the Study

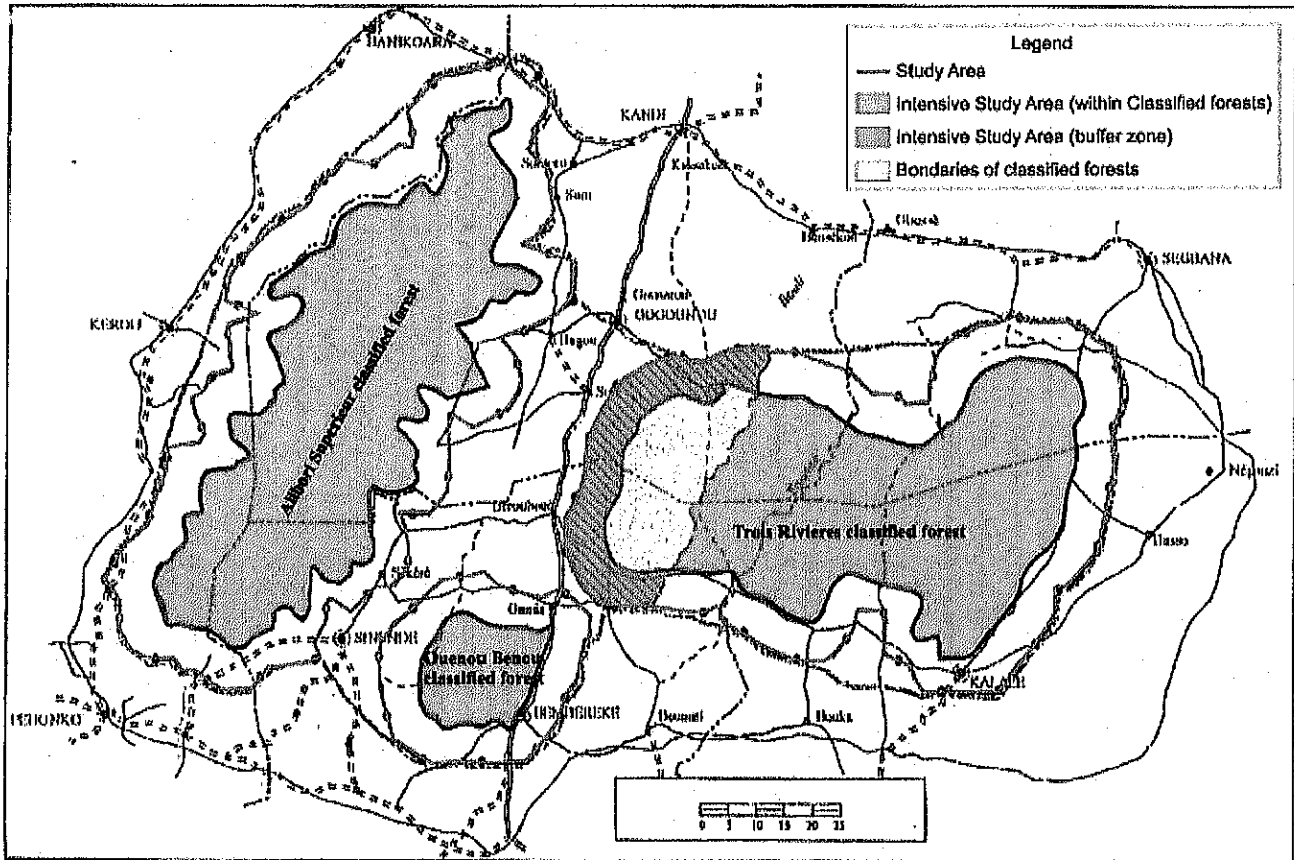
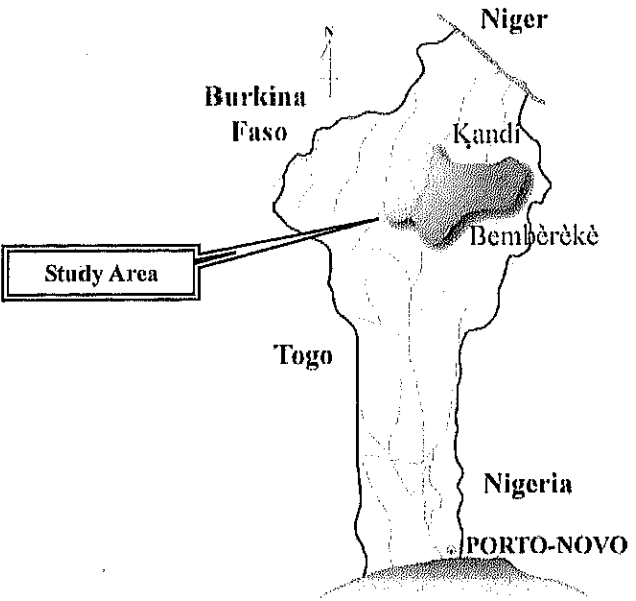
- (1) To provide basic information on the forests and to formulate a forest management plan through people's participation in the three classified forests in the northern area of Benin in order to prevent the progress of savanna in the area
- (2) To transfer relevant technologies to the counterpart personal through the study.



**Study Area**

- (1) Study Area  
The area consists of three classified forests in the northern part of Benin such as Trois Rivières classified forest, Ouenou Benou and Alibori upper stream classified forests, totaling to about 550,000 ha, and their surrounding area 7 km wide buffer zone.
- (2) Intensive Study Area ( for formulation of a forest management plan )  
Within the Study Area, an Intensive Study Area was established covering a part of western side of Trois Rivières classified forest, which is about 46,000 ha, and the surrounding buffer zone.

**Location Map**



## Study Items and Flow

### Study Flow

Survey of Study Area



Baseline Assessment



Development of Forest Management Basic Plan on the assumption of participation of local



Survey of Intensive Study Area



Baseline Assessment



Identification of the Problem to prepare Forest Management Plan



Development of Forest Management Plan



Formulation of Forest Management Plan for Intensive Area and Recommendation

### Items of the Study

- (1) General conditions
  - Survey of natural conditions : location, weather, topography, geology, soil, water system, vegetation
  - Survey of socio-economic conditions : population, industry, land ownership system, villager's organization, living infrastructure
  - Agriculture and livestock raising : characteristics of each area, agriculture production, livestock industry, sources of livestock fodder, distribution and processing of agricultural products, support services for agriculture
  - Forest and forestry : forest resources, timber production, afforestation, forest utilization, forest fire, timber processing and sale, forest management
- (2) Aerial photography : covering some 1,200,00 ha area, including the study area located in the north of Benin
- (3) Land use and vegetation survey : enlargement of existing topographical maps, preparation land use and vegetation maps
- (4) Survey to ascertain the Actual state of the local inhabitants (first part)
  - Survey of actual conditions of the village : population, population distribution by Ethnic group, immigration, land utilization
  - living conditions of local inhabitant : household size, education level, income and expenditure, living condition, major economic activities, forest utilization
- (5) Initial environmental examination : survey of natural and social environments of the study areas, evaluation of environmental items, survey of environmental elements to be considered for plan preparation

- (1) Preparation of topography maps : land survey, aerial triangulation, digital mapping, editing figures
- (2) Forest survey : preliminary survey, interpretation of aerial photographs, creation of Forest type maps, sampling survey, creation of forest inventory books
- (3) Soil survey : soil classification, soil distribution, land use by soil conditions
- (4) Farming and stock raising survey
  - Farming : ownership of farmland, planted extent and trends, estimated area of land for growing food crop for self sufficiency, farming population, farm production, present statement of farming
  - Livestock raising : number of main livestock, livestock raising system
- (5) Forest and forestry survey : logging, regeneration methods, age at maturity / cutting cycle, forest fires, forest management system / organization
- (6) Community forest survey : fuel wood production, seeding production, fruit trees, bee-keeping, Fish breeding, processing of forest products
- (7) Survey to ascertain the actual state of the local inhabitants (second part) : village mapping, key informant interviews, seasonal labor calendar and household economy, group discussion
- (8) Workshop with villagers :
  - (first part) explanation of the necessity of a forest management plan, presentation and discussions of the basic concept
  - (second part) response to the opinions of the local inhabitants, formulation of the plan, causes of social restrictions on the implementation of the forest improvement plan
- (9) Establishing the boundaries of the classified forest : verification of areas where boundaries are to be established, staking act of landmarks, implementation of the staking act

- (1) Classified forest plan : setting goals, zoning (forest zone, Silivi-Pastral zone, village forestry zone, buffer zone), improvement standards, improvement plans
- (2) Buffer zone management plan : agroforestry in areas of cultivated land and fallow ground, bee-keeping, charcoal production
- (3) Living environmental improvement plan : facilities for livestock, facilities for local promotion (road, wells, schools, health care center, etc.)
- (4) Plans for management, administration and maintenance : organizations, forest improvement fund
- (5) Plans for the implementation of projects : formulation, signing contract and effectuation of forest improvement plan, implementation of forest improvement projects, operation cost
- (6) Extension and training plan : nurseries, bee-keeping, charcoal production, commercial farming

## Outline of the Plan

### Summary of the Plan

- (1) Target Group : local inhabitants in Intensive study area
- (2) Overall Goal : to prevent degradation of classified forest by local inhabitant, rational management together with local inhabitant
- (3) Objectives of the Plan(s) : a formulation of forest management plan in order to ease the pressure of livestock farming, and forestry on farming and participatory forest management with local inhabitant
- (4) Proposed Plan(s) : development of forest management plan
- (5) Main Project(s) : classified forest plan, buffer zone management plan, living environment improvement plan, plans for management, administration and maintenance, implementation plan, extension and training plans
- (6) Expected Result(s) :  
 1) a conservation of water resource forest  
 2) maintenance and improvement of the forest productivity  
 3) a change from shifting extensive cultivation to intensive settled cultivation  
 4) a change from extensive grazing to intensive animal husbandry
- (7) Implementation Period : 10 years

### Target Area & the Plan

(Unit : ha)

Target Area	Management Unit (district)	Improvement Unit	Classified Forest	Buffer Zone	Total
	GOGOUNOU	ZOUGOU-PANTROSSI	11,518	13,998	25,516
		WESSENE	13,179	6,563	19,742
		PIGOUROU	8,506	9,277	17,783
		Sub Total	33,203	29,838	63,041
	BEMBEREKE	KANBANOU	10,054	9,222	19,276
		MANI-BOKE	8,324	12,561	20,885
		Sub Total	18,378	21,783	40,161
Total			51,581	51,621	103,202

### Improvement Plan of Classified Forest

- (1) Conservation forest plan : for public benefit function of forest such as the fostering of water sources and forest conservation
- (2) Production forest plan : production of timber
- (3) Silvi-Pastoral plan : the transition from the style of extensive grazing to intensive gathering
- (4) Village forestry plan : land preparation plan, commercial farming, plan of planting by distribution
- (5) Forest roads : for operation in the production forest & management of conservation forest
- (6) Nurseries : production of seedlings to be planted in areas of production forest, conservation forest, and for boundary planting
- (7) Forest protection : controlling forest fires  
(high density planting of fire-resistant tree species)
- (8) Forest improvement center : the promotion of forest improvement, encouraging forest management cooperation between the DFRN and local inhabitants (by each improvement unit)

### Buffer Zone Management Plan

- (1) Agroforestry in areas of cultivated and fallow land : change cultivation species toward size of cultivation area
- (2) Beekeeping : planting as boundaries and prevention from spreading fire, set beehives
- (3) Charcoal production : prevention of illegal felling, establishment of a simple charcoal kiln to each village

**Living Environment  
Improvement Plan**

- (1) Facilities for Livestock :  
water holes and health care facilities for livestock
- (2) Facilities for improvement of local livelihood :  
road, storage facilities for agricultural products, wells, health care center, schools, woman's center

**Plans for Management,  
Administration and**

- (1) Organization of local inhabitants :  
forestry management communication council, forest management council, forest improvement unit committee, zone group (forestry zone group, Silvi-Pastoral zone group, village forestry zone group, buffer zone group)
- (2) Forest improvement fund :  
income from timber production at the production forest, income from levies from beneficiaries, income from nurturing the conservation forest, income from timber production in the village forestry zone and Silvi-Pastoral zone

**Plans for Implementation**

- (1) Formulation, signing of contract and effectuation of forest improvement plan :  
consultation among the DFRN, NGO and organization of local inhabitants
- (2) Implementation of forest improvement projects :  
improvement activity of lifestyle, participation of the local inhabitants to the projects
- (3) Preliminary cost estimation :  
infrastructure improvement costs, classified forest improvement costs, forest improvement activities costs

**Extension and Training Plans**

- (1) Nurseries : training by experts from the DFRN
- (2) Bee-keeping : introduce modern bee-keeping system, assistance by the NGO Bee-keeping Center
- (3) Charcoal Production : introduction of a simple charcoal kiln
- (4) Commercial Farming : pilot farm by advanced model farmers, exchange of techniques with farmers in leading areas
- (5) Livestock farming : breeding and propagation methods and management, improvement of business management of animal husbandry

**Flow of Project Implementation**

A preparation of frame work for improvement plan (DFRN)



Formulation of villagers' organization, holding of Workshops. Solutions following the presentation of concept of the improvement plan

Determination of activities concerning committees to be involved in the implementation of the plan and preparation of preliminary improvement plan be proposed to the local inhabitants



Presentation of the preliminary plan to the local inhabitants, review and formulation of improvement plans



Submission of a completed forest improvement plan to the cabinet

A contract signing between the Minister of Rural Development, the DFRN and the representative of the local inhabitants

## Organization Structure

Forestry

Provinces

Recognition  
advice  
arbitrating

Collating the  
annual plans

### Forest Management Communication Council (Provincial Level)

**Member:** Chairman, chief of DFPN, representatives from provincial government, chief of the agriculture administration Bureau's farmers organization support bureau

**Roles:**

- Collation of the annual work plans for each forest management unit into a single classified area and giving approval to such plans
- Following up of planned activities and the giving of necessary advice
- The arbitration of disputes among forest management units

Districts

Following-up activities  
controlling activities  
advice  
arbitrating

### Forest Management Council (District Level)

**Member:** Representative from each forest management unit committee (2), representative from each commune, representative from the district level DFRN, representative from district, representative from the agriculture administration bureau district office.

**Roles:**

- Collating the annual work plans of each improvement unit to formulate annual work plans for the forest management unit level and submitting them to them forest management communication council.
- Following up and controlling the activities planned in the annual work plans as well as giving advice as necessary
- Arbitrating disputes between forest improvement units

**Executives:** Chairman, secretary, accountant, forest management fund officer, and activity officer (Select from among other than government related persons.)

**Audits:** Outside specialized NGO (once every six months)

Settlements

Following-up survey  
advice  
arbitrating

### Forest Improvement Committee (Settlement Level)

**Member:** 2 representatives from each of the four zone blocks, elderly representative, Delege(Village chief), on-site forestry office, agricultural administration bureau forest improvement fund officer

**Roles:**

- Preparation of user's register by zone and revision of such as necessary
- Formulation of annual work plans based on forest improvement plan. The annual work plan states who does the work and when they should be done
- Organization and implementation of planned activities and follow-up surveys.
- Collection and payment of charge for the forest improvement fund
- Function as a go-between government organization, NGO's and villagers with regard to forest improvement fund.
- Arbitration of disputes between zones.

**Executives:** Chairman, secretary, accountant, dispute officer, forestry development officer, forest preservation officer, commercial farming improvement officer, livestock farming improvement officer, income improvement activity officer

Zone Groups

### Zone Groups

**Forestry Zone Group:** Production, planting, and nurturing, etc.

**Silvi-Pastoral Zone Group:** Improve livestock farming (Management of early controlled burning and the maintenance of water holes for livestock), unregistered grazing shall be also monitored

**Village Forestry Zone Group:** Preparation of the land for cultivation and improvement activities for commercial farming, planting fruits trees and timber for charcoal

**Buffer Zone Group:** Management, training regarding the improvement of commercial farming

**Roles :**

- Preparation of user's registers by zone (Someone assigned by the forest improvement unit committee)
- Function as a go-between users and forest improvement unit committees
- Organization and implementation of work
- Arbitration of small disputes among users

**Executives :** Delegate director, assistant, director for disputes

# Implementation Schedule

		Activity	Work	Implementing Body			Year										
				DER N	Inhabitants	Others	Preparation Period	1-3 (Preparation)	4	5	6	7	8	9	10		
All Zones	Management for Organizations of Inhabitants	Establishment of Forest Improvement Committee			○		△										
		Preparation of Resident Register			○	○	△										
		Formulation, Contracting & Issuance of Plans			○	○		△									
		Village Nurseries	5		○	○			■								
		Seeding Production in Village Nurseries				○			■	■	■	■	■	■	■	■	■
	Infrastructure Improvement	Access Road	9km		○		○		■								
		Establishment of Forest Road	54.9km		○		○		■	■	■	■	■	■	■	■	■
		Construction of Watchtowers	5		○		○		■								
		Forest Improvement Centers	5		○		○		■								
		Simple Charcoal Kilns	10		○		○		■						■	■	■
	Classified Forest Improvement	Establishment of Classified Forest Boundaries	64.7km		○		○		■	■	■	■	■	■	■	■	■
		Establishment of Boundaries of Zones and Improvement Unit	150.4km		○		○		■	■	■	■	■	■	■	■	■
		Timber Production in Village Forestry & Silvi-Pastoral Zone	3,119ha		○		○		■	■	■	■	■	■	■	■	■
		Establishment of Compartment Boundaries			○				■	■	■	■	■	■	■	■	■
		Planting for Firebreak Belt and Along Classified Forest Boundaries	107ha		○		○		■	■	■	■	■	■	■	■	■
Transfer of People Carrying out Cultivation					○			■	■	■	■	■	■	■	■	■	
New Planting		685ha		○		○		■	■	■	■	■	■	■	■	■	
Conservation Forest Zone	Enrichment	7,095ha		○		○		■	■	■	■	■	■	■	■	■	
	Production Forest Zone	Transfer of People Carrying out Cultivation			○			■	■	■	■	■	■	■	■	■	
		Timber Forest (Felling, Regeneration, Enrichment)	5,100ha		○				■	■	■	■	■	■	■	■	
Forest Improvement Activity	New Planting Direct Sowing	1,464ha		○				■	■	■	■	■	■	■	■	■	
	Felling, Regeneration	7,731ha		○				■	■	■	■	■	■	■	■	■	
	Village Forestry Zone	Establishment of Areas for Cultivation	5,005ha		○		○		■	■	■	■	■	■	■	■	■
Improvement of Land for Cultivation		1,960ha			○			■	■	■	■	■	■	■	■	■	
Improvement of Land for Cultivation for Transferred					○			■	■	■	■	■	■	■	■	■	
Planting(Fuelwood/Fruit)		1,960ha			○			■	■	■	■	■	■	■	■	■	
Planting of Trees Around Cultivated Areas		502ha			○			■	■	■	■	■	■	■	■	■	
Planting of Bells of Fire Resistant Trees and Boundaries		2,000ha			○			■	■	■	■	■	■	■	■	■	
Silvi-Pastoral Zone	Transfer of People Carrying out Cultivation				○			■	■	■	■	■	■	■	■	■	
	Creation of Pasture	2,368ha			○			■	■	■	■	■	■	■	■	■	
	Improvement of Pasture	5,603ha			○			■	■	■	■	■	■	■	■	■	
	Creation of Reservoirs and Dams	6 locations			○			■	■	■	■	■	■	■	■	■	
Regional Promotion	Beekeeping				○			■	■	■	■	■	■	■	■	■	
	Charcoal Production				○			■	■	■	■	■	■	■	■	■	
Extension and Training	Extension			○		○		■	■	■	■	■	■	■	■	■	
	Education / Trainings			○		○		■	■	■	■	■	■	■	■	■	
	Literacy Education					○		■	■	■	■	■	■	■	■	■	
Living Environment	Road	48.5km		○		○		■	■	■	■	■	■	■	■	■	
	Storage for Crops	5 unit		○		○		■	■	■	■	■	■	■	■	■	
	Creation of Reservoirs/Dam on Bouli	2 Locations		○		○		■	■	■	■	■	■	■	■	■	

## Project Costs

(Unit : 1 million FCFA (1FCFA=¥0.1562 as of June 1, 2000))

Fiscal Year		1	2	3	4	5	6	7	8	9	10	Total	
Initial Investment	Infrastructure Improvement Costs		253	705	198	111	111	111	111	111	111	1,930	
	Classified Forest Improvement Costs	Conservation Forest Restoration				116	116	116	93				440
		Planting of Boundaries and Belts of Fire-Resistant Trees			5								5
		Establishment of Boundaries	51	33									83
	<b>Total</b>		<b>304</b>	<b>736</b>	<b>203</b>	<b>226</b>	<b>226</b>	<b>226</b>	<b>203</b>	<b>111</b>	<b>111</b>	<b>111</b>	<b>2,459</b>
Forest Improvement Fund	Income		237	237	287	287	287	287	287	287	307	2,785	
	Fees from Beneficiaries				4	7	7	7	7	36	36	36	140
	Loans				109	120	120	120	120	120	120	120	952
	<b>Total Income</b>		<b>237</b>	<b>237</b>	<b>399</b>	<b>414</b>	<b>414</b>	<b>414</b>	<b>414</b>	<b>443</b>	<b>443</b>	<b>463</b>	<b>3,878</b>
	Expenditure		172	172									345
	Timber Production Costs	Village Forestry Zone / SP Zone											
		Production Forest			209	209	209	209	209	209	209	213	1,675
		Enrichment				12	12	12	12	12	12	12	81
	Production Forest Planting Costs	New Planting in Fuelwood Forest			109	109	109	109	109	109	109	109	871
		Subtotal			109	120	120	120	120	120	120	120	952
		Enrichment Preparation Fund				12	12	12	12	12	12	12	81
	Fuelwood Forest New Planting Preparation Fund				22	22	22	22	22	22	22	22	174
	Planting Cost Repayments				22	24	24	24	24	24	24	24	190
	Management / Operating Costs		23	23	23	23	23	23	23	23	23	23	226
	<b>Subtotal</b>		<b>195</b>	<b>195</b>	<b>384</b>	<b>409</b>	<b>409</b>	<b>409</b>	<b>409</b>	<b>409</b>	<b>409</b>	<b>413</b>	<b>3,643</b>
National Forest Fund		4	4	1							1	11	
Management Costs for Organizations of Local Inhabitants	Preparation Fund	37	37	14	3	3	3	3	27	27	41	224	
	Fee Collection Costs			1	1	1	1	1	7	7	7	28	
	<b>Total</b>	<b>37</b>	<b>37</b>	<b>14</b>	<b>5</b>	<b>5</b>	<b>5</b>	<b>5</b>	<b>34</b>	<b>34</b>	<b>49</b>	<b>224</b>	
<b>Total Expenditure</b>		<b>37</b>	<b>37</b>	<b>399</b>	<b>414</b>	<b>414</b>	<b>414</b>	<b>414</b>	<b>443</b>	<b>443</b>	<b>463</b>	<b>3,877</b>	
Balance		0	0	0	0	0	0	0	0	0	0	0	

## Operation and Maintenance Costs

<Expenditures>	<Financial Sources>
(1) Repayment of loans	1/5 of annual planting costs will be repaid each year
(2) Enrichment of timber forest and fuelwood forest	An enrichment preparation fund shall be formed each year after the start of activities in the fourth year
(3) Fuelwood Forest Planting	A fuelwood forest planting preparation fund shall be formed each year after the start of activities in the fourth year
(4) Forest Improvement and National Forest Fund	Income from the sale of timber
(5) Management Costs associated with Organization of Local Inhabitants	A preparation fund shall be established.

## Recommendations

- (1) **Operating an organization with the aim of forest conservation by local inhabitants' involvement**  
It is recommended that special technician should support local organization by leading or giving advice becomes the organization objected to forest conservation have no experience on the project implementation. (The formulation and implementation of annual work plans, and with regard to the collection of payments to the Forest Improvement Fund, the management of savings and the preparation of budgets ,etc.)
- (2) **Changes from extensive production system to intensive production measures**  
It is required to change production system from extensive to intensive measures because of limited land area. Therefore, the DFRN, the Agriculture Administration Bureau, and NGOs shall carry out extension activities and training regarding implementation of new technology. The cost of initial term shall be paid by the government of Benin.
- (3) **The development of income generation for woman**  
It is recommended to promote projects such as beekeeping, livestock, raising, soap production, and karite butter, etc for women's income generation. The project budget shall be landed loans by CLAM, micro-credit, or government assistance.
- (4) **Support activities of organization of local inhabitants**  
It is recommended to arrange assistance by animations of NGOs to the organization
- (5) **Relocation and settlement of local inhabitants to village forestry zone and development their self sustainable agriculture on time**  
The very first priority is to established areas for relocated local inhabitants by staking out landmark, establish the boundaries of the classified forest, establish the boundaries of each improvement unit and zone, and carry out activities such as the logging, etc. So the government of Benin shall make an expends budgets
- (6) **Initial investment for infrastructures' construction of the improvement project**  
It is recommend to fund raising of Infrastructure Improvement as soon as possible (The government of Benin, the assistance of foreign aid state forest fund)
- (7) **Repletion of the basic data for implementation of concerning project**  
Forest activities, commercial farming improvement, and silvi-pastoral (establishment of local permanent experimental sites, etc.)

## Watershed Management Plan in Mantasoa and Tsiacompaniry Region

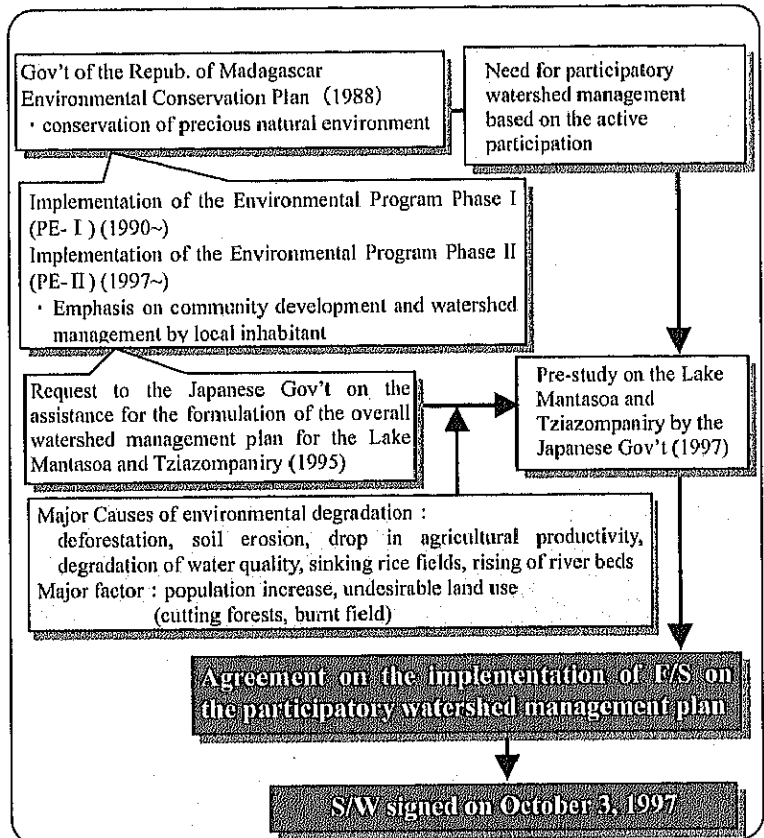
Counterpart	Ministry of Water and Forestry
Consultant Company	Japan Overseas Forestry Consultants Association
Team Leader	Tsutomu HANDA
Study Period	1998.4~2000.9
Type of Study	Feasibility Study, Pilot Study

### Background of the Study

The Republic of Madagascar is an insular country considered very important from a biological viewpoint due to the presence of various and highly endemic animal and vegetation species. In order to safeguard this precious natural environment, the Malagasy Government established a 15-year Environmental Program in 1988, subdivided into three phases of five years each. Phase II of the Environmental Program (PE-II) started in 1997, was focused on regional development and participation in the watershed management.

In December 1995, the Malagasy Government submitted a request to the Japanese Government for conducting a development study concerning the establishment of an overall management plan for watersheds in the Mantasoa/Tsiacompaniry zone, located at around 60 kilometers south-east of the Antananarivo, the capital of the country. These watersheds are water resource for the capital and suffer from the environmental degradation such as the forest clearing, water quality problem triggered development pressure and the improper land use.

In response to the Malagasy request, the Japanese Government, through the Japanese International Cooperation Agency (JICA) sent a preparatory study team twice, in April and September 1997 to conduct a study in the zones concerned. Following this study, the Japanese Government made an agreement with the Malagasy Government to conduct a feasibility study (abbreviated hereinafter as F/S) for the plan to develop the watersheds. The present study was carried out based on this survey, according to the scope of works (S/W) and the minutes signed on October 3, 1997 between the Japanese International Cooperation Agency and the Ministry of Water and Forests.



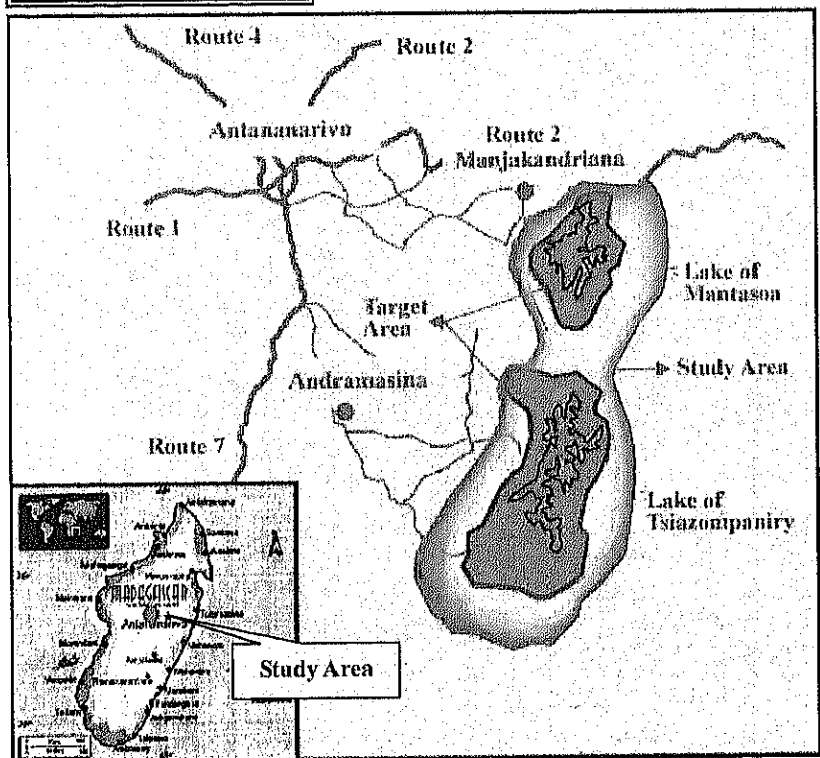
### Objectives of the Study

- (1) To implement a Feasibility Study on the formulation of the participatory watershed management plan
- (2) To transfer related technology to the counterpart agency through the study

### Study Area

- (1) Study Area, : Catchment area of the lakes mentioned below and its surrounding area (aprox. 90,000ha)
- (2) Target Area, : Catchment areas of the Lake Mantasoa and Lake Tsiacompaniry (aprox. 50,000ha)
- (3) Pilot Study Area, : Four selected village in the watershed ( Andrefanivorona Vil., Ambohimanjaka Vil., Angodongodona Vil., Analamihotra Vil.)

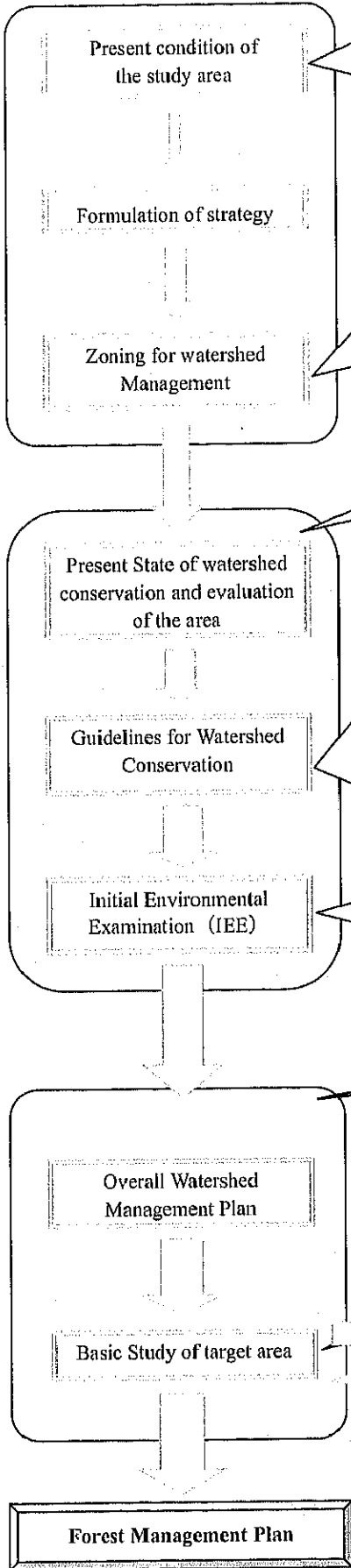
### Location Map





# Study Items and Flow

## Study Flow



## Items of the Study

- (1) aerial Photographs of the study area (1:20,000)
- (2) collection and analysis of existing data and in-situ survey
- (3) establishment of topographical map for the target area
- (4) establishment of maps for land use and the vegetation in the study area
- (5) clearing of obstacles for watershed conservation, including identification of the causes of these obstacles

- (1) Area for the participatory management of watersheds  
Area recommended for the villagers to develop their watersheds through their production activities. Formulating a plan through participation approach and adequate advice in implementing projects are required. Pilot studies were carried out at four model villages in the watershed, in order to make the watershed management plan more feasible.
- (2) Forest conservation zone  
Area where villagers' access for daily activities is limited. Strongly recommended as a forest for the water resources. Implementing agency should be the Ministry of Water and Forests.

Criteria : water resource conservation and landslide hazard

### Guidelines for Watershed conservation

- (1) Area for the participatory management of watersheds  
 Mantanoa Area : ①Erosion Control by cultivation method, ②increase of forestation rate at the southern zone and the elusion of cultivation on steep slope, ③Not suitable for cultivation in northern zone  
 Tsiacompaniry Area : ①protection of natural forest at valley head, ②prioritized plantation at valley head, ③the elusion of cultivation at steep slope etc.
- (2) Forest conservation zone  
 Mantanoa Area : Pine forest at east, natural forest at east, capable of Water conservation and soil erosion control, Philipia shrub (natural forest cover) is suitable for forest fire prevention. Promote natural regeneration.  
 Tsiacompaniry Area : existence of natural forest, high potential for soil and water conservation, precious water fouling habitat, active reforestation and limit to prohibit cutting ZODAFARB area.  
 ※ZODAFARB : The program which is transfer national forests to local inhabitants subject to afforestation.

Preliminary survey on potential impact on the activities of participatory watershed management plan

- (1) activity items of the watershed management plan
- (2) overview of the environment of the planning area
- (3) potential impact on each environmental items

Basic Objectives: Healthy use of land for the environment

- (1) Survey and Analysis of natural conditions such as geomorphology, geology, soil, climate, vegetation, forestation activity, land use etc.
- (2) Socio-Economic Survey in related community (administrative divisions, population, living conditions, traffic, industries in the area, agriculture, commuting farming and migration, dissemination of family planing, Organization for agricultural extension, land ownership, questionnaire )

Implementation of Pilot Study

Evaluation of pilot project

Forest Management Plan

Participatory Watershed Management Plan

**Object of Pilot Study**

The study aims to formulate a participatory watershed management plan in the target area. Based on the results and evaluation of PS projects, participatory watershed plan was examined which aims to improve the villagers' lives. Four villages in the watershed zone were selected.

**Method of Pilot Study**

- (1) Zone (considering natural and socioeconomic condition )
  - A : Zone with few hamlets and many low/unused areas, with increasing afforestation.
  - B : Zone with statue housing sites, mainly occupied by hotels and secondary residences.
  - C : Zone with intensive and increasing use of the land, and active afforestation.
  - D : Zone under the control of the Ministry of Land Management, where land is used by the villagers and presently being privatized; zone with few hamlets and where use of the land is extensive.
  - E : Forest conservation zone under the control of the Ministry of Water and Forests, with immigrants and established farm area by the western part of the lake.

**Participatory plan in approach**

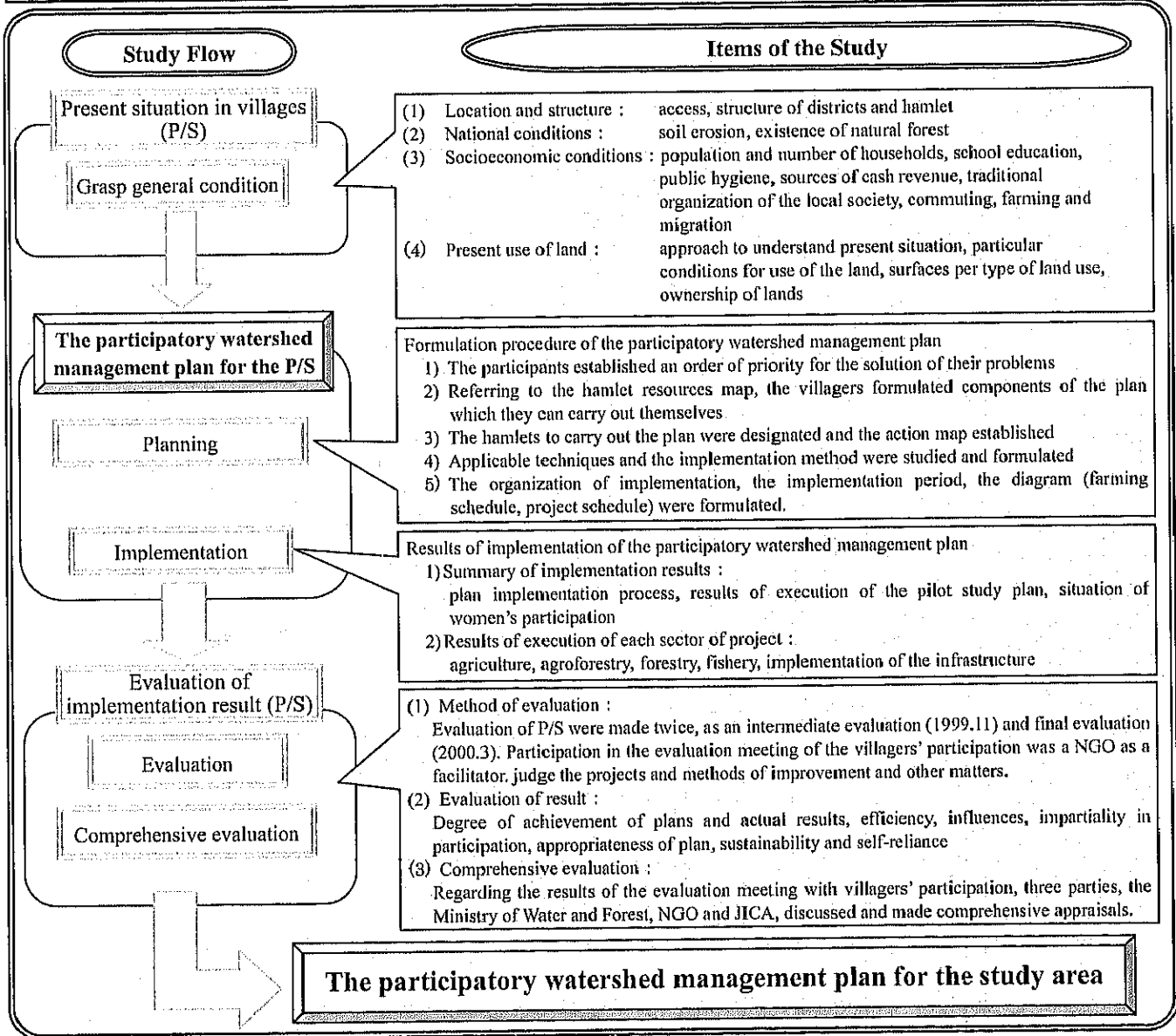
- 1) Holding of explanatory meetings
- 2) Study of correct situation in villages by the RRA
- 3) Selection of participants to workshops
- 4) Preparation of resource maps (Understanding of present situation)
- 5) Problem analysis and counter measures
- 6) Preparation of action maps (Preparation of action plan)



**The participatory watershed management plan (P/S)**

- (2) Approach by participatory planning  
See left figure
- (3) Selection of villages covered by the pilot study  
Selected four villages based on following four criteria 1) existence of leaders, 2) existence of a cooperative system among villagers, 3) the actual project is implemented on that basis, 4) topographical locations for extension or demonstration.
  - 1) Andrefanivorona : located west of the Lake Mantasona in Mantasona zone.
  - 2) Ambohimanjaka : located south of the Lake Mantasona in Miadanandriana zone.
  - 3) Angodongodona : located north-west of the Lake Tsiazompaniry, in Anososibe Trimoloharano zone.
  - 4) Analamihoatra : located south of the Lake Tsiazompaniry, in Tankafatora zone
- (4) Selection of participants to the PRA  
Generally participants were selected from each village for the workshop under RRA through discussion between villagers and NGO.

**Flow of Pilot Study**



# Study Items and Flow through Implementation of Pilot Study

## Study Flow

Component of the pilot study

## Evaluation & Items

- <evaluation method>**
- 1) On-the-spot inspection at site  
Ministry of Water and Forest, NGO, investigation team of JICA, representatives of inhabitants
  - 2) Interview  
Watershed Management Committee and villagers.
  - 3) Data and materials supplemented with local periodical regular reports.

## Achievement of study

Over all evaluation of P/S

## Items of the Study

Project	Andrefanivorona	Ambohimanjaka	Angodongodona	Analamihoatra
Agri-culture	Planting of fruit trees	Planting of fruit trees	Planting of fruit trees Irrigation systems	Planting of fruit trees
Agro-Forestry	Soil improvement Fodder production	Soil improvement Prevention of soil erosion Fodder production	Soil improvement Fodder production	Fodder production Soil improvement Prevention of soil erosion
Forestry	Afforestation with eucalyptus and other trees Improvement of eucalyptus coppice forest			Afforestation with eucalyptus and other trees
Fishery	—	Fish farming in paddy field	Improvement of fishing equipment	—

※ Only Analamihoatra, small-scale hydroelectric power supply project has been carried out as a project of social infrastructure establishment.

Evaluation Item	Contents of evaluation	Evaluation Index
Degree of achievement of a project and its effect	Degree of achievement of a project	Performance of each project
	Lecture classes held	How many times? How much popularity?
Efficiency	Difference between the project schedule and real performance	Delay in the execution and its reason
Impact	Positive and negative influences on society	Influence on income, influence on life environment, Unexpected effects, Difference between participating residents and residents who did not participate, Change in residents' consciousness
	Positive and negative influence on nature	Change which residents felt
Fairness in the process of executing the plan	Participation of the social unempowered	Participate or not
	Fair sharing of the cost	Joint work, procurement of materials and equipment
	Residents who did not participate	Analysis of social factors
Validity of project	Target and needs	Degree of agreement
	Degree of satisfaction	Contents of project, approach to residents' participation, Technology transfer, Advice support, Organization reinforcement
Endurance and independence	Competence to run the organization	Analysis of leader, analysis of participants, problems in organization management
	Residents' participation	Participants' characteristics, Number of participants, Desire to participate
	Cooperation among residents	Status

Fokontany (Village)	Project with a high degree of achievement	Project with a low degree a low degree of achievement
Andrefanivorona	Planting of fruit trees, production of compost	Agroforestry, afforestation with eucalyptus or other trees, improvement of eucalyptus coppice forest
Ambohimanjaka	Production of compost	Planting of fruit trees, agroforestry, afforestation with eucalyptus or others, improvement of eucalyptus coppice forest, improvement to charcoal-making technique, fish farming in rice fields
Angodongodona	Production of compost, afforestation with eucalyptus or others; improvements of charcoal-making techniques	Planting of fruit trees, agroforestry, improvement of eucalyptus coppice forest, fish farming in rice fields
Analamihoatra	Production of compost, afforestation with eucalyptus or others, ZODAFARB, small scale hydraulic power generation	Planting of fruit trees, agroforestry

Among the four villages, the willingness of participation in Analamihoatra and the coordination between villagers was strong, because of the little gap between the rich and the poor, and the influence of the Protestant church. Therefore, the village has the capability of continuing the projects of participatory watershed management plan. The results of the evaluation are expected to be helpful in the formulation of the participatory watershed management plan.

## Outline of the Plan

### Summary of the plan

- |                            |  |
|----------------------------|--|
| (1) Target Group           | residents living in the target area  |
| (2) Overall Goal           | Forest Conservation and Watershed Management based on the peoples' participation   |
| (3) Objectives of the Plan | establishment of the sustainable forest management   |
| (4) Proposed Plans         | 1) participatory watershed management plan (agriculture, agro-forestry, forestry, fishery)<br>2) forestry management plan  |
| (5) Main Projects          | 1) participatory watershed management plan, and :<br>fruit-tree orchards, tree planting, fish cultivation etc.<br>2) forestry management plan :<br>law; promotion by administrative agencies, etc. |
| (6) Expected Results       | coordination of agencies concerned, self-sustenance of the area  |
| (7) Implementation Period  | 1) participatory watershed management 5 year plan,<br>2) forestry management plan : not mentioned  |

Forestry

## Target Area & Plan

### Target Area

#### 1. Participatory watershed management plan

Objective ; Sustainability of development and self-sustenance of the participatory watershed plan, Area : 36,801 ha

(Unit : ha)

Zone	Mantanoa	Tsiacompaniry	Total
A	514	4,304	4,818
B	-	-	-
C	1,772	4,755	6,527
D	3,208	17,850	21,058
E	1,158	5,570	6,728
計	6,652	32,479	39,131

※water area excluded

#### 2. Forest management plan

Objective ; Preservation of natural environment (Zone B) and water conservation (Zone E), Area : 5,166ha

(Unit : ha)

Zone	Mantanoa	Tsiacompaniry	Total
A	0	0	0
B	1,461	0	1461
C	-	-	-
D	-	-	-
E	1,180	2,525	3,705
計	2,641	2,525	5,166

※Watershed preservation zone classification based on prediction of collapse risk

### 1. Participatory watershed management

#### Agriculture

- |                           |  |
|---------------------------|--|
| (1) Fruit-tree planting : | planting by half of the participants/household and targeting women's involvement                       |
| Selected species :        | existing species of peach, plum, apple, persimmon, and pear, etc.                                      |
| (2) Compost production :  | Implemented as a women-centered activity. Problem is the shortage of materials for compost production. |

#### Agroforestry (AF)

- |  |   |
|--|---|
| (1) Hedgerow :   | Planting shrub, grass in fallow land for erosion control.<br>Half of the participants are targeted to be women. |
| (2) Forage production :  | Implementing as a women-centered activity   |
| ※ Both activities should be implemented with technical assistance. |   |

#### Forestry

- |   |  |
|---|--|
| (1) Seedling production :                           | Install a local nursery. Technical advise on nursing seedling is required.<br>Half of the participants are targeted to be women. |
| (2) Tree plantation :                               | Conservation of cultivated land and erosion control.<br>Half of the participants are targeted to be women.                       |
| (3) Plantation activity at Public land by ZODAFARB. |  |

#### Fishery

Fish farming in rice paddy fields : purchase of fingerlings and distributed to participants, women-centered activity, selection of fish pond is on the agenda.

**2. Forestry Management Plan**

**Improvement of the natural environmental quality (zone B)**

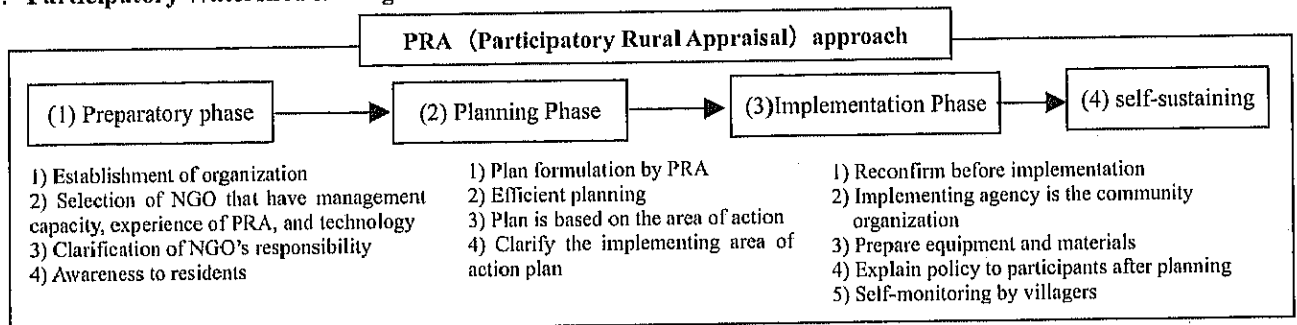
- (1) Issuance of felling permits in consideration of the natural environment :  
implement issuance of permit pass to conserve landscape and preserve soil in lakeside
- (2) Prohibit burning in principle :  
prohibit burning to prevent soil erosion by backdown of vegetation
- (3) Obligation to replant after cutting :  
To protect the landscape, the Ministry of Water and Forests will give guidelines for planting and will supervise the selection of plant species and planting methods.
- (4) Required environmental evaluation of non-agricultural development which may modify the relief :  
To maintain the natural environment, an environmental evaluation will be carried out by a specialized committee formed under the Ministry of Water and Forests.
- (5) Activities to encourage the planting of ornamental trees in sections by the Regional Forest Department and the rural commune and prefectural authorities :  
Since there is no natural forest in this area (Zone B) which is mainly occupied by hotels and secondary residences, and so as to shelter and encourage birds-life and small animals, the regional organizations under prefectures and rural communes must promote and encourage the planting organizations in these areas.

**Creation and conservation of forests (Zone E)**

- (1) No more issuance of cutting permits :  
Cutting is prohibited in all natural forests of the zone to allow their renewal of growth.
- (2) Prohibition of access for a certain time period :  
Entry into the forest will be prohibited for a certain period to allow the renewal of the forest grows.
- (3) No issuance of burning permits :  
For the same reason as the preceding paragraph, issuance of burning permits will be stopped.
- (4) Raising awareness of the villagers :  
Request for collaboration and cooperation of regional administrative organization and a police patrol, Activities to raise awareness through market days and radio etc.
- (5) Villagers-led forest management by ZODAFARB :  
Make good use of having strong desire to afforest and conservation.

**Project Plan**

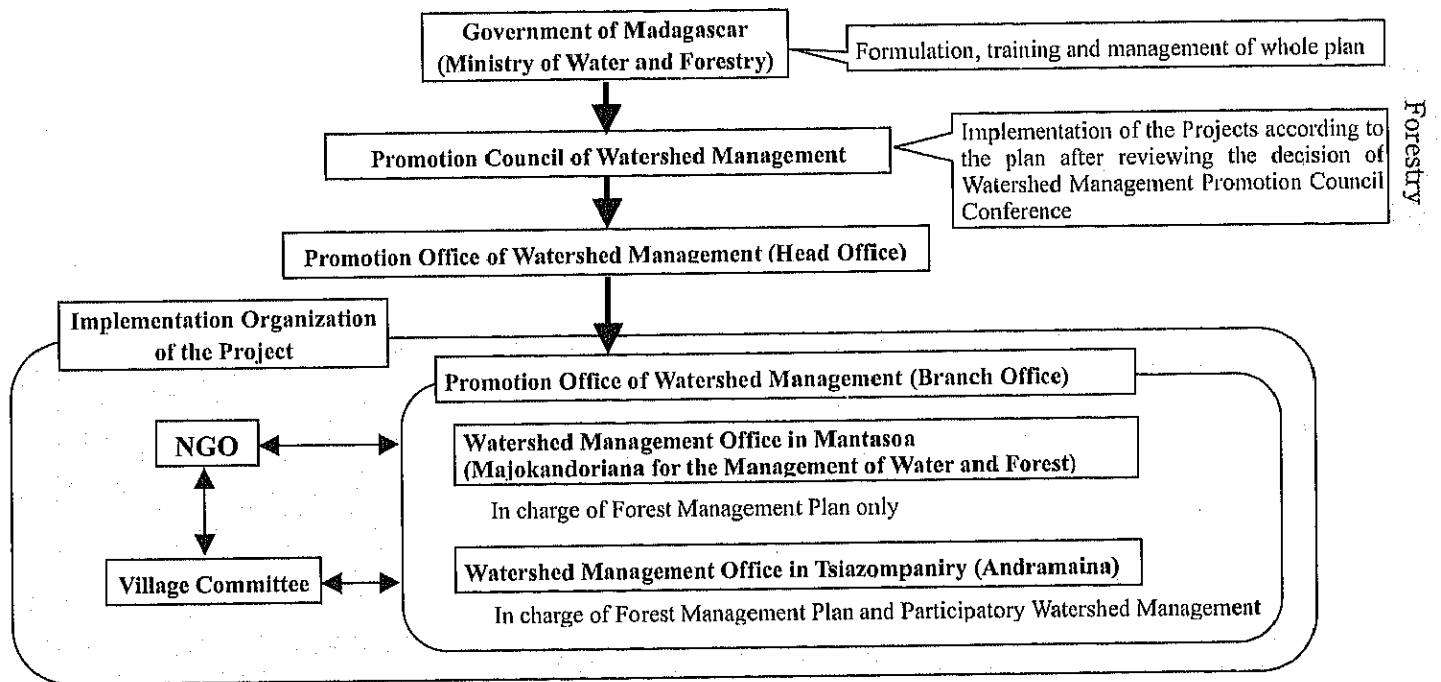
**1. Participatory Watershed Management**



**2. Forest Management Plan**

Zone	Principles	Management Standard	Implementation Items
Zone B : 1,461ha (Mantaoa)	Improvement of natural environment quality	Regulation of tree cutting	1) Issuance of cutting permits in consideration of the natural environment 2) Principle of prohibiting burning
		Balance between planting and cutting	Obligation to replant after cutting
		Regulations for development	Required environmental evaluation for non-agricultural development which may modify the relief
		Recommendation for planting ornamental trees	Activities to encourage the planting of ornamental trees in sections by the Regional Forest Department and the rural commune and prefectural authorities
Zone E : 3,705ha (Tsiacompaniry)	Creation and conservation of forest	Prohibition of cutting trees in natural forests	No more issuance of cutting permits
		Renewal of vegetation through the forces of nature	1) Prohibition of access for a certain time period 2) Non issuance of burning permits 3) Raising the awareness of the villagers a. Request for the collaboration and cooperation of regional administrative organizations including the police force b. Activities to raise awareness during market days c. Activities to raise awareness through the mass media such as radio d. Request for a police patrol e. Placement of signs at the natural forest limits
		Forest management at the initiative of the villagers	Tree planting by ZODAFARB will be actively encouraged to ensure forest management under the responsibility of the villagers and use of the tree planting areas as a buffer zone. Tree planting for grasslands will be included in the participatory watershed management plan

## Organization Structure



## Implementation Schedule

### 1. Participatory Watershed Management

Type	Village Name (No of household)	1 <sup>st</sup> year	2 <sup>nd</sup> year	3 <sup>rd</sup> year	4 <sup>th</sup> year	5 <sup>th</sup> year	6 <sup>th</sup> year and after
I	Andriantsijo(60)	Planning	Execution	Execution	Independent execution	Independent execution	Independent execution
	Angodongodona (280)	Planning	Execution	Execution	Independent execution	Independent execution	Independent execution
II	Andrefanivorona(70)	Planning	Execution	Execution	Independent execution	Independent execution	Independent execution
	Anbohimanjaka (130)	Planning	Execution	Execution	Independent execution	Independent execution	Independent execution
III	Morarano so-afiraiSana(140)		Planning	Execution	Execution	Independent execution	Independent execution
	Anosivola(100)		Planning	Execution	Execution	Independent execution	Independent execution
	Andohariana(70)		Planning	Execution	Execution	Independent execution	Independent execution
	Ambohijanaka (560)			Planning	Execution	Execution	Independent execution
	Kelimafana(210)			Planning	Execution	Execution	Independent execution
	Ankazotelo(100)		Planning	Execution	Execution	Independent execution	Independent execution
	Analamihoatra	Independent execution	Independent execution	Independent execution	Independent execution	Independent execution	Independent execution

**2. Forestry Management Plan** : Detailed schedule for implementation has not been determined, as it seems appropriate to adjust the schedule during project implementation and to obtain support from the secretary under the present scheme.

### Project Cost

(Unit: 1,000,000 fmg)

Contents of the projects		Quantity of the project	Implementing agencies			Total	
			Ministry of water and forest	residents	NGO		
1. Participatory water-shed	agriculture	Fruit trees	10,560 trees	383,353	209,042	283,714	825,268
		Compost	1,265 unit	34,804	18,979	25,758	66,258
	A F	Hedge	638 kg	38,632	21,066	28,591	79,357
		Fodder	38,631,972 kg	111,964	61,054	82,863	250,477
	Forestry	Production of young plants	998,000 trees	242,100	132,017	179,175	496,007
		Tree planting	838,600 trees	325,417	177,450	240,837	566,254
		ZODAFARB	13,160 trees	81,849	44,632	60,575	142,424
fishery	Fish farming in rice fields	68,930 fishes	63,856	34,820	47,259	126,634	
Sub-total			1,281,975	699,061	948,772	2,929,807	
2. Forest Management Plan	Zone B		43,110	0	0	43,110	
	Zone E		43,110	0	0	43,110	
Sub-total			86,220	0	0	86,220	
Watershed management Plan Total			1,368,195	321,932	948,772	3,016,028	

\* IUS \$ = approx. 5,274 fmg (as of December, 1998)

### Project Evaluation

Target Evaluation Area (Unit) : Mantanoa and Tsiazonpaniry

Evaluation Item	Contents of Evaluation	Evaluation Index
1) Villagers' technical ability	Forest age of technique	Necessity
	Practice of technique	Possibility
	Spread of technique	Possibility
	Ability to solve problem	Degree of improvement
	Traditional techniques	Influence
2) Legal System	Land ownership system	Appropriateness
	Land inheritance system	Appropriateness
	PE - II	Appropriateness
	Forest law system	Appropriateness
3) Organizational Operation	Organizational system of the administration side	Human, Financial, Technical, Facilities aspect
	Establishment and continuity of residents' organization	Degree of difficulty, Continuousness of the organization, Independence of the organization
4) Natural Environment	Forests	Preservation of forest resources, Increase in quantity of charcoals
	Soil	Improvement of soil fertility, Prevention of soil erosion
	Water	Improvement to soil and water conservation systems; Increase in the volume of water retention
5) Social Environment	Residents' lives	Improvement to the living standards, Increase in cash inflow, Reduction of farming away from home, Reduction of migration, Improvement in inheritance of farming, Elevation of the status of women
	Traditional social organization	Influence upon Dina (a Hamlet autonomous guarding organization), Influence upon Faritana (an organization for mutual aid for agricultural Activities), Influence upon Indorana (a mutual aid organization)

\* PE - II : Government-Implemented Environmental Program Phase II

### Recommendation

- (1) **Decision-making and cooperation of ministries concerned for the purpose of execution of plans**  
As these plans are made from the viewpoint of villager's lives, the contents of the projects extend to various fields. Therefore, the Ministry of Water and Forests cannot execute them alone, so cooperation of each ministry is indispensability.
- (2) **Continuous assistance to Analamihoatra Village in succession of the P/S (Outside of S/W of the Study)**  
The Analamihoatra village was excluded from the area covered in the plan, because this village is within very close range to the goal of independence, and able to become independent with little assistance. For the independence of the village, however, two requisites are necessary : (a) that the village be positioned as a model of execution and (b) that assistance be given by the Ministry of Water and Forests in succession of the PS.
- (3) **Appropriate loads of beneficiary group**  
Considering severe financial situation of the related agencies, no financial support for the plan could be expected. Therefore, examination on the appropriate method of burdening the beneficiary groups must be on the agenda for future implementation.

<p><b>The Study on Yellow River Basin Agriculture and Fisheries Development</b></p>	Counterpart Agency	Ministry of Agriculture P.R.China Shanxi Provincial Department of Water Conservancy
	Consultant Companies	Overseas Agrofiseries Consultants Inc. / Sanyu Consultants Inc.
	Team Leader	Yasuo ISHIMOTO
	Study Period	1999.3~2000.5
	Study Type	Feasibility Study

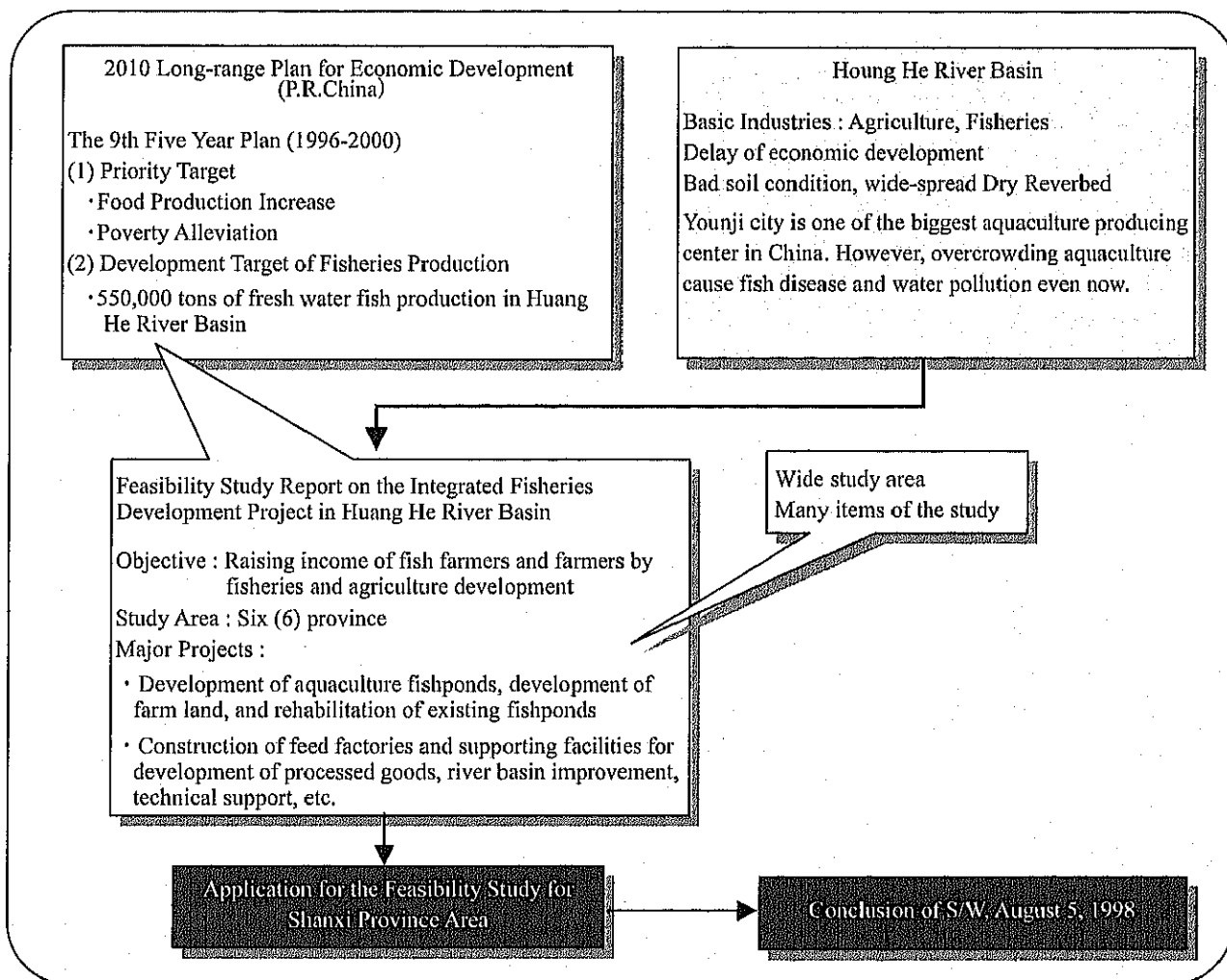
**Background of the Study**

Based on the 9th Five Year Plan and the 2010 Long-range Plan for Economic Development, The Government of People's Republic of China puts emphasis on "Food Production Increase" and "Poverty Alleviation". The Plan sets the development target of fisheries production in Huang He River Basin as 550,000 tons.

To accomplish this target, Ministry of Agriculture prepared "Feasibility Study Report on the Integrated Fisheries Development Project in Huang He River Basin" and planned to increase fisheries and agriculture production by providing supporting facilities such as aquaculture fishponds, farming sites, development of processed goods, technical assistance, and so on.

However, the study area was so wide and the study items are so many that it was pointed out that more detailed study was necessary. Ministry of Agriculture placed this study as a priority project for the accomplishment of national development policy and made a request to the Government of Japan for a technical cooperation on this study.

In response, the Government of Japan conducted a preliminary study and had discussion among both Governments, then concluded Scope of Works (S/W) on August 5, 1998, which defined detailed implementation plan of the development study.



**Objectives of the Study**

To prepare integrated development plan for agriculture and fisheries

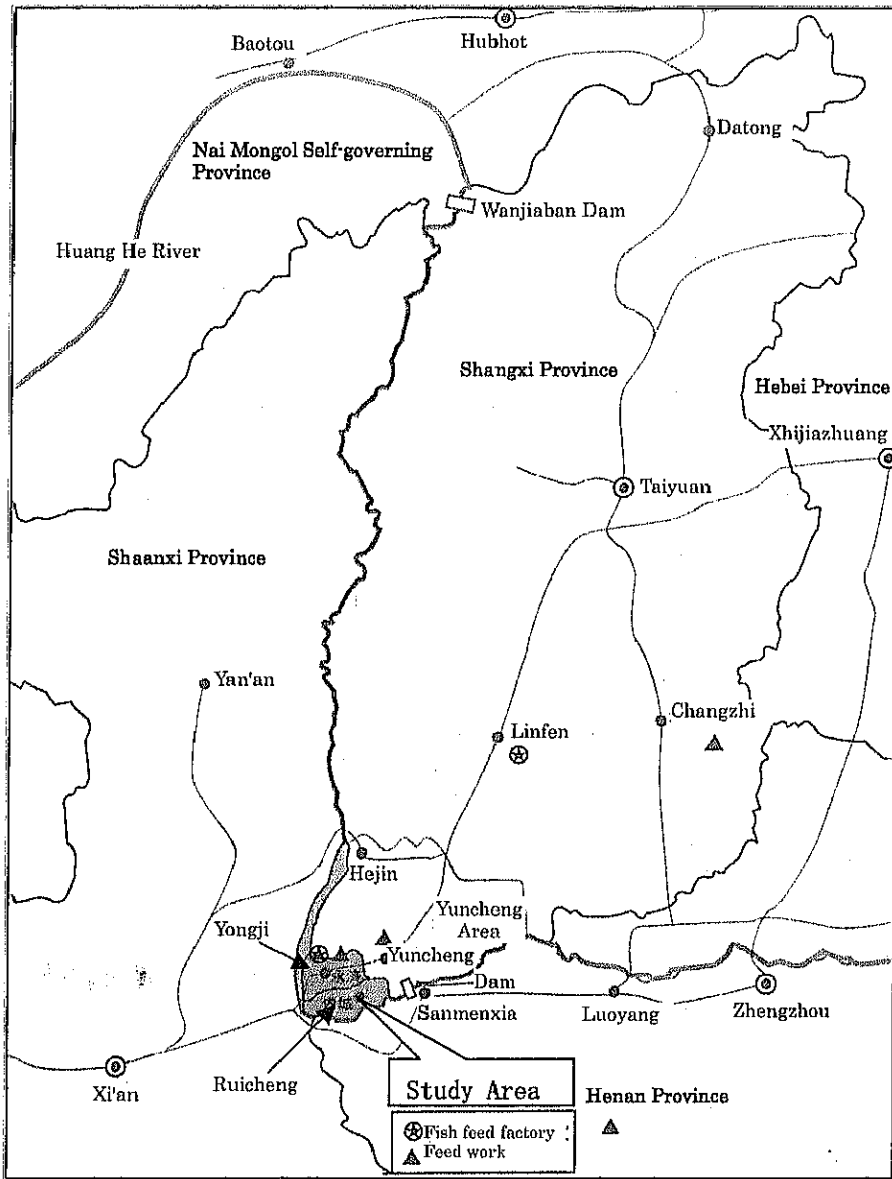
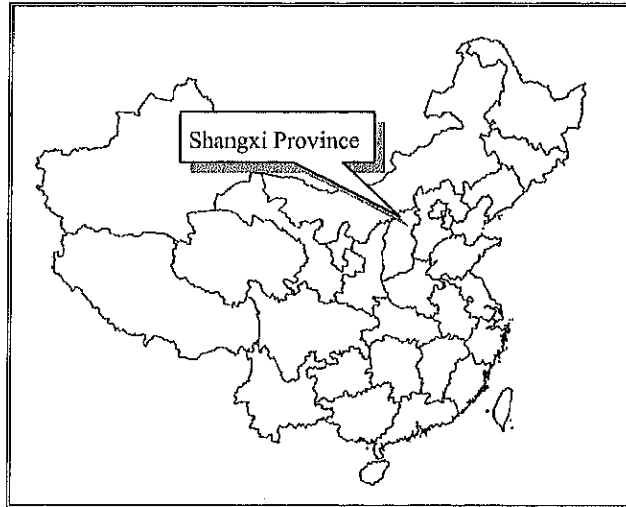
To carry out feasibility studies on priority projects, such as development of aquaculture fishponds, rehabilitation of existing fishponds, development of banking field with improvement of alkaline soil, construction of feed factory, fish seed center, fisheries processing factory, training center for fisheries technique, etc.



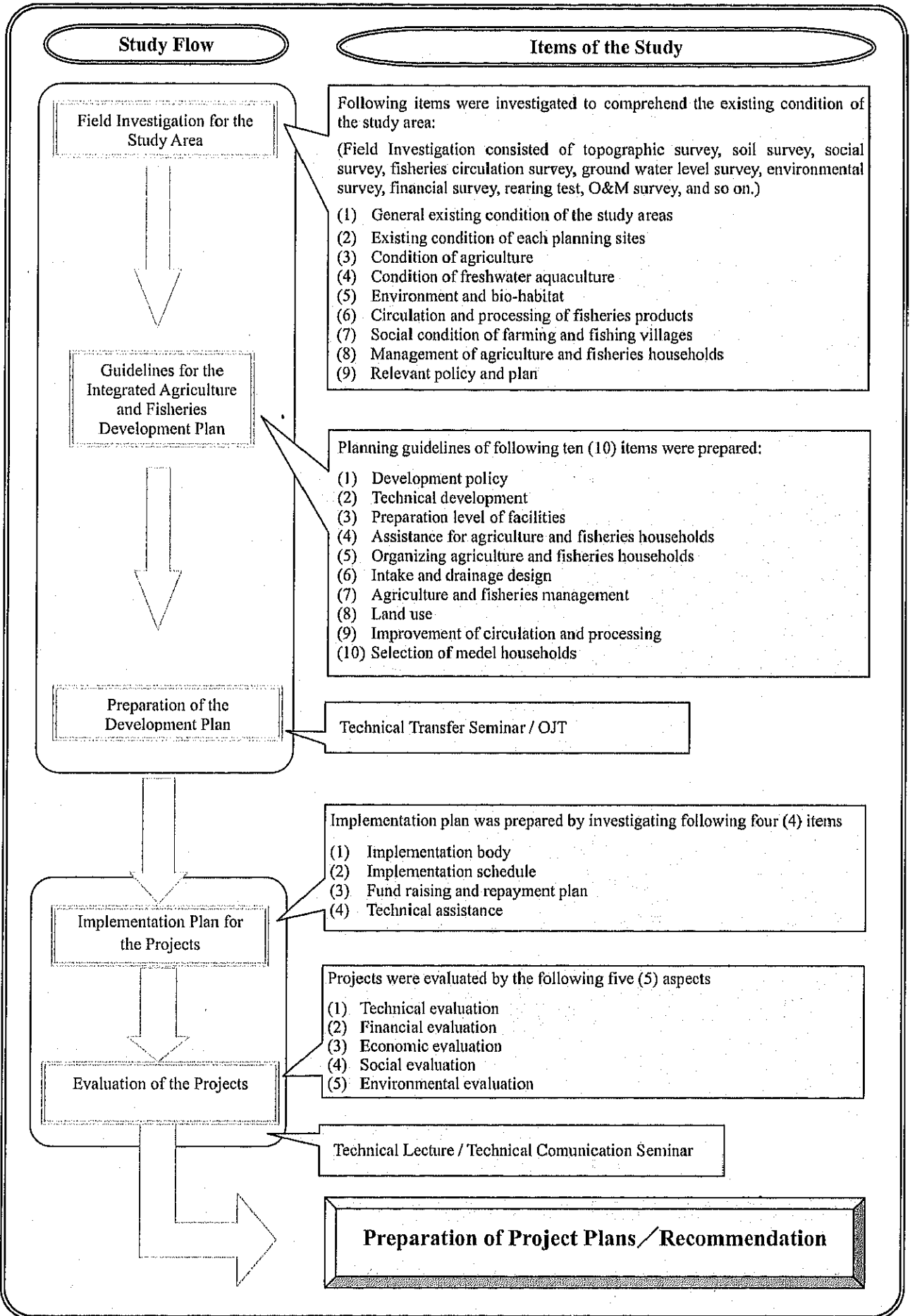
**Study Area**

Ten (10) sub-districts in Ruicheng district and Yongji city in Yuncheng Area

**Location Map**



## Study Items and Flow



## Outline of the Plan

### Summary of the Plan

- |                          |   |
|--------------------------|---|
| (1)Target Group          | Culture fisheries households in the model areas   |
| (2)Overall Goal          | Sound and competitive vitalization of local industry under market economy   |
| (3)Objective of the Plan | Improvement of efficiency and stability by environmental friendly aquaculture   |
| (4)Proposed Plans        | ①Agriculture and fisheries technology development plan<br>②Agriculture and fisheries households assistance plan<br>③Circulation and processing improvement plan<br>④Agriculture and fisheries infrastructure preparation plan |
| (5)Main Projects         | ①Construction and rehabilitation of aquaculture fishponds<br>②Construction of various supporting facilities   |
| (6)Expected Results      | 1) Achievement of intensive land use<br>2) Improvement of supporting system for technical extension, research & development<br>3) Promotion of cooperative work of agriculture and fisheries households                       |
| (7)Target Year           | 7 years (2002 - 2008)   |

### Target Area & Plan

#### Target Area

Name of Area		Construction of new fishponds	Rehabilitation of existing fishponds	Annexed bank field	Facilities
1	Yongji City	333ha	400ha	80ha	Feed factory (new) Fish seed center (improvement)
2	Ruicheng District	333ha	80ha	80ha	Fisheries processing factory (new) Net cage aquaculture

#### Agriculture and Fisheries Technology Development Plan

- Construction of aquaculture zone (housing units : 965, Area of aquaculture fishpond 1,222ha)
- Construction and rehabilitation of aquaculture fishponds
  - Construction of drainage channels
  - Development of farm site for feed production
  - Preparation of production and management plan

#### Agriculture and Fisheries Households Assistance Plan

##### Facilities Plan

Supporting facilities will be prepared to assist agriculture and fisheries households in the following three (3) aspects

- ①Stable provision of fish seed and feed
- ②Research & development of fishery technique / training for technical extension
- ③Operation & maintenance of aquaculture facilities and provision of common use materials

Name of facilities	Functions of facilities
Fish seed center	Provision of fish seed to be increased
Feed work	Provision of feed for increasing demand
Fishery technical center	Research and development, such as fish seed, fish disease, feed, feed environment, processing, etc. Training and extension services, such as training of extension workers, technical transfer, training of new fisherman.
Machinery and materials center	Construction and maintenance of facilities with construction machinery and pumps Provision of common use materials

Following four (4) plans were prepared for assistance of agriculture and fisheries households

- (1) Facilities management plan
- (2) Financial assistance plan for agriculture and fisheries households
- (3) Promotion of organizing agriculture and fisheries households
- (4) Cooperation with agricultural organization

#### Circulation and Processing Improvement Plan

- (1) Planning of long distance distribution facilities for increasing freshwater fisheries production
- (2) ①Technical development for fisheries processing ②Promotion of fish consumption for consumers in Fisheries technology center

#### Agriculture and fisheries infrastructure preparation plan

- (1) Preparation of design guideline for facilities
- (2) Preparation of aquaculture fishponds development plan, aquaculture materials preparation plan, water supply/drainage plan, road and power supply development plan, supporting facilities plan.

## Implementation Plan

### 1. Aquaculture Facilities

Facilities		Yongji City	Ruicheng District	Total	Notes
Aquaculture Fishpond	Newly-establishment	339ha	360ha	699ha	Wells excavation : Yongji (223), Ruicheng (156)
	Adaptation	453ha	70ha	523ha	Work shed : Yongji (627), Ruicheng (338)
Road	Main road	18.3km	7.2km	25.5km	Planting tree on each side of main and second road at interval of 5m (25,400 seedling)
	Second road	17.4km	20.6km	38.0km	
	Adjacent road	61.7km	61.1km	122.8km	
Electricity	High-voltage cable	85km	56km	141km	Transformer : Yongji (107), Ruicheng (67)
	Low-voltage cable	147km	83km	230km	
Drainage Channels	Main drain	17.0km	8.4km	25.4km	Drainage facilities : Puzhou (1), Hang Yang (2), Xiyang (1), Xiosli (1)
	Secondary drain	28.6km	7.7km	36.3km	
	Ditch	69.5km	45.7km	115.2km	

### 2. Facilities of support

Facilities	Area	Site area	Building area	Notes
Fish seed center	Yongji (1)	400 ha	1,750 m <sup>2</sup>	Broodstock/nursery pond (18ha), fishpond for fries (6,000 m <sup>2</sup> ) etc.
	Ruicheng (1)	100 ha	650 m <sup>2</sup>	Broodstock/nursery pond (6ha), fishpond for fries (2,000 m <sup>2</sup> ) etc.
Feed work	Yongji (1)	1.3 ha	4,800 m <sup>2</sup>	Feed production system (6t/h)
	Ruicheng (1)	1.3 ha	4,800 m <sup>2</sup>	Feed production system (6t/h)
Fishery technical center	Main office	3.3 ha	4,944 m <sup>2</sup>	Laboratory, Processing laboratory, Accommodation, Residence
	Branch office	3.3 ha	624 m <sup>2</sup>	Broodstock/nursery pond(1.3ha), fishpond for fries (4,000 m <sup>2</sup> ) etc.
Machinery and materials center	Yongji (4)	0.9 ha	3,327 m <sup>2</sup>	Construction machinery shed, Office, shed
	Ruicheng (4)	0.8 ha	2,340 m <sup>2</sup>	ditto

### 3. Main Machinery

Machinery	Contents
Aquaculture fishpond machinery	Water Pump (379), Drainage pump (1,517), Aerator (2,481), Generator (379), Trike truck (552), Automatic feeding machine (1,517), Fishing net (758)
Fish seed center machinery	Nursery production and management machinery (2) (Pump, Aerating equipment, Fishing net, measure equipment) 4t Truck (3), 4WD Wagon (2), Office equipment (2)
Feed work machinery	Pellet feed production equipment (2), 8t truck (10), 4WD Wagon (4), Office equipment (2)
Fishery technical center machinery	Equipment for nursery production laboratory, equipment for feed development, equipment for feed environment, equipment for fish disease laboratory, equipment for genetics breeding, equipment for processing laboratory, equipment for training and extension, vehicle, Office equipment, etc.
Machinery for machinery center	Bulldozer (29), Back hoe (7), Grader/Roller (7), Tractor (31), Hedoto pump (54), Bucket elevator (26), 4t alive fish transport truck (22), Refrigerator (8), Repair tool (8)

### 4. Training (Overseas Training)

Training Items	M/M
Fish disease and bio-habitat	18
Forage production and nutrition	12
Fishery processing and distribution	12
Association organization and activities	12
Fishery development management	6



## Project Costs

1 Yuan = 13 Yen

(1) Construction and equipment costs				
Items	Roughly scale	Construction and civil (Thousand Yuan)	Equipment (Thousand Yuan)	Total (Thousand Yuan)
New aquaculture fishpond and equipment	699.2 ha	45,225	15,931	61,156
Adaptation of aquaculture fishpond and equipmer	522.8 ha	25,453	4,226	29,679
Road and power supply		20,327	9,684	30,011
Drainage		17,430	371	17,801
Fish seed center	2 areas, total 200 million fishes	3,015	1,702	4,717
Feed work	6t/h × 2areas	8,680	22,002	30,682
Fishery technical center	3.3 ha	7,027	22,382	29,409
Thermal drain water recycling system	3.3 ha	1,324	0	1,324
Machinery center	8 areas	3,400	17,234	20,634
<b>Total</b>		<b>131,881</b>	<b>93,532</b>	<b>225,413</b>
(2) Design management costs				
Items	Summary	Total (Million Yen)		
Personnel costs	Chinese 600 M/M, Foreigner 60M/M	240		
Direct costs	Travel expenses, perdiem, lodging expenses	60		
<b>Total</b>		<b>300</b>		
(3) Overseas training costs				
Items	Man/Month	Unit (Thousand Yen)	Total (Million Yen)	
Training costs	60	900	54	
(4) Reserve				
A cost of living reserve ( I + II ) × 24.2% (boost rate 4%/year)				794
(5) Total				
Total implementation costs				4,079

Fisheries

## Economic Evaluation

Viewpoint	Evaluation Result
Technique	(1) It could be corresponded enough measure against flood, soil quality and soil, aquaculture technique, fish species, need of fresh water fish, construction facilities by present technique level. (2) It is necessary to take the technical support at home and abroad on feed production, aquaculture of new fish species, environment reservation, fishery processing, quality control etc. for improvement of aquaculture technique and substantial production system.
Finance	(1) It is possible to be profitable on all aquaculture models from first year. And it is possible to repay development cost, special agricultural product tax, maintenance cost of channels. (2) Economic internal rate of return (EIRR) (20th year) is 9.1~21.% that depends cultivation models.
Economy	Economic internal rate of return (EIRR) (20th year) is 16.3%. It exceeds economic growth rate of country (8%). It is necessary to measure when fish price declines more than 20%, so monitoring of fish price is necessary.
Society	It contributes for making employment opportunity, activation of rural economy, constancy supply of animal protein.
Environment	It does not affect ①Drain for general river from cultivation fishpond ②Groundwater utilization ③ Rare plants and animals ④Buried cultural property. But it is impossible to use drain from cultivation fishpond for irrigation water. Environmental evaluation : It is not necessary for environment evaluation, It should present leave application at Environment reservation department of ministry level by result of this study.



- (1) The project is justified.
- (2) It is necessary to monitor because economical effect of fish price is high.

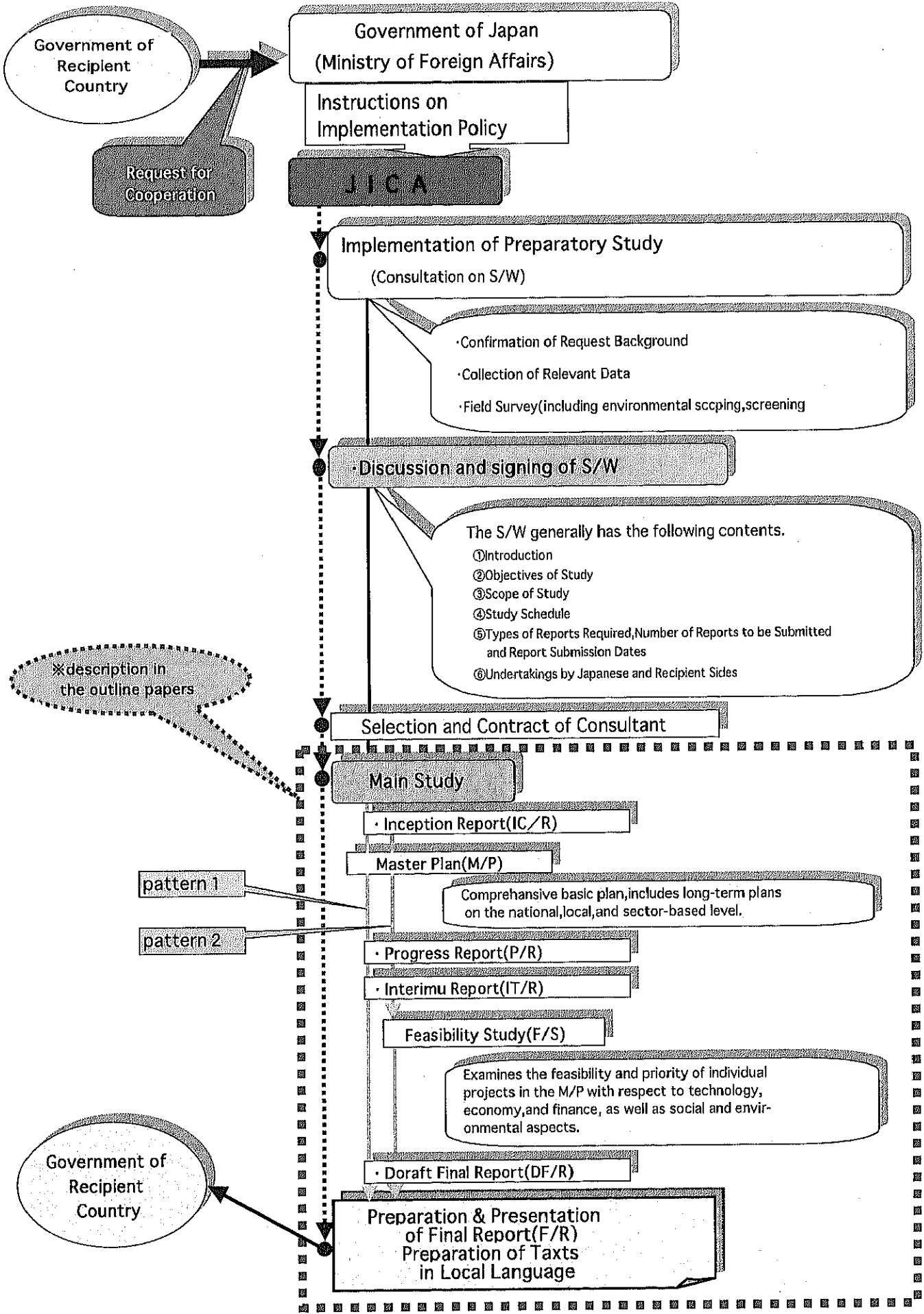
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**Recommendations**

- (1) **Model case of cultivation development in Huang He River basin**  
This project is model case of six(6) province in Huang He River basin. It is pressed extension for other province and other areas. And the technique and facilities developed in this project exhibit information for widely, it is necessary to send experts trained by reply.
  - (2) **Sustainable production that considered ecosystem**  
It is set low production for control of environment on this project. Extension worker should guide fisheries household to understand this point.
  - (3) **Material development**  
Shanxi Province has many problems for material development and establishment because it does not have education department, etc. It is necessary to implement many approaches.
  - (4) **Effort for organization of cooperation**  
Organization of fishery household that has advantage finance, shipment, cooperative purchase, etc. is essential to realize the sustainable development.
  - (5) **Necessity of maintenance for fishery market**  
It is expected to increase distribution of fish and shellfish after implemented project. It is desirable for promotion establishment and management of fishery wholesales market for honest business, implementation of quality, fair price, etc.
  - (6) **Finance and framework of fishery household support**  
It is necessary to execute allowances and loan for agriculture and fisheries household priority to develop stability cultivation to basic industry.
  - (7) **Preparation establishment of provident society fund of rural fisheries**  
It is necessary to establish rural fisheries fund system that executed a portion compensation for damage and bringing finance. It is desirable for preparation of establishment for period of project implementation.
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# Development Study Process







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PLANNING DIVISION

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