

**THE MASTER PLAN STUDY ON
FOREST MANAGEMENT FOR
DISASTER PREVENTION
IN THE NORTHERN PACIFIC REGION
IN THE REPUBLIC OF NICARAGUA**

FINAL REPORT

OCTOBER, 2004

**JAPAN INTERNATIONAL COOPERATION AGENCY
GLOBAL ENVIRONMENT DEPARTMENT**

**JAPAN FOREST TECHNOLOGY ASSOCIATION
SANYU CONSULTANTS INC.**

GE
JR
04-015

**THE MASTER PLAN STUDY ON
FOREST MANAGEMENT FOR
DISASTER PREVENTION
IN THE NORTHERN PACIFIC REGION
IN THE REPUBLIC OF NICARAGUA**

FINAL REPORT

OCTOBER, 2004

**JAPAN INTERNATIONAL COOPERATION AGENCY
GLOBAL ENVIRONMENT DEPARTMENT**

**JAPAN FOREST TECHNOLOGY ASSOCIATION
SANYU CONSULTANTS INC.**

PREFACE

In response to a request from the Government of Nicaragua, the Government of Japan decided to conduct a study on the Master Plan on Forest Management for Disaster Prevention in the Northern Pacific Region in the Republic of Nicaragua and entrusted to the study to the Japan International Cooperation Agency (JICA).

JICA selected and dispatched a study team headed by Mr. Noriyuki Anyoji of the Japan Forest Technology Association and consists of the Japan Forest Technology Association and Sanyu Consultants Inc., between December, 2000 and July, 2004.

The team held discussions with the officials concerned of the Government of Nicaragua and conducted field surveys at the study area. Upon returning to Japan, the team conducted further studies and prepared this final report.

I hope that this report will contribute to the promotion of this project and to the enhancement of friendly relationship between our two countries.

Finally, I wish to express my sincere appreciation to the officials concerned of the Government of Nicaragua for their close cooperation extended to the study.

October, 2004

Etsuo KITAHARA,
Vice President
Japan International Cooperation Agency

LETTER OF TRANSMITTANCE

October, 2004

Mrs. Sadako OGATA
President
Japan International Cooperation Agency

Dear Mrs. OGATA

The study to formulate the Master Plan on Forest Management for Disaster Prevention in the Northern Pacific Region in the Republic of Nicaragua has now been completed and the Final Report for the Study is submitted herewith.

This report compiles the findings of various surveys and analyses, the formulated Master Plan and relevant manuals conducted in the period from December, 2000 to July, 2004 by a joint venture formed by the Japan Forest Technology Association and Sanyu Consultants Inc. in accordance with the contract concluded with the Japan International Cooperation Agency.

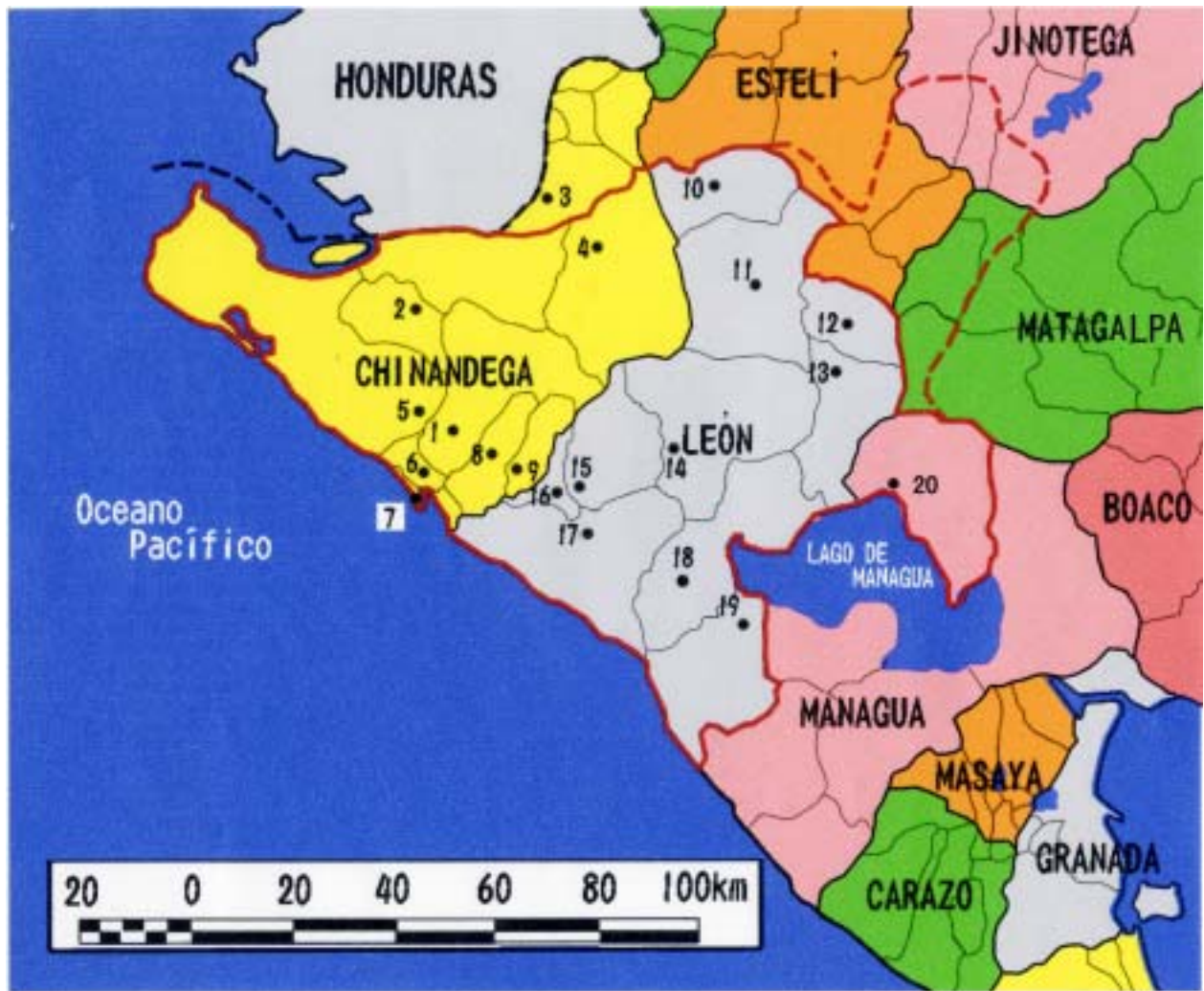
Through this study, the Master Plan on Forest Management Plan for Disaster Prevention designed to improve the soil and water conservation functions of forests through participatory forest management has been formulated together with the Guidelines for Formulation of Forest Management Action Plan for Disaster Prevention explaining how to prepare an action plan and the Community Guidance Manuals explaining how to implement an action plan, prepared in accordance with the said Guidelines, for each community. Moreover, the Pilot Study for the experimental implementation of the Master Plan with the initiative of local residents was conducted in nine communities. During the implementation process of this Pilot Study, efforts were made to enhance the awareness of these local residents in view of sustaining the activities. The final Master Plan incorporates the lessons and important points learned from the Pilot Study.






It is sincerely hoped that the Forest Management Plan for Disaster Prevention, Guidelines and Community Guidance Manuals will be put into practice with the conscious efforts of those in

Nicaragua to improve the conditions of forests in Nicaragua, thereby contributing to disaster prevention and the development of the country.

On behalf of the Study Team members, I would like to express my heartfelt gratitude for the useful guidance and assistance provided to the Study Team by officials of the Japan International Cooperation Agency, the Ministry of Foreign Affairs and the Ministry of Agriculture, Forestry and Fisheries throughout the study period. The Study Team members greatly appreciate the valuable advice and assistance they received in Nicaragua from officials of the JICA-Nicaragua Office, the Embassy of Japan, the Ministry of Agriculture, Livestock and Forestry and the Institute of National Forestry.

Noriyuki Anyoji
Team Leader
Study Team of the Joint Venture for the Master
Plan Study on Forest Management for Disaster
Prevention in the Northern Pacific Region in the
Republic of Nicaragua



Legend	
	National boundary
	Departmental boundary
	Municipal boundary
	Boundary of the Study area
	Boundary of drainage basin

Municipalities			
1	Chinandega	11	El Sauce
2	Puerto Morazán	12	Santa Rosa del Peñón
3	Somotillo	13	El Jicaral
4	Villanueva	14	Malpaisillo (Larreynaga)
5	El Viejo	15	Telica
6	El Realejo	16	Quezalguaque
7	Corinto	17	León
8	Chichigalpa	18	La Paz Centro
9	Posoltega	19	Nagarote
10	Achuapa	20	San Francisco Libre

Location Map of the Study Area



1. Explanation of Inception Report to INAFOR officials



2. Municipal profile survey



3. Rural survey by RRA



4. Pilot study (Participatory planning)



5. Pilot study (Communal nursery activity)



6. Pilot study (Eucalyptus forest planted in October 2002, 2-year-old)



7. Pilot study (Soil conservation work)



8. Pilot study (Forest fire prevention campaign)



9. Pilot study (Home garden)



10. Pilot study (Improved stove)



11. Pilot study (Final evaluation workshop)



12. Technology transfer seminar

CONTENTS

Preface	
Letter of Transmittance	
Location Map of the Study Area	
Photos	
List of Figures and Tables	
Abbreviation	
Summary	
Part I Outline of the Study	
Chapter 1 Background of the Study and Other Related Matters.....	1
1.1 Background of the Study	1
1.2 Objectives of the Study.....	2
1.3 Study Area	2
1.4 Study Flow.....	2
Chapter 2 Present Situation of the Study Area.....	4
2.1 Natural Conditions.....	4
2.2 Socio-economic Conditions.....	12
2.3 Forest Management and Forest Use	32
Part II Master Plan on Forest Management for Disaster Prevention	
Chapter 1 Forest Management Plan for Disaster Prevention.....	55
1.1 Objectives of the Plan.....	55
1.2 Concept of Plan Formulation.....	57
1.2.1 Appropriate Forest Management.....	57
1.2.2 Master Plan Targets.....	63
1.3 Common Plans.....	68
1.3.1 Natural Forest Management Plan.....	68
1.3.2 Reforestation Plan	75
1.3.3 Soil Conservation Plan.....	80
1.3.4 Forest Protection Plan	93
1.3.5 Livelihood Improvement Plan.....	98
1.3.6 Disaster Prevention Reforestation Site Maps.....	105
1.4 Planning by Municipality (Project Volumes and Project Costs, etc.)	107
1.5 Development of Implementation System	142
1.6 Project Evaluation.....	174

Chapter 2	Guidelines for Formulation of Forest Management Action Plan for Disaster Prevention.....	187
2.1	Basic Concept of Guidelines for Formulation of Action Plan.....	187
2.2	Guidelines for Formulation of Action Plan.....	187
2.2.1	Preliminary Study on Communities.....	188
2.2.2	Formulation of Action Plan.....	194
2.2.3	Organization Operation and Development of Implementation System.....	215
2.2.4	Estimated Costs.....	220

Chapter 3	Recommendations.....	221
-----------	----------------------	-----

Part III Pilot Study Report

Chapter 1	Outline of the Pilot Study.....	229
1.1	Purposes of the Pilot Study.....	229
1.2	Target Communities of the Pilot Study.....	229
1.3	Pilot Study.....	231
1.3.1	Stages of the Pilot Study.....	231
1.3.2	Main Activities Under the Pilot Study.....	235
1.3.3	Inputs of the Pilot Study.....	241
Chapter 2	Results of the Pilot Study.....	244
2.1	Results of the Pilot Study.....	244
2.2	Changes in the Communities.....	255
2.3	Lessons Learned.....	268

Appendices

- Appendix 1 List of the Team Members and Their Dispatch Periods
- Appendix 2 Study Schedule
- Appendix 3 Initial Environmental Examination
- Appendix 4 Area by Land Use and Forest Type
- Appendix 5 Design Quantities
- Appendix 6 Materials and Equipment Provided by the Pilot Study

Annex

Community Guidance Manuals

1. Forest Management and Community Development
2. Operation of the Organization
3. Training Activities

LIST OF FIGURES AND TABLES

<Part I>

(Chapter 2)

Fig. 2-1-1-1	Monthly Rainfall (Mean Value).....	4
Fig. 2-2-3-1	Problem Analysis	24
Table 2-1-4-1	Area of Each Land Use and Forest Type by Inclination Class	7
Table 2-1-4-2	Comparison of Forest Ratios.....	8
Table 2-1-4-3	Land Use and Forest Type Area by Drainage Basin and Percentage Ratio	8
Table 2-1-5-1	Past Disasters in Nicaragua	10
Table 2-2-1-1	Population, No. of Districts and Population Density	12
Table 2-2-1-2	Major Crop and Livestock Production	14
Table 2-2-2-1	Social Infrastructure (Water Supply System, Electrification).....	16
Table 2-2-2-2	Social Infrastructure (Health & Education Facilities).....	17
Table 2-2-3-1	Income and Expenditure at Household Level	18
Table 2-2-3-2	Food.....	19
Table 2-2-3-3	Firewood Consumption and Sale	20
Table 2-2-3-4	Experience of Reforestation and Awareness of Forest Resources	21
Table 2-2-4-1	Gender Analysis and Points to be Considered for Forest Management Project.....	27
Table 2-2-6-1	Situation of Land Ownership by Municipality.....	32
Table 2-3-1-1	Staff Deployment at Municipal Office in Charge of Forests and the Environment.....	44
Table 2-3-1-2	Situation of Permits Granted to Cut Trees (Fiscal 2000).....	46
Table 2-3-1-3	Area Damaged by Forest Fires (January to May, 2000)	48
Table 2-3-1-4	Number of Forest Fires by Month (2003)	48
Table 2-3-2-1	Situation of Use of Forest Products and Non-Wood Forest Products..	50

<Part II>

(Chapter 1)

Fig. 1-2-1-1	Mechanism to Support Sustainable Forest Management	59
Fig. 1-3-1-1	Fallow Period Extension Model.....	74
Fig. 1-3-3-1	Classification of Soil Conservation Works	89
Fig. 1-3-6-1	Disaster Prevention Reforestation Site Map	106
Fig. 1-5-2-1	Implementation System (Basic Model).....	144
Fig. 1-5-3-1	Example of Community-Level Implementation Body.....	147

Fig. 1-5-4-1	Main Functions of Municipal Environment Office (Technical Team)	149
Fig. 1-5-4-2	Composition and Functions of the CAM	152
Fig. 1-5-6-1	FAM Project Implementation Mechanism	160
Fig. 1-5-6-2	M/P Project Implementation Mechanism (at the Start).....	161
Fig. 1-5-6-3	M/P Project Implementation Mechanism (Transitional Stage).....	162
Fig. 1-5-6-4	M/P Project Implementation Mechanism (Future).....	163
Fig. 1-5-7-1	Priority Area, Core Community and Extension of Activities to Neighbouring Communities.....	165
Fig. 1-5-7-2	Maintenance of Liaison System Between Administration and Communities.....	172
Table 1-2-2-1	Target Areas for Forest Improvement	66
Table 1-3-1-1	Current State of Natural Forests and Target Forests	70
Table 1-3-2-1	Candidate Species for Reforestation	77
Table 1-3-3-1	Characteristics of Drainage Basins.....	82
Table 1-3-3-2	Main Planting Species and Farming Crops for Agroforestry.....	84
Table 1-3-3-3	Types of and Application Criteria for Civil Engineering Methods.....	87
Table 1-4-1	Project Costs.....	107
Table 1-5-4-1	Main Members of the CAM and Their Roles.....	152
Table 1-5-7-1	Flow of Project Implementation.....	164
Table 1-5-7-2	Observation and Evaluation of Indigenous Development Capability	166

(Chapter 2)

Fig. 2-2-2-1	Example of Current Land Use Map	197
Fig. 2-2-3-1	External Assistance System.....	218
Table 2-2-2-1	Forest Management Measures.....	198
Table 2-2-2-2	Main Selection Criteria for Activities	199
Table 2-2-2-3	Indicators Used for Monitoring.....	200
Table 2-2-2-4	Environmental Education Conducted During the P/S.....	203
Table 2-2-2-5	Indicators Used for Monitoring.....	204
Table 2-2-2-6	Detailed Items by Activity Plan	205
Table 2-2-2-7	Items of Activities	207
Table 2-2-2-8	Priority Conditions for Prioritised Implementation.....	208
Table 2-2-2-9	Indicators Used for Monitoring.....	210
Table 2-2-3-1	Indicators Used for Monitoring and Key Points for Evaluation	217
Table 2-2-4-1	Estimated Costs	220

<Part III>

(Chapter 1)

Fig. 1-2-1	Target Communities of the P/S	230
Table 1-2-1	Target Communities of the P/S	229
Table 1-3-1-1	P/S Schedule.....	232
Table 1-3-2-1	Characteristics of Community and Main Activities.....	237
Table 1-3-3-1	Target Communities and Responsible NGOs/Consultants	241
Table 1-3-3-2	Changes of Number of Participants.....	242
Table 1-3-3-3	Material and Equipment Procurement Cost (for Nine Communities)	243

(Chapter 2)

Table 2-1-1	Number of Seedlings Produced.....	247
Table 2-1-2	Number of Trees Planted.....	247
Table 2-1-3	Outline of Activities (1)	249
Table 2-1-3	Outline of Activities (2)	252
Table 2-3-1	Outline of Similar Projects.....	268

ABBREVIATION

ACAC	Asociación de Campesino a Campesino
ADESA	Ambiente y Desarrollo S. A.
ADP	Asociación para el Desarrollo de los Pueblos
ADP	Asociación para el Desarrollo Popular
AID	Agencia Interamericano de Desarrollo
APRODESA	Asociación de Profesionales para el Desarrollo Agrario
BLOQUE	BLOQUE Intercomunitario
C/P	Counterpart
CAM	Municipal Environment Commission (Comisión Ambiental Municipal)
CARE	Cooperative for Assistance and Relief Everywhere
CESADE	Centro de Estudios y Acción para el Desarrollo
CIPRES	Centro para la Promoción, Investigación y el Desarrollo Rural y Social
CODISA	Consejo Desarrollo Integral de Santa Rosa del Peñón
DAC	Development Assistance Committee
FAM	Fondo Ambiental Municipal
FAO	Food and Agriculture Organization of the United Nations
FISE	Fondo de Inversión para Sociedad y Educación
FONADEFO	Fondo Nacional de Desarrollo Forestal
FORESTAN	Forestadores Asociados de Nicaragua
GTZ	Deutsche Gesellschaft für Technische Zusammenarbeit
IDB	Inter-American Development Bank (Banco Interamericano de Desarrollo)
IDR	Instituto de Desarrollo Rural
IICA	Instituto Interamericano de Cooperación para la Agricultura
INAFOR	Institute of National Forestry (Instituto Nacional Forestal)
INETER	Instituto Nicaragüense de Estudios Territoriales
INIFOM	Instituto Nicaragüense de Fomento Municipal
INTA	Instituto Nicaragüense de Tecnología Agropecuario
IRENA	Instituto Nicaragüense de Recursos Naturales y del Ambiente
JICA	Japan International Cooperation Agency
lts	Littres (Litros)
MAGFOR	Ministry of Agriculture, Livestock and Forestry (Ministerio Agropecuario y Forestal)
Manuel López	Proyecto Manuel López
MARENA	Ministerio de Ambiente y Recursos Naturales
MECD	Ministerio de Educación, Cultura y Deportes
MIFIC	Ministerio de Fomento, Industria y Comercio
MINSA	Ministerio de Salud
M/P	Master Plan
Mz	Manzana, 1M z 0.7ha
NGO	Non-Governmental Organization
OCI	Oficina de Cuantificación e Indemnización
OJT	On- the- Job Training
OTR	Oficina de Titulación Rural
PCM	Project Cycle Management
PDM	Project Design Matrix
Pikin Guerrero	Proyecto Pikin Guerrero
POSAF	Programa Socio Ambiental y de Desarrollo Forestal
PRA	Participatory Rural Appraisal
PROCASITAS	PROCASITAS Project
PROCHILEON	Proyecto de Desarrollo Rural Chinandega-León

PRODISA	Proyecto de Desarrollo Integral de Santa Rosa del Peñón
PROFOR	Proyecto de Promoción a la Inversión en Forestería Sostenible
PROLEÑA	PROLEÑA Project
PROTIERRA	Proyecto de Desarrollo Rural
P/S	Pilot Study
PTA	Proyecto de Tecnología de Agropecuaría
qq	1qq 45kg
RRA	Rapid Rural Appraisal
SFN	Servicio Forestal Nacional
SINAP	Sistema Nacional de Área Protegidas
UTT-PPM	Unidad Técnica Territorial del Proyecto P/M (M/P Project Territorial Technical Unit)
UNAG	Unión Nacional de Agricultores y Ganaderos
vrs	varas, 1vara 84cm
WFP	World Food Programme
WID	Women In Development

Foreign Exchange Rate

1US\$=15.32 cordoba (C\$)

(7th October,2003)

SUMMARY

SUMMARY

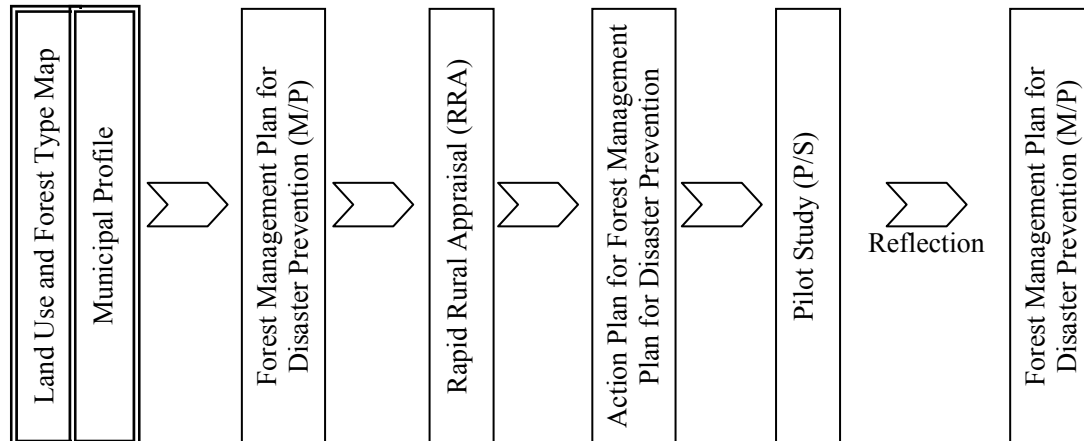
1. Objectives of the Study

(1) To formulate a Master Plan on Forest Management for Disaster Prevention to improve the soil and water conservation functions of forests through participatory forest management activities in an area of some one million ha in the Northern Pacific Region in the Republic of Nicaragua and also to conduct a pilot study to clarify the plan implementation processes and concrete measures required to ensure project implementation with the participation of local residents.

(2) To provide the transfer of technology and guidance on the survey method and the planning and design processes as well as the concepts for each survey items to the INAFOR, the counterpart for the Study.

2. Study Flow

The Study roughly followed the flow described below.



3. Forest Management Plan for Disaster Prevention (M/P)

3.1 Purpose of the M/P

The M/P has been formulated for the purpose of “improving the soil and water conservation functions of forests through sustainable forest management by local residents on their own initiative”.

3.2 Basic Concepts of the M/P

The basic concepts (or twin pillars) of the M/P are “sustainable forest management by local residents” and “appropriate forest distribution”.

3.2.1 Sustainable Forest Management by Local Residents

The effective functioning of the mechanism composed of basic activities, priority approaches and factors to support forest management activities is essential for the success of sustainable forest management by local residents.

There are three basic activities which must be conducted in every community.

- Environmental education
- Prevention of forest fires
- Livelihood improvement

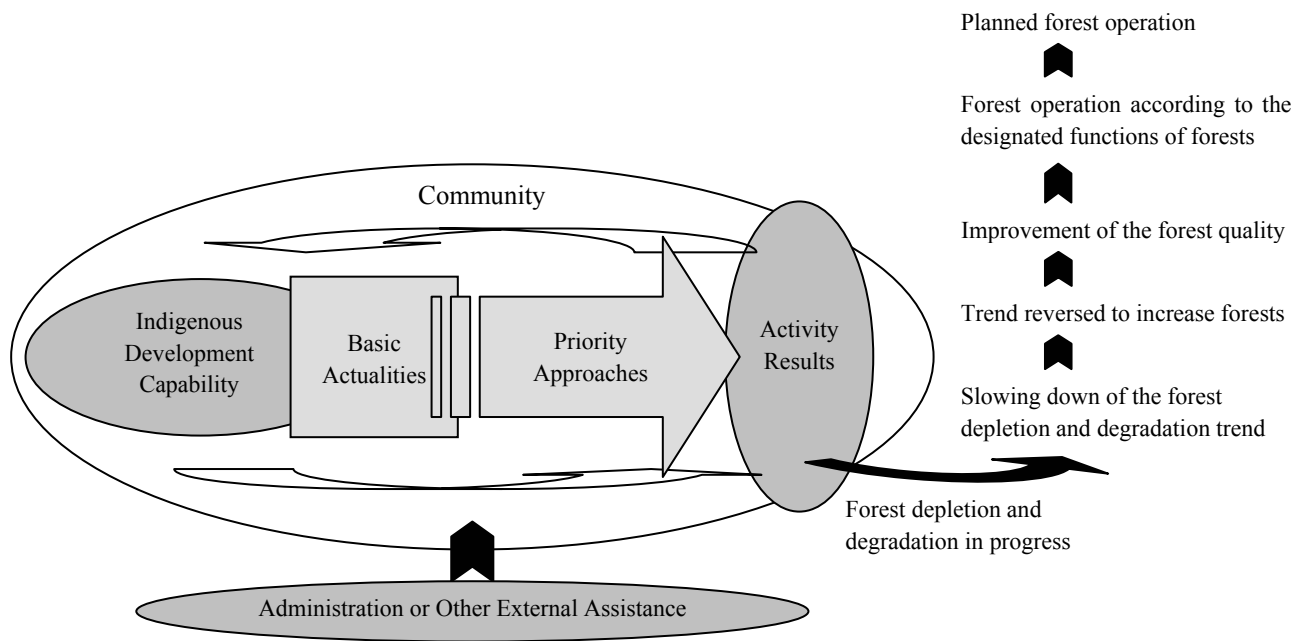
There are three types of priority approaches.

- Slash and burn farming control measures
- Soil conservation measures
- Forest improvement measures

There are also three factors to support forest management activities.

- Indigenous development capability : capacity of local residents to contribute to the promotion of forest management activities (technical capability, organizational strength, resources procurement capability and willingness to initiate activities)
- Administration or other external assistance : function to provide technical and financial assistance for communities from outside
- Activity results : perception of local residents of the improved state/conditions resulting from activities as favourable changes

The relationship between these three factors and the priority approaches and basic activities is shown in the schematic diagramme below. While receiving external assistance, local residents conduct activities which suit the present conditions of the community among the basic activities and priority approaches and their indigenous development capability is enhanced as a result of these activities. It is believed that the forest management level will improve as the repetition of this process will slow down the present trend of forest depletion or degradation and even start to increase forests.



3.2.2 Appropriate Forest Distribution

As the main focus is disaster prevention, northern León Department which forms the headwater area is given the highest priority from the viewpoint of watershed management. Meanwhile, sloping areas where the soil is unstable are considered to be priority areas from the viewpoint of priority classification in terms of the land inclination.

3.3 Outline of the M/P

3.3.1 Forest Improvement Plan

- Thin natural forests — enrichment of 11,000 ha
 - Shrub forests — restoration of 5,500 ha by switching to permanent farming
 - Farmland — planting of 7,700 ha
 - └─ agroforestry of 11,600 ha
 - Pasture — silvopastoral of 15,000 ha
- Total: 50,800 ha

3.3.2 Other Plans

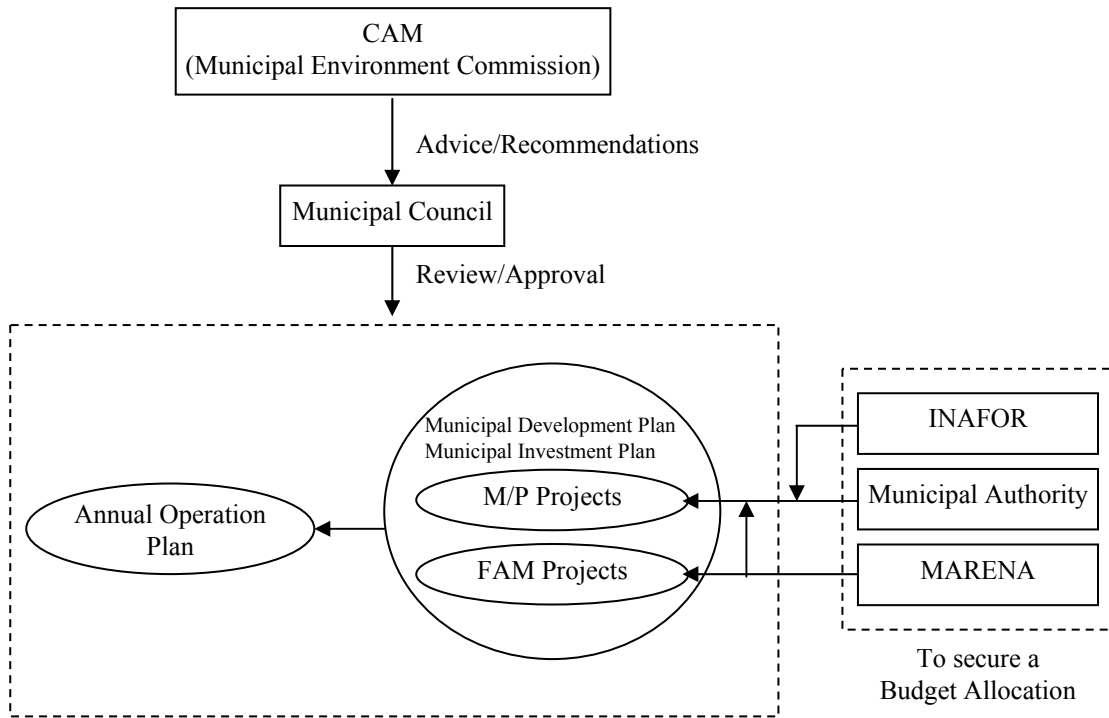
- Erosion control facilities ————— dry masonry dams, fence dams and dry masonry works, etc.
- Forest protection ————— forest fire control measures and environmental education, etc.
- Livelihood improvement ————— home gardens and improved stoves, etc.
- Development of implementation system— local residents’ side and administration side

3.4 Implementation of the M/P

3.4.1 Incorporation of the M/P in the Municipal Development Plan

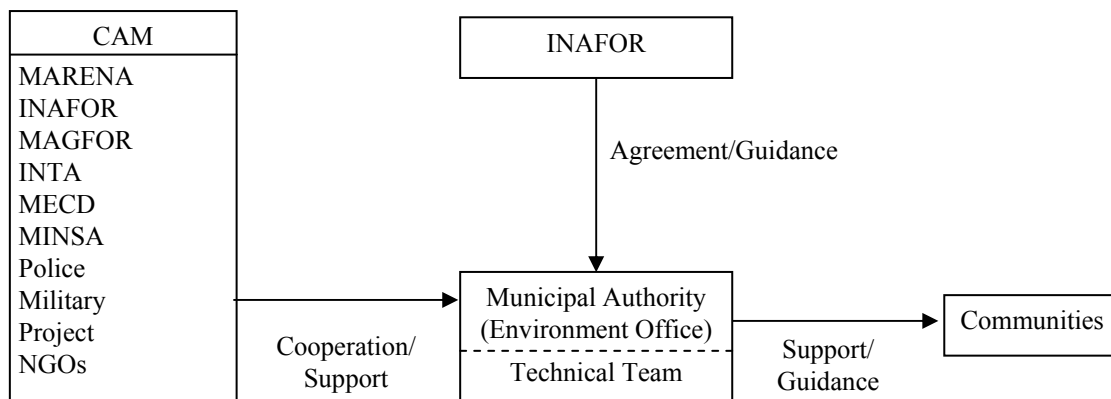
In view of the fiscal conditions of administrative bodies and the current situation of administrative organizations, local residents who own the land must play a leading role in forest management in a sustainable manner with the assistance of the administration. Appropriate arrangements for the provision of assistance by the administration appear to be that the INAFOR responsible for forest management administration should be in charge of such assistance at the national level while municipalities directly involved in the daily life of local residents provide guidance and assistance at the local level. Accordingly, each municipality is required to incorporate the M/P projects in the Municipal Development Plan, Municipal Investment Plan and Annual Operation Plan to implement the M/P as its own project. The division of work between the INAFOR and municipalities must conform to the provisions of Article 7 of the New Forest Law.

The likely mechanism to incorporate the M/P projects in the Municipal Development Plan, Municipal Investment Plan and Annual Operation Plan is shown in the schematic drawing below. The municipality should prepare the budget for the implementation of the M/P projects using its own budget, funding sources available at the INAFOR (FONADEFO) and/or FAM of the MARENA and incorporate the M/P projects in the Municipal Development Plan with the approval of the municipal council.



3.4.2 Implementation System

For the implementation of the M/P, a technical team will play a central role in the provision of assistance and guidance for communities under an agreement made between the INAFOR and municipal authority in line with the provisions of Article 7 of the New Forest Law. However, the INAFOR engineers will form a joint team with municipal engineers during the period when the technical level of the municipal team is not sufficient or the municipal team has not yet been properly formed.



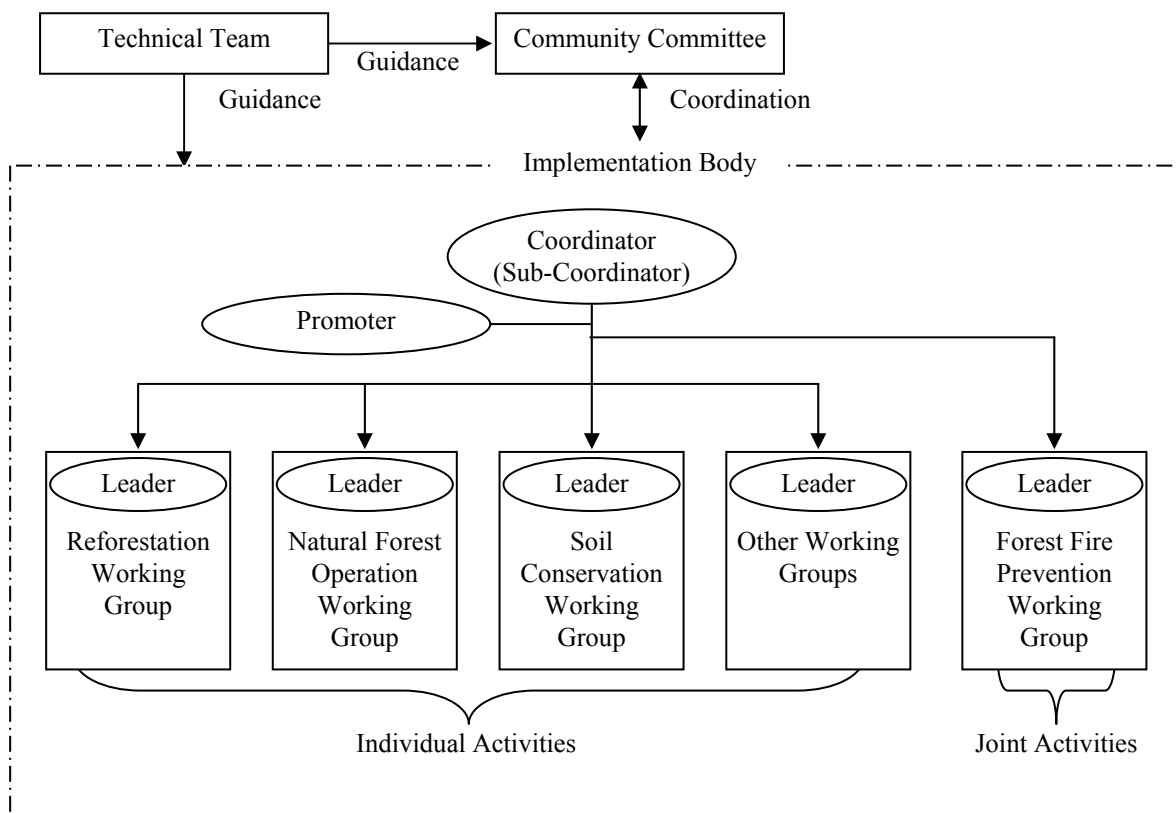
3.4.3 Processes of Forest Management Activities at the Community Level

Coordination with the community committee is essential for the implementation of the M/P at the community level and the following four steps should be followed prior to the actual implementation of the M/P.

- Request by the municipal authority to the community committee to implement forest management activities
- Approval by the community committee
- Explanation of the activities to local residents
- Organization of the participants

3.4.4 Implementation System at the Community Level

The M/P implementation body at the community level consists of working groups of individual persons and working groups for joint activities under the supervision of a coordinator. These working groups will conduct their own activities in coordination with the community committee while receiving appropriate guidance from the technical team.



3.4.5 Implementation System at the Municipal Level

Many municipal authorities have set up their own environment office and this office will act as the principal body for the promotion of the M/P projects in each municipality. The expected functions of this office are listed below.

- To incorporate municipal policies on forests and the environment in the Municipal Development Plan
- To act as a facilitator for local residents
- To implement environmental education to raise and maintain awareness of the importance of forests and the environment among local residents
- To support community organizations to enhance their capacity
- To train promoters in communities
- To act as the secretariat for the CAM to liaise with other related organizations

3.4.6 Implementation System at the INAFOR

The INAFOR has set up the UTT-PPM in its Department of Forest Promotion and increased the number of staff from three to five in 2004. The INAFOR will assist municipal authorities through the following activities.

- Conclusion of an agreement for the implementation of the M/P with municipal authorities as part of its forest promotion efforts
- Provision of guidance for municipal authorities for the incorporation of the M/P in Municipal Development Plans
- Introduction of fiscal measures to fund the necessary expenses of the municipal environment offices and cost of activities at the community level for the implementation of the M/P
- Provision of education and training for the teams of engineers working at municipal environment offices for the implementation of the M/P
- Coordination with similar activities of such related organizations as the MARENA, INTA and MECD for the smooth implementation of the M/P.

4. Recommendations

While forests constitute part of the most basic infrastructure for the prevention of natural disasters, their development requires an extremely long period of time, making the continual implementation of development efforts with the support of local residents, including those who are directly involved in such efforts, essential. Given this specific nature of forest development, special attention must be paid to the following points.

- Forest development must be continuously conducted by local residents, who are land owners, themselves covering fairly large areas. The relevant administrative organizations must, therefore, develop a system which is capable of providing the necessary support and guidance to ensure the early start of forest development/improvement efforts while being aware of the need to enhance the indigenous development capability of local residents.
- The INAFOR should make every effort to secure the necessary funding sources for the execution of a wide range of work of not only the UTT-PPM but also municipal environment offices.
- The Head Office of the INAFOR has already set up the UTT-PPM and has been developing the system required to implement the M/P. It should continue to consolidate the system by means of i) securing funding sources through coordination with other related government organizations in addition to its own funding source, ii) increasing the staff strength of the UTT-PPM by appointing those with experience of participatory projects, iii) implementing the various activities jointly with well-experienced consultants/NGOs and iv) training its staff members with the cooperation of a donor(s).
- The UTT-PPM must provide assistance for the incorporation of the M/P in the Municipal Development Plans and the development of a system whereby each municipal environment office can provide guidance for local communities in the municipality. The guidance for local communities should initially involve the training of municipal engineers through the creation of a joint technical team by the INAFOR and each municipal environment office.
- The INAFOR must establish a cooperative/collaborative relationship with other administrative organizations, including the MARENA, INTA and MECD, as well as implementing bodies of other similar projects to materialise the implementation of the M/P.

- Engineers of the UTT-PPM and municipal environment offices will be required to maintain a neutral position to act as facilitators as far as local residents are concerned. Guidance and support for local residents must be provided in a manner which does not favour particular local residents and demand the existence of key persons on both the local resident side and the administration side. The possibility of receiving guidance from industries and the market should be explored.
- When the external guidance by the administration, etc. has passed a certain period of time, it will be necessary to rely on promoters. As the first step to ensure energetic activities by promoters, it will be necessary to create an appropriate atmosphere among local residents which will eventually lead to the establishment of a consensus to reward promoters in some way.
- The present forest management planning system has the risk that local residents will lose their motivation to proceed with the small-scale restoration of natural forests. Institutional measures should be introduced to change this situation.
- For the designation of protection forests, the establishment of a local consensus on the need to preserve specified forests is essential. As such a consensus cannot be established in a short period of time, the INAFOR should adopt a long-term strategy to accumulate positive achievements with a view to eventually establishing the required consensus.

5. Pilot Study (P/S)

5.1 Purposes of the P/S

The P/S was conducted for the purposes of i) implementing the Forest Management Action Plan for Disaster Prevention proposed by the Interim Report with the initiative of local residents, ii) fostering the awareness of local residents through the implementation processes of the Action Plan to ensure the continuity of various activities and iii) reflecting the lessons and important points learned from the actual experience of the Action Plan on the planning processes of the final M/P.

5.2 Target Communities of the P/S

The nine communities listed below were targeted by the P/S.

Department	Municipality	Community
Chinandega	Puerto Morazán	La Sandino
	Villaneuva	Los Tololos
	El Viejo	Palermo
	Chichigalpa	Versalle - Apastepe
León	Achuapa	El Pajarito - Las Brisas
	El Sauce	El Cacao
	Santa Rosa del Peñon	El Charco
	León	Lechecuagos (Urroces)
Managua	San Francisco Libre	Las Mercedes

5.3 P/S Schedule

Year	2002												2003										
Month	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11
Participatory Planning Stage																							
Planning	■	■	■																				
Implementation Stage																							
Baseline Survey						●																	
Activities in the First Season						■	■	■	■	■	■	■											
Workshop for Interim Evaluation											■	■											
Nursing Period in the Second Season													■	■	■	■	■	■	■	■	■	■	■
Activities in the Second Season																							
Technical Meeting																							
Meeting with Municipal Officials																							
Participatory Evaluation Stage																							
Monitoring Survey																							
Workshop for Final Evaluation																							

5.4 Inputs Under the P/S

The amounts of the inputs in the three periods, i.e. First Season, nursing period of the Second Season and Second Season, are listed below.

- Manpower Inputs
 - Entrusted engineers : 12 person-days/month/community
 - Local participants : 284 at the beginning 236 at the end

- Physical Inputs
- Equipment and materials supplied : slightly less than US\$ 200 per participant as the total for the three periods

5.5 Main Activities of the P/S

- Nursing of seedlings : 165,000 seedlings
- Planting for reforestation : 97,400 seedlings
- Natural forest management : enrichment with 43,400 seedlings
- Slash and burn farming control and soil conservation measures : creation of rock ridges, earth ridges and live fence, etc.
- Forest fire prevention : establishment of community rules on burning cultivation, implementation of a forest fire prevention campaign and creation of firebreaks, etc.
- Environmental education : implementation of a forest fire prevention campaign and educational activities targeting primary school pupils, etc.
- Livelihood improvement : installation of improved stoves, home gardens and compost-making, etc.
- Strengthening of community organizations : seminars, etc.

5.6 Changes of Communities

The following changes of communities occurred with the implementation of the P/S in terms of four components of indigenous development capability.

- Technical capacity: The learning of new skills is cited by local residents as a favourable aspect of participation in the P/S and the learning of nursing techniques in particular is positively evaluated by many participants.
- Organizational strength: A preference for personal activities can be observed among the participants after the learning of new techniques. The level of leadership strength appears to have produced different activity results. Differences in the capacity for united action among the participants have manifest themselves in the form of different degrees of satisfaction in participation in the P/S.

- Resources procurement capability: Even though a tendency to rely on external assistance is still evident, there are growing signs of efforts to use their own resources.
- Willingness to initiate activities: Such direct benefits as recognisable economic value of reforestation work, the improvement of farmland due to soil conservation measures and diversification of the diet have increasingly formed the motivation for participation in various activities.

5.7 Lessons Learned

- As the priority of issues related to the forest environment is not necessarily high for local residents, improvement of the various conditions to stimulate their participation in various activities is essential while considering possible coordination or mutual supplementation with other projects.
- Some incentives are believed to be necessary for the promotion of soil and water conservation activities and the examination of suitable incentives and an approach designed to encourage self-reliance among local residents is required.
- The voluntary participation of local residents in various activities is important. Instead of forcing them to conduct all types of work jointly, it is more acceptable for them to individually conduct certain types of work which can be conducted in this manner.
- The key matters for group work are the strength of unity among local residents, leadership and motivation for participation.
- Coordination between the implementation bodies and the community committee is critical for community-based activities.
- An activity plan should not become a burden for the participants due to an excessive work volume.
- The posture to proceed with guidance while identifying what local residents really need is important.
- Careful consideration is required for the formulation of a product marketing plan.
- Coordination with educators is effective for environmental education.
- The sustainable application of technologies/techniques which local residents have thought of themselves, recognising their usefulness, is believed to be higher than those thought useful based on the unilateral judgement of technicians. Repeated guidance is also important.
- From the administrative point of view, what is essential is a system under which municipal offices, which are the closest administrative bodies to local residents, provide

guidance and assistance. Another essential requirement is stronger coordination between related organizations.

- To obtain the approval of community rules regarding burning cultivation, it is hoped that the INAFOR will act as the leader to facilitate the approval work.
- As activities related to forest development and environmental improvement take a long time to achieve their objectives, it is important to emphasise the monitoring and evaluation processes.

6. Guidelines for Formulation of Forest Management Action Plans for Disaster Prevention

Three sets of guidelines are introduced as the basis for the formulation of forest management action plans for disaster prevention at the community level.

- Forest management
- Environmental education
- Livelihood improvement

These guidelines have the following components.

- Method to clarify the current situation of a community
- Method to select desirable activities
- Indicators used for monitoring
- Method to compile an action plan

Another set of guidelines is introduced to illustrate desirable ways of developing an organization and system to ensure the smooth implementation of various activities.

- Development of systems for the operation of an organization and the implementation of activities

These guidelines have the following components.

- Organization of communities
- Enhancement of the strength of community organizations
- External assistance system
- Improvement of the indigenous development capability

7. Community Guidance Manuals

Three manuals are introduced to show the methods to provide guidance for local residents for the implementation of forest management action plans for disaster prevention.

- Forest management and village development: matters to be taken into consideration for i) the preparation of activity plans for both individuals and groups and ii) guidance
- Operation of organizations: methods to organize implementing organizations and to enhance the organizational strength
- Training activities: activity guidance methods (with the principal purpose of improving the indigenous development capability)

PART I OUTLINE OF THE STUDY

CHAPTER 1 BACKGROUND OF THE STUDY AND OTHER RELATED MATTERS

1.1 Background of the Study

Some 4,000 people, the largest ever number of casualties recorded by a single hurricane in the history of Nicaragua, were reported dead or missing due to Hurricane Mitch which hit the country in October, 1998. 40,000 homes and 83 bridges were damaged along with extensive damage to farmland and roads, etc. In the area lying at the foot of the western hillsides of the Maribios Mountain Range on the Pacific side in particular, the occurrence of a massive debris flow decimated two villages, causing many human casualties. The flooding of rivers in the Viejo River System flowing into Lake Managua and the rise of the water level of the lake has forced many local people to relocate their homes.

While the area to the north of Lake Managua and volcanic ash land around the Maribios Mountain Range where the damage was particularly severe require the implementation of flood control and debris flow prevention measures, the possibility of introducing large-scale civil engineering projects in these areas is limited because of their natural and socioeconomic conditions. For this reason, restoration of the soil and water conservation functions through forest management and reforestation in the drainage basin is expected to be an effective medium and long-term disaster prevention measure. Such reforestation work can also be expected to have the secondary effect of the sustained supply of fuelwood.

In November, 1999, the Government of Japan dispatched a study team to formulate a project for the implementation of hurricane damage rehabilitation and disaster prevention measures in Central America and this study team suggested the possibility of a development study on reforestation as a disaster prevention measure to Nicaragua. Following this suggestion, the Government of Nicaragua made a request to the Government of Japan for the implementation of a development study for the formulation of a disaster prevention reforestation project in January, 2000, designating the INAFOR of the MAGFOR as the counterpart. The target areas of the project were the area to the north of Lake Managua and the Maribios Mountain Range area. In response to this request, the Government of Japan dispatched the Preliminary Study Team to Nicaragua which subsequently concluded the S/W with the Nicaraguan side in September, 2000.

1.2 Objectives of the Study

(1) To formulate a master plan on forest management for disaster prevention to improve the soil and water conservation functions of forests through participatory forest management activities in an area of some one million ha in the Northern Pacific Region in the Republic of Nicaragua and also to conduct a pilot study to clarify the plan implementation processes and concrete measures required to ensure project implementation with the participation of local residents.

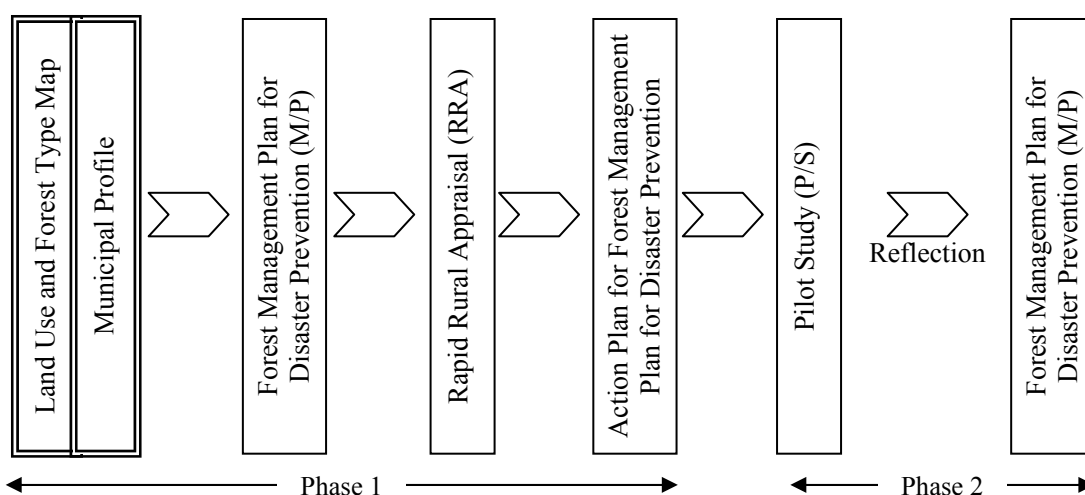
(2) To transfer technology and guidance on the survey method and planning and design processes as well as the concepts for each of the survey items to the INAFOR, the counterpart for the Study.

1.3 Study Area

The target area of the Study (Study Area) is an area of some one million ha stretching over the Chinandega, León and Managua Departments along the Pacific coast (see Location Map of the Study Area). This area contains 20 municipalities, i.e. nine in the Chinandega Department, 10 in the León Department and one (San Francisco Libre) in the Managua Department. The Negro River drainage basin in the Chinandega Department has been removed from the Study Area. Although the upper reaches of Sinecapa River and Viejo River located in the Matagalpa Department and Estelí Department are outside the Study Area, these (total area of approximately 230,000 ha) are included on the land use and forest type map based on the aerial photograph interpretation in view of the necessity to understand the situation of land use in the upper reaches.

1.4 Study Flow

The Study roughly followed the flow described below.



< Phase 1 >

(1) Preparation of Land Use and Forest Type Map and Municipal Profiles

A land use and forest type map covering the entire Study Area was prepared together with a profile of each municipality in the Study Area.

(2) Formulation of Forest Management Plan for Disaster Prevention

The Forest Management Plan for Disaster Prevention (hereinafter referred to as the “M/P”) was formulated based on the “Land Use and Forest Type Map” and “Municipal Profile”. Out of the 20 municipalities in the Study Area, Somotillo, El Realejo and Corinto are situated in a flat coastal area and could not be the targets of the M/P designed to improve the soil and water conservation functions, the formulation of which is the objective of the Study. For this reason, no planning was conducted for these three municipalities.

(3) Implementation of Rapid Rural Appraisal

One community in each municipality (except for Chichigalpa where two communities were selected) of the 17 municipalities for which the M/P was formulated was selected and a Rapid Rural Appraisal (RRA) was conducted to clarify the current situation of these 18 communities.

(4) Formulation of Forest Management Action Plan for Disaster Prevention

Based on the RRA results, a forest management action plan for disaster prevention was formulated to clarify the principles for forest management activities for disaster prevention in the 18 communities.

< Phase 2 >

(1) Implementation of Pilot Study

Out of the 18 communities for which the Action Plan was formulated, nine communities were selected based on the results of the RRA and other surveys for the implementation of the Pilot Study (hereinafter referred to as the “P/S”). This P/S was conducted for the purpose to clarify the plan implementation process, particularly concrete measures to ensure the participatory implementation of the Plan.

(2) Revision of the M/P

The M/P formulated in Step 2) in Phase 1 was revised to reflect the lessons and important points learned during the P/S and the final M/P was produced.

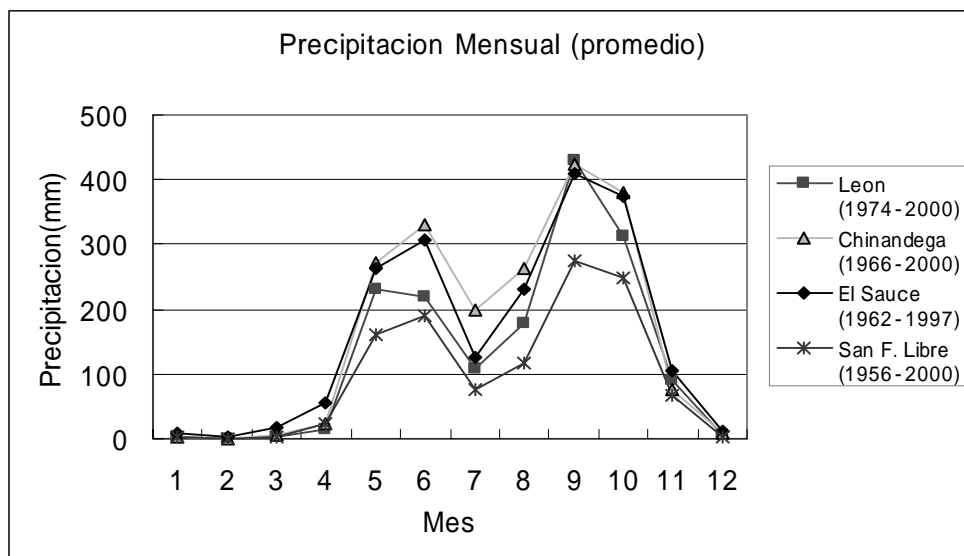
The study schedule, including the timing of each work, field survey and various reports, is shown in Appendix 2.

CHAPTER 2 PRESENT SITUATION OF THE STUDY AREA

2.1 Natural Conditions

2.1.1 Climate

The mean annual temperature in the Study Area is 27°C – 28°C with little monthly fluctuation. In contrast, the rainfall level considerably fluctuates from one season to another. In general, the first rainfall peak occurs from May to June, followed by a second peak from September to October. The period between these peaks, i.e. from mid-June to early September, is called the minor dry season (Canícula). However, the rainfall level from May to July may be low, depending on the year, indicating the unreliability of the rainy seasons. The dry season lasts for some five months from December to the following April and presents harsh climatic conditions with hardly any rainfall.



Source: Based on data published by the INETER.

Fig. 2-1-1-1 Monthly Rainfall (Mean Value)

2.1.2 Topography and River Systems

The topography consists of the Maribios Mountain Range (Cosigtüina – San Cristobal – Telica – El Hoyo – Momotombo) which runs through the Study Area from the northwest to the southeast, volcanic hills and mountains in the northeastern part (Sauce Mountains) and the northwestern part (Mount Cerro Partido, etc.) and plains and hilly areas located between the

mountains and along the coast. The most representative topographical features are listed below.

- Quaternary volcanic plain : plain with an elevation of 200 m or lower which is made up of volcanoclastic materials and volcanic ash of the Holocene and which has been dissected to a medium degree; distributed in the lower reaches of Estero Real River and around volcanic mountain ranges
- Volcanic sedimentary plain : plain with an elevation of 200 m or lower which is made up of volcanoclastic materials of the Pleistocene and which has been weakly dissected; distributed in the drainage basin of Estero Real, Olomega, Tecomapa and Villaneuva Rivers and the drainage basin of Sinecapa and Viejo Rivers.
- Tertiary volcanic hill : hill with an elevation of 100 – 450 m and an inclination of 15 – 30% which is made up of volcanic rocks of the late Miocene and where gullies have developed due to strong dissection; hills at the foot of the Sauce Mountains, Santa Rosa del Peñón Hill, Buena Vista Hill and Mina El Limón Hill, etc.
- Tertiary volcanic mountains : mountains with an elevation of 200 – 1,000 m and an inclination of 30 – 50% which are made up of volcanic rocks of the Miocene; Sauce Mountains
- Volcanic cone : cone of which the inclination is 50% or more and which was originally formed by volcanic eruption in the Holocene of the Quaternary; Maribios volcanic mountain range
- Quaternary volcanic hill : a transition zone of the Quaternary volcanic plain and volcanic cone; distributed at the feet of the Maribios Mountain Range
- River mouth swamp : swamp which is distributed at a river mouth in a coastal area and which is made up of alluvial and marine deposits; lower reaches of Estero Real River, Estero Padre Ramos, Isla del Aserradores, Paso Caballos, PoneLOYA and El Tamarindo, etc.

Local river systems are largely grouped into three drainage basins: (i) drainage basin of Estero Real River in the northern part of the Study Area, (ii) drainage basin of various rivers flowing into Lake Managua in the southeastern part of the Study Area and (iii) drainage basin of rivers originating from the Maribios Mountain Range and emptying into the Pacific.

2.1.3 Geology and Soil

The Study Area is geologically made up of volcanic rocks, volcanoclastic materials, volcanic ash and marine deposits, etc. of the Miocene of the Tertiary and later. The main soil types are Entisols at the slopes and feet of volcanic mountains, Vertisols at plains, Inceptisols at plains

in the western part and feet of volcanic mountains and Millisols at plains in the western part, Nicaragua Basin and Tertiary volcanic hills and mountains. The US Soil Taxonomy describes the characteristics of these soil types in the following manner.

- Entisols : immature soils where soil formation has been developing or soils subject to intensive erosion; with a very shallow A horizon; equivalent to Regosols in the FAO/Unesco soil classification
- Vertisols : clay-rich soils in which deep cracks form during the dry season; can be used for paddy fields with irrigation but unsuitable for dry field farming; the tree growth on Vertisols is limited and Jicaro mainly grows in the Study Area; the same name is used in the FAO/Unesco soil classification
- Inceptisols : young soils in the process of soil formation with the presence of a Mollic A horizon; Inceptisols are further classified as Mollic Vitrandepts (Regosols in the FAO/Unesco soil classification) without a B horizon and Typic Eutrandedpts (Andosols in the FAO/Unesco soil classification) with a Cambic B horizon
- Mollisols : soils with a high degree of saturation and a Mollic A horizon; Mollisols are further classified as Haplustolls with a Cambic B horizon and Argiustolls with an Argilic B horizon; equivalent to Kastanozems in the FAO/Unesco soil classification

2.1.4 Land Use and Forest Types

The land use and forest types in the Study Area were grasped based on existing materials, the field survey findings, the results of the aerial photograph interpretation and the land use and forest type map established using aerial photograph interpretation. While most of the aerial photographs were taken from December, 1999 to March, 2000, those taken from December, 1995 to March, 1996 were used for three areas, i.e. ① the northern part of Achuapa and the upper reaches outside the Study Area, ② the area along the Pacific coast of El Viejo and ③ the area from the southern part of León to Nagarote because of the lack of photographs taken in the later period. However, the interpretation accuracy of these photographs was not high, partly because of their small scale (1:40,000 based on ultra-high altitude photography) and partly because of the low level of sharpness and contrast, presumably due to mist.

Three land use categories, i.e. forests, agropasture and others, were applied for interpretation purposes. Natural forests were primarily classified as broad-leaved forests, coniferous forests, mixed forests with coniferous and broad-leaved species and mangrove forests. Further classification was then conducted using the tree height and crown density. In the case of mangrove forests, only the crown density was used as their height was fairly uniform. Shrub forests mainly used as pasture were classified as grazing forests and only the crown density

was used for further classification. Man-made forests were classified in the single category of man-made forests, partly because most stands of some 1 cm x 1 cm which could be indicated on the topographical map (1:50,000) were Eucalyptus forests and partly because the tree height mainly fell in the range of 7 – 20 m. Farmland and pasture were combined in the category of agropasture, partly because of the common practice of grazing on post-harvest farmland and partly because of the difficulty of distinguishing them on the aerial photographs. Others were further classified into treeless land, such as landslide sites and rocky land, shrimp farms/salt farms, urban areas/hamlets and water bodies.

Using the land use and forest type map prepared based on the aerial photograph interpretation results, an area table by municipality and by land use and forest type category was compiled (see Appendix 4). Table 2-1-4-1 shows the area by land use and forest type category for the entire Study Area. The most popular type of land use is agropasture, followed by broad-leaved forests and mixed forests.

Table 2-1-4-1 Area of Each Land Use and Forest Type by Inclination Class

(Unit: ha)

Land Use and Forest Type Category	Inclined Zone				Flat Zone	Total
	Steep Sloping	Mixed Sloping	Gentle Sloping	Sub-Total		
Coniferous Forests	30	1,988	0	2,019	0	2,019
Broad-Leaved Forests	47,155	86,974	48,287	182,416	106,958	289,374
Mixed Forests	0	132	0	132	0	132
Mangrove Forests	0	0	0	0	42,652	42,652
Man-Made Forests	0	45	2,238	2,283	3,003	5,286
Grazing Forests	1,728	11,382	4,656	17,767	92,729	110,495
Agropasture	5,290	110,221	17,003	132,514	318,315	450,829
Others	6,777	2,442	1,787	11,005	78,369	89,374
Total	60,980	213,185	73,970	348,136	642,024	990,160

Notes

1. The total figures may not be consistent with the sum of the relevant individual figures because of rounding.
2. Others include urban areas, shrimp culture farms and water bodies, etc.
3. For more details of the categories of steep inclination, medium inclination, gentle inclination and flat area, see Part II 1.2.1-2) – Classification of Areas.

Source : Totalised from the land use and forest type map prepared by the Study Team.

Table 2-1-4-2 shows the calculation results for the forest ratio based on the above area table. The forest criteria used for this calculation was the criteria used by the National Land Planning Department of the MAGFOR for its Year 2000 version of the National Forest Type Map (tree height of 7 m or higher and a crown density of 30% or higher).

If stands of which the tree height was less than 7 m and of which the crown density was 10% or higher but less than 30% had been included in the forest ratio calculation, the result would have been nearly three times the initially calculated forest ratio for the entire Study Area. This fact indicates the presence of many thin stands with a low tree height throughout the Study Area.

Table 2-1-4-2 Comparison of Forest Ratios

Forest Physiognomy	Department of Chinandega	Department of León	Municipality of S.F. Libre	Total Study Area
Tree Height \geq 7 m Crown Density \geq 30%	19.4%	13.5%	8.1%	15.6%
Tree Height < 7 m and 10% \leq Crown Density < 30%	35.3%	49.7%	76.5%	45.4%

Source: Totalised from the land use and forest type map prepared by the Study Team.

The Study Area was classified into three drainage basins, i.e. the Lake Managua drainage basin, Pacific coast drainage basin and Estero Real River drainage basin. Table 2-1-4-3 shows the area by land use and forest type category for each of these three drainage basins. The characteristics of each drainage basin based on their comparison are described below.

The Lake Managua drainage basin has less agropasture and fewer man-made forests but has many broad-leaved forests. Half of the Pacific coast drainage basin is occupied by agropasture and this drainage basin has the largest area of man-made forests among the three drainage basins. Although the Estero Real River drainage basin appears similar to the Pacific coast drainage basin at first glance, it has many open stands because of the higher level of aridness compared to the Pacific coast drainage basin. Coniferous forests and mixed forests are found in areas with a high elevation in the Estero Real River drainage basin.

Table 2-1-4-3 Land Use and Forest Type Area by Drainage Basin and Percentage Ratio

Land Use and Forest Type Category	Drainage Basin						Total	
	Lake Managua		Pacific Coast		Estero Real River			
	ha	%	ha	%	ha	%	ha	%
Coniferous Forests	162	-	0	0	1,856	-	2,019	2
Broad-Leaved Forests	109,342	46	95,953	27	84,079	21	289,374	29
Mixed Forests	0	0	0	0	132	-	132	-
Mangrove Forests	0	0	18,474	5	24,178	6	42,652	4
Man-Made Forests	43	-	3,259	1	1,984	-	5,286	1
Grazing Forests	40,066	17	32,286	9	38,143	10	110,495	11
Agropasture	71,313	31	180,579	51	198,937	50	450,829	46
Others	12,754	6	25,882	7	50,739	13	89,374	9
Total	233,680	100	356,432	100	400,048	100	990,160	100

Notes

1. The total figures may not be consistent with the sum of the relevant individual figures because of rounding.
2. Others include urban areas, shrimp culture farms and water bodies, etc.

Source : Totalised from the land use and forest type map prepared by the Study Team.

The main land use categories in the Study Area are agriculture, grazing and forests and areas with prominent activity of one of these categories are classified as agricultural areas, grazing areas and forest areas respectively. The main agricultural area in the Study Area is the plain at the feet of the Maribios mountain system. This area is the largest agricultural area in Nicaragua. Up until the 1980's, cotton was commonly grown in this area but has now been replaced by sugar cane, maize, kidney beans, sesame and peanuts.

Eucalyptus forests created on former cotton fields are also observed in this area and were mostly created by sugar companies to obtain firewood or as part of forest environment-related projects. Other agricultural areas include lowland paddy fields and orchards on the west bank of Lake Managua.

The main grazing land is the plain stretching from León to Nagarote, plains in the middle reaches of Estero Real River and the plain of San Francisco Libre. These areas are unsuitable for farming because of the poor soil fertility due to the presence of much gravel or the outcropping of bedrock and also because of the high level of aridness. Grazing on post-harvest land in agricultural areas and silvopasture in forest areas are commonly observed, suggesting the popularity of stock raising over a wide area.

The main forest areas are 1) areas above the halfway of mountains along the Pacific coast, such as Mt. Cosigüina, Mt. Cerro Partido and the Maribios Mountain Range, 2) the mountainous area in the northern part of the Study Area, including the upper reaches of Estero Real River, Viejo River and Sinecapa River and 3) the upper reaches of Pacora River which runs through San Francisco Libre. Natural forests at Mt. Cosigüina and the Maribios Mountain Range still have large diameter trees and are designated as natural reserves under the jurisdiction of the MARENA. Other prominent forests are intermittent mangrove forests in the delta of Estero Real River and along the Pacific coast from El Viejo to León and riparian forests in the middle reaches of Estero Real River and the lower reaches of Sinecapa River.

Slash and burn agriculture is practiced on the hillsides in mountainous forest areas and maize, kidney beans and sorghum are popular crops. Coffee is grown on the forest floor of some natural broad-leaved forests. Many mountain forests have been subject to burning for slash and burn agriculture or grazing, forming a mosaic pattern consisting of slash and burn agricultural plots of some 4 – 5 ha each and shrub forests or open forests used as grazing forests (emerging at former slash and burn plots).

2.1.5 Natural Disasters in the Past

(1) Disaster Records

Nicaragua has suffered from many large-scale natural disasters because of its natural conditions. Table 2-1-5-1 lists the main natural disasters in the past based on various records.

Table 2-1-5-1 Past Disasters in Nicaragua

Type of Disaster	Year of Occurrence (Date)	Disaster Site(s)	Description of Disaster
Drought	1972 – 1973, 1976 – 1977, 1982 – 1983, 1986 – 1987, 1991 – 1992, 1993 – 1994, 1997	Nationwide	Extensive damage to agriculture and fauna
Volcanic Eruption	1957, 1960, 1968, 1971, 1992, 1995, 1999	Mt. Cerro Negro	Fatal casualties and damage to social infrastructure
	1948, 1965, 1969, 1981, 1994, 1999	Mt. Telica	Fatal casualties and damage to social infrastructure and farm crops
	1997	Mt. San Cristobal	Damage to banana and coffee production
	1965	Mt. Masaya	Fatal casualties and damage to social infrastructure; this mountain is still active and acid rain is causing damage to social infrastructure and farm crops
	1951, 1957, 1984	Mt. Concepción	Fatal casualties and damage to social infrastructure
Earthquake	1931 (31 st March)	Managua	M5.6 killing some 1,000 people and destroying most buildings
	1968 (4 th January)	Managua; Colonial Centroamerica	M4.6 damaging some 500 houses
	1992 (23 rd December)	Managua	M6.2 killing some 10,000 people and demolishing the central area of the city
Tsunami	1972 (1 st September)	Pacific coast	Tsunami of 8 – 12 m in height which assaulted the entire Pacific coast, causing severe damage to such production and service sectors as agriculture, stock raising, fisheries, trade and tourism; the damage to infrastructure included water supply, sewerage, power supply and port facilities and some people lost their lives
Tropical Pressure	Low 1950 (King) 1963 (Alice) 1964 (Isabelle) 1993 (Gert) 1993 (Bret) 1994 (Gordon)		
Hurricane	1964 (Gilda) 1971 (Edith) 1971 (Irene) 1974 (Fifi) 1982 (Alleta) 1985 (Allen) 1988 (Juan) 1996 (Cesar) 1998 (Mitch)	While hurricanes directly threaten the Pacific coast side, their direct and indirect impacts are felt nationwide.	Hurricane Mitch in 1998 inflicted the most damage of all as shown below <ul style="list-style-type: none"> • Death toll : approx. 3,000 • Number of people reported missing : approx. 900 • Number of people evacuated : 763,000 • Damaged houses : 41,420 • Damaged schools : 512 • Damaged bridges : 83 • All sectors, including agriculture, manufacturing and commerce, were affected
Flood	Almost every year		Affecting people's livelihoods and the national economy
Landslide	Almost every year	<p>< Volcanic ></p> <ul style="list-style-type: none"> • Mt. San Cristobal • Mt. Telica • Mt. Mombacho • Mt. Maderas • Mt. Concepción <p>< Roadside ></p> <ul style="list-style-type: none"> • Managua-Matagalpa • Matagalpa-Ocetal • León-San Isidro • Masaya-Laguna de Apoyo • Juigalpa-Rama • La Virgen-San Juan del Sur • Rio Blanco-Paiwas • Jinotega-Cua Bocay 	
	1990	Quebrada Soca in Tecolo State; Cerro Wana on Rio Blanc-Paiwas Road; Cerro El Caballo in Muy Muy	Casualties, some fatal, and damage to hamlets

Source: Based on records obtained from the INETER.

(2) Characteristics of Natural Disasters in Nicaragua

The analysis of natural disasters in Nicaragua found the following characteristics.

1) High Frequency

The frequency of natural disasters is fairly high with every one to five years for drought, every six years for the volcanic eruption of Mt. Cerro Negro and every seven years for Mt. Telica which are two examples volcanoes in the Maribios Mountain Range, three earthquakes of M4.6 or larger every 70 years centering on Managua, nine hurricanes in 40 years and every year for flooding.

2) Diversity

There is a diversity of natural disasters, ranging from drought and volcanic eruptions to earthquakes, tsunami, tropical low pressures, hurricanes, floods and landslides.

3) Compound Damage

Because of the high frequency and diversity of natural disasters in Nicaragua, the actual situation of disasters tends to be complex. Against this background, the inadequate development of social infrastructure in Nicaragua means that each disaster poses a risk of compound damage with a tendency to cause serious social problems.

(3) Causes of Disasters

Most disasters in Nicaragua are believed to be attributable to the natural characteristics of the country as described below.

- 1) Droughts : caused by El Niño
- 2) Volcanic eruptions : caused by the sinking of the Cocos Plate into the Meso-America Trench
- 3) Earthquakes : caused by the sinking of the Cocos Plate into the Meso-America Trench
- 4) Tsunami : caused by earthquakes
- 5) Tropical low pressures : mainly those developed in the Caribbean Sea
- 6) Hurricanes : large-scale tropical low pressure mainly developed in the Caribbean Sea
- 7) Floods : caused by various reasons, including torrential rain, tropical low pressures, hurricanes, high tide and debris flow, etc.
- 8) Landslides : induced by a rise of the groundwater table due to rain, earthquake or volcanic explosion in an area with a clay layer

2.2 Socio-economic Conditions

2.2.1 Social Conditions

(1) Population

There are 20 municipalities, including 818 districts, in the Study Area, with a total population of 763,600 (as of 2000) and a density of 77 persons per km². The population movement between 1990 and 2000 is shown in Table 2-2-1-1. As shown below, the rate of population increase is between 0.7 and 5.3%. Though El Jicaral shows a drastic population increase, this is partly caused by the change of the border between the departments of León and Matagalpa. The population in rural areas accounts for around 60% of the total. It is observed that the population movement from rural areas to urban areas is not large due to lack of employment in urban areas. However, the population in rural areas fluctuates depending on the season due to the increase of migrant workers to neighboring countries.

Table 2-2-1-1 Population, No. of Districts and Population Density

No	Municipalities	Population (parsons) ^{a)}		Increase (%/Year)	Population Comparison (%) ^{b)}		No. of Districts (No.) ^{c)}		Area ^{d)} (ha)	Population Density (2000) (Prs/km ²)
		(1990)	(2000)		Urban	Rural	Urban	Rural		
1	Chinandega	99,173	137,833	3.9	83	17	52	23	66,373.80	208
2	Puerto Morazan	9,683	13,418	3.9	38	62	2	28	51,660.70	26
3	Somotillo	21,846	27,943	2.8	40	60	7	33	40,502.50	-
4	Villa Nueva	18,577	26,846	4.5	14	86	1	52	72,021.00	37
5	El Viejo	57,227	83,280	4.6	49	51	20	34	130,368.60	64
6	El Realejo	6,593	10,096	5.3	41	59	5	10	10,531.80	96
7	Corinto	16,507	17,813	0.8	99	1	9	0	6,534.80	273
8	Chichigalpa	38,804	46,511	2.0	69	31	18	17	21,912.30	212
9	Posoltega	14,138	16,494	1.7	27	73	5	12	14,972.50	110
10	Achuapa	12,664	13,595	0.7	18	82	4	42	39,035.70	35
11	El Sauce	24,196	30,088	2.4	27	73	4	16	69,950.90	43
12	Santa Rosa del Penon	8,768	9,412	0.7	23	77	3	21	22,497.90	42
13	El Jicaral	8,139	12,398	5.2	6	94	3	36	43,659.40	28
14	Larreynaga	28,619	30,722	0.7	18	82	4	59	74,339.00	41
15	Telica	21,825	23,546	0.8	27	73	4	18	39,282.80	60
16	Quezalguaque	7,003	9,054	2.9	13	87	3	14	8,358.30	108
17	Leon	142,835	181,927	2.7	77	23	88	105	81,515.40	223
18	La Paz Centro	24,490	30,759	2.6	63	37	5	19	68,856.00	45
19	Nagarote	26,363	32,164	2.2	67	33	20	17	60,828.70	53
20	San Francisco Libre ^{e)}	8,846	9,683	0.9	-	-	2	3	66,959.10	14
	Total	596,296	763,582	2.8	42	58	259	559	990,161.20	77

a) INEC "Poblacion total por anos calendario segun Departamento y Municipios. Anos 1990-2000"

b) MAGFOR "Regionalizacion Biofisica para el Desarrollo Agropecuario, Septiembre, 1999" The comparison of the population is calculated based on the 1995 data.

c) A "district" is not a formal administrative unit. The number of districts shows the number of "sectors" in urban areas and the number of "comarca" in rural areas.

d) Based on the Land Use and Forest Type Map. Areas to the north of the Rio Negro drainage basin are not included in the figures for Somotillo.

e) Comparison of the population in San Francisco Libre is unclear.

(2) Race and Religion

Around 75%¹⁾ of Nicaragua's entire population is Mestizo (half Indio-half Spanish origin) who are especially predominant in the Pacific Region. In regard to religion, Catholics account for some 80% of the total, followed by Evangelicans with 15% (a protestant sect²⁾). There are no conflicts caused by race or differences in religion in the Study Area.

(3) Principal Productive Activities

The principal industries are agriculture and livestock farming, accounting for 40% of the entire working population³⁾ which in turn accounts for some 80% of the potential working population⁴⁾. It is said that the real ratio of the working population is below 50% as the figure of 80% includes temporary workers who only work once a week.

Agriculture along the Pacific Coast used to concentrate on such commercial products as sugarcane and cotton in the past. Cotton production in particular had a large share from the 1950's to the early 1980's. However, due to the heavy decline of the cotton price in the mid-1980's, the scale has drastically decreased and such staple crops as maize and beans are now the main production items. Moreover, as the land of haciendas was divided and handed over to agricultural labourers and small-scale farmers after the revolution in the 1980's, the farming scale is limited to small or medium. Small farmers basically cultivate beans and maize for self-consumption, particularly in sloping areas. Large-scale farmers are only found in plain areas where they conduct the large-sale farming of rice and sugarcane.

Table 2-2-1-2 shows the yields and areas of the main production items by municipality. Livestock is mainly for meat production although a few cases of dairy production are observed in Nagarote and La Paz Centro. The damage caused to the main crops by Hurricane Mitch in 1998 in the Study Area amounted to 177 million C\$ with the damage to livestock amounting to 34 million C\$⁵⁾. Furthermore, the drought which continued from 1998 has been causing low productivity and creating difficulties for farmers in terms of their own self-consumption.

1) CENSO 2001

2) Municipal profile and CENSO 2001

3) Calculated from data of the MAGFOR, "Regionalización Biofísica para el Desarrollo Agropecuario, Septiembre, 1999"

4) Anyone of more than 10 years of age is regarded as belonging to the working population in Nicaragua.

5) Source: Calculated from Presidencia de la República, Secretaría de Acción Social (1999.9), "Censo sobre la población damnificada por el huracán Mitch—Resultados Finales", Tabla 16 Pérdidas Económicas en Cultivos, Según Dept. y Municipio

Table 2-2-1-2 Major Crop and Livestock Production

No	Municipality	Crops for Self-Consumption									Export Crops ^{b)}	Livestock	
		Kidney Beans		Maize		Rice		Sorghum		Area (ha)		No. of Heads	Production Value (1000CS)
		Area (ha)	Yield (qq)	Area (ha)	Yield (qq)	Area (ha)	Yield (qq)	Area (ha)	Yield (qq)				
1	Chinandega	589	8,430	5,168	184,825	2,665	125,796	823	58,900	13,243	8000	25,798.7	
2	Puerto Morazan	34	384	768	32,970	124	6,903	106	3,775	221	5000	724.1	
3	Somotillo	87	620	2,422	58,905	6	104	213	6,100	1,551	5000	1,794.2	
4	Villa Nueva	71	510	4,864	104,370	145	2,704	705	20,160	3,297	20000	791.9	
5	El Viejo	449	5,136	5,377	269,234	1,425	40,760	1,376	78,760	7,824	17352	5,410.4	
6	El Realejo	14	160	187	6,700	128	6,039	21	750	1,897	ND	ND	
7	Corinto	3	32	16	575	0	0	1	60	2	5000	ND	
8	Chichigalpa	201	2,296	766	32,880	793	37,422	66	3,760	1,382	1583	8,497.7	
9	Posoltega	322	4,610	1,042	37,250	329	10,362	62	2,225	2,211	5000	809.3	
10	Achuapa	1,409	14,112	2,199	62,920	17	950	303	10,850	484	5000	365.6	
11	El Sauce	1,019	14,580	2,848	114,100	22	1,240	696	19,900	951	5000	1,233.1	
12	St. Rosa del Penon	1,605	9,184	2,235	15,990	129	6,992	433	17,360	8	2500	486.0	
13	El Jicaral	146	418	952	6,810	16	1,219	502	14,360	260	6500	701.5	
14	Larreynaga	46	726	5,216	126,854	129	7,030	3,552	121,968	3,630	25000	1,689.0	
15	Telica	678	7,760	2,534	90,625	71	4,040	542	23,250	1,938	5000	1,120.0	
16	Quezalguaque	55	869	400	14,300	17	1,000	489	27,960	575	1501	440.9	
17	León	440	12,600	4,311	129,507	372	29,792	3,788	216,760	8,378	22505	31,589.4	
18	La Paz Centro	122	2,610	2,721	77,860	275	14,972	830	23,740	2,498	22980	2,651.2	
19	Nagarote	98	1,540	1,804	38,715	23	1,254	1,060	45,480	139	21500	2,907.1	
20	S. F. Libre	35	400	207	6,000	-	-	276	10,000	138	18000	NA	
	Total	7,423	86,977	46,037	1,411,390	6,686	298,579	15,844	706,118	50,627	202,421	87,010	

a) The data for No. 1 ~ 19 is from the MAGFOR's "Regionalización Biofísica para el Desarrollo Agropecuario, Septiembre, 1999". The data for No.20 - San Francisco Libre is from the result of the Study

b) The main export crops are peanuts, sesame, sugar, cotton, soybeans, coffee and bananas.

(4) Poverty

The GDP in Nicaragua is only 445 US\$/person (1998: Central Bank) due to the economic blockade by the United States during the period of the socialist government as well as internal conflict in the 1980's. The population below the poverty line accounts for 58% of the total population of the Study Area and is lower in rural areas at approximately 67%⁶⁾. In particular, mountainous areas in the northern León Department are the poorest areas in the Study Area and some 85% of the population lives in serious poverty. The gap between the rich and poor is obvious and is illustrated by the fact that the poorest class (20%) account for only 4% of the total consumption while the richest class (20%) account for more than 50% of the total consumption⁷⁾.

The Government of Nicaragua finalized the PRSP (Poverty Reduction Strategy Paper) with the assistance of the IMF and the World Bank in September, 2001, with the aim of improving the worst situation of poverty and is now in the process of realizing debt reduction and other assistance. Furthermore, as part of the PRSP, the government has calculated poverty indices for each municipality based on the indicators for social infrastructure, livelihood, housing

6) Calculated from "Mapa de Pobreza Extrema de Nicaragua, CENSO, 1995-EMNV, 1998"

7) Human Development Report, 2000

conditions and education, etc. for the purpose of the adequate allocation of funds and other external assistance.⁸⁾

2.2.2 Social Infrastructure

(1) Roads

Apart from main roads, there are no paved roads. Particularly in four municipalities in the northern León Department, the land is generally steep and access to communities is mainly on foot or by horse. Communities which are located beyond a river or those using a cause⁹⁾ as access face problems in the rainy season when they are isolated. Save the Children has recently implemented road rehabilitation projects in many areas with the cooperation of the WFP. The improvement of roads is given high priority in development in general. According to the RRA results, the need for road improvement is listed as one of the highest needs for the rural population apart from four communities where the access road has been rehabilitated with external assistance.

(2) Drinking Water and Domestic Water

The service ratio of tap water is limited to approximately 26%¹⁰⁾ in the Study Area. The rate is lower in rural areas. According the RRA results, one-third of the target communities have some type of tap water system in parts of the community with the assistance of international NGOs, such as CARE. Communities which have not received any assistance rely on rivers and wells as their main water sources. The time spent for fetching drinking water is between 10 minutes and one hour a day as the water source, such as a river or well, is located inside the community. In some cases, individual households have their own well with the assistance of a NGO. Although this length of time is not long in terms of the daily working hours, the additional time required to fetch water for agricultural use, partly due to recurring droughts in current years, has become a heavy burden for local residents. Well ownership varies from individual ownership to communal ownership. Even in the case of communal ownership, the establishment of a water users group for well maintenance is uncommon. The lack of appropriate conditions for watering for existing forestry projects is one of the major causes of tree death in addition to damage due to drought.

8) Since the indicators are based on data collected before Hurricane Mitch in 1998, it is argued that they do not reflect the reality.

9) A “cause” is a river which is dry during the dry season and which flows only at the time of heavy rain.

10) This figure is calculated from the results of the Municipality Profiles made during this Study.

(3) Electricity

The electrification rate is limited to around 30% in the Study Area and is certainly lower in rural areas. For example, only two out of the 18 communities targeted by the RRA have electricity. The government has been proceeding with electrification with the assistance of PROTIERRA.¹¹⁾ However, there are many cases where people do not use electricity because of their inability to pay the electricity charge or extension cost or because they have no need for electricity as they do not have any electrical appliances in their home.

Table 2-2-2-1 Social Infrastructure (Water Supply System, Electrification)

Source: Municipality Profile by the Study

NO	Municipality	Population	No. of Households	Electrification (%)	Water Supply System (%)	NO	Municipality	Population	No. of Households	Electrification (%)	Water Supply System (%)
1	Chinandega	137,833	27,567	95		12	Santa Rosa del Penon	9,412	1,882	42	27
2	Puerto Morazan	13,418	2,684	18	74	13	El Jicaral	12,398	2,480	ND	8
3	Somotillo	27,943	5,589	22	12	14	Larreynaga	30,722	6,144	19	19
4	Villa Nueva	26,846	5,369	24	16	15	Telica	23,546	4,709	20	13
5	El Viejo	83,280	16,656	39	5	16	Quezalguaque	9,054	1,811	70	21
6	El Realejo	10,096	2,019	34	33	17	Leon	181,927	36,385	56	78
7	Corinto	17,813	3,563	ND	45	18	La Paz Centro	30,759	6,152	43	38
8	Chichigalpa	46,511	9,302	62	94	19	Nagarote	32,164	6,433	41	37
9	Posoltega	16,494	3,299	35	53	20	San Francisco Libre	9,683	1,937	15	19
10	Achuapa	13,595	2,719	20	29		Average			33	32
11	El Sauce	30,088	6,018	15	20		Total	217,877	43,575	-	-

* The actual situation of electrification may be higher than these figures if illegal extension is included.

(4) Health and Education Facilities

There is generally one primary school in each comarca¹²⁾. However, most have combined classes and schools which have complete classes from first to sixth grades account for less than half of the schools. In the communities targeted by the RRA survey, there are primary schools which have combined classes of the first to fourth grades. The ratio of pupils completing fourth grade is approximately 39% in the Study Area and the illiteracy rate of approximately 40% is fairly high¹³⁾. Secondary schools are only found in urban areas or larger comarcas and are insufficient. To respond to the demand, most secondary schools operate three shifts per day. The FTSE is actively constructing school buildings.

Meanwhile, health facilities with doctors are only found in urban areas. In rural areas, there are health centres called “case base” promoted by the CARE which play a significant role in the provision of vaccinations, medicines and health education for local people. Only three communities of the target communities of the RRA survey have a public health centre, none of which have a doctor working full-time. The lack of health centres, doctors and medicines

11) This project is financially supported by the INIFOM with the cooperation of the World Bank and the ADB.

12) See (2.2.5 Administration and Development Plan)

13) CENSO, 2002

are common problems in all of the communities surveyed. Major diseases in the Study Area are bronchitis, diarrhea, ascariasis, dengue fever and malaria.

Table 2-2-2-2 Social Infrastructure (Health & Education Facilities)

NO	Municipality	No. of Health Centres	No. of Schools (no)				NO	Municipality	No. of Health Centres	No. of Schools (no)			
			Nursery	Primary (Ordinary)	Primary (Compound)	Secondary				Nursery	Primary (Ordinary)	Primary (Compound)	Secondary
1	Chinandega	16	ND	268	117	121	12	Santa Rosa del Penon	9	20	1	27	1
2	Puerto Morazan	5	14	42	14	7	13	ElJicaral	8	15	3	29	1
3	Somotillo	10	34	0	31	6	14	Larreynaga	9	26	0	39	3
4	Villa Nueva	10	30	0	38	5	15	Telica	6	ND	0	36	2
5	El Viejo	8	8	23	58	6	16	Quezalguaque	3	ND	0	24	1
6	El Realejo	4	4	0	8	1	17	Leon	33	65	105	67	63
7	Corinto	5	13	64	3	23	18	La Paz Centro	12	3	7	19	5
8	Chichigalpa	10	ND	0	24	4	19	Nagarote	7	15	116	26	19
9	Posoltega	7	1	13	3	1	20	San Francisco Libre	7	8	12	30	1
10	Achuapa	10	ND	0	110	17		Average	-	-	-	-	-
11	El Sauce	9	42	0	67	4		Total	188	298	654	770	291

Source: Municipality Profile by the Study

* When a municipality does not have separate data for primary schools with ordinary classes and those with compound classes, primary schools are classified as primary schools with compound classes.

2.2.3 Conditions of Rural Livelihood

(1) Farm Economy

The main productive activities in the Study Area are agriculture and livestock farming. Most farmers and stock farmers have less than 10 Mz of land and are categorized as small-scale farmers. Even if farmers have more than 20 Mz of land, the conditions of the land are poor, reducing the size of the cultivable land. The main crops are basic crops for self-consumption, such as maize, kidney beans, millet and sorghum, etc. While such cash crops as sesame, cassava and bananas have been cultivated by some farmers in recent years, their cultivation is unstable due to the unreliable rain situation, causing constant food shortages.

The main sources of cash income are surplus from agricultural production, milk, traditional cheese (coajada), meat (beef, pork and chicken), firewood, waged agricultural work and remittance from family members working abroad. The number of people working in Costa Rica on a seasonal basis has been drastically increasing and, depending on the community, some 70% of the working populations are migrant workers during the dry season.

The main expenses are food, including staples, vegetables, meat and spices, farm inputs and medicines, etc. School supplies and clothing are paid only when extra income is earned through temporary employment. Taxes are seldom paid by small and medium size farmers.

Meanwhile, employment or “food for work” by external aid organizations plays quite an important role for farm economy in terms of obtaining wages or payment in kind. There are a large number of externally assisted projects involving school, road and house construction,

providing employment opportunities for local people, as well as projects for afforestation or the construction of soil conservation structures in which communities may participate under the food for work scheme.

Access to loans is limited due to the lack of the registration of land ownership, based on which land could be used as collateral for a loan.

According to the results of the baseline survey conducted in the target communities of the P/S in May, 2002, the average annual income is around C\$13,300 and the average annual expenses are C\$10,600. Around 49% of the cash income comes from agriculture, followed by waged farm work or working abroad at 19%. The reason for the high average income in Los Tololos and El Pajarito may be the cultivation of such cash crops as sesame and coffee. In contrast, the dependency on waged labour is higher in El Charco, El Cacao and La Sandino where the income from cultivation is insufficient. In Urroces, the location of which is relatively near to an urban area, the ratio of income from forest products of 43% is remarkably high.

The largest expenditure item in all of the surveyed communities is food, accounting for 50% or more of the total expenditure.

Table 2-2-3-1 Income and Expenditure at Household Level

Community	Ave. Income (C\$/HH/Year)	Main Income Sources (%)					Ave. Expenditure (C\$/HH/Year)	Main Expenditure (%)							
		Agri.	Livestock	Forestry	Wages	Others		Agri.	Livestock	Educa-tion	Food	Medica-tion	Tax	Light/Fuel	Others
Palermo	7,961	45.0	13.0	10.0	26.0	6.0	9,100	17.0	9.0	2.0	64.0	6.0	1.0	0.0	1.0
Los Tololos	19,090	51.0	19.0	4.0	15.0	11.0	12,350	27.0	5.0	14.0	39.0	7.0	0.0	0.0	8.0
Urroces	11,740	35.0	13.0	43.0	2.0	7.0	9,750	26.0	3.0	14.0	52.0	0.0	0.0	5.0	0.0
Versa-Apast	12,136	62.0	18.0	3.0	7.0	10.0	7,496	21.0	7.0	6.0	49.0	8.0	3.0	0.0	6.0
El Cacao	10,758	59.2	2.9	0.0	30.8	7.1	9,145	7.0	1.4	24.4	49.9	5.7	0.7	0.0	10.9
La Sandino	9,970	26.1	21.5	0.4	29.4	22.6	7,959	10.0	1.1	1.7	70.0	5.7	0.5	0.0	11.0
Pajar-Brisa	17,624	65.6	17.5	0.0	6.9	10.0	14,637	24.6	8.6	6.0	55.9	2.8	0.5	0.0	1.6
Las Mercedes	13,848	64.7	12.2	0.0	20.3	2.8	12,070	22.0	1.0	9.0	61.0	5.0	0.0	0.0	2.0
El Charco	16,710	29.0	23.0	0.0	36.0	12.0	13,359	15.0	3.0	4.0	65.0	7.0	0.0	0.0	6.0

* Source: Results of the Baseline Survey in the P/S (May, 2002)

** The income from wages includes remittance by family members in other countries

** The data for Palermo shows that the expenditure exceeds the income. This is because of the fact that temporary income from the sale of firewood and waged labour are not considered as main sources of income and does not mean that people in Palermo are burdened with debt.

In regard to access to loans, some communities have a micro credit system operated by a NGO. However, most communities do not feature for loans from private banks due to the lack of registration of land which could be used as collateral. Under the micro credit system, the average repayment rate is as low as less than 30%. Other systems are in places which involve both loans and repayment in kind to avoid the recurrence of a low repayment rate or more

realistic measures. A seed bank where double the amount of seeds originally loaned is repaid and a chicken bank where both the initial loan and repayment take the form of live chickens are two examples. However, these remain localized efforts in certain communities covered by a relevant project.

(2) Food

The food supply and demand situation at the household level (assuming that a household consists of 5 - 9 family members) is shown below. In regard to the situation of self-consumption, around 47% of farmers sell agricultural products only when they have a surplus and some 30% purchase less than 50% of their total food requirement. Vegetables, fruit and eggs are eaten when the opportunity arises. Communities located relatively near to a market, such as Las Mercedes, Urroces and Apastepe-Versalle, sell more products than others on a permanent basis.

The largest cash expenditure item is rice. In the case of communities with a relatively high level of rice consumption (for example, Las Mercedes, Apastepe-Versalle and Palermo), rice accounts for some 50 – 60% of the food purchase cost. The cultivation of home gardens is not prevalent as only approximately half of the total households have a home garden.

Table 2-2-3-2 Food

Community	Ave. No. of Family Members	Self-Sufficiency*				Monthly Average Food Consumption									
		A	B	C	D	Maize (lb)	Frijol (lb)	Rice (lb)	Cheese (lb)	Milk (l)	Beef (lb)	Pork (lb)	Chicken (lb)	Eggs (no)	
Palermo	7	1	5	8	1	166.0	57.0	66.0	8.0	8.0	4.0	1.0	5.0	-	
Los Tololos	7	3	7	5	0	131.0	86.0	54.0	10.0	-	6.0	0.0	3.0	-	
Urroces	7	4	11	0	0	71.0	43.0	58.0	5.0	3.0	2.0	0.0	7.0	-	
Versa-Apast	7	4	10	2	0	110.0	60.0	80.0	12.0	20.6	6.5	8.8	9.0	41.0	
El Cacao	9	6	7	2	0	160.0	70.0	40.0	23.3	3.7	11.6	5.0	5.6	24.6	
La Sandino	6	7	5	3	0	130.0	30.0	60.0	15.1	8.7	5.8	3.9	11.8	46.1	
Pajar-Brisa	6	1	5	9	0	199.8	56.1	26.7	13.2	25.5	0.0	0.0	0.0	90.0	
Las Mercedes	5	0	12	3	0	199.8	48.9	71.4	5.7	7.8	1.8	4.5	4.5	30.0	
El Charco	5	4	1	6	4	99.0	39.3	29.4	10.5	59.8	5.4	1.0	5.4	59.1	

*Self Sufficiency: A: Always self-sufficient and possible to sell.
 B: Basically sufficient. Sale when surplus products are available
 C: Not sufficient. Buy less than 50% of the food for self-consumption
 D: Not sufficient at all. Buy more than 50% of the food for self-consumption

*Source: Results of the Baseline Survey in the P/S (May, 2002).

(3) Domestic Fuel

Fuel for domestic use is almost exclusively firewood. According to the results of the Baseline Survey in May, 2002, approximately 60% of the surveyed households are able to collect

firewood within a 1 km radius of their homes, and consume 1 caretta¹⁴⁾ of firewood per month. It appears that people do not find the collection of firewood an inconvenience due to the existence of bushes which can be used as sources of firewood near their homes.

Table 2-2-3-3 Firewood Consumption and Sale

Community	Consumption of Firewood (carretada /HH)	Distance for Collection (no)			Frequency of Collection (Times/Month)	Firewood Saving (no)			Sales	
		less than 1km	1 ~ 2km	More than 2km		No	Extinguish When Not Used	Improved Stoves	Person in practice (no)	Amount (carreta/HH, Month)
Palermo	0.64	10	4	1	1.5	3	10	2	0	-
Los Tololos	1.07	12	1	2	1.6	1	8	6	0	-
Urroces	1.00	9	1	5	1.2	0	15	0	12	3.25
Versa-Apast	1.25	10	2	3	3.4	2	11	2	4	4.25
El Cacao	1.34	8	6	1	7.2	6	5	4	0	-
La Sandino	0.70	1	4	5	1.6*	1	11	3	1	2.0
Pajar-Brisa	1.70	15	0	0	1	3	6	6	0	-
Las Mercedes	0.86	12	2	1	4.1	3	12	0	0	-
El Charco	0.43	7	8	0	3.6	0	11	4	0	-

* Source: Results of the Baseline Survey (May, 2002)

* In La Sandino, five HH buy firewood.

In those communities near urban areas, such as Trinidad, Urroces and Sabanetas, for example, there is a tendency for residents to rely on the sale of firewood as their main income source and natural forests are cut in a disorderly manner. While some communities, such as Urroces, have experience of reforestation under projects in the past, their management style is extensive. There are no organized efforts and sale is left to individuals.

The price of firewood depends on the season, fluctuating from 100 to 300 C\$ per carreta, sold one to four times a month. The price of firewood is almost equal to the average wages, meaning that the value of firewood as a natural resource is not considered. (Assuming the sale of firewood four times a month at a price of 200 C\$ per carretada, necessitating a total of 24 days for collection and sale, the earnings are equivalent to 33 C\$/day which is equal to the average wage for a day's labour.)

Meanwhile, improved stoves have been introduced in 16 communities out of the 18 surveyed communities for the purpose of reducing firewood consumption to conserve forest resources and to alleviate smoke-related diseases. The number of actual stoves in use is not large as they are basically for demonstration purposes. Only in some communities, such as El Pajarito-Las Brisas and Los Tololos, where the use of improved stoves is promoted by external agencies, is the ratio is much higher at around 40%. The reasons why improved stoves are not popularly used despite their positive impacts are the absence of need, lack of metal materials for the chimney, hard work for construction and inability of improved ovens to make traditional smoked cheese.

14) 1 caretta =1,000-1,200 pieces of firewood 2.5m³ (solid volume)

(4) Use of Forest Resources

Although “forests” are a reproductive natural resource, they are not managed in a reproductive manner. Environmental education, including forest conservation, has been implemented by municipalities or external agencies. However, it can be observed that the economic conditions for continuous efforts for forest management are insufficient, resulting in the disorderly use of forest resources.

Forests are used to produce firewood for domestic and commercial purposes, posts for land demarcation, building materials for houses, feed for livestock and herbs as well as the enrichment of water sources, places for hunting (iguanas, armadillos and rabbits, etc.) and the gathering of honey. Although large-scale landowners sell logs, the sale of logs is not common.

According to the results of the Baseline Survey conducted in May, 2002, some 70% of the respondents have experience of reforestation in one way or another. 40% of these have taken advantage of the seedling supply by external agencies. The motivations for participation are improvement of the living environment and expectation of forest products for domestic use.

Table 2-2-3-4 Experience of Reforestation and Awareness of Forest Resources

Community	Experience of Reforestation			Motivation for Reforestation					Value of Forests					Present Use of Forests	
	Total	External Assistance	Voluntary	External Assistance	Soil & Water Conservation	Income Source	Forest Products (Domestic Use)	Improvement of Living Environment	Economic Resource	Protection of Environment	Economic Resource & Environment	Water and Soil Conservation	Protection of Water Sources	Good	Improvement Necessary
Palermo	11	11	0	2	6	2	0	1	0	14	0	0	1	8	7
Los Tololos	8	3	5	0	4	2	0	2	2	2	9	2	0	6	9
Urroces	9	6	3	0	2	7	0	0	1	4	10	0	0	11	4
Versa-Apast	13	9	4	1	3	0	4	5	7	2	5	1	0	0	15
El Cacao	9	4	5	4	1	0	2	2	6	2	2	0	5	8	7
La Sandino	15	15	0	0	4	0	8	3	3	3	7	2	0	0	15
Pajar-Brisa	11	1	10	4	0	0	5	2	1	2	12	0	0	2	13
Las Mercedes	8	5	3	1	0	0	0	7	0	6	9	0	0	0	15
El Charco	12	4	8	0	0	4	4	4	4	3	8	0	0	2	13

Approximately 30% of the respondents believe that the principal value of forests lies with such forest products as firewood, timber and fruit while, at the same time, recognizing their value in terms of improving the living environment by increasing the greenery in the community. Moreover, 10% of the respondents recognize the importance of forests for soil and water conservation and 70% feel that the further promotion of reforestation and forest management is required.

It was found that people in the target communities have some experience of reforestation, soil conservation activities or agroforestry with the assistance of external agencies although the activity density varies. However, most activities disappear following the end of external

assistance and it is rare to see continued activities. Furthermore, even when there are participants who continue activities, no case of the newly acquired knowledge and techniques being disseminated within or without the community was observed.

While it was found that reforestation is regarded as the work of men by 70% of the total respondents, 15% responded that husbands and wives work together. Particularly in such communities as La Sandino and El Charco where the absence of men is noticeable due to their working in urban areas or being migrant workers, 40% of the respondents stated that women conduct forest-related work while a further 40% stated that it is conducted by both men and women. In regard to the collection of firewood, 70% of the respondents stated that this is the work of men and that male children help their father in many cases.

(5) Principal Problems and Needs

The main problems raised by the RRA are 1) lack of agricultural funds, 2) lack of agricultural knowledge and techniques and 3) lack of health facilities. Others include lack of food, low yield, lack of employment opportunities, lack of infrastructure, lack of registration of land, forest fires, depletion of forests, insect damage, lack of irrigation facilities and weak organization, etc.

The problem of 1) lack of agricultural funds is prominent as most farmers do not have access to bank loans due to lack of registration of the land to be used as collateral. Although some informal micro credit systems managed by NGOs exist, access is still limited. Users are limited to less than 10% of the target communities due to the high interest rate (approximately 20%), no collateral and lack of opportunities to access. However, considering the situation of agricultural production which may only covers self-consumption at best, it could be said that the problem will not be solved by expanding the access to loans as there is little possibility of loan repayment by means of agricultural production.

The second problem of “lack of knowledge and techniques” may be rooted in the historical background of the Study Area, i.e. insufficient experience of farming on the part of farmers. However, given the results of the RRA, the majority of the target farmers have experience of environment-related projects, such as soil conservation work, environmental education, nursery management and reforestation, etc. There may be many reasons for the emergence of this problem despite such experience, including inappropriate approaches adopted by past projects, lack of ownership in various activities, inadequate awareness of the problem and motivation for participation being dominated by short-term incentives (food and financial assistance).

The depletion of forests and crude forest management are also pointed out as problems. Factors causing these problems include such social factors as inevitable forest cutting to create new farming land, the collection and sale of firewood to compensate for the lack of employment opportunities and insufficient knowledge of the reproductive use of forests in addition to forest loss by fire. Fig. 2-2-3-1 shows the forest and environment-related problems analysed by the RRA and it is clear that many of the identified problems are factors for the worsening of forests and the environment.

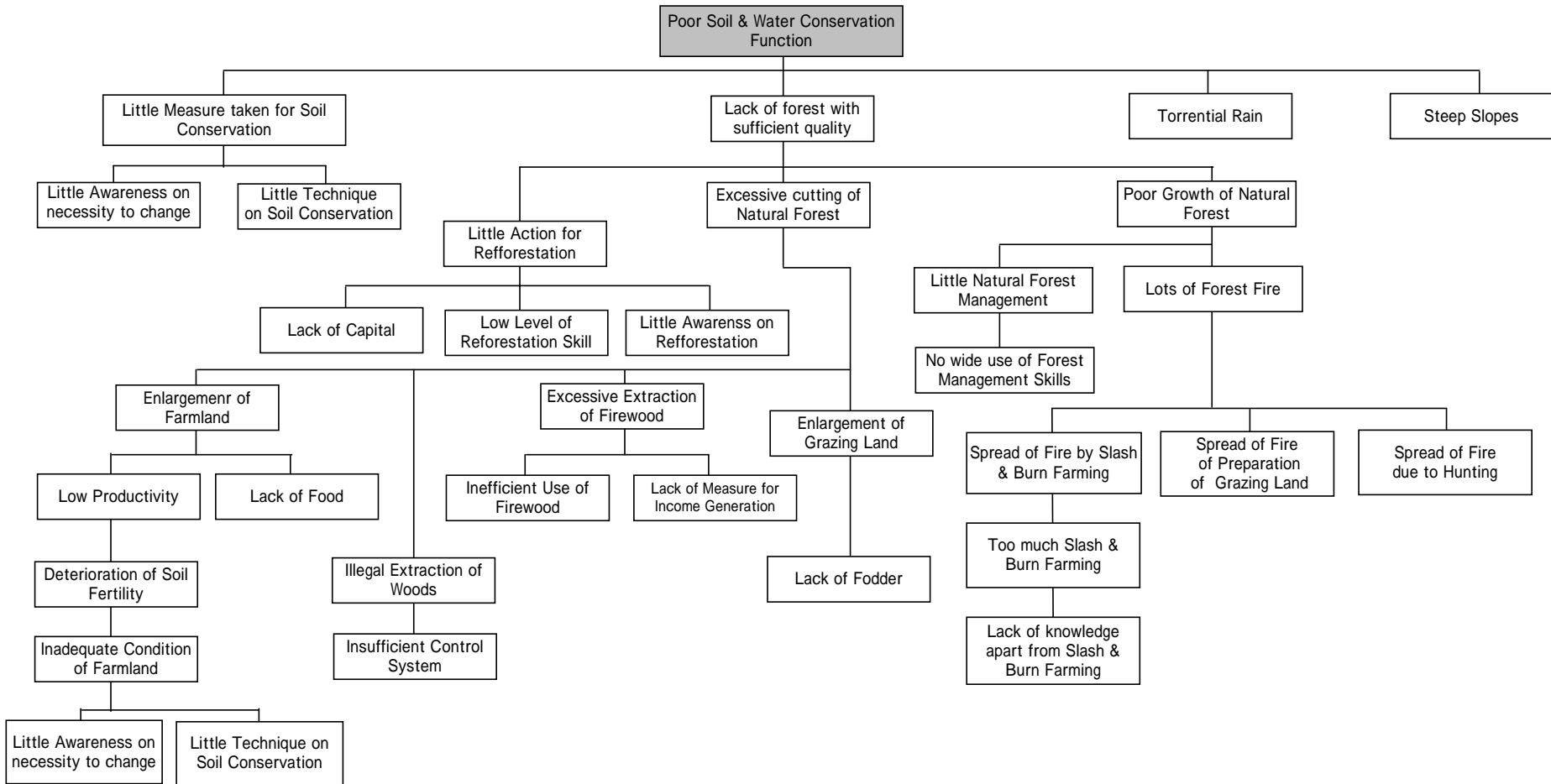


Fig. 2-2-3-1 Problem Analysis

2.2.4 Characteristics of Communities and Social Structure

(1) Characteristics of Communities Based on the Background of Their Establishment

Communities in the Study Area can be categorized as follows: 1) communities established by migrants 100 - 300 years ago, 2) communities formed by former agricultural labourers of haciendas before the revolution or of state farms after the revolution who were allocated land under the agrarian reform in 1980's and who formed cooperatives or people who obtained land from them, 3) mixed communities of former cooperative¹⁵⁾ members who formed them to receive public services and individual farmers and 4) mixed communities of former cooperative members and farmers who bought land from former cooperative members. In all cases, the location of residence areas are scattered in the community.

Members of community type 1) are originally related by birth and a relative tendency towards solidarity and a spirit of mutual assistance can be observed. Because of geographical disadvantages, access to markets is limited which places them among the poorest in the Study Area. Members of community type 2) have a weak unity which may be caused by a lack of awareness of the "community" as a unit. It can be assumed that they were formerly agricultural labourers working at the same hacienda which means that they used to be "workers" and not the "farmers". They were allocated land for cultivation in the 1990's¹⁶⁾ despite their lack of knowledge of small-scale agriculture. It could be argued that a lack of knowledge and techniques is a fundamental problem for small-scale farmers at present.

Though community type 3) has the features of both community types 1) and 2), it's characteristic is near to types 2). Community types 2) and 3) are dominant in the Study Area. Cooperatives are not functioning these days and it can be observed that former members have tendency to rely on public assistance in terms of capital inputs as well as other services. Community type 4) consists of new communities formed in late 1980's. Following allocation of the land of former cooperatives¹⁷⁾, the land has been continuously sold to others without any land registration. Although the conditions of the land in general are rather unfavourable, especially in terms of access, community members have moved in because of the lack of other alternatives. It could be said that such a handicap may be one of the reasons forcing them to think about improving their lives based on self-help efforts.

15) Most cooperatives are cooperatives in name only and do not function today. The name remains generally in those cases where the land was registered as a unit holding by the cooperative.

16) There is a serious problem regarding land registration as an enormous amount of land has been sold without clarification of its official ownership.

17) After 1985, in response to the increasing demand for land allocation to individual farmers not in the form of a cooperative unit, land ownership began to be given to individual farmers.

(2) Individualism and Dependency

The target communities can be characterized by “individualism” and “dependency”. “Individualism” is caused by historical reasons, such as 1) a loss of mutual trust between people during the civil war which lasted for years and 2) the hacienda system. Reason 1) may be easily imagined while reason 2) may have resulted in a tendency to rely on individual efforts. To be more precise, mutual cooperation was unnecessary to survive under the historical hacienda system under which people worked as labourers. In regard to the characteristic of “dependency”, three main reasons can be pointed out, i.e. 1) living with natural disasters, 2) the effects of grant-oriented governance under the socialist administration and 3) the change from waged labour under the hacienda system to small or medium scale agriculture. Reason 1) means the situation of continuous external support for the rehabilitation of damage caused by natural disasters. As continuous support has been provided by outsiders, people expect such support for this part of their lives and the expectations sometimes exceed the reality. In regard to reason 2), farmers were provided with much support under the socialist government in the 1970’s, such as the allocation of land, credit and the supply of agricultural materials. This policy gave people excessive expectations of the government which continue today. Finally in regard to reason 3), the lives of farmers were basically assured under the hacienda system. Following land reform, however, they had to start managing their own land by themselves regardless of their inexperience and many of them still cannot effectively manage their land and expect external support for improvement.

Due to these kinds of social characteristics, the idea of mutual cooperation, such as that for public work, is unfamiliar and few examples of mutual cooperation are observed in the Study Area.

(3) Social Authority

While landowners historically have strong authority in society, they tend to live in urban areas and have no authority beyond employment, such as decision making at the community level.

In addition, as there is a tendency towards individualism and little unity between people, the strength of the traditional authorities has weakened. The elders of the villages usually retire from the decision making process. Village leaders are generally relatively young and play the role of coordinators of a series of activities rather than have any decision making power.

(4) Gender

The results of the gender analysis and the points to be considered for forest management from the gender aspect are analyzed below.

Table 2-2-4-1 Gender Analysis and Points to be Considered for Forest Management Project

Item	Present Situation	Points to be Considered for Forest Management from Gender Aspect
Cultural Aspect	Generally a male-dominated culture. Men participate in public activities in general. There is a tendency for men and women to regard certain tasks as their own without question and it can be observed that they do not feel that this situation is unbalanced or unfair.	Due to the male-dominated culture, women tend to feel inferior to men and lack the ability to take action. The facilitation of activities in which it may be easy for women to participate is important to improve the awareness of women to participate in social activities.
Household Level	Approximately 80% of all household heads are men. In regard to the allocation of work, agriculture-related work, including livestock keeping and forestry, is conducted by men while other work, such as household work, taking care of children, working on the patio (small-livestock, home garden, etc.) is the work of women. As they are responsible for such work, they each have the right to decide how to use their products which means that income opportunities for women are quite limited.	Work related to soil conservation and forestry is originally the work of men. However, due to the increase of waged labour outside the village or the excessive work load of men, women may assist the men these days. It may, therefore, be an idea to include people with an interest in participating in these kind of activities regardless of gender and the present labour responsibility.
Community Level	The participants of meetings and training are decided depending on the theme. According to the Baseline Survey results, 56% stated that men participate in meetings while 29% stated that women do. In the P/S, the women participants were more active than the men with more responsibilities. However, many women participated in activities because of the absence of male members. In general, women are generally passive.	As many of the men may be absent from the village due to waged labour outside the village, the participation of more women in activities may be possible regardless of the initial registration. The inclusion of women in the committee is, therefore, important.
Legal Aspects	In regard to land inheritance, half of the property goes to the wife and the remainder is divided equally among the children. There are no differences in terms of gender. In regard to education, work and wages, etc., there are no differences in terms of gender. In practice, however, there appears to be a wage differential between men and women for agricultural labour.	Considering the present situation, it is unnecessary to provide special gender-oriented support for the project as both sexes have equal rights in terms of land and work. However, given the male-dominated culture, a series of rules within the context of the project should be decided, taking gender into consideration.
Access to Education and Information	The illiteracy rate is 35% for women and 29% for men. Information on activities in villages appears to suggest that all community members, including women, participate. However, in the case of training courses, for example, most of the participants are men regardless of the actual practice in the field.	For training courses to have positive effects, it is important to match the participants of the training courses and the people actually conducting the activities. As the literacy rate is generally low, the inclusion of literacy education may be effective.
Access to Natural Resources	There are no social and cultural taboos related to access to natural resources in the Study Area. In existing forestry-related projects, women are responsible for the nurseries. Reforestation around farmland to obtain firewood and timber tends to be conducted by men while women are generally responsible for reforestation in the garden (including fruit trees).	Men are generally responsible for the management of natural resources as the type of work involved is quite heavy. In consideration of this situation, it may be important to respect the present work arrangements instead of trying to promote the participation of women in all activities so that the scope of the activities of each sex can be maximized.

While society in Nicaragua is said to be male-dominated in general, there is evidence that women have started to become more active and appear to be gaining confidence in them, particularly in those communities where a policy of appointing both sexes as executive members of activity groups is deliberately adopted under the guidance of external agencies. Considering the purpose of the M/P to achieve “forestry management for disaster prevention”,

it may not be important to treat gender issues as a strategic WID approach. Nevertheless, as it observed that the imbalanced gender situation is changed through the participation of women, it is essential to treat gender issues as cross-cutting issues in the project.

2.2.5 Administration and Development Plan

(1) Administrative Division

There are departments and municipalities as local administrative units with clear boundaries. Municipalities can be divided into urban areas and rural areas. Rural areas are divided into comarcas and under the comarcas are caserios (communities) and sitios (private large-scale farms). A comarca is a group of several caserios and the number of caserios in one comarca varies. The unit of “comunidad” is often used in the Study Area and is a general term for comarcas and caserios. A group of caserios or a caserio may be called a “comunidad” while a single comarca may also be called a “comunidad”.

There is no administrative body at the department level in general. A municipality called a “cabecera” represents the department and plays a leading role in departmental administration. The cabecera in the Chinandega Department is the “Municipality of Chinandega” while that in the León Department is the “Municipality of León”.

While central government ministries have offices in the cabecera, many of these offices do not have sufficient manpower due to a lack of funding to perform their functions.

(2) Administration at Municipal Level

The organization of the municipal office varies from one municipality to another. The mayor is elected by the inhabitants. The term of service is generally four years and the most recent election was held in November, 2000. Along with the mayoral election, the election of members of the assembly is held. The municipal council is formed by the mayor and members of the assembly and has supreme authority for municipal affairs.

The revenue resources of the municipality are a central government subsidy, tax and the financial support of external agencies. The average budget of the 20 target municipalities of the Study is approximately 180 C\$¹⁸⁾/ person/year in 2000.

18) Calculated based on the results of municipal profile survey of this Study.

(3) Relationship between Municipalities and External Support Agencies

There are many external agencies providing assistance for the rehabilitation of damage caused by natural disasters and the civil war. In some municipalities, a special unit to coordinate external support or public works conducted with external support has been established. The INIFOM is making efforts to strengthen the capacity of municipalities through funding and a series of support for the preparation of a municipal development plan with the support of the World Bank and the IDB. Municipalities mainly use the provided funds to commission NGOs to implement development projects in villages.

As there are NGOs which support communities without informing the municipal authority of their activities, the municipal authority finds it difficult to establish the real picture of all activities in their communities and to coordinate all activities.

(4) Municipal Development Plan and Municipal Environmental Plan

Each municipality prepares an integrated development plan, proposing policies and programmes for the development of society, economy, environment, health and sanitation, etc. It is reviewed every four years. This municipal development plan contains the municipal development strategy, policies and proposals for concrete sub-projects and the relevant sections of the municipal authority request prioritized projects from external agencies to assist their chosen projects. As each municipality depends on funding by external agencies, such as NGOs, and international aid organizations for the implementation of the sub-projects in the municipal development plan, it has a close relationship with NGOs and other external agencies.

For the forest and environment sector, the Environment Action Plan was prepared in 2000 as a sub-plan under the Municipal Development Plan with the assistance of the MARENA. Wide-ranging environmental issues are analyzed in this Action Plan and improvement measures are also proposed.¹⁹⁾

(5) Organization at Community Level

Most communities have a community committee which is organized by the residents for self-governance. The function and organization of this committee vary from one community to another. The members of the board of executives are elected at a general meeting of the residents, and consists of the president (presidente), vice-president (vice-presidente), secretary (secretario), auditor (fiscal), organizer (vocal) and treasurer (tesorero) and they are all

¹⁹⁾ The summary of the natural environmental issues of each environment action plan is explained in each forest management plan for disaster prevention at the municipal level.

volunteers without any financial reward. The board of executives holds meetings in accordance with their necessity. When an issue cannot be managed by themselves, it is taken to the municipality.

The board of executives plays the role of a coordinator for the municipality, other external support agencies and local people. If an offer of any kind of assistance is made by an external agency, local people are informed and the offer is discussed. The board does not have a specific budget.

Apart from the board of executives, groups are formed for the implementation of external projects in the community. The main groups in the community are the health group, fire brigade, forest guards, women's group, parents and teachers association and religious group.

While these groups are recognized as community organizations, they are not part of the community committee in most cases. There is no standard format but activities and meetings are held by activity groups which form a loose organization.

As described above, the community committee and activity groups are recognized as the host organizations in the community by external agencies even though they are not registered with the government as public organizations.

2.2.6 Land Holding

(1) Situation of Land Ownership and Problems

The Sandinista Administration established in 1979 firstly confirmed all land owned by the former ruling Somoza family and ownerless land, transferred its ownership to the state and established the basis for state farms by 1981. The Agrarian Reform Law was enacted in 1981 and the government basically assured the existing land ownership. In addition, the government granted land (generally devastated land or undeveloped land) to landless people on the condition that they formed a cooperative. However, under the new Chamorro Administration established in 1990, this land ownership was not legally acknowledged and much of the land was returned to the state. It was decided not to seize cooperatives and privately-owned land while paying more attention to the privatization of state farms. Furthermore, landowners who had lost their land under the former administration were compensated in the form of government bonds or stocks of companies conducting public works. However, the repeated institutional and policy reforms have resulted in confusion among landowners and have caused land ownership disputes and problems.

Under these circumstances, the OTR and the OCI, both under the Ministry of Finance, are making efforts to solve the problems relating to land ownership. The OTR mediates between former landowners and farmers who were given their land by the former administration by means of compensating the former landowners while confirming the land ownership of the present owner.

At the same time, the OTR reorganizes the registration records with the assistance of the World Bank. The OTR does not possess data on the ratio of formally registered land and it is said that the ratio is around 30% in urban areas and less than 5% in rural areas. Though land which is cultivated by individual farmers is customarily used as individual land, some land is registered under a cooperative and some land are not yet registered even though the land has already been inherited within families.

A formal survey of the land under the supervision of a lawyer is necessary for land registration but the commission involved is beyond the means of small-scale farmers. Some farmers obtain loans by mortgaging cooperative land. In the older communities, farmers recognize their properties between themselves and there are no problems. In consideration of this situation, land does not pose a huge problem for a forestry project aiming at achieving soil conservation and small-scale reforestation. However, for the more commercial use of forest land, registration is a crucial condition to promote more responsible forest management.

(2) Situation of Land Ownership

The size of land ownership by each municipality is shown in Table 2-2-6-1. The percentage of very small farmers with less than 20 Mz is around 60% of the total and small-scale farmers with less than 100 Mz, including very small farmers, account for 90% of the total. Medium size farmers with 100 – 500 Mz account for around 9% and large-scale farmers with 500 Mz account for only 2%. The total size of land ownership by each category of farmers shows some 30% for each category despite a large difference in the number of farmers in each category.

While there is no clear statistical data on the landless²⁰⁾, their ratio varies from 0% to 50% depending on the community. Communities which have more landless people tend to be old communities where the land has been inherited from generation to generation, leaving no sufficient land for further inheritance.

20) It is not possible to compare the number of registered land with the number of households due to repeated illegal inheritance.

Table 2-2-6-1 Situation of Land Ownership by Municipality

	Municipalities	Total Area (ha)	< 20 Mz		20-100 Mz		100-500 Mz		>500 Mz	
			Households (%)	Areas (%)	Households (%)	Areas (%)	Households (%)	Areas (%)	Households (%)	Areas (%)
1	El Viejo	130,368.6	58	5.69	25.81	14.16	12.14	34.21	4.05	45.95
2	Puerto Morazan	51,660.7	61.93	8.67	26.28	16.44	8.46	24.58	3.32	50.31
3	Somotillo	40,502.5	50.61	7.06	34.68	24.36	12.38	41.59	2.33	26.99
4	Villa Nueva	72,021.0	45.96	7.27	34.66	31.39	16.06	6.36	3.31	54.98
5	Chinandega	66,373.8	75.06	9.95	16.14	18.85	7.59	41.06	1.21	30.14
6	El Realejo	10,531.8	55.66	5.66	27.36	20.75	14.15	40.65	2.83	32.94
7	Corinto	6,534.8	90.48	53.42	9.52	46.58	0	0	0	0
8	Chichigalpa	21,912.3	68.93	4.92	21.01	8.93	7.69	17.76	2.37	68.39
9	Posoltega	14,972.5	68.37	11.72	21.99	22.51	8.73	48.24	0.9	17.53
10	Achuapa	39,035.7	34.47	7.27	55.48	49.47	9.47	31.73	0.57	11.55
11	El Sauce	69,950.9	46.06	6.94	43.29	34.37	9.12	31.59	1.52	27.1
12	Santa Rosa del Penon	22,497.9	50.8	13.56	43.08	57.01	6.32	29.43	0	0
13	ElJicaral	43,659.4	48.97	5.71	40.28	24.78	8.51	20.31	2.26	49.2
14	Larreynaga	74,339.0	50.31	5.86	35.54	20.44	11.16	32.41	3	41.28
15	Telica	39,282.8	71.05	12.99	22.13	24.64	5.24	28.71	1.58	33.66
16	Quezalguaque	8,358.3	83.83	23.82	11.65	25.68	4.14	35.81	0.38	14.68
17	Leon	81,515.4	70.5	11.55	21.48	22.83	6.8	35.13	1.21	30.49
18	La Paz Centro	68,856.0	49.41	4.4	33.97	13.3	12.1	24.53	4.52	57.77
19	Nagarote	60,828.7	49.9	5.07	33.43	21.44	14.2	42.92	2.47	30.56
20	San Francisco Libre ^{b)}	66,959.1	ND	ND	ND	ND	ND	ND	ND	ND
	Total		59.49	11.13	29.36	26.21	9.17	29.84	1.99	32.82

a) Source: MAGFOR "Regionalizacion Biofisica para el Desarrollo Agropecuario, Septiembre, 1999"

b) Data is not available for San Francisco Libre.

2.3 Forest Management and Forest Use

2.3.1 Present Situation of Forest Management

(1) Definition of Forest

When discussing forest management, clarification of the definition of a forest is firstly necessary.

According to the Forest Act of Nicaragua (Decree No. 45-93), a forest is defined as "an ecosystem which is dominated by trees (7 m or higher) but includes undergrowth, wild animals, soils and water". Meanwhile, forest land is defined as "a forest where no intensive agropastoral activities (cultivation of coffee and cacao, etc.) are taking place or shrub land and grassland in a potential forest land (which could be used for forestry in view of its climatic, soil and topographical conditions) where no intensive use other than forestry is taking place". Based on the above definitions, it is clear that "forest land" includes some shrub land and grassland in addition to "forests".

The Year 2000 version of the National Forest Type Map (scale: 1 to 750,000) published by the MAGFOR places coniferous forests, broad-leaved forests and mangrove forests with a tree height of 7 m or higher and a crown density of 30% or higher in the category of "forest",

excluding such forest land in the process of regeneration as cut-over land and fallow land for slash and burn agriculture and grazing forests. These excluded sites are very important for the purpose of soil and water conservation and should not be excluded from the category of forest from the viewpoint of effective forest management in the future (these types of land are classified in the category of “forest land” by the Forest Act).

The land use and forest type map prepared by the Study Team puts the total area of forests in the Study Area at 339,463 ha, out of which 154,053 ha or 45% are forests with a tree height of 7 m or higher and a crown density of 30% or higher. The remaining 185,410 ha or 55% are forests with a tree height of less than 7 m and a crown density of less than 30%. These figures suggest that more than half of forests show a state of degradation with a low tree height and a low crown density due to slash and burn agriculture, grazing, cutting and/or forest fires, etc.

Decree No. 14-99 of Nicaragua stipulates the existence of reserves which are defined as “areas which are designated for the protection, rational management or restoration of the biodiversity of wildlife or ecosystem and which include spaces where topographical phenomena or important sites from the viewpoint of history, archaeology, culture, landscape or tourism should be restored and conserved”. These reserves are incorporated in the SINAP and nine reserves have so far been established in the Study Area, mainly at the rivermouth area of Estero Real River, along the Pacific coast and at the Maribios Mountain Range.

Although the MARENA has jurisdiction over reserves, it can entrust their management to municipalities or non-profit organizations. The land of reserves is, in principle, owned by the government. Some reserves, however, have private land and land used for farming or grazing which existed prior to the designation of reserve status. Decree No. 14-19 stipulates the formulation of a management plan for each reserve and the regulation of activities by local residents within reserves in accordance with the policies adopted by the said management plan. However, no ground marking of reserves has been conducted and no management plan has been formulated.

(2) Forest Policies

1) Outline of Forest Policies

The Forest Development Policies adopted in August, 2000 indicate the direction for forest policies in Nicaragua. The objective of these policies is “to achieve the sustainable development of the forest industry for the purposes of improving the lives of people involved in the use of forest resources and of developing the national economy”. The primary aim is the sustainable management of forests to secure an improvement of national life and economic benefits through industrial development which in turn should result from the

securing of forest resources which are not only economic resources but which also represent a value as public infrastructure not attainable in the market. In order to achieve this primary aim, the following individual goals are listed.

- Adequate evaluation of forest resources from the social, economic and environmental viewpoints
- Increased profit from forests so that it can be fairly distributed for each generation in the years to come
- Halting of the rapid forest degradation and expansion of forests through the sustainable management of reforestation sites and natural forests
- Development of appropriate conditions for sustainable investment in forests
- Strengthening and development of markets for forest products and forest operations
- Modernisation of industries relating to forest
- Conservation of the formative base for forest resources and protection of forest resources
- Securing of the forest functions to conserve soil, water and biodiversity
- Modernisation of forest-related technologies and introduction of capital to achieve modernisation on a larger scale

The policies in question consist of five components, i.e. access to resources, promotion, forest protection, research and regulation/control to achieve the above goals. The main contents of each component are outlined below.

① Access to Resources

- i. Research to achieve land development and zoning for agropasture areas and forestry areas in rural areas and extension of the research results
- ii. Appropriate land use to make 20% of agropasture land or 80% of forestry land into forests
- iii. Promotion of joint investment to increase investment in private forest as well as national forest management
- iv. Enforcement of the responsibility of owners of registered land and forests on such land to use the forests in question in a sustainable manner
- v. Demarcation of the boundaries of reserves and river system

② Promotion

- i. Application of the following measures to promote reforestation
 - Implementation of multi-purpose reforestation with a long-term guarantee of forest access or a private sector initiative and implementation of plans or projects which take reforestation in the upper reaches to secure headwater areas into consideration
 - Formulation of an reforestation plan by the central government giving priority to local species facing extinction
 - Provision of a subsidy for the adoption of agroforestry, reforestation and/or sustainable forest management
- ii. Establishment of a “forest information system” which is easily accessible and which provides the latest information
- iii. Preparation of an economic evaluation map of forests, including man-made forests and natural forests, and its periodic updating
- iv. Introduction of a taxation system designed to promote sustainable as well as rational forest management
- v. Provision of subsidies for the promotion of forest-related markets, diversification of forest products and the forest certification system
- vi. Guarantee of the supply and demand balance of biomass energy resources
- vii. Promotion of the use of domestic wood and non-wood products by domestic industries and public organizations
- viii. Development of the organizational base to improve the management capacity of agricultural and forestry organizations at the local or municipal level and provision of subsidies to assist such development
- ix. Strengthening of international coordination in the environmental sector, particularly the forest sector

③ Forest Protection

- i. Strengthening of the botanical hygiene control to avoid forest damage due to diseases and harmful insects
- ii. Campaign, provision of fire-fighting equipment and establishment of a fire monitoring system to implement forest fire prevention/control measures
- iii. Strengthening of the collaborative forest protection mechanism involving local communities

- iv. Promotion of education, skill training and technical guidance for the protection and conservation of forest resources

④ Research

- i. Strengthening of wood technology research offices
- ii. Strengthening of breeding centres and seed banks and supply of high quality seeds
- iii. Establishment of a databank on forests and forest research
- iv. Introduction of model areas for forests and agroforestry

⑤ Regulation/Control

- i. Prohibition of the conversion of natural forests
- ii. Approval of cutting under a forest management plan
- iii. Designation of the INAFOR as the sole competent body for the management of domestic forest resources
- iv. Strengthening of coordination between the INAFOR and other forest-related organizations and introduction of the following reforms of the INAFOR
 - Decentralisation
 - Establishment of local forest departments
 - Implementation of a wood monitoring and storage system
 - Clear indication of technical standards which are valid for a certain period and of supervisory rules for each ecosystem
 - Modernisation and speeding up of the permission system
 - Exemption from government regulations and control on forestry management, cutting, transportation, processing and marketing for registered reforestation sites
- v. Strengthening of the statistics and information system through the implementation of a national forest inventory
- vi. Registration and certification of forest controllers and inspectors to facilitate communal participation in forest management
- vii. Implementation of a procedure to allow the participation of individuals and groups in forest protection and establishment of measures to deal with violations of forest protection

The Forest Development Policies also state the need to employ the following measures to realise the above-listed policies.

- Establishment of the FONADEFO (Fondo Nacional de Desarrollo Forestal)
- Strengthening of the public forestry sector with emphasis on the INAFOR, the principal function of which is to implement forest policies focusing on the development, promotion, regulation and control of forests
- Cooperation of policies in various industrial sectors, particularly the agropasture and forestry sectors
- Establishment of land boundaries, a register and title deeds at the national level

2) Outline of New Forest Law

Development of the legal framework is important for the successful realisation of the policies described in the above 1). For this reason, the “Law Concerning Conservation, Promotion and Sustainable Development of the Forest Sector” (Law No. 462, hereinafter referred to as the “New Forest Law”) has been introduced (promulgated in September, 2003 and enforced in April, 2004).

This Law has been introduced to ensure that the forest sector in Nicaragua contributes to (i) the economic and social development of the country, (ii) the conservation, improvement and sustainable development of forest resources in harmony with the forest policies and (iii) the creation of employment as well as improvement of the standard of living through the participation of people in forest-related activities with the active participation of local governments and local communities.

The objective of the Law is defined as “the establishment of a legal regime for the conservation, promotion and sustainable development of the forest sector based on the management of natural forests, the promotion of reforestation and the protection, conservation and restoration of the forest area” and its main contents are outlined below.

[Outline of the New Forest Law]

- Establishment of the National Forest Commission (CONAFOR)²¹⁾ (Article 5)
- Jurisdiction of the MAGOR over the planning, etc. of forest policies ²²⁾ (Article 6)

21) CONAFOR: A national organization which is composed of minister of the MAGFOR and other related ministries, the Director General of the INAFOR and representatives of forestry companies, forest owners, local governments and forest technicians, etc. and which conducts various activities, including the approval of forest policies, issue of permission for cutting and operation.

- Jurisdiction of the INAFOR (Article 7)

1. Monitoring of the sustainable use of national forest resources, execution of inspections, application of necessary measures, corrections and sanctions in compliance with the Law and its regulations
2. Implementation of forest management policies in Nicaragua within the scope of jurisdiction
3. Approval of cutting permits and confirmation, evaluation and inspection of forest management plans
4. Proposal of obligatory technical standards regarding diversified forest management to the MAGFOR, the superior organization, for the purpose of conducting approval in accordance with the Law
5. Conclusion of agreements with municipal governments or public/private organizations to entrust forest monitoring and control work and delegation of forest promotion work with the transfer of the necessary funds in the case of agreements with municipal governments
6. Implementation of all necessary measures for the prevention of and fight against diseases and harmful insects with the cooperation of the diseases control section of the MAGFOR and supervision of the state of observation of the diseases and harmful insects control standards (sanitation standards) for forest tree species
7. Implementation of the necessary measures for the prevention, mitigation and extinguishing of forest fires
8. Recommendation to the MAGFOR to coordinate with the MARENA for the introduction of a measure to prohibit forest operations when ever necessary and the monitoring and withdrawal of such measure
9. Preparation of statistical data for the forest sector
10. Control of the National Forest Register to manage the national forest resources inventory
11. Issue of documents guaranteeing the receipt of incentives set forth by the present Law
12. Facilitation of national and international forest certification
13. Promotion of forest promotion programmes, particularly reforestation programmes in areas of forest degradation, with local governments and private organizations
14. Implementation of public forest hearings with a view to solving the problems based on the results of such hearings

22) The planning of forestry policies is conducted by the Directorate General of Forest Development, an internal organ of the MAGFOR. The INAFOR, an external organ of the MAGFOR, is responsible for the execution of the planned forestry policies.

15. Acknowledgement of petitions which relate to administrative procedures

16. Certification of municipal forest managers and forest technicians

- Items to be entered in the National Forest Register (Article 8)
- Definition of forest technicians to be certified by the INAFOR as necessary for the implementation of forest management plans (Article 9)
- Procedure for agreement to transfer the authority concerning forests to municipalities and public or private organizations (Articles 10 and 11)
- General provisions regarding the regulation and law enforcement of cutting and observation of the technical standards, etc. (Article 12 through Article 20)
- Procedure to obtain permission for the cutting of natural forests (Article 21 through Article 23)
- Creation of man-made forests and deregulation of cutting, etc. (Articles 24 and 25)
- Jurisdiction of the MARENA over reserves (Article 26)
- Establishment of municipal forest reserves (Article 27)
- Promotion of forest restoration (Article 28)
- Creation of a fund to motivate carbon fixation (Article 29)
- Transportation, storage and processing of forest products (Articles 30 and 31)
- Measures for the prevention, alleviation and control of damage by diseases and harmful insects and forest fires (Article 32 through Article 35)
- Various measures to promote and provide incentives for the private sector to participate in forest promotion (Article 36 through Article 40)

Article 38 stipulates the following incentives.

1. Exemption from payment of the municipal sales tax by 50% and the profit tax by 50% for the use of wood from man-made forests registered in the first ten years of the enforcement date of the present Law
2. Exemption of reforestation sites and natural forests managed in accordance with a forest management plan from payment of the fixed property tax for the first ten years of the enforcement date of the present Law
3. Deduction of 50% of the amount invested by an enterprise in man-made forests from earnings subject to the corporation tax

4. Exemption of secondary and tertiary processing enterprises which import machinery, equipment and accessories designed to improve the technical level of wood processing, excepting sawing, from payment of the import tax
 5. Priority to be given by all government organizations to wood products procurement contracts which are accompanied by a forest certificate issued by the INAFOR if the cost difference in the tender or competitive tender is 5% or less
 6. Deduction up to 100% of the payment for the corporate tax (income tax) for all individuals and juridical persons when such payment is made for the promotion of reforestation or for the creation of man-made forests. For the application of this deduction, taxpayers must indicate the relevant forest initiative to the INAFOR in advance
- Taxation rate imposed on wood produced from natural forests and distribution of this tax revenue (Articles 48 and 49)

Article 49 sets forth the distribution method in the following manner.

1. For autonomous regions, the Law Concerning the Land Ownership System for Indigenous People and Ethnic Communities in the Atlantic Coast Autonomous Regions and the Bocay, Coco and Indio Maíz Rivers Autonomous Regions (Law No. 445) was announced in Official Gazettes No. 16 and No. 23 in January, 2003. This Law stipulates the following distribution method.
 - ① 25% to communities or indigenous communities where the resources used exist
 - ② 25% to the municipality where an indigenous community exists
 - ③ 25% for the regional council and corresponding regional government
 - ④ 25% to the national treasury
 2. In the rest of the country
 - ① 35% directly to municipalities where wood is originally cut
 - ② 50% to the FONADEFO
 - ③ 15% to the national treasury
- Creation and capitalisation of the FONADEFO and establishment of the Coordinating Committee (Article 50 through Article 52)

Article 51 stipulates the following sources for the capitalisation of the FONADEFO.

1. Allocation from the ordinary budget of the Republic
2. Domestic and international donations.

3. Funding from conventions made at the domestic and international levels
 4. 50% of the forest-related earnings, including taxes, fines and income from the auction of seized materials as set forth in Article 49 of the Law
 5. Funding from a special credit line, environmental services, programmes and projects
- Violations and penal rules (Article 53 through Article 58)
 - Temporary provisions and additional rules (Article 59 through Article 68)

The significance of the enforcement of the present Law lies with (i) the creation of the legal foundation for the development of forest policies based on a single law and (ii) the development of the functions of the INAFOR backed by law.

From the viewpoint of policy making, the implementation problems of various policies led by the forest development policies have been identified and suitable measures to solve them are now in place. It is hoped that these measures will be properly realised with the necessary budgetary arrangements. The matters directly relating to the promotion of the M/P include partial tax exemption for cutting at reforestation sites, deregulation of the cutting procedure at reforestation sites, decentralisation and the creation of the FONADEFO.

(3) Competent Authorities

The forest and environment administration is in the hands of the MAGFOR, INAFOR, MARENA and municipalities. The responsibilities and activities of these administrative organizations are outlined below.

1) MAGFOR, INAFOR and MARENA

For forests other than those in reserves under the jurisdiction of the MARENA, the MAGFOR is responsible for the planning of forest policies while the INAFOR is responsible for the execution of forest policies as the sole organization in charge of the coordination and management of forest resources. These two organizations conduct their respective work in coordination with municipalities.

The INAFOR conducts wide-ranging work relating to forest management, including the promotion of reforestation, permission for cutting, control of diseases and harmful insects, prevention and fighting of forest fires and management of statistical data on forests as set forth in Article 7 of the New Forest Law mentioned earlier.

Although central government organizations have local offices, the INAFOR has only two technicians in the León Department and four technicians in the Chinandega Department in the Study Area. These technicians do not have time to implement forestry extension work as their time is taken up by dealing with applications for cutting permits, controlling pine beetles and forest fire prevention work²³⁾. For the implementation of the present Study, the INAFOR established a section within the Forest Promotion Department in 2002. The head of the Chinandega Office has been appointed as the section manager as an additional assignment and two technicians have been allocated. It officially established the M/P Project Territorial Technical Unit (hereinafter referred to as “the UTT-PPM”) in 2004 together with the appointment of two additional technicians so that there is a team of five full-time staff members for the full-scale implementation of the M/P.

The estimated budget size of the INAFOR for 2003 is C\$ 28,537,000, consisting of C\$ 17,762,000 for general expenses (personnel and other operating costs) and C\$ 10,775,000 for capital expenditure (implementation cost of projects, etc. with C\$ 400,000 earmarked for the UTT-PPM).

In addition to the INAFOR, the MAGFOR has another external organization called the INTA which was established for the extension of agricultural and stock raising techniques and which is said to be capable of providing technical guidance for not only agriculture and stock raising but also for agroforestry and the production of seedlings, etc. The work to provide guidance for communities for the implementation of the M/P can, therefore, be effectively conducted in coordination with the INTA.

The MARENA is responsible for the protection of reserves established in the Maribios Mountain Range, Mt. Cosigüina and mangrove forests. Other activities of the MARENA include the POSAF Project and supporting for the environmental administration of municipalities through FAM and environmental education in coordination with the MECD.

The POSAF Project features forestry, agriculture and stock raising and its activities often fall under the jurisdiction of the INAFOR. However, as the Project has been implemented since 1996 which was prior to the transfer of the INAFOR from the MARENA to the MAGFOR, it is now under the joint jurisdiction of the MARENA and the INAFOR. At present, the MARENA is involved in activities relating to forest management. However, the INAFOR will probably assume sole jurisdiction for such activities with the completion of the POSAF Project. In the case of environmental education, the MECD is responsible for its promotion

23) In March 2004, the offices in the León Department and the Chinandega Department were integrated as a District Forestry Office and this office was set up in the municipality of León.

and conducts environmental education at schools, including the distribution of guidelines for school education in coordination with the section responsible for environmental education of the MARENA. The activities of the FAM are described in 2) below.

The primary work of the MARENA features measures relating to environmental administration and protection of the natural environment while that of the INAFOR features measures to improve forests by means of appropriate forest management.

2) Municipalities

The municipal section in charge of forests and the environment is usually called the office of environment which has one or two staff members in most municipalities. In some municipalities, the functions of this office are performed by another office. The work of the municipal office of environment is fairly diverse as listed below.

- Inspection and law enforcement regarding forests
- Processing of complaints relating to the environment
- Requests for, planning, implementation, monitoring and evaluation of support projects
- Education and training for environment-related sectors and assistance for organization in such sectors
- Liaisoning and coordination with government organizations (INAFOR, MARENA and INIFOM, etc.), NGOs and others

The staff deployment at the office in charge of forests and the environment in each city is shown in Table 2-3-1-1.

Table 2-3-1-1 Staff Deployment at Municipal Office
in Charge of Forests and the Environment

Department	Municipality	Section in Charge of Forests and the Environment (Staff Strength)	Environmental Committee
Chinandega	El Viejo	Office of Environment (2)	Yes
	Puerto Morazán	Office of Environment (2)	Yes
	Somotillo	Office of Environment (1)	Yes
	Villaneuva	Office of Environment (1)	Yes
	Chinandega	Office of Environment (3 technicians)	Yes
	El Realejo	Office of Environment (1)	Yes
	Corinto	Deputy Mayor	Yes
	Chichigalpa	Office of Environment (2)	Yes
	Posolterga	Deputy Mayor	Yes
León	Achuapa	Office of Planning (2)	Yes
	El Sauce	Office of Planning (2)	Yes
	Santa Rosa del Peñón	Office of Environment (1 technician)	Yes
	El Jicaral	Office of Environment (1 technician)	Yes
	Larreynaga	Deputy Mayor	Yes
	Telica	Office of Environment (1)	Yes
	Quetzalquaque	Deputy Mayor	Yes
	León	Office of Environment (5)	Yes
	La Paz Centro	Deputy Mayor	Yes
	Nagarote	Office of Environment (1 technician)	Yes
Managua	San Francisco Libre	Office of Environment (1)	Yes

Source: INAFOR survey in December, 2003

The Environment and Natural Resources Law (Law No. 217) makes it a compulsory requirement for each municipal authority to establish a Municipal Environment Commission (CAM) which is an advisory as well as support organ for municipal forest and environmental policies and which consists of representatives of the following organizations.

Municipal Authority, MARENA, INAFOR, MAGFOR, INTA, MECD, MINSa, Police, Military, Forest and Environment Project and related NGOs

Strengthening of the environmental administration at the municipal level has been mainly supported by the Municipal Environment Fund (FAM) Project which was set up with World Bank funding and the assistance of the MARENA and this Project has assisted 43 municipalities, including all municipalities in the Chinandega and León Departments.

The FAM aims at helping municipalities to implement environment-related projects and is incorporated in the Municipal Development Plan, Municipal Investment Plan (hereinafter referred to as the “Municipal Development Plan” together with Municipal Investment Plan) and the Annual Operation Plan of municipality. In order for the office of environment to

implement the present M/P using the FAM, incorporation of the M/P in the Municipal Development Plan and the Annual Operation Plan of the municipality is essential.

Although the FAM can be used for the various funding purposes listed below, its main use is for environmental pollution control measures. In practice, its use is limited to extension and educational activities concerning conservation of the natural environment in terms of forestry sector and related small projects, such as the distribution of simple tools for forest fire prevention and seedling production, including revegetation trees at small nurseries.

- Strengthening of the municipal office of environment: provision of a personal computer, office furniture and vehicle, etc. and the deployment of one technician (to cover his wage)
- Conservation and protection of natural resources: support for the implementation of projects relating to agroforestry, silvopastoral system, forest fire prevention measures, natural forest protection and wildlife protection, etc.
- Use of forest resources: support for the implementation of such projects as the development of man-made forests assuming their sustainable use and wildlife protection
- Environmental pollution control measures

(4) Permits for Forest Use

The INAFOR issues permits relating to cutting and the transportation of wood and firewood, including such activities in reserves where the cutting of old, over-mature, damaged, fallen or dead trees is permitted. The cutting of these trees also requires the approval of the MARENA. Table 2-3-1-2 shows the situation of permits granted to cut trees in the Managua, León and Chinandega Departments in Fiscal 2000.

Table 2-3-1-2 Situation of Permits Granted to Cut Trees (Fiscal 2000)

Department	Municipality	Annual Forest Use Plan		Wood for Home Consumption		Firewood	
		No. of Permits	Volume (m ²)	No. of Permits	Volume (m ²)	Permits	Weight (tons)
Managua	San Francisco Libre	1	100	-	-	-	-*
León	Achuapa	-	-	7	88	2	18
	El Sauce	8	1,949	26	709	2	35
	Larreynaga	-	-	14	945	8	166
	Telica	-	-	5	140	-	-
	León	-	-	12	217	2	30
	La Paz Centro	-	-	7	397	3	68
	Nagarote	-	-	1	93	6	258
	Sub-Total	8	1,949	73	2,589	23	691
Chinandega	El Viejo	1	192	66	3,019	32	2,487
	Puerto Morazán	-	-	5	266	3	693
	Somotillo	-	-	4	92	2	212
	Villaneuva	3	509	33	1,682	7	252
	Chinandega	-	-	15	314	2	635
	El Realejo	-	-	1	58	-	-
	Chichigalpa	-	-	3	34	-	-
	Posoltega	-	-	-	-	3	312
Sub-Total	4	701	127	5,465	49	4,591	

* No permit but the INAFOR estimates the firewood transportation volume to be 960 tons.

Source: INAFOR

There are three types of procedures to obtain a permit for the cutting and transportation of such forest products as firewood and wood, etc.

- Up to 10 standing trees: permit for home consumption (in reality, mainly for industrial use)
- More than 10 standing trees: approval under the Annual Operation Plan and the Forest Management Plan
- Firewood: permit for firewood use

The Annual Operation Plan is subject to annual renewal of the permit. When the planned cutting extends for more than one year, approval under the Forest Management Plan is required. Application for a permit/approval must be made by submitting a range of documents, including the INAFOR forms (land registration, home use, Annual Operation Plan and Forest Management Plan, etc.), letter of municipal consent, official land registration document (either an authenticate document, registration certificate or ownership certificate), trade agreement and application paper by the planned cutter.

For all of these procedures, completed registration of the subject land is an essential condition. However, this registration has not made full progress in the Study Area, restricting the legal use and management of forests. Given the fact that the departmental office of the INAFOR is located in the principal municipality in each department, the reality of forest use is that illegal use is not uncommon because of the time-consuming and costly nature of such procedures for potential applicants.

(5) Reforestation

Reforestation has taken place in the past in the Study Area under the Windbreak Forest Project of the IRENA, the Pikín Guerrero Project, the Maribios Project, the Manuel López Project and the PROCASITA Project, etc. Reforestation is currently being conducted by sugar companies and NGOs and also under the PROLEÑA Project and the POSAF Project, etc. Under the Maribios Project, reforestation was conducted over 3,561 ha from 1989 to 1998. Meanwhile, San Antonio sugar company planted eucalyptus and teak over 4,530 ha up to 1998 to obtain firewood for power generation.

The reforestation results indicate that the survival rate of such fast-growing species as eucalyptus is favourable but that the actual operation is not necessarily ideal as shown by the lack of bud pruning for post-cutting regeneration by sprouting. The survival rate of local species planted by individuals at many communities is not particularly high, presumably because of the planting of insufficiently hardened seedlings although the handling of the seedlings during the period from their shipment from nurseries to the actual planting sites is also not without problems.

(6) Agroforestry and Silvopastoral

Agroforestry has been employed in the Study Area by the Maribios Project, the Manuel López Project, the Pikín Guerrero Project, INTA projects and POSAF projects, etc. for various purposes, including soil conservation, restoration of the land productivity and/or the diversification of agricultural products. The municipal profile survey found that agroforestry is practiced in Chinandega, Chichigalpa, Posoltega, El Sauce, Quezalquarque and San Francisco Libre. The common application of agroforestry is for live fence, contour hedgerow, alley cropping and earth ridge. Its application for rock ridge is also observed in steep rocky areas. One example of silvopastoral is the planting of shelter trees in San Francisco Libre. Live fence is traditionally created for the purpose of clearly indicating land boundaries and is not exactly the result of the implementation of agroforestry or silvopastoral.

The RRA findings suggest that the level of recognition of agroforestry among local residents is relatively higher in such communities as San Cristóbal, Pellisco Occidental and Tololar 3, etc. where the Pekín Guerrero Project was implemented than in other communities.

As described above, most cases of agroforestry and silvopastoral have been conducted as model attempts under forest or environment-related projects and have involved many different application methods. However, some attempts have been suspended due to the end of the project. Neither agroforestry nor silvopastoral can be said to be widely practiced in the Study Area although their application will be highly necessary in the future as part of soil conservation measures, particularly at sloping land.

(7) Forest Fires

Table 2-3-1-3 shows forest fires which occurred from January to May, 2000 in León, Chinandega and Managua Departments, including the Study Area.

Table 2-3-1-3 Area Damaged by Forest Fires (January to May, 2000)

Department	No. of Forest Fires	Forests	Agropasture	Total
Managua	175	192	2,749	2,941
León	345	421	5,419	5,840
Chinandega	285	655	4,477	5,132
Nationwide	4,765	92,356	74,851	167,207

Source: INAFOR

Table 2-3-1-4 shows the number of forest fires by month for the period from January to May, 2003.

Table 2-3-1-4 Number of Forest Fires by Month (2003)

Department	January	February	March	April	May	Total
Managua	94	61	65	1	3	224
León	173	110	103	1	5	392
Chinandega	111	178	139	3	4	435
Nationwide	481	516	1,712	206	444	3,359

Source: INAFOR

The main causes of forest fires are said to be hunting, honey collection, burning for farming or grazing, failure to properly extinguish bonfire and the careless disposal of cigarettes by passersby. The Study Area has degraded forests dominated by relatively fire-resistant species due to the loss of trees and impediment to the generation of succeeding trees by the repetition

of forest fires. The prevention of forest fires which impede the healthy growth of forests is an important task for forest management.

The INAFOR is promoting training sessions for village leaders, publicity using the mass media and the distribution of posters, etc. nationwide as part of its “Forest Fire Prevention and Fire-Fighting Campaign”. While some villages have formed their own forest fire-fighting teams, the total coverage of these teams is not yet large, making the provision of indirect assistance for such village initiatives important.

2.3.2 Situation of Use of Forest Products and Non Wood Forest Products

The production of firewood for home consumption, fencing posts and building timber is common in the Study Area. Table 2-3-2-1 shows the situation of use of forest products and non-wood forest products by municipality.

Table 2-3-2-1 Situation of Use of Forest Products and Non-Wood Forest Products

Department	Municipality	Situation of Use of Forest Products
Chinandega	El Viejo	<ul style="list-style-type: none"> Furniture production (Laurel, Caoba, Cedro real, Pochote) Firewood prices: producer - C\$ 125/cartload; consumer - C\$ 330/cartload
	Puerto Morazán	<ul style="list-style-type: none"> Use of mangrove forests for firewood production: three firewood producers' unions (production volume of 58,000 – 230,000 rajas/month) 400 people are engaged in firewood production: hourly wage of C\$ 3.06 (compared to C\$ 2.00 for farm workers) Production of raw wood for plywood (Ceiba, Panamá)
	Chinandega	<ul style="list-style-type: none"> Three sawmills: production capacity of 20 m³/day (Guanacaste, Espavel, Genizaro and Almendro, etc.) Furniture production (Laurel, Caoba, Cedro real, Pochote) Firewood demand: 100,000 tons/year (mainly supplied from Villaneuva and El Viejo) Firewood prices: producer - C\$ 30/marca; consumer - C\$ 35 – 45/100 rajas
	El Realejo	<ul style="list-style-type: none"> Five mangrove firewood producers: production volume of 22,000 rajas/week; production site - Pacific coast of El Viejo; market - Chinandega (consumer price of C\$ 35/100 rajas)
	Chichigalpa	<ul style="list-style-type: none"> Furniture production (Laurel, Caoba, Cedro real, and Pochote) Use of planted Eucalyptus as fuel for power generation by a sugar company
	Posoltega	<ul style="list-style-type: none"> Furniture production (Laurel, Caoba, Cedro real, and Pochote) Use of damaged trees by Hurricane Mitch (Caoba and Cedro real, etc. since 1999) Medicinal herb and natural insecticide project by CIEETS (NGO) (La Pelona and El Porvenir)
León	Achuapa	<ul style="list-style-type: none"> Sale of standing trees: C\$ 50/tree (Pine, Caoba, Laurel, Guanacaste and Pochote) Cut volume: 164 m³/month (cutting area of 4,757 Mz)
	El Sauce	<ul style="list-style-type: none"> Production of pine logs by a logger based in Estalí Production of hardwood logs (Guanacaste, Pochote, Genizaro and Almendro, etc.) Furniture production (Laurel, Caoba, Cedro real, and Pochote) Plywood production (Ceiba) Apiculture Union (1)
	Santa Rosa del Peñón	<ul style="list-style-type: none"> Producer price of firewood: C\$ 100/cartload
	El Jicaral	<ul style="list-style-type: none"> Producer price of firewood: C\$ 0.25/manojo
	Telica	<ul style="list-style-type: none"> Furniture production (Laurel, Caoba, Cedro real, and Pochote) Producer price of firewood: C\$ 180/cartload
	Quetzalquaque	<ul style="list-style-type: none"> Firewood price: producer – C\$ 120/cartload; consumer – C\$ 45/sesenta (120 rajas)
	León	<ul style="list-style-type: none"> Estimated firewood demand: 100,000 tons/year (requiring the planting of Eucalyptus over 10,000 ha) Firewood price: producer – C\$ 150/cartload (8 – 10 sesenta); consumer – C\$ 35 – 45/120 rajas One sawmill: production capacity of 12 m³/day Furniture production (Laurel, Caoba, Cedro real, and Pochote)
	La Paz Centro	<ul style="list-style-type: none"> Firewood production for brick and roof tile production (Cornizuelo, Quebracho, Guácimo de Ternero, etc.) Producer price of firewood: C\$ 120/cartload Use of nipa palm (mainly for the Masaya market and traditional summer house construction)
Nagarote	<ul style="list-style-type: none"> Firewood production for brick and roof tile production and the Managua market Producer price of firewood: C\$ 120/cartload El Charcoal price: producer – C\$ 25/bag; consumer – C\$ 50 – 60/bag (1 bag = 150 lbs) 	
Managua	San Francisco Libre	<ul style="list-style-type: none"> Production of firewood for Managua: transportation volume of 80 tons/month Producer price of firewood: C\$ 0.25/manojo

Firewood units : cartload = 2.52 m³ (solid volume) or 1,000 – 1,200 pieces; raja = 1 kg per one piece (6 – 7 cm in diameter x 50 – 70 cm in length); sesenta = 120 pieces; manojo = approximately 1.7 kg

Source : Profile of Municipalities (JICA-CESADE, 2001)

2.3.3 Restrictive Factors for Forest Management

The following restrictive factors for forest management are conceivable in view of the present conditions of forests and the socioeconomic conditions surrounding forests in the Study Area.

(1) Factors Originating from Forest Handling

Many natural forests are experiencing depletion as well as degradation because of the following reasons and, therefore, cannot fully perform their soil and water conservation functions.

a. Selective cutting of useful large diameter trees

Many secondary forests are characterised by a low crown density and few fine trees because of the lack of suitable regeneration measures after the selective cutting of useful large diameter trees.

b. Degradation due to forest fires or grazing

In some open forests, species which are highly fire-resistant but which have a low value from the viewpoint of forestry are dominant as the growth of regenerating young trees has been hampered by constant forest fires and grazing.

c. Irrational land use

The clearance of forests, even those on sloping land which is essentially suitable land for forest development, for farming and grazing purposes has reduced the overall forest area. In addition, the population increase and decline of the land productivity have shortened the rotation period for customary slash and burn agriculture. Consequently, cutting and cultivation at fallow land take place before the stage where the soil and water conservation functions are fully performed by regenerated forests is reached.

d. Poor access conditions

Because of the poor access conditions of forests, it is difficult to conduct adequate forest management work.

e. Forest management capacity and awareness on the part of local residents

While local residents as forest owners are aware of the importance of forest and environmental conservation, the priority of reforestation and natural forest management, etc. is quite low among the economic activities. Moreover, they have little experience of

reforestation and natural forest management activities. Their awareness of the risks regarding natural disasters associated with soil erosion, etc. is low under the present circumstances where they are hard pressed to maintain their livelihood.

(2) Socioeconomic Factors

a. Question of land ownership

Anyone planning to use a forest to obtain wood must obtain the approval of the INAFOR under the forest management plan and registration of the forest land in question is an essential condition for this approval. According to an IICA study, 70% of the land owned by small and medium size producers in Nicaragua has not been officially registered.

Forest land registration by producers with little capital of their own has been very slow because of the time-consuming and costly nature of the registration procedure, impeding the legal and rational use of forests.

b. Poverty and firewood production

Many people living in forest areas are engaged in firewood production in the remaining natural forests as a source of cash income because of poverty, meteorological disasters (drought and hurricanes, etc.), food shortage and insufficient availability of employment opportunities. Meanwhile, the firewood demand for brick and roof tile production has been accelerating the depletion and degradation of forest resources. Many forests have been degraded to shrub forests because of excessive firewood production well above the production capacity of forests and/or the lack of regeneration efforts after cutting. The firewood prices do not properly reflect the value of forests and the distribution margins of middlemen, etc. have kept the income of producers at a low level.

c. Question of commercialisation of forest products

Wood is distributed through the route of landowner → logger → sawmill → furniture plant/builder, etc. Sawmills mainly deal with large diameter logs of indigenous species. The distribution and marketing routes for Eucalyptus and other planted trees which local users are not particularly familiar with have not yet sufficiently been developed. As mentioned earlier, producers of firewood are forced to accept low prices and one study shows the margin of middlemen at more than 60% of the consumer price.

d. Low awareness of forests as public property

Forests are valuable public property because of their soil and water conservation functions, contribution to carbon circulation and conservation of biodiversity, etc. and forest owners

have the responsibility to manage forests to allow them to properly perform their functions. In reality, forest owners are failing to fully fulfill their responsibility because of their socioeconomic conditions (poverty, food shortage and unemployment, etc.) and the decline of their forest management awareness resulting from such conditions. Meanwhile, the public as well as administration should promote understanding of the importance of forests among forest owners and also policy assistance for them so that forests can be conserved as public property. However, the provision of such assistance has been insufficient due to financial difficulties and insufficient awareness as the beneficiaries of forests (lack of understanding of the benefits of forests among the public).

(3) Problems with the Administration

a. Manpower shortage

There is a substantial manpower shortage to control illegal cutting and to provide appropriate guidance on forest management and the process for the approval of forest use permits requires a long time to complete. The current staff strength of related organizations (MARENA, INAFOR and municipalities) cannot sufficiently cover their respective areas of jurisdiction.

b. Insufficient communication between administrative organizations

From the legal point of view, applicants for forest use are subject to the control and supervision of the INAFOR and the municipality (the MARENA in the case of reserves). However, the opinions of these two organizations differ, causing problems (while the municipality gives priority to political judgments and the needs of local residents, etc., the INAFOR's judgments are based on the technical point of view). Full coordination between related organizations is essential, ranging from schedule adjustment for site inspection to the unification of technical standards. In this context, the INAFOR should take the initiative to guide municipalities within the framework of the municipal environment committee.

c. High cost of forest use

Forest owners are subject to the following taxation based on the current law.

Forest Category	Fixed Property Tax	Tree Cutting Tax
Natural Forest (Natural Regeneration Site)	No*	Yes
Reforestation Site	No*	Yes

* No fixed property tax is imposed if forest operation takes place in accordance with a forest management plan.

In connection with forest use and the cutting of trees, landowners have liability to pay tax based on the New Forest Law and if the landowners have not forest management plan they

must pay the fixed property tax based on the Law Concerning Municipalities (Ley de Municipio; Decree No. 40-97).

d. Inadequate forest management measures

The Technical Standards and Administrative Measures for Forest Development introduced by the MARENA in 1997 are technical standards assuming wood production forests and there are no standards at present for the development of forests equipped with functions to benefit the public, such as soil and water conservation and the prevention of soil erosion, etc.

Forest management must be conducted so that the various functions of forests can be maintained, nurtured and secured. For this purpose, forests performing headwater conservation, soil erosion prevention and other functions as public property should be developed in addition to forests designed to produce wood and measures to ensure the precise management of these forests in correspondence with their designated functions must be introduced.

e. Importance of monitoring of forest resources

As the monitoring of forest resources, which includes the preparation of a forest type map, quantification of forest resources by means of a forest inventory and clarification of the situation of forest degradation, etc., can provide important basic data and materials for forest management, such monitoring of forest resources must be periodically conducted in a continual manner.

**PART II MASTER PLAN ON FOREST MANAGEMENT
FOR DISASTER PREVENTION**

CHAPTER 1 FOREST MANAGEMENT PLAN FOR DISASTER PREVENTION

1.1 Objectives of the Plan

Economic activities in the Study Area are mainly farming and stock raising by individual farmers and farming and grazing are widely conducted from low-lying flat land to mountainous areas. Farmers who do not have their own flat land cut into forests in their quest for farmland and make their living from slash and burn farming and grazing. As a result of such a practice, there has been the progressive devastation of forests, including the depletion or qualitative decline of forests. As already described in Part I – 2.3.3, the convergence of irrational land use and other technical issues, land ownership and other social factors and administrative factors is believed to form the background for the inappropriate conservation of forests. The unbalanced hydrological conditions where a rapid rise of rivers follows rain while there is hardly any running river water during dry spells are almost constant because of the decline of the soil and water conservation functions of the degraded drainage basins. Under such natural conditions, the Study Area suffered extensive damage due to flooding and landslides caused by Hurricane Mitch in October, 1998. Restoration of the soil and water conservation functions of drainage basis is, therefore, necessary as part of the measures to prevent the occurrence of natural disasters.

One effective method to enhance the declined soil and water conservation functions of drainage basins is the restoration of forests throughout drainage basins as land which is covered by high quality forests offers better soil and water conservation functions. For this purpose, it is important to change the mode of forest use from the current disorderly use to use based on an appropriate management method for the purposes of improving forest resources and using them in a sustainable manner while conducting forest restoration.

From the viewpoint of national land conservation, reforestation, the tending of natural forests and the construction of erosion control facilities should be actively conducted as public work. Given the current state of public finance and the administration, however, it is difficult for the public sector to conduct such work and local residents who own the land are required to play a central role in forest management. It is, therefore, essential for local residents to develop the concept that they are responsible for the proper management of their own land to protect their living as well as a productive environment by themselves. It is also essential for both the administration and local residents to recognise that the proper development/improvement of forests cannot be achieved without the understanding and cooperation of all stakeholders, including themselves.

It is difficult for local residents to recognise the advantages of forest management in the short term and, therefore, forest management appears unattractive. It is important that they recognise the benefits of forest development as such recognition will lead to their willingness to improve the forest conditions. Improvement of the livelihood of local residents through the process leading to forest development/improvement is essential so that local residents have time to turn their attention to forests. As forest management activities are expected to be led by local residents, the contents and scale of such activities must reflect the reality of the daily life of local residents, including their economic strength, labour availability and technical level. On the administration side, it is believed appropriate for the INAFOR, which is the competent organization for forest management administration, to be responsible for overall forest management at the national level while municipalities in direct contact with local people conducting forest management activities play the role of guiding and supporting local residents.

Article 7 of the New Forest Law stipulates that the INAFOR and municipal governments conclude an agreement to delegate forest promotion work to the latter. As it is necessary for local residents to take the initiative in forest management, the provision of guidance and support for local residents by municipal governments which are the closest administrative organs to local residents is deemed to be the most appropriate arrangement.

The present Study intends the formulation of the M/P for the Study Area under which local residents are expected to play a central role in forest management, taking the current situation of the Study Area and the expected role of the administration described above into consideration. The objectives of this M/P are outlined below.

Objectives of the M/P

The M/P aims at enhancing the soil and water conservation functions of forests through spontaneous as well as appropriate forest development/improvement by local residents in their own areas to mitigate the adverse impacts of such natural disasters as flood, drought and sediment disasters and at achieving the sustainable management of forest resources.

To achieve these objectives, the M/P also aims at developing the willingness of local residents to participate in forest development/improvement activities on their own initiative by means of deepening the understanding of local residents of the various functions of forests and such beneficial effects of trees as soil conservation, preservation of soil fertility and creation of shaded areas for domestic animals on the productive activities of local residents while enlisting the assistance of the administration and other external organizations.

1.2 Concept of Plan Formulation

1.2.1 Appropriate Forest Management

In consideration of the current reality of the financial and administrative capability of the competent authority, forest management in the Study Area must be led by land-owning local residents in a sustainable manner based on an appropriate technical rationality in terms of forest and forestry management.

Meanwhile, such natural conditions as the topography, geology, soil and climate and the social conditions, including the current land use, labour conditions and social customs, etc. must be properly considered to ensure well-balanced and suitable forest distribution which is rational in the light of the natural and socioeconomic conditions of each drainage basin.

In view of these requirements, appropriate forest management is considered from the viewpoints of achieving sustainable forest management by local residents and a suitable forest distribution for the formulation of an appropriate M/P.

(1) Sustainable Forest Management by Local Residents

When examining the living environment of local communities, local farming methods and natural conditions in the Study Area, there are three possible approaches to proceed with forest management to improve the soil and water conservation functions of forests as listed below.

- Slash and burn farming control
- Soil conservation
- Forest improvement

The selection of a priority approach from among these three approaches for individual communities in response to their reality appears to be rational.

There are three basic activities as listed below which must be implemented in all communities to proceed with precise forest management activities.

- Environmental education
- Prevention of forest fires
- Livelihood improvement

It is necessary for local residents to continually conduct these activities on their own initiative and also to raise the level of forest management to nurture forests with better conditions. There are three factors to support the above forest management activities.

- “Indigenous development capability” of communities
- “Administration or other external assistance” for communities
- “Activity results”

“Indigenous development capability” means the capability of local residents to contribute to the promotion of forest management activities and consists of such elements as the technical capability, organizational strength, resources procurement capability and willingness to initiate activities. A higher level of indigenous development capability enables continuous forest management activities at a higher level, pushing up the level of forest management.

“Administration or other external assistance” has the function of technically and financially assisting communities from outside to produce better activity results. It plays the role of extending technologies/skills, guiding local residents to organize themselves and providing financial (and material) assistance. The INAFOR as the competent agency for forest and forestry administration and municipal governments as direct administrative organizations in contact with local residents are important organizations to perform this function. In addition, the MARENA, INTA, UNAG and NGOs can be expected to perform this function.

“Activity results” are the consequences of the various activities of local residents based on their “indigenous development capability” with “administration or other external assistance” and it is important “for local people to understand these results as favourable changes by seeing an improved state and conditions”.

As local residents rely on farming to provide their livelihood, their interest in forests is weaker than their interest in farming. This is the reason why it is important for local residents to actually feel the benefits of the existence of forests and to recognise the necessity for forests. Even if their lives centre on farming, their recognition of the usefulness of forests increases the routine character of forest tending work, eventually unifying forest management activities with farming activities to achieve sustainable forest management.

The relationship between these factors, priority approaches and basic activities is shown in Fig. 1-2-1-1. While receiving administration or other external assistance, local residents conduct the basic approaches and priority approaches using their forest management capability (indigenous development capability) to obtain results. These activity results favourably affect and enhance the indigenous development capability to enable local residents

to move on to the next new activities. Through the repetition of this process, the forest management level improves, resulting in the improvement of forests from the present situation of “forest depletion and degradation in progress” to a situation of “the slowing down of forest depletion and degradation trend” and further to a situation where “the trend to increase forests”.

For sustainable forest management by local residents, a mechanism whereby the indigenous development capability, administration or other external assistance, basic activities, priority approaches and activities results function effectively is essential and the M/P to be formulated must bear the proper functioning of this mechanism in mind.

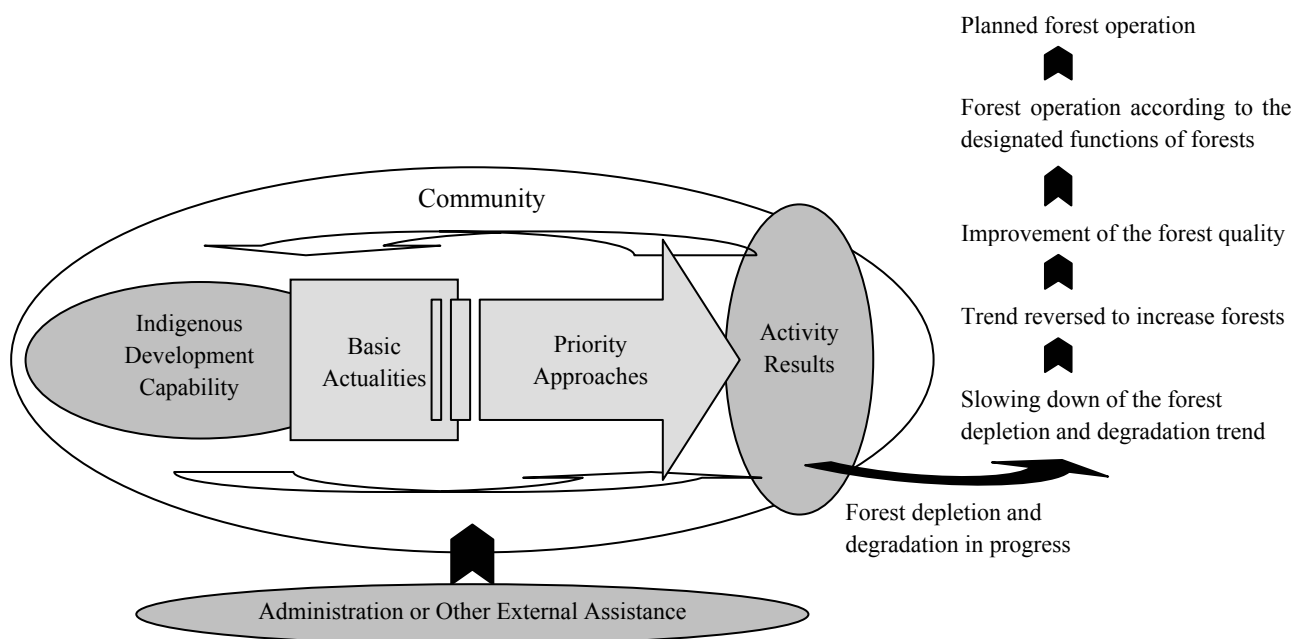


Fig. 1-2-1-1 Mechanism to Support Sustainable Forest Management

(2) Appropriate Forest Distribution

The characteristics of the Study Area are generally reviewed below from the viewpoint of watershed management in an attempt to examine forest distribution where such natural conditions as the topography and geology are well balanced with the land use and other conditions.

1) Viewpoint of Watershed Management

Firstly, the Study Area can be classified into ① the Lake Managua drainage basin, ② the Pacific coast drainage basin and ③ the Estero Real River drainage basin based on the characteristics described below.

① Lake Managua Drainage Basin

This drainage basin is situated around Lake Managua and consists of the plains to the east of Mt. El Hoyo, the area to the south of the mountainous land of Santa Rosa del Peñón and the El Jicaral area.

- i. This drainage basin has the lowest rainfall in the Study Area.
- ii. Flat land is rocky and is used as grazing land.
- iii. The soil is greyey brown and is fragile.
- iv. Mountainous land is used for farming and grazing up to the mountain summit.

② Pacific Coast Drainage Basin

This drainage basin lies on the Pacific coast side of the Maribios Mountain Range stretching from Mt. Cosigüina to Mt. El Hoyo via Mt. San Cristóbal.

- i. This drainage basin has the highest rainfall in the Study Area.
- ii. The hillside of Mt. Casita collapsed at the time of Hurricane Mitch in 1998 and a series of debris flows devastated the land and rivers in the drainage basin.
- iii. The soil of the plains is reddish brown and fertile and the plains are used as farmland.
- iv. Many municipalities have been formed on the plains and are linked by a network of paved roads. The traffic volume is particularly high between León and Chinandega on Route 12 which is a trunk road.
- v. The population density in this drainage basin is the highest in the Study Area.
- vi. Rivers flowing from the Maribios Mountain Range to the Pacific include the Posoltega and Telica, etc. in addition to small rivers with a width of approximately 5 m. The river water of relatively long rivers, such as the Posoltega and Telica, form underground streams in the upper reaches and flows out in the lower reaches. Small rivers normally dry up and their gentle gradient and deposited sand bed allow their use as convenient passageways for local residents.
- vii. Volcanic ejecta from recent eruptions has been deposited around Mt. Cerro Negro.

③ Estero Real River Drainage Basin

This drainage basin lies to the north of the Maribios Mountain Range and to the west of the mountain regions in the municipal territories of Achuapa and El Sauce.

- i. Pine forests covering a small area are observed in the upper part of the mountain regions of Achuapa and El Sauce. There are also many scattered small landslide sites.

- ii. Hilly areas in the mountain regions and in the middle reaches are mainly used for farming or grazing.
- iii. The lower reaches are swamps where mangrove forests spread.
- iv. There are no large urban areas.

As each drainage basin has specific natural and socioeconomic conditions, each municipal forest management plan for disaster prevention must take these conditions into consideration.

A consistent approach to the upper reaches through the lower reaches must be applied for watershed management to be implemented from the viewpoint of soil and water conservation. To be more precise, as floods, sediment disasters and drought are often caused by the destructive cutting of forests in the upper reaches, inappropriate farming and stock raising and/or forest fires, a well-balanced approach must be adopted to deal with the different conditions in the upper and lower reaches of a drainage basin. In the headwater areas of the upper reaches, the desirable measures include the tending of natural forests, promotion of reforestation and rational cutting, control of farming and grazing on steep sloping land, prevention of forest fires, a longer rotation period for slash and burn farming or a change of such farming sites to permanent farming sites and civil engineering work at headwater sites located in devastated areas. In the middle and lower reaches, the desirable measures are the proper management of farmland and grazing land, small-scale civil engineering work on both banks of dry rivers and planting work.

Even though examination of suitable soil and water conservation measures to meet the objectives of watershed management is not a simple task, those things which can be conducted under projects conceived in the M/P will be identified for examination of their feasibility with emphasis on the improvement and appropriate use of forests. It is believed that the northern part of the León Department which constitutes the upper reaches and which is characterised by a low forest ratio and much steep sloping land has high priority for forest improvement.

2) Zones

In order to ensure balanced forest improvement in the upper, middle and lower reaches of drainage basins incorporating the viewpoint of watershed management, the M/P firstly macroscopically categorises the entire Study Area into flat zones, gentle sloping zones and steep sloping zones based on the degree of inclination of the land and appropriate planning is conducted for each type of zone. The underlying reasoning for this categorisation is described below.

① Flat Zones: land inclination of less than 5%

These zones are noticeably found in the lower reaches of the Maribios Mountain Range and of Estero Real River and the 5% inclination line roughly coincides with the upper limit of farmland on plains. Land of which the inclination is less than 5% is classified as a flat zone as it appears practically flat when observed on the spot.

② Gentle Sloping Zones: land inclination of 5% or more but less than 15%

Land between a flat zone and a steep sloping zone is classified as a gentle sloping zone and is particularly noticeable at the feet of the Maribios Mountain Range. A cross-sectional view of the hillsides in such zones reveals alternate natural forests and cultivated land, indicating the mixed existence of forests and farming areas.

③ Steep Sloping Zones: land inclination of 15% or more

As forest development at land of which the inclination is 15% or more but less than 35% requires a development permit based on the technical standards issued by INAFOR based on the New Forest Law, land of which the inclination is 15% or more is classified as a steep sloping zone. Land of which the inclination is 35% or more falls under the jurisdiction of the MARENA (Technical Standards for Forest Management 18001-01, June, 2002 and Administrative Rules for Forest Management No. 07-02, April, 2002).

These flat zones, gentle sloping zones and steep sloping zones are given the status of farming priority areas, coexistent areas of farming and forests and forest priority areas respectively.

Flat zones were developed as farming areas mainly centering on cotton growing in the early years. Many of them have an existing earth ridge as a soil conservation measure and no special soil conservation measures are currently required. While flat zones include mangrove forests in deltas and swamp forests in the downstream of rivers, the degree of necessity for the application of disaster prevention measures is low.

Gentle sloping zones are located between flat zones and steep sloping zones and are areas where farming is spreading to forest areas. As water and soil conservation is necessary to enable farming, it is imperative to ensure soil and water conservation through the utilization of the water and soil conservation functions of forests and other measures. These zones have high potential for forestry as well as farming because of the site conditions and the commercial production of firewood or timber is considered at suitable sites. Meanwhile, low quality natural forests will be improved.

Steep sloping zones should preferably be covered by forests to improve the soil and water conservation function and the restoration of degraded natural forests is planned. Forests with good conditions are given the status of priority forest conservation areas and forest improvement will be attempted through the provision of guidance for landowners to ensure the appropriate use and management of such forests. In areas marked by the advanced devastation of forests due to burning for slash and burn farming or grazing, the introduction of agroforestry or silvopastoral is planned.

Some steep sloping zones are marked by a relatively large number of landslide sites. These zones are identified as hazardous areas for landslides and feasible land devastation prevention measures will be applied.

Areas where grazing is primarily conducted are mostly found in either flat zones or gentle sloping zones and are characterised by the shallow depth of the bedrock, the presence of many stones and pebbles, a shallow soil depth and harsh aridity, making them difficult areas for both farming and forestry. The cutting of shrubs from thin stands should be avoided to reserve them as seed trees for regeneration by natural seeding in order to encourage the growth of succeeding trees and to expand forests.

1.2.2 Master Plan Targets

The implementation period of the M/P is set at 20 years because of the reasons given below and the forest improvement targets to be achieved in these 20 years are determined.

< Basis for Implementation Period >

While the creation of a forest generally takes 50 years or even longer, eucalyptus and other fast growing species are selected as the main planting species for the M/P. These fast growing species allow cutting in approximately 5 – 7 years and a second harvest is possible with their regeneration by sprouting after the first harvest. In other words, a period of 15 – 21 years after original planting is considered to form a single silviculture system, making 20 years the general span of the M/P.

< Target Area for Forest Improvement >

As shown in Table 1-2-2-1, the target area for forest improvement is set at 50,800 ha in total, mainly featuring sloping land areas where the improvement of natural forests and the improvement of farmland and pasture through the introduction of agroforestry and silvopastoral are intended together with an expansion of forests. This target figure is determined based on the following.

Although there are isolated examples of the small-scale enrichment of natural forests in the Study Area, it has been difficult to find a desirable direction for natural forest restoration, resulting in failure to stop the trend of natural forest degradation and depletion. Neither agroforestry nor silvopastoral are widely practiced in the Study Area. Moreover, the reality of the lives of local residents who are expected to practice agroforestry or silvopastoral is that farming to obtain food is the most important activity. Consequently, forests do not necessarily command high priority among local residents who have no financial room to turn their eyes to forest restoration.

Under these circumstances, it is difficult to quantitatively clarify the past performance of natural forest restoration, agroforestry and silvopastoral because of the fragmented nature of existing data and, therefore, it is practically impossible to obtain data on what quantitative targets have been set. Accordingly, targets which constitute the minimum figures, some of which may be wishful thinking, are set in the following manner, taking the feasibility of certain activities in view of the reality of the lives of local residents into consideration.

In the case of reforestation, however, the area of existing man-made forests is roughly established based on aerial photograph interpretation as these man-made forests are the result of planting in the last 20 years since the 1980's. As it is judged that these interpretation results can be used as basic data for the setting of targets, quantitative targets are set based on the area of existing man-made forests.

Table 1-2-2-1 shows the target areas for forest improvement based on the above understanding.

(1) Restoration of Natural Forests

71,000 ha of sloping zones are covered by natural forests (stands of which the crown density is 30% or higher and the tree height is 7 m or higher) counted as forests based on the criteria of the MAGFOR. Natural forests of this type occupy 20% of the total area of sloping zones and the target is to increase this ratio to 25% in 20 years. To achieve this target, the improvement of 16,500 ha of low quality natural forests, which are not counted as forests, to good quality natural forests is necessary.

Out of the 16,500 ha, 11,000 ha are subject to the planting of useful trees in those open forests of which the crown density is less than 30%. The remaining 5,500 ha are subject to a shift from slash and burn farming to permanent cultivation to prolong the fallow period at certain sites so that fallow forests can be improved to good quality natural forests.

(2) Agroforestry

The aerial photograph interpretation results and municipal profile survey results indicate that some 58,000 ha²⁴⁾ of sloping land are used as farmland. The conservation of at least 20% of this farmland will be attempted in 20 years through the introduction of agroforestry, such as live fencing, contour planting and alley cropping, etc., with a subject area of improvement of 11,600 ha. The planting of 1,200 ha, which is roughly 10% of the target improvement area, is planned.

(3) Reforestation

Reforestation will aim at doubling the area of existing man-made forests in 20 years by means of planting an area which is equivalent to the area of existing man-made forests.

The area of existing man-made forests in flat zones is approximately 3,000 ha. Considering the existence of small man-made forests which are not displayed on the land use and forest type map and the expansion of man-made forests in recent years, the area of existing man-made forests is estimated to be approximately 5,000 ha. Accordingly, the new reforestation of 5,000 ha in flat zones is planned.

The area of existing man-made forests in sloping zones is approximately 2,300 ha. Based on the reasoning applied to flat zones, the total area of existing man-made forests is inferred to be approximately 3,900 ha. Given the planting area of 1,200 ha for agroforestry, the reforestation of 2,700 ha is planned to make a total reforestation area of 3,900 ha.

(4) Silvopastoral

The aerial photograph interpretation results and the municipal profile survey results indicate that some 75,000 ha of sloping land are used as pasture (grazing land). The conservation of at least 20% of this pasture will be attempted in 20 years through the creation of live fencing and the planting of shade trees and fodder trees. Accordingly, the planned area for improvement by silvopastoral is 15,000 ha.

24) The aerial photograph interpretation results put the farming and grazing area in sloping land zones at 133,000 ha. Meanwhile, the municipal profile survey has established the area of farming and pasture in each municipality. Based on the respective ratios of these areas, the farming area and grazing area in sloping zones are estimated to be 58,000 ha and 75,000 ha respectively.

Table 1-2-2-1 Target Areas for Forest Improvement

(Unit: ha)

Inclination Category	Improvement Subject		Target Area					Total
	Category	Area	Natural Forest Restoration		Reforestation	Agroforestry	Silvopastoral	
			By Enrichment	By Permanent Farming				
Steep Sloping Zone	Natural forest with crown density of $\geq 30\%$ and tree height of $\geq 7\text{m}$	22,938						4,280
	Natural forest with crown density of $\geq 30\%$ and tree height of $< 7\text{m}$	14,853		1,360				
	Natural forest with crown density of $\geq 10\%$ but $< 30\%$	9,395	2,150					
	Man-made forest	0						
	Grazing forest	1,728						
	Farmland	2,910			130	560		
	Pasture	2,380					80	
	Others	6,777						
Total	60,980	2,150	1,360	130	560	80		
Mixed Sloping Zone	Natural forest with crown density of $\geq 30\%$ and tree height of $\geq 7\text{m}$	28,591						34,210
	Natural forest with crown density of $\geq 30\%$ and tree height of $< 7\text{m}$	28,409		2,290				
	Natural forest with crown density of $\geq 10\%$ but $< 30\%$	32,094	7,440					
	Man-made forest	45						
	Grazing forest	11,382						
	Farmland	42,830			2,020	8,600		
	Pasture	67,391					13,860	
	Others	2,442						
Total	213,185	7,440	2,290	2,020	8,600	13,860		
Gentle Sloping Zone	Natural forest with crown density of $\geq 30\%$ and tree height of $\geq 7\text{m}$	19,179						7,310
	Natural forest with crown density of $\geq 30\%$ and tree height of $< 7\text{m}$	23,007		1,850				
	Natural forest with crown density of $\geq 10\%$ but $< 30\%$	6,101	1,410					
	Man-made forest	2,238						
	Grazing forest	4,656						
	Farmland	12,107			550	2,440		
	Pasture	4,895					1,060	
	Others	1,787						
Total	73,970	1,410	1,850	550	2,440	1,060		

Part II Chapter 1 Forest Management Plan for Disaster Prevention

Inclination Category	Improvement Subject		Target Area					Total
	Category	Area	Natural Forest Restoration		Reforestation	Agroforestry	Silvopastoral	
			By Enrichment	By Permanent Farming				
Sloping Zone Total	Natural forest with crown density of $\geq 30\%$ and tree height of $\geq 7\text{m}$	70,708						45,800
	Natural forest with crown density of $\geq 30\%$ and tree height of $< 7\text{m}$	66,269		5,500				
	Natural forest with crown density of $\geq 10\%$ but $< 30\%$	47,590	11,000					
	Man-made forest	2,283						
	Grazing forest	17,767						
	Farmland	57,848			2,700	11,600		
	Pasture	74,666					15,000	
	Others	11,005						
Total	348,136	11,000	5,500	2,700	11,600	15,000		
Flat Zone	Natural forest with crown density of $\geq 30\%$ and tree height of $\geq 7\text{m}$	78,059						5,000
	Natural forest with crown density of $\geq 30\%$ and tree height of $< 7\text{m}$	49,516						
	Natural forest with crown density of $\geq 10\%$ but $< 30\%$	22,034						
	Man-made forest	3,003						
	Grazing forest	92,729						
	Farmland	210,030			5,000			
	Pasture	108,286						
	Others	78,369						
Total	642,024	0	0	5,000	0	0		
Grand Total	Natural forest with crown density of $\geq 30\%$ and tree height of $\geq 7\text{m}$	148,767						50,800
	Natural forest with crown density of $\geq 30\%$ and tree height of $< 7\text{m}$	115,785		5,500				
	Natural forest with crown density of $\geq 10\%$ but $< 30\%$	69,624	11,000					
	Man-made forest	5,286						
	Grazing forest	110,495						
	Farmland	267,878			7,700	11,600		
	Pasture	182,951					15,000	
	Others	89,374						
Total	990,160	11,000	5,500	7,700	11,600	15,000		

1.3 Common Plans

The M/P is formulated based on the municipal profile survey findings, the land use and forest type map, the field survey results and the basic planning principles. Among the plan components, those commonly applicable to the entire Study Area are described in this section while others applicable to individual municipalities are described in the next section of 1.4.

1.3.1 Natural Forest Management Plan

(1) Basic Ideas of Natural Forest Management

In view of the objectives of the M/P, the following basic ideas of natural forest management are adopted for natural forests with a low density and fallow forests (shrub forests) on former slash and burn farming sites, all of which are currently used for extensive grazing.

a. Preservation and Enhancement of Soil and Water Conservation Functions

Forests should be tended to make them capable of fully performing their headwater conservation function and erosion control function.

b. Preservation of Productive Capacity of Forests

Forests should be tended to enable them to produce timber and firewood in a sustainable manner.

In the light of the objectives of the M/P, while it is essential to firstly secure the soil and water conservation functions, development of the timber production function will make it possible to improve the willingness of local residents to conduct activities to achieve the former. It is, therefore, desirable for forest management activities to enable all functions to coexist as much as possible except at such special sites as reserves and the upper reaches of headwater sources for villages.

Natural forests can be classified into the following types based on either the state of forests or their use.

a. State of Forests

- Forests of which the primeval state has been relatively preserved
- Secondary forests where selective cutting is conducted
- Open stands where extensive grazing is conducted

- Shrub forests in the process of regeneration after cutting to produce timber and/or firewood
- Regenerated forests (fallow forest) emerging at fallow land for slash and burn farming
- Riverine forests

b. Forest Use

- Timber production
- Firewood production
- Grazing
- Slash and burn farming (including fallow forests)

(2) Current Situation of Forests and Target Forests

Forests distributed in the Study Area are classified into different types. Table 1-3-1-1 shows the current state, target forest and urgent activities to be conducted to achieve the target forests for each type of classified forests.

Table 1-3-1-1 Current State of Natural Forests and Target Forests

Type	Current State	Target Forest	Urgent Activities Required
Pine Forests	<ul style="list-style-type: none"> • Forests distributed above sea level 900m and dominated by Pinus oocarpa • Approximate density of 600 trees/ha and volume of 100 – 200 m³/ha • Used for timber production • Not many trees have reached the utilisable diameter class due to selective cutting • Some are damaged by bark beetles 	<ul style="list-style-type: none"> • Forests consisting of stands of different ages • Coverage of the forest floor by shrubs, herbaceous plants or other undergrowth • Clear cutting of a small area with a cutting period of 30 – 40 years • Regeneration by natural seeding • Forests allowing the sustainable production of timber 	<ul style="list-style-type: none"> • Clear cutting by block to encourage regeneration by natural seeding • Thinning to encourage the growth of forest floor vegetation • Forest fire prevention measures: firebreaks, patrols, extension and education, etc.
Broad-Leaved High Density Forests	<ul style="list-style-type: none"> • Closed forests dominated by large diameter trees of guanacaste, cedro real and genizaro, etc. with a tree height of 20m or more • Distributed in deep mountainous areas (including some reserves) of the Maribios Mountain Range and others • Not much affected by cutting 	<ul style="list-style-type: none"> • Forests left to nature where old trees, dead trees and fallen trees are observed (reserves) 	<ul style="list-style-type: none"> • No artificial intervention • Forest fire prevention measures: firebreaks, patrols, extension and education, etc.
		<ul style="list-style-type: none"> • Multi-story forests allowing the sustainable use of large diameter trees • Selection cutting and regeneration by natural seeding 	<ul style="list-style-type: none"> • Encouragement of natural regeneration (enrichment if necessary) • Forest fire prevention measures: firebreaks, patrols, extension and education, etc.
Broad-Leaved Medium Density Forests	<ul style="list-style-type: none"> • Secondary forests where the selective cutting of useful trees has been conducted in the past • Dominated by guacimo and laurel of which the height is 20m or less • Low shrubs underneath • Mainly distributed on hills and sloping land 	<ul style="list-style-type: none"> • Multi-story forests allowing the sustainable use of large diameter trees (inducement to high density forests) • Selection cutting and regeneration by natural seeding 	<ul style="list-style-type: none"> • Encouragement of the natural regeneration of useful trees (including enrichment) • Forest fire prevention measures: firebreaks, patrols, extension and education, etc.
		<ul style="list-style-type: none"> • Multi-story forests allowing the sustainable use of medium diameter trees and firewood collection • Selection cutting and regeneration by natural seeding/enrichment 	<ul style="list-style-type: none"> • Encouragement of the natural regeneration of useful trees • Enrichment • Forest fire prevention measures: firebreaks, patrols, extension and education, etc.
Broad-Leaved Open Forests	<ul style="list-style-type: none"> • Density of 30% or less and where extensive grazing is taking place • Jiñocuabo, quebracho and escobillo, etc. are growing on hills • Jícaro and nacascolo, etc. are growing on flat land of Vertisols • Regular burning of the forest floor 	<ul style="list-style-type: none"> • Multi-story forests with a density of 30% or more • Forests capable of producing timber, firewood and fodder in a sustainable manner 	<ul style="list-style-type: none"> • Forest fire prevention measures: firebreaks, patrols, extension and education, etc. • Prohibition of grazing for a certain period • Encouragement of natural regeneration • Planting of shade trees, etc.

Type	Current State	Target Forest	Urgent Activities Required
Shrub Forests	<ul style="list-style-type: none"> • Shrub forests dominated by sardinillo, etc. with a tree height of 7m or less due to cutting in the past • Frequently seen on ridges and slopes in hilly areas with a shallow soil depth 	<ul style="list-style-type: none"> • Forests with a tree height of 10m or more • Forests capable of sustainable producing timber and firewood 	<ul style="list-style-type: none"> • Forest fire prevention measures: firebreaks, patrols, extension and education, etc. • Enrichment with useful trees
Fallow Forests	<ul style="list-style-type: none"> • Forests in the process of regeneration where dwarf trees grow at fallow land of slash and burn farming on sloping land • Returning to cultivation sites after some 5 – 10 years 	<ul style="list-style-type: none"> • Forests with a tree height of 10m or more • Forests capable of producing firewood 	<ul style="list-style-type: none"> • Extension of the rotation period of slash and burn farming • Forest fire prevention measures: firebreaks, patrols, extension and education, etc.
Riverine Forests	<ul style="list-style-type: none"> • Forests along a river bank or on lowland near a river • Large diameter trees, such as guanacaste, ceiba, panamá, ojoche and almendro del rio, etc. are growing • Becoming open forests with a diminishing width due to the enlargement of cultivated land and the cutting of useful trees 	<ul style="list-style-type: none"> • Closed multi-story forests • Forests with rich undergrowth 	<ul style="list-style-type: none"> • Enrichment in gaps • Encouragement of natural regeneration • Forest fire prevention measures: firebreaks, patrols, extension and education, etc.

(3) Forest Improvement Principles

1) Forests with Emphasis on Their Protection

Forests in reserves will be primarily subject to protection. The forests subject to protection will also include those in priority areas for forest conservation, hazardous areas for landslides and headwater areas and also those on steep sloping land. The cutting of forests in reserves will, in principle, be prohibited. Old over-mature trees, dead trees and fallen trees will be left to nature where possible while forest fire prevention measures will be introduced. Hazardous areas for landslides are those where many landslide sites are observed, suggesting geological fragility. As forest disappearance over a large area increases the risk of landslides, control of burning for grazing and the prevention of forest fires are important to prevent forest disappearance. In regard to forests in headwater areas, cutting over a small area or selection cutting will not necessarily be prohibited. In the case of degraded forests in the water source areas of villages or on steep sloping land or land with a thin soil cover, making timber production unsuitable, forest fire prevention measures will be introduced together with measures to restore forests. Enrichment is planned at those sites where natural regeneration of the trees is difficult.

2) Forests for Timber and Firewood Production

Among forests and shrub forests capable of producing timber and firewood because of their topography, soil and access conditions, pine forests will be subject to small area clear cutting while broad-leaved forests will be subject to selection cutting. The determination and implementation of the cutting age, selection cutting rate and return period to suit the actual conditions of each stand are desirable.

Regeneration should primarily be conducted by natural regeneration while enrichment should be conducted at those sites where useful trees are failing to regenerate.

The following measures will be urgently adopted to improve degraded forests to the target forests.

a. Demarcation of Forest Area

Forests will be demarcated to establish blocks for management purposes.

b. Forest Fire Prevention and Grazing Control

The prevention of forest fires and control of grazing for a certain period are essential requirements to improve the present forests to the target forests.

In addition to the above, planned forest management based on the following work is desirable for those forests which exceed a certain size and which aims at actively producing timber and/or firewood.

a. Forest Inventory

A simple forest inventory (including a survey on the state of natural regeneration) and a soil survey should be conducted for the demarcated stands to clarify the current state and site conditions of each forest.

b. Formulation and Implementation of Forest Management Plan

Based on the forest inventory results, a long-term forest management plan, including the target forest type and desirable tending method, etc., should be formulated and various types of forest operation should be implemented to achieve the target forest type based on the plan in question.

3) Fallow Forests

While fallow forests in the process of regeneration at fallow land of slash and burn farming should ideally be left to nature for their restoration, a change of the customary slash and burn farming to permanent farming is difficult. Extension of the rotation period of slash and burn farming should, therefore, be attempted by promoting a change to permanent farming through agroforestry and irrigation, which are described in a separate section, as a compromise at this time.

Slash and burn farming in the Study Area consists of the rotation of farming every 2 – 3 years, followed by a fallow period of 2 – 10 years. The general tree growth situation of fallow land is that trees reach a height of 3 – 6 m in the 6th year and 7 – 10 m in height in the 12th year.

Assuming an average fallow period of six years, farming should be conducted in rotation consisting of three blocks as shown on the left-hand side of Fig. 1-3-1-1 and cutting and cultivation should be conducted when trees at fallow land reach a height of approximately 4 m. When half of the shifting cultivation land has been converted to permanent farming as shown on the right-hand side, the fallow period can be extended to 12 years, enabling the development of forests of which the tree height is 7 m or more and which provide better soil and water conservation functions.

The introduction of permanent farming will enable the creation of stands of an older age, contributing to both the establishment of better soil and water conservation functions and the production of timber and firewood. If a change of three-quarters of shifting cultivation sites to permanent farming sites is assumed, the fallow period can be extended to a maximum of 24 years.

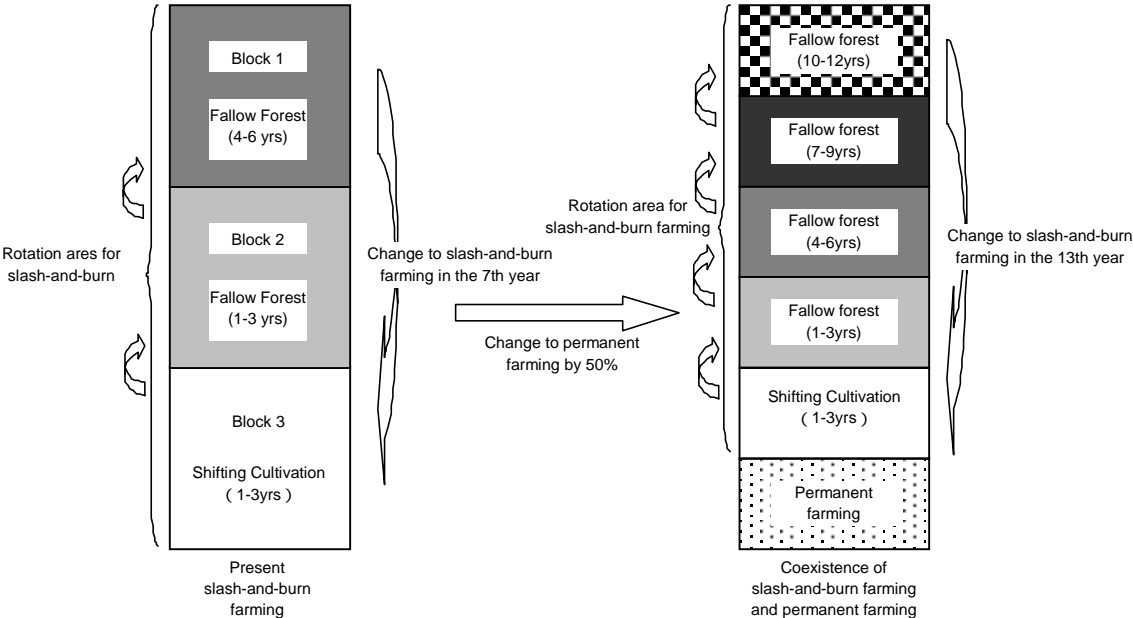


Fig. 1-3-1-1 Fallow Period Extension Model

(4) Assistance by the Administration

Many forests in the Study Area are owned by individual persons who will, therefore, mainly conduct forest management. While the relevant administrative procedure varies depending on the forest size, a forest owner must formulate a forest management plan for its approval by the INAFOR when intending to cut trees in a natural forest. In practice, only those with suitable financial capability can currently use this system and the following administrative assistance for the formulation of forest management plans by forest owners is deemed necessary so that landowners with weak financial capacity can use forests in an appropriate manner based on their forest management plans.

- Facilitation of the registration of land
- Simplification of the forest management plan approval procedure
- Technical assistance: forest inventory, forest management plan formulation and forest management activities

1.3.2 Reforestation Plan

(1) Planning Principles for Reforestation Plan

The reforestation plan aims at enhancing the soil and water conservation functions in the Study Area by means of enlarging the forest area through the creation of new forests and should reflect the characteristics of each of the Lake Managua drainage basin, the Pacific coast drainage basin and the Estero Real River drainage basin. The following two points are particularly important.

① Forest degradation due to farming is in progress in the upper reaches of the Lake Managua drainage basin and in the middle and upper reaches of the Estero Real River drainage basin. While active reforestation is highly desirable to enhance the soil and water conservation functions in these areas, efforts to achieve the coexistence with slash and burn farming and grazing are equally important.

② Gentle sloping land at the feet of the Maribios Mountain Range is close to consumption areas and reforestation using eucalyptus for firewood production is in progress. The planning focus for such sites will be increased reforestation efforts using eucalyptus and other fast growing species.

(2) Target Sites for Reforestation

The target sites for reforestation are described below for each of flat zones, gentle sloping zones and steep sloping zones.

1) Flat Zones

Many eucalyptus forests exist at the feet of the Maribios Mountain Range. Given the favourable prospects for increased reforestation, the planting of eucalyptus and others is planned centering on agropasture.

There are sites where new gullies have emerged along the banks of dry rivers. As such gullies may gradually expand, the early implementation of a preventive measure is required. Reforestation of the necessary scale should be conducted at these sites. This measure is described in more detail in 1.3.3 of Part II.

At other sites, the foot of the river bank has been eroded by running water, causing the collapse of the bank above for nearly 10 m at a sharp angle and leaving the sites treeless. Fixation of the foot using a civil engineering method and planting on the remaining top of the

bank are effective for bank protection. However, such civil engineering work is bound to be on a large scale and is incompatible with the character of the reforestation plan. The planning of such civil engineering work, therefore, is not considered here.

2) Gentle Sloping Zones

Eucalyptus has been planted in the suburbs of León to create firewood production forests which comprise a stable source of income for local farmers. Reforestation aimed at the production of firewood is planned at these sites. At gentle sloping zones other than the above sites, the coexistence of farming or grazing with soil conservation measures is required. Reforestation by means of introducing agroforestry or silvopastoral is planned to achieve such coexistence.

3) Steep Sloping Zones

Many steep sloping zones have natural forests, making natural forest management important. In some areas, slash and burn farming or grazing is taking place. Reforestation by means of introducing agroforestry or silvopastoral is planned in these areas as in the case of gentle sloping zones. In the case of agropasture where reforestation is deemed possible, active reforestation will be conducted in view of forest restoration.

(3) Planting Species

Common species for reforestation in the Study Area are listed below.

- Exotic species : casia amarillo, eucalyptus, leucaena, neem
- Local species : aripin, brazil blanco, caoba, cedro real, ceiba, genizaro, guanacaste negro, guanacaste blanco, madero negro, pochote, roble

The five species listed in Table 1-3-2-1 are most recommended for the reforestation plan as they are popular species for reforestation in the Study Area. These species can be used for such purposes related to daily life or farming as firewood, posts and live fencing. Moreover, the continuous forest management of these species is easy because they can be regenerated by natural seeding or sprouting.

Many of the above-mentioned species other than the five recommended species are promising planting species and the actual decision on the species to be planted will be made in line with requests by local residents and the prospective use of the planted trees.

Table 1-3-2-1 Candidate Species for Reforestation

Species	Academic Name	Main Use	Characteristics
Eucalyptus	<i>Eucalyptus camaldulensis</i>	Firewood, pulp, posts, live fencing, timber and windbreak forests, etc.	Capable of regeneration by sprouting
Leucaena	<i>Leucaena leucocephala</i>	Firewood, charcoal, posts, fodder, live fencing and windbreak forests, etc.	Capable of regeneration by sprouting; nitrogen fixation; direct seeding possible
Guanacaste negro	<i>Enterolobium cyclocarpum</i>	Building timber, furniture, plywood, shading and fodder	Capable of regeneration by natural seeding
Madero negro	<i>Gliricidia cepium</i>	Firewood, posts, live fencing, shading for crops and fodder, etc.	Capable of regeneration by sprouting; nitrogen fixation; direct planting of cuttings possible
Neem	<i>Azadirachta indica</i>	Firewood, timber and live fencing, etc.	Capable of regeneration by sprouting

(4) Reforestation

Reforestation by eucalyptus at the feet of the Maribios Mountain Range will presumably be decided based on the selection of farmers to either cultivate cassava or sesame or to plant eucalyptus. The scale of reforestation is likely to be 1 to several Mz. The standard planting distance will be 3 m x 3 m (planting density: 1,110 seedlings/ha or 800 seedlings/Mz) as this is the commonly used planting distance.

Although such local species as guanacaste negro, madero negro, Brazil blanco, caoba, cedro real, ceiba and genizaro are not widely used for reforestation, their planting distance appears to be approximately the same as that used for eucalyptus based on examples observed so far. Accordingly, a planting density of 1,110 seedlings/ha (800 seedlings/Mz) is adopted as the standard planting density.

(5) Nursing

As the transportation of seedlings over a long distance weakens their vigour, possibly causing their death, the nursing of seedlings by local residents themselves in the community is appropriate. If a nursery is located nearby, however, the use of seedlings procured from such a nursery will be considered. When the nursing of seedlings by local residents is opted for, certain conditions, including convenient access to water, prevention of the entry of domestic animals and fowl to the nursery and convenience for transportation of seedlings, must be considered in the selection of the nursery site.

A nursery may be operated jointly or by an individual person. A joint nursery is effective under the following circumstances.

- When it is possible to jointly conduct such work as watering and weeding because of the existence of a strong community spirit
- When the nursing skills of individuals are poor

Nurseries run by individual persons will be opted for if a joint working system cannot be established or if individuals possess a certain level of nursing skill.

Assuming the use of vinyl pots (of which the dimensions are 20 cm in length and 10 cm in width when folded flat) which are commonly used in the Study Area, the standard scale of a single nursery is approximately 15 m² per 1,000 pots, including the space for nursery beds and auxiliary working space, etc. The number of seedlings to be nursed should be some 20% more than the planned quantity for planting in view of the need for supplementary planting to replaced dead seedlings after original planting.

It is important to conduct hardening by means of gradually reducing the watering volume for the seedlings, commencing approximately two weeks before the planned planting date, so that the seedlings can develop strong resistance to drought. In this way, the resulting seedlings will acquire resistance to drought after planting and offer a high survival rate.

The common nursing calendar is shown below.

Nursing Calendar

Main Activities	December	January	February	March	April	May	June
Site Selection & Preparation	←→						
Soil Preparation		←→					
Filling Pots with Soil		←→					
Seeding		←→					
Watering		←→					
Weeding		←→					
Disease & Insect Control		←→					
Shipping						←→	

Note) The work for slow-growing species starts earlier than that for fast-growing species.

(6) Tending, Harvesting and Regeneration by Sprouting

All of the five species considered to be promising under the M/P are fast growing and their height exceeds that of weeds within a year after planting. Weeding should be conducted twice in the year of planting and should be determined in accordance with the state of competition between the planted trees and weeds as well as miscellaneous trees from the second year

onwards. Thinning is usually conducted to raise sawn timber trees but is not planned here because planting is intended to produce firewood.

While the prospect of tree growth differs depending on the species and site conditions, harvesting is generally believed to be possible in 5 – 10 years. On average, the first harvesting is assumed to take place in the 7th year after planting. The second harvesting is assumed to take place seven years after that as sprouts from the stumps will grow to become new stems for harvesting by that time. Many buds sprout from a stump and, if unattended, thin stems grow densely from the stump, making them unattractive for firewood use. Under the M/P aiming at the production of firewood, two new buds (three if the soil is fertile) will be left and all others will be removed. Regeneration by sprouting will take place twice and, after the third harvesting, new seedlings will be planted to start the process again.

The canopies of eucalyptus stands where regeneration by sprouting has taken place tend to close more quickly than those of newly planted stands. For this reason, the repetitive retention of young stands regenerated by sprouting is said to lack forest floor vegetation, possibly resulting in a decline of the land productivity. In order to avoid such a shortcoming, some of the trees will be left uncut at the time of the third cutting after planting and these trees will be tended for some 20 years with long rotation operation. With the adoption of this practice, fallen leaves and branches will deposit on the forest floor, assisting the recovery of the land productivity together with the invasion of undergrowth. This practice is, therefore, effective for sustainable forest management and must be taken into particular consideration for efforts to successfully develop reforestation sites.

1.3.3 Soil Conservation Plan

(1) Examination from Viewpoint of Watershed Management

1) Basic Principles

The soil conservation plan adopts the following basic principles from the viewpoint of watershed management described earlier.

- ① The rehabilitation of large-scale devastated torrent sites and large-scale landslide sites in mountainous areas is not featured in the present soil conservation plan as the necessary work should be conducted by the administration in view of its scale, cost and technologies involved.
- ② Given the fact that the activities under the plan should be implemented with the participation of local residents, the direct target sites for conservation are farmland, pasture, mountain land and dwelling land, most of which are privately owned. The final selection of the target conservation sites will be made based on the state of devastation and urgency to prevent sediment discharge and the type, location and structure, etc. of the soil conservation works will be planned for each site.
- ③ The type, location and construction method of the planned soil conservation works should be appropriate for the characteristics of each drainage basin and should be both effective and economical.

2) Characteristics of Drainage Basins Viewed from Soil Conservation Aspect

The characteristics, desirable direction for improvement and suitable soil conservation measures are outlined in Table 1-3-3-1.

One common characteristic of all of the drainage basins in question is the existence of many gullies at sloping parts of forests, farmland, pasture, dwelling land and roads because of the historical lack of genuine soil conservation measures. While these gullies can be primarily attributed to such natural factors as the topography, geology, torrential rain, drought, earthquakes and volcanic eruptions, their development has been significantly assisted by such artificial factors as the cutting of forests, cultivation or grazing at mountain land (particularly when accompanied by burning), forest fires and road construction.

The Study Area is characterised by adverse conditions for soil conservation as described below.

- ① Topography : much steep sloping land around volcanoes in the Maribios Mountain Range and in the northern mountainous areas of the León Department
- ② Geology : wide distribution of a sedimentation layer of volcanic product
- ③ Drought : frequent occurrence which worsens the conditions for the growth of vegetation
- ④ Torrential rain : constantly hit by hurricanes
- ⑤ Earthquakes : as Nicaragua is located at a point where the Cocos Plate on the Pacific side sinks under the crust along the eastern coast, the crust is very sensitive to movement of the Cocos Plate
- ⑥ Volcanoes : frequent eruptions due to the influence of the Cocos Plate as in the case of ⑤ above

Table 1-3-3-1 Characteristics of Drainage Basins

Drainage Basin	Characteristics	Soil Conservation Measures
Lake Managua Drainage Basin	There is mountain land with highly noticeable devastation.	These areas are considered to be primary areas for the implementation of soil conservation measures.
	Landslide sites are highly observed along trunk roads in mountainous areas.	These sites are not included in the scope of the soil conservation plan because of their large scale.
	The erosion of farmland and pasture is highly noticeable.	Small-scale transversal works will be constructed at small valleys. Proposals will be made in regard to the farmland development method and the planting method.
	<p>< Improvement Direction ></p> <p>① In this drainage basin, the erosion of farmland and pasture will be reduced in order to reduce the sediment inflow to the lake.</p> <p>② The soil erosion at roads and hamlets in mountainous areas in particular will be controlled to improve the environment.</p>	
Pacific Coast Drainage Basin	Large rivers emptying into the Pacific are characterised by much meandering, bank erosion and sedimentation.	River improvement and bank protection works should be implemented but are not included in the present plan because of their large scale.
	The riverbeds of small dry rivers crossing Trunk Route 12 are deposited with sand.	Because of the geological conditions, both banks rise vertically and there is little risk of collapse. As these dry rivers are currently used as passageways by local residents, the implementation of transversal works is not considered. The construction of a check dam and/or revetment works will be considered to prevent expansion of the lateral erosion of dry rivers and gullies.
	A large volume of debris has been deposited on the hillsides of Mt. Casita which collapsed at the time of Hurricane Mitch and in areas below them.	The valley head areas of collapsed sites and large rivers are not included in the present plan because of the large scale of the required work.
	Many landslide sites triggered by cattle trails are noticeable at pasture on bare sloping land.	Planting will be planned for bare sloping pasture while small transversal works will be planned for small valleys.
	Gullies are highly noticeable around pasture, farmland and hamlets.	Small transversal works will be constructed at gullies. Proposals will be made in regard to the farmland development method and the planting method.
	<p>< Improvement Direction ></p> <p>① The Pacific coast drainage basin has the highest population concentration among the three drainage basins. Active efforts will be made to control soil erosion in mountain foot areas and flat zones to assist the preservation of public facilities in the lower reaches.</p>	
	Estero Real River Drainage Basin	Landside sites can be observed everywhere in mountainous areas.
Landslide sites are observed along roads.		A series of gabion works will be placed at the mountain sides.
Eroded sites are observed at farmland and pasture.		Transversal works involving rock ridge and wicker works will be implemented. Proposals will be made in regard to the farmland development method and the planting method.
<p>< Improvement Direction ></p> <p>① Although the importance of this drainage basin in terms of public safety is not as great as that of the other two drainage basins, measures designed to prevent the progress of soil erosion will be implemented to protect the environment of hamlets in mountainous areas.</p>		

The artificial factors described below for which the local socioeconomic conditions form the background also exist.

- ① Slash and burn farming : slash and burn farming is widespread in mountainous areas, resulting in erosion of the top soil of farmland
- ② Forest fires : forests are lost due to burning for slash and burn farming and accidental fires
- ③ Cutting : trees are cut for domestic fuel and for fuel for brick-making and also for building timber; the worst is indiscriminate cutting to obtain firewood
- ④ Land clearance : even land at a high elevation and steep sloping land is used as dry farmland
- ⑤ Grazing : cattle trails resulting from grazing cause the collapse of steep sloping land
- ⑥ Roads : roads are constructed carelessly, ignoring the gradient and drainage, etc.

3) Soil Conservation Measures

The current situation of devastation can only be improved at present by methods which are regarded as symptomatic treatment as far as the natural factors are concerned. However, some artificial factors can be effectively dealt with by changing the work method, etc.

In view of the above, ① the introduction of agroforestry, ② facilities adopting an erosion control method, ③ rearing and protection of natural forests and ④ reforestation can be considered effective soil conservation measures. As ③ and ④ have already been described earlier, only ① and ② are described next.

(2) Concrete Soil Conservation Measures

1) Agroforestry

① Vegetative Measures

a. Purposes

Farming and grazing activities in the Study Area are characterised by customary burning at the end of the dry season and the soil fertility has declined due to human influences, including burning for slash and burn farming and grazing, particularly in mountainous areas. Soil erosion is in progress at treeless land due to such natural causes as strong wind during the dry season and downpours during the rainy season.

Agroforestry is one measure to solve the present problematic situation by combining trees with crops or grass at farmland for a long period of time in order to achieve soil conservation and the continued improvement of the productivity of farmland. In the case of pasture, its continued use and soil conservation will be attempted by the silvopastoral system.

b. Selection of planting species and farming crops

The planting species and farming crops for agroforestry will be selected based on their suitability for the natural conditions (rainfall, temperature, soil and elevation), economic conditions (demand, marketability and transportability) and other conditions (purpose of use, drought-resistance, shade-resistance and disease/insect-resistance) in the Study Area and also based on the need of participating local residents. Careful attention must be paid to the fact that suitability in terms of the natural conditions does not necessarily mean suitability in terms of the economic conditions.

Many places in the Study Area have been experiencing drought because of the declining rainfall in the last few years. Accordingly, the selection of tree species, crops and particular varieties which are highly resistant to drought is important. For households which lack a sufficient supply of firewood for their own consumption, eucalyptus and other fast growing species should be selected. In this context, consideration should be given to ensuring the equal distribution of labour and income throughout the year.

The main candidate planting species and farming crops for agroforestry are listed in Table 1-3-3-2.

Table 1-3-3-2 Main Planting Species and Farming Crops for Agroforestry

Multi-Purpose Species	Eucalyptus, madero negro, leucaena, neem, roble, genízaro, guásimo de ternero, guanacaste negro, acetuno, palm and marango
Fruit Trees	Mango, avocado, orange, lemon, banana, coffee, cashew nut, coconut, papaya, coco-plum, pitahaya, guava, red mombin, tamarind, marmalade plum, soursop, mamón, melocotón, achiote and pineapple
Crops	Maize, sorghum, trigo millón (a type of millet), up land rice, kidney-bean, peanut, cassava, sesame, sugar cane, soybean and gandúl bean
Vegetables	Pumpkin, tomato, cucumber, pipián (a type of melon), green pepper and garlic
Grass	Jaragua, taiwan, gamba, estrella, brquiaria and angleton
Medicinal Herbs	Lemon grass, oregano, mint and coriander

Note: The list includes the planting species and farming crops for the livelihood improvement plan.

c. Methods

(a) Live Fencing

The creation of live fencing whereby trees are planted in a line around farmland or pasture can prevent the soil erosion of such farmland or pasture and can also clearly indicate the land boundaries. At sloping land, trees are planted in two or three lines as this type of land is particularly vulnerable to soil erosion.

The standard planting distance will be 1 – 3 m. Eucalyptus, madero negro and leucaena, etc. are suitable species as these species can be used for timber, firewood, green manure and/or fodder. Cuttings of madero negro can be planted directly into the ground as they have excellent rooting ability.

(b) Contour Hedgerow

Contour hedgerow where trees or grass are planted along the contour lines will be applied at steep sloping farmland and pasture. This method can also be applied at collapsing sites or hazardous sites for collapse on the sloping farmland and pasture. It will also be used to reinforce the civil engineering methods described later.

The standard planting distance will be 1 – 2 m and the planting species will be selected as in the case of live fencing.

(c) Alley Cropping

Alley cropping involves the line planting of trees at a uniform distance to protect the crops to be cultivated between the lines, to prevent soil erosion and to maintain and improve the land productivity. This method is very effective for farmland with low soil fertility.

The standard planting distance will be 5 – 10 m between the lines and 1 – 3 m between the trees. If the death or poor growth of the planted seedlings is observed, supplementary planting should be conducted as soon as possible. The planted trees should be pruned at appropriate times to improve the light intensity under the crown.

The preferable planting species are those which have a deep root system and which are less competitive with crops in terms of their water and nutrient demand. From the viewpoint of maintaining the soil productivity, leguminous species are preferable. While fruit trees are preferable from the economic viewpoint, they tend to create a large shady area. Careful consideration should be given to their spatial distribution, such as planting at boundary areas to avoid the central areas of farming plots.

(d) Planting of Shade Trees

The planting of shade trees at a distance at pasture can create shady areas for animals to rest. At the same time, this type of planting aims at preventing the soil erosion of pasture and maintaining as well as improving the land productivity.

The standard planting distance will be 10 m x 10 m. Planting will be conducted at those sites where the distance between the existing trees exceeds this distance. Genízaro, madero negro, guásimo de ternero, leucaena and guanacaste negro, etc. are the preferred planting species as they can be used as shade trees for domestic animals, timber, firewood, green manure and/or fodder.

It will be necessary to protect the planted trees from being eaten by domestic animals for some time after planting by means of erecting a fence around them. It will also be necessary to prune shade trees at appropriate times to improve the light intensity under the crown in order to ensure good growth of the grass. The pruned branches and leaves can be used as animal fodder.

The introduction of improved grass at pasture will be discussed in 1.3.5.

② Civil Engineering Measures

a. Purposes

Earth ridges, rock ridges and terraces, etc. will be created at sloping farmland using a suitable civil engineering method to prevent soil loss by rainwater. In addition to their soil conservation effect, these structures are expected to have a water retention effect, making the sustainable use of farmland possible. The conservation of farmland by a civil engineering method is an effective means of changing slash and burn farming to permanent farming in mountainous areas.

Contour hedgerow will be combined to reinforce the effects of the civil engineering work.

b. Types of and application criteria for civil engineering methods

Earth ridges, trenches, rock ridges or terracing will be selected as a suitable civil engineering method depending on the soil characteristics and degree of inclination of the target farmland. The types of and application criteria for civil engineering methods are shown in Table 1-3-3-3.

Table 1-3-3-3 Types of and Application Criteria for Civil Engineering Methods

Type of Civil Engineering Method	Inclination of Farmland	Application Distance
Earth Ridge	2 – 15%	17 – 30 m
Earth Ridge; Trench; Rock Ridge	10 – 40%	6 – 20 m
Terrace	30 – 45%	4 – 10 m

Leguminous shrubs, fruit trees and improved grass, etc. are appropriate choices as these trees and grass can be used for contour hedgerow to reinforce the civil engineering method. Gandúl, which is a leguminous crop and which can be used as green manure, is particularly promising.

c. Methods

(a) Earth Ridges

At farmland with few stones and pebbles, earth ridges will be created along the contour lines. The size of these earth ridges will be approximately 0.5 – 0.8 m in height and 0.8 m in width. If the soil of farmland is dug to make an earth ridge at the upper part of a slope, a trench-like ditch is created at the foot of the earth ridge. This ditch is useful to replenish water for the farmland as it collects water for gradual permeation into the ground.

These earth ditches will be reinforced by contour hedgerow. The trees or grass planted for contour hedgerow will be pruned or cut at appropriate times. The pruned branches and cut grass will be used to mulch the crops. This mulching will reduce the water loss of the ground due to evaporation, enhancing the soil's water retention during the dry season and controlling the propagation of weeds during the rainy season. Moreover, mulching is also useful for the prevention of a ground temperature increase, the supply of humus and the prevention of soil loss at sloping land.

(b) Rock Ridges

At farmland with many stones and pebbles and with an inclination of 10 – 40%, rock ridges will be created along the contour lines to form stone wall-like structures. The size of these rock ridges will be approximately 0.5 – 0.8 m in height and 0.8 m in width and the base section will be excavated to create stable ridges.

Contour hedgerow will be created along the lower side of rock ridges to reinforce the latter. Further contour hedgerow will be created in the sedimentation area along the upper side of rock ridges.

(c) Terraces

At farmland with an inclination of 30 – 45%, bench terraces will be created along the contour lines by removing the soil at the upper part of the slope. Contour hedgerow will be conducted along the edges of terraces to reinforce the latter. At steep sloping land with many stones and pebbles, rock ridges may be constructed along the terrace edges using such stones and pebbles. Cutting and banking work should be conducted to create a slight slope from the bottom to the edge of each terrace to ensure good drainage. At places with high rainfall, a ditch should be dug along the bottom of each terrace and channel works should be introduced at a right angle to the terraces so that water flows down these works from lateral ditches.

There is concern in regard to a temporary decline of the crop yields following the creation of terraces due to the turning over of the soil by cutting and banking. However, the yield will subsequently increase because of the reduction of the amount of soil loss.

2) Erosion Control Facilities

a. Preconditions

There are several preconditions as listed below for the examination of erosion control facilities.

- ① The facilities should be those which can and will be constructed by local residents themselves.
- ② Locally available materials should be used where possible.
- ③ Efforts should be made to ensure soil conservation at such privately owned land as forests, farmland, pasture and dwelling sites.

b. Classification

Erosion control facilities conventionally constructed in Nicaragua can be classified in the following manner.

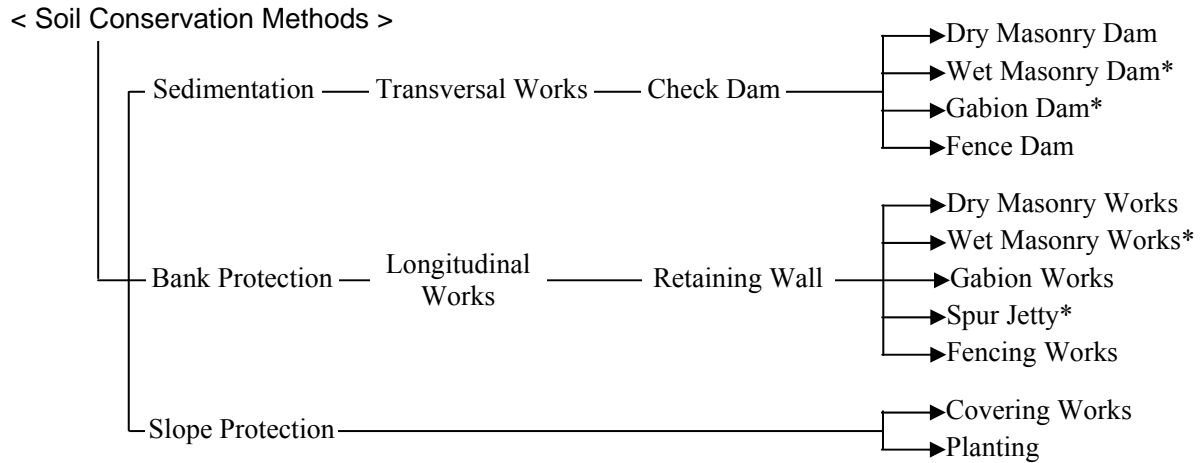


Fig. 1-3-3-1 Classification of Soil Conservation Works

Among the various types of soil conservation facilities which are observed in Nicaragua as shown in Fig. 1-3-3-1, those marked with an asterisk are not included in the present soil conservation plan because they are unsuitable for participatory work because of the reasons given below.

- Wet masonry dams : examples in Nicaragua indicate that wet masonry dams are constructed to secure the bridge piers of trunk roads and are not used as common check dams
- Gabion dams : gabion dams are not commonly used for small rivers because of the difficulty of construction management, including the need to make the gabion dimensions and river width compatible
- Wet masonry retaining walls : these are used to secure important road sections and are uncommon
- Spur jetty : one example of a wet masonry spur jetty is observed at Posoltega River. Although a spur jetty is effective to regulate a water course and to prevent the collapse of a river bank, it is not commonly used because of the tendency to destroy the opposite bank at a narrow river section

c. Explanation of Each Type of Works

(a) Check Dams

As a check dam is constructed across the stream bed, it is called a transversal works. It has several purposes as listed below.

- i. To reduce the stream bed gradient to achieve an equilibrium gradient, preventing longitudinal as well as transversal erosion
- ii. To check the free flow of sediment
- iii. To adjust the amount of sediment
- iv. To raise the stream bed to fix the footslope in order to prevent its collapse
- v. To control the watercourse at a turbulent flow section

Soil conservation can be achieved by the multiplication effect of the above functions.

A check dam must have a structure which is capable of withstanding such external forces as the water pressure and soil pressure.

An important component of a check dam is a flood channel which aims at guiding the flowing water in a specific direction and determining the site for the spill to fall. For these reasons, a flood channel must be introduced, however small check dam is.

A check dam can be either a dry masonry dam or a fence dam depending on the locally available materials, i.e. stones or wood.

① Dry Masonry Dam

Locally available stones of some 30 cm in diameter are piled up to create a dam. The approximate unit dimensions of such a dam should be 2 m in length, 1.0 m in height, 0.8 m in crown width (W1) and 1.2 m in bottom width (W2). Some 0.7 m long wings should be introduced at both ends of the crown to construct a flood channel of which the approximate dimensions are 0.7 m in length and 0.3 m in height. In addition, stones should be laid in the place where the water falls to prevent scouring of the downstream side of the dam.

② Fence Dam

Logs of approximately 0.09 m in diameter and 1.20 in length are piled into the stream bed and a fence is created using laterally placed logs or brush wood.

(b) Retaining Wall

A retaining wall is called a longitudinal works as it is constructed in parallel to the stream bed and it has several purposes as listed below.

- i. To prevent bank erosion
- ii. To prevent the collapse of a road, hillside or farmland
- iii. To stop collapsed sediment

Careful consideration is required for the construction of a retaining wall, including the placing of stones in order to prevent the incursion of flowing water behind the retaining wall.

A retaining wall can be by either dry masonry works or fencing works depending on the locally available materials, i.e. stones or wood.

A retaining wall using wire gabions is appropriate for a place where there is a risk that the wall will be destroyed due to ground movement, such as the uneven subsidence of the foundation ground or a landslide.

① Dry Masonry Works

Stones of some 30 cm in diameter are piled up to create a retaining wall to prevent the collapse of a river bank or the expansion of a gully. The construction of a flood channel is unnecessary unlike the case of a check dam.

② Gabion Works

Wire gabions are placed at the lower end of a landslide site. The standard practice is to pile up two gabions all the way to form the required retaining wall.

③ Fencing Works

Logs of approximately 0.09 m in diameter and 1.20 m in length are piled into the foot of a collapsing site and a fence is created using laterally placed logs or brush wood to prevent the expansion of the collapsing site. At collapsing sites on the banks of dry rivers, either dry masonry works or fencing works are constructed at the base and the soil is banked and compacted at the back of such works to construct further fencing works in steps above the original dry masonry works or fencing works.

(c) Slope Protection

There are many types of works which are used for slope protection. In Nicaragua, covering works are a typical example of slope protection works.

① Covering Works

Covering works means the covering of wet and sloping bare river banks with the stems and leaves of grass. And limbs and tops capable of rooting are used as fixed holding wood to stimulate the greening of these river banks.

② Planting

As planting is an effective way of protecting slopes, eucalyptus, leucaena and/or madero negro, etc. can be planted on compacted collapsing slopes as described in (b)-③ above to reinforce the slopes.

1.3.4 Forest Protection Plan

Forest fires and insect damage are serious problems in the Study Area from the viewpoint of forest protection. As it is difficult for the INAFOR or each municipality alone to protect forests from the damage caused by these problems, the cooperation of local residents who are in a position to constantly observe the state of forests is essential. The spontaneous cooperation of local residents for forest protection activities is important in view of the fact that local residents who greatly benefit from forests in terms of water supply and firewood, etc. should be responsible for the protection and management of forests. Accordingly, desirable forest protection activities are described here based on the assumption that local residents participate in such activities.

A better understanding of the forest functions and benefits on the part of local residents is also essential to successfully achieve sustainable forest management, making the provision of environmental education for local residents necessary.

(1) Forest Fires

Forest fires frequently occur during the dry season and are particularly concentrated in April and May at the end of the dry season. The main causes of forest fires are said to be the spread of burning for slash and burn farming, the use of fire to catch iguanas or for honey collection and the careless disposal of cigarettes.

1) Prevention of Forest Fires

a. Community rules for burning cultivation

One effective way to improve awareness of the need for forest fire prevention is the establishment of rules for burning cultivation in each community. These rules must be thoroughly understood by local residents. The spread of these rules to neighbouring communities is also necessary to prevent the occurrence of forest fires in a wider area.

These rules must clearly state the matters to be decided, including notification of intended burning cultivation to the owners of nearby land and the burning method, etc. The municipal authority and the INAFOR should provide guidance on the initial examination of the desirable rules, the procedure to finalise the rules and working with neighbouring communities to adopt the same or similar rules.

b. Thorough enforcement of caution for burning cultivation

Slash and burn farming is not prohibited in Nicaragua although burning for this purpose requires the permission of the INAFOR. However, there are several points which must be observed at burning sites. The following points are extracted from the INAFOR's guidebook on burning and these must be strictly observed.

- Downward burning from the upper part of a slope
- Creation of a firebreak (5 m wide at the top and 2 m wide at the sides and bottom)
- Burning during morning or evening hours when the air is cool
- Ignition at the leeward side
- Deployment of people around the planned burning site

c. Self-control of use of fire for hunting

While the catching of iguanas and the collection of honey are important sources of cash income and nutrition for local residents, the careless handling of fire risks massive damage. It is important for local residents to be fully aware of the need for forest fire prevention and to adopt the necessary measures, including self-control of the use of fire for the purpose of catching iguanas or collecting honey, during the period of at least from November to May when forest fires easily occur.

d. Extension and educational activities

Elimination of the causes is the most important point for forest fire prevention. However, fire which can cause a forest fire is everywhere and it is ultimately necessary to rely on the awareness of local residents of the need "to use fire safely" as they are the people actually using fire. Such awareness of local residents can be developed by them firstly being made aware of the advantages of forests in terms of water supply and firewood and the disadvantages of forest fires for the daily lives. Local residents should then recognise that the stability of their lives cannot be achieved unless they protect forests. The effective protection of forests demands the establishment of a consensus among local residents on the basic requirements to prevent the occurrence of forest fires, including "the minimum use of fire", "the safe use of fire" and "the proper extinguishing of fire". Further consensus on cooperation for fire-fighting activities is important to protect the vital basis for daily life when a forest fire occurs.

Educational activities are essential to facilitate the establishment of such consensus among local residents. Educational activities which only rely on letters and pictures are insufficient and activities which are designed to make local residents think and improve their awareness

are necessary. The provision of time for local residents to think about what is required is necessary at meetings to which local residents are invited and at which various problems are analysed. The spontaneous development of the awareness of local residents regarding the necessary cautions for the use of fire, including how to conduct burning for slash and burn farming, self-control of the use of fire for hunting and the careless disposal of cigarettes, during the process of establishing the said consensus is desirable. The provision of education on forest fire prevention for primary school pupils as part of environmental education and forest fire prevention campaigns are also effective to improve awareness of the need for forest fire prevention among local residents.

Once the consensus mentioned above are established, activities to maintain awareness should take centre stage. The importance of this awareness should be repeatedly emphasised by the distribution and/or posting of posters and pamphlets. These activities are especially important during the season of frequent forest fires. Simulated fire-fighting exercises are considered to be an effective way of raising awareness as described in 2) next.

2) Fire-Fighting Activities

a. Formation of fire brigades

- A fire brigade should be formed in each community.
- The command system for fire-fighting at the community level should be clearly established and the members should be given specific primary roles, such as command and communication, etc.
- The communication system after the detection of a fire should be clearly indicated to ensure the swift commencement of fire-fighting activities.

b. Activities of fire brigades

Even though prevention is the primary issue to deal with forest fires, fire-fighting activities after the outbreak of a fire are important to minimise the damage. For this reason, a system centering on fire brigades should be established to ensure the early detection of forest fires and effective fire-fighting activities.

- Various activities designed to prevent forest fires as described in 1) above should be conducted.
- The tools and equipment to be used for fire-fighting should be determined in advance and their locations should be clearly understood.

- Fire-fighting activities should be given the highest priority for fire brigades when a forest fire breaks out.
- Participatory fire-fighting simulation exercises should be conducted under the guidance of the INAFOR and municipal authority. Particularly important for local residents are to learn how to understand the state of a forest fire, fire-fighting methods and strategies.
- When a forest fire has been extinguished, a meeting should always be held to review the fire-fighting activities to learn lessons to be used for future reference.

(2) Insect Damage

The most damaging insects for trees in the Study Area are pine beetles (*Dendroctonus* sp.) in pine forests. Pine beetles are likely to damage unhealthy forests at former fire sites, sites with a low soil productivity and sites with over-crowding trees. Damaged trees suffer from the destruction of cambium and eventually die. If unattended, the damage rapidly spreads in concentric circles.

If damage by pine beetles is found, damaged trees should be cut and burned to contain the spread of the damage. In general, the most effective measure to contain damage by pine beetles is the disposal of the damaged trees at an early stage of the damage and, therefore, the routine forest patrols should be conducted to discover damage as early as possible. Another method to deal with pine beetles is the spraying of an insecticide. However, this method is not considered for the present forest protection plan because of its high cost.

(3) Environmental Education

Environmental education will be provided for the purpose of enhancing knowledge of the following matters concerning the relationship between forests and the living environment.

- The inadequate forest management so far and the present situation resulting from such inadequate forest management
- The adverse impacts of forest fires and burning of farmland
- The positive effects of forests and trees for local life

As these matters are related to all local residents regardless of sex or age, educational activities on the environment will be widely held for entire communities. The relevant educational activities are listed in the table below.

Primary Category	Concrete Activities
Inclusion of environmental education in primary education	<ul style="list-style-type: none"> • Practical forest reconnaissance exercises (observation of the state of forest destruction and state of soil erosion in progress, etc.) • Practical exercises to identify the tree species growing in the community area • Creation of a nursery, production of seedling, planting and tending trees on primary school premises • Planting and tending at communal sites (roadsides and churchyards, etc.) • Purchase and reading of textbooks • Preparation and posting of posters on the environment • Establishment of children's environmental brigades and the implementation of various activities
Implementation of forest fire prevention campaigns	<ul style="list-style-type: none"> • Extension of the community rules for burning • Introduction of forest conservation activities • Preparation and posting of posters and banners • Invitation to neighbouring communities • Performance of short plays featuring forest fires and nature protection
Inclusion of environmental education in religious education	<ul style="list-style-type: none"> • Talks about forests and the environment during mass
Tree Day events	<ul style="list-style-type: none"> • Reporting on forest activities implemented • Lectures on environmental conservation • Queen of Ecology contest
General environmental education by the INAFOR and the MARENA	<ul style="list-style-type: none"> • Hosting of lecture meetings (using the forest fire prevention programme or environmental education programme)

While the inclusion of environmental education in primary education is judged to be an effective measure because of the expected strong reverberations among the local communities, its success is largely dependent on the degree of interest in the relevant activities on the part of primary school teachers who will be the key persons. The INAFOR should, therefore, work on the MECD to provide indirect assistance, including appropriate guidance for teachers, to promote educational activities on the environment at primary schools.

1.3.5 Livelihood Improvement Plan

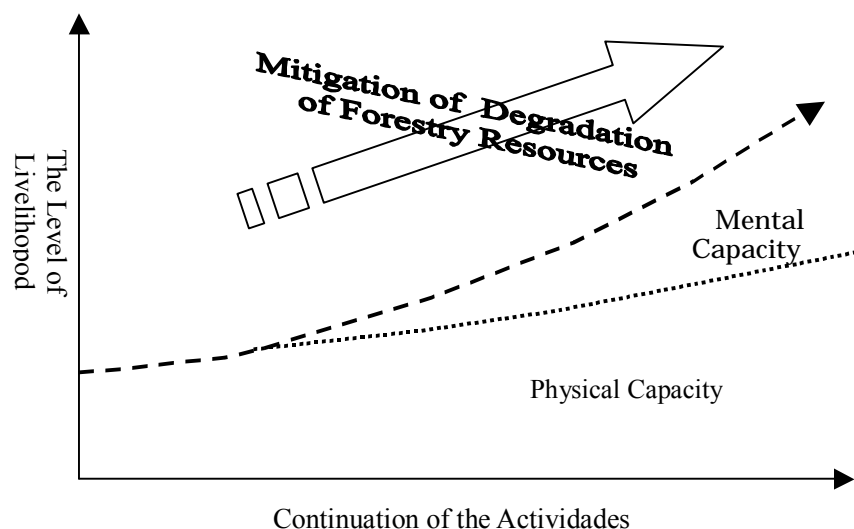
(1) Background

Poverty in the Study Area has led to excessive pressure on forests in terms of the planless sale of firewood and the disorderly setting of fires in fields for land preparation, etc. Furthermore, poverty has created a difficult situation where people do not have the physical and mental capacity to seek the long-term advantages of the sustainable use of forest resources.

(2) Basic Concept

Considering the above situation, the basic concept of the Livelihood Improvement Plan is as follows:

- The plan aims at facilitating a better living environment for the people to carry out continuous forestry-related activities while strengthening the “physical capacity” and “mental capacity” through a series of activities.
- The contents of the plan focus on those activities which can contribute to mitigating forest degradation.
- The approach of the assistance is not one of providing materialistic incentives to participate in the activities but one of strengthening the capacity for sustainable livelihood improvement.
- Considering the gender balance, the participation of women in a series of activities will be promoted, especially in the decision-making process.



(3) Major Components and Objective

The activities, scale of activities and motivation for people to participate will vary depending on the needs of the people, land conditions and economic conditions, etc. As the objective of the plan is to improve the motivation of the participants by means of improving their living environment, the plan components listed below will be combined in a flexible manner.

1) Home Garden: Home gardens aim at the planting of trees around homes, improving the self-supply of food, reducing expenses and increasing income. At the same time, this home-based activity creates a condition for women to easily participate in a productive activity.

2) Improved Stoves: Improved stoves contribute to the saving of firewood. The improvement of kitchens can improve the working environment for women and create surplus time for women to participate in forestry-related activities.

3) Small-Scale Water Supply System: This water supply system will enable the supply of clean water, the introduction of home gardens and the nursing of seedlings in such gardens.

4) Improvement of Crop Production: (a) gravity-type simple watering system, (b) diversification of crops and (c) coffee production can lead to the expansion of agricultural production. The agroforestry system is one important means of improving crop production. Further details are given in the section on the Soil Conservation Plan.

5) Profitable Sales Method: Profitable sales methods are examined for products from the activities proposed in the M/P in order to increase income.

(4) Concrete Measures

1) Home Garden

A home garden will be prepared near each farming household and will include vegetables (such as tomatoes, ayote (a kind of gourd), pipián (the king of gourds) and green peppers), fruit trees (citrus, mango and avocado, etc.), trees and herbs, etc. The use of graft fruit trees will ensure an earlier harvest and better quality. In order that something can be harvested throughout the year, various species will be planted considering the possible harvest period of each crop, fruit, tree and herb.

According to the results of the P/S, income of around C\$ 100 – 1,000 is earned beyond self-consumption in one season from 1/4 Mz of land where papaya, tomatoes, chiltoma and

pipián are planted. The size of the garden will vary depending on the land holding size and available manpower. However, judging from the work load of other activities, 1/4 – 1/2 Mz will be a suitable size to start with.

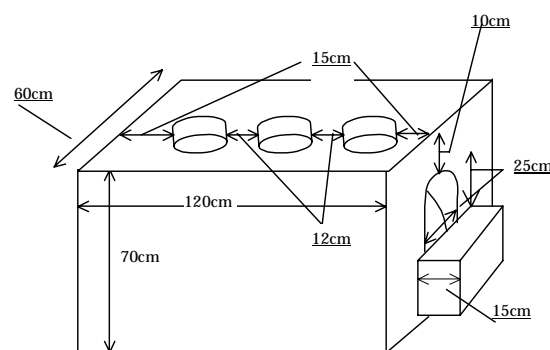
In order to minimize the production inputs, production techniques and the method of use of organic pesticides and compost will be transferred. Fencing of the garden using barbed wire or live fencing with small trees will also be important.

2) Improved Stoves

The collection of firewood is not regarded as a heavy chore in the Study Area as the results of the survey show that more than 60% of households are able to collect firewood within 1 km and 20% between 1 km and 2 km.

However, it appears common not to put the fire out after cooking as people think that it is troublesome to do so. As changing this custom could contribute to reducing the firewood consumption, people should be encouraged to discuss the advantages of reducing firewood consumption. In addition, information of improved stoves should be provided as method to reduce firewood consumption. It is expected that women could participate more easily in this activity than other activities.

There are many communities which already have introduced this type of cooking stove of which the materials vary from brick and cement to metal. The present plan proposes the use of simple materials so that local residents can easily build and repair the improved stoves. The materials will be clay, water and flat stones (or bricks) only and the basic model is shown below. The size may be changed depending on the size of the kitchen.



It has been confirmed that the cooking time is reduced by 1/2 - 1/3 using this type of stove apart from the effect of reducing firewood consumption. It is expected that the time created by reducing the cooking time could be utilized to participate in other activities, such as home gardens and other forest management activities.

3) Small-Scale Water Supply System :

Around one-third of the targeted communities have a small-scale water supply system with the assistance of an external agency but others entirely rely on wells or rivers as the principle water source. As NGOs promote the introduction of wells in many communities, it could be said that access to the minimum amount of water is increasingly secured these days. However, the situation is insufficient for the introduction of a home garden or nursery in many cases. The promotion of communal nurseries faces the same problem and external assistance will be essential to build a water tank, communal well or small-scale water supply system.

As the creation of a water supply system can assure the supply of clean water for drinking, there is a great incentive for people to participate in the construction of such facilities. Meanwhile, the operation and maintenance (O & M) of such facilities may be difficult due to the fact that (1) houses are scattered in communities in the Study Area and (2) individualism. Due to these problems, efforts to develop a small-scale water supply system in Apastepe were unsuccessful during the P/S period.

In consideration of this situation, the introduction of a water supply system after starting other forestry-related activities is recommended rather than at the beginning or prior to the commencement of such activities. In short, the introduction of a water supply system should be conducted after confirming people's capacity for the O & M of the facility to be built.

4) Improvement of Crop Production:

a. Gravity-type simple watering system

In the Study Area, cultivation during the dry season is uncommon because of the predominance of rain-fed agriculture. In order to improve the land use for cultivation and to enhance the possibility of cultivation during the dry season, a gravity-type simple watering system will be effective, using small pipes or hoses which convey water from a spring to sprinklers on the farmland.

This system may be effective not only for the improvement of crop production but also for the reduction of slash and burn farming, possibly directly contributing to prolonging the fallow period to achieve soil and water conservation.

The introduction of an irrigation system which covers several farms or a wide area is impractical in view of the fact that the land consists of scattered and small-scale private land on slopes. Accordingly, the system proposed here should be constructed using such low cost

materials as polyvinylchloride pipes and a manual pump which can be easily obtained and repaired by local farmers.

b. Crop diversification

The cultivation of maize, sorghum, millet and kidney beans by slash and burn farming is common in hilly areas. In flat areas, sesame, sugarcane and peanuts are also cultivated. Particularly in areas with convenient access to urban areas or market, the cultivation of vegetables and fruit which are sold by individual growers is also common.

As these crops are mainly for self-consumption, farmers tend to avoid high inputs to reduce the risk posed by a possible poor harvest. However, single crop cultivation and the cultivation of few crops are vulnerable to natural disasters, insects and the decline of crop prices, limiting the potential for further income generation.

Considering this situation, the plan proposes the introduction of such cash crops as peanuts, sesame and vegetables, etc. as a practice for crop diversification for income generation as well as avoidance of the risks posed by single crop cultivation. The cropping calendar for the main crops is shown below.

Cropping Calendar

Month \ Crops	Jan.	Feb.	Mar.	Apr.	May.	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
Maize					First season			Second season				
Sorghum												
Millet												
Kidney bean												
Sesame												
Peanut												
Cassava												
Vegetable												

Attention should be paid to how to combine the crops, taking the season, climate, land conditions, market potential and seasonal labour shortage, etc. into consideration. Problems caused by repeated cultivation should be avoided by means of the alternate cropping of cereals and pulses together with mitigation of the damage caused by harmful insects through mixed cropping.

Rainfall in the Study Area significantly fluctuates from one month to another and droughts have often caused serious damage, particularly from 1999 to 2002. As droughts can easily occur due to the El Niño phenomenon, the selection of drought-resistant species or those with a short cultivation period (refer to the section on agroforestry) is essential. Sorghum, millet and cassava are not recommended for soil conservation purposes despite their strong resistance to dry weather as they reduce the soil fertility by quickly absorbing the nutrients in the soil.

c. Coffee production

Coffee is produced in Achuapa and Sauce which are located at a relatively high altitude (more than 500m). Coffee production not only generates cash income but also protects and enriches natural forests as it requires the shade of trees. The introduction of coffee production is, therefore, recommended in areas with suitable conditions.

Coffee cooperatives are already established in Achuapa and Sauce and joint shipment has become the norm. The use of these existing cooperatives for marketing is, therefore, recommended rather than the establishment of new organizations.

5) Examination of Profitable Sales Method

The P/S confirmed that more than 90% of the participants in reforestation work expect to enjoy economic benefits from such work. Judging from this result, the high marketability of forest products can not only contribute to livelihood improvement but can also constitute the greatest incentive for local people to participate in activities designed to promote stable farming and forest as well as environmental improvement and conservation. For this reason, information gathering on possible marketing outlets and clarification of the target marketing volumes will be actively sought from the planning stages of timber and firewood production through reforestation and agroforestry and of home gardens, all of which will be promoted by the M/P, to determine low risk livelihood improvement measures.

In practice, the best marketing methods will be examined through (i) study meetings on the available markets and marketing potential of various products and (ii) study tours to advanced communities and existing markets to learn the current situation, problems and potential of marketing, taking the available human resources and their capacity into consideration. These activities will be conducted as part of the technical guidance and will be facilitated by the technicians. It is hoped that these activities will not only identify the best marketing methods but will also lead to clarification of the goals of activities, continual motivation on the part of participants and sustained income generation to improve the livelihood of the participants.

This search for the best marketing methods should start with the examination and implementation of small-scale but reliable marketing methods instead of examining the possibility of joint shipping to urban markets from the onset of activities. At the same time, study meetings should be continually held to find better marketing methods.

Forest products require a long period of time for harvesting even though the actual time depends on the species and place of growth. The required time will be at least 3 – 5 years for firewood and 8 – 20 years for timber. It is a common practice in the Study Area for individual growers (or collectors) to market firewood in urban areas. In the case of timber, the predominant practice is illegal purchase from loggers because of the lack of proper distribution channels.

Under these circumstances, it will be appropriate to continually hold study meetings during the growing period of the planted trees on the planned utilization of firewood and timber other than for self-consumption and also on the concrete marketing methods of these products to develop awareness of avoiding disorderly cutting and marketing routes offering appropriate prices for producers. In the case of timber, joint marketing by all participants should not be forced as timber can be a personal asset which can be utilized for emergency purposes.

1.3.6 Disaster Prevention Reforestation Site Maps

For the preparation of disaster prevention reforestation site maps, the Study Area was macroscopically classified in terms of the land inclination into three types of zones based on the basic principle for the formulation of the M/P. These zones are flat zones (inclination of less than 5%), gentle sloping zones (inclination of 5% or more but less than 15%) and steep sloping zones (inclination of 15% or more). Areas which are difficult to classify as gentle sloping zones or steep sloping zones because of the mixed existence of these zones are classified as mixed sloping zones (inclination of 5% or more) in a blanket manner.

As indicated in Appendix 4 – Area by Land Use and Forest Type, the classification results based on the land inclination show the characteristics of each area. In the case of the Maribios Mountain Range area, including the municipalities of Chinandega and Chichigalpa, flat zones, gentle sloping zones and steep sloping zones are situated in accordance with the rising elevation of the land. Meanwhile, in the case of areas belonging to the municipalities of Achuapa and Santa Rosa del Peñón, the entire municipal areas consist of mixed sloping zones, illustrating the fact that mixed sloping zones are prominent in the upper reaches of Estero Real River and Viejo River.

Because of the difficulty of selecting concrete sites for the implementation of various plans under the M/P, the target area for M/P implementation was calculated for each inclination zone as shown in Table 1-2-2-1 of Part II. The target area by municipality is shown in Appendix 5.1.

The disaster prevention reforestation site maps indicate hazardous areas for collapse, i.e. areas with a high risk of devastation because of the presence of many collapsing sites, in addition to the inclination zones. Moreover, as the preservation of excellent natural forests in some areas other than reserves is desirable, the maps indicate priority forest conservation areas, including those areas consisting of excellent natural forests other than reserves. These disaster prevention reforestation site maps (total of 35 sheets with a scale of 1:50,000) were prepared as independent maps and submitted to the INAFOR in January, 2002. Their coverage of the Study Area is shown on the next page.

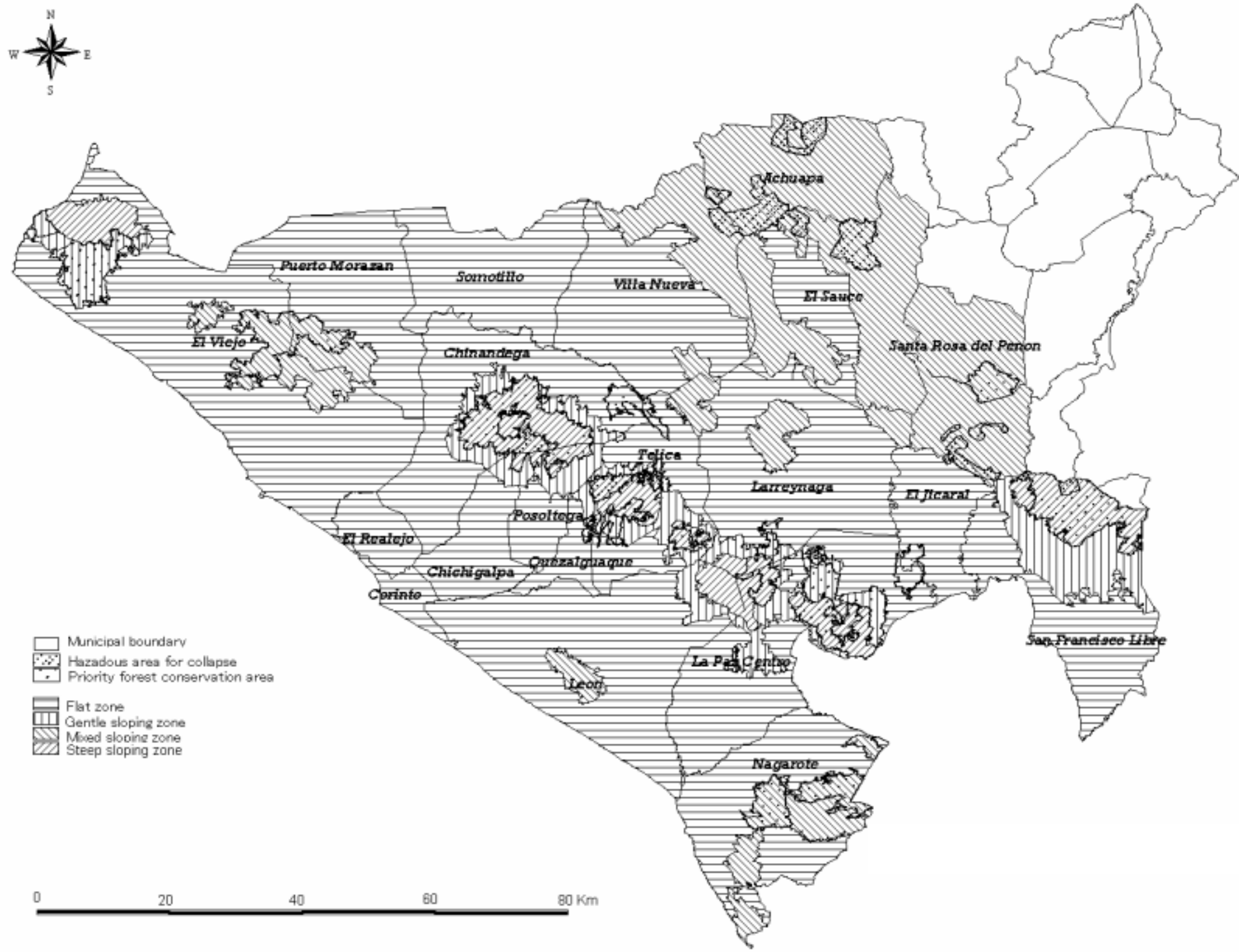


Fig. 1-3-6-1 Disaster Prevention Reforestation Site Map

1.4 Planning by Municipality (Project Volumes and Project Costs, etc.)

The items of the M/P which are common to the entire Study Area are described in 1.3 of Part II and the plan contents for each municipality are described from the next page onwards. While the target project volumes for the entire Study Area are shown in Table 1-2-2-1, the total project cost by type of project is listed in Table 1-4-1 below. For further details, refer to Appendices 5.3-(1) and 5.3-(2).

Table 1-4-1 Project Costs

		(Unit: US\$)
Plan (Project)		Project Cost
Natural Forest Management		1,133,000
	Forest Inventory and Preparation of Forest Management Plan	110,000
	Enrichment	231,000
	Creation of Firebreaks	792,000
Planting		7,132,500
Soil Conservation		4,831,300
	Agroforestry	4,376,200
	Farmland	2,616,350
	Change to Permanent Cultivation	537,350
	Pasture	1,222,500
	Erosion Control Facilities	455,100
Livelihood Improvement Measures		2,298,400
	Home Gardens	63,000
	Improved Stoves	295,400
	Gravity Type Simple Watering	178,330
	Product Diversification	942,940
	Manure Making	451,370
	Introduction of Improved Grass Varieties	367,350
Total		15,395,200
Material and Equipment Cost in the Above Total		944,600

Forest Management Plan for Disaster Prevention																							
Department: CHINANDEGA						Municipality: CHINANDEGA																	
Drainage Basin: Estero Real River				Location in Basin: Middle or Lower Reaches				Topography: Flat															
Annual Rainfall: 1,791mm						Mean Annual Temperature: 27.0																	
Distribution of Land Use and Forest Type	Type	Natural Forest				Man-Made	Grazing forest	Agropas ture	Water Body	Others	Total												
		Conifer-ous	Broad-Leaved	Mixed	Mangrove																		
	(ha)	0	13,331	0	2,144	1,368	1,641	34,408	899	12,583	66,374												
	(%)	0.0	12.8	0.0	9.1	0.1	2.1	52.1	5.5	18.3	100.0												
Land Ownership	Category		<20Mz		20 - 100 Mz		100 - 500 Mz		500 Mz<		Total												
	Ratio of Households (%)		75.1		16.1		7.6		1.2		100.0												
	Average Area (ha)		5.8		5.1		236.4		1,086.7		43.7												
Main Agricultural Products	Product		Maize		Kidney Beans		Sorghum		Rice		Sesame	Others											
	Cultivation Area (Mz)		7,393		843		1,178		3,812														
Population (2000): 137,833				Population Density: 208/km ²				Annual Rate of Increase (1990 – 2000): 3.9%															
Municipal Environment Office: Yes, 3 staff members						Municipal Environment Committee: Yes																	
Municipal Environment Plan (Natural Environment)																							
Consolidation of environmental education			<ul style="list-style-type: none"> ■ Implementation of an environmental education programme ■ Strengthening of the local organization for environmental control ■ Development of a model area and model actions for environmental activities ■ Implementation of field trips by young people and teachers to reserves ■ Implementation of municipal discussion meetings on the environment ■ Introduction of an Environment Day 																				
Low level of interest in the environment and natural resources among local residents			<ul style="list-style-type: none"> ■ Promotion of resident participation in environmental and natural resources protection ■ Strengthening of the local organization for environmental control ■ Dissemination of environment-related laws and regulations ■ Promotion of environmental activities involving all family members 																				
Extinction of wild animals			<ul style="list-style-type: none"> ■ Observation of the relevant laws ■ Hunting permit system run by a local organization with the guidance of the MARENA ■ Development of hunting control facilities ■ Establishment of shelters for wild animals ■ Organization, education and training of producers to breed wild animals 																				
Development of living infrastructure in reserves			<ul style="list-style-type: none"> ■ Request to people living in reserves to move out ■ Strengthening of the management of reserves together with landowners ■ Planning and implementation of an eco-tour project in reserves ■ Formulation of a reserve management plan ■ Promotion of appropriate joint reserve management with landowners ■ Education and extension of knowledge on reserves 																				
Soil erosion			<ul style="list-style-type: none"> ■ Implementation of reforestation and soil conservation programmes ■ Education and training of producers on appropriate production techniques ■ Introduction of agroforestry and silvopastoral systems ■ Construction of soil conservation works ■ Implementation of a dry river rehabilitation programme ■ Introduction of green manure crops to improve the soil fertility 																				
Excessive cutting of broad-leaved forests in arid areas			<ul style="list-style-type: none"> ■ Observation of the relevant laws ■ Promotion of reforestation using local species ■ Restriction of commercial cutting ■ Creation of firewood forests ■ Wide use of improved stoves 																				
Zoning																							
											N												
<p style="text-align: center;">Legend</p> <table border="1" style="margin-left: auto; margin-right: auto;"> <tr><td></td><td>Flat Zone</td></tr> <tr><td></td><td>Gentle Sloping Zone</td></tr> <tr><td></td><td>Mixed Sloping Zone</td></tr> <tr><td></td><td>Steep Sloping Zone</td></tr> <tr><td></td><td>Priority Forest Conservation Area</td></tr> <tr><td></td><td>Hazardous Area for Collapse</td></tr> </table>													Flat Zone		Gentle Sloping Zone		Mixed Sloping Zone		Steep Sloping Zone		Priority Forest Conservation Area		Hazardous Area for Collapse
	Flat Zone																						
	Gentle Sloping Zone																						
	Mixed Sloping Zone																						
	Steep Sloping Zone																						
	Priority Forest Conservation Area																						
	Hazardous Area for Collapse																						

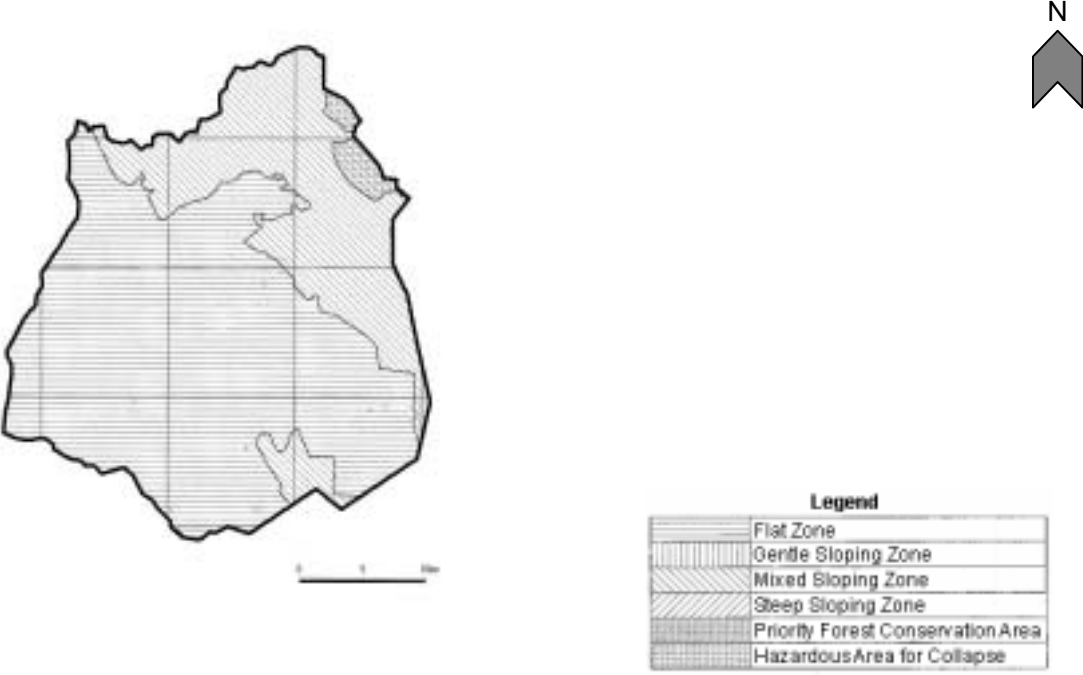
Note : The areas for land use and forest type distribution are estimated based on the land use and forest type map and the totals slightly differ from the official figures.

Project Components				
Natural Forest Management Plan	Plan Contents	<ul style="list-style-type: none"> Main target sites: hillsides and foot of Mt. San Cristóbal Forest inventory/formulation of a forest management plan Enrichment: 200 trees/ha Introduction of firebreaks 		
	Quantities and Costs	<ul style="list-style-type: none"> Forest inventory/formulation of a forest management plan: 450 ha; US\$ 4,500 Enrichment: 450 ha; 90,000 seedlings; US\$ 9,450 Introduction of firebreaks: 450 ha; US\$ 32,400 	Sub-Total Cost US\$ 46,400	
Reforestation Plan	Plan Contents	<ul style="list-style-type: none"> Main target sites: agropasture area around Mt. San Cristóbal Main planting species: Steep sloping zone: Leucaena, Madero Negro Gentle sloping zone: Eucalyptus Number of seedlings to be planted: 1,110 seedlings/ha 		
	Quantities and Costs	<ul style="list-style-type: none"> Planting area: 120 ha Required number of seedlings: 160,000 	Sub-Total Cost US\$ 111,200	
Soil Conservation Plan	Agroforestry	Plan Contents	<ul style="list-style-type: none"> Farmland Gentle sloping zone: live fencing; earth ridges Steep sloping zone: contour hedgerows; rock ridges Change to permanent farming Pasture: planting of shade trees; live fencing 	
		Quantities and Costs	<ul style="list-style-type: none"> Farmland: 540 ha; 169,000 seedlings; US\$ 111,730 Change to permanent farming: 125 ha; US\$ 24,430 Pasture: 60 ha; 10,000 seedlings; US\$ 4,890 	Sub-Total Cost US\$ 141,100
	Erosion Control Work	Plan Contents	<ul style="list-style-type: none"> Check dams: dry masonry dams; fence dams Retaining walls; dry masonry works; fencing works Slope protection: covering works 	
		Quantities and Costs	<ul style="list-style-type: none"> Dry masonry dams: 585; US\$ 10,420 Fence dams: 234; US\$ 3,460 Dry masonry works: 468; US\$ 5,530 Fencing works: 234; US\$ 3,460 Covering works: 117 sites; US\$ 1,730 	Sub-Total Cost US\$ 24,600
Livelihood Improvement Plan	Plan Contents	<ul style="list-style-type: none"> Improvement of living: home garden and improved stoves Improvement of production techniques: introduction of the gravity-type simple watering system, diversification of crops and production of compost Improvement of grazing techniques: introduction of improved grass 		
	Quantities and Costs	<ul style="list-style-type: none"> Home gardens: 12 ha; 1,200 seedlings; US\$ 4,320 Improved stoves: 120; US\$ 20,260 Installation of gravity type simple watering systems: 60 ha; US\$ 7,790 Diversification of crops: 110 ha; US\$ 44,900 Production of compost: 110 sites; US\$ 21,490 Introduction of improved grass: 6 ha; US\$ 1,470 	Sub-Total Cost US\$ 100,200	
Implementation System Development Plan	Plan Contents	<p>(Municipal Forest and Environment Section)</p> <ul style="list-style-type: none"> Increase of staff and their education/training Coordination with the Municipal Development Plan Technical support for communities Education of local residents on forests and the environment Guidance on the operation and management of community organizations Training of promoters <p>(Municipal Environment Committee)</p> <ul style="list-style-type: none"> Reorganization and consolidation of the municipal environment committee (reorganization of the participating organizations and definition of their respective roles) Guidance for the municipal forest and environment section) Strengthening of the coordination and exchange of opinions with related organizations and NGOs <p>(INAFOR)</p> <ul style="list-style-type: none"> Deployment of an INAFOR official (Chinandega Office) Technical guidance and financial support for the municipal forest and environment section 		
Total Cost			US\$ 423,500	

Forest Management Plan for Disaster Prevention																							
Department: CHINANDEGA						Municipality: PUERTO MORAZÁN																	
Drainage Basin: Estero Real River				Location in Basin: Lower Reaches				Topography: Flat															
Annual Rainfall: 1,834mm						Mean Annual Temperature: 27.0																	
Distribution of Land Use and Forest Type	Type	Natural Forest				Man-Made	Grazing forest	Agropas ture	Water Body	Others	Total												
		Conifer-ous	Broad-Leaved	Mixed	Mangrove																		
	(ha)	0	3,462	0	14,085	7	1,242	11,924	11,160	9,781	51,661												
	(%)	0.0	6.7	0.0	27.3	0.0	2.4	23.1	21.6	18.9	100.0												
Land Ownership	Category	<20Mz		20 - 100 Mz		100 - 500 Mz		500 Mz<		Total													
	Ratio of Households (%)	61.9		26.3		8.5		3.3		100.0													
	Average Area (ha)	9.6		42.9		199.3		1,038.2		68.6													
Main Agricultural Products	Product	Maize		Kidney Beans		Sorghum		Rice		Sesame													
	Cultivation Area (Mz)	1,099		48		151		177															
Population (2000): 9,683				Population Density: 26/km ²				Annual Rate of Increase (1990 – 2000): 3.9%															
Municipal Environment Office: Yes, 2 staff members						Municipal Environment Committee: Yes																	
Municipal Environment Plan (Natural Environment)																							
Destruction of broad-leaved forests				<ul style="list-style-type: none"> ■ Promotion of reforestation using local species ■ Introduction and wide use of improved stoves ■ Education on the negative impacts of forest fires ■ Education/training for producers on forest fire prevention techniques ■ Observation of the relevant laws 																			
Soil erosion				<ul style="list-style-type: none"> ■ Introduction of agroforestry and silvopastoral systems ■ Construction of soil conservation works ■ Education/training for producers on an appropriate production system ■ Introduction of green manure crops to improve the soil fertility 																			
Extinction of wild animals				<ul style="list-style-type: none"> ■ Observation of the relevant laws ■ Introduction of a closed season and facilities to enforce control ■ Introduction of shelters for wild animals ■ Breeding of wild animals 																			
Zoning																							
											<p>Legend</p> <table border="1"> <tr> <td></td> <td>Flat Zone</td> </tr> <tr> <td></td> <td>Gentle Sloping Zone</td> </tr> <tr> <td></td> <td>Mixed Sloping Zone</td> </tr> <tr> <td></td> <td>Steep Sloping Zone</td> </tr> <tr> <td></td> <td>Priority Forest Conservation Area</td> </tr> <tr> <td></td> <td>Hazardous Area for Collapse</td> </tr> </table>		Flat Zone		Gentle Sloping Zone		Mixed Sloping Zone		Steep Sloping Zone		Priority Forest Conservation Area		Hazardous Area for Collapse
	Flat Zone																						
	Gentle Sloping Zone																						
	Mixed Sloping Zone																						
	Steep Sloping Zone																						
	Priority Forest Conservation Area																						
	Hazardous Area for Collapse																						

Note : The areas for land use and forest type distribution are estimated based on the land use and forest type map and the totals slightly differ from the official figures.

Project Components				
Natural Forest Management Plan	Plan Contents	<ul style="list-style-type: none"> Main target sites: around Cerro Partido Forest inventory/formulation of a forest management plan Enrichment: 200 trees/ha Introduction of firebreaks 		
	Quantities and Costs	<ul style="list-style-type: none"> Forest inventory/formulation of a forest management plan: 130 ha; US\$ 1,300 Enrichment: 130 ha; 26,000 seedlings; US\$ 2,730 Introduction of firebreaks: 130 ha; US\$ 9,360 	Sub-Total Cost US\$ 13,400	
Reforestation Plan	Plan Contents	<ul style="list-style-type: none"> Main target sites: Agropastoral land in mixed sloping zones around Cerro Partido Main planting species: Eucalyptus Number of seedlings to be planted: 1,110 seedlings/ha 		
	Quantities and Costs	<ul style="list-style-type: none"> Planting area: 90 ha Required number of seedlings: 120,000 	Sub-Total Cost US\$ 83,400	
Soil Conservation Plan	Agroforestry	Plan Contents	<ul style="list-style-type: none"> Farmland: <ul style="list-style-type: none"> Mixed Sloping Zone: live fencing; contour hedgerows; earth ridges; rock ridges Change to permanent farming Pasture: planting of shade trees; live fencing 	
		Quantities and Costs	<ul style="list-style-type: none"> Farmland: 400 ha; 134,000 seedlings; US\$ 92,800 Change to permanent farming: 95 ha; US\$ 18,560 Pasture: 150 ha; 24,000 seedlings; US\$ 12,230 	Sub-Total Cost US\$ 123,600
	Erosion Control Work	Plan Contents	<ul style="list-style-type: none"> Check dams: dry masonry dams; fence dams Retaining walls; dry masonry works; fencing works Slope protection: covering works 	
		Quantities and Costs	<ul style="list-style-type: none"> Dry masonry dams: 196; US\$ 3,490 Fence dams: 98; US\$ 1,450 Dry masonry works: 147; US\$ 1,730 Fencing works: 98; US\$ 1,450 Covering works: 49 sites; US\$ 720 	Sub-Total Cost US\$ 8,800
Livelihood Improvement Plan	Plan Contents	<ul style="list-style-type: none"> Improvement of living: home garden and improved stoves Improvement of production techniques: introduction of the gravity-type simple watering system, diversification of crops and production of compost Improvement of grazing techniques: introduction of improved grass 		
	Quantities and Costs	<ul style="list-style-type: none"> Home gardens: 2 ha; 200 seedlings; US\$ 720 Improved stoves: 20; US\$ 3,380 Installation of gravity type simple watering systems: 48 ha; US\$ 6,230 Diversification of crops: 80 ha; US\$ 32,660 Production of compost: 80 sites; US\$ 15,630 Introduction of improved grass: 15 ha; US\$ 3,670 	Sub-Total Cost US\$ 62,300	
Implementation System Development Plan	Plan Contents	<p>(Municipal Forest and Environment Section)</p> <ul style="list-style-type: none"> Increase of staff and their education/training Coordination with the Municipal Development Plan Technical support for communities Education of local residents on forests and the environment Guidance on the operation and management of community organizations Training of promoters <p>(Municipal Environment Committee)</p> <ul style="list-style-type: none"> Reorganization and consolidation of the municipal environment committee (reorganization of the participating organizations and definition of their respective roles) Guidance for the municipal forest and environment section) Strengthening of the coordination and exchange of opinions with related organizations and NGOs (INAFOR) Deployment of an INAFOR official (Chinandega Office) Technical guidance and financial support for the municipal forest and environment section 		
Total Cost			US\$ 291,500	

Forest Management Plan for Disaster Prevention												
Department: CHINANDEGA						Municipality: VILLANUEVA						
Drainage Basin: Estero Real				Location in Basin: Middle Reaches				Topography: Flat – Mixed Sloping				
Annual Rainfall: 1,647mm						Mean Annual Temperature: 27.0						
Distribution of Land Use and Forest Type	Type	Natural Forest				Man-Made	Grazing forest	Agropas ture	Water Body	Others	Total	
		Conifer-ous	Broad-Leaved	Mixed	Mangrove							
	(ha)	0	1,847	0	0	281	7,556	53,943	25	8,369	72,021	
	(%)	0.0	12.8	0.0	9.1	0.1	2.1	52.1	5.5	18.3	100.0	
Land Ownership	Category		<20Mz		20 - 100 Mz		100 - 500 Mz		500 Mz<		Total	
	Ratio of Households (%)		46.0		34.7		16.1		3.2		100.0	
	Average Area (ha)		8.9		51.0		22.3		933.6		56.3	
Main Agricultural Products	Product		Maize		Kidney Beans		Sorghum		Rice		Sesame	Others
	Cultivation Area (Mz)		6,958		102		1,008		208			
Population (2000): 26,846				Population Density: 37/km ²				Annual Rate of Increase (1990 – 2000): 4.5%				
Municipal Environment Office: Yes, 1 staff member						Municipal Environment Committee: Yes						
Municipal Environment Plan (Natural Environment)												
Forest destruction			<ul style="list-style-type: none"> ■ Promotion of reforestation using local species ■ Technical and financial assistance for reforestation by producers in accordance with the forest management plan ■ Education/training for producers on regeneration, enrichment and conservation of natural forests ■ Application of the relevant laws and regulations ■ Law enforcement against illegal cutting and hauling 									
Fire control at farmland			<ul style="list-style-type: none"> ■ Formation of a fire brigade ■ Education on the negative impacts of fires ■ Education/training for producers on fire prevention measures ■ Observation of the relevant laws and regulations 									
Zoning												
												

Note : The areas for land use and forest type distribution are estimated based on the land use and forest type map and the totals slightly differ from the official figures.

Project Components				
Natural Forest Management Plan	Plan Contents	<ul style="list-style-type: none"> • Main target sites: hills in the middle reaches of Estero Real River • Forest inventory/formulation of a forest management plan • Enrichment: 200 trees/ha • Introduction of firebreaks 		
	Quantities and Costs	<ul style="list-style-type: none"> • Forest inventory/formulation of a forest management plan: 780ha; US\$ 7,800 • Enrichment: 780 ha; 156,000 seedlings; US\$ 16,380 • Introduction of firebreaks: 780 ha; US\$ 56,160 	Sub-Total Cost US\$ 80,300	
Reforestation Plan	Plan Contents	<ul style="list-style-type: none"> • Main target sites: Agropastoral land on hills in the north • Main planting species: Mixed Sloping Zone: Leucaena, Madero Negro Flat Zone: Eucalyptus, Neem • Number of seedlings to be planted: 1,110 seedlings/ha 		
	Quantities and Costs	<ul style="list-style-type: none"> • Planting area: 1,000 ha • Required number of seedlings: 1,332,000 	Sub-Total Cost US\$ 926,300	
Soil Conservation Plan	Agroforestry	Plan Contents	<ul style="list-style-type: none"> • Farmland Mixed Sloping Zone: live fencing; contour hedgerows; earth ridges; rock ridges • Change to permanent farming • Pasture: planting of shade trees; live fencing 	
		Quantities and Costs	<ul style="list-style-type: none"> • Farmland: 2,000 ha; 672,000 seedlings; US\$464,000 • Change to permanent farming: 470 ha; US\$ 91,840 • Pasture: 1,550 ha; 251,000 seedlings; US\$ 126,330 	Sub-Total Cost US\$ 682,200
	Erosion Control Work	Plan Contents	<ul style="list-style-type: none"> • Check dams: dry masonry dams; fence dams • Retaining walls; dry masonry works; gabion works; fencing works • Slope protection: covering works 	
		Quantities and Costs	<ul style="list-style-type: none"> • Dry masonry dams: 464; US\$8,260 • Fence dams: 232; US\$3,430 • Dry masonry works: 348; US\$4,140 • Gabion works: 232; US\$20,040 • Fencing works: 232; US\$3,430 • Covering works: 116; US\$1,720 	Sub-Total Cost US\$ 41,000
Livelihood Improvement Plan	Plan Contents	<ul style="list-style-type: none"> • Improvement of living: home garden and improved stoves • Improvement of production techniques: introduction of the gravity-type simple watering system, diversification of crops and production of compost • Improvement of grazing techniques: introduction of improved grass 		
	Quantities and Costs	<ul style="list-style-type: none"> • Home gardens: 12 ha; 1,200 seedlings; US\$ 4,320 • Improved stoves: 120; US\$ 20,260 • Installation of gravity type simple watering systems: 235 ha; US\$ 30,480 • Diversification of crops: 400 ha; US\$ 163,280 • Production of compost: 400 sites; US\$ 78,160 • Introduction of improved grass: 155 ha; US\$ 37,960 	Sub-Total Cost US\$ 334,500	
Implementation System Development Plan	Plan Contents	<p>(Municipal Forest and Environment Section)</p> <ul style="list-style-type: none"> • Increase of staff and their education/training • Coordination with the Municipal Development Plan • Technical support for communities • Education of local residents on forests and the environment • Guidance on the operation and management of community organizations • Training of promoters <p>(Municipal Environment Committee)</p> <ul style="list-style-type: none"> • Reorganization and consolidation of the municipal environment committee (reorganization of the participating organizations and definition of their respective roles) • Guidance for the municipal forest and environment section) • Strengthening of the coordination and exchange of opinions with related organizations and NGOs <p>(INAFOR)</p> <ul style="list-style-type: none"> • Deployment of an INAFOR official (Chinandega Office) • Technical guidance and financial support for the municipal forest and environment section 		
Total Cost			US\$ 2,064,300	

Forest Management Plan for Disaster Prevention											
Department: CHINANDEGA						Municipality: EL VIEJO					
Drainage Basin: Pacific Coast				Location in Basin: Lower Reaches				Topography: Flat			
Annual Rainfall: 1,834mm						Mean Annual Temperature: 27.0					
Distribution of Land Use and Forest Type	Type	Natural Forest				Man-Made	Grazing forest	Agropas ture	Water Body	Others	Total
		Conifer-ous	Broad-Leaved	Mixed	Mangrove						
	(ha)	0	16,677	0	11,840	126	2,739	67,891	7,180	23,916	130,369
	(%)	0.0	12.8	0.0	9.1	0.1	2.1	52.1	5.5	18.3	100.0
Land Ownership	Category		<20Mz	20 - 100 Mz		100 - 500 Mz		500 Mz<		Total	
	Ratio of Households (%)		58.0		25.8		12.1		4.1		100.0
	Average Area (ha)		8.6		48.1		247.0		999.5		87.7
Main Agricultural Products	Product		Maize	Kidney Beans	Sorghum	Rice		Sesame		Others	
	Cultivation Area (Mz)		7,692	5,136	1,969	2,038					
Population (2000): 83,280				Population Density: 64/km ²				Annual Rate of Increase (1990 – 2000): 4.6%			
Municipal Environment Office: Yes, 2 staff members						Municipal Environment Committee: Yes					
Municipal Environment Plan (Natural Environment)											
Destruction of broad-leaved forests			<ul style="list-style-type: none"> ■ Promotion of reforestation (for timber and firewood) ■ Diversification of the production activities of small farmers ■ Diversification of crops using appropriate techniques ■ Law enforcement against illegal cutting and hauling ■ Education/training for producers on forest fire prevention/control 								
Soil erosion			<ul style="list-style-type: none"> ■ Introduction of agroforestry and silvopastoral systems ■ Implementation of soil conservation measures ■ Education/training on an appropriate production system ■ Introduction of green manure crops to improve the soil fertility 								
Consolidation of environmental education			<ul style="list-style-type: none"> ■ Implementation of environmental education for local residents ■ Strengthening of local environment-related organizations ■ Implementation of an environment-related publicity programme ■ Promotion of youth participation in environmental conservation activities 								
Zoning											

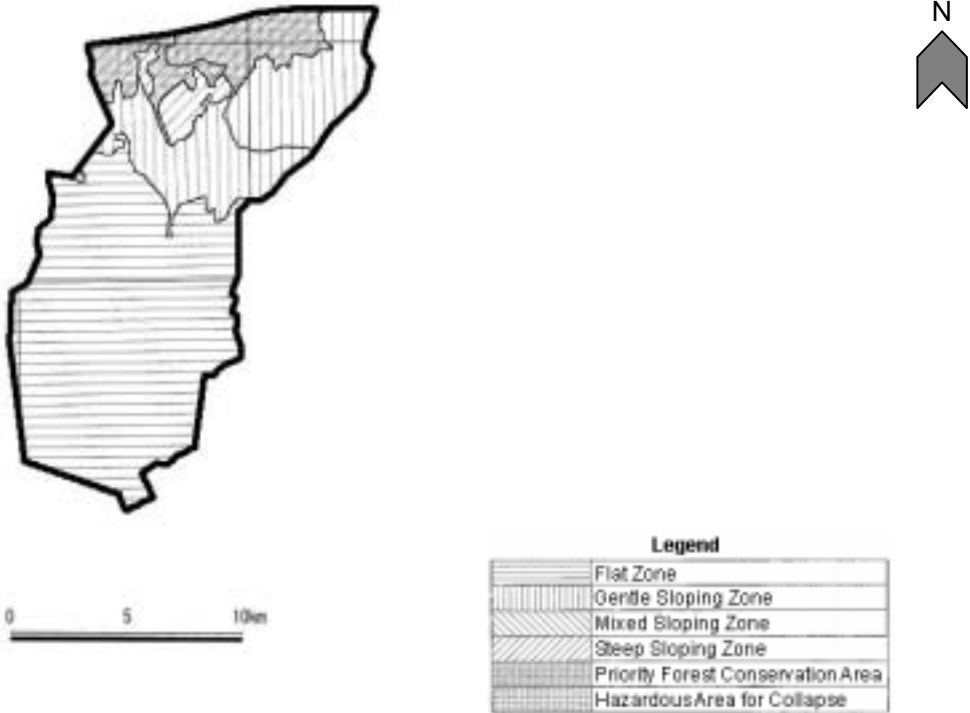
Note : The areas for land use and forest type distribution are estimated based on the land use and forest type map and the totals slightly differ from the official figures.

Project Components				
Natural Forest Management Plan	Plan Contents	<ul style="list-style-type: none"> Main target sites: around Cerro Partido; southern foot of Mt. Cosigüina Forest inventory/formulation of a forest management plan Enrichment: 200 trees/ha Introduction of firebreaks 		
	Quantities and Costs	<ul style="list-style-type: none"> Forest inventory/formulation of a forest management plan: 2,330ha; US\$23,300 Enrichment: 2,330ha; 466,000 seedlings; US\$48,930 Introduction of firebreaks: 2,330ha; US\$167,760 	Sub-Total Cost US\$ 240,000	
Reforestation Plan	Plan Contents	<ul style="list-style-type: none"> Main target sites: around Cerro Partido, southern foot of Mt. Cosigüina and along National Route 12 Main planting species: Mixed sloping zone at Cerro Partido: Leucaena, Madero Negro Southern foot of Mt. Cosigüina: Eucalyptus, Neem Along National Route 12: Eucalyptus, Neem Number of seedlings to be planted: 1,110 seedlings/ha 		
	Quantities and Costs	<ul style="list-style-type: none"> Planting area: 1,330 ha Required number of seedlings: 1,772,000 	Sub-Total Cost US\$ 1,232,000	
Soil Conservation Plan	Agroforestry	Plan Contents	<ul style="list-style-type: none"> Farmland Gentle sloping zone: live fencing; earth ridges Mixed Sloping Zone: live fencing; contour hedgerows; earth ridges; rock ridges Steep sloping zone: contour hedgerows; rock ridges Change to permanent farming Pasture: planting of shade trees; live fencing 	
		Quantities and Costs	<ul style="list-style-type: none"> Farmland: 510ha; 164,000 seedlings; US\$109,350 Change to permanent farming: 120ha; US\$23,450 Pasture: 170ha; 27,000 seedlings; US\$13,860 	Sub-Total Cost US\$ 146,700
	Erosion Control Work	Plan Contents	<ul style="list-style-type: none"> Check dams: dry masonry dams; fence dams Retaining walls; dry masonry works; fencing works Slope protection: covering works 	
		Quantities and Costs	<ul style="list-style-type: none"> Dry masonry dams: 945; US\$16,820 Fence dams: 378; US\$5,600 Dry masonry works: 756; US\$8,930 Fencing works: 378; US\$5,600 Covering works: 189; US\$2,790 	Sub-Total Cost US\$ 39,700
Livelihood Improvement Plan	Plan Contents	<ul style="list-style-type: none"> Improvement of living: home garden and improved stoves Improvement of production techniques: introduction of the gravity-type simple watering system, diversification of crops and production of compost Improvement of grazing techniques: introduction of improved grass 		
	Quantities and Costs	<ul style="list-style-type: none"> Home gardens: 16ha; 1,600 seedlings; US\$5,760 Improved stoves: 160; US\$27,010 Installation of gravity type simple watering systems: 60ha; US\$7,780 Diversification of crops: 100ha; US\$40,820 Production of compost: 100site; US\$19,540 Introduction of improved grass: 17ha; US\$4,160 	Sub-Total Cost US\$ 105,100	
Implementation System Development Plan	Plan Contents	<p>(Municipal Forest and Environment Section)</p> <ul style="list-style-type: none"> Increase of staff and their education/training Coordination with the Municipal Development Plan Technical support for communities Education of local residents on forests and the environment Guidance on the operation and management of community organizations Training of promoters <p>(Municipal Environment Committee)</p> <ul style="list-style-type: none"> Reorganization and consolidation of the municipal environment committee (reorganization of the participating organizations and definition of their respective roles) Guidance for the municipal forest and environment section) Strengthening of the coordination and exchange of opinions with related organizations and NGOs <p>(INAFOR)</p> <ul style="list-style-type: none"> Deployment of an INAFOR official (Chinandega Office) Technical guidance and financial support for the municipal forest and environment section 		
Total Cost			US\$ 1,763,500	

Forest Management Plan for Disaster Prevention																									
Department: CHINANDEGA						Municipality: CHICHIGALPA																			
Drainage Basin: Pacific Coast				Location in Basin: Middle and Upper Reaches				Topography: Flat																	
Annual Rainfall: 1,755mm						Mean Annual Temperature: 27.7																			
Distribution of Land Use and Forest Type	Type	Natural Forest				Man-Made	Grazing forest	Agropas ture	Water Body	Others	Total														
		Conifer-ous	Broad-Leaved	Mixed	Mangrove																				
		(ha)	0	1,691	0							105	607	84	17,610	3	1,812	21,912							
	(%)	0.0	7.7	0.0	0.5	2.8	0.4	80.4	0.0	8.2	100.0														
Land Ownership	Category		<20Mz		20 - 100 Mz		100 - 500 Mz		500 Mz<		Total														
	Ratio of Households (%)		68.9		21.0		7.7		2.4		100.0														
	Average Area (ha)		7.9		47.1		255.6		3,199.5		110.7														
Main Agricultural Products	Product		Maize		Kidney Beans		Sorghum		Rice		Sesame	Others													
	Cultivation Area (Mz)		1,096		287		94		1,134																
Population (2000): 46,511				Population Density: 212/km ²				Annual Rate of Increase (1990 – 2000): 2.0%																	
Municipal Environment Office: Yes, 2 staff members						Municipal Environment Committee: Yes																			
Municipal Environment Plan (Natural Environment)																									
Consolidation of environmental education			<ul style="list-style-type: none"> ■ Implementation of an environmental education programme ■ Strengthening of the local organization for environmental control ■ Development of a model area and model actions for environmental activities ■ Municipal meeting to discuss the environment ■ Extension/education through publicity ■ Introduction of an Environment Day 																						
Soil erosion			<ul style="list-style-type: none"> ■ Education and training of producers on appropriate production techniques ■ Introduction and strengthening of agroforestry and silvopastoral systems ■ Introduction of green manure crops which improve the soil fertility ■ Implementation of soil conservation measures ■ Introduction of crops which do not require much labour input or soil nutrition ■ Implementation of an integrated dry river management programme 																						
Low level of interest in protection of natural resources among local residents			<ul style="list-style-type: none"> ■ Education/extension on forests and the environment ■ Patrolling in the dry season ■ Observation of forest/environment-related laws and regulations 																						
Forest clearance and forest fires			<ul style="list-style-type: none"> ■ Application of a law or regulation in correspondence to damage ■ Promotion of reforestation using local species ■ Formation of a fire brigade ■ Education on the negative impacts of forest fires ■ Education/training for producers on forest fire prevention measures ■ Education/training for producers on the protection, operation and regeneration of natural forests 																						
Insufficient coordination between related organizations			<ul style="list-style-type: none"> ■ Introduction of a municipal section dealing with the environment ■ Strengthening of the functions of the municipal environment committee ■ Clarification of the coordination between the local organizations concerned ■ Harmonisation of the action plans of NGOs, municipal authority and administrative organizations 																						
Zoning																									
<table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th colspan="2">Legend</th> </tr> </thead> <tbody> <tr> <td style="width: 20px; height: 10px; background-color: #cccccc;"></td> <td>Flat Zone</td> </tr> <tr> <td style="width: 20px; height: 10px; background-color: #e0e0e0;"></td> <td>Gentle Sloping Zone</td> </tr> <tr> <td style="width: 20px; height: 10px; background-color: #d0d0d0;"></td> <td>Mixed Sloping Zone</td> </tr> <tr> <td style="width: 20px; height: 10px; background-color: #c0c0c0;"></td> <td>Steep Sloping Zone</td> </tr> <tr> <td style="width: 20px; height: 10px; background-color: #a0a0a0;"></td> <td>Priority Forest Conservation Area</td> </tr> <tr> <td style="width: 20px; height: 10px; background-color: #808080;"></td> <td>Hazardous Area for Collapse</td> </tr> </tbody> </table>												Legend			Flat Zone		Gentle Sloping Zone		Mixed Sloping Zone		Steep Sloping Zone		Priority Forest Conservation Area		Hazardous Area for Collapse
Legend																									
	Flat Zone																								
	Gentle Sloping Zone																								
	Mixed Sloping Zone																								
	Steep Sloping Zone																								
	Priority Forest Conservation Area																								
	Hazardous Area for Collapse																								

Note : The areas for land use and forest type distribution are estimated based on the land use and forest type map and the totals slightly differ from the official figures.

Project Components				
Natural Forest Management Plan	Plan Contents	<ul style="list-style-type: none"> Main target sites: southern foot of Mt. San Cristóbal Forest inventory/formulation of a forest management plan Enrichment: 200 trees/ha Introduction of firebreaks 		
	Quantities and Costs	<ul style="list-style-type: none"> Forest inventory/formulation of a forest management plan: 30ha; US\$300 Enrichment: 30ha; 6,000 seedlings; US\$630 Introduction of firebreaks: 30ha; US\$2,160 	Sub-Total Cost US\$ 3,100	
Reforestation Plan	Plan Contents	<ul style="list-style-type: none"> Main target sites: southern foot of Mt. San Cristóbal Main planting species: Gentle sloping zone: Eucalyptus Flat Zone: Eucalyptus Number of seedlings to be planted: 1,110 seedlings/ha 		
	Quantities and Costs	<ul style="list-style-type: none"> Planting area: 780ha Required number of seedlings: 1,039 	Sub-Total Cost US\$ 722,500	
Soil Conservation Plan	Agroforestry	Plan Contents	<ul style="list-style-type: none"> Farmland Gentle sloping zone: live fencing; earth ridges Change to permanent farming Pasture: planting of shade trees; live fencing 	
		Quantities and Costs	<ul style="list-style-type: none"> Farmland: 260ha; 78,000 seedlings; US\$49,220 Change to permanent farming: 62ha; US\$12,110 Pasture: 30ha; 5,000 seedlings; US\$2,450 	Sub-Total Cost US\$ 63,800
	Erosion Control Work	Plan Contents	<ul style="list-style-type: none"> Check dams: dry masonry dams; fence dams Retaining walls; dry masonry works; gabion works; fencing works Slope protection: covering works 	
		Quantities and Costs	<ul style="list-style-type: none"> Dry masonry dams: 145; US\$2,570 Fence dams: 58; US\$860 Dry masonry works: 116; US\$1,360 Gabion works: 87; US\$7,530 Fencing works: 58; US\$860 Covering works: 29; US\$430 	Sub-Total Cost US\$ 13,600
Livelihood Improvement Plan	Plan Contents	<ul style="list-style-type: none"> Improvement of living: home garden and improved stoves Improvement of production techniques: introduction of the gravity-type simple watering system, diversification of crops and production of compost Improvement of grazing techniques: introduction of improved grass 		
	Quantities and Costs	<ul style="list-style-type: none"> Home gardens: 4ha; 400 seedlings; US\$1,440 Improved stoves: 40; US\$6,750 Installation of gravity type simple watering systems: 32ha; US\$4,150 Diversification of crops: 50ha; US\$20,410 Production of compost: 50site; US\$9,770 Introduction of improved grass: 3ha; US\$730 	Sub-Total Cost US\$ 43,300	
Implementation System Development Plan	Plan Contents	<p>(Municipal Forest and Environment Section)</p> <ul style="list-style-type: none"> Increase of staff and their education/training Coordination with the Municipal Development Plan Technical support for communities Education of local residents on forests and the environment Guidance on the operation and management of community organizations Training of promoters <p>(Municipal Environment Committee)</p> <ul style="list-style-type: none"> Reorganization and consolidation of the municipal environment committee (reorganization of the participating organizations and definition of their respective roles) Guidance for the municipal forest and environment section) Strengthening of the coordination and exchange of opinions with related organizations and NGOs <p>(INAFOR)</p> <ul style="list-style-type: none"> Deployment of an INAFOR official (Chinandega Office) Technical guidance and financial support for the municipal forest and environment section 		
Total Cost			US\$ 846,300	

Forest Management Plan for Disaster Prevention																							
Department: CHINANDEGA						Municipality: POSOLTEGA																	
Drainage Basin: Pacific Coast				Location in Basin: Middle/Upper Reaches				Topography: Flat-Gently Sloping															
Annual Rainfall: 1,834mm						Mean Annual Temperature: 27																	
Distribution of Land Use and Forest Type	Type	Natural Forest				Man-Made	Grazing forest	Agropas ture	Water Body	Others	Total												
		Conifer-ous	Broad-Leaved	Mixed	Mangrove																		
	(ha)	0	1,322	0	0	274	1,153	9,710	0	2,514	14,973												
	(%)	0.0	8.8	0.0	0.0	1.8	7.7	64.9	0.0	16.8	100.0												
Land Ownership	Category		<20Mz		20 - 100 Mz		100 - 500 Mz		500 Mz<		Total												
	Ratio of Households (%)		68.4		22.0		8.7		0.9		100.0												
	Average Area (ha)		7.5		44.9		242.4		851.4		43.9												
Main Agricultural Products	Product		Maize		Kidney Beans		Sorghum		Rice		Sesame	Others											
	Cultivation Area (Mz)		1,490		461		89		471														
Population (2000): 16,494				Population Density: 110/km ²				Annual Rate of Increase (1990 – 2000): 1.7%															
Municipal Environment Office: Yes, 1 staff member						Municipal Environment Committee: Yes																	
Municipal Environment Plan (Natural Environment)																							
Soil erosion			<ul style="list-style-type: none"> ■ Education and training of producers on appropriate production techniques ■ Introduction and strengthening of agroforestry and silvopastoral systems ■ Use of green manure to improve the soil fertility ■ Implementation of soil conservation measures ■ Introduction of crops which do not much require labour input and soil nutrition 																				
Consolidation of environmental education			<ul style="list-style-type: none"> ■ Development of an environmental education programme ■ Strengthening of the local organization for environmental control ■ Development of a model area and model actions for environmental activities ■ Implementation of municipal discussion meetings on the environment ■ Introduction of an Environment Day 																				
Zoning																							
																							
<p>Legend</p> <table border="1"> <tr> <td>[Horizontal lines]</td> <td>Flat Zone</td> </tr> <tr> <td>[Diagonal lines /]</td> <td>Gentle Sloping Zone</td> </tr> <tr> <td>[Diagonal lines \]</td> <td>Mixed Sloping Zone</td> </tr> <tr> <td>[Vertical lines]</td> <td>Steep Sloping Zone</td> </tr> <tr> <td>[Dotted pattern]</td> <td>Priority Forest Conservation Area</td> </tr> <tr> <td>[Cross-hatch pattern]</td> <td>Hazardous Area for Collapse</td> </tr> </table>												[Horizontal lines]	Flat Zone	[Diagonal lines /]	Gentle Sloping Zone	[Diagonal lines \]	Mixed Sloping Zone	[Vertical lines]	Steep Sloping Zone	[Dotted pattern]	Priority Forest Conservation Area	[Cross-hatch pattern]	Hazardous Area for Collapse
[Horizontal lines]	Flat Zone																						
[Diagonal lines /]	Gentle Sloping Zone																						
[Diagonal lines \]	Mixed Sloping Zone																						
[Vertical lines]	Steep Sloping Zone																						
[Dotted pattern]	Priority Forest Conservation Area																						
[Cross-hatch pattern]	Hazardous Area for Collapse																						

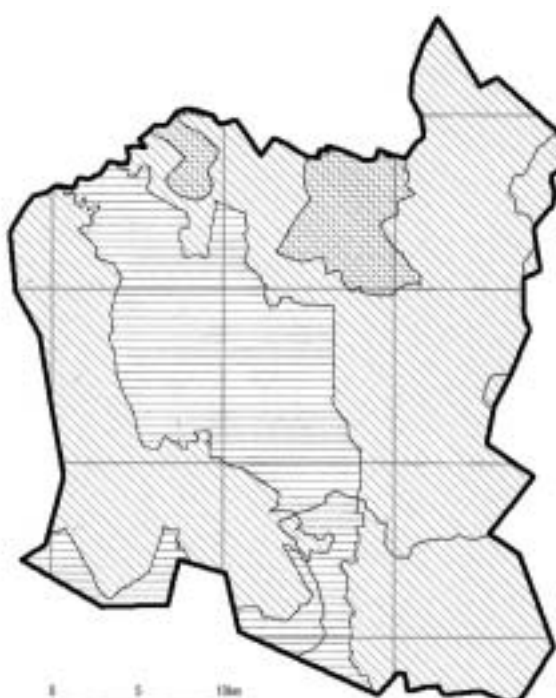
Note : The areas for land use and forest type distribution are estimated based on the land use and forest type map and the totals slightly differ from the official figures.

Project Components				
Natural Forest Management Plan	Plan Contents	<ul style="list-style-type: none"> Main target sites: hillside and foot of Mt. Casita Forest inventory/formulation of a forest management plan Enrichment: 200 trees/ha Introduction of firebreaks 		
	Quantities and Costs	<ul style="list-style-type: none"> Forest inventory/formulation of a forest management plan: 170 ha; US\$ 1,700 Enrichment: 170ha; 34,000 seedlings; US\$3,570 Introduction of firebreaks: 170ha; US\$12,240 	Sub-Total Cost US\$ 17,500	
Reforestation Plan	Plan Contents	<ul style="list-style-type: none"> Main target sites: southern foot of Mt. Casita Main planting species: Steep sloping zone: Leucaena, Madero Negro Gentle sloping zone: Eucalyptus, Neem Number of seedlings to be planted: 1,110 seedlings/ha 		
	Quantities and Costs	<ul style="list-style-type: none"> Planting area: 380ha Required number of seedlings: 506,000 	Sub-Total Cost US\$ 352,000	
Soil Conservation Plan	Agroforestry	Plan Contents	<ul style="list-style-type: none"> Farmland Gentle sloping zone: live fencing; earth ridges Change to permanent farming Pasture: planting of shade trees; live fencing 	
		Quantities and Costs	<ul style="list-style-type: none"> Farmland: 360ha; 111,000 seedlings; US\$71,960 Change to permanent farming: 86ha; US\$16,800 Pasture: 90ha; 15,000seedlings; US\$7,340 	Sub-Total Cost US\$ 96,100
	Erosion Control Work	Plan Contents	<ul style="list-style-type: none"> Check dams: dry masonry dams; fence dams Retaining walls; dry masonry works; fencing works Slope protection: covering works 	
		Quantities and Costs	<ul style="list-style-type: none"> Dry masonry dams: 140; US\$2,490 Fence dams: 56; US\$840 Dry masonry works: 112; US\$1,320 Fencing works: 56; US\$840 Covering works: 28; US\$410 	Sub-Total Cost US\$ 5,900
Livelihood Improvement Plan	Plan Contents	<ul style="list-style-type: none"> Improvement of living: home garden and improved stoves Improvement of production techniques: introduction of the gravity-type simple watering system, diversification of crops and production of compost Improvement of grazing techniques: introduction of improved grass 		
	Quantities and Costs	<ul style="list-style-type: none"> Home gardens: 8ha; 800 seedlings; US\$2,880 Improved stoves: 80; US\$13,500 Installation of gravity type simple watering systems: 43ha; US\$5,580 Diversification of crops: 70ha; US\$28,570 Production of compost: 70site; US\$13,680 Introduction of improved grass: 9ha; US\$2,200 	Sub-Total Cost US\$ 66,400	
Implementation System Development Plan	Plan Contents	<p>(Municipal Forest and Environment Section)</p> <ul style="list-style-type: none"> Increase of staff and their education/training Coordination with the Municipal Development Plan Technical support for communities Education of local residents on forests and the environment Guidance on the operation and management of community organizations Training of promoters <p>(Municipal Environment Committee)</p> <ul style="list-style-type: none"> Reorganization and consolidation of the municipal environment committee (reorganization of the participating organizations and definition of their respective roles) Guidance for the municipal forest and environment section) Strengthening of the coordination and exchange of opinions with related organizations and NGOs (INAFOR) Deployment of an INAFOR official (Chinandega Office) Technical guidance and financial support for the municipal forest and environment section 		
Total Cost			US\$ 537,900	

Forest Management Plan for Disaster Prevention																							
Department: LEÓN						Municipality: ACHUAPA																	
Drainage Basin: Estero Real River				Location in Basin: Upper Reaches				Topography: Gently Sloping/Steeply Sloping															
Annual Rainfall: 1,865mm						Mean Annual Temperature: 27.7																	
Distribution of Land Use and Forest Type	Type	Natural Forest				Man-Made	Grazing forest	Agropasture	Water Body	Others	Total												
		Coniferous	Broad-Leaved	Mixed	Mangrove																		
	(ha)	66	546	35	0	0	48	34,367	0	3,974	39,036												
	(%)	0.2	1.4	0.1	0.0	0.0	0.1	88.0	0.0	10.2	100.0												
Land Ownership	Category	<20Mz		20 - 100 Mz		100 - 500 Mz		500 Mz<		Total													
	Ratio of Households (%)	34.5		55.5		9.5		0.5		100.0													
	Average Area (ha)	10.6		45.0		169.0		1,021.4		50.5													
Main Agricultural Products	Product	Maize		Kidney Beans		Sorghum		Rice		Sesame Others													
	Cultivation Area (Mz)	3,146		2,016		434		25															
Population (2000): 13,595				Population Density: 35/km ²				Annual Rate of Increase (1990 – 2000): 0.7%															
Municipal Environment Office: Yes, 2 staff members						Municipal Environment Committee: Yes																	
Municipal Environment Plan (Natural Environment)																							
Forest destruction			<ul style="list-style-type: none"> ■ Promotion of reforestation using local species ■ Technical and financial assistance for the owners of reforestation sites to implement the management plan ■ Reforestation to obtain firewood ■ Wide use of improved stoves ■ Coordination of the local organizations concerned to apply the laws and municipal ordinances ■ Promotion of the participation of residents in forest conservation 																				
Spread of fire from pasture burning			<ul style="list-style-type: none"> ■ Extension of fire prevention techniques to local residents ■ Education for producers on fire prevention regulations ■ Formation of a fire brigade ■ Deployment of forest guards and forest policemen ■ Observation of the fire prevention regulations 																				
Inappropriate land use			<ul style="list-style-type: none"> ■ Implementation of soil and water conservation measures ■ Introduction and strengthening of the agroforestry system ■ Use of green manure crops to improve the soil fertility 																				
Insufficient incentives in the forest sector			<ul style="list-style-type: none"> ■ Formulation of a strategic plan ■ Comprehensive loans for the reforestation of private land through wood processing ■ Use of tree species other than local species 																				
Insufficient knowledge of forest/environment laws and regulations			<ul style="list-style-type: none"> ■ Education/training for local administrative organizations on the contents and scope of application of laws and regulations ■ Establishment of a mechanism to apply environment laws and regulations ■ Strengthening of the implementation capability of related organizations ■ Implementation of environmental education for local residents 																				
Zoning																							
										<p style="text-align: center;">Legend</p> <table border="1"> <tr><td>[Pattern]</td><td>Flat Zone</td></tr> <tr><td>[Pattern]</td><td>Gentle Sloping Zone</td></tr> <tr><td>[Pattern]</td><td>Mixed Sloping Zone</td></tr> <tr><td>[Pattern]</td><td>Steep Sloping Zone</td></tr> <tr><td>[Pattern]</td><td>Priority Forest Conservation Area</td></tr> <tr><td>[Pattern]</td><td>Hazardous Area for Collapse</td></tr> </table>		[Pattern]	Flat Zone	[Pattern]	Gentle Sloping Zone	[Pattern]	Mixed Sloping Zone	[Pattern]	Steep Sloping Zone	[Pattern]	Priority Forest Conservation Area	[Pattern]	Hazardous Area for Collapse
[Pattern]	Flat Zone																						
[Pattern]	Gentle Sloping Zone																						
[Pattern]	Mixed Sloping Zone																						
[Pattern]	Steep Sloping Zone																						
[Pattern]	Priority Forest Conservation Area																						
[Pattern]	Hazardous Area for Collapse																						

Note : The areas for land use and forest type distribution are estimated based on the land use and forest type map and the totals slightly differ from the official figures.

Project Components				
Natural Forest Management Plan	Plan Contents	<ul style="list-style-type: none"> Main target sites: river basins of Achuapita River and Grande River Forest inventory/formulation of a forest management plan Enrichment: 200 trees/ha Introduction of firebreaks 		
	Quantities and Costs	<ul style="list-style-type: none"> Forest inventory/formulation of a forest management plan: 680ha; US\$6,800 Enrichment: 680ha; 136,000 seedlings; US\$14,280 Introduction of firebreaks: 680ha; US\$48,960 	Sub-Total Cost US\$ 70,000	
Reforestation Plan	Plan Contents	<ul style="list-style-type: none"> Main target sites: river basins of Achuapita River and Grande River Main planting species: Leucaena, Madero Negro Number of seedlings to be planted: 1,110 seedlings/ha 		
	Quantities and Costs	<ul style="list-style-type: none"> Planting area: 440ha Required number of seedlings: 586,000 	Sub-Total Cost US\$ 407,600	
Soil Conservation Plan	Agroforestry	Plan Contents	<ul style="list-style-type: none"> Farmland Gentle sloping zone: live fencing; contour hedgerows; earth ridges; rock ridges Change to permanent farming Pasture: planting of shade trees; live fencing 	
		Quantities and Costs	<ul style="list-style-type: none"> Farmland: 1,900ha; 638,000 seedlings; US\$440,800 Change to permanent farming: 450ha; US\$87,930 Pasture: 5,000ha; 810,000 seedlings; US\$407,500 	Sub-Total Cost US\$ 936,200
	Erosion Control Work	Plan Contents	<ul style="list-style-type: none"> Check dams: dry masonry dams; fence dams Retaining walls; dry masonry works; gabion works; fencing works Slope protection: covering works 	
		Quantities and Costs	<ul style="list-style-type: none"> Dry masonry dams: 390; US\$6,940 Fence dams: 156; US\$2,310 Dry masonry works: 312; US\$3,680 Gabion works: 234; US\$20,220 Fencing works: 156; US\$2,310 Covering works: 78; US\$1,150 	Sub-Total Cost US\$ 36,600
Livelihood Improvement Plan	Plan Contents	<ul style="list-style-type: none"> Improvement of living: home garden and improved stoves Improvement of production techniques: introduction of the gravity-type simple watering system, diversification of crops and production of compost Improvement of grazing techniques: introduction of improved grass 		
	Quantities and Costs	<ul style="list-style-type: none"> Home gardens: 19ha; 1,900 seedlings; US\$6,840 Improved stoves: 190; US\$32,070 Installation of gravity type simple watering systems: 225ha; US\$29,180 Diversification of crops: 380ha; US\$155,120 Production of compost: 380site; US\$74,250 Introduction of improved grass: 500ha; US\$122,450 	Sub-Total Cost US\$ 419,900	
Implementation System Development Plan	Plan Contents	<p>(Municipal Forest and Environment Section)</p> <ul style="list-style-type: none"> Increase of staff and their education/training Coordination with the Municipal Development Plan Technical support for communities Education of local residents on forests and the environment Guidance on the operation and management of community organizations Training of promoters <p>(Municipal Environment Committee)</p> <ul style="list-style-type: none"> Reorganization and consolidation of the municipal environment committee (reorganization of the participating organizations and definition of their respective roles) Guidance for the municipal forest and environment section) Strengthening of the coordination and exchange of opinions with related organizations and NGOs <p>(INAFOR)</p> <ul style="list-style-type: none"> Deployment of an INAFOR official (LeónOffice) Technical guidance and financial support for the municipal forest and environment section 		
Total Cost			US\$ US\$1,870,300	

Forest Management Plan for Disaster Prevention																									
Department: LEÓN						Municipality: EL SAUCE																			
Drainage Basin: Estero Real River				Location in Basin: Upper Reaches				Topography: Flat-Mixed Sloping																	
Annual Rainfall: 1,762mm						Mean Annual Temperature: 27.7																			
Distribution of Land Use and Forest Type	Type	Natural Forest				Man-Made	Grazing forest	Agropas ture	Water Body	Others	Total														
		Conifer-ous	Broad-Leaved	Mixed	Mangrove																				
	(ha)	119	3,660	0	0	36	3,293	45,886	0	16,957	69,951														
	(%)	0.2	5.2	0.0	0.0	0.1	4.7	65.6	0.0	24.2	100.0														
Land Ownership	Category		<20Mz		20 - 100 Mz		100 - 500 Mz		500 Mz<		Total														
	Ratio of Households (%)		46.1		43.3		9.1		1.5		100.0														
	Average Area (ha)		8.6		45.3		197.7		1,017.7		57.1														
Main Agricultural Products	Product		Maize	Kidney Beans	Sorghum	Rice	Sesame	Others																	
	Cultivation Area (Mz)		4,075	1,458	995	31																			
Population (2000): 30,088				Population Density: 43/km ²				Annual Rate of Increase (1990 – 2000): 2.4%																	
Municipal Environment Office: Yes, 2 staff members						Municipal Environment Committee: Yes																			
Municipal Environment Plan (Natural Environment)																									
Spread of fire from pasture burning			<ul style="list-style-type: none"> ■ Education/training for community leaders on fire prevention ■ Forming of a fire brigade ■ Education for local residents on fire prevention ■ Observation of forest-related laws and regulations 																						
Forest destruction			<ul style="list-style-type: none"> ■ Promotion of reforestation using local species ■ Reforestation to obtain firewood ■ Wide use of improved stoves ■ Introduction and strengthening of agroforestry and silvopastoral systems ■ Technical and financial assistance for the owners of man-made forests to implement the management plan ■ Observation of forest-related laws and municipal ordinances 																						
Consolidation of environmental education			<ul style="list-style-type: none"> ■ Implementation of an environmental education programme ■ Strengthening of the local organization for environmental control ■ Promotion of the participation of residents in environmental protection ■ Education for local residents on the environment 																						
Zoning																									
																									
<table border="1"> <thead> <tr> <th colspan="2">Legend</th> </tr> </thead> <tbody> <tr> <td></td> <td>Flat Zone</td> </tr> <tr> <td></td> <td>Gentle Sloping Zone</td> </tr> <tr> <td></td> <td>Mixed Sloping Zone</td> </tr> <tr> <td></td> <td>Steep Sloping Zone</td> </tr> <tr> <td></td> <td>Priority Forest Conservation Area</td> </tr> <tr> <td></td> <td>Hazardous Area for Collapse</td> </tr> </tbody> </table>												Legend			Flat Zone		Gentle Sloping Zone		Mixed Sloping Zone		Steep Sloping Zone		Priority Forest Conservation Area		Hazardous Area for Collapse
Legend																									
	Flat Zone																								
	Gentle Sloping Zone																								
	Mixed Sloping Zone																								
	Steep Sloping Zone																								
	Priority Forest Conservation Area																								
	Hazardous Area for Collapse																								

Note : The areas for land use and forest type distribution are estimated based on the land use and forest type map and the totals slightly differ from the official figures.

Project Components				
Natural Forest Management Plan	Plan Contents	<ul style="list-style-type: none"> Main target sites: mountainous area to the east Forest inventory/formulation of a forest management plan Enrichment: 200 trees/ha Introduction of firebreaks 		
	Quantities and Costs	<ul style="list-style-type: none"> Forest inventory/formulation of a forest management plan: 2,650ha; US\$26,500 Enrichment: 2,650ha; 530,000 seedlings; US\$55,650 Introduction of firebreaks: 2,650ha; US\$190,800 	Sub-Total Cost US\$ 273,000	
Reforestation Plan	Plan Contents	<ul style="list-style-type: none"> Main target sites: agropastoral land in the mountainous are to the east Main planting species: Leucaena, Madero Negro Number of seedlings to be planted: 1,110 seedlings/ha 		
	Quantities and Costs	<ul style="list-style-type: none"> Planting area: 650ha Required number of seedlings: 866,000 	Sub-Total Cost US\$ 602,100	
Soil Conservation Plan	Agroforestry	Plan Contents	<ul style="list-style-type: none"> Farmland Mixed Sloping Zone: live fencing; contour hedgerows; earth ridges; rock ridges Change to permanent farming Pasture: planting of shade trees; live fencing 	
		Quantities and Costs	<ul style="list-style-type: none"> Farmland: 2,780ha; 934,000seedlings; US\$644,960 Change to permanent farming: 660ha; US\$128,960 Pasture: 3,500ha; 567,000 seedlings; US\$285,250 	Sub-Total Cost US\$ 1,059,200
	Erosion Control Work	Plan Contents	<ul style="list-style-type: none"> Check dams: dry masonry dams; fence dams Retaining walls; dry masonry works; gabion works; fencing works Slope protection: covering works 	
		Quantities and Costs	<ul style="list-style-type: none"> Dry masonry dams: 600; US\$10,680 Fence dams: 240; US\$3,550 Dry masonry works: 480; US\$5,670 Gabion works: 360; US\$31,100 Fencing works: 240; US\$3,550 Covering works: 120; US\$1,770 	Sub-Total Cost US\$ 56,300
Livelihood Improvement Plan	Plan Contents	<ul style="list-style-type: none"> Improvement of living: home garden and improved stoves Improvement of production techniques: introduction of the gravity-type simple watering system, diversification of crops and production of compost Improvement of grazing techniques: introduction of improved grass 		
	Quantities and Costs	<ul style="list-style-type: none"> Home gardens: 27ha; 2,700 seedlings; US\$9,720 Improved stoves: 270; US\$45,580 Installation of gravity type simple watering systems: 330ha; US\$42,800 Diversification of crops: 555ha; US\$226,550 Production of compost: 555site; US\$108,450 Introduction of improved grass: 350ha; US\$85,720 	Sub-Total Cost US\$ 518,800	
Implementation System Development Plan	Plan Contents	<p>(Municipal Forest and Environment Section)</p> <ul style="list-style-type: none"> Increase of staff and their education/training Coordination with the Municipal Development Plan Technical support for communities Education of local residents on forests and the environment Guidance on the operation and management of community organizations Training of promoters <p>(Municipal Environment Committee)</p> <ul style="list-style-type: none"> Reorganization and consolidation of the municipal environment committee (reorganization of the participating organizations and definition of their respective roles) Guidance for the municipal forest and environment section) Strengthening of the coordination and exchange of opinions with related organizations and NGOs <p>(INAFOR)</p> <ul style="list-style-type: none"> Deployment of an INAFOR official (León Office) Technical guidance and financial support for the municipal forest and environment section 		
Total Cost			US\$ 2,509,400	

Forest Management Plan for Disaster Prevention																									
Department: LEÓN						Municipality: SANTA ROSA DEL PEÑÓN																			
Drainage Basin: Lake Managua				Location in Basin: Upper Reaches				Topography: Mixed Sloping																	
Annual Rainfall: 1,230 mm						Mean Annual Temperature: 27.7																			
Distribution of Land Use and Forest Type	Type	Natural Forest				Man-Made	Grazing forest	Agropas ture	Water Body	Others	Total														
		Conifer-ous	Broad-Leaved	Mixed	Mangrove																				
	(ha)	0	519	0	0	9	127	15,856	0	5,987	22,498														
	(%)	0.0	2.3	0.0	0.0	0.6	70.5	0.0	26.6	100.0															
Land Ownership	Category		<20Mz		20 - 100 Mz		100 - 500 Mz		500 Mz<		Total														
	Ratio of Households (%)		50.6		43.1		6.3		0		100.0														
	Average Area (ha)		9.1		44.9		157.8				33.9														
Main Agricultural Products	Product		Maize	Kidney Beans	Sorghum	Rice	Sesame	Others																	
	Cultivation Area (Mz)		3,198	2,296	620	184																			
Population (2000): 9,412				Population Density: 42/km ²				Annual Rate of Increase (1990 – 2000): 0.7%																	
Municipal Environment Office: Yes, 1 staff member						Municipal Environment Committee: Yes																			
Municipal Environment Plan (Natural Environment)																									
Forest destruction			<ul style="list-style-type: none"> ■ Technical and financial assistance for the owners of man-made forests to formulate and implement a management plan ■ Promotion of reforestation using local species ■ Reforestation to obtain firewood ■ Wide use of improved stoves ■ Coordination between related organizations for the application of environment-related laws, regulations and municipal ordinances ■ Permission for cutting for home consumption only ■ Participation of local residents in forest protection ■ Observation of environment-related laws and standards 																						
Insufficient education/training on use/management of natural resources			<ul style="list-style-type: none"> ■ Implementation of an environmental education programme at communities ■ Education for local administrative staff on environment-related laws, regulations and standards ■ Implementation of a participatory integrated project 																						
Inappropriate land use			<ul style="list-style-type: none"> ■ Education/training on appropriate production techniques ■ Implementation of soil conservation measures ■ Introduction of the agroforestry system ■ Introduction of green manure crops to improve the soil fertility ■ Cultivation suitable for the soil type 																						
Frequent outbreaks of forest fires			<ul style="list-style-type: none"> ■ Education/extension on forest fire prevention ■ Education/training on burning ■ Formation of a fire brigade 																						
Coordination with related organizations			<ul style="list-style-type: none"> ■ Consolidation of the office of the municipal environment committee ■ Strengthening of the functions of the municipal environment committee ■ Formulation and implementation of an action plan designed to facilitate coordination between the local organizations concerned 																						
Zoning																									
<table border="1"> <thead> <tr> <th colspan="2">Legend</th> </tr> </thead> <tbody> <tr> <td style="width: 30px; height: 15px; background: repeating-linear-gradient(45deg, transparent, transparent 2px, black 2px, black 4px);"></td> <td>Flat Zone</td> </tr> <tr> <td style="width: 30px; height: 15px; background: repeating-linear-gradient(90deg, transparent, transparent 2px, black 2px, black 4px);"></td> <td>Gentle Sloping Zone</td> </tr> <tr> <td style="width: 30px; height: 15px; background: repeating-linear-gradient(-45deg, transparent, transparent 2px, black 2px, black 4px);"></td> <td>Mixed Sloping Zone</td> </tr> <tr> <td style="width: 30px; height: 15px; background: repeating-linear-gradient(-90deg, transparent, transparent 2px, black 2px, black 4px);"></td> <td>Steep Sloping Zone</td> </tr> <tr> <td style="width: 30px; height: 15px; background: radial-gradient(circle, black 1px, transparent 1px); background-size: 4px 4px;"></td> <td>Priority Forest Conservation Area</td> </tr> <tr> <td style="width: 30px; height: 15px; background: radial-gradient(circle, black 1px, transparent 1px); background-size: 8px 8px;"></td> <td>Hazardous Area for Collapse</td> </tr> </tbody> </table>												Legend			Flat Zone		Gentle Sloping Zone		Mixed Sloping Zone		Steep Sloping Zone		Priority Forest Conservation Area		Hazardous Area for Collapse
Legend																									
	Flat Zone																								
	Gentle Sloping Zone																								
	Mixed Sloping Zone																								
	Steep Sloping Zone																								
	Priority Forest Conservation Area																								
	Hazardous Area for Collapse																								




Note : The areas for land use and forest type distribution are estimated based on the land use and forest type map and the totals slightly differ from the official figures.

Project Components				
Natural Forest Management Plan	Plan Contents	<ul style="list-style-type: none"> Main target sites: mountainous areas from the west to the north Forest inventory/formulation of a forest management plan Enrichment: 200 trees/ha Introduction of firebreaks 		
	Quantities and Costs	<ul style="list-style-type: none"> Forest inventory/formulation of a forest management plan: 780ha; US\$7,800 Enrichment: 780ha; 156,000 seedlings; US\$16,380 Introduction of firebreaks: 780ha; US\$56,160 	Sub-Total Cost US\$ 80,300	
Reforestation Plan	Plan Contents	<ul style="list-style-type: none"> Main target sites: agropastoral land in the mountainous areas from the west to the north Main planting species: Leucaena, Madero Negro Number of seedlings to be planted: 1,110 seedlings/ha 		
	Quantities and Costs	<ul style="list-style-type: none"> Planting area: 180ha Required number of seedlings: 240,000 	Sub-Total Cost US\$ 166,700	
Soil Conservation Plan	Agroforestry	Plan Contents	<ul style="list-style-type: none"> Farmland Mixed Sloping Zone: live fencing; contour hedgerows; earth ridges; rock ridges Change to permanent farming Pasture: planting of shade trees; live fencing 	
		Quantities and Costs	<ul style="list-style-type: none"> Farmland: 760ha; 255,000 seedlings; US\$176,320 Change to permanent farming: 180ha; US\$35,170 Pasture: 2,500ha; 405,000 seedlings; US\$203,750 	Sub-Total Cost US\$ 415,200
	Erosion Control Work	Plan Contents	<ul style="list-style-type: none"> Check dams: dry masonry dams; fence dams Retaining walls; dry masonry works; fencing works Slope protection: covering works 	
		Quantities and Costs	<ul style="list-style-type: none"> Dry masonry dams: 267; US\$4,750 Fence dams: 89; US\$1,320 Dry masonry works: 178; US\$2,100 Fencing works: 89; US\$1,320 Covering works: 89; US\$1,320 	Sub-Total Cost US\$ 10,800
Livelihood Improvement Plan	Plan Contents	<ul style="list-style-type: none"> Improvement of living: home garden and improved stoves Improvement of production techniques: introduction of the gravity-type simple watering system, diversification of crops and production of compost Improvement of grazing techniques: introduction of improved grass 		
	Quantities and Costs	<ul style="list-style-type: none"> Home gardens: 12ha; 1,200 seedlings; US\$4,320 Improved stoves: 120; US\$20,260 Installation of gravity type simple watering systems: 90ha; US\$11,670 Diversification of crops: 150ha; US\$61,230 Production of compost: 150site; US\$29,310 Introduction of improved grass: 250ha; US\$61,230 	Sub-Total Cost US\$ 188,000	
Implementation System Development Plan	Plan Contents	<p>(Municipal Forest and Environment Section)</p> <ul style="list-style-type: none"> Increase of staff and their education/training Coordination with the Municipal Development Plan Technical support for communities Education of local residents on forests and the environment Guidance on the operation and management of community organizations Training of promoters <p>(Municipal Environment Committee)</p> <ul style="list-style-type: none"> Reorganization and consolidation of the municipal environment committee (reorganization of the participating organizations and definition of their respective roles) Guidance for the municipal forest and environment section) Strengthening of the coordination and exchange of opinions with related organizations and NGOs (INAFOR) Deployment of an INAFOR official (León Office) Technical guidance and financial support for the municipal forest and environment section 		
Total Cost			US\$ 861,000	

Forest Management Plan for Disaster Prevention											
Department: LEÓN						Municipality: EL JICARAL					
Drainage Basin: Lake Managua				Location in Basin: Middle Reaches				Topography: Flat-Mixed Sloping			
Annual Rainfall: 1,179mm						Mean Annual Temperature: 27.7					
Distribution of Land Use and Forest Type	Type	Natural Forest				Man-Made	Grazing forest	Agropas ture	Water Body	Others	Total
		Conifer-ous	Broad-Leaved	Mixed	Mangrove						
	(ha)	0	6,411	0	0	32	7,530	11,499	723	17,464	43,659
	(%)	0.0	14.7	0.0	0.0	0.1	17.2	26.3	1.7	40.0	100.0
Land Ownership	Category		<20Mz		20 - 100 Mz		100 - 500 Mz		500 Mz<		Total
	Ratio of Households (%)		49.0		40.3		8.5		2.2		100.0
	Average Area (ha)		9.0		47.4		184.0		1,679.2		77.0
Main Agricultural Products	Product		Maize	Kidney Beans	Sorghum	Rice		Sesame		Others	
	Cultivation Area (Mz)		1,362	209	718	23					
Population (2000): 12,398				Population Density: 28/km ²				Annual Rate of Increase (1990 – 2000): 5.2%			
Municipal Environment Office: Yes, 1 staff member						Municipal Environment Committee: Yes					
Municipal Environment Plan (Natural Environment)											
Insufficient education/training on the use and management of natural resources			<ul style="list-style-type: none"> ■ Implementation of an environmental education programme in communities ■ Education for local residents on the use of forests and other natural resources ■ Education for local administrative organizations on environment-related laws, regulations and municipal ordinances ■ Implementation of a participatory integrated project 								
Forest destruction			<ul style="list-style-type: none"> ■ Implementation of a reforestation project along Sinecapa River ■ Reforestation using multi-purpose species ■ Coordination between the local organizations concerned for the application of environment-related laws, regulations and municipal ordinances ■ Technical and financial assistance for the owners of man-made forests to implement the management plan ■ Permission for cutting for home consumption only ■ Participation of local residents in forest protection 								
Low level of interest in the environment among local residents			<ul style="list-style-type: none"> ■ Participation of local residents in environmental and natural resources protection ■ Implementation of environmental education ■ Strengthening of the local organization for environmental control ■ Implementation of municipal discussion meetings on the environment 								
Zoning											

Note : The areas for land use and forest type distribution are estimated based on the land use and forest type map and the totals slightly differ from the official figures.

Project Components				
Natural Forest Management Plan	Plan Contents	<ul style="list-style-type: none"> Main target sites: mountainous areas in the north Forest inventory/formulation of a forest management plan Enrichment: 200 trees/ha Introduction of firebreaks 		
	Quantities and Costs	<ul style="list-style-type: none"> Forest inventory/formulation of a forest management plan: 550ha; US\$5,500 Enrichment: 550ha; 110,000 seedlings; US\$11,550 Introduction of firebreaks: 550ha; US\$39,600 	Sub-Total Cost US\$ 56,700	
Reforestation Plan	Plan Contents	<ul style="list-style-type: none"> Main target sites: agropastoral land in mountainous areas in the north Main planting species: Leucaena, Madero Negro Number of seedlings to be planted: 1,110 seedlings/ha 		
	Quantities and Costs	<ul style="list-style-type: none"> Planting area: 50ha Required number of seedlings: 67,000 	Sub-Total Cost US\$ 46,300	
Soil Conservation Plan	Agroforestry	Plan Contents	<ul style="list-style-type: none"> Farmland Mixed Sloping Zone: live fencing; contour hedgerows; earth ridges; rock ridges Change to permanent farming Pasture: planting of shade trees; live fencing 	
		Quantities and Costs	<ul style="list-style-type: none"> Farmland: 200ha; 67,000seedlings; US\$46,400 Change to permanent farming: 50ha; US\$9,770 Pasture: 500ha; 81,000 seedlings; US\$40,750 	Sub-Total Cost US\$ 96,900
	Erosion Control Work	Plan Contents	<ul style="list-style-type: none"> Check dams: dry masonry dams; fence dams Retaining walls; dry masonry works; gabion works; fencing works Slope protection: covering works 	
		Quantities and Costs	<ul style="list-style-type: none"> Dry masonry dams: 404; US\$7,200 Fence dams: 202; US\$2,990 Dry masonry works: 303; US\$3,570 Gabion works: 202; US\$17,450 Fencing works: 202; US\$2,990 Covering works: 101; US\$1,490 	Sub-Total Cost US\$35,700
Livelihood Improvement Plan	Plan Contents	<ul style="list-style-type: none"> Improvement of living: home garden and improved stoves Improvement of production techniques: introduction of the gravity-type simple watering system, diversification of crops and production of compost Improvement of grazing techniques: introduction of improved grass 		
	Quantities and Costs	<ul style="list-style-type: none"> Home gardens: 9ha; 900 seedlings; US\$3,240 Improved stoves: 90; US\$15,190 Installation of gravity type simple watering systems: 25ha; US\$3,240 Diversification of crops: 40ha; US\$16,330 Production of compost: 40site; US\$7,820 Introduction of improved grass: 50ha; US\$12,250 	Sub-Total Cost US\$ 58,100	
Implementation System Development Plan	Plan Contents	<p>(Municipal Forest and Environment Section)</p> <ul style="list-style-type: none"> Increase of staff and their education/training Coordination with the Municipal Development Plan Technical support for communities Education of local residents on forests and the environment Guidance on the operation and management of community organizations Training of promoters <p>(Municipal Environment Committee)</p> <ul style="list-style-type: none"> Reorganization and consolidation of the municipal environment committee (reorganization of the participating organizations and definition of their respective roles) Guidance for the municipal forest and environment section) Strengthening of the coordination and exchange of opinions with related organizations and NGOs <p>(INAFOR)</p> <ul style="list-style-type: none"> Deployment of an INAFOR official (León Office) Technical guidance and financial support for the municipal forest and environment section 		
Total Cost			US\$ 293,700	

Forest Management Plan for Disaster Prevention																							
Department: LEÓN						Municipality: LARREYNAGA																	
Drainage Basin: Lake Managua				Location in Basin: Middle Reaches				Topography: Flat															
Annual Rainfall: 1,179mm						Mean Annual Temperature: 27.3																	
Distribution of Land Use and Forest Type	Type	Natural Forest				Man-Made	Grazing forest	Agropas ture	Water Body	Others	Total												
		Conifer-ous	Broad-Leaved	Mixed	Mangrove																		
	(ha)	0	10,132	0	0	427	19,312	26,764	34	17,670	74,339												
(%)	0.0	13.6	0.0	0.0	0.6	26.0	36.0	0.0	23.8	100.0													
Land Ownership	Category		<20Mz		20 - 100 Mz		100 - 500 Mz		500 Mz<		Total												
	Ratio of Households (%)		50.3		35.5		11.2		3.0		100.0												
	Average Area (ha)		8.8		43.6		220.2		1,044.5		75.8												
Main Agricultural Products	Product		Maize	Kidney Beans	Sorghum	Rice	Sesame	Others															
	Cultivation Area (Mz)		7,462	66	5,082	185																	
Population (2000): 30,722				Population Density: 41/km ²				Annual Rate of Increase (1990 – 2000): 0.7%															
Municipal Environment Office: Yes, 1 staff member						Municipal Environment Committee: Yes																	
Municipal Environment Plan (Natural Environment)																							
Forest destruction			<ul style="list-style-type: none"> ■ Promotion of reforestation using local species ■ Technical and financial assistance for the owners of man-made forests to formulate and implement a management plan ■ Reforestation to obtain firewood ■ Wide use of improved stoves ■ Participation of local residents in forest protection ■ Coordination between the related organizations for the application of environment-related laws, regulations and municipal ordinances ■ Observation of forest-related laws, regulations and municipal ordinances 																				
Frequent outbreaks of forest fires			<ul style="list-style-type: none"> ■ Workshop on forest fire prevention and control targeting local residents ■ Formation of a fire brigade ■ Education/extension on forest fire prevention 																				
Decline of the soil fertility			<ul style="list-style-type: none"> ■ Introduction of the agroforestry system ■ Introduction of green manure crops to improve the soil fertility ■ Implementation of soil conservation measures ■ Education/training for producers on appropriate production techniques 																				
Extinction of wild animals			<ul style="list-style-type: none"> ■ Introduction of facilities to control hunting ■ Introduction of a closed season ■ Prohibition of the catching and sale of wild animals ■ Establishment of shelters for wild animals ■ Establishment of wild animal breeding facilities 																				
Coordination with the related organizations			<ul style="list-style-type: none"> ■ Strengthening of the functions of the municipal environment committee ■ Establishment of a municipal environment section ■ Coordination of environmental actions between local leaders under the guidance of the municipal environment committee 																				
Zoning																							
																							
											<p>Legend</p> <table border="1"> <tr> <td></td> <td>Flat Zone</td> </tr> <tr> <td></td> <td>Gentle Sloping Zone</td> </tr> <tr> <td></td> <td>Mixed Sloping Zone</td> </tr> <tr> <td></td> <td>Steep Sloping Zone</td> </tr> <tr> <td></td> <td>Priority Forest Conservation Area</td> </tr> <tr> <td></td> <td>Hazardous Area for Collapse</td> </tr> </table>		Flat Zone		Gentle Sloping Zone		Mixed Sloping Zone		Steep Sloping Zone		Priority Forest Conservation Area		Hazardous Area for Collapse
	Flat Zone																						
	Gentle Sloping Zone																						
	Mixed Sloping Zone																						
	Steep Sloping Zone																						
	Priority Forest Conservation Area																						
	Hazardous Area for Collapse																						

Note : The areas for land use and forest type distribution are estimated based on the land use and forest type map and the totals slightly differ from the official figures.

Project Components			
Natural Forest Management Plan	Plan Contents	<ul style="list-style-type: none"> Main target sites: northern foot of Mt. El Hoyo and the boundary area with El Sauce Forest inventory/formulation of a forest management plan Enrichment: 200 trees/ha Introduction of firebreaks 	
	Quantities and Costs	<ul style="list-style-type: none"> Forest inventory/formulation of a forest management plan: 840ha; US\$8,400 Enrichment: 840ha; 168,000 seedlings; US\$17,640 Introduction of firebreaks: 840ha; US\$60,480 	Sub-Total Cost US\$ 86,500
Reforestation Plan	Plan Contents	<ul style="list-style-type: none"> Main target sites: agropastoral land on the northeastern hillside and foot of Mt. Telica Main planting species: Eucalyptus, Neem Number of seedlings to be planted: 1,110 seedlings/ha 	
	Quantities and Costs	<ul style="list-style-type: none"> Planting area: 400ha Required number of seedlings: 533,000 	Sub-Total Cost US\$ 370,500
Soil Conservation Plan	Agroforestry	Plan Contents	<ul style="list-style-type: none"> Farmland Mixed Sloping Zone: live fencing; contour hedgerows; earth ridges; rock ridges Change to permanent farming Pasture: planting of shade trees; live fencing
		Quantities and Costs	<ul style="list-style-type: none"> Farmland: 100ha; 34,000 seedlings; US\$23,200 Change to permanent farming: 25ha; US\$4,890 Pasture: 240ha; 39,000 seedlings; US\$19,570
	Erosion Control Work	Plan Contents	<ul style="list-style-type: none"> Check dams: dry masonry dams; fence dams Retaining walls; dry masonry works; fencing works Slope protection: covering works
		Quantities and Costs	<ul style="list-style-type: none"> Dry masonry dams: 484; US\$8,620 Fence dams: 242; US\$3,590 Dry masonry works: 363; US\$4,290 Fencing works: 242; US\$3,590 Covering works: 121; US\$1,780
Livelihood Improvement Plan	Plan Contents	<ul style="list-style-type: none"> Improvement of living: home garden and improved stoves Improvement of production techniques: introduction of the gravity-type simple watering system, diversification of crops and production of compost Improvement of grazing techniques: introduction of improved grass 	
	Quantities and Costs	<ul style="list-style-type: none"> Home gardens: 10ha; 1,000 seedlings; US\$3,600 Improved stoves: 100; US\$16,860 Installation of gravity type simple watering systems: 13ha; US\$1,680 Diversification of crops: 20ha; US\$8,160 Production of compost: 20site; US\$3,910 Introduction of improved grass: 24ha; US\$5,880 	Sub-Total Cost US\$ 40,100
Implementation System Development Plan	Plan Contents	<p>(Municipal Forest and Environment Section)</p> <ul style="list-style-type: none"> Increase of staff and their education/training Coordination with the Municipal Development Plan Technical support for communities Education of local residents on forests and the environment Guidance on the operation and management of community organizations Training of promoters <p>(Municipal Environment Committee)</p> <ul style="list-style-type: none"> Reorganization and consolidation of the municipal environment committee (reorganization of the participating organizations and definition of their respective roles) Guidance for the municipal forest and environment section) Strengthening of the coordination and exchange of opinions with related organizations and NGOs (INAFOR) Deployment of an INAFOR official (León Office) Technical guidance and financial support for the municipal forest and environment section 	
Total Cost		US\$ 566,700	

Forest Management Plan for Disaster Prevention																							
Department: LEÓN						Municipality: TELICA																	
Drainage Basin: Pacific Coast				Location in Basin: Middle/Upper Reaches				Topography: Flat-Gently Sloping															
Annual Rainfall: 1,501mm						Mean Annual Temperature: 27.3																	
Distribution of Land Use and Forest Type	Type	Natural Forest				Man-Made	Grazing forest	Agropas ture	Water Body	Others	Total												
		Conifer-ous	Broad-Leaved	Mixed	Mangrove																		
	(ha)	0	6,733	0	0	70	4,436	17,944	31	10,069	39,283												
	(%)	0.0	17.1	0.0	0.0	0.2	11.3	45.7	0.1	25.6	100.0												
Land Ownership	Category		<20Mz		20 - 100 Mz		100 - 500 Mz		500 Mz<		Total												
	Ratio of Households (%)		71.1		22.1		5.2		1.6		100.0												
	Average Area (ha)		7.2		43.8		215.8		838.2		39.4												
Main Agricultural Products	Product		Maize	Kidney Beans	Sorghum	Rice	Sesame	Others															
	Cultivation Area (Mz)		3,625	970	775	101																	
Population (2000): 23,546				Population Density: 60/km ²				Annual Rate of Increase (1990 – 2000): 0.8%															
Municipal Environment Office: Yes, 1 staff member						Municipal Environment Committee: Yes																	
Municipal Environment Plan (Natural Environment)																							
Forest destruction			<ul style="list-style-type: none"> ■ Promotion of reforestation using local species ■ Education/training for the owners of man-made forests on the use of man-made forests ■ Technical and financial assistance for the owners of man-made forests to formulate and implement a management plan ■ Reforestation to obtain firewood ■ Participation of local residents in forest protection ■ Coordination between the related organizations for the application of environment-related laws, regulations and municipal ordinances ■ Observation of environment-related laws, regulations and municipal ordinances 																				
Forest fires			<ul style="list-style-type: none"> ■ Workshop on forest fire prevention and control targeting local residents ■ Formation of a fire brigade ■ Education/extension on forest fire prevention ■ Education/training on the techniques and standards for forest fire prevention ■ Observation of environment-related laws, regulations and municipal ordinances 																				
Decline of the soil fertility			<ul style="list-style-type: none"> ■ Technical assistance for producers for sustainable farming ■ Introduction of the agroforestry system ■ Use of green manure crops to improve the soil fertility ■ Implementation of soil conservation measures 																				
Zoning																							
<p style="text-align: center;">Legend</p> <table border="1" style="margin-left: auto; margin-right: auto;"> <tr> <td></td> <td>Flat Zone</td> </tr> <tr> <td></td> <td>Gentle Sloping Zone</td> </tr> <tr> <td></td> <td>Mixed Sloping Zone</td> </tr> <tr> <td></td> <td>Steep Sloping Zone</td> </tr> <tr> <td></td> <td>Priority Forest Conservation Area</td> </tr> <tr> <td></td> <td>Hazardous Area for Collapse</td> </tr> </table>													Flat Zone		Gentle Sloping Zone		Mixed Sloping Zone		Steep Sloping Zone		Priority Forest Conservation Area		Hazardous Area for Collapse
	Flat Zone																						
	Gentle Sloping Zone																						
	Mixed Sloping Zone																						
	Steep Sloping Zone																						
	Priority Forest Conservation Area																						
	Hazardous Area for Collapse																						

Note : The areas for land use and forest type distribution are estimated based on the land use and forest type map and the totals slightly differ from the official figures.

Project Components				
Natural Forest Management Plan	Plan Contents	<ul style="list-style-type: none"> Main target sites: hillsides and foot of Mt. Telica and foot of Mt. Cerro Negro Forest inventory/formulation of a forest management plan Enrichment: 200 trees/ha Introduction of firebreaks 		
	Quantities and Costs	<ul style="list-style-type: none"> Forest inventory/formulation of a forest management plan: 280ha; US\$2,800 Enrichment: 280ha; 56,000 seedlings; US\$5,880 Introduction of firebreaks: 280ha; US\$20,160 	Sub-Total Cost US\$ 28,800	
Reforestation Plan	Plan Contents	<ul style="list-style-type: none"> Main target sites: agropastoral land at the hillsides and foot of Mt. Telica and the foot of Mt. Cerro Negro Main planting species: Steep sloping zone: Leucaena, Madero Negro Gentle sloping zone: Eucalyptus, Neem Number of seedlings to be planted: 1,110 seedlings/ha 		
	Quantities and Costs	<ul style="list-style-type: none"> Planting area: 200ha Required number of seedlings: 266,000 	Sub-Total Cost US\$ 185,300	
Soil Conservation Plan	Agroforestry	Plan Contents	<ul style="list-style-type: none"> Farmland Gentle sloping zone: live fencing; earth ridges Steep sloping zone: contour hedgerows; rock ridges Change to permanent farming Pasture: planting of shade trees; live fencing 	
		Quantities and Costs	<ul style="list-style-type: none"> Farmland: 870ha; 280,000 seedlings; US\$190,370 Change to permanent farming: 207ha; US\$40,450 Pasture: 280ha; 45,000 seedlings; US\$22,820 	Sub-Total Cost US\$ 253,600
	Erosion Control Work	Plan Contents	<ul style="list-style-type: none"> Check dams: dry masonry dams; fence dams Retaining walls; dry masonry works; gabion works; fencing works Slope protection: covering works 	
		Quantities and Costs	<ul style="list-style-type: none"> Dry masonry dams: 440; US\$7,830 Fence dams: 176; US\$2,600 Dry masonry works: 352; US\$4,160 Gabion works: 264; US\$22,810 Fencing works: 175; US\$2,600 Covering works: 88; US\$1,290 	Sub-Total Cost US\$ 41,300
Livelihood Improvement Plan	Plan Contents	<ul style="list-style-type: none"> Improvement of living: home garden and improved stoves Improvement of production techniques: introduction of the gravity-type simple watering system, diversification of crops and production of compost Improvement of grazing techniques: introduction of improved grass 		
	Quantities and Costs	<ul style="list-style-type: none"> Home gardens: 13ha; 1,300 seedlings; US\$4,680 Improved stoves: 130; US\$21,940 Installation of gravity type simple watering systems: 104ha; US\$13,490 Diversification of crops: 175ha; US\$71,440 Production of compost: 175site; US\$34,200 Introduction of improved grass: 28ha; US\$6,860 	Sub-Total Cost US\$ 152,600	
Implementation System Development Plan	Plan Contents	<p>(Municipal Forest and Environment Section)</p> <ul style="list-style-type: none"> Increase of staff and their education/training Coordination with the Municipal Development Plan Technical support for communities Education of local residents on forests and the environment Guidance on the operation and management of community organizations Training of promoters <p>(Municipal Environment Committee)</p> <ul style="list-style-type: none"> Reorganization and consolidation of the municipal environment committee (reorganization of the participating organizations and definition of their respective roles) Guidance for the municipal forest and environment section) Strengthening of the coordination and exchange of opinions with related organizations and NGOs (INAFOR) Deployment of an INAFOR official (León Office) Technical guidance and financial support for the municipal forest and environment section 		
Total Cost			US\$661,600	

Forest Management Plan for Disaster Prevention												
Department: LEÓN						Municipality: QUEZALGUAQUE						
Drainage Basin: Pacific Coast				Location in Basin: Middle Reaches				Topography: Flat				
Annual Rainfall: 1,326mm						Mean Annual Temperature: 27.3						
Distribution of Land Use and Forest Type	Type	Natural Forest				Man-Made	Grazing forest	Agropas ture	Water Body	Others	Total	
		Conifer-ous	Broad-Leaved	Mixed	Mangrove							
	(ha)	0	560	0	0	268	0	6,577	0	953	8,358	
	(%)	0.0	6.7	0.0	0.0	3.2	0.0	78.7	0.0	11.4	100.0	
Land Ownership	Category		<20Mz		20 - 100 Mz		100 - 500 Mz		500 Mz<		Total	
	Ratio of Households (%)		83.8		11.7		4.1		0.4		100.0	
	Average Area (ha)		5.8		45.2		177.4		800.0		20.5	
Main Agricultural Products	Product		Maize		Kidney Beans		Sorghum		Rice		Sesame	Others
	Cultivation Area (Mz)		572		79		699		25			
Population (2000): 9,054				Population Density: 108/km ²				Annual Rate of Increase (1990 – 2000): 2.9%				
Municipal Environment Office: Yes, 1 staff member						Municipal Environment Committee: Yes						
Municipal Environment Plan (Natural Environment)												
Unregulated use of natural resources			<ul style="list-style-type: none"> ■ Wide understanding of environment-related laws, regulations and municipal ordinances ■ Education for local administrative staff on laws and regulations ■ Strengthening of the ability of organizations regulating the use of natural resources and the environment ■ Establishment of facilities for control ■ Coordination between the municipal environment committee and local organizations ■ Establishment of a municipal environment section ■ Strengthening of the municipal environment committee 									
Forest destruction and decline of the soil fertility			<ul style="list-style-type: none"> ■ Promotion of reforestation ■ Economic and financial assistance for the implementation of the forest management plan ■ Introduction of the agroforestry system ■ Coordination between the related organizations for the application of environment-related laws, regulations and municipal ordinances ■ Construction of soil conservation structures ■ Introduction of green manure crops to improve the soil fertility ■ Preparation and approval of a law relating to land use 									
Low level of interest in the environment and natural resources among local residents			<ul style="list-style-type: none"> ■ Promotion of the development and conservation of natural forests and provision of loans for forest owners ■ Certification of persons promoting environmental protection ■ Reduction of the fixed property tax for the purposes of natural forest conservation and reforestation 									
Zoning												


Note : The areas for land use and forest type distribution are estimated based on the land use and forest type map and the totals slightly differ from the official figures.

Project Components				
Reforestation Plan	Plan Contents	<ul style="list-style-type: none"> Main target sites: agropastoral land at the foot of Mt. Telica Main planting species: Gentle sloping zone: Leucaena, Madero Negro Flat Zone: Eucalyptus, Neem Number of seedlings to be planted: 1,110 seedlings/ha 		
	Quantities and Costs	<ul style="list-style-type: none"> Planting area: 190ha Required number of seedlings: 253,000 	Sub-Total Cost US\$ 176,000	
Soil Conservation Plan	Agroforestry	Plan Contents	<ul style="list-style-type: none"> Farmland Gentle sloping zone: live fencing; earth ridges Change to permanent farming Pasture: planting of shade trees; live fencing 	
		Quantities and Costs	<ul style="list-style-type: none"> Farmland: 110ha; 33,000 seedlings; US\$20,820 Change to permanent farming: 26ha; US\$5,080 Pasture: 20ha; 3,000 seedlings; US\$1,630 	Sub-Total Cost US\$ 27,500
	Erosion Control Work	Plan Contents	<ul style="list-style-type: none"> Check dams: dry masonry dams; fence dams Retaining walls; dry masonry works; fencing works Slope protection: covering works 	
		Quantities and Costs	<ul style="list-style-type: none"> Dry masonry dams: 50; US\$890 Fence dams: 50; US\$730 Dry masonry works: 40; US\$470 Fencing works: 40; US\$600 Covering works: 10; US\$140 	Sub-Total Cost US\$ 2,800
Livelihood Improvement Plan	Plan Contents	<ul style="list-style-type: none"> Improvement of living: home garden and improved stoves Improvement of production techniques: introduction of the gravity-type simple watering system, diversification of crops and production of compost Improvement of grazing techniques: introduction of improved grass 		
	Quantities and Costs	<ul style="list-style-type: none"> Home gardens: 2ha; 200 seedlings; US\$720 Improved stoves: 20; US\$3,380 Installation of gravity type simple watering systems: 13ha; US\$1,690 Diversification of crops: 20ha; US\$8,160 Production of compost: 20site; US\$3,910 Improved grass: 2ha; US\$490 	Sub-Total Cost US\$ 18,400	
Implementation System Development Plan	Plan Contents	<p>(Municipal Forest and Environment Section)</p> <ul style="list-style-type: none"> Increase of staff and their education/training Coordination with the Municipal Development Plan Technical support for communities Education of local residents on forests and the environment Guidance on the operation and management of community organizations Training of promoters <p>(Municipal Environment Committee)</p> <ul style="list-style-type: none"> Reorganization and consolidation of the municipal environment committee (reorganization of the participating organizations and definition of their respective roles) Guidance for the municipal forest and environment section) Strengthening of the coordination and exchange of opinions with related organizations and NGOs (INAFOR) Deployment of an INAFOR official (León Office) Technical guidance and financial support for the municipal forest and environment section 		
Total Cost			US\$ 224,700	

Forest Management Plan for Disaster Prevention																									
Department: LEÓN						Municipality: LEÓN																			
Drainage Basin: Pacific Coast				Location in Basin: Lower to Upper Reaches				Topography: Gently Sloping																	
Annual Rainfall: 1,470mm						Mean Annual Temperature: 27.3																			
Distribution of Land Use and Forest Type	Type	Natural Forest				Man-Made	Grazing forest	Agropas ture	Water Body	Others	Total														
		Conifer-ous	Broad-Leaved	Mixed	Mangrove																				
	(ha)	26	4,759	0	4,275	1,353	12,640	39,112	1,817	17,533	81,515														
	(%)	0.0	5.8	0.0	5.2	1.7	15.5	48.0	2.2	21.6	100.0														
Land Ownership	Category		<20Mz		20 - 100 Mz		100 - 500 Mz		500 Mz<		Total														
	Ratio of Households (%)		70.5		21.5		6.8		1.2		100.0														
	Average Area (ha)		6.8		44.2		214.8		1,047.2		41.6														
Main Agricultural Products	Product		Maize		Kidney Beans		Sorghum		Rice		Sesame	Others													
	Cultivation Area (Mz)		6,167		630		5,419		532																
Population (2000): 181,927 人				Population Density: 223/km ²				Annual Rate of Increase (1990 - 2000): 2.7 %																	
Municipal Environment Office: Yes, 5 staff members						Municipal Environment Committee: Yes																			
Municipal Environment Plan (Natural Environment)																									
Consolidation of environmental education			<ul style="list-style-type: none"> ■ Increase of citizens' participation in environmental and natural resources protection ■ Strengthening of the local organization for environmental control ■ Development and implementation of an environmental education programme ■ Municipal environment forum ■ Joint events on the environment with neighbouring communities ■ Introduction of an Environment Day 																						
Inappropriate land use			<ul style="list-style-type: none"> ■ Enactment of a law relating to land use ■ Formulation and application of a development plan to determine land use ■ Technical guidance ■ Introduction of the agroforestry system ■ Use of green manure crops to improve the soil fertility ■ Education/training on appropriate land use 																						
Zoning																									
<table border="1"> <thead> <tr> <th colspan="2">Legend</th> </tr> </thead> <tbody> <tr> <td></td> <td>Flat Zone</td> </tr> <tr> <td></td> <td>Gentle Sloping Zone</td> </tr> <tr> <td></td> <td>Mixed Sloping Zone</td> </tr> <tr> <td></td> <td>Steep Sloping Zone</td> </tr> <tr> <td></td> <td>Priority Forest Conservation Area</td> </tr> <tr> <td></td> <td>Hazardous Area for Collapse</td> </tr> </tbody> </table>												Legend			Flat Zone		Gentle Sloping Zone		Mixed Sloping Zone		Steep Sloping Zone		Priority Forest Conservation Area		Hazardous Area for Collapse
Legend																									
	Flat Zone																								
	Gentle Sloping Zone																								
	Mixed Sloping Zone																								
	Steep Sloping Zone																								
	Priority Forest Conservation Area																								
	Hazardous Area for Collapse																								

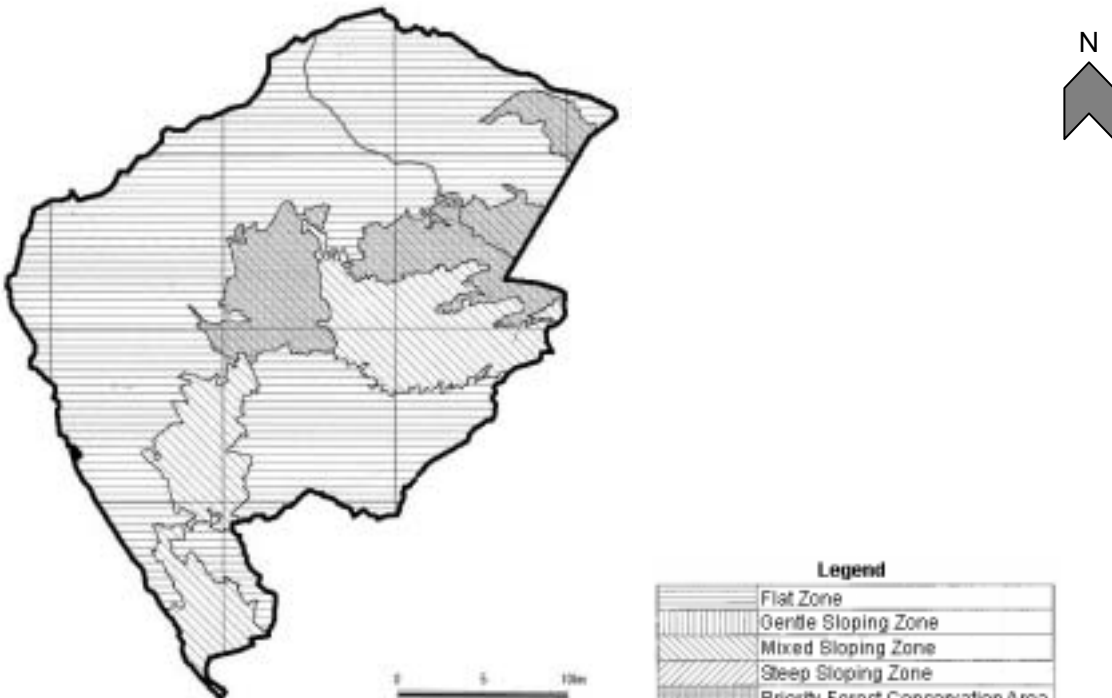
Note : The areas for land use and forest type distribution are estimated based on the land use and forest type map and the totals slightly differ from the official figures.

Project Components			
Natural Forest Management Plan	Plan Contents	<ul style="list-style-type: none"> Main target sites: foot of Mt. Cerro Negro and Mt. Las Pilas Forest inventory/formulation of a forest management plan Enrichment: 200 trees/ha Introduction of firebreaks 	
	Quantities and Costs	<ul style="list-style-type: none"> Forest inventory/formulation of a forest management plan: 70ha; US\$700 Enrichment: 70ha; 14,000 seedlings; US\$1,470 Introduction of firebreaks: 70ha; US\$5,040 	
		Sub-Total Cost US\$ 7,200	
Reforestation Plan	Plan Contents	<ul style="list-style-type: none"> Main target sites: agropastoral land at the foot of Mt. Cerro Negro and Mt. Las Pilas Main planting species: Steep sloping zone: Leucaena, Madero Negro Gentle sloping zone: Eucalyptus, Neem Flat Zone: Eucalyptus, Neem Number of seedlings to be planted: 1,110 seedlings/ha 	
	Quantities and Costs	<ul style="list-style-type: none"> Planting area: 1,280ha Required number of seedlings: 1,705,000 	
		Sub-Total Cost US\$ 1,185,700	
Soil Conservation Plan	Agroforestry	Plan Contents	<ul style="list-style-type: none"> Farmland Gentle sloping zone: live fencing; earth ridges Steep sloping zone: contour hedgerows; rock ridges Change to permanent farming Pasture: planting of shade trees; live fencing
		Quantities and Costs	<ul style="list-style-type: none"> Farmland: 310ha; 98,000 seedlings; US\$65,340 Change to permanent farming: 72ha; US\$14,070 Pasture: 60ha; 10,000 seedlings; US\$4,890
	Erosion Control Work	Plan Contents	<ul style="list-style-type: none"> Check dams: dry masonry dams; fence dams Retaining walls; dry masonry works; fencing works Slope protection: covering works
		Quantities and Costs	<ul style="list-style-type: none"> Dry masonry dams: 465; US\$8,280 Fence dams: 186; US\$2,750 Dry masonry works: 372; US\$4,390 Fencing works: 186; US\$2,750 Covering works: 93; US\$1,370
		Sub-Total Cost US\$ 19,500	
Livelihood Improvement Plan	Plan Contents	<ul style="list-style-type: none"> Improvement of living: home garden and improved stoves Improvement of production techniques: introduction of the gravity-type simple watering system, diversification of crops and production of compost Improvement of grazing techniques: introduction of improved grass 	
	Quantities and Costs	<ul style="list-style-type: none"> Home gardens: 9ha; 900 seedlings; US\$3,240 Improved stoves: 90; US\$15,190 Installation of gravity type simple watering systems: 36ha; US\$4,670 Diversification of crops: 60ha; US\$24,490 Production of compost: 60site; US\$11,720 Introduction of improved grass: 6ha; US\$1,470 	
		Sub-Total Cost US\$ 60,800	
Implementation System Development Plan	Plan Contents	<p>(Municipal Forest and Environment Section)</p> <ul style="list-style-type: none"> Education/training for staff Increase of staff and their education/training Coordination with the Municipal Development Plan Technical support for communities Education of local residents on forests and the environment Guidance on the operation and management of community organizations Training of promoters <p>(Municipal Environment Committee)</p> <ul style="list-style-type: none"> Reorganization and consolidation of the municipal environment committee (reorganization of the participating organizations and definition of their respective roles) Guidance for the municipal forest and environment section) Strengthening of the coordination and exchange of opinions with related organizations and NGOs <p>(INAFOR)</p> <ul style="list-style-type: none"> Deployment of an INAFOR official (León Office) Technical guidance and financial support for the municipal forest and environment section 	
Total Cost		US\$ 1,357,500	

Forest Management Plan for Disaster Prevention																									
Department: LEÓN						Municipality: LA PAZ CENTRO																			
Drainage Basin: Pacific Coast				Location in Basin: Middle Reaches				Topography: Flat-Gently Sloping																	
Annual Rainfall: 1,181mm						Mean Annual Temperature: 28.5																			
Distribution of Land Use and Forest Type	Type	Natural Forest				Man-Made	Grazing forest	Agropasture	Water Body	Others	Total														
		Conifer-ous	Broad-Leaved	Mixed	Mangrove																				
	(ha)	0	14,647	0.0	327	206	7,720	21,891	2,211	21,854	68,856														
	(%)	0.0	21.3	0.0	0.5	0.3	11.2	31.8	3.2	31.7	100.0														
Land Ownership	Category		<20Mz		20 - 100 Mz		100 - 500 Mz		500 Mz<		Total														
	Ratio of Households (%)		49.4		34.0		12.1		4.5		100.0														
	Average Area (ha)		10.0		43.9		227.3		1,432.8		112.1														
Main Agricultural Products	Product		Maize		Kidney Beans		Sorghum		Rice		Sesame	Others													
	Cultivation Area (Mz)		3,893		174		1,187		394																
Population (2000): 30,759				Population Density: 45/km ²				Annual Rate of Increase (1990 - 2000): 2.6%																	
Municipal Environment Office: Yes, 1 staff member						Municipal Environment Committee: Yes																			
Municipal Environment Plan (Natural Environment)																									
Consolidation of environmental education				<ul style="list-style-type: none"> ■ Promotion of citizens' participation in environmental and natural resources conservation ■ Development and implementation of an environmental education programme ■ Formulation of an environmental plan for each area and education for local residents on the environment 																					
Coordination between related organizations				<ul style="list-style-type: none"> ■ Development of the facilities of the municipal environment committee ■ Strengthening of the organization of and coordination between the local organizations concerned ■ Strengthening of the local organizations for environmental control 																					
Zoning																									
																									
<table border="1"> <thead> <tr> <th colspan="2">Legend</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;">[Horizontal lines]</td> <td>Flat Zone</td> </tr> <tr> <td style="text-align: center;">[Diagonal lines /]</td> <td>Gentle Sloping Zone</td> </tr> <tr> <td style="text-align: center;">[Diagonal lines \]</td> <td>Mixed Sloping Zone</td> </tr> <tr> <td style="text-align: center;">[Vertical lines]</td> <td>Steep Sloping Zone</td> </tr> <tr> <td style="text-align: center;">[Dotted pattern]</td> <td>Priority Forest Conservation Area</td> </tr> <tr> <td style="text-align: center;">[Cross-hatch pattern]</td> <td>Hazardous Area for Collapse</td> </tr> </tbody> </table>												Legend		[Horizontal lines]	Flat Zone	[Diagonal lines /]	Gentle Sloping Zone	[Diagonal lines \]	Mixed Sloping Zone	[Vertical lines]	Steep Sloping Zone	[Dotted pattern]	Priority Forest Conservation Area	[Cross-hatch pattern]	Hazardous Area for Collapse
Legend																									
[Horizontal lines]	Flat Zone																								
[Diagonal lines /]	Gentle Sloping Zone																								
[Diagonal lines \]	Mixed Sloping Zone																								
[Vertical lines]	Steep Sloping Zone																								
[Dotted pattern]	Priority Forest Conservation Area																								
[Cross-hatch pattern]	Hazardous Area for Collapse																								



Note : The areas for land use and forest type distribution are estimated based on the land use and forest type map and the totals slightly differ from the official figures.

Project Components				
Natural Forest Management Plan	Plan Contents	<ul style="list-style-type: none"> Main target sites: southern foot of Mt. El Hoyo and foot of Mt. Momotombo Forest inventory/formulation of a forest management plan Enrichment: 200 trees/ha Introduction of firebreaks 		
	Quantities and Costs	<ul style="list-style-type: none"> Forest inventory/formulation of a forest management plan: 690ha; US\$6,900 Enrichment: 690ha; 138,000 seedlings; US\$14,490 Introduction of firebreaks: 690ha; US\$49,680 	Sub-Total Cost US\$ 71,100	
Reforestation Plan	Plan Contents	<ul style="list-style-type: none"> Main target sites: agropastoral land at the southern foot of Mt. El. Hoyo Main planting species: Eucalyptus, Neem Number of seedlings to be planted: 1,110 seedlings/ha 		
	Quantities and Costs	<ul style="list-style-type: none"> Planting area: 540ha Required number of seedlings: 719,000 	Sub-Total Cost US\$ 500,200	
Soil Conservation Plan	Agroforestry	Plan Contents	<ul style="list-style-type: none"> Farmland Gentle sloping zone: live fencing; earth ridges Change to permanent farming Pasture: planting of shade trees; live fencing 	
		Quantities and Costs	<ul style="list-style-type: none"> Farmland: 200ha; 60,000 seedlings; US\$37,860 Change to permanent farming: 47ha; US\$9,180 Pasture: 200ha; 32,000 seedlings; US\$16,300 	Sub-Total Cost US\$ 63,300
	Erosion Control Work	Plan Contents	<ul style="list-style-type: none"> Check dams: dry masonry dams; fence dams Retaining walls; dry masonry works; fencing works Slope protection: covering works 	
		Quantities and Costs	<ul style="list-style-type: none"> Dry masonry dams: 484; US\$8,620 Fence dams: 242; US\$3,570 Dry masonry works: 363; US\$4,290 Fencing works: 242; US\$3,570 Covering works: 121; US\$1,790 	Sub-Total Cost US\$ 21,800
Livelihood Improvement Plan	Plan Contents	<ul style="list-style-type: none"> Improvement of living: home garden and improved stoves Improvement of production techniques: introduction of the gravity-type simple watering system, diversification of crops and production of compost Improvement of grazing techniques: introduction of improved grass 		
	Quantities and Costs	<ul style="list-style-type: none"> Home gardens: 7ha; 700 seedlings; US\$2,520 Improved stoves: 70; US\$11,820 Installation of gravity type simple watering systems: 23ha; US\$2,980 Diversification of crops: 40ha; US\$16,330 Production of compost: 40site; US\$7,820 Introduction of improved grass: 20ha; US\$4,900 	Sub-Total Cost US\$ 46,400	
Implementation System Development Plan	Plan Contents	<p>(Municipal Forest and Environment Section)</p> <ul style="list-style-type: none"> Increase of staff and their education/training Coordination with the Municipal Development Plan Technical support for communities Education of local residents on forests and the environment Guidance on the operation and management of community organizations Training of promoters <p>(Municipal Environment Committee)</p> <ul style="list-style-type: none"> Reorganization and consolidation of the municipal environment committee (reorganization of the participating organizations and definition of their respective roles) Guidance for the municipal forest and environment section) Strengthening of the coordination and exchange of opinions with related organizations and NGOs (INAFOR) Deployment of an INAFOR official (León Office) Technical guidance and financial support for the municipal forest and environment section 		
Total Cost			US\$ 702,800	

Forest Management Plan for Disaster Prevention																									
Department: LEÓN						Municipality: NAGAROTE																			
Drainage Basin: Lake Managua				Location in Basin: Lower-Upper Reaches				Topography: Flat-Mixed Sloping																	
Annual Rainfall: 1,226mm						Mean Annual Temperature: 28.5																			
Distribution of Land Use and Forest Type	Type	Natural Forest				Man-Made	Grazing forest	Agropas ture	Water Body	Others	Total														
		Conifer-ous	Broad-Leaved	Mixed	Mangrove																				
	(ha)	0	13,051	0	326	0	11,992	14,311	209	20,940	60,829														
	(%)	0.0	21.5	0.0	0.5	0.0	19.7	23.5	0.3	34.5	100.0														
Land Ownership	Category		<20Mz		20 - 100 Mz		100 - 500 Mz		500 Mz<		Total														
	Ratio of Households (%)		49.9		33.4		14.2		2.5		100.0														
	Average Area (ha)		7.7		48.7		229.7		942.2		76.0														
Main Agricultural Products	Product		Maize		Kidney Beans		Sorghum		Rice		Sesame	Others													
	Cultivation Area (Mz)		2,581		140		1,516		33																
Population (2000): 32,164				Population Density: 53/km ²				Annual Rate of Increase (1990 - 2000): 2.2%																	
Municipal Environment Office: Yes, 1 staff member						Municipal Environment Committee: Yes																			
Municipal Environment Plan (Natural Environment)																									
Consolidation of environmental education and low level of interest in the environment among local residents			<ul style="list-style-type: none"> ■ Promotion of citizens' participation in environmental and natural resources protection ■ Extension/education on the environment ■ Strengthening of local organizations for environmental control ■ Implementation of a study trip to an environmentally protected area for school children ■ Municipal discussion meeting on the environment ■ Introduction of an Environment Day 																						
Violation of forest/environment-related laws and regulations			<ul style="list-style-type: none"> ■ Wide understanding of environment-related laws, regulations, municipal ordinances and standards ■ Determination of a mechanism for coordination with the related organizations for the application of laws and regulations ■ Education/training for local administrative staff on the application of environment-related laws, regulations and standards ■ Strengthening of the related organizations to make people observe the laws and regulations 																						
Zoning																									
																									
<table border="1"> <thead> <tr> <th colspan="2">Legend</th> </tr> </thead> <tbody> <tr> <td></td> <td>Flat Zone</td> </tr> <tr> <td></td> <td>Gentle Sloping Zone</td> </tr> <tr> <td></td> <td>Mixed Sloping Zone</td> </tr> <tr> <td></td> <td>Steep Sloping Zone</td> </tr> <tr> <td></td> <td>Priority Forest Conservation Area</td> </tr> <tr> <td></td> <td>Hazardous Area for Collapse</td> </tr> </tbody> </table>												Legend			Flat Zone		Gentle Sloping Zone		Mixed Sloping Zone		Steep Sloping Zone		Priority Forest Conservation Area		Hazardous Area for Collapse
Legend																									
	Flat Zone																								
	Gentle Sloping Zone																								
	Mixed Sloping Zone																								
	Steep Sloping Zone																								
	Priority Forest Conservation Area																								
	Hazardous Area for Collapse																								

Note : The areas for land use and forest type distribution are estimated based on the land use and forest type map and the totals slightly differ from the official figures.

Project Components			
Natural Forest Management Plan	Plan Contents	<ul style="list-style-type: none"> Main target sites: upper reaches of Tamarindo River Forest inventory/formulation of a forest management plan Enrichment: 200 trees/ha Introduction of firebreaks 	
	Quantities and Costs	<ul style="list-style-type: none"> Forest inventory/formulation of a forest management plan: 280ha; US\$2,800 Enrichment: 280ha; 56,000 seedlings; US\$5,880 Introduction of firebreaks: 280ha; US\$20,160 	Sub-Total Cost US\$ 28,800
Reforestation Plan	Plan Contents	<ul style="list-style-type: none"> Main target sites: agropastoral land in the upper reaches of Tamarindo River Main planting species: Leucaena, Madero Negro Number of seedlings to be planted: 1,110 seedlings/ha 	
	Quantities and Costs	<ul style="list-style-type: none"> Planting area: 40ha Required number of seedlings: 53,000 	Sub-Total Cost US\$ 37,100
Soil Conservation Plan	Agroforestry	Plan Contents	<ul style="list-style-type: none"> Farmland Mixed Sloping Zone: live fencing; contour hedgerows; earth ridges; rock ridges Change to permanent farming Pasture: planting of shade trees; live fencing
		Quantities and Costs	<ul style="list-style-type: none"> Farmland: 160ha; 54,000 seedlings; US\$37,120 Change to permanent farming: 40ha; US\$7,820 Pasture: 350ha; 57,000 seedlings; US\$28,530
	Erosion Control Work	Plan Contents	<ul style="list-style-type: none"> Check dams: dry masonry dams; fence dams Retaining walls; dry masonry works; fencing works Slope protection: covering works
		Quantities and Costs	<ul style="list-style-type: none"> Dry masonry dams: 468; US\$8,330 Fence dams: 234; US\$3,460 Dry masonry works: 351; US\$4,150 Fencing works: 234; US\$3,460 Covering works: 117; US\$1,730
Livelihood Improvement Plan	Plan Contents	<ul style="list-style-type: none"> Improvement of living: home garden and improved stoves Improvement of production techniques: introduction of the gravity-type simple watering system, diversification of crops and production of compost Improvement of grazing techniques: introduction of improved grass 	
	Quantities and Costs	<ul style="list-style-type: none"> Home gardens: 6ha; 600 seedlings; US\$2,160 Improved stoves: 60; US\$10,130 Installation of gravity type simple watering systems: 20ha; US\$2,590 Diversification of crops: 30ha; US\$12,250 Production of compost: 30site; US\$5,860 Introduction of improved grass: 35ha; US\$8,570 	Sub-Total Cost US\$ 41,600
Implementation System Development Plan	Plan Contents	<p>(Municipal Forest and Environment Section)</p> <ul style="list-style-type: none"> Increase of staff and their education/training Coordination with the Municipal Development Plan Technical support for communities Education of local residents on forests and the environment Guidance on the operation and management of community organizations Training of promoters <p>(Municipal Environment Committee)</p> <ul style="list-style-type: none"> Reorganization and consolidation of the municipal environment committee (reorganization of the participating organizations and definition of their respective roles) Guidance for the municipal forest and environment section) Strengthening of the coordination and exchange of opinions with related organizations and NGOs <p>(INAFOR)</p> <ul style="list-style-type: none"> Deployment of an INAFOR official (León Office) Technical guidance and financial support for the municipal forest and environment section 	
Total Cost		US\$ 202,100	

Forest Management Plan for Disaster Prevention																							
Department: MANAGUA						Municipality: SAN FRANCISCO LIBRE																	
Drainage Basin: Lake Managua				Location in Basin: Middle/Upper Reaches				Topography: Flat-Gently Sloping															
Annual Rainfall: 1,200mm						Mean Annual Temperature: ND																	
Distribution of Land Use and Forest Type	Type	Natural Forest				Man-Made	Grazing forest	Agropas ture	Water Body	Others	Total												
		Conifer-ous	Broad-Leaved	Mixed	Mangrove																		
	(ha)	30	5,418	0	0	0	17,528	11,135	3,304	29,544	66,959												
	(%)	0.0	8.1	0.0	0.0	0.0	26.2	16.6	4.9	44.2	100.0												
Land Ownership	Category		<20Mz		20 - 50Mz		50Mz<		Total														
	Ratio of Households (%)		6.7		74.6		18.7		100.0														
	Average Area (ha)		ND		ND		ND		ND														
Main Agricultural Products	Product		Maize	Kidney Beans	Sorghum	Rice	Sesame	Others															
	Cultivation Area (Mz)		300	50	400		200																
Population (2000): 9,683				Population Density: 14/km ²				Annual Rate of Increase (1990 - 2000): 0.9 %															
Municipal Environment Office: Yes, 1 staff member						Municipal Environment Committee: Yes																	
Municipal Environment Plan (Natural Environment)																							
Water shortage			<ul style="list-style-type: none"> ■ Implementation of a watershed protection, conservation and rehabilitation programme ■ Implementation of a headwater area protection programme ■ Construction of community-owned wells 																				
Insufficient control of the use of forest resources			<ul style="list-style-type: none"> ■ Enactment of a municipal ordinance to control cutting ■ Suspension of the issue of cutting permits by the INAFOR ■ Vitalisation of the activities of the INAFOR and the MARENA ■ Transfer of the cutting permit authority from the INAFOR to municipality 																				
Forest destruction			<ul style="list-style-type: none"> ■ Establishment of conservation, reforestation and natural regeneration zones ■ Administrative assistance for the formulation and implementation of a management plan ■ Protection of reforestation sites (from forest fires and illegal cutting) ■ Wide use of improved stoves and kerosene stoves ■ Promotion of reforestation using local species ■ Organization of a forest guard ■ Implementation of a reforestation programme and the inclusion of environmental education in school education 																				
Control of the hunting of wild animals			<ul style="list-style-type: none"> ■ Enactment of a municipal ordinance relating to the hunting of wild animals ■ Establishment of shelters for wild animals ■ Publicity on a closed season ■ Introduction of facilities to control hunting 																				
Soil erosion			<ul style="list-style-type: none"> ■ Cultivation of non-traditional crops ■ Implementation of soil conservation measures ■ Introduction of organic fertiliser ■ Promotion of the agroforestry system ■ Education/training for local residents on the appropriate use of soil ■ Promotion of hydroponic culture 																				
Zoning																							
																							
<p style="text-align: center;">Legend</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 30px; height: 15px; background-color: #cccccc;"></td> <td>Flat Zone</td> </tr> <tr> <td style="width: 30px; height: 15px; background-image: linear-gradient(to right, transparent 49%, #cccccc 49% 51%, #cccccc 51% 53%, transparent 53%);"></td> <td>Gentle Sloping Zone</td> </tr> <tr> <td style="width: 30px; height: 15px; background-image: linear-gradient(to right, transparent 49%, #cccccc 49% 51%, #cccccc 51% 53%, #cccccc 53% 55%, transparent 55%);"></td> <td>Mixed Sloping Zone</td> </tr> <tr> <td style="width: 30px; height: 15px; background-image: linear-gradient(to right, transparent 49%, #cccccc 49% 51%, #cccccc 51% 53%, #cccccc 53% 55%, #cccccc 55% 57%, transparent 57%);"></td> <td>Steep Sloping Zone</td> </tr> <tr> <td style="width: 30px; height: 15px; background-color: #808080;"></td> <td>Priority Forest Conservation Area</td> </tr> <tr> <td style="width: 30px; height: 15px; background-color: #404040;"></td> <td>Hazardous Area for Collapse</td> </tr> </table>													Flat Zone		Gentle Sloping Zone		Mixed Sloping Zone		Steep Sloping Zone		Priority Forest Conservation Area		Hazardous Area for Collapse
	Flat Zone																						
	Gentle Sloping Zone																						
	Mixed Sloping Zone																						
	Steep Sloping Zone																						
	Priority Forest Conservation Area																						
	Hazardous Area for Collapse																						

Note : The areas for land use and forest type distribution are estimated based on the land use and forest type map and the totals slightly differ from the official figures.

Project Components			
Natural Forest Management Plan	Plan Contents	<ul style="list-style-type: none"> • Main target sites: mountainous areas in the north • Forest inventory/formulation of a forest management plan • Enrichment: 200 trees/ha • Introduction of firebreaks 	
	Quantities and Costs	<ul style="list-style-type: none"> • Forest inventory/formulation of a forest management plan: 290ha; US\$2,900 • Enrichment: 290ha; 58,000 seedlings; US\$6,090 • Introduction of firebreaks: 290ha; US\$20,880 	Sub-Total Cost US\$ 29,900
Reforestation Plan	Plan Contents	<ul style="list-style-type: none"> • Main target sites: agropastoral land in mountainous areas in the north • Main planting species: Leucaena, Madero Negro • Number of seedlings to be planted: 1,110 seedlings/ha 	
	Quantities and Costs	<ul style="list-style-type: none"> • Planting area: 30ha • Required number of seedlings: 40,000 	Sub-Total Cost US\$ 27,800
Soil Conservation Plan	Agroforestry	Plan Contents	<ul style="list-style-type: none"> • Farmland • Gentle sloping zone: live fencing; earth ridges • Steep sloping zone: contour hedgerows; rock ridges • Change to permanent farming • Pasture: planting of shade trees; live fencing
		Quantities and Costs	<ul style="list-style-type: none"> • Farmland: 140ha; 48,000 seedlings; US\$34,110 • Change to permanent farming: 35ha; US\$6,840 • Pasture: 300ha; 49,000 seedlings; US\$24,450
	Erosion Control Work	Plan Contents	<ul style="list-style-type: none"> • Check dams: dry masonry dams; fence dams • Retaining walls; dry masonry works; gabion works; fencing works • Slope protection: covering works
		Quantities and Costs	<ul style="list-style-type: none"> • Dry masonry dams: 608; US\$10,820 • Fence dams: 304; US\$4,500 • Dry masonry works: 456; US\$5,380 • Gabion works: 304; US\$26,270 • Fencing works: 304; US\$4,500 • Covering works: 152; US\$2,250
Livelihood Improvement Plan	Plan Contents	<ul style="list-style-type: none"> • Improvement of living: home garden and improved stoves • Improvement of production techniques: introduction of the gravity-type simple watering system, diversification of crops and production of compost • Improvement of grazing techniques: introduction of improved grass 	
	Quantities and Costs	<ul style="list-style-type: none"> • Home gardens: 7ha; 700 seedlings; US\$2,520 • Improved stoves: 70; US\$11,820 • Installation of gravity type simple watering systems: 18ha; US\$2,340 • Diversification of crops: 30ha; US\$12,250 • Production of compost: 30site; US\$5,860 • Introduction of improved grass: 30ha; US\$7,350 	Sub-Total Cost US\$ 42,100
Implementation System Development Plan	Plan Contents	<p>(Municipal Forest and Environment Section)</p> <ul style="list-style-type: none"> • Increase of staff and their education/training • Coordination with the Municipal Development Plan • Technical support for communities • Education of local residents on forests and the environment • Guidance on the operation and management of community organizations • Training of promoters <p>(Municipal Environment Committee)</p> <ul style="list-style-type: none"> • Reorganization and consolidation of the municipal environment committee (reorganization of the participating organizations and definition of their respective roles) • Guidance for the municipal forest and environment section) • Strengthening of the coordination and exchange of opinions with related organizations and NGOs (INAFOR) • Deployment of an INAFOR official • Technical guidance and financial support for the municipal forest and environment section 	
Total Cost		US\$ 218,900	

1.5 Development of Implementation System

This section describes the planning for the development of the implementation system which is required at both the administration level and the local resident level and also describes the M/P implementation processes and basic ideas for guidance for communities.

1.5.1 INAFOR Functions

Forest administration used to be under the jurisdiction of the National Forestry Service of the MARENA but was transferred to the MAGFOR in 1998 as part of the Public Sector Reform and Modernisation Programme in Nicaragua. At the MAGFOR, the Directorate General of Forestry Development, an internal division of the MAGFOR, decides forest policies while the INAFOR is in charge of the implementation of these policies (work involving technical issues).

The Forest Development Policies decided in August, 2000 give the INAFOR the status of the sole organization responsible for the adjustment and management of domestic forest resources in Nicaragua and states that “the INAFOR strengthens the inter-institutional coordination mechanism and implements the reform process for the current forest regulation and control system as the base for the application of the basic principles, criteria and guideline for sustainable forest management”.

In regard to the implementation of forest promotion measures which has direct implications for the M/P, the Forest Development Policies restated the importance of such measures although the INAFOR has been internally promoting such measures in one way or another before this fresh declaration. One result was the establishment of the Forest Promotion Department to be in charge of the promotion of the said measures.

At that time, the jurisdiction of the INAFOR was set forth by the Administrative Disposition of the INAFOR and were not statutory duties. However, the New Forest Law clearly establishes such statutory duties and rearranges and lists the range of roles traditionally conducted by the INAFOR in Article 7.

Among the roles of the INAFOR stipulated in Article 7, those of Item 5 and Item 13 are directly related to the implementation of the M/P, providing the legal basis for the INAFOR to act as the organization directly responsible for the implementation of the M/P as a forest promotion project.

5. Conclusion of agreements with municipal governments or public/private organizations to entrust forest monitoring and control work and delegation of forest promotion work with the transfer of the necessary funds in the case of agreements with municipal governments
13. Promotion of forest promotion programmes, particularly reforestation programmes in areas of forest degradation, with local governments and private organizations

The transfer of the forest promotion function to municipal authorities based on the relevant agreements under Item 5 is in line with the ongoing decentralisation policy in Nicaragua and appears to be the most suitable measure at present for the implementation of the M/P in view of the reality of the organizational structure of the INAFOR.

Under these circumstances, forest promotion policies and measures are principally designed to solve specific problems in each of three categories of forest-related areas, i.e. forest areas, areas where forests are depleting and areas where forests have disappeared. Accordingly, the restoration of forests is the most emphasised task on the Pacific side to the west of the Central Mountains where forests are either depleting or have disappeared while natural forest management is the primary task in frontier areas for farming. Emphasis on participatory forest restoration is considered to be especially important on the Pacific side to the west of the Central Mountains, including the target areas of the M/P, and the M/P and Community Guidance Manuals are expected to function as important tools for forest restoration.

1.5.2 Implementation System

As described before, Article 7 of the New Forest Law stipulates the delegation of the authority for the implementation of forest promotion measures from the INAFOR to municipal authorities based on the relevant agreements. Given the principal character of the M/P in that it should be implemented through participatory activities, arrangements whereby municipal authorities, which are the closest administrative bodies to local residents, develop an implementation system can be described as the most suitable way to implement the M/P. In accordance with this idea, the M/P will basically be implemented under the implementation system described next.

However, when the availability of technicians and budgetary appropriation situation of the environment office of each municipality are taken into consideration, the immediate implementation of the M/P under the system shown in Fig. 1-5-2-1 is practically impossible. For some time from the start, it will be essential for INAFOR technicians to form joint teams with technicians of municipal environment offices and to play a central role in these teams,

providing the necessary guidance for communities. To be more precise, efforts should be made to make the implementation system as close as possible to the basic model shown in Fig. 1-5-2-1 through the expansion of municipal technical staff and training to enhance the technical guidance capability based on better budgetary assistance while following the steps shown in 1.5.6-(2) – Implementation Mechanism.

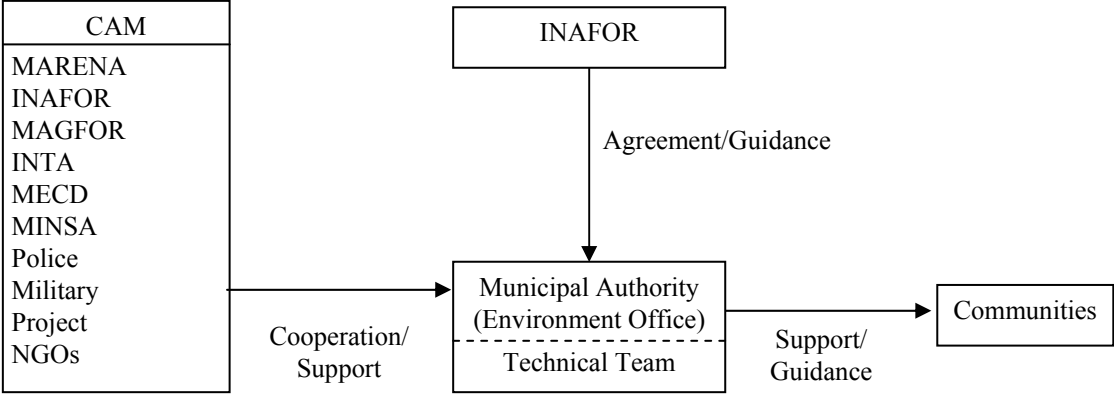


Fig. 1-5-2-1 Implementation System (Basic Model)

The basic ideas behind this implementation system are explained below.

- ① The INAFOR will conclude an agreement for the implementation of the M/P with the municipal authority.
- ② The municipal authority will use the existing environment office as the implementation organization to provide guidance for local residents.
- ③ The municipal environment office will form a technical team and will promote various activities by guiding local residents.
- ④ The INAFOR will provide guidance for the technical team on methods to assist and guide local residents.
- ⑤ The CAM of each municipality will provide the necessary cooperation and assistance for the municipal environment office.

For the effective functioning of the M/P implementation system, it will be necessary for communities, municipal environment offices and the INAFOR to develop their own appropriate M/P implementation systems to cooperate with each other as discussed in more detail in the following sections.

1.5.3 Development of Community-Level Implementation System

(1) Community-Level Implementation System

Each community has a community committee which is established as a self-governing body with the consensus of local residents. Even though there is no set formula for the structure and functions of such committee, all community committees generally perform similar functions. All municipal authorities acknowledge that community committees are representative bodies of local residents and consider them to be official routes for administrative work between the municipal authority and such communities.

Based on the existing administrative arrangement described above, when a municipal authority plans to proceed with forest management activities at the community level, it must follow the following processes.

- ① The municipal authority informs the community committee of the target community of its intention to implement forest management activities and explains such activities.
- ② The community committee approves the planned activities.
- ③ The municipal authority explains the purposes of the planned activities to all residents of the target community.
- ④ A participants' group is then organized, comprising local residents interested in the implementation of the activities, and this group is called the community forest management activity implementation body (hereinafter referred to as "the implementation body") and is acknowledged as the promoting body for forest management activities in the community in question by the community committee.

Through these processes, the implementation body is acknowledged as an official organization in the community with the approval of the community committee. In this manner, the activities of the implementation body are widely known by the local residents of the same community. This makes it possible for even those local residents who do not participate to have access to information on the activities of the implementation body so that they can participate if and when they want.

In the P/S, there were many cases where activities stopped when landless people joined in the activities. Therefore, it appears essential to give landowners priority in the formation of the implementation body. In the case of environmental education and forest fire prevention activities, however, special consideration should be given to the acceptance of landless people

who are willing to perform such activities as members as these activities are not related to anyone's status of being a landowner.

(2) Establishment of Executive Committee

An executive committee should be established as a body to represent the implementation body and the participants should elect the executives (chairman, secretary, treasurer and leaders of the working groups which are described later) from among themselves. These executives are expected to perform the following functions.

- To represent the participants in dealings with the technical team
- To comprehensively grasp and control the activities conducted by the participants
- To deal with problems as they emerge
- To deal with matters relating to forests in the community
- To liaise with the community committee so that information on various activities can be spread to all residents of the community

(3) Establishment of Working Groups

1) Individual Activities

While the participants will individually perform such activities as reforestation, natural forest operation and soil conservation at farmland, etc., working groups will be formed for each type of activity or for each area to ensure the effective implementation of the relevant plans. These working groups establish forums for participants to discuss common issues. Each group will have a leader who will perform the following functions together with other group members.

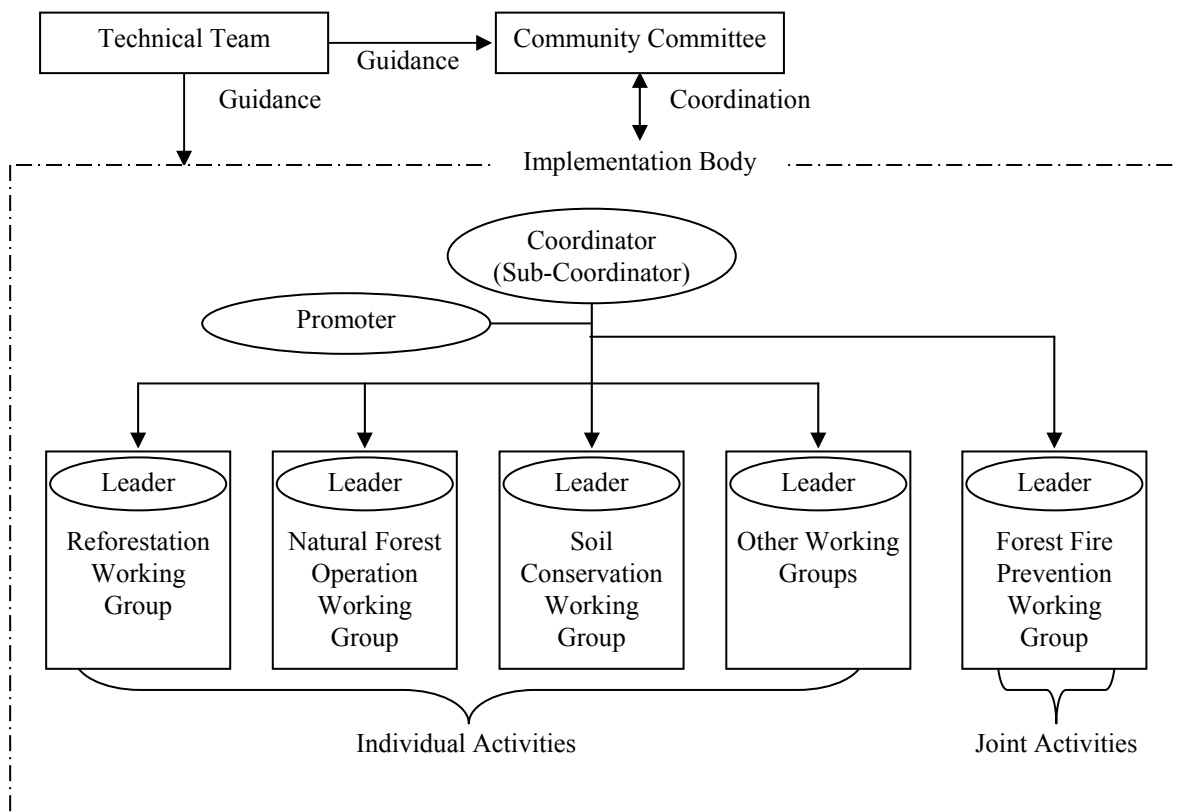
- Clarification of the state of activities of the group
- Clarification of problems emerging in the group and examination of possible solutions
- Assistance for those participants whose activities have little progressed or who find it difficult to understand the technical issues
- Acting as a technical consultant for the group members
- Preparation of a general activity plan for the group and monitoring and evaluation of the activities conducted by the group members

2) Group Activities

The creation and management of headwater forests, construction of erosion control facilities, implementation of forest fire prevention measures and environmental education, etc. should comprise group activities featuring all participants or all local residents. When these activities are planned, the relevant working groups for each type of group activity should be formed

within the implementation body (in some case, the implementation body itself will conduct these activities in view of their character) with the election of group leaders. The working groups for group activities will plan and implement the relevant activities together with local residents related to such activities while collaborating with the community committee. The leaders of these working groups will have the following duties.

- Preparation of an activity plan for the working group, understanding of the state of progress of specific activities and monitoring as well as evaluation of activities
- Clarification of any emerging problems in the group and examination of possible solutions
- Provision of guidance for those participants with problems



Note: The roles, etc. of a promoter are explained in 1.5.7-(9)-a.

Fig. 1-5-3-1 Example of Community-Level Implementation Body

1.5.4 Development of Implementation System of External Assistance Organizations, such as INAFOR and Municipal Authorities

In reality, it will be difficult for local residents themselves to prepare and implement the necessary plans in their community in line with the M/P formulated under the Study. Accordingly, the development of the administrative and other external assistance systems to

provide guidance and assistance for local residents is important. This external assistance can be provided by such government organizations as the INAFOR and the MARENA as well as municipal organizations acting as local organizations. These organizations cannot be said to have been sufficiently implementing forest promotion measures in the target areas of the M/P for the benefit of local residents. While other administrative organizations, including the INTA, and non-administrative organizations, including the UNAG, have also been providing guidance and assistance to supplement the main administrative organizations, their activities are based on their own principles and their guidance and assistance for local residents are directed towards scattered target sites rather than covering wide areas.

Given the need for forest development and the implementation of soil conservation measures over a wide area to enhance the soil and water conservation functions of forests, the best arrangement appears to be for the INAFOR, which is responsible for nationwide forest administration, to promote the M/P as a national policy with the cooperation of the MARENA while municipal authorities receiving the guidance and assistance of the INAFOR develop a system which is capable of directly guiding and assisting local residents in communities in their own areas of jurisdiction based on agreements with the INAFOR which are concluded pursuant to the provision of Article 7 of the New Forest Law.

The INTA and other administrative organizations and the UNAG and other non-administrative organizations are required to continue their cooperation activities while liaising with the INAFOR and municipal authorities through the CAMs

(1) Implementation System for Municipal Authorities

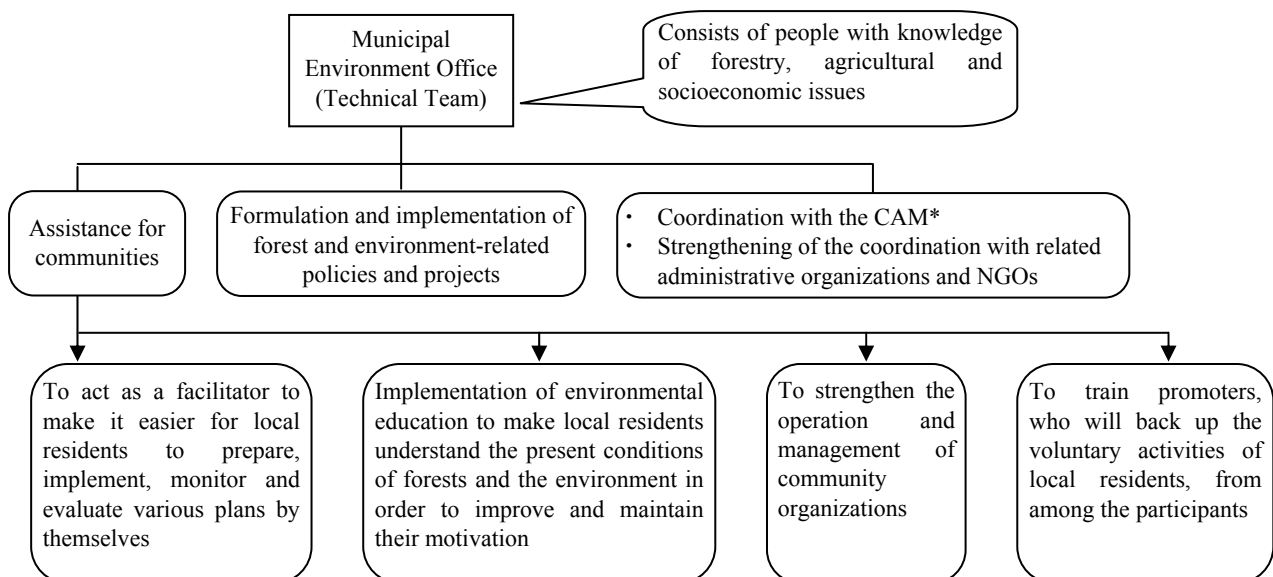
As municipal authorities already have their own environment office which has been promoting similar activities, these environment offices will be used as bodies to promote the implementation of the M/P at the municipal level (in the case of those municipalities which have not yet appointed a full-time technician(s), the INAFOR should provide guidance for the appointment of such a technician(s)).

Each municipal environment office should form a technical team consisting of people with knowledge of forests/forestry, agriculture and sociology and this team will be responsible for providing direct guidance and assistance for the implementation of forest management activities by communities. At the same time, the technical team will also be responsible for planning and implementation, etc. regarding the implementation of the M/P by the municipal environment office.

At present, however, many municipal authorities lack the necessary system because of the absence or small number of forest experts. This system must be developed with the active guidance and assistance of related organizations, including the INAFOR which is directly responsible for the implementation of forest policies.

The technical team of the municipal environment office is expected to perform the following functions for the implementation of the M/P.

- To establish the M/P as a municipal plan featuring the forest and environmental policies of the municipality and its incorporation in the Municipal Development Plan
- To act as a facilitator to make it easier for local residents to prepare, implement, monitor and evaluate various plans by themselves
- To implement environmental education to make local residents understand the present conditions of forests and the environment in order to improve and maintain their motivation
- To assist and strengthen the operation and management of community organizations
- To train promoters from among the participants who will back up the voluntary activities of local residents
- To conduct the administrative work of the CAM and to liaise with other related organizations



* Refer to 1.5.4-(3) for the CAM.

Fig. 1-5-4-1 Main Functions of Municipal Environment Office (Technical Team)

In most municipalities, the number of staff responsible for the environment is currently only one but this should be increased to at least two or more in the medium-term. It will be necessary for the municipal environment office to continue monitoring and evaluation in cooperation with local residents when a new project commences in a community and also to act as a window for the local community for contact with the municipal authority or other related organizations when a problem which cannot be solved by the community arises. Continuous follow-up activities will integrate the activities conceived by the M/P to the daily activities of local residents, ensuring the long-term implementation of M/P-related activities and also enhancement of the soil and water conservation functions in a wide area. With the expansion of various activities, the early recruitment of new technical staff will be required.

To promote the firm rooting of the M/P in each municipality, the municipal environment office should deploy key persons to play a central role in the provision of guidance for communities to ensure the continuation of community-level activities and the training of these key persons by means of OJT is important.

(2) Implementation System for the INAFOR

As the M/P has the character of a public plan to be implemented over a wide area, the INAFOR, which is in control of various activities under the M/P as a national policy, should provide assistance for municipal authorities acting as the main implementation bodies in the following manner.

- Conclusion of an agreement with each municipal authority and the provision of guidance for municipal authorities on the implementation of the M/P as part of the forest promotion policy
- Provision of guidance and assistance for municipal authorities to firmly root the M/P as a municipal plan which is part of the Municipal Development Plan
- Provision of budgetary measures to fund the expenses of the municipal environment office to recruit personnel and those of communities to conduct various activities
- Provision of education and training for members of the municipal technical teams to implement the M/P
- Liaisoning with similar activities of such related organizations as the MARENA, the ENTA and the MECD at the central government and local levels to ensure the smooth implementation of the M/P

The INAFOR upholds the implementation of the M/P as part of its forest promotion work and the Forest Promotion Department is in charge of the promotion of the M/P. The Forest

Promotion Department established a section in 2002 to develop the implementation system for the Study. The head of the Chinandega Office has been assigned the additional position of project manager and two engineers have been assigned to the UTT-PPM. Although these three officials also work for the local office, priority is given to the work connected to the Study. The budget relating to the M/P Project has been accounted for in the central government budget for the payment of the salaries and work expenses of the three employees of UTT-PPM and the cost of equipment and materials required for the Study.

The M/P project implementation system has been consolidated in 2004 for full-scale implementation in the coming years as the number of full-time staff members of the UTT-PPM has been increased to five. The office of the UTT-PPM is provisionally located at Chinandega as in the case of the earlier system but is due to be relocated to León together with the rearrangement of a seed bank in León.

In order for the INAFOR to conduct the full-scale implementation of the M/P, it must firstly establish a coordination system with municipal authorities. To be more precise, it must explain the M/P, obtain the consent of the municipal authorities directly providing guidance and assistance for communities, conclude an agreement with each municipal authority so that the municipal environment offices can perform their expected functions and ensure that the contents of the M/P are reflected on the Municipal Development Plan and Annual Operation Plan while establishing a system which allows each municipal authority to take the initiative in the implementation of the M/P. The INAFOR should deploy key persons for a certain period of time to ensure that the implementation of the M/P is on track and, at the same time, should train future key persons by means of OJT.

(3) Use of CAM

The MARENA, the INTA, bodies implementing similar projects to the M/P and NGOs have their own style for the implementation of their work and programmes, etc. Meanwhile, a CAM has been established in each municipality to act as a consultation and assistance body for municipal and environmental policies to implement forest and environmental improvement measures in an orderly manner. The establishment of a system which is designed to strengthen the coordination of various members of the CAM is essential. While the members of the CAM and their roles are shown in Table 1-5-4-1, other organizations (MECD, MINSA, the police and the military, etc.) may become members if and when necessary.

For the implementation of the M/P, the CAM is expected to act beyond its ordinary functions of providing advice and recommendations so that it can facilitate coordination between such

related organizations as the MARENA, the INTA and the MECD, etc. for the successful implementation of the M/P, particularly the use of the FAM, technical guidance by the INTA and the inclusion of other similar projects in M/P-related activities through mutual cooperation under the initiative of the INAFOR.

Table 1-5-4-1 Main Members of the CAM and Their Roles

External Assistance Organization	Roles
Municipal Authority	As the representative of the CAM, it manages the CAM and promotes forest and environmental policies from the viewpoint of municipal administration. It performs the administrative work of the CAM.
INAFOR	Provides advice and recommendations from the viewpoint of forest administration
MARENA	Provides advice and recommendations from the viewpoint of environmental administration
INTA	Provides advice and recommendations on the extension of agricultural and agroforestry techniques
Forest/Environment Projects and NGOs, etc.	Efficiently implement their own projects through enhanced coordination with other related organizations and implementation bodies of other projects

The main functions of the CAM are shown in Fig. 1-5-4-2.

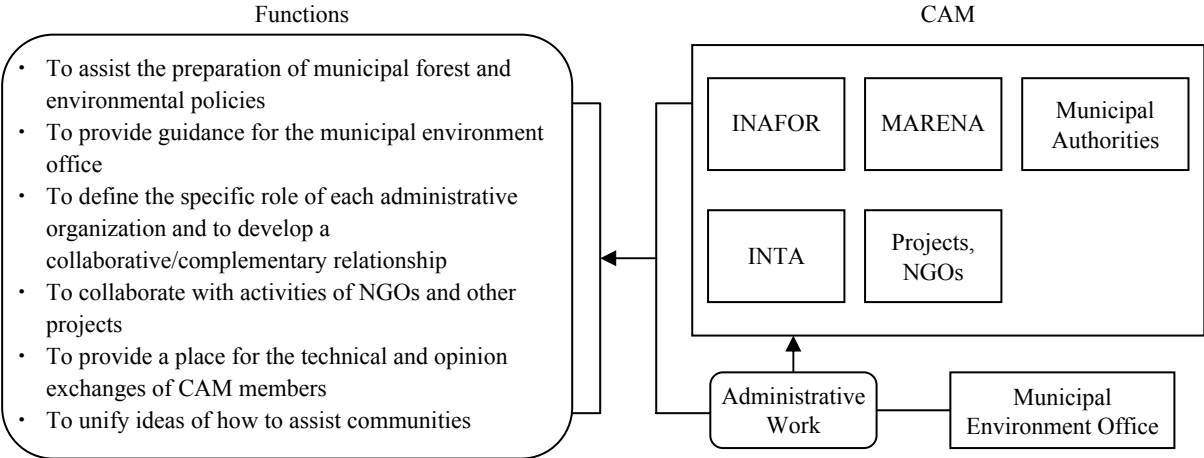


Fig. 1-5-4-2 Composition and Functions of the CAM

1.5.5 Tasks for Implementation System of External Assistance Organizations

All organizations providing external assistance have their own limitations in terms of finance and human resources and, therefore, will find it difficult to immediately commence their roles described earlier. There are several tasks as listed below to be dealt with by the INAFOR and

municipal authorities to ensure the smooth implementation of the M/P while trying to overcome such limitations as much as possible.

- As the simultaneous implementation of the M/P in all municipalities will be difficult in view of the financial and human resources, the INAFOR should prioritise the target municipalities for the implementation of the M/P based on the topography, state of forest devastation, financial situation and state of staff deployment, etc. in each municipality. The northern part of the León Department should have high priority in consideration of its topography and forest conditions, etc.
- Activities of the Technical Team
 - It will be difficult for the municipal environment office alone to form a technical team in view of the financial and human resources. Under these circumstances, the INAFOR plans to increase the number of its staff so that joint technical teams can be formed by technicians of the INAFOR and municipal authorities based on an agreement with a view to strengthening the guidance system for communities.
 - Among the technicians of the INAFOR, new technicians who were not counterparts at the P/S stage should be recruited from among people with experience of similar activities to those envisaged by the M/P at NGOs, consultancy firms or other organizations.
 - Staff members of the municipal environment offices tend to lack experience even though they have some knowledge of the P/S. It will be advisable to provide the necessary guidance for local residents with INAFOR technicians playing a leading role for a certain period from the start while training municipal technicians through OJT.
 - Even though municipal technical teams will be formed through the above processes, there is a distinct possibility that these teams will undergo a trial and error process at the early stage of their activities. It is, therefore, necessary to examine additional measures to get the activities of municipal technical teams on the right track as soon as possible. These measures include (i) joint implementation with a well-experienced consultant or NGO with funding provided by the INAFOR and (ii) the steady development of a system to conduct various activities while training municipal technicians with the cooperation of a donor.
- The INAFOR and municipal authorities should establish concrete measures to secure human resources and funding sources for the implementation of the M/P.

- Staff of the INAFOR who experienced the P/S should provide training for the respective members of the technical teams of the INAFOR and municipal environment offices to improve the latter's understanding of the M/P. Detailed debates should be held, particularly on such issues as ① the roles and functions of the INAFOR and municipal authorities, ② tasks relating to the implementation of the M/P faced by the INAFOR and municipal authorities and implementation strategies, ③ project management and control and ④ guidance for communities to enhance their indigenous development capability so that the prospective technical team members can obtain a better understanding of these issues. Moreover, this training should be designed to enhance the self-awareness of the INAFOR and municipal authorities as the project implementation bodies.
- Under the guidance of the INAFOR, each municipal environment office should prepare short, medium and long-term M/P implementation plans for its own municipality and should include the M/P as a concrete component of the Municipal Development Plan.
- By liaising with the MARENA, the INTA and other related organizations, the INAFOR should discuss the possibility of the cooperation of these organizations for the implementation of the M/P, clarify the roles and functions of each organization and request their cooperation at the central and local (CAM) levels.
- The technical team consisting of technicians of the INAFOR and environment office in each municipality should conduct the following work.
 - Arrangement of data (on the natural conditions, social conditions and indigenous development capability, etc.) for communities in the municipality; preparation of an implementation strategy to materialise the M/P in line with the conditions and characteristics of the municipality (clarification of restrictive factors, problems regarding the implementation of M/P Project and measures to deal with them, establishment of goals and objectives and establishment of priority implementation areas and guidance policies, etc.)
 - Preparation of a community guidance plan and guidance schedule based on the M/P
 - Firm establishment of monitoring and evaluation methods regarding the implementation of the M/P
 - Further elaboration of the direction for community guidance to enhance the indigenous development capability of communities following the lead provided by the P/S and establishment of an efficient enhancement method

- Examination and firm establishment of a support system following the completion of extensive technical guidance

1.5.6 Implementation Mechanism

(1) Budget

Given the importance of securing a proper budget for the implementation of various projects, realistic planning which takes the budgetary aspect into careful consideration must be conducted to examine a suitable project implementation mechanism. For this reason, the current situation and future prospects of the funding sources of the INAFOR, municipal authorities and the MARENA, all of which will play the important role of securing the budget for the implementation of the M/P Project, were examined and the findings are described below.

1) INAFOR

The funding sources of the INAFOR which can be used for the implementation of the M/P are the FONADEFO and the PTA (Proyecto de Tecnología de Agropecuaria).

The FONADEFO is a fund which was established for forest development pursuant to Article 50 of the New Forest Law. Article 51 stipulates that this fund consists of the following funds.

1. Allocation from the ordinary budget of the Republic
2. Domestic and international donations.
3. Funding from conventions made at the domestic and international levels
4. 50% of the forest-related earnings, including taxes, fines and income from the auction of seized materials as set forth in Article 49 of the Law
5. Funding from a special credit line, environmental services, programmes and projects

Out of these possible funds, the transfer of 50% of the funds referred to under 4. above to the FONADEFO has already been ascertained. However, other funds which are external sources have not yet been made available. As the rules of the Regulating Committee, which will act as the executive office of the FONADEFO, will be set forth by October, 2004 at the latest so that the Regulating Committee can officially examine the operation of the fund, it is not yet certain when the FONADEFO will be realised as a funding source for the implementation of the M/P.

Meanwhile, the PTA is a follow-up project of the PROFOR which was implemented with a World Bank loan and which ended in December, 2003. It is a project to promote agricultural

and stock raising techniques with the participation of the MAGFOR, the MARENA, the INAFOR and the INTA, etc. In view of the fact that the promotion of afforestation is one component, the INAFOR believes that the PTA budget can be partly used for the M/P Project. But, at present, the PTA budget has not yet been materialised and it is hoped that active efforts will be made to secure the necessary funding from various sources, including funding under the PTA, in the coming years.

In addition to the above two possible funding sources, the INAFOR has been allocated a budget to operate the UTT-PPM from the ordinary budget of the government. This budget mainly covers the various activity expenses of the UTT-PPM and meets the personnel cost of technicians, the vehicle fuel cost and the administrative cost.

2) Municipalities

Among the funding sources of the municipal budget, allocation from the tax on tree cutting (including fines for illegal cutting and proceeds from public auctions of confiscated illegally cut trees) as set forth in Article 49 of the New Forest Law appears to be a likely source of funding for the M/P Project budget. Prior to the enforcement of the New Forest Law, 25% of this tax was allocated to municipalities. Under the New Forest Law, this ratio has been increased to 35%, contributing to the improvement of municipal finance²⁵⁾. This allocation is commonly paid to the ordinary budget of each municipality and is not necessarily used for special purposes relating to forests and forestry. In fact, there is no guarantee that this practice will change in the future. In the case of El Viejo for example, while the allocated amount in Fiscal 2002 was C\$ 55,870, this amount was not put straight into the forest-related budget. Instead, it appears that part of this allocation found its way to the forest-related budget together with financial aid provided by NGOs and others based on the overall review of the municipal revenue and expenditure. As this allocation originates from forests, it is desirable for it to be mainly used for the promotion of forest-related work and projects in the future.

3) MARENA

The funding sources of the MARENA include the FAM which is funded by a World Bank loan. The FAM is currently used by 43 municipalities, including all municipalities in the Chinandega Department and León Department for the purpose of implementing environment-related projects.

25) The current regime will be in place until the end of 2004 as a provisional measure and it appears that enforcement of the new Forest Law under which the allocation ratio is 35% will be in 2005 at the earliest.

As the FAM can be used for the implementation of the M/P Project based on a municipal request to the MARENA, it is believed to be an important funding source for the M/P Project. Funding available under the FAM, however, covers wide-ranging aspects of the environment in general, including drinking water, environmental pollution and cleaning in the municipality, and its use for the forest sector has been restricted to such limited activities as extension of the protection of nature and related minor activities, etc.

Fig. 1-5-6-1 shows the implementation mechanism for environment-related measures currently in place under the FAM Project. Projects formulated using the FAM budget are incorporated in the Municipal Development Plan to establish the Annual Operation Plan. At the planning stage, the CAM provides advice and recommendations to the municipal council which examines and approves the Municipal Development Plan and Annual Operation Plan. With the guidance and support of the municipal environment office, which in turn is under the guidance of the MARENA, communities implement the various projects listed in the Annual Operation Plan each year. Meanwhile, the municipal environment office receives the cooperation and assistance of the CAM.

(2) Implementation Mechanism

As the M/P Project is similar to the FAM Project in that it is partly related to the environment, the implementation of the M/P Project using the FAM implementation mechanism which is already in operation in each municipality is believed to be rational.

The implementation mechanism shown in Fig. 1-5-6-4 offers the basic model based on the FAM mechanism shown in Fig. 1-5-6-1. However, the immediate implementation of the M/P Project using this model will be difficult when the current implementation system and available budget of the INAFOR and each municipal environment office are taken into consideration. For this reason, it is essential for the INAFOR and each municipal environment office to make continual efforts to materialise the basic model through the following processes while trying to develop their own implementation systems and to secure the necessary budget.

Firstly, at the start of the M/P Project, it will be uncertain whether or not funding can be secured from the FONADEFO and/or the PTA as described earlier, making it difficult to rely on such funding. In the case of the allocation of part of the tax on tree cutting to municipalities, it is unlikely to constitute a sufficient budget for the M/P Project in view of the reality of its use so far. Accordingly, the FAM will remain the sole funding source at this stage and the resulting implementation mechanism is shown in Fig. 1-5-6-2.

At this stage, it is likely that the number of municipal technicians and the size of the budget

secured will be insufficient although it will depend on the size of the FAM budget. A joint technical team consisting of two INAFOR technicians and one technician of the municipal environment office will be formed in each municipality and the INAFOR technicians will play a leading role in this technical team to provide guidance for communities. Even though it is difficult to expect a sizable budget for the implementation of a wide range of activities except for some using funds from the FAM, extension/education and guidance for some types of work including rock ridges, earth ridges, firebreaks, etc., which can be conducted by local residents themselves, can be provided at a certain level. The actual activities at this stage are likely to be limited to some guidance activities by visiting technicians of the INAFOR and municipal environment office such as (i) extension and education on activities which can be conducted with a manpower contribution by local residents as described above and on forest fire prevention and (ii) the provision of some tools and equipment.

Because of the impossibility of fully providing practical field guidance on nursing, reforestation and soil conservation, etc., it will be difficult to make local residents recognise the positive effects of activities at this stage. Even though a technician of the municipal environment office will jointly implement the work with the INAFOR technicians, the training of the municipal technician will be insufficient because of the restrictions on a whole range of activities. Maximum efforts will, therefore, be required to raise funds from the FONADEFO and others so that a full-scale implementation mechanism can be established with a sufficient budget. Meanwhile, it will still be possible to facilitate understanding of the M/P among staff of the municipal environment office and to prepare for the incorporation of the M/P in the Municipal Development Plan and this stage should be considered to constitute the approach run to full-scale implementation. Even if the available budget is insufficient, proper moves at this stage will lead to the smooth implementation of activities in subsequent years.

The next stage is when the FONADEFO begins to function with the efforts of all related organizations. At this stage, funding from the PTA will be secured and part of the tax on tree cutting allocated to each municipality will be made available for the M/P Project. These funds and the FAM funding will create a sufficient budget to commence the full-scale implementation of the M/P Project. The implementation mechanism at this stage is shown in Fig. 1-5-6-3.

Depending on the actual budget size, it will be possible to procure some materials and equipment at this stage to provide field guidance on various activities in communities. At the same time, the staff size of the municipal environment office can be expanded and increased opportunities for municipal technicians to provide direct guidance for local communities will facilitate the transfer of techniques/skills from the INAFOR technicians to municipal technicians.

As the desirable implementation mechanism in the future involves the provision of guidance for communities by municipal technicians, this second stage is considered to be a transitional stage to proceed to the desirable mechanism. If the transfer of techniques/skills from the INAFOR technicians to municipal technicians and an appropriate budget are successfully secured at this stage, it will be possible to move to the desirable implementation mechanism (Fig. 1-5-6-4) to vitalise wide-ranging activities.

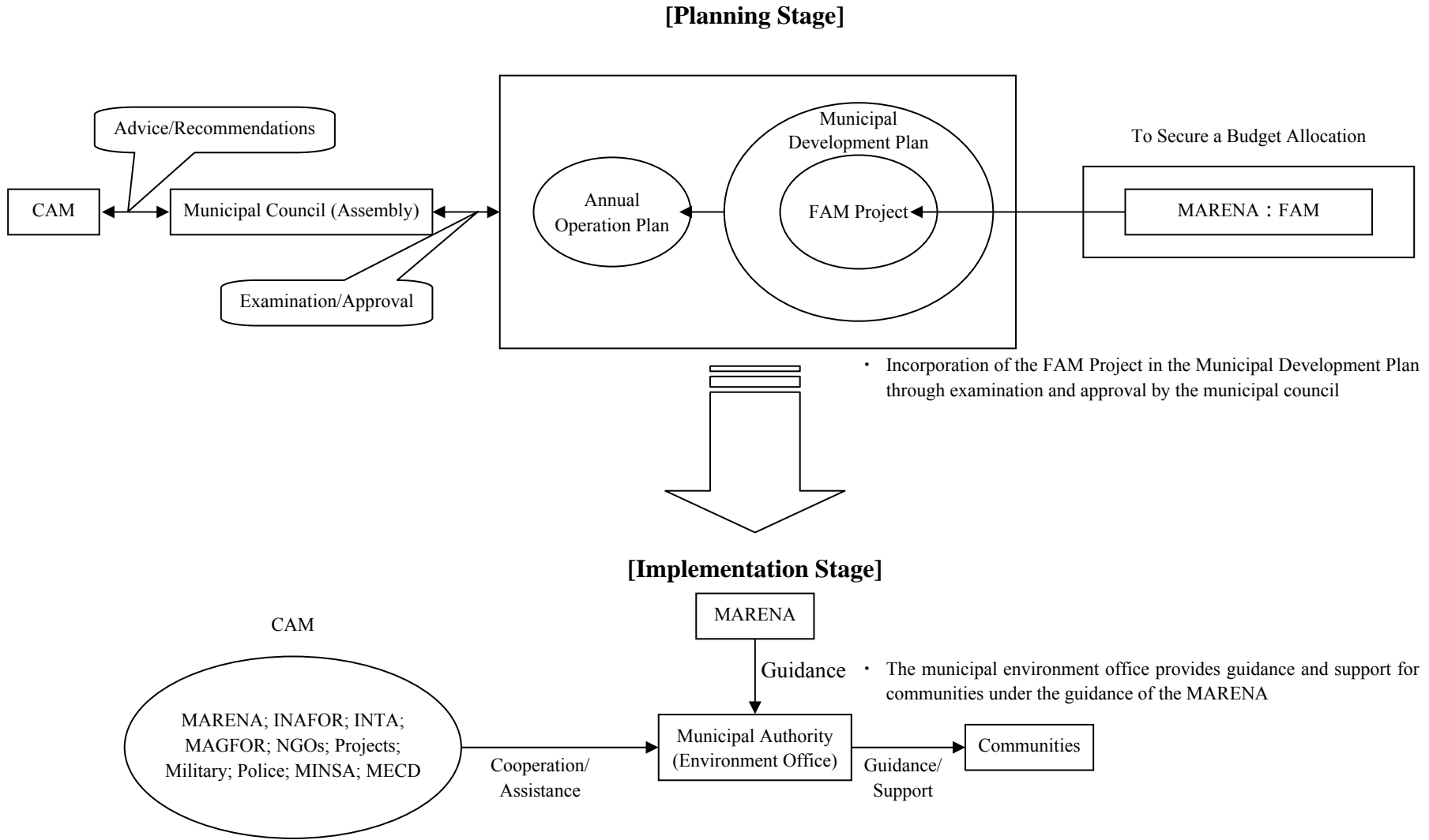


Fig. 1-5-6-1 FAM Project Implementation Mechanism

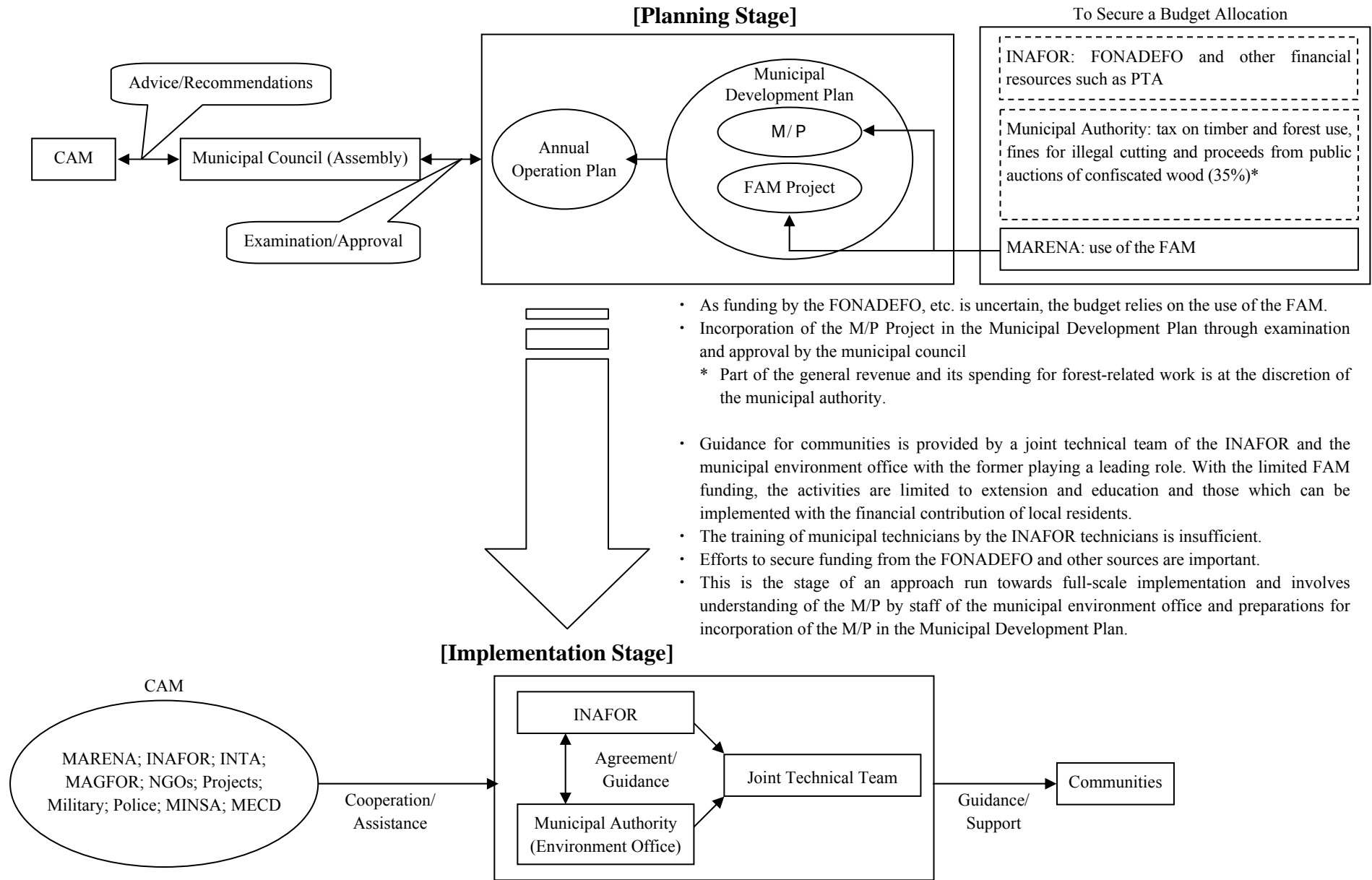


Fig. 1-5-6-2 M/P Project Implementation Mechanism (at the Start)

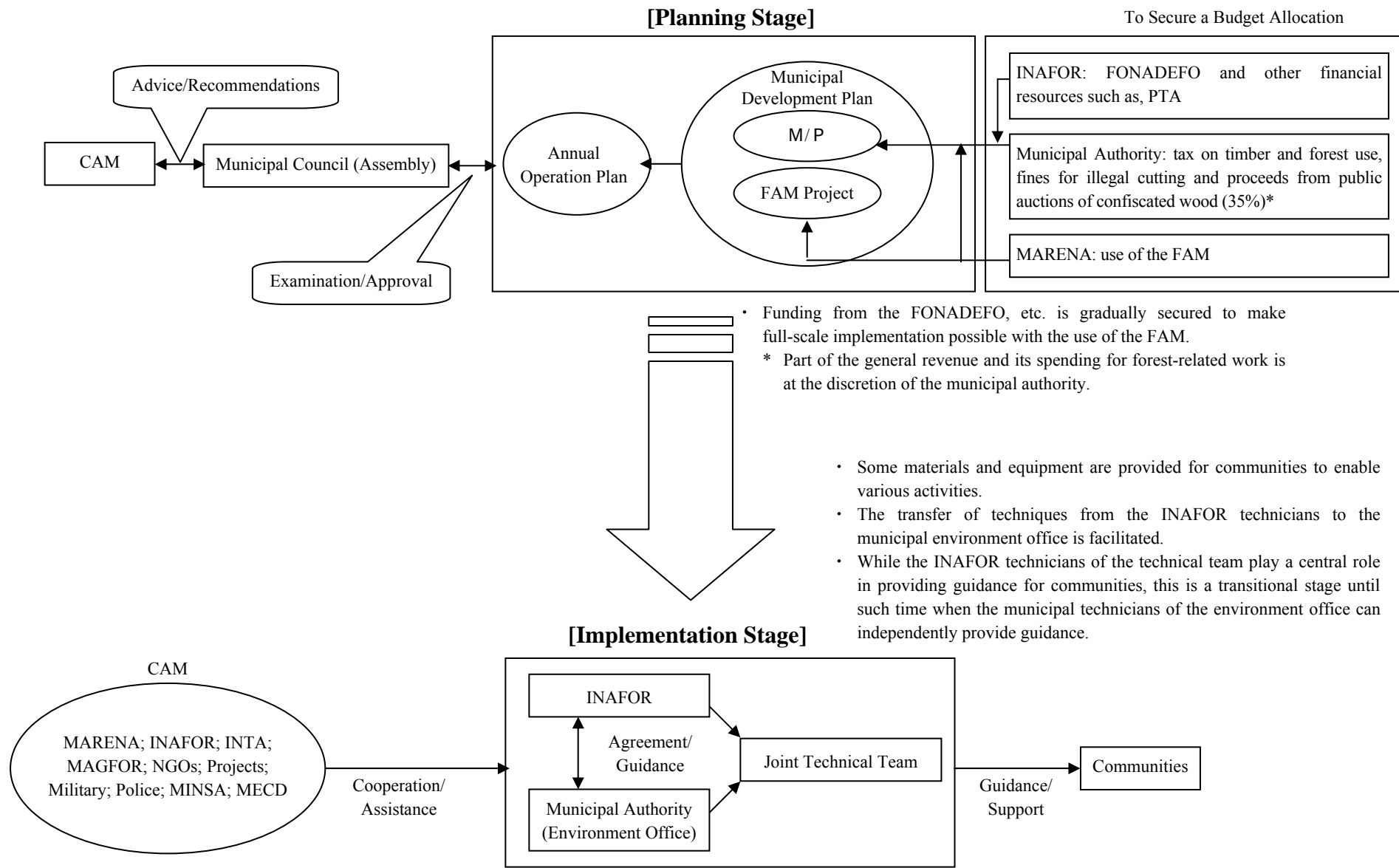


Fig. 1-5-6-3 M/P Project Implementation Mechanism (Transitional Stage)

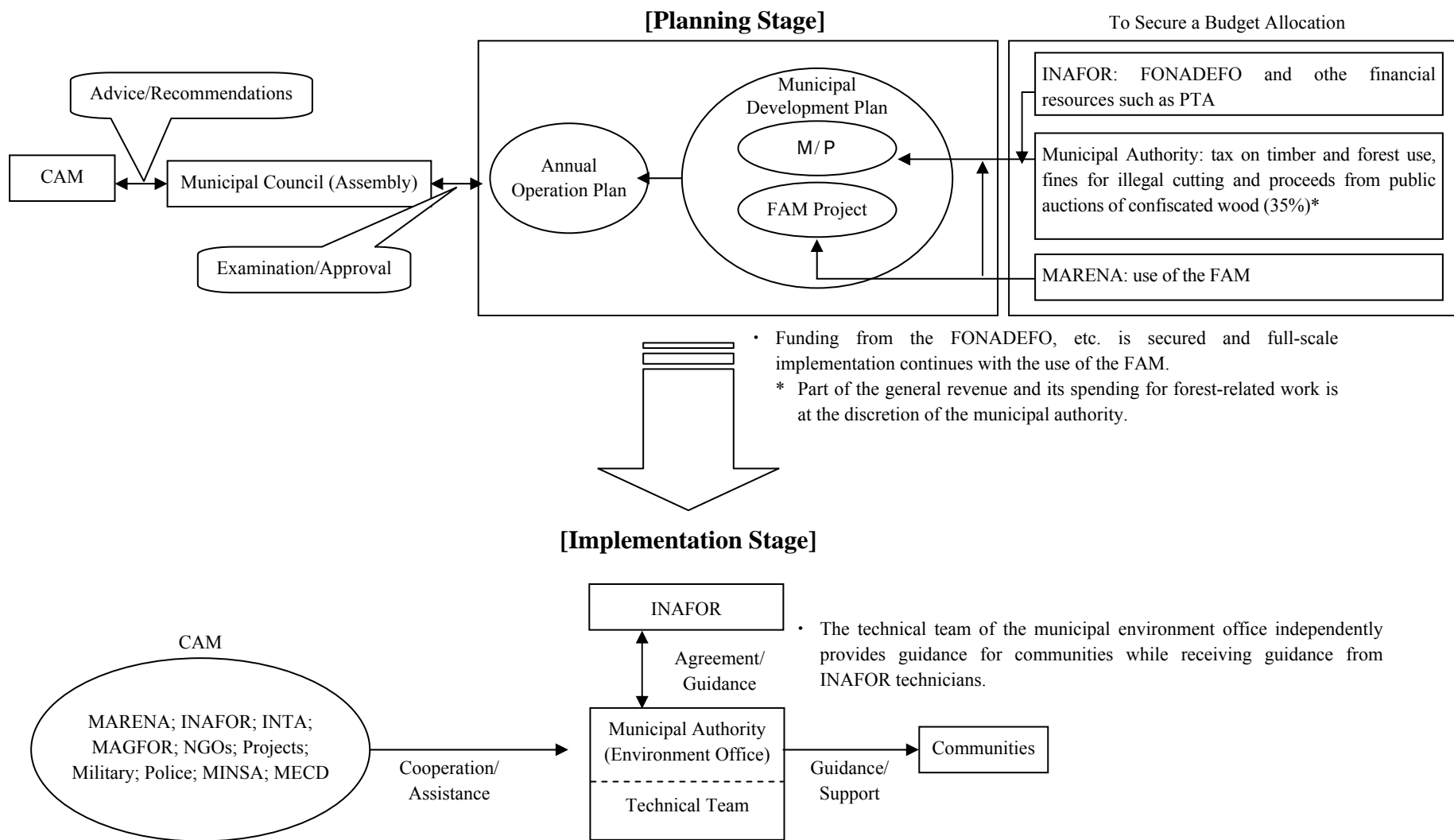


Fig. 1-5-6-4 M/P Project Implementation Mechanism (Future)

1.5.7 Project Implementation Processes

The flow of project implementation in each community based on the implementation mechanism described in 1.5.6-(2) is shown in Table 1-5-7-1.

Table 1-5-7-1 Flow of Project Implementation

Process	Implementation Body
1. Incorporation of the M/P in the Municipal Development Plan and formulation of a municipal strategy for implementation	Technical team and municipal environment office
2. Prioritisation of the target communities	Technical team and municipal environment office
3. Explanation of the implementation of “forest management” activities to the community committee and local residents	Technical team
4. Formulation of an action plan	Technical team (with the participation of local residents)
5. Organization of participating residents	Participating residents (facilitated by the technical team)
6. Formulation of activity plans	Participating residents (facilitated by the technical team)
7. Implementation of activities	Participating residents (facilitated by the technical team)
8. Monitoring and evaluation	Participating residents (facilitated by the technical team)
9. Follow-up	Technical team

(1) Incorporation of the M/P in the Municipal Development Plan and Formulation of a Municipal Strategy for Implementation

The INAFOR will provide guidance for the municipal environment office for the incorporation of the M/P in the Municipal Development Plan to gain the status of the municipality’s own plan. The concrete implementation strategy (clarification of restrictive factors, problems regarding the implementation of the M/P Projects and measures to deal with them, establishment of goals and objectives and establishment of priority implementation areas and guidance policies, etc.) will then be formulated, taking the conditions of each municipality into consideration.

(2) Prioritisation of the Target Communities

The technical team will prioritise the target communities through the following processes with a view to ensuring the effective implementation of the M/P.

① Decision on the priority areas where activities should be implemented in preference to other areas, taking the topography, presence of forests and situation of devastation, etc. into consideration.

② Selection of a core community for which an implementation plan should be prepared and implemented in a priority manner in each priority area based on the observation and evaluation results of the indigenous development capability (shown in Table 1-5-7-2) of each community and judgement on the ease of implementing the planned activities and the prospects for the community to become an extension model for such activities.

③ Spread of the activities to neighbouring communities while using the core community as an extension model for activities; determination of the priority of communities for the implementation of activities based on the observation and evaluation results of the indigenous development capability of each community and judgement on the ease of implementing the planned activities as in the case of ② above.

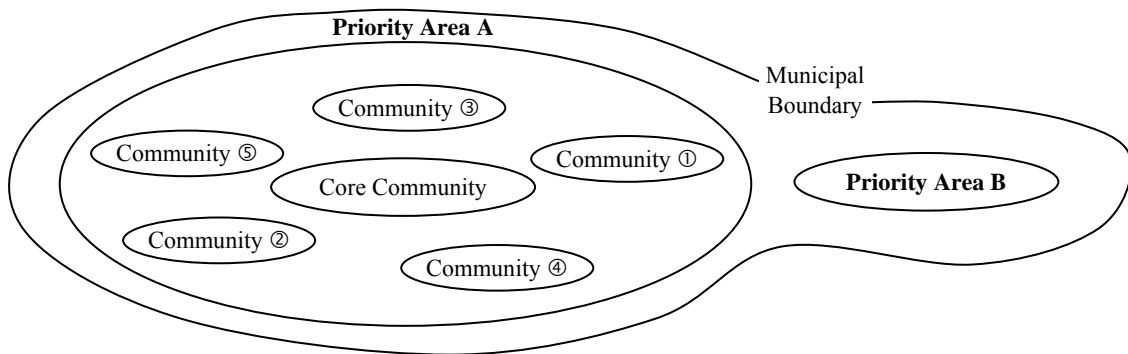


Fig. 1-5-7-1 Priority Area, Core Community and Extension of Activities to Neighbouring Communities

Table 1-5-7-2 Observation and Evaluation of Indigenous Development Capability

Factor	Indicator	Key Points for Observation and Evaluation
Technical Capability	Past experience of activity	<p><u>To clarify how much local residents understand and practice the techniques/skills learned</u></p> <ul style="list-style-type: none"> • Have they received any guidance on forest and soil conservation techniques/skills through the relevant activity? • Are they putting the techniques/skills learned into practice? • Are they using the techniques/skills learned correctly?
	Ability to apply techniques/skills	<p><u>To clarify the degree of understanding and application ability of techniques/skills</u></p> <ul style="list-style-type: none"> • Do they understand the technical significance of individual work to be implemented? • Do they understand the position of individual work to be implemented in the production cycle? • Do they understand the future effects of individual work to be implemented? • Have they applied the techniques/skills learned to other situations? • Can they conduct the work individually without technical guidance? • Do they understand what technical knowledge is insufficient?
	Ability to implement activities in a planned manner	<p><u>To clarify the degree of understanding of own resources and ability to implement activities in a planned manner</u></p> <ul style="list-style-type: none"> • Do they understand the extent of their own resources (land and labour)? • Do they think about future land use? • How do they plan? • How have they conducted their activities? • Have they observed the implementation processes? • Have they reviewed their activities? • Have they used the review results to improve subsequent activities?
Organizing Capability	Organization according to need	<p><u>To clarify the degree of capability to establish a system to deal with emerging problems in an organized manner</u></p> <ul style="list-style-type: none"> • Do local residents gather to discuss problems when necessary? • Is information shared within the community? • Are there any community rules and are such rules abided by? • What are the existing organizations? • Are there any events which are held by the entire community? • Is any joint work conducted? • Are suitable measures in place to ensure the effective functioning of created organizations? • Are the leaders of organizations active and are the participating residents cooperative?
	Existence of leading persons	<p><u>To clarify the degree of capability of each leading person (leaders of active community organizations, leader of the community committee, leaders of activity groups and promoters, etc.)</u></p> <ul style="list-style-type: none"> • How clearly do leaders understand the situation of the activities of participating residents? • Do the participants trust the leaders? • Are the leaders themselves involved in activities to set an example? • Do the leaders actually lead the participants? • Has anyone experienced the role of being a promoter? • Does anyone have the required qualities to act as a promoter? • Are people in the above two categories willing to guide other local residents?

Factor	Indicator	Key Points for Observation and Evaluation
Resources Procurement Capability	Ability to utilise resources in the community	<p><u>To clarify the degree of capability to utilise the resources available in the community (materials, equipment, funds and labour, etc.)</u> (Materials and Equipment)</p> <ul style="list-style-type: none"> • What materials and equipment required for activities are available? • Do they understand the available resources in the community? • Do they have the knowledge to use something else when the available materials and equipment are insufficient? Do they actually utilise such knowledge? • Is there a tendency to be excessively dependent on external assistance? <p>(Funds)</p> <ul style="list-style-type: none"> • Do they have sufficient funding capability to invest in forest management activities? • Have they had the experience of combining funds or goods to achieve a common objective? <p>(Labour)</p> <ul style="list-style-type: none"> • What is the situation of waged labour in and out of the community? • In what way do family members participate in activities? • How is extra labour obtained to supplement a labour shortage?
	Ability to utilise resources outside the community	<p><u>To clarify the degree of capability to utilise external resources (external organizations and neighbouring communities)</u></p> <ul style="list-style-type: none"> • Have they had the experience of using an external organization on their own initiative? • How do they use the municipal authority and other administrative bodies? • Do they effectively use the representatives of administrative bodies and NGOs visiting the community? • Have they ever implemented an activity in coordination with another community? • Do they have information on external assistance organizations?
Willingness to Initiate Activities	Marketability of forest products	<p><u>To clarify the marketability of forest products</u></p> <ul style="list-style-type: none"> • Have they ever marketed forest products? • Is there any potential for the marketing of forest products in the future? Are there any forest products which can be marketed?
	Understanding of the benefits of activities	<p><u>To clarify whether the benefits resulting from activities are understood or not</u></p> <ul style="list-style-type: none"> • Is there any need for local residents to implement activities? • Do they understand the benefits of their own activities? Do they understand such indirect benefits as soil conservation, etc? • Do they understand what should be conducted to gain the conceivable benefits?
	Sense of purpose	<p><u>To clarify whether or not local residents implement activities with a concrete sense of purpose</u></p> <ul style="list-style-type: none"> • Do they implement each activity for a concrete purpose? • Are the purposes of activities realistic or achievable?
	Leeway in daily life	<p><u>To clarify how leeway in daily life is linked to the implementation of activities</u></p> <ul style="list-style-type: none"> • Do they have spare time to be used for forest-related activities? • Do the actual conditions of daily life (in terms of food, clothing and housing) allow them to direct their attention to forest-related activities?

(3) Explanation of Implementation of Forest Management Activities to Community Committee and Local Residents

The technical team will approach the community committee in regard to the implementation of forest management activities and will then explain these activities to all local residents with the acknowledgement of the community committee.

(4) Formulation of Action Plan

The technical team will clarify the outline of the natural and social conditions of the subject communities of activities, jointly analyse the problems faced by these communities with local residents and examine suitable measures to solve such problems. The technical team will then formulate an action plan stating these measures and the desirable direction for the development of an implementation system to actually implement the said measures (refer to the Guidelines for Formulation of Forest Management Action Plan for Disaster Prevention described later). In formulating the action plan, the technical team should use interviews and other means to make the plan reflect the opinions of local residents so that the action plan is not simply the result of the ideas of the team members.

For evaluation of the implementation of action plan, a simple PDM incorporating the objectives, results, necessary activities to achieve the objectives and indicators to be used for evaluation, etc. should be prepared from the viewpoint of the technical team.

(5) Organization of Participating Residents

As already mentioned in 1.5.3 of Part II, an implementation body will be formed by means of organizing those local residents who are willing to participate. The participation in and withdrawal from this body should be entirely based on the free will of each participating resident.

(6) Formulation of Activity Plans

Based on the action plan, individual activity plans and joint activity plans will be prepared.

a. Individual activity plans

Each individual participant will prepare a schematic drawing of the shape and position of the land he/she owns under the guidance of the technical team and will enter the planned activities on this drawing to formulate an individual activity plan which will include descriptions, schedule and inputs (man-days, required materials and equipment and budget, etc.) The working group leaders will compile the relevant contents of these individual plans into working group plans.

b. Joint activity plans

The joint activity working group will formulate a plan incorporating the anticipated results, schedule, person in charge and inputs (man-days, required materials and equipment and budget, etc.) for each type of activity of which the benefits spread to the entire community. In this planning process, the working group will coordinate with the community committee and receive assistance from the technical team.

(7) Implementation of Activities

Activities will be implemented in accordance with the individual plans and joint plans with careful attention paid to the following issues.

a. Provision of materials and equipment

The participating residents will examine the planned contents of the activities and discuss the contributions to be made by themselves and those to be made by external assistance organizations, including the INAFOR, the municipal authority and other related administrative bodies, prior to the commencement of activities. The principal rule for the provision of materials and equipment will be for the contributions made by the said external assistance organizations to be limited to those which cannot be provided by local residents, making the maximum use of the available resources in the community essential from the viewpoint of developing the ownership of local residents as well as ensuring the sustainability of activities.

Given the severe economic situation of communities, however, it may be a good idea to provide some materials and equipment if possible until such time when local residents develop a willingness to conduct activities at their own expense. Even in this case, it must be explained to local residents that the provision of such materials and equipment is part of the technical guidance and that the actual contents of such materials and equipment will be determined based on their necessity, productivity and educational implications in terms of productive activities. The providing sides should contrive suitable ways of providing such materials and equipment so that the receipt of materials and equipment is not the purpose of the activities.

b. Guarantee of fairness

To guarantee fairness among the participants, participation in and withdrawal from the implementation body by local residents should be freely allowed. Efforts should be made to develop an environment in which everyone regardless of sex or age can participate and freely express their opinions.

In the Study Area, it is not unusual for the head of the household to be absent from the community for a long period of time to work away from home. The people, including men, women and children, who will benefit from the activities and the people who will be adversely affected by the activities should be clarified when proceeding with activities while developing participation methods suitable for the specific circumstances of individual participants.

(8) Monitoring and Evaluation

The monitoring and evaluation of activities will constitute important processes to ensure the sustainability of activities. Monitoring and evaluation by the participants themselves is an effective means of making them constantly aware of the fact that they are stakeholders, developing the habit of thinking for themselves and motivating their self-development.

Monitoring should be conducted to check the progress situation of activities and the original plans may be modified depending on the monitoring results. Meanwhile, evaluation should be conducted to judge the achievement of each indicator shown on the PDM based on activity records and the analysis results of monitoring data so that the activity results can be reviewed and reflected on future activities to ensure that they are on the right track.

In consideration of the educational level of local residents, the adoption of complicated monitoring and evaluation methods is not a good idea and very simple methods which allow local residents to conduct monitoring and evaluation without external assistance should be used as much as possible.

(9) Follow-Up

a. Training and deployment of promoters

At the initial implementation stage of activities, the technical team should provide fairly intensive technical guidance in each community. In accordance with the progress of activities, the intensity of this technical guidance should then be reduced to move to the follow-up stage as the technical team shifts its primary focus to guidance in another community. At the follow-up stage, even though the technical team will still provide guidance depending on the situation, it will find the maintenance of a constant guidance regime practically impossible. It will, therefore, be essential to train a promoter in each community to supplement the guidance provided by the technical team.

Actual examples of promoters for other projects, however, suggest that it is difficult to expect them to play an active function, such as that of extension workers, when only relying on their

volunteer spirit without incentives (in the form of economic and labour assistance, etc.) and it must be fully recognised that the scope of their cooperation for technical guidance is limited.

As there is no financial room to employ promoters for the implementation of the M/P, prospective promoters will be selected from among the participants. Given the fact that these promoters will be volunteers as in the case of the executive members of the implementation body, their roles will be basically passive, including acting on instructions from the coordinator and teaching in response to requests made by local residents. These promoters must be aware of their own capabilities to perform their functions or work. For this reason, when educating and training prospective promoters, the technical team must ensure that they learn not only the necessary techniques/skills but also essential knowledge required to perform their functions, including that on leadership, plan implementation management, organizational operation and technique/skill transfer methods. Although promoters will not be paid, the development of an environment which enables their smooth functioning by means of introducing a mechanism by which some form of economic support (supply of labour and food, etc.) can be provided by all participants should prove effective to enhance the motivation of promoters.

b. Follow-up by administration

Although it is reasonable to expect that some activities will be conducted during the period of intensive guidance by the technical team, experience of forest-related projects in the past shows that most activities become stagnant once a project ends. In view of this, it is desirable for the administration (the INAFOR and municipal environment offices) to provide periodic assistance or to follow up the activities of the participants when necessary instead of leaving the participants unassisted following the end of the initial period of technical guidance by the technical team.

For this reason, the administration should establish a system which is capable of maintaining regular contact and providing information on new technical knowledge and government assistance in order to ensure the continued activities of organizations established at the time of the technical guidance as the implementation bodies. This system should also enable such bodies to exchange information with other communities. Moreover, the finding and training of people to act as key persons is important to ensure the continued activities of these implementation bodies.

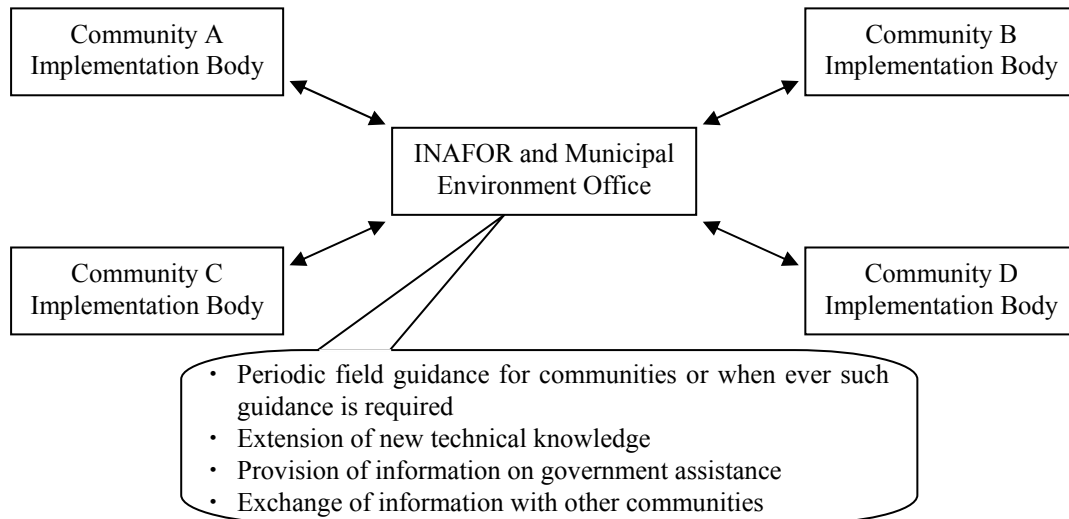


Fig. 1-5-7-2 Maintenance of Liaison System Between Administration and Communities

1.5.8 Basic Concept of Community Guidance

Even though many forest or environment-related projects have been implemented in Nicaragua in the past, the reality is that the various activities under these projects failed to continue once the projects ended. The following characteristics of these past projects are believed to be responsible for the discontinuation of activities.

- As these projects primarily focused on poverty relief for local residents because of Nicaragua's severe economic circumstances, local residents conducted various activities without pursuing the proper objectives of forest activities.
- Technical knowledge was unilaterally handed down to local residents from the project implementation body and no emphasis was placed on the continuity of activities.

In view of such past experience, the Study sets the continued activities of participants as the most important goal. There are many conditions (factors and requirements) which must be met for "activities to be continued" and those conditions which are close to the participants are listed below.

- ① The participants have a sense of purpose to implement activities.
- ② The participants have a high level of technical understanding and application capability.
- ③ The participants are capable of identifying their own resources and implementing activities in a planned manner.

- ④ The participants are capable of establishing a system to systematically deal with emerging problems.
- ⑤ The leading persons (leaders of active community organizations, leader of the community committee, leaders of activity groups and promoters, etc.) have leadership abilities.
- ⑥ The participants understand the benefits resulting from activities.
- ⑦ The participants can obtain the resources required for activities.
- ⑧ The forest products produced by activities are marketable.
- ⑨ Leeway in daily life leads to the implementation of activities.

Once many or all of these conditions are met, there is a stronger likelihood that the activities will continue. It is, therefore, important to establish concrete guidance policies for each community based on the key points for guidance shown in the Community Guidance Manuals to enhance the indigenous development capability of communities and the participants should be guided in line with these policies to meet the above-listed conditions.

1.6 Project Evaluation

The M/P was evaluated from the five viewpoints of DAC, based on the results of evaluation of the P/S. Regarding efficiency, the activities in the P/S were analyzed, and economic evaluation was conducted for the M/P when it was formulated in Phase I. As the key to the successful implementation of the M/P is whether residents will actively take part in the activities, the implementation system was also evaluated.

(1) Relevance

A study was conducted on whether the overall goal of the P/S, i.e. “enhancement of the soil and water conservation functions of forest as a result of voluntary and continual activities by local residents”, would meet their needs. The relevance of the P/S is judged to be high since i) voluntary activities were carried out under the Study as a result of their understanding of the need for conservation of forests and ii) they were ready to begin forest conservation activities in 8 out of the 9 communities in the P/S, indicating the conformity of these activities to their needs.

Judging from their voluntary activities in the P/S and positive remarks in the evaluation workshop, it was confirmed that the conservation of forests in their communities and of cultivated land is a definite priority among residents as these constitute their livelihood. The target land belongs to each resident and the outcomes of the activities will constitute private property for the next or future generations. These facts act as a basic incentive for participation in the project. Such facts show the relevance of implementing the M/P based on the initiative of residents and also show the realistic possibility of realizing the Plan in the huge Study Area under the condition of the limited capability of forest administration.

Some communities have more urgent matters which must be dealt with before they undertake forest management activities. In this case, they should commence forest management activities on their own initiative after solving these problems. The project should be launched with communities of which the needs are consistent with the objectives of forest management activities and which are ready to begin key forest management activities immediately.

(2) Effectiveness

The contents, period and timing of the activities under the P/S were studied to see whether they were effective in achieving the goal of the project, i.e. “establishment of the foundations for the continual implementation of forest management activities for soil and water conservation through the implementation of such activities.” The activities were judged to be effective as the goal was achieved in 8 out of the 9 communities in the P/S.

The contents of the project activities are considered to be appropriate because (i) the relationship between the activities and the soil and water conservation function of forests is clear and (ii) the abilities of residents are developed not only by lectures but also by practical guidance and training. The project period of two years is suitable because it allows residents to implement activities during two seasons and they can apply the lessons learned from their failures in the first year to the second year. These points were favourably received in all communities in the Study Area against the background of past projects of which the contents were very one-sided and which were implemented in a short period of time with external aid.

Special mention should be made of the fact that the two year P/S gave the residents a variety of skills and experience of group work and the confidence they gained by achieving the project goal enhanced their willingness to take part in activities. Careful attention should be paid to ensuring that the commencement of the project matches the nursing season of seedlings in the first year and that adequate time is allowed for preparations, including planning.

(3) Efficiency

1) Efficiency of Activities

The efficiency of the activities under the P/S was studied focusing on ideas to achieve the stated goal with low inputs and a desirable systematic approach. The activities of the M/P consist of three basic activities and three priority approaches. Five categories of activities were studied, combining the slash and burn farming control approach and the soil conservation approach.

<Slash and burn farming control/ soil conservation activities>

These activities were carried out efficiently in one-third of the communities. In the remaining communities, however, the residents did not act efficiently enough due to a lack of awareness.

<Forest improvement activities>

Though the survival rate of the seedlings or planted trees was low in the first season, the activities were carried out efficiently in the second season based on experience obtained in the previous year. However, activities were not active in two communities due to the lack of a strong sense of purpose.

<Prevention of forest fire activities>

The activities were carried out more or less as planned in each community and achieved good results. However, about only half of the communities attempted to work in cooperation with neighboring communities or external organizations.

< Livelihood improvement activities>

Home gardening activities were carried out effectively as the participants had a strong interest in improving their livelihood though a difference in attitude was evident in each community in terms of their self-help efforts to procure materials and equipment.

<Environmental education activities>

The activities were carried out positively in communities where emphasis was given to environmental education. The activities were particularly efficient in communities where the cooperation of a teacher was sought.

2) Economic Evaluation

a. Object of evaluation

Regarding the soil and water conservation function, qualitative evaluation was carried out targeting the entire Study Area. Among the various individual plans, the “reforestation plan”, “soil conservation plan” and “livelihood improvement plan”, the benefits of which could be directly determined, were analyzed in the form of economic evaluation. In the case of the soil conservation plan, measures to improve the vegetation on agricultural and grazing land were studied in the form of agroforestry and silvopasture. In the case of the livelihood improvement plan, “home gardens”, “improved stoves”, “gravity type simple watering” and “diversification of crops”, for which it was relatively easy to make models, were evaluated. Other activities were excluded from the economic evaluation because it was difficult to make models as the cases involved greatly differed.

As components of the economic evaluation, one qualitative evaluation of the “soil and water conservation function” and seven quantitative evaluations of the “reforestation plan”, “agroforestry”, “silvopastoral”, “home gardens”, “improved stoves”, “gravity type simple watering” and “diversification of crops” were carried out.

b. Methods of evaluation

The FIRR (Financial Internal Rate of Return) was calculated as the index for the farming economy while the EIRR (Economical Internal Rate of Return) was calculated as the index for the national economy.

Evaluation period (project life)

The 22-year project life of the reforestation plan is the longest period among the individual plans. The evaluation period was set uniformly at 22 years to allow the comparison of different plans.

Sharing the project costs

For the sake of simplification, all costs except the resident's share are assumed to be borne by the central government though in actual fact there may be donors, NGOs and others in addition to the government sharing the project costs. Division of the cost between the government and the residents was assumed for each plan and the economic evaluation was based on the premise that the costs were shared according to the assumed division.

Financial price and economic price

The price used in the economic evaluation was based on information obtained in the field survey in July, 2001. The conversion coefficients used in POSAF were applied to conversion from the financial price to the economic price.

Inflation

The annual inflation rate in Nicaragua has been less than 20% since 1992. The average annual inflation rate from 1996 to 2000 was 10.97%. As a general rule, economic evaluation does not take inflation into consideration and does not change the prices, which are used to calculate the cost effectiveness through the life of the project. This is because the prediction of future inflation is difficult and the inclusion of inflation in the calculation affects the accuracy of the evaluation as the original concept considers the passage of time in judging the value of resources. On the basis of this argument, the present economic evaluation does not allow for inflation.

However, in the calculation of the prices of agricultural products and others, past inflation was taken into consideration and past prices were converted into prices as of July, 2001 (= 1.0) since the average prices were calculated using past prices.

c. Conclusions of economic evaluation

Soil and water conservation function

A 20-year plan for the restoration of forests and conservation of slopes is proposed in the M/P, which includes a natural forest management plan, reforestation plan, soil conservation plan, forest protection plan and others. Implementation by residents is a precondition for the M/P, considering the financial situation of the administrative authorities and the lack of the necessary administrative set-up, etc. The M/P tries to shift forests from a 'negative' state of decline in quality and quantity to a 'positive' state through activities led by residents. While major achievements cannot be obtained in a short time, forest resources in the Study Area will improve step by step and the soil and water conservation function of forests will grow through the continued pursuit of similar plans after 20 years.

It is difficult to quantitatively grasp and specify the degree and effect of improving the soil and water conservation function but it is empirically well known that the restoration of forests improves the flow regime of rivers and their erosion control function. The economic effects due to the reduction of economic loss and improved agricultural and livestock productivity are judged to be high because the frequency of natural disasters, such as flood and sediment disasters, is reduced with the improved soil and water conservation function of forests.

People have exploited forest resources in a wide area for agriculture and stock raising, causing the degradation of forests and a decrease of the forest area. The various plans mentioned above propose a shift of the main focus from the consumption of forest resources to an attempt to restore forests. People need to recognize that such activities require a vast amount of time and money. It is important to continue these activities and steadily obtain results based on this recognition.

Reforestation plan

The FIRR stands at 19% according to the results of household analysis (with government support). The reforestation plan is expected to be profitable as a development project because this value is higher than the standard value for reference of 15% for development projects in Nicaragua.

The presumed contribution of residents is about 90%, the unit labour cost is C\$ 40 per day and the unit price of wood is C\$ 119 per m³. A detailed survey of prices will be needed in each area in the feasibility study because the unit labour cost and unit price of wood change according to region and time. The method and frequency of each task must be reviewed if the price of firewood is low and the earning rate is poor as the contribution of residents is entirely

made in the form of labour. Though the share of the government is as low as 10%, the FIRR falls to 16% when residents cover the full cost without government support.

In the economic analysis, the EIRR is 20% with a conversion coefficient of the unit labour cost (unskilled labour) of 0.70 and a conversion coefficient for firewood and materials (non-imported goods) of 1.15. The earning rate from the viewpoint of the national economy exceeds the FIRR because the unit labour cost is evaluated lower in the national economy even though the cost includes the material cost covered by the government in the household analysis.

Agroforestry

The FIRR stands at 24% with government support and it stands at 22% without government support. The EIRR is about 25% and, as in the case of the reforestation plan, it exceeds the FIRR. Unlike the reforestation plan, agroforestry does not require ground clearance, weeding, building of fences and fence materials since nursery stocks are planted in cultivated fields.

However, some fields need to be protected by fencing if livestock can currently come and go freely due to the absence of fencing. The FIRR becomes 20% (with government support) and 16% (without government support) and the EIRR falls to 18% if residents bear the erection cost of fencing.

Agroforestry is the second-best way that conforms to reality because agriculture and stock raising can be performed in harmony with forests on sloping land. However, the soil and water conservation effects in the entire basin are small compared to the option where the entire surface of the ground by forests.

Silvopastoral

The FIRR for the silvopastoral field is 19% with government support and 18% without government support; and the EIRR stands at 21%. This plan is more profitable than the reforestation plan since it does not require ground clearance and the erection of fencing but the earning rate is lower than that for agroforestry as weeding is required.

Grazing is avoided after planting in this plan in order to prevent the small trees being eaten by livestock. When grazing cannot be avoided, separate allowance must be made for the cost of fencing. The FIRR becomes 10% with government support and 4% without government support and the EIRR drops to 7% if the cost of fencing is included. Therefore, it is wise to implement silvopastoral in parts little by little using the existing fences.

Home gardens

The FIRR and EIRR for home gardens are 92% and 10% respectively. Residents cover the entire cost and this plan is more profitable than the production of firewood. In regard to the cost, nursery stocks for home gardens are more than ten times more expensive than those for firewood. However, ground clearance, weeding and the erection of fencing are not required as seedlings are planted in home gardens. The labour cost for home gardens is also lower than that for firewood collection even though some management, such as pruning, is required.

In the P/S, it was observed that some gardens require fencing because livestock can freely enter these gardens because of the lack of fencing. In such cases, new fencing will be required, reducing the FIRR to 76% and the EIRR to 84% based on the cost of a 2 m x 2 m fence for every small fruit tree.

Regarding the benefits, residents can harvest high value fruit every year. With easy tending, they can consume the fruit themselves. Adequate effects can be expected from the livelihood improvement plan to cultivate about 10 fruit trees in the home gardens although additional costs and marketing problems will arise if they try to earn their main income from selling fruit.

Improved stoves

If the government pays for the materials for the improved stoves with the residents providing the manpower, the FIRR is 51%. If the residents cover the entire cost, including that of the materials, the FIRR is 34% and the EIRR is 53%. The reason for this high profitability is that the daily amount of firewood consumption can be greatly reduced (assumed to be 30% here) with only relatively small-scale initial investment. By simple calculation, the investment cost for improved stoves will be recovered in three years. Accordingly, their early introduction is hoped for if residents can afford the initial cost.

The maintenance cost will not increase very much as traditional stoves also incur a maintenance cost. However, 20% of the manpower required at the time of installation will be required every year to cover the maintenance cost to ensure that the stoves can be used for as long as possible.

Gravity type simple watering

Gravity type simple watering needs to be carefully examined on a case-by-case basis because the costs and benefits are very different for each case. The FIRR is 14% if the residents meet the entire cost, including that of the materials, and the EIRR is 15% in this trial calculation. If

the construction materials, which account for about 70% of the total cost, are paid for by the government, the FIRR rises extraordinarily. The initial investment is so great that some financial support by the government appears to be required for the implementation of this plan and the actual proportions of the cost-sharing between the government and residents must be analysed in detail.

Diversification of crops

The change of crop cultivation from corn to pumpkins was estimated here by considering the income from corn as the opportunity cost of pumpkins. Residents bear the entire cost and both the FIRR and EIRR stand at 31%. In short, there appears to be room to consider the introduction of more profitable crops based on the precondition that the existing production volume is more than adequate, allowing a change to other crops.

(4) Impacts

The indirect effects of the P/S, centering on the ripple effect on neighbouring communities, were examined. Sizable positive impacts, such as those listed below, have occurred in some communities even though the occurrence of the ripple effect was limited by geographical factors.

- Free distribution of surplus nursery stocks to non-participants or neighboring communities
- Observation of the activities by residents from neighboring communities
- Formation of a fire brigade in every community in the area of a municipality as a result of forest fire prevention campaigns.
- Initiative for formulating common rules on forest use by all the communities in a municipality
- Official commendation of the environmental education for children by the MECD.
- Talk of starting a similar project in neighboring communities stimulated by the P/S.

The leadership and solidarity in communities which were formed and strengthened through joint activities in the P/S will be utilized not only for the continuation of the project but also for the administration of the community and other activities.

From the viewpoint of gender, there was no evidence of an excessive concentration of either sex in certain activities although there were cases when women made up for the lack of manpower for some activities as the men were working outside the communities. The active

invitation of women to participate in the P/S led to more dialogue between men and women and increased their cooperative relationship, albeit to a different degree depending on each community.

Programs for acquiring skills led to an interest in learning new things in addition to the effects of the skills themselves. It was an unexpected result that the residents' motivation to learn was improved. Literacy education was carried out during the process of implementing the activities and significant progress was made in some communities.

(5) Sustainability

It is judged that the residents will continue the activities in the future in 8 out of the 9 communities and the sustainability is believed to be high judging from the results of the comprehensive analysis which focused on whether the residents of the target communities in the P/S would continue the activities or not.

There are many participants who have acted with a sense of purpose in those communities where the activities are likely to continue and they are learning the necessary skills for the continuation of the forest management activities. The participants are able to earn cash income through their activities in some communities.

However, even in communities that seem likely to continue the activities, attention must be paid to the following points.

- Activities based on each area (in a community) may be important due to the location of their houses.
- Future land use plans should have a clear vision.
- The activity plan should correspond to the labour capacity in order to avoid an excessive workload.
- A liaison system with the municipality should be established and a close relationship should be formed.
- A cooperative system with neighboring communities should be established in order to protect the forests.

The need of residents for forest management is relatively low in communities that are not likely to continue the activities. They have a deep-rooted custom of expecting remuneration for their labour and lack initiative. The key to the continuation of activities is whether the

residents will use their ingenuity for the activities. The indigenous development capability of the community is important for ingenious ideas.

(6) Evaluation of Implementation System

1) Implementation System of Communities

Regarding the implementation system of the communities, the style adopted by the P/S is judged to be appropriate based on the results of monitoring and interviews with community leaders and coordinators of the implementation body of the P/S. There were two types of cooperation between the implementation body and the community committees: i) the community leader was also the coordinator of the implementation body, and ii) a resident other than the community leader was the coordinator of the implementation body.

Some leaders were changed at the end of the P/S because the burden on the leader was very heavy in case i). However, case i) is preferable whenever possible as good cooperation between the community committee and the implementation body is very important. Generally speaking, the role of the leader is very important for the implementation of forest management projects and it is impossible to expect there will be more than one person with leadership qualities and the ability to act in every community.

In case ii), a relationship of mutual trust was observed between the leaders and the community leaders who were members of the implementation body actively participated in the project. There were no problems regarding cooperation between the community committee and the implementation body. It can be assumed that a resident who was able to build a good relationship with the community committee was selected as the coordinator of the implementation body.

Explanations and proposals regarding implementation were firstly made to the community committee during the P/S and an explanatory meeting for all the residents of the community was held after obtaining the agreement of the committee. The residents who were able to take part in the activities formed the implementing organization. Forest management activities were conducted as activities of the entire community. It appears that technology transfer to non-participants and participation in the middle of activities will continue freely in the future because there appears to be no barrier between non-participants and participants who have a sense of participating in a project which is carried out by their own community.

2) Utilization of Promoters

In many communities, residents with a higher technological level than that of ordinary residents were found in the P/S. These residents appear to have the ability to teach other residents although not to the extent of being leaders. There is a possibility of improving their mastery of skills or increasing the number of participants by incorporating such people in activities as technical advisors or persons in charge of small groups when implementing forest management activities. It should prove effective to use them as “promoters” and the municipality and INAFOR have great expectations of them.

However, there is no budget for the employment of promoters in the M/P project. They cannot be expected to actively serve as so-called extension workers as this is a voluntary activity like that of the leaders. Their role is to act on the instructions of the leader or give advice when asked by residents which is basically a passive role. Their role should be considered as one of complementing the guidance by the technical team.

The INAFOR and municipalities must be careful that they do not expect promoters to play the role of extension workers and do not rely on them for the promotion of the project. The municipal environment office and the INAFOR who liaise with municipalities should play that role.

3) Support System of Municipal Environment Offices

Under strict budget restrictions, it is realistic for municipalities to support the concrete activities for the M/P in every community. This arrangement is appropriate as it can unify the support systems. Therefore, the first requirement is good access to communities by staff of the municipal environment offices. There are few municipalities where the staffs have exclusive use of motorcycles despite the fact that in many municipalities a single staff member may have to cover about 40 communities even though the number of staff of the environment office differs from municipality to municipality as mentioned earlier. They must make the maximum use of each single staff member because they cannot afford to employ any additional staff in the short term. Measures regarding means of transport (bicycle, horse, motorcycle or car) must be taken, including provision to cover the running and maintenance costs, taking the geographical conditions and how staffs are used into consideration.

An additional person must be employed to achieve a two staff system in the environment office in the medium-term. The municipal environment office should continue monitoring and evaluation with residents and act as a contact point with the municipal government and related organizations when a problem that cannot be solved by the community arises. Such continued follow-up enables the activities of the M/P to be integrated into the daily activities of

residents, making it possible to carry out activities in the long term and improving the soil and water conservation function in a wide area. The municipalities are requested to increase their staff strength as soon as possible to meet this expansion of activities.

4) Support System of INAFOR

Firstly, the INAFOR must establish a cooperative relationship with municipalities in order to continue the activities of the P/S and develop them. Article 7 of the New Forest Law also states that the INAFOR can conclude agreements with municipalities and delegate the promotion work of forest management to the municipal government.

To be more precise, efforts must be made with the environment office to reflect the contents of the M/P in the Municipal Development Plans and Annual Operation Plans of the municipalities after explaining the M/P to the municipalities in which the project will be carried out and obtaining their agreement. Linking of the Municipal Development Plans and the M/P makes the municipalities the main implementing organization of the M/P.

It is no problem for the municipalities to apply for a budget to the ministries although the INAFOR cannot directly access funds managed by other ministries. These funds will be necessary to conduct the M/P. Application for government funding by municipalities is a financial procedure which is in line with the support system where municipalities are the main actors.

The INAFOR must support the forest management project jointly with the municipal environment office in the short term in order to solve the aforementioned problem of access to communities. The INAFOR must make staff of the municipal environment offices understand the details of the M/P (Municipal Development Plans) and adequate discussions with staff on the contents of and support for the forest management project (Annual Operation Plan) are required. These are worthwhile tasks for the INAFOR (even excluding the viewpoint of the implementation of the M/P).

Staffs of the INAFOR, who are the counterparts for the Study, do not have enough knowledge or experience of facilitation in communities because their daily work is the planning of forest management and the authorization, inspection and regulation of tree-felling from the standpoint of the national administration. They have little experience of project management. Undertaking guidance and supporting activities for communities will be a good opportunity for OJT for INAFOR technicians as the planning and administration of forest management require knowledge and experience in the field.

The participation by local consultants or NGOs will be necessary for some time due to the lack of staff in municipalities although INAFOR has decided to increase the staff to five to work full-time for the project. The securing of excellent staff and the necessary budget will determine the progress of the M/P (differences of ability were observed among the local consultants in the P/S).

CHAPTER 2 GUIDELINES FOR FORMULATION OF FOREST MANAGEMENT ACTION PLAN FOR DISASTER PREVENTION

2.1 Basic Concept of Guidelines for Formulation of Action Plan

This M/P aims at preventing floods, drought and soil discharge by means of enhancing the soil and water conservation functions of drainage basins through appropriate forest management in which local residents play a central role. As forest management activities are primarily implemented by local residents, the implementation of such activities using each community, which is closely related to the daily life of local residents, as the implementation unit is appropriate. However, as each community has its own characteristics, it will be practically impossible to implement various activities in all communities under a uniform plan, making examination of a suitable implementation method for each community based on the M/P necessary. The formulation of a forest management action plan for disaster prevention to be implemented by local residents based on the results of this examination will be essential.

In this chapter, the guidelines for the formulation of a forest management action plan for disaster prevention are explained as a method for the formulation of such an action plan. These guidelines have been developed based on the following three presuppositions.

- The guidelines do not present a method for the formulation of plans for individuals.
- The guidelines explain the method to formulate an action plan for an entire community so that each community can implement forest management activities.
- An action plan is formulated by the INAFOR and the municipal authority with the participation of the targeted community.

2.2 Guidelines for Formulation of Action Plan

Three sets of guidelines are introduced here featuring the following subjects, all of which are related to the formulation of a forest management action plan at the community level.

- Forest management (including the production of seedlings and forest fire prevention measures)
- Environmental education
- Livelihood improvement

In addition, the way to develop an organization and system for the smooth implementation of activities is explained under the following heading.

- Development of systems for the operation of an organization and the implementation of activities.

These guidelines consist of the following components.

- Method to clarify the current situation to obtain basic information on the community.
- Selection method for activities
- Indicators for monitoring
- Compilation method for an action plan

Moreover, two forms are shown for reference purposes.

- Example of a forest management action plan for disaster prevention
- Example of PDM: The preparation of a PDM is necessary to clarify the goals, types and anticipated results of activities and indicators to check the achievements of activities prior to the implementation of an action plan.

Furthermore, the roughly estimated costs are shown under the following heading as yardsticks for the project costs when local residents implement an action plan.

- Estimated costs

2.2.1 Preliminary Study on Communities

(1) Objectives and Principals of the Study

In order to examine practical measures for the restoration of forests in line with the characteristics and present situation of each community, a preliminary study on each community should be conducted. This study should not be implemented in a one-sided interviewing side but with the participation of local residents in order that the process of the study itself constitutes an opportunity to empower local residents by confirming their situation, taking the prospect of local residents playing a central role in the activities into consideration.

Concurrently, baseline data on the community should be gathered to monitor changes during/after the series of activities.

(2) Survey Items to Draw Up an Activity Plan

The main items to be surveyed are listed below. The existing information should be used as much as possible and the focus should be placed on items which are simple and necessary to clarify the activity plan and technical guidance.

Main Items	Sub Items
1) General Information	Population (M,F), number of HH, population changes and their reasons Basic infrastructure (roads, bridges, electricity, water supply system, schools, health centres, community centres and churches, etc.) Brief history of the community
2) Natural Condition & Natural Resources	Natural conditions (climate, soil conditions, vegetation, animals and rivers) Natural resources (mountains, rivers, water sources, natural forests, artificial forests and mines, etc.) Changes of natural resources and natural disasters which have recently occurred Hazard areas of natural disasters Community boundaries
3) Organization, Human Resources	Community committee and other committees attached to the committee (functions, number of members and roles, etc.) Reliance on leaders, existence of leadership, degree of vitality of community decision makers and activities in the community Existing organizations (members, purpose, background of establishment, activities, outcome, functionability, capital and relationship with community committee, etc.) Problems of organization management External support for the community/ dependency on them Cooperative activities spontaneously carried out by the community Conflicts within the community Relationship with neighbouring communities
4) Land Information	Land holding size Land registration Existence of communal land and communal forests and their management method, if any
5) Agriculture, Livestock Farming	Land use tendency Implementation of slash and burn farming Major crops, their yields and sales amount Use situation of insecticides, chemical fertilizers and compost Erosion of farmland Problems of agriculture ----- Livestock (kind and number) Method of stock raising, including fodder in the dry season Present situation of introduction of improved grass and possibility of its introduction Problems of livestock farming
6) Social and Livelihood Conditions	State of self-sustenance Major income sources, including temporary income measures Waged labour (inside/outside of the community and outside of the country, etc.) Main expenses (cash, products) Sales channels for products and their problems, if any Access to rural credit. If any, organization providing a credit system, frequency of use and repayment rate Production activities for livelihood improvement, if any

Main Items	Sub Items
7) Forestry & Environment-Related Information	Increase/decrease of forests Main problems of forests and environment (forest fires, changes of quantity of water, problems of harmful insects, forest cutting, and soil erosion, etc.) Rules for forest fire prevention Experience of planting trees (areas/numbers and external support, etc.) Experience of nurseries (communal and individual) Number of produced nursing stock Awareness of the necessity for soil conservation Intention to practice forestry/environment-related activities Places necessary to plant trees / places likely to plant trees Favoured/unfavoured species, reasons and usage Place necessary to protect forests ----- State of supply and demand of firewood Distance to places to collect firewood Frequency and amount of firewood collection Sale of firewood, measure of sales, amount and price Measures to reduce firewood consumption, if any State of usage of timber and non-wood forest product ----- State of implementation of environment education
8) Experience of Technical Guidance & Other External Support	Experience of training on forestry/environment-related themes Experience of technical assistance in the past (contents, techniques/skills learnt, outcome and evaluation, etc.) Techniques/skills used after the training Useless/ unaccepted techniques/skills and their reasons Existence of promoters (functions and incentives, if any) Existence of potential promoters
9) Problems and Needs of the Community	Problems, needs and priority issues at community level Problems, needs and priority issues at individual level Constraints of community development or strength of the community

(3) Survey Method

- 1) Surveyor : 2–3 surveyors, who cover forestry, agriculture and socio-economy
- 2) Participants : Residents of the target communities and external organizations who are working in the community, if possible
- 3) Period required : 3-5 days / community
- 4) Tools : Such tools as PRA and PCM, interviews and observation, etc.

Survey method and its important points

Survey Tool	Information to be Collected	Remarks
Secondary data review	1)- 9)	In advance of the interview and workshop, review of the secondary data on communities available at the municipal government of existing external support organization for better efficiency
Key informant interview	1) General information 2) Natural conditions and natural resources 3) Organization and human resources 4) Land 7) Forest & environment -related information	In order to obtain general information on the community, conduct interviews with representatives of the community
Workshop a. Participant analysis b. Group discussion c. Problem analysis	3) Organization and human resources 5) Agriculture and stock raising 7) Forest and environment -related information 9) Needs of the community	<ul style="list-style-type: none"> • Invite all residents to the workshop for equal and transparent information distribution • It could be the case that the community has several external supports. Information of these activities should be analysed. • Regarding the collection of information on 5) and 7), it is preferable to divide into small groups for more interactive discussion. • Analysis of the problems and needs of the community, taking the results of the group discussions into consideration • Cross-checking of all the information obtained
Transect (village map)	2) Natural conditions and natural resources 7) Forest and environment -related information	<ul style="list-style-type: none"> • Checking of the natural resources, existing infrastructure and boundaries with neighbouring communities, etc. by means of field investigation in the community with the assistance of residents • It is anticipated that some issues which should be tackled by the community as a whole will emerge in this process. Recognition of these issues should contribute to fostering of the perspective of how to manage the community.
Interview with questionnaire	6) Social and livelihood conditions 7) Forest and environment -related information 8) Technical guidance and other external support	At the end of activities, the restoration of forests for disaster prevention as well as livelihood improvement is aimed at. For the purpose of monitoring changes during the process, the collection of quantitative data by means of a questionnaire survey will be necessary.
Study tours (to targeted communities of the P/S or other project sites)	8) Technical guidance and other external support	Provision of study tours to advanced communities to study the lessons learned as well as outcomes expected of the activities. Exchanges of opinions between farmers and observation of the results are the most effective way of learning. This process may contribute to enhancing the motivation to continue the work.
Observation	1)-9)	Observation of the attitude of the participants, potential leaders, decision makers and gender balance, etc. in the workshop. Cross-checking of the information obtained by other surveys

* The item numbers under “Information to be Collected” correspond to the numbers of (2) – Survey Items to Draw Up an Activity Plan.

(4) Analysis of Results / Selection of Activities

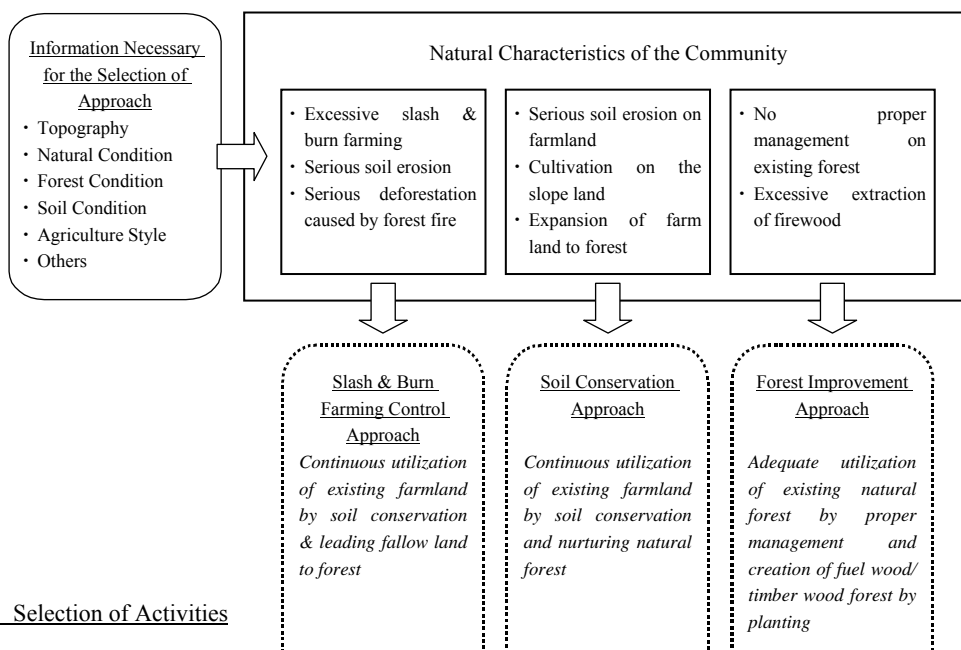
Based on the results of the series of surveys mentioned above, the likely activities should be examined. Firstly, the desirable priority approaches (slash and burn farming control, soil conservation and forest improvement) proposed by the M/P should be selected according to the natural conditions, agriculture style, situation of forests and soil erosion, etc. (refer to the figure below).

Practical activities should then be examined. As it is unlikely that forest management activities will fall in the category of a single approach, the methodology to achieve the goals may well overlap. Activities should, therefore, be selected based on the needs of the community as well as the socioeconomic conditions.

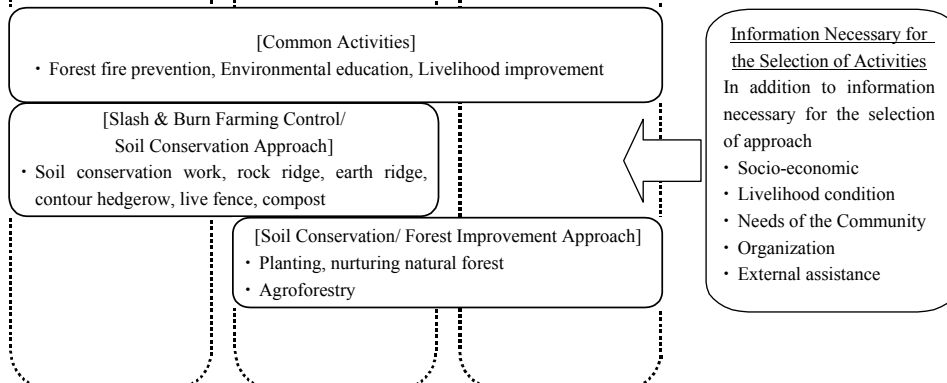
Because activities for forest fire prevention, environmental education and livelihood improvement are essential for all approaches, these items should be included as “common items” in the list of the planned activities. Further details and practical measures should then be decided, taking the socioeconomic and other specific conditions of each community into consideration.

There are activities of which the benefits are felt by the entire community or only by individuals. Such activities as “the prevention of forest fires” and “environmental education” should basically be regarded as activities for public benefit. Accordingly, it is important for the implementation body to cooperate with the community committee to conduct these activities. Other activities can be implemented by the community or small groups depending on the characteristics of the community regarding the locations of water sources, etc. A detailed description of the implementation system for various activities is given in 2.2.3.

1) Selection of Priority Approach



2) Selection of Activities



2.2.2 Formulation of Action Plan

(1) Forest Management

1) Basic Principles

Forest management activities should be examined and planned in accordance with the following principles.

- Constant attention should be paid to the desirable forest distribution and land use in the future from the viewpoint of the development of the entire community.
- Forest management activities should adopt the viewpoint of the community management of activities relating to the desirable forest distribution and land use.

2) Important Information

For the examination of realistic forest management in a target community, special attention should be paid to the following findings of the preliminary survey so that the information obtained can be used for judgement of the desirable activities.

- Topography (degree of inclination)
- Form of distribution and locations of houses
- Distribution of forests and cultivated land
- Distribution of pasture and distribution of trees on pasture
- Locations of water sources and headwater forests
- Cultivation methods (burning, shifting cultivation based on slash and burn farming and permanent cultivation)
- Soil of cultivated land (state of soil discharge, soil depth and amount of stones and pebbles)
- Labour force (main players for outdoor work and number of people working away from home)
- Prospect of forming a fire brigade
- Others

3) Preparation of Current Land Use Map

A proper understanding of the current situation of forest distribution and land use is important to proceed with appropriate forest management. A sketch map showing the current situation of land use in the community should be prepared in the following manner to develop such understanding.

< Clarification of the general situation from a distance >

- a. To check the general situation of land use in the entire community from a point providing an entire view of the community, accompanied by a local resident who is familiar with the community boundaries and the local situation
 - Tools to be prepared: pen, field book and others (a topographical map (scale: 1:50,000) and binoculars will be very useful, if available)
- b. To clarify the community boundaries, general topography and rivers, etc.
- c. To confirm the locations of the main facilities in the community, such as a school and church, as well as roads and water sources, etc.
- d. To clarify the distribution of hamlets, cultivated land, forests (natural forests, man-made forests and shrub forests), pasture and bare land

< Clarification of the details by field investigation >

- a. To observe by means of field interview the situation of cultivated land, forests and soil discharge which are believed to be typical examples in the target community
 - Situation of cultivated land: crops grown, practice of burning cultivation, crop rotation, use of manure and use of land for grazing, etc.
 - Situation of forests: species in natural and man-made forests, gaps and state of propagation of climbers and shrubs, etc.
 - Situation of soil discharge: existence of rills/gullies and presence and size of pebbles, etc.

< Workshop >

- a. To return to base and to draw a sketch map of the current land use (see Fig. 2-2-2-1) on paper using the gathered information
- b. Possible land use categories to be used:
 - Road and river
 - Dwelling (including school and church)
 - Farmland, pasture, forest, headwater area and reservoir, etc.

c. To discuss the current situation of land and the causes of such situation with local residents using the current land use map to develop the understanding of local residents of the importance of forest management and soil conservation

d. To use the current land use map as a tool to explain appropriate forest distribution and land use from the viewpoints of community development

4) Items of Forest Management Measures

a. There are three priority approaches to be taken by communities, i.e. “slash and burn farming control approach”, “soil conservation approach” and “forest improvement approach”. The priority approaches to be actually applied to a specific community should be determined in line with the conditions to prioritise an approach(es) shown in Table 2-2-2-1.

b. As planting is required for the three approaches and for the livelihood improvement, which is a basic activity, the seedling production should be applied for all communities.

c. The application of a forest fire prevention measure will be necessary for all communities.

d. Table 2-2-2-1 shows the likely activities under each approach. These activities are suitable for locations which meet the main selection criteria for activities shown in Table 2-2-2-2. As these tables simply arrange the various approaches and activities as the principal items, the construction of small erosion control facilities should be planned for those sites where such facilities are judged to be necessary.

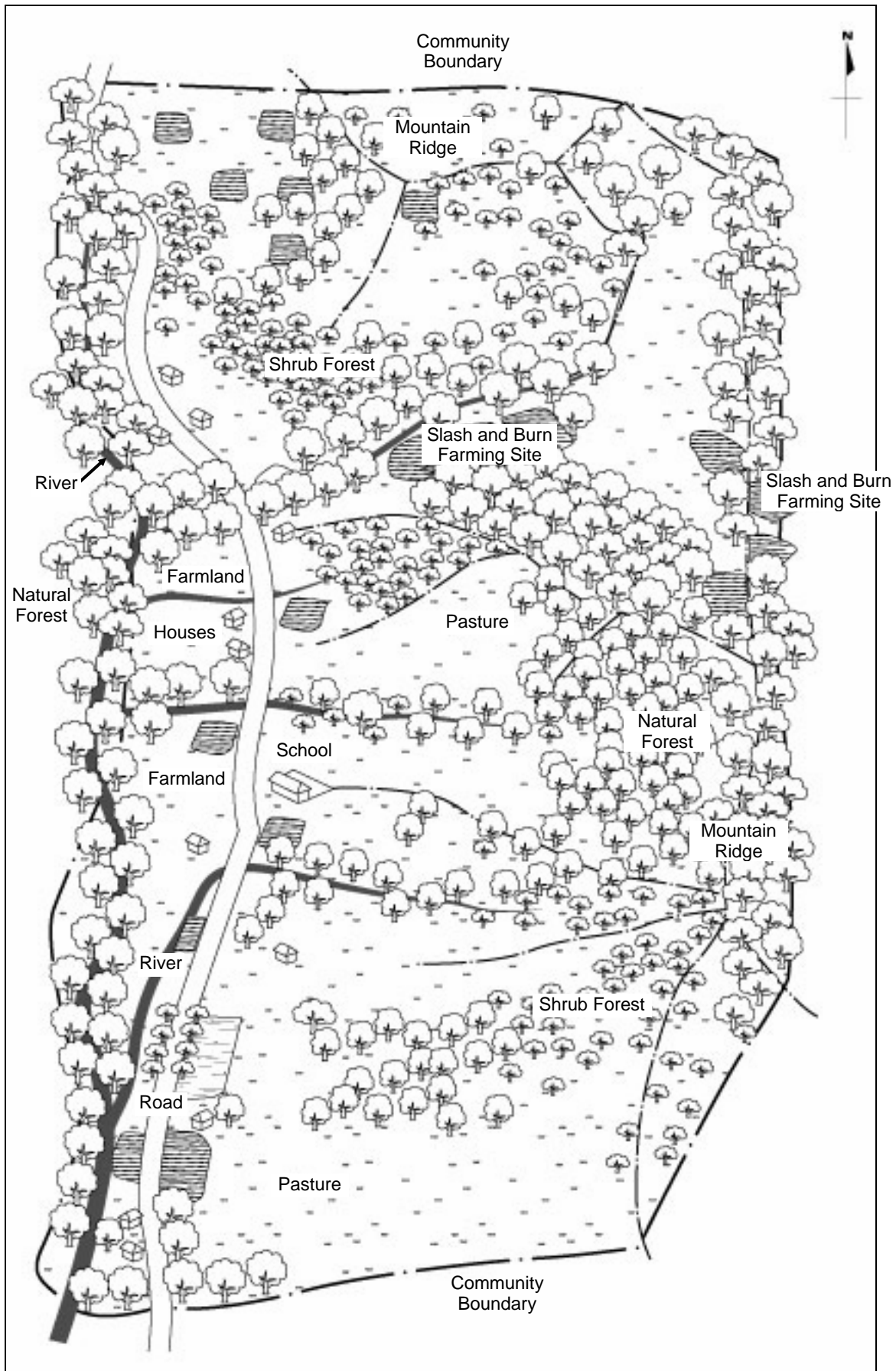


Fig. 2-2-2-1 Example of Current Land Use Map

Table 2-2-2-1 Forest Management Measures

Measures	Conditions to Prioritise Measure	Outline of Activities	Individual Activities																					
			Earth ridge	Rock ridge	Contour hedgerow	Live fencing	Manure input	Small erosion control facilities	Silvopastoral	Enrichment	Planting	Weeding	Climber cutting	Improvement cutting	Thinning	Pruning	Bud Pruning	Introduction of firebreaks	Collection of seeds	Nursing	Formulation and wide use of community rules for burning	Forest fire prevention campaign		
Priority Approaches	Slash and burn farming control	Slash and burn farming conducted for many years has turned many forests into shrub forests.	O	O	O	O	O	O	O															
	Soil conservation	While forests have not been severely devastated, poor cultivation methods have deteriorated the soil. The resulting decline of the soil productivity is causing concern for the spread of cultivated land to neighbouring forests.																						Improvement of cultivated land and pasture
	Forest improvement	Some natural forests have become open forests or require tending because of the existence of old and/or damaged trees.	Natural forest management																					
		<ul style="list-style-type: none"> The existence of abandoned cultivation sites and former pasture makes reforestation work necessary. Man-made forests require tending (over-crowding and/or suppressed trees by weeds or climbers) High expectations for the production of timber and firewood for domestic use or marketing. 	Man-made forest management																					
Seedling production	All communities																							
Forest fire control	All communities	Fire prevention																						
		Fire-fighting																						

Note: In selecting individual activities, the range of activities should not be restricted to those marked with a O and other activities should also be selected depending on the actual situation of each community.

Table 2-2-2-2 Main Selection Criteria for Activities

Activities		Main Selection Criteria
Improvement of cultivated land and pasture	Earth ridge	-Farmland on sloping land -Few stones and pebbles with a thick layer of deposited soil
	Rock ridge	-Farmland on sloping land -Many stones and pebbles
	Contour hedgerow	-Farmland or pasture on sloping land or collapsing /hazardous site -Presence of a rock ridge, earth ridge or terracing works
	Live fencing	-Surrounding of farmland or pasture -Shortage of firewood and fodder trees
	Manure input	All communities (this activity is particularly important when a rock ridge or earth ridge cannot be constructed because of the shortage of able men)
	Small erosion control facilities	Occurrence of a gully
	Silvopastoral	Few trees on pasture
Natural forest management	Enrichment	Open forest site resulting from the selective cutting of fine trees
	Weeding	Much propagation of weeds, hampering the growth of planted trees
	Climber cutting	Much propagation of climbers, hampering tree growth
	Improvement cutting	Existence of trees which hamper the growth of fine succeeding trees
	Thinning	Obstruction to thickening growth due to overcrowding
	Pruning	Suppression of nearby trees due to the vigorous growth of branches
	Introduction of firebreak	Risky site for the spread of a forest fire
Man made forest management	Planting	Farmland or pasture or their abandoned site
	Weeding	Much propagation of weeds, hampering the growth of planted trees
	Climber cutting	Much propagation of climbers, hampering tree growth
	Improvement cutting	Existence of trees which hamper the growth of fine succeeding trees
	Thinning	Obstruction to thickening growth due to overcrowding
	Pruning	Suppression of nearby trees due to the vigorous growth of branches
	Bud pruning	Too many buds
Introduction of firebreak	Risky site for the spread of a forest fire	
Collection of seeds and nursing		All communities (including the nursing of seedlings for enrichment for natural forest management, reforestation and slash and burn farming control/ soil conservation approach and of fruit trees for the livelihood improvement)
Fire prevention	<ul style="list-style-type: none"> • Formulation and wide use of community rules for burning • Forest fire prevention campaign • Wide use of firebreaks 	All communities
Fire-fighting	Formation of a fire brigade	

5) Indicators Used for Monitoring

Examples of the indicators used for monitoring at the implementation stage of activities are shown in Table 2-2-2-3. It is unnecessary to use all of these indicators and those which are easy to understand and for which data is easy to gather should be selected to suit a specific activity in view of the fact that monitoring work will primarily be conducted by local residents. In the case of forest management for example, data on the person-day input may be used instead of the completed area of implementation because of the difficulty to determine the latter. The target figure for each indicator should be determined as a concrete figure, taking the implementation method, length and work volume of the activity into consideration.

Table 2-2-2-3 Indicators Used for Monitoring

Measures	Activity		Indicator(s)
Slash and burn farming control		<ul style="list-style-type: none"> • Earth ridge • Rock ridge 	<ul style="list-style-type: none"> • Total length of construction • Total length of construction
Soil conservation	Improvement of cultivated land/ pasture	<ul style="list-style-type: none"> • Contour hedgerow • Live fencing • Manure input • Small erosion control facilities • Silvopastoral 	<ul style="list-style-type: none"> • Total length of construction • Number of trees planted • Volume of input • Number of facilities • Number of trees planted
	Natural forest management	<ul style="list-style-type: none"> • Enrichment • Improvement cutting and climber cutting • Introduction of firebreak 	<ul style="list-style-type: none"> • Number of trees planted • Implementation area; person-day input • Total length
Forest improvement	Man-made forest management	<ul style="list-style-type: none"> • Planting • Weeding and climber cutting • Improvement cutting and thinning • Bud pruning • Introduction of firebreak 	<ul style="list-style-type: none"> • Number of trees planted • Implementation area; person-day input • Implementation area; person-day input • Implementation area; person-day input • Total length
	Seedling production	Collection of seeds Nursing	<ul style="list-style-type: none"> • Volume of seeds collected by species • Number of seedlings produced by species
Forest fire control	Fire prevention	<ul style="list-style-type: none"> • Formulation and wide use of community rules for burning 	<ul style="list-style-type: none"> • Number of households agreeing • Number of households engaged in burning cultivation
		<ul style="list-style-type: none"> • Fire prevention campaign 	<ul style="list-style-type: none"> • Number of campaigns conducted • Number of forest fire occurrences
		<ul style="list-style-type: none"> • Wide use of firebreaks 	<ul style="list-style-type: none"> • Total length
	Fire-fighting	<ul style="list-style-type: none"> • Formation of a fire brigade • Turning out of fire brigade 	<ul style="list-style-type: none"> • Number of members • Number of turn outs

6) Compilation Method of Action Plan

The part of the action plan relating to forest management should be compiled by selecting the planning items in the following manner.

- a. A conceptual land use map should be attached to the forest management action plan for disaster prevention.
- b. Priority approaches and activities
 - Priority ranking should be made for the priority approaches relating to slash and burn farming control, soil conservation and forest improvement based on the actual situation of each community.
 - Activities should be selected for the higher priority approach.
 - Several activities should be selected depending on their necessity and should be combined to formulate an action plan.
 - Given the diverse situation of individual communities, activities should also be selected for the middle and lower ranked approaches depending on their needs instead of limiting the selection of activities to the higher ranked approach.
 - The seedlings should be produced within each community.
- c. Forest Fire Control Approach and Activities
 - The forest fire control approach should always be included in the action plan.
 - The activities for fire prevention and fire-fighting should be separately determined.

(2) Environmental Education

1) Basic Principles

Environmental education should be examined in accordance with the following principles for inclusion in the action plan.

- Local residents should be given the opportunity to review what they have been doing up to the present in regard to the environment.
- Knowledge on the impacts of forest fires and the burning of farmland should be taught.
- The awareness of all residents of the community, regardless of sex or age, of the importance of forests and the environment should be enhanced.
- The positive effects of forests and trees on daily life should be recognised.

2) Important Information for Selection of Activities

For the planning of environmental education in a target community, a preliminary survey which particularly focuses on the following points should be conducted so that the information obtained can be used for judgement of the desirable activities.

- Reality of burning and shifting cultivation based on slash and burn farming
- Frequency of forest fires
- Increasing/decreasing trend of the water volume of rivers and other water sources and associated problems
- Situation of the cutting of forest trees
- Situation of soil erosion
- Awareness of the necessity for soil conservation
- Willingness to implement forest and environment-related activities
- Situation of environmental education in primary education
- Intentions of primary school teachers
- Types of religious education

3) Idea of Concrete Activities

The contents of environmental education attempted during the P/S are shown in Table 2-2-2-4. These contents were practically the same for all communities and this attempt contributed to improving the environmental awareness of local residents to a certain extent.

The planning of environmental education by the technical team should combine the various activities shown in Table 2-2-2-4 to suit the actual situation of each community so that all ages, from school children to adults, can participate.

As the INAFOR and the MARENA are conducting their own educational activities for forest fire prevention and environmental improvement/conservation, efforts should be made to utilise these activities. For example, if a primary school teacher is found to be very interested in environmental education, environmental education should be planned using this teacher as a key person. One essential requirement for environmental education is its combination of field education in the form of planting work and field investigation, etc. instead of solely relying on lectures. Areas where parents can participate or cooperation should be identified in the course of the planning work.

Meanwhile, the INAFOR and the MARENA should provide training on forests and the environment for the residents of communities in general, enhance the understanding of the

reality of forests and the environment on the part of residents through field investigation and point out what they should do in the future.

The creation of a situation whereby all generations participate in environmental education is essential.

Table 2-2-2-4 Environmental Education Conducted During the P/S

Primary Component	Concrete Activities	Main Conditions to Conduct Activities
Inclusion of environmental education in primary education	<ul style="list-style-type: none"> • Practical forest reconnaissance exercises (observation of the state of forest destruction and state of soil erosion in progress, etc.) • Practical exercises to identify the tree species growing in the community area • Creation of a nursery, production of seedlings, planting and tending trees on primary school premises • Planting and tending at communal sites (roadsides and churchyards, etc.) • Purchase and reading of textbooks • Preparation and posting of posters on the environment • Establishment of children's environmental brigades and the implementation of various activities 	<ul style="list-style-type: none"> • Willingness of teachers • Cooperation of parents • Worsening housing environment (shade and water, etc.) • Forest destruction
Implementation of forest fire prevention campaigns	<ul style="list-style-type: none"> • Extension of the community rules for burning • Introduction of forest conservation activities • Preparation and posting of posters and banners • Campaign with invitation to neighbouring communities • Performance of short plays featuring forest fires and nature protection 	<ul style="list-style-type: none"> • Situation of forest fire occurrence • Reality of burning • Availability of community rules on burning and situation of compliance
Inclusion of environmental education in religious education	<ul style="list-style-type: none"> • Talks about forests and the environment during mass 	<ul style="list-style-type: none"> • Types of religious education • Willingness of religious leaders
Tree Day events	<ul style="list-style-type: none"> • Reporting on forest activities implemented • Lectures on environmental conservation • Queen of Ecology contest 	<ul style="list-style-type: none"> • Willingness of community leaders • Awareness of forests and the environment among local residents
General environmental education by the INAFOR and the MARENA	<ul style="list-style-type: none"> • Hosting of lecture meetings 	<ul style="list-style-type: none"> • Access by the INAFOR and the MARENA

When planning environmental education, special attention must be paid to the following matters.

- As environmental education is a type of activity which targets not only the participants but also all residents of the community, the implementation body should plan such education to target all residents while liaising with the community committee.
- Primary school teachers, who are believed to be the most highly educated in the community, should be co-opted as the key persons for environmental education. In addition, the use of the curriculum for environmental education developed by the MECED should be attempted.
- Through planning of field visits to sites of environmental destruction, the participants should be made to recognise the importance of forests and environmental conservation by means of comparison between the past and the present.

4) Indicators Used for Monitoring

Examples of the indicators used for monitoring at the implementation stage of activities are shown in Table 2-2-2-5. These indicators should be as simple as possible based on the assumption that monitoring can be conducted by the participants without guidance by the technical team.

Table 2-2-2-5 Indicators Used for Monitoring

Component of Environmental Education	Indicator(s)
Inclusion of environmental education in primary education	• Number of participating children and parents
Implementation of forest fire prevention campaigns	• Number of participants • Number of forest fires • Availability of community rules on burning and situation of compliance
Inclusion of environmental education in religious education	• Number of participants
Tree Day events	• Number of participants
General environmental education by the INAFOR and the MARENA	• Number of participants • Number of burnings • Number of people involved in shifting cultivation based on slash and burn farming

5) Plan Compilation Method

The actual contents of environmental education will vary depending on the needs, situation of forests and farmland and economic situation of each community and should aim at boosting the motivation of local residents to participate in activities to promote forest management and also to reduce the pressure on forests.

In view of the above-mentioned activities of environmental education, those components which can be recommended for individual communities should be selected from the list of components and combined in a flexible manner to formulate the action plan, taking the needs and current situation of each community and the feasibility of each component into consideration.

The detailed items for the selected components should then be planned using Table 2-2-2-6 as a reference based on the criteria that such items are required and their implementation is feasible for a specific community.

Table 2-2-2-6 Detailed Items by Activity Plan

Component of Environmental Education	Detailed Items
Inclusion of environmental education in primary education	<ul style="list-style-type: none"> • Various activities (see Table 2-2-2-4) • Participation methods for parents • Selection of common land where planting can be conducted • Implementers
Implementation of forest fire prevention campaigns	<ul style="list-style-type: none"> • Contents of the community rules on burning • Menu of feasible activities (see Table 2-2-2-4) • Invitation to neighbouring communities • Implementers
Inclusion of environmental education in religious education	<ul style="list-style-type: none"> • Use of mass • Implementers
Tree Day events	<ul style="list-style-type: none"> • Contents of the events • Invitation to neighbouring communities • Securing of planting sites • Implementers
General environmental education by the INAFOR and the MARENA	<ul style="list-style-type: none"> • Explanation of general theories and forest-related laws and regulations; forest fire prevention • Timing of implementation • Target persons • Implementers

(3) Improvement of Livelihood

1) Basic Principles

Activities for the livelihood improvement should be examined in accordance with the following principles and should be included in the action plan.

- The planned activities should contribute to the generation of “physical leeway” as well as “mental leeway” and should aim at developing living conditions which allow local residents to continually conduct forest management activities.
- The planned activities should be limited to those which can contribute to reducing the pressure on forests.
- The proposed contents of support should contribute to the sustained livelihood improvement rather than temporary incentives, such as food assistance.
- From the viewpoint of gender equality, consideration should be given to encouraging the participation of women in agricultural and forest-related activities which are generally believed to be men’s work, particularly participation in the decision-making process.

2) Important Information for Selection of Activities

For the planning of realistic activities to improve livelihood in a target community, a preliminary survey which particularly focuses on the following points should be conducted so that the information obtained can be used for judgement of the desirable activities.

- Main productive activities, household income and expenditure, labour force and food situation
- Firewood-related information (consumption volume, time spent for collection, expenditure and reality of marketing, etc.)
- Natural conditions (water sources and land conditions, etc.)
- Type of agriculture
- Conditions of basic infrastructure (existence and locations of water supply facilities and road conditions, etc.)
- Markets, assumed marketability and suitable marketing methods
- Gender
- Others

3) Idea for Concrete Activities

The actual contents and scale of the livelihood improvement plan will vary depending on the needs of individual communities and the land as well as economic conditions, etc. of individual farming households. As the activities to be selected aim at boosting the motivation of local residents to participate in activities to promote forest management and also at indirectly reducing the pressure on forests, the plan should combine the various activities listed in Table 2-2-2-7 in a flexible manner.

Table 2-2-2-7 Items of Activities

Component	Activities
Home gardens	<ul style="list-style-type: none"> • Creation of home gardens for the planting of crops, fruit trees, trees and medicinal herbs, etc. around the individual homes of farmers • Production of organic pesticides and fertilisers (green manure and compost)
Improved stoves	<ul style="list-style-type: none"> • Introduction and wide use of improved stoves
Simple water supply facilities	<ul style="list-style-type: none"> • Rehabilitation or new construction of a communal water tank, well or simple water supply facilities
Gravity type simple watering system	<ul style="list-style-type: none"> • Installation of a gravity type simple watering system • Reduction of slash and burn farming or prolongment of the fallow period for fallow forests on slash and burn farming sites
Diversification of crops	<ul style="list-style-type: none"> • Introduction of cash crops (examples are peanuts, sesame and vegetables, etc.) • Avoidance of damage caused by the repeated cultivation of the same crops by means of crop rotation using grains and leguminous crops • Reduction of the damage caused by harmful insects by means of the mixed cultivation of two or three crops • Selection and introduction of crops or varieties which can be harvested in a short period of time and which are highly drought resistant
Cultivation of coffee	<ul style="list-style-type: none"> • Cultivation of coffee in natural forests
Profitable marketing of products	<ul style="list-style-type: none"> • Holding of a study meeting on the market (including the gathering of information on possible purchasers, clarification of the target sales volume and examination of models of marketing and the marketing potential)

4) Priority Conditions for Implementation

When the possible amounts of inputs are considered, not all people wanting to participate will be able to participate in the components of their choice. It may be impossible to implement some components because of the land and other conditions. Accordingly, the priority conditions for the implementation of each component are shown in Table 2-2-2-8 as yardsticks for the selection of components.

Table 2-2-2-8 Priority Conditions for Prioritised Implementation

Component	Conditions for Prioritised Implementation
Home gardens	<ul style="list-style-type: none"> • There is a need for and willingness on the part of local residents to grow vegetables and fruit trees. • Vegetables and fruit account for a high proportion of the household expenditure. • Land which can be frequently watered is available. • The necessary labour force is available.
Improved stoves	<ul style="list-style-type: none"> • There is a need for such stoves among those using a kitchen. • The purchase cost of firewood accounts for a high proportion of the household expenditure. • The collection of firewood poses a heavy physical burden. • The wasteful consumption of firewood is highly noticeable despite the depletion of forests. • Clay and stones suitable for improved stoves are available.
Simple water supply facilities	<ul style="list-style-type: none"> • There is a water source with an ample volume of water. • Although the introduction of home gardens or a nursery is planned, there is no water source or water supply facilities nearby. • The fetching of water poses a heavy physical burden. • The introduction of water supply facilities is assumed to be the biggest incentive for local residents to implement forest management activities. • The maintenance capability is judged to be available (especially when fuel and repair tools are required).
Gravity type simple watering system	<ul style="list-style-type: none"> • There is a water source from which water can be supplied. • The maintenance capability is judged to be available (especially when repair tools are required). • There is a strong need for an increased yield. • There is willingness among local people to switch to permanent farming if an irrigation system is available.
Diversification of crops	<ul style="list-style-type: none"> • There is willingness among local residents to market farming products. • The land conditions suggest that the cultivation of other crops than grains and leguminous crops is possible.
Cultivation of coffee	<ul style="list-style-type: none"> • There is a natural forest of which the elevation is approximately 500 m or higher. • There is a reliable marketing route(s).
Profitable marketing of products	<ul style="list-style-type: none"> • The commercialisation of products is the biggest motivation for participation; there is willingness among local residents to market products. • There is an existing marketing route(s). • Access to existing markets is easy (in consideration of the required labour input and preservation of the product quality).

5) Scope of Participants

The targets of the activities under the livelihood improvement plan should, in principle, be those implementing forest management activities on the grounds that forest management activities should be effectively implemented. However, in the light of the objective of the M/P, i.e. forest management for disaster prevention, if many people hope to participate, their

participation in livelihood improvement activities should be accepted on the condition that they also participate in or cooperate with other forest and environment-related activities.

The activities in question are basically assumed to be individually implemented and a flexible response should be made depending on the water source or land conditions or strength of the bonds within the community. For example, home gardens can be put into practice in the form of a collective farm.

6) Indicators Used for Monitoring

At the activity implementation stage, the technicians and local residents should monitor the respective processes for the implementation of activities and revise the plan, if necessary, to proceed with the activities. Examples of the indicators to be used for monitoring are shown in Table 2-2-2-9. Referring to these examples, the concrete target figures and other indicators should be examined, taking the reality of each community, perceived implementation method and period of each activity and other relevant matters into consideration.

As confirmation of the progress and activity results by local residents by means of monitoring is an important process to motivate local residents to continue activities, careful attention should be paid to making the indicators simple and not to establish too many indicators.

Table 2-2-2-9 Indicators Used for Monitoring

Component	Indicators	Remarks
Home gardens	<ul style="list-style-type: none"> • Number of participants • Progress of skill learning • Types, quantities and situation of growth of crops and fruit trees • Improvement of the diet • Reduction of household expenditure/increase of income 	Equal profit distribution among the participants should be checked from the viewpoint of gender.
Improved stoves	<ul style="list-style-type: none"> • Number of improved stoves introduced • Change of the firewood consumption volume • Creation of free time due to the reduced time for firewood collection and cooking • Situation of use and maintenance of improved stoves 	The impacts of the reduced firewood consumption volume and shorter cooking time should be checked.
Simple water supply facilities	<ul style="list-style-type: none"> • Situation of use • State of facility maintenance • Effects on crops and tree growth 	-
Gravity type simple watering system	<ul style="list-style-type: none"> • Situation of use • State of system maintenance • Change of production volumes • Area of land turned into permanent cultivation land 	Given the objective of establishing permanent cultivation through the introduction of watering system, the monitoring emphasis should be placed on the progress of change towards permanent cultivation.
Diversification of crops	<ul style="list-style-type: none"> • Changes of the crops grown and their production volumes • Improvement of the diet 	-
Cultivation of coffee	<ul style="list-style-type: none"> • Number of participants • Number of trees planted and their state of growth • Sales situation of coffee beans 	The participants must bear in mind that the conservation and effective use of natural forests are the principal objectives.
Profitable marketing of products	<ul style="list-style-type: none"> • State of information gathering on the market • Types and quantity of crops marketed • Establishment of fixed marketing routes 	-

7) Plan Compilation Method

The contents and scale of the livelihood improvement plan will vary depending on the needs of each community, land and economic conditions of the participating farming households and others. The livelihood improvement primarily aims at strengthening the motivation of local residents to participate in activities designed to promote forest management and also at indirectly reducing the pressure on forests. Accordingly, the actual plan should combine those components which can be recommended for each community based on its needs and current situation from among the list of components shown in Table 2-2-2-7 in a flexible manner.

In the case of activities relating to the profitable marketing of products, their contents and timing of commencement may well differ from one community to another depending on the level of expectation for the commercialisation of local products, which constitutes strong motivation on the part of participants, and the level of commitment of local residents to other components/activities. The action plan should, therefore, only state ① the main crops and tree species of which profitable marketing is aimed at and ② the main themes for study meetings (for example, clarification of the existing markets, clarification of adequate prices for crops and tree species and examination of suitable marketing methods for the existing markets, etc.) and further details should be planned at the time of formulating individual activity plans.

(4) Action Plan Sheet

Examples of a forest management action plan for disaster prevention and a PDM for the action plan to be prepared for each community are shown below.

Example of Forest Management Action Plan for Disaster Prevention

Forest Management Action Plan for Disaster Prevention			
Department:		Municipality:	
Community:			
Area: 490ha	Topography: gently sloping	Population/No. of Households: 340/68	Road Conditions: poor during the rainy season
Primary School: up to 5 th grade		Main Water Sources: river, well (privately-owned), springs (4)	
Scale of Landholding: 0 – 2 Mz (), 2 – 10 Mz (), 10 – 20 Mz (), 20 Mz or more ()			
Main Means of Livelihood: farming (maize, kidney beans, cassava, millet, sorghum and vegetables); stock raising (meat cattle and milking cows, 168 heads); work away from home			
Main Sources of Cash Income: sale of surplus farming products and waged labour			
Types of Community Organizations: Community Committee, Disaster Committee, Health Committee, Environmental Squad (assistance for reforestation activities)			
Situation of Activities and Characteristics of Community Committee	<ul style="list-style-type: none"> • Committee Executives: 7 • Meetings of Executives: every 15 days • General Meetings: every month for decision-making by the community 		<ul style="list-style-type: none"> • Vigorous activities led by the leader • Active participation by women
Experience of Forest or Environment-Related Project(s)	<ul style="list-style-type: none"> • PROCUENCA-INTA (1999 -): operation of two communal nurseries based on a rota and afforestation <ul style="list-style-type: none"> - Seedlings produced: 20,000 - Seedlings planted: 18,000 		
Present Situation and Problems of Forests and Environment of Community	<ul style="list-style-type: none"> • Forest depletion (enlargement of cotton or sesame growing sites and pasture) • Occurrence of forest fire (causes: hunting, spread from burning cultivation sites and spread from neighbouring communities, etc.) • Firewood shortage • Insufficient knowledge and skills regarding forest/soil conservation • Fodder shortage during the dry season 		
[Action Plan]			
Priority Approach	First Priority	Improvement of cultivated land by the soil conservation approach	
	Second Priority	Expansion of man-made forests and tending of natural forests by the forest improvement approach	
	Third Priority		
Main Actions		Contents	
Priority Approaches	Introduction of soil conservation work at farmland and change to permanent farming	<ul style="list-style-type: none"> • Earth ridges; contour hedgerows • Introduction of green manure and manure 	<ul style="list-style-type: none"> • Application at cultivated land of which the productivity is declining due to soil loss • As above
	Creation of man-made forests	<ul style="list-style-type: none"> • Obtaining of firewood 	<ul style="list-style-type: none"> • Abandoned cultivated land and pasture near home
	Tending of natural forests	<ul style="list-style-type: none"> • Enrichment 	<ul style="list-style-type: none"> • Sites where natural forests have degraded to become open forests with few useful trees
	Nursing	<ul style="list-style-type: none"> • Joint work to collect seeds • Operation of a communal nursery 	
Basic Activities	Forest fire control	<ul style="list-style-type: none"> • Formation of a fire brigade • Establishment and wide use of community rules on burning/forest use • Forest fire prevention campaigns 	
	Environmental education	<ul style="list-style-type: none"> • Inclusion of environmental education in primary education • Forest fire prevention campaigns 	
	Livelihood improvement	<ul style="list-style-type: none"> • Home gardens • Improved stoves 	
Implementation System		<ul style="list-style-type: none"> • Name of Leader: • Name of Sub-Leader: • Work Groups: groups based on the neighbourhood in different areas in the community as the houses are scattered throughout the community 	
Points to Note		<ul style="list-style-type: none"> • Many people work abroad to earn income during the dry season. 	
Other Problems		<ul style="list-style-type: none"> • The road conditions are poor. • No public transport is available. • No electricity supply is available. 	
Current Land Use Map Conceptual Land Use Map		<ul style="list-style-type: none"> • Separately attached 	

Example of PDM

PDM: Department:

Municipality:

Community:

Overall Goal: Enhancement of the soil and water conservation functions of forests as a result of voluntary and continual activities by local residents		
Goal Establishment of the basis for the continual implementation of forest management activities for soil and water conservation through the implementation of such activities	Indicators for achievements <ul style="list-style-type: none"> • State of activities by groups of participants • Level of understanding of the necessity for forest management activities among the participants • Increased number of participants in activities 	M & E and Timing <ul style="list-style-type: none"> • Interviews with the participants (one year after the commencement of activities) • Interviews or questionnaire survey with participants (one year after the commencement of activities and annually thereafter) • Results of self-monitoring (as it happens)
Expected results <ol style="list-style-type: none"> 1. Commencement of the application of soil conservation measures 2. Increased number of trees due to planting 3. Improvement of natural forests by natural forest management 4. Production of seedlings 5. Implementation of forest fire prevention measures 6. Implementation of environmental education 7. Contribution to livelihood improvement 	Indicators for achievements <ol style="list-style-type: none"> 1.1 Number of participants in the group 1.2 Volume of work implemented by each component 2.1 Number of participants in the group 2.2 Number of trees planted by species 3.1 Number of participants in the group 3.2 Person-day input for natural forest management 3.3 Number of trees planted 4.1 Number of participants in the group 4.2 Quantity of seeds collected by species 4.3 Number of seedlings produced by species 5.1 Number of fire brigade crew members 5.2 Establishment of community rules on burning/forest management 5.3 Forest fire prevention campaigns 5.4 Number of households engaged in burning 5.5 Number of turn outs of the fire brigade 5.6 Decline of the number of forest fires 6.1 Number of participants in the group 6.2 Number of activities conducted by primary school pupils 7.1 Number of participants in the group 7.2 Total area of home gardens created 7.3 Number of improved stoves installed 	Means of obtaining indicator data <ol style="list-style-type: none"> 1.1 Members' list 1.2 Activity records 2.1 Members' list 2.2 Activity records 3.1 Members' list 3.2 Activity records 3.3 Activity records 4.1 Members; list 4.2 Activity records 4.3 Activity records 5.1 Members' list 5.2 Activity records 5.3 Activity records 5.4 Activity records 5.5 Activity records 5.6 Activity records 6.1 Members' list 6.2 Activity records 7.1 Members' list 7.2 Activity records 7.3 Activity records
Main activities <ol style="list-style-type: none"> 1. Implementation of soil conservation measures <ul style="list-style-type: none"> - Earth ridges and contour hedgerows 2. Planting <ul style="list-style-type: none"> - Creation of firewood forests 3. Natural forest management <ul style="list-style-type: none"> - Enrichment 4. Production of seedlings <ul style="list-style-type: none"> - Joint collection of seeds - Joint management of a nursery 	Inputs <ul style="list-style-type: none"> < Local inhabitants > <ul style="list-style-type: none"> - Land and labour < Technical team > <ul style="list-style-type: none"> - Provision of materials, equipment and technologies required for the work 	Remarks

<p>5. Forest fire prevention measures</p> <ul style="list-style-type: none"> - Establishment and wide use of community rules on burning/forest management - Forest fire prevention campaigns - Turning out of the fire brigade <p>6. Environmental education</p> <ul style="list-style-type: none"> - Environmental education at primary schools - Forest fire prevention campaigns <p>7. Livelihood improvement measures</p> <ul style="list-style-type: none"> - Creation of home gardens - Making of improved stoves 		
--	--	--

2.2.3 Organization Operation and Development of Implementation System

(1) Basic Principles

A system to allow the implementation organization in a community to perform the following functions should be developed.

- Performance of the function of a front desk to receive external assistance to facilitate the efficient and smooth implementation of technical guidance
- Provision of a place for study meetings for the participants to learn new techniques/skills
- Division of the participants into groups to consolidate the unity among the participants and also to ensure efficient activities
- Election of executives to functionally and efficiently run the organization
- Swift conveyance of information to the participants

(2) Important Information

The preliminary study results regarding the following points should be particularly noted as materials for the examination and planning of the systems in question in the target communities. Given the fact that it will be impossible to completely gather information on the indigenous development capability described in Table 1-5-7-2 of Part II during the preliminary study period, supplementary data should be gathered through interviews with community leaders and other means.

- Size and roles of the executive committee and degree of its functioning
- Degree of trust in the leader, availability of leadership, degree of vitality of the community and decision-makers
- Existing organizations and their members in the community
- Purposes, history, functions, activities, main achievements, degree of vitality, fund raising methods, relationship with the community committee and communication system between the participants of each organization
- Operational problems of organizations
- Existence of activities promoted independently by the community and any conflict within the community
- State of distribution of houses

(3) Concrete Examination

1) Organization

The participating residents in each community should be organized to ensure the efficient and smooth implementation of activities. Examination of the following matters in advance will be essential to establish a reliable system for the operation of an organization and the implementation of activities under the action plan.

① Grouping

A suitable method of grouping the participants should be examined to facilitate the development of a sense of unity among the participants and also to enable the efficient implementation of activities (grouping based on the type of activity or dwelling area as a unit).

② Selection of executives and definition of duties

A suitable method of selecting the executives of the implementation organization and leaders of working groups, definition of their duties and their rights, etc. should be examined. In addition, the state of activities, problems and pending tasks, etc. of existing organizations in the community should be clarified.

③ Establishment of communication system

Using the communication systems and their state of implementation of existing organizations as references, a suitable method to convey information to the participants should be examined (establishment of a communication network and communication system using circular notices or primary school pupils, etc.)

④ Raising of activity funds

The possibility of fund raising to pay the work expenses of executives and the procurement cost of stationary, etc. for the executive committee (collection of a membership fee from the participants, bazaars and bingo, etc.) should be examined.

⑤ Coordination with community committee

Using the methods employed by existing organizations to coordinate with the community committee as references, the desirable method to coordinate with the community committee should be examined.

⑥ Others

● Characteristics of Participants

In regard to organization of the participants, it will be necessary to examine (i) problems regarding the operation of the organization originating from the place of dwelling, political allegiance and religious belief, etc. and (ii) possible measures to deal with such problems.

● Consideration of Gender

Suitable ways for women and school children to participate in activities should be examined, taking their ability to implement activities into consideration.

2) Indicators Used for Monitoring and Guidance to Enhance Organizational Strength

In regard to monitoring of the implementation system, the organizational strength as a factor of the indigenous development capability (organization as required and existence of leading persons) should be used as the indicator. The technical team should observe, analyse and evaluate the said indicator as required to reveal the weak points of the implementation body and should plan and modify its guidance for the community to enhance the organizational strength of the community.

Table 2-2-3-1 Indicators Used for Monitoring and Key Points for Evaluation

Indicator Used for Monitoring	Key Points for Evaluation
<p><u>Organization as required</u> To clarify the level of ability of the community to establish an organization to deal with emerging problems in a systematic manner.</p>	<ul style="list-style-type: none"> • Is it possible for the participants to joint together to discuss specific problems as required? Are measures to deal with the problems introduced as a result of discussion? • How is information given to the participants? Do the participants of the implementation body share information? • Is joint work conducted? • Are measures in place to ensure the effective functioning of a created organization? • Are the leaders of organizations active? Are the participating residents cooperative? • Do organizations have their own rules? • Is there any coordination with the community committee?
<p><u>Existence of leading persons</u> To clarify the level of the ability of leaders (coordinator of the implementation organization, leader of the community committee, leaders of working groups and promoters)</p>	<ul style="list-style-type: none"> • In what way does the coordinator clarify the state of activities of the participating residents? Is there any coordination between the executives? • Do the participants trust the leaders? • Are the leaders themselves involved in activities to set an example? Do they perform their leadership role? • Is there anyone who has experienced the role of being a promoter for past projects? Is there anyone suitable to act as a promoter? Are these people willing to lead other local residents?

The importance of promoters will increase in the process of forest management activities as people playing a supplementary role to the technical team. At the action plan formulation stage, simple information on who has been trained as a promoter under other projects, what are the incentives and what functions do they perform should be sufficient. However, it will gradually become necessary to determine how promoters should be used as the activities progress, in what way they can be encouraged to perform their functions and whether or not new persons to train as promoters should be identified.

3) Supporting System of INAFOR and Municipal Authority

A suitable system to provide guidance and support for local residents of communities is for the INAFOR as the competent authority for nationwide forest administration to promote the M/P as a national policy with the cooperation of the MARENA while each municipal authority provides direct guidance and assistance for local residents of the communities under its jurisdiction with the guidance and support of the INAFOR.

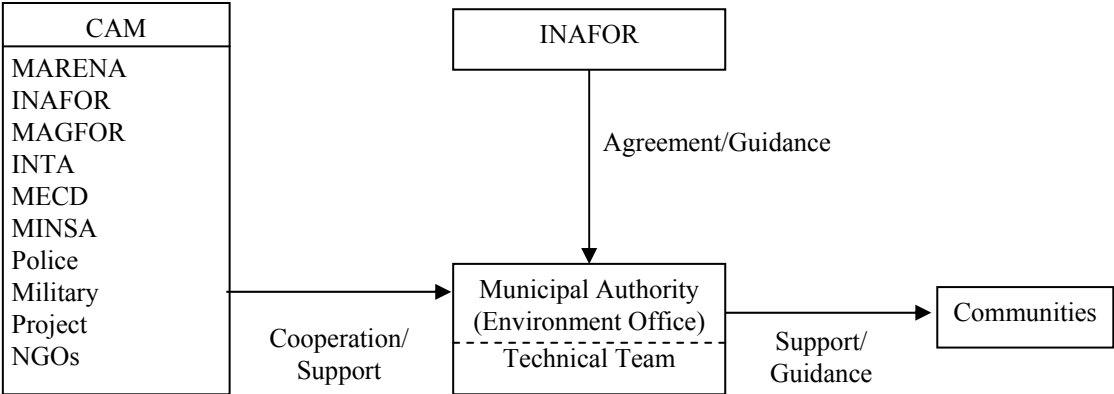


Fig. 2-2-3-1 External Assistance System

As each organization has its own limitations in terms of finance and manpower, the systematic planning of suitable measures to deal with the following matters in due course will be necessary.

< Financial Aspect >

- The National Forest Development Fund (FONADEFO) and other usable funds should be utilised as funding sources to meet the cost of strengthening the M/P implementation systems of the INAFOR and municipal authorities (recruitment and/or training of personnel) and the procurement cost of the equipment and materials required for the implementation of various activities.
- Municipal authorities should utilise the available funding mechanism by which 35% of the tax revenue from the use of wood/timber and forests, fines for illegal cutting, etc. and the

proceeds of public auctions of confiscated wood can be used as a municipal revenue source with a view to strengthening the implementation system of the municipal environment office. In addition, efforts should be made to utilise the FAM to implement activities with the understanding of the MARENA.

< Manpower Aspect >

- To start with, a joint technical team consisting of INAFOR and municipal technicians should be formed to assist communities. This team should include at least one municipal staff member and a system to provide guidance in the forest, agricultural and social fields should be established.
- As these INAFOR and municipal technicians currently lack sufficient experience of forest development work, they should undergo OJT to improve their understanding of the M/P and their project management skills, etc.

< Others >

- With the cooperation of the MARENA, the contents of the M/P should be incorporated in the Municipal Development Plan and the Annual Operation Plan.
- Many municipal environment offices lack sufficient means of transportation, including vehicles, and urgent action will be required to secure a means of transportation and funding to cover the cost of such transportation.

4) Guidance to Enhance Indigenous Development Capability

Indicators for the factors of the indigenous development capability (technical capability, organizational capability, resources procurement capability and willingness to initiate activities), which have been identified by analysis of the P/S results, should be observed, analysed and evaluated at appropriate times and a suitable guidance method should be examined to enhance those factors which are believed to be weak (see 1.5.7 of Part II and the Manual for Training Activities).

The technical team should provide intensive technical guidance at the early stage. However, it is important for the technical team to reduce the guidance frequency with the passing of time while facilitating the mechanism for local residents to solve problems by themselves with a view to developing the self-reliance of communities.

2.2.4 Estimated Costs

The costs shown in Table 2-2-4-1 should be used as yardsticks for the likely cost of various activities when local residents plan to implement such activities themselves.

Table 2-2-4-1 Estimated Costs

Activity		Unit Cost (US\$)	Remarks
Slash and Burn Farming Control	Improvement of Cultivated Land/Pasture	Earth Ridge	10.0/ 100 m
		Rock Ridge	19.0/ 100 m
		Contour Hedgerow	3.0/ 100 m
Soil Conservation	Improvement of Cultivated Land/Pasture	Input of Manure	9.0/ ha
		Small Erosion Control Works	15.0/ work
		Silvopastoral	6.0/ ha
	Natural Forest Management	Enrichment	6.0/ ha
Improvement Cutting; Climber Cutting		11.0/ ha	
Forest Improvement	Natural Forest Management	Introduction of Firebreak	9.0/ 1,000m 2 m wide
		Man-Made Forest Management	Planting
	Weeding; Climber Cutting		11.0/ ha
	Improvement Cutting; Thinning		11.0/ ha
	Introduction of Firebreak	9.0/ 1,000 m 2 m wide	
Seedlings Production	Nursing	107.0/ 1,000 seedlings	
Forest Fire Control	Fire Prevention	Fire Prevention Campaign	333.0/ community Cost of materials only
	Fire-Fighting	Turning Out for Fire-Fighting	548.0/ community Cost of materials only
Environmental Education		100.0/ community	Cost of materials only
Improvement of Livelihood	Home Gardens		11.0/ household
	Improved Stoves		44.0/ stove
	Simple Water Supply Facilities	Communal Water Tank	2,733/ tank
		Gravity-Type Simple Watering System	1,381.0/ system
	Cultivation of Coffee		56.0/ ha

CHAPTER 3 RECOMMENDATIONS

The present M/P intends the restoration of the soil and water conservation functions of forests as a measure to prevent such disasters as floods, collapses and the discharge of soil in the Study Area.

While forests constitute one of the most basic types of infrastructure to prevent the occurrence of natural disasters, their improvement requires an extremely long time, making the continual and patient implementation of the relevant activities with the support of local residents who directly participate in such activities important.

For the implementation of the M/P, understanding of such characteristics of forest improvement is essential and it is necessary to pay particular attention to the matters explained below.

- Understanding of the essence of the M/P

The staff members concerned of the INAFOR, other related government organizations and municipal authorities, who are in a position to promote the M/P, should fully recognise the essential character of the M/P as listed below and should implement the M/P with a proper understanding of its contents.

- Forest improvement to restore the soil and water conservation functions should be conducted over large expanses of land.
- Activities to restore, maintain and manage forests constitute a never-ending cycle which must permanently continue.
- Direct forest management activities should be conducted by local residents who own the land.
- Related administrative organizations, including the INAFOR and municipal authorities, which are in a position to promote forest improvement policies, should establish appropriate systems to provide the necessary guidance and support so that local residents can continue forest management activities with a sense of purpose.
- As the implementation of the said activities will largely rely on the indigenous development capability, enhancement of this capability should prove effective to strengthen the ability and willingness of local residents to conduct the said activities. Accordingly, the emphasis of the guidance and support for local residents should be placed on enhancement of the indigenous development capability.

Another important requirement is for the relevant officials of the INAFOR, CAM and municipal authorities to hold joint study meetings to streamline their understanding of the M/P.

- Early full-scale implementation

As the M/P is intended to contribute to disaster prevention through forest improvement with the participation of local residents, its urgent implementation is essential because of the nature of the plan. As those communities where the P/S was implemented are incapable of immediately implementing and continuing various activities on a self-help basis, the provision of appropriate follow-up support for these communities is required so as not to miss the presently available opportunity in view of these communities sustaining their activities as models for other communities. The full-scale implementation of the M/P as soon as possible after the completion of the Study is, therefore, required to ensure the smooth and effective implementation of the M/P.

For this reason, every effort to realise the matters discussed next should be made in order to proceed with the precise and early implementation of the M/P.

- Securing of funding sources

Given the severe financial situation, it will be necessary to utilise various usable funds in a precise manner to implement the M/P. As the leading implementation body for the M/P, the INAFOR should make the following efforts to secure the necessary funds required to allow not only the UTT-PPM but also municipal environment offices to perform their work.

- Early realisation of the operation of the FONADEFO

The New Forest Law stipulates the creation of the National Forest Development Fund (FONADEFO) as a funding source for the implementation of forest promotion projects. The Fund appears to be the most important source of funding for the implementation of the M/P. A concrete system for the operation of this Fund should be established as soon as possible for the early implementation of the M/P.

- Securing of funding from the ordinary budget

Although the INAFOR has already secured funding for the M/P Project in the ordinary government budget, it should make further efforts to increase the allocation amount from the said budget in view of the fact that more vigorous activities will be required at the full-scale implementation stage in the coming years.

- Utilisation of various related funding sources

There is no guarantee that the necessary budget for the M/P will be secured even if the use of the above funding sources becomes a reality. As the FONADEFO has not been put into practice officially, the effective use of other funding sources relating to forest development/improvement should be considered until the above FONADEFO is on the right track.

For this reason, coordination with related government organizations should be strengthened with a view to effectively using PTA funds, FAM funds and other funds provided by international aid organizations, etc. which may be used for activities similar to those planned under the M/P.

- Securing of independent funding sources for municipalities

The New Forest Law stipulates that part of the tax revenue from the use of wood and forests be allocated to municipal finance. As this tax revenue originates from forests and forestry, it should in principle be used as a funding source for forest promotion. Municipal authorities should fully understand the background of this tax revenue and should use it for the implementation of the M/P. Meanwhile, the INAFOR should actively provide guidance to achieve the allocation of the tax revenue in question for the implementation of the M/P.

● Consolidation of the implementation system at the INAFOR

For the implementation of the M/P, while the INAFOR has been developing the implementation system, including the establishment of the UTT-PPM and the increase of the full-time staff members, it should pay continuous attention to the following points to ensure the effective implementation of the M/P.

- System to secure funding sources

It will be practically impossible for the UTT-PPM to plan and negotiate the use of various funds for the implementation of the M/P. It will, therefore, be necessary for the INAFOR to establish a proper system to secure usable funding sources through coordination with other related government organizations in addition to its own funding sources.

- Deployment of new staff

Efforts should be made to ensure that the new staff to be deployed at the M/P Project has sufficient knowledge and experience of implementing the planned activities, including experience of participatory projects by consultants, NGOs or others, in view of the smooth provision of guidance for municipal environment offices and local residents.

- Utilisation of well-experienced consultants and others

Even though the UTT-PPM will establish a new system, the smooth implementation of the M/P right from the beginning will be difficult to achieve. Accordingly, the INAFOR should consider joint implementation with well-experienced consultants/NGOs using its own budget at the initial implementation stage of the M/P and/or the gradual consolidation of the system to conduct the planned activities while training its staff with the cooperation of a donor.

- Establishment of the municipal implementation system and relevant guidance by the INAFOR

The INAFOR intends to conclude an agreement with each municipal authority with a view to transferring the power to implement the M/P in each municipality to the said authority in accordance with Article 7 of the New Forest Law. However, as the environment office of each municipality currently lacks a system for the smooth implementation of the required work, it will be necessary for the INAFOR to provide the guidance and assistance described below for the municipal authorities concerned to ensure the establishment of the necessary implementation system by the municipal environment offices.

- Incorporation of the M/P in the Municipal Development Plan

Each municipal authority formulates and implements its Municipal Development Plan aimed at achieving social, economic, environmental, health care and other development. For the implementation of the M/P, its incorporation in the Municipal Development Plan will enable the promotion of the M/P as an official plan of each municipality. For this reason, the INAFOR should rearrange the M/P as a concrete plan to be implemented by each municipal authority on its own initiative and should provide guidance for each municipal authority on the incorporation of the M/P in its Municipal Development Plan.

- Development of a community guidance system by the municipal environment office

Staff members of the municipal environment office tend to lack experience even though they have some knowledge of the P/S. Coupled with the small number of staff of each municipal environment office, it will be difficult for each municipality to establish its own technical team to provide guidance for communities. The establishment of a joint technical team consisting of INAFOR and municipal technicians is more realistic so that INAFOR technicians can play a leading role at the beginning while training municipal technicians through OJT with a view to developing an appropriate municipal community guidance system in the coming years.

- Coordination with related organizations

As the current organizational situation of the INAFOR lacks the necessary system for the provision of appropriate guidance for municipal environment offices and local residents on the implementation of the M/P, the INAFOR should enlist the cooperation of other related organizations to ensure the proper implementation of the M/P by means of the following measures.

- The INAFOR should discuss the possibility of cooperation for the implementation of the M/P with other related organizations, such as the MARENA and the INTA, clarify the roles and functions of each organization and establish mutual cooperation and coordination at the central and local levels.
- The INAFOR should take the initiative in municipal environment committees to establish linkage between the activities envisaged by the M/P and similar activities implemented by other organizations, such as the MARENA, the INTA and the MECD, so that the activities of other organizations, particularly the FAM, technical guidance and environmental education can contribute to the effective implementation of the M/P through mutual cooperation and coordination.
- Many projects of government organizations, international aid organizations and NGOs, etc. are being implemented in the Study Area. It is important to regard the activities of projects similar to the M/P as being part of the activities under the M/P so that the concept of the M/P include all such activities in their totality. Based on this concept, the INAFOR should strengthen the linkage between the M/P and other related projects.
- Environmental education at primary schools has great positive repercussions on local communities and is highly effective. However, the success of environmental education is largely determined by the degree of interest in the relevant activities on the part of teachers. The INAFOR should approach the MECD with the request that the environmental education conducted by the latter include assistance for M/P-related activities and that the MECD provide suitable guidance for primary school teachers to obtain their active participation in M/P-related activities.

- Principal ideas of guidance for local residents

- Attitude of staff members of the UTT-PPM

The staff members of the UTT-PPM will play the role of facilitating the activities of local residents together with staff members of the municipal environment offices. In this case, the

staff members of the UTT-PPM will be required to adopt an attitude of sharing common objectives and beliefs with the staff members of the municipal environment offices at the same level to provide the desirable guidance for local residents instead of adhering to the conventional relationship between staff members of higher and lower administrative bodies.

- Securing of fairness

The forest management activities of local residents to implement the M/P will be conducted with official guidance and assistance provided by administrative bodies. These activities should not serve specific persons and should be realised by ordinary local residents in view of the character of the activities to improve forests over large expanses of land. The technical team must ensure its fair treatment of the participants in the provision of guidance and assistance for local residents and should also ensure a shared understanding of the contents of the activities on the part of non-participants.

- Securing of key persons

For the continued implementation of the M/P for a long period of time, it is desirable for those persons possessing a willingness to lead others to be continually engaged on their own initiative in the activities as key persons. The existence of these key persons will be equally significant for both the administration and community leadership. Any appointment of a person to a key post should take such significance into consideration and efforts should be made to train successors for key persons.

- Guidance by private enterprises

In the case of a forest product with strong marketability potential, as in the case of plywood material (as observed at Urroces), technical guidance provided by the industrial and market sides should be taken into proper consideration in addition to the technical guidance provided by the administration in order to explore such potential.

● Incentives for promoters

As promoters cannot be expected to conduct active extension activities, such as those of extension workers, without proper incentives, their basic function will be a passive one. However, it is a fact that it will be necessary to rely on promoters to a certain extent after a certain period of external assistance by the administration and others. It will be necessary to start with the creation of a mood leading to a consensus that local residents will provide some kind of reward for promoters in expectation of the more active commitment by promoters.

It may be an idea for the administration to introduce a qualification system for promoters to stimulate their willingness to be more involved in activities. However, there are many issues, including the requisites and procedure to certify qualification, which must be clarified. Careful examination will, therefore, be necessary and the question of introducing such a promoter qualification system should be treated as a pending issue.

- Cutting of trees in natural forests

In addition to the development of reforestation sites, the M/P plans the restoration of natural forests by means of enrichment. Local residents who are engaged in enrichment obviously conduct enrichment activities in expectation of a harvest following the restoration of forests. While there is an institutional arrangement which requires the preparation of a forest management plan to allow the cutting of some trees, the problem of land registration is a major obstacle for the preparation of such a plan. There is strong concern that this problem of land registration will lead to a loss of motivation among local residents to improve natural forests. Therefore, the introduction of institutional measures to solve this problem is required as soon as possible.

- Introduction of protection forests

The protection forest system is intended to conserve those forests which are believed to be particularly necessary to secure the forest functions which benefit the public, such as headwater conservation and the prevention of land collapse, by designating them as protection forests backed by the imposition of certain restrictions on forest operation. The necessity for protection forests under this system is generally accepted by the public based on the general understanding that forests serve public interests. However, the system interferes with the property rights of individual forest owners and cannot be established as a working system at once at any given time because it can only start after securing a national consensus regarding such issues as the consent of the forest owners in question and the provision of compensation by the administration for forest owners. The creation of a social situation where the necessity to conserve certain forests to ensure the safe lives of local residents in their area is recognised in the form of a local consensus as a preceding stage to the introduction of the forest protection system is important so that the said forests can essentially be conserved based on such a consensus, followed by a succession of similar examples throughout the country.

In the M/P, it is proposed that a community be viewed in its totality from the viewpoint of community management. It is inferred that a local consensus regarding the necessity for protection forests will spontaneously emerge among local residents through the continuation of forest management activities and that such a consensus will further spread to other areas to eventually form a national consensus. When examining the introduction of the protection

forest system, this system should be presented as a system which is suitable for developing a consensus in society on the need for protection forests instead of the sudden proposal of the system. This process, however, cannot be conducted in a short period of time. The continual building up of actual examples by the INAFOR from a long-term perspective should open up the way for the introduction of this system.

PART III PILOT STUDY REPORT

CHAPTER 1 OUTLINE OF THE PILOT STUDY

1.1 Purposes of the Pilot Study

The P/S was conducted for the purposes of facilitating the implementation of the forest management action plan for disaster prevention proposed in the Interim Report by local residents, who will play a central role, fostering of the awareness of residents through the implementation process to achieve the continuity of the implemented activities and formulating the ultimate M/P to reflect the lessons and important points learned through these experiences.

1.2 Target Communities of the Pilot Study

Nine communities, i.e. half of the 18 communities for which a forest management action plan for disaster prevention was formulated, were selected as the target communities for the P/S based on the findings of the rural survey (see Field Report (1)) and other surveys.

The selection process took such characteristics as the natural, social and economic conditions, including the distribution of communities by drainage basin, their locations in particularly drainage basins, types of forest management activities required, situation of forest resources, state of implementation of similar projects, willingness of leaders and residents of communities and distribution of communities by department, into consideration. The selected nine communities are listed below and their locations are indicated on the map on the next page.

Table 1-2-1 Target Communities of the P/S

Department	Municipality	Community
Chinandega	Puerto Morazán	La Sandino
	Villaneuva	Los Tololos
	El Viejo	Palermo
	Chichigalpa	Versalle-Apastepe
León	Achuapa	El Pajarito- Las Brisas
	El Sauce	El Cacao
	Santa Rosa del Peñón	El Charco
	León	Lechecuagos (Urroces)
Managua	San Francisco Libre	Las Mercedes

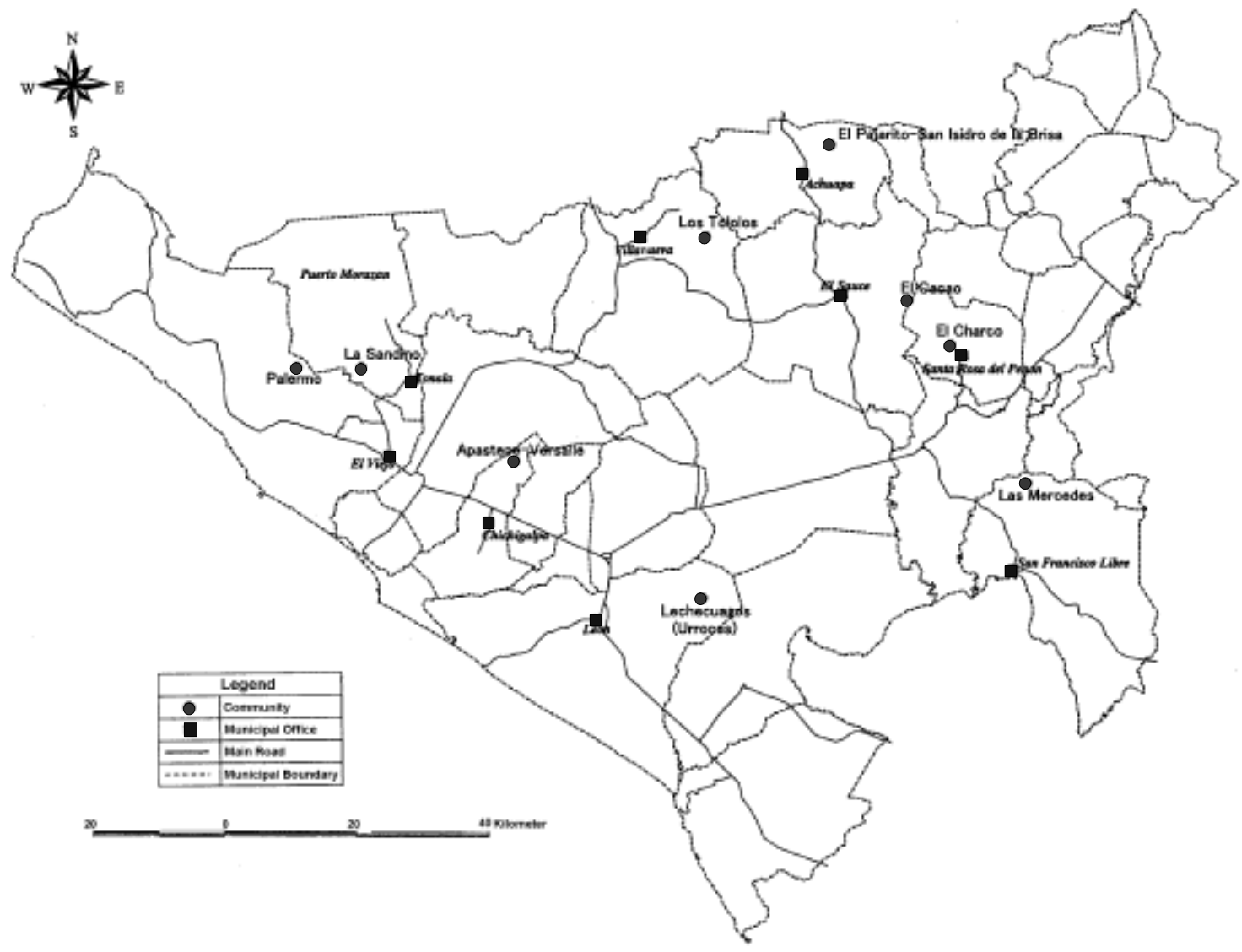


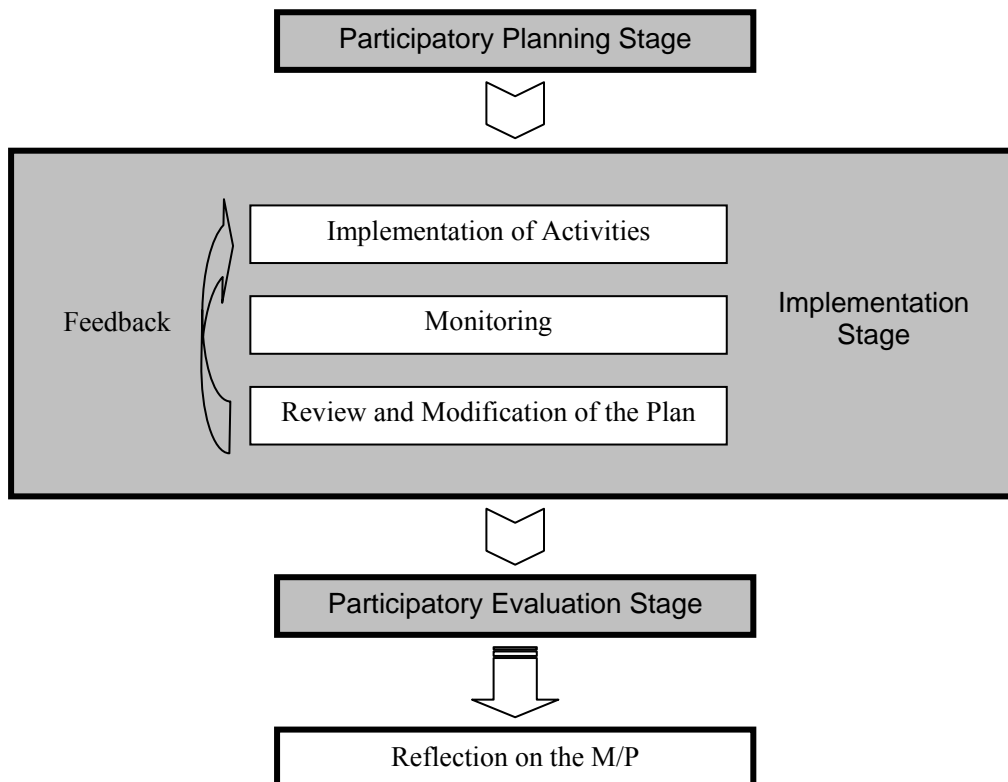
Fig. 1-2-1 Target Communities of the P/S

1.3 Pilot Study

1.3.1 Stages of the Pilot Study

All stages of the P/S were implemented for each community with discussions and practice led by local residents who were supported by subcontracted local NGO/consultants to conduct the field work, counterparts of the INAFOR and the Study Team. The municipal officials mainly participated in the planning work and workshops, including an evaluation meeting, with a view to understanding the progress at key points of each activity.

The P/S was largely implemented in the three stages shown below. The participatory planning stage involved a workshop utilising the PRA and PCM methods to formulate a concrete plan for activities. The implementation stage involved the repetition of the cycle whereby activities were principally conducted by local residents while the internal and external monitoring of activities was conducted, leading to review and modification of the original plan if necessary to ensure the continuity of activities. At the final participatory evaluation stage, final evaluation of the entire P/S was conducted in the form of a workshop.



The schedule of the P/S and outline of various studies are described below.

Table 1-3-1-1 P/S Schedule

Year	2002												2003												
Month	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11		
Participatory Planning Stage																									
Planning	■																								
Implementation Stage																									
Baseline Survey						●																			
Activities in the First Season						■																			
Workshop for Interim Evaluation											■														
Nursing Period in the Second Season													■												
Activities in the Second Season																		■							
Technical Meeting																			●						
Meeting with Municipal Officials																			●						
Participatory Evaluation Stage																									
Monitoring Survey																						●			
Workshop for Final Evaluation																							■		

Planning (January – March, 2002)

At the first stage of the P/S, an activity plan for the P/S period lasting for two seasons was formulated with the participation of local residents based on the Forest Management Action Plan for Disaster Prevention (the Action Plan) for each of the nine selected communities. In this planning, the main focus was placed on the local residents’ role of leading the planning process, taking the land owned and labour capacity of individual residents into consideration. The workshop to formulate this plan lasted for a total of five days with two or three spare days being placed in the middle to provide sufficient time for local residents to think about the plan. During the workshop period, a one day study tour was organized to visit pioneering communities to learn useful tips for the formulation of the plan in question.

Baseline Study (June, 2002)

A baseline study (BL/S) was conducted with several leading figures and 15 participants in the P/S in each community prior to the commencement of activities under the P/S for the purpose of subsequently clarifying changes of the community, awareness of the participants and forest management, etc. before and after the implementation of the P/S.

Activities in the First Season (June – October, 2002)

A workshop was held in each community prior to the commencement of the first season of the P/S to review the formulated action plan, to check the state of implementation of the preparatory activities, to modify the action plan and to confirm the implementation processes

of the planned activities. Based on the results of this workshop, various activities planned for the first season of the P/S were conducted in the period of five months from early June to the end of October, 2002. During this period, the subcontractors, INAFOR counterparts and the Study Team provided technical guidance and support equipment for local residents while clarifying the situation of the activities. The Study Team also provided technical advice for the subcontractors and INAFOR counterparts.

Workshop for Interim Evaluation (November, 2002)

Following the end of the activities in the first season, a workshop was held in each community to conduct the interim evaluation of the P/S. At this workshop, the progress situation of the activity plan was checked and the details of the activities conducted were evaluated to identify the necessity to modify the contents of the P/S and problems of the implementation system, etc. so that subsequent activities would produce meaningful results. This workshop lasted for two days in each community and took place during the 10 day period from 4th to 13th November. In addition to the active participation of local residents, the subcontractors acted as facilitators and the INAFOR counterparts and Study Team members also participated. In half of the target communities, an official of the relevant municipal authority also participated in the workshop.

Nursing Period in Second Season (December, 2002 – March, 2003)

During the period from the formulation of the activity plan in March, 2002 to the commencement of the first season, local residents in some of the communities independently attempted the nursing of seedlings. However, partly because of technical immaturity, the seedlings produced were not necessarily satisfactory. During the nursing period in the second season, the necessary technical guidance was provided to assist the nursing with a view to creating the basis for the production of appropriate seedlings by local residents in each community.

At the same time, the inclination for joint as well as individual activities was observed together with the characteristics of each community based on how local residents conducted nursing. This observation work provided the opportunity to examine the leadership ability of community leaders and the preferable way to form groups.

Activities in the Second Season (June – October, 2003)

The activities in the second season lasted for five months from early June to the end of October, 2003. During this period, the subcontractors, INAFOR counterparts and the Study Team members provided technical guidance and support equipment for local residents while

clarifying the situation of activities. A second study tour was organized in the first half of the second season. The main emphasis of the second season was placed on checking the indigenous development capability, desirable external assistance and results with a view to enhancing the ability of local residents to independently as well as continually implement forest management activities following the end of the P/S.

Technical Meeting (June, 2003)

In order for forest management activities involving planting, agroforestry and soil conservation work, etc. to be continually implemented in the future, it is essential that these activities produce results which meet the expectations of local residents while reducing the burden of these activities on local residents by means of introducing simple, low cost methods and efficient work processes. In view of such necessity, an on-the-spot technical discussion meeting for the exchange of opinions between technicians of the subcontractors was held to check appropriate techniques and work methods in order to identify better work methods suitable for the local conditions to facilitate the continuation of forest management activities.

This meeting was held in Palermo on 20th June with the participation of the subcontractors, INAFOR counterparts and the Study Team members and involved the on-the-spot checking of soil conservation, eucalyptus planting, communal nursery, home garden and improved stoves sites.

Meetings with Municipal Official (June, 2003)

Active extension activities by the administration side, including the INAFOR and municipal authorities, will be required for the successful implementation of the M/P. Particularly important will be the roles played by municipal authorities which directly deal with local residents. For this reason, a series of meetings were held between the INAFOR counterparts, Study Team members and officials of the municipal environment offices to confirm the current situation of the activities of these offices and to exchange opinions on the municipal roles for the implementation of the M/P.

Monitoring Survey (October, 2003)

In order to conduct a comparative analysis with the results of the BL/S conducted at the beginning of the first season, a monitoring survey was conducted at the final stage of the second season. As in the case of the BL/S, the targets of this monitoring study were community leaders and participants of the P/S.

Workshops for Final Evaluation (November, 2003)

After the end of the activities in the second season, community workshops were held to conduct the final evaluation of the P/S. These workshops were held to evaluate the results of the various activities under the P/S during two seasons and to analyse the accelerating as well as restrictive factors with implications for the sustainability of forest management activities of local residents to reflect the analysis results on the formulation of the ultimate M/P. The workshop lasted for two days in each community and took place during the 10 day period from 31st October to 9th November. In addition to the active participation of local residents, the subcontractors acted as facilitators and the INAFOR counterparts and Study Team members also participated. In seven of the target communities, an official of the relevant municipal authority also participated in the workshop.

1.3.2 Main Activities Under the Pilot Study

The causes of forest degradation vary from one community to another because of differences in the natural conditions, including the geographical location and topography, and social conditions, including the history and economic situation. For example, impediment to forest recovery by slash and burn farming, cutting of natural forests to collect firewood, disappearance of forests due to forest fires and soil discharge due to farming on sloping land are some of the direct causes. The interaction of these causes has also resulted in forest degradation and decline of the soil and water conservation functions of forests. As efforts to improve the soil and water conservation functions through appropriate forest management make the solving of such problems in a manner which is appropriate for the local situation essential, a number of approaches were identified.

As far as the target communities of the P/S are concerned, “slash and burn farming control”, “soil conservation” and “forest improvement” are considered to be the most important priority approaches. These can be considered direct approaches to improve the soil and water conservation functions from the viewpoint of disaster prevention. Meanwhile, “environmental education”, “prevention of forest fire” and “livelihood improvement” were implemented in all of the target communities as basic and essential activities (basic activities) to promote the three priority approaches.

These “slash and burn farming control”, “soil conservation” and “forest improvement” approaches are outlined below.

Slash and Burn Farming Control Approach

The principal purpose is to change the state of fallow land for slash and burn farming where trees only grow like shrubs because of repeated slash and burn farming with a short rotation period to the state of forests. The change from slash and burn farming to permanent farming is encouraged by maintaining or enhancing the soil fertility of the land for cultivation. The resulting decline of the dependence on slash and burn farming is expected to prolong the rotation period of slash and burn farming while efforts are made to facilitate the growth of shrub forests at former slash and burn farming sites.

Soil Conservation Approach

The decline of the soil fertility of cultivated land currently in use leads to the abandonment of the land and the use of nearby natural forests for new cultivation land, increasing the pressure on forests. The purpose of this approach is to enable the continued use of existing cultivated land through soil conservation at such land while rearing nearby forests.

Forest Improvement Approach

This approach aims at directly rearing forests to enhance their quality as well as quantity. Active efforts are made to expand man-made forests to consolidate the forest resources, primarily firewood. In the case of natural forests, their management is made more effective and efficient to allow the effective use of the available resources.

Both the slash and burn farming control approach and the soil conservation approach aim at ultimately using the land for permanent farming by means of maintaining or even improving the soil fertility of currently cultivated land to avoid an increase of the pressure on nearby shrub and other forests. From this viewpoint, both approaches adopt such agroforestry methods as rock ridges, earth ridges, contour hedgerows and the input of manure, etc. These approaches are eventually replaced in the future by the forest improvement approach when the forest growth reaches a certain stage as a result of these approaches. However, these three approaches are not completely independent from each other and, in reality, may be simultaneously implemented. For this reason, the contents of the plan for each community are quite diverse in that while they are based on one particular approach, selected as the priority approach for a specific community, they also contain components of the other two approaches.

Table 1-3-2-1 outlines the natural and social conditions, priority approach and main activities in each community.

Table 1-3-2-1 Characteristics of Community and Main Activities

Community	Natural Characteristics	Social Characteristics	Priority Approach and Main Activities
Palermo	<ul style="list-style-type: none"> • Lowland is used as agropasture land. Grassland and forests are prominent at higher elevations. • Ridge areas are gentle and the soil is generally deep. • Farmers who lack sufficiently large land in lowland areas spread slash and burn farming to ridge areas in an effort to exploit the good soil conditions of these areas. • The cutting of natural forests to produce firewood is a cause of forest degradation. 	<ul style="list-style-type: none"> • Livelihood: self-sufficient households of 40% mainly relying on farming; waged labour at a nearby sugar factory during the dry season; some 30% of households have experience of selling firewood • Landholding size: 10 – 28 Mz (33 households) • Land registration rate: 1% • Organization: active individuals • Degree of self-reliance: little tendency to rely on external assistance despite poverty as little assistance has been available in the past • Others: no technical experience relating to forest improvement or soil conservation 	<p>Priority approach: soil conservation</p> <ul style="list-style-type: none"> • Agroforestry and other soil conservation activities • Production of seedlings • Forest fire prevention • Natural forest management • Creation of firewood forests • Improved stoves • Environmental education
Los Tololos	<ul style="list-style-type: none"> • The creation of large-scale agropasture land due to the cutting of forests has led to the virtual disappearance of forests in the hilly area in the centre of the community. • Widespread slash and burn farming is conducted on mountainous land to compensate for the low agricultural productivity of the central hilly area. • The occurrence of forest fires is a problem in mountainous areas. 	<ul style="list-style-type: none"> • Livelihood: mainly farming and stock raising; more than 10% of the population work outside the community; self sufficient households of 70% • Landholding size: 20 – 30 Mz (56 households); 30 – 42 Mz (20 households) • Land registration rate: 0% (registered as a cooperative) • Organization: the community committee is weak in terms of coordinating externally assisted projects • External assistance: much assistance (five organizations) but no coordination or cooperation between the assisting organizations 	<p>Priority approach: forest improvement</p> <ul style="list-style-type: none"> • Strengthening of organization • Creation of forests • Production of seedlings and planting using the taungya system • Agroforestry • Forest fire prevention • Natural forest conservation/management • Livelihood improvement • Environmental education

Community	Natural Characteristics	Social Characteristics	Priority Approach and Main Activities
Lechecuagos (Urroces)	<ul style="list-style-type: none"> • Sand ejected by a volcano has formed a thick top layer all over the community. • Drought-resistant sesame, cassava and millet, etc. are cultivated. • Eucalyptus is widely planted and sold as firewood in León, constituting the main source of income. • Natural forests (shrub forests) are gradually degrading because of the collection of firewood. 	<ul style="list-style-type: none"> • Livelihood: farming centered on vegetables and fruit trees; self-sufficient households of 100%; sale of firewood constitutes the livelihood for most households; 40% of the population work outside the community • Landholding size: average of 20 – 25 Mz • Land registration rate: 0% • Organization: a community committee has not been established, indicating an individualistic tendency • Sense of self-reliance: strong individual initiatives are observed for problem solving and other matters • Others: 98% of households are electrified because of the proximity to an urban area 	<p>Priority approach: forest improvement</p> <ul style="list-style-type: none"> • Strengthening of organization • Production of seedlings and planting • Increased production and commercialisation of firewood • Activities to collect firewood, fodder and wood to make posts • Forest fire prevention • Conservation and enrichment of natural forests • Production of fruit for home consumption and marketing
Versalle-Apastepe	<p>Versalle</p> <ul style="list-style-type: none"> • Agropasture land is expanding towards land at a higher elevation, gradually converting the existing forests to such land. • No soil conservation measures are implemented for new farmland created on sloping land and soil erosion has started. <p>Apastepe</p> <ul style="list-style-type: none"> • Terraced farmland created by earth ridges spreads over gentle slopes, causing few problems in terms of soil conservation. • However, the collection of firewood relies on natural and shrub forests located above the dwelling area and the small size of the collection area makes the collection of firewood a problem for local residents. 	<ul style="list-style-type: none"> • Livelihood: self-sufficient households of 90%, mainly based on farming; 10% of the population work outside the community • Landholding size: landless (3 households); 1 – 10 Mz (2 households); 10 – 20 Mz (14 households); 20 Mz or more (50 households) • Land registration rate: 0% (registered as a cooperative) • Organization: there is a tendency for any organization which is formed with external assistance to quickly disappear • Experience: experience of activities under forest/soil conservation projects but the activities are not continued • Degree of self-reliance: generally passive 	<p>Priority approach: soil conservation</p> <ul style="list-style-type: none"> • Strengthening of organization • Agroforestry and other soil conservation activities • Forest fire prevention • Production of seedlings • Natural forest management and planting • Home gardens • Environmental education

Community	Natural Characteristics	Social Characteristics	Priority Approach and Main Activities
El Cacao	<ul style="list-style-type: none"> • Located in a ridge area with an elevation of 800 – 1,000 m, most of the land is steeply sloping with little flat land. • Natural pine forests are located at the summit area and broad-leaved forests spread below. • Organic coffee has been cultivated in recent years in broad-leaved forests. • The shortage of suitable land for cultivation means that farming is conducted on steep sloping land with many stones and pebbles. 	<ul style="list-style-type: none"> • Livelihood: self-sufficient households of 90%, mainly based on farming; 10% of the population work outside the community • Landholding size: 2 – 10 Mz (5 households); 10 – 20 Mz (5 households); 20 Mz or more (2 households) • Land registration rate: 50% • Organization: the strong organization with an excellent leaders has created a sense of community solidarity • Degree of self-reliance: the poor site conditions have strengthened the tendency of self-reliance, resulting in a positive attitude towards livelihood improvement 	<p>Priority approach: soil conservation</p> <ul style="list-style-type: none"> • Erosion control • Improvement of the soil productivity by organic farming • Elimination of forest fires • Production of seedlings to enrich broad-leaved natural forests • Improvement of natural forests (pine forest management and coffee cultivation in broad-leaved natural forests) • Disaster prevention measures for collapsing sites • Extermination of pine beetles • Increase of the household income by the marketing of organic coffee beans and fruit • Improvement of the household economy • Environmental education
La Sandino	<ul style="list-style-type: none"> • The community is located in a hilly area surrounded by slightly elevated mountains. • The owned land is small and there are few forests in the community as it is surrounded by large farms run by large landowners. • The task for forest resources management is to secure the supply of firewood while conserving the few forest resources. 	<ul style="list-style-type: none"> • Livelihood: self-sufficient households of 80%, mainly based on farming, stock raising and waged labour; most men work at neighbouring farms • Landholding size: 0 – 2 Mz (12 households); 2 – 10 Mz (30 households); 10 – 20 Mz (12 households); 12 – 99 Mz (12 households); 100 Mz or more (2%) • Land registration rate: 50% • Organization: the organizational strength is growing under an excellent leader and external assistance is effectively used • Participation by women: as men are engaged in waged labour, women account for 70 – 80% of the participants 	<p>Priority approach: forest improvement</p> <ul style="list-style-type: none"> • Forest fire prevention • Production of seedlings • Planting to obtain firewood • Agroforestry and other soil conservation activities • Natural forest management • Home gardens • Environmental education
El Pajarito – Las Brisas	<ul style="list-style-type: none"> • The elevation range is between 500 m and 1,300 m. El Pajarito is located at a higher elevation with much steep sloping land. Las Brisas is located below and has gentle topography. • Except for a pine forest zone above an elevation of 1,000 m, farmland and pasture dominate the area. Lines or blocks of trees along valleys, ridges and land boundaries remain. • Coffee is cultivated in some broad-leaved natural forests. • The existence of many stones and pebbles means that little land is suitable for farming and the crop yield is low. 	<ul style="list-style-type: none"> • Livelihood: self-sufficient households of 40% • Landholding size: landless (20 households); 1 – 5 Mz (44 households); 6 – 19 Mz (3 households); 20 Mz or more (13 households) • Land registration rate: 5% (4 households) • Organization: both communities have excellent leaders, resulting in many participants • Degree of self-reliance: most of the participants are generally passive, presumably because of the high level of external assistance • Others: as houses are scattered throughout the community, individual activities appear to be preferred 	<p>Priority approach: soil conservation</p> <ul style="list-style-type: none"> • Strengthening of organization • Agroforestry and other soil conservation activities • Production of seedlings and planting • Silvopastoral • Natural forest management and forest fire prevention • Home gardens • Environmental education • Planting in headwater areas

Community	Natural Characteristics	Social Characteristics	Priority Approach and Main Activities
Las Mercedes	<ul style="list-style-type: none"> • The land is generally steep with many stones and pebbles. • Most forests have degraded to become shrub forests as a result of the continued use of arable land for slash and burn farming. • Slash and burn farming land is steeply sloping and is in a state of advanced soil erosion. 	<ul style="list-style-type: none"> • Livelihood: self-sufficient households of 80%, mainly based on farming; the food assistance of external organizations is an important means of livelihood • Landholding size: 1 – 10 Mz (23 households); 10 Mz or more (10 households) • Land registration rate: 20% • Organization: the organizational strength is strong under an excellent leader, creating a sense of community solidarity • Experience: while some local residents have a strong awareness of the problems because of their experience with previous forest-related projects, forest conservation techniques have not been widely spread 	<p>Priority approach: slash and burn farming control</p> <ul style="list-style-type: none"> • Agroforestry and other soil conservation activities • Production of seedlings and planting • Home gardens • Natural forest management and forest fire control • Silvopastoral • Environmental education • Planting in headwater areas
El Charco	<ul style="list-style-type: none"> • Forests in the community have been continually declining due to slash and burn farming, the expansion of farmland and pasture and the cutting of trees to produce timber. • Many shrub forests and grassland are located at sites with many stones and gravel. • Advanced soil erosion has made the top soil shallow, resulting in little land which is suitable for farming. • Slash and burn farming has been gradually spreading to areas with a high elevation to seek fertile land. • The low headwater conservation function of drainage basins means that most rivers in the community run dry during the dry season. 	<ul style="list-style-type: none"> • Livelihood: mostly farming and stock raising; some 30% work outside the community: self-sufficient households of 30% • Landholding size: landless (46 households); 1 – 5 Mz (13 households); 6 – 20 Mz (18 households); 21 Mz or more (6 households) • Land registration rate: 0% • Organization: there is a sense of community solidarity as observed with the communal management of wells • Degree of self-reliance: while generally passive, some participants are noticeably active • Participation of women: as many heads of households work away from home, more than 50% of the participants are women 	<p>Priority approach: slash and burn farming control</p> <ul style="list-style-type: none"> • Strengthening of organization • Agroforestry and other soil conservation activities • Improved production of stock raising by silvopastoral • Forest fire prevention • Creation of high quality man-made forests • Conservation and rearing of natural forests • Improved household economy and diet based on home gardens • Environmental education

1.3.3 Inputs of the Pilot Study

(1) Human Inputs

The activities under the P/S were conducted by local residents with the support of subcontracted local NGOs/consultants, INAFOR counterparts and the Study Team. The INAFOR counterparts formed a team consisting of the leader and two technicians. The subcontract NGOs/consultants are listed below and each NGO or consultant was responsible for three communities.

Table 1-3-3-1 Target Communities and Responsible NGOs/Consultants

Municipality	Community	NGO/Consultant
Puerto Morazán	La Sandino	ADESA
Villaneuva	Los Tololos	FORESTAN
El Viejo	Palermo	FORESTAN
Chichigalpa	Versalle-Apastepe	ADESA
Achuapa	El Pajariton - Las Brisas	APRODESA
El Sauce	El Cacao	ADESA
Santa Rosa del Peñón	El Charco	APRODESA
León	Lechecuagos (Urroces)	FORESTAN
San Francisco Libre	Las Mercedes	APRODESA

There were four periods for subcontracting as listed below.

- Planning : January – March, 2002 (two months)
- First season : June – October, 2002 (five months) and a 10 day workshop thereafter
- Nursing period in second season : December, 2002 – March, 2003 (four months)
- Second season : June – October, 2003 (five months) and a 10 day workshop thereafter

The total number of person-days spent by technicians of the subcontractors for lectures for local residents, technical guidance in the field, monitoring and the distribution of materials and equipment, etc. during these three periods except the planning period was 505 person-days for the nine communities with an average of 56 person-days per community.

As each subcontractor formed a technical team consisting of three members specialising in social affairs, agriculture and forestry respectively, the actual number of person-days per community was 168 person-days. Given the subcontracting period of 14 months, the number

of person-days per technical team per community per month was 12 person-days (3 persons x 4 days). In the case of the FORESTAN, one technician was stationed for 3 – 4 days a week in each target community while the team leader visited the three communities in turn at appropriate times to provide guidance for both the technicians and local residents.

The number of participants in the P/S dropped from from 284 (183 men and 101 women) at the beginning to 236 (165 men and 71 women) at the end, indicating that some 50 people stopped participating without completing the activity. The main reasons for withdrawal appear to have been lack of interest in the activity, non-possession of target land for an activity to start with and the sale of land to move out of the community. Although the number of participants decreased in eight communities, it increased from 13, including one from a neighbouring community, to 16 at the end in the case of El Cacao.

Table 1-3-3-2 Changes of Number of Participants

Community	Beginning			End		
	Men	Women	Total	Men	Women	Total
Palermo	28	8	36	16	8	24
Los Tololos	18	9	27	15	4	19
Urroces	25	1	26	20	1	21
Versalle-Apastepe	18	14	32	17	12	29
El Cacao	8	5	13	12	4	16
La Sandino	3	26	29	5	19	24
El Pajarito-Las Brisas	39	6	45	39	6	45
Las Mercedes	23	2	25	22	2	24
El Charco	21	30	51	19	15	34
Total	183	101	284	165	71	236

(2) Material Inputs

During the P/S, materials and equipment were provided in each of the three periods except planning periods. The selection of the materials and equipment was based on the list of necessary materials and equipment prepared by the local residents at the time of participatory planning from January to March, 2002. The principle for the listing of the materials and equipment to be provided was that only those items which were essential but which could not be procured by the local residents themselves should be listed. However, some lists included lamps, gloves and medicines which were judged to be unsuitable for the purposes of the P/S and these were omitted from the scope of the materials and equipment to be provided. In the case of barbed wire, the provision of which during the first season was hoped for by local residents, some was provided during the nursing period in the second season because of

budgetary restrictions and most was provided in time for full-scale planting activities in the second season.

The total cost of the materials and equipment for the nine communities was approximately US\$ 46,900 as shown in Table 1-3-3-3. The cost per participant for the three periods based on the number of participants at the end was slightly less than US\$ 200.

Table 1-3-3-3 Material and Equipment Procurement Cost (for Nine Communities)

Season	Material and Equipment Cost (US\$)
First Season	14,263
Nursing Period in Second Season	8,573
Second Season	24,017
Total	46,853

CHAPTER 2 RESULTS OF THE PILOT STUDY

2.1 Results of the Pilot Study

The main results of the activities implemented in the target communities are described below.

(1) Nursing

- The total number of seedlings produced was approximately 165,000.
- Out of this total number of seedlings, 127,500 seedlings or 77% were forestry species.
- 27,400 coffee seedlings were produced in two communities.
- Some 10,000 fruit tree seedlings were produced in the second season.
- Prior to the commencement of the first season, six communities commenced their own nurseries but most of the seedlings died in the middle of nursing because of technical immaturity.
- During the nursing period in the second season, the nursing work steadily progressed under the guidance of a technician and many local residents gained confidence in their nursing ability.
- Despite the initial prediction that the communal nurseries run by joint work would form the mainstay of nursing activities during the nursing period in the second season, many individually-run nurseries were created, suggesting the preference of local residents for individual activities.
- Eucalyptus seedlings accounted for slightly less than half of the produced seedlings of forestry species. Other popular species were caoba, genizaro and pochote.
- Coffee seedlings, fruit tree seedlings for home gardens (papaya, citrus and cashew, etc.) were also produced.

(2) Reforestation

- A total of 97,400 seedlings were planted.
- The reforestation of former cultivated land, pasture and headwater areas, etc. was conducted.
- In the first season, 19,000 seedlings were supplied to two communities. However, only 17,600 seedlings were planted because of damage to 1,400 seedlings during transportation.

- The seedlings planted in the second season were entirely produced by local residents. As a result, 79,800 seedlings (97,400 – 17,600) nursed by local residents were planted for the creation of man-made forests.
- Weeding after planting and bud pruning at existing eucalyptus man-made forests were conducted as part of the tending work.
- Firebreaks were created around man-made forests.

(3) Natural Forest Management

- A total of 43,400 seedlings were planted.
- 16,000 seedlings of forestry species and 27,400 coffee seedlings were planted at natural forests for the purpose of enrichment.
- While the cultivation of coffee trees is effective to ensure the continued existence of natural forests, it is also useful to increase cash income for livelihood improvement.
- Firebreaks were created around natural forests.

(4) Slash and Burn Farming Control and Soil Conservation

- Rock ridges, earth ridges, live fences and contour hedgerows, etc. were created.
- While the activities were confined to the rehabilitation of existing earth ridges and terrace works in some communities, such structures were newly created in most communities.
- Out of 127,500 seedlings of forestry species, most of the 31,700 seedlings were planted to create live fences or on pasture.
 $\{127,500 - (79,800 \text{ for man-made forests} + 16,000 \text{ for enrichment of natural forests}) = 31,700\}$
- As the number of seedlings used to create live fences and on pasture was calculated based on the total length of such fences and the total area of pasture, the exact number of seedlings used for these purposes is unknown.
- A fair quantity of stakes were used for live fences but the exact number is unknown for the reason given above.

(5) Forest Fire Prevention

- Community rules on burning were prepared together with the implementation of forest fire prevention campaigns and the introduction of firebreaks around cultivated land as well as forests.
- Forest fire prevention campaigns were implemented as part of environmental education.

- Some communities conducted activities to appeal forest fire prevention to neighbouring communities.
- As a result of the forest fire prevention activities, the number of burning cultivation and forest fires declined in most communities.

(6) Environmental Education

- Forest fire prevention campaigns, Tree Day campaigns and environmental education at primary schools were conducted.
- These campaigns involved the putting up of banners and posters in various places in communities.
- Some communities held events involving neighbouring communities and one community performed a short play appealing environmental conservation.
- One primary school received an award from the MECD for its extra-curricula environmental education activities, including school nursery and school vegetable garden activities.

(7) Livelihood Improvement

- Activities conducted for livelihood improvement included the creation of home gardens and the production of improved stoves.
- The seedlings of such fruit trees as citrus, mango and avocado, etc. were provided and planted.
- The seedlings nursed by local residents included those of papaya, citrus and cashew.
- Such vegetables as green peppers, tomatoes and gourd, etc. were cultivated and some participants sold the surplus vegetables.
- Local residents learned how to produce compost and organic pesticides and actually produced some by themselves.
- One community increased the number of improved stoves from two model stoves to eleven as a result of the work of its residents.

(8) Strengthening of Organization

- Lecture meetings were held on such issues as strengthening of the organization, leadership and gender.

Among the activities described above, the number of seedlings produced and planted by community are shown in Tables 2-1-1 and 2-1-2 as values typically representing the numerical achievement of the activities under the P/S.

Table 2-1-1 Number of Seedlings Produced

Community	2002			2003			Total			
	Forestry Species	Coffee	Fruit Trees	Forestry Species	Coffee	Fruit Trees	Forestry Species	Coffee	Fruit Trees	Total
Palermo	2,070	0	0	34,130	0	1,710	36,200	0	1,710	37,910
Los Tololos	90	0	0	9,250	0	2,710	9,340	0	2,710	12,050
Urroces	15,780	0	0	25,700	0	0	41,480	0	0	41,480
Versalle-Apastepe	0	0	0	3,950	0	3,440	3,950	0	3,440	7,390
El Cacao	750	6,500	0	900	5,950	420	1,650	12,450	420	14,520
La Sandino	5,220	0	0	4,580	0	1,100	9,800	0	1,100	10,900
El Pajarito-Las Brisas	1,910	0	0	8,910	14,980	250	10,820	14,980	250	26,050
Las Mercedes	0	0	0	7,630	0	0	7,630	0	0	7,630
El Charco	0	0	0	6,650	0	340	6,650	0	340	6,990
Total	25,820	6,500	0	101,700	20,930	9,970	127,520	27,430	9,970	164,920

Table 2-1-2 Number of Trees Planted

Community	2002				2003				Total						
	Reforestation	Coffee	Fruit Trees		Reforestation	Coffee	Fruit Trees		Reforestation	Natural Forest Management			Fruit Trees		Total
			Self-Produced	Supplied			Self-Produced	Supplied		Enrichment	Coffee	Total	Self-Produced	Supplied	
Palermo	9,750	0	0	270	18,280	0	1,400	170	28,030	1,340	0	1,340	1,400	440	31,210
Los Tololos	7,850	0	0	140	6,650	0	0	120	14,500	2,600	0	2,600	0	260	17,360
Urroces	15,780	0	0	140	25,700	0	0		41,480	0	0	0	0	140	41,620
Versalle-Apastepe	0	0	0	0	0	0	3,440	410	0	3,950	0	3,950	3,440	410	7,800
El Cacao	0	6,500	0	0	0	5,950	0	400	0	940	12,450	13,390	0	400	13,790
La Sandino	5,220	0	0	0	3,290	0	1,100	450	8,510	2,390	0	2,390	1,100	450	12,450
El Pajarito-Las Brisas	1,450	0	0	90	1,160	14,980	0	530	2,610	1,440	14,980	16,420	0	620	19,650
Las Mercedes	0	0	0	370	1,190	0	0		1,190	2,150	0	2,150	0	370	3,710
El Charco	0	0	0	130	1,060	0	0	110	1,060	1,170	0	1,170	0	240	2,470
Total	40,050	6,500	0	1,140	57,330	20,930	5,940	2,190	97,380	15,980	27,430	43,410	5,940	3,330	150,060

Notes

1. 9,750 seedlings were planted in 2002 in Palermo because of damage to 250 seedlings out of the 10,000 seedlings supplied.
2. 7,850 seedlings were planted in 2002 in Los Tololos because of damage to 1,150 seedlings out of the 9,000 seedlings supplied.
3. The figures for enrichment cover the two seasons because the figures for individual seasons are unknown.
4. Some self-produced fruit tree seedlings were not planted as of the end of October, 2003.

The details of the activities conducted in the nine communities are shown in Table 2-1-3. As both “slash and burn farming control” and “soil conservation” are similar because rock ridges and earth ridges, etc. are conducted under both of these approaches, they are combined in the single heading of “slash and burn farming control/soil conservation”. In the case of silvopastoral, it has an aspect of one type of agroforestry while agroforestry itself is part of the soil conservation approach. For these reasons, these activities are shown under the heading of “slash and burn farming control/soil conservation”.

Table 2-1-3 Outline of Activities (1)

Community	Palermo	Los Tololos	Urroces	Versalle-Apastepe	El Cacao	
Forest Improvement	Nursing	<ul style="list-style-type: none"> Number of seedlings produced 2002: 2,070 2003: 35,840 (forestry species: 34,130; fruit trees: 1,710) Collection of natural seeds Compilation of a list of local species 	<ul style="list-style-type: none"> Number of seedlings produced 2002: 90% dead (90 survived) 2003: 11,960 (forestry species: 9,250; fruit trees: 2,710) Collection of natural seeds 	<ul style="list-style-type: none"> Number of seedlings produced 2002: 15,780 2003: 25,700 (entirely eucalyptus seedlings) Collection of eucalyptus seeds 	<p>Versalle</p> <ul style="list-style-type: none"> Repair of water supply pipe for watering of the nursery Number of seedlings produced 2003: 5,640 (forestry species: 3,030; fruit trees: 2,610) <p>Apastepe</p> <ul style="list-style-type: none"> Excavation of a communal well Number of seedlings produced 2003: 1,750 (forestry species: 920; fruit trees: 830) 	<ul style="list-style-type: none"> Nursing of wilding stock (Cedro real) 2002: 750 2003: 80 Number of seedlings produced 2002: 6,500 (entirely coffee) 2003: 7,190 (forestry species: 820; fruit trees: 420; coffee trees: 5,950)
	Reforestation	<ul style="list-style-type: none"> Number of seedlings planted 2002: 9,750 (supplied seedlings) 2003: 18,280 	<ul style="list-style-type: none"> Number of seedlings planted 2002: 7,850 (supplied seedlings) 2003: 6,650 Weeding: 17.8 Mz 	<ul style="list-style-type: none"> Number of seedlings planted 2002: 15,780 2003: 25,750 Tending of man-made forests: 127 Mz 		
	Natural Forest Management	<ul style="list-style-type: none"> Pruning/climber cutting: 87 Mz Firebreaks 2002: 2,200 Vrs 2003: 55,570 Vrs Riverine forest enrichment: 1,344 seedlings 	<ul style="list-style-type: none"> Pruning Enrichment: 2,600 seedlings Firebreaks 	<ul style="list-style-type: none"> Improvement cutting; pruning /climber cutting: 17 Mz Firebreaks: 6,800 Vrs 	<p>Versalle</p> <ul style="list-style-type: none"> Forest reconnaissance for formulation of natural forest management plan: 13 Mz Study meeting with INAFOR, MARENA and municipal officials for formulation of the above plan Enrichment: 3,030 seedlings <p>Apastepe</p> <ul style="list-style-type: none"> Enrichment: 920 seedlings 	<p>Natural pine forests</p> <ul style="list-style-type: none"> Improvement cutting and thinning: 3 Mz Firebreaks: 180 Mz Patrolling Removal of trees damaged by pine beetles (2002) <p>Broad-leaved natural forests</p> <ul style="list-style-type: none"> Enrichment: 940 seedlings Planting of coffee seedlings 2002: 6,500 2003: 5,950 Patrolling

Community	Palermo	Los Tololos	Urroces	Versalle-Apastepe	El Cacao
Slash and Burn Farming Control/Soil Conservation	<ul style="list-style-type: none"> • Live fences 2003 Stakes: 3,900 Planting: 4,440 Stump seedlings: 540 • Contour hedgerows (rock ridges; earth ridges) 2002/2003: 5,780 seedlings (approx. 17,300 Vrs) • Silvopastoral 2003: 12.75 Mz; 3,950 seedlings 	<ul style="list-style-type: none"> • Taungya system: 5 Mz • Contour hedgerows: 3,600 Vrs • Live fences: 10,950 Vrs 	<ul style="list-style-type: none"> • Live fences: 5,360 Vrs 	<p>Versalle</p> <ul style="list-style-type: none"> • Repair and new construction of earth ridges: 2,560 m <p>Apastepe</p> <ul style="list-style-type: none"> • Repair of existing terrace works: 1,840 m 	<ul style="list-style-type: none"> • Rock ridges 2002: 550 m new 1,010 m repaired 2003: 120 m new 2,870 m repaired • Contour hedgerows 2002: 330 m 2003: 70 m • Check dams 2002: 24 m 2003: 15 m • Live fences 2002: 500 Vrs 2003: 90 Vrs • Use of compost and organic pesticide
Forest Fire Prevention	<ul style="list-style-type: none"> • Formulation of community rules on forest fire prevention and activities to make these rules widely known • Formation of a fire brigade • Firebreaks 2002: 1,070 Vrs 2003: 59,050 Vrs including natural forest management • Forest fire prevention activities targeting neighbouring communities (five times) • Forest fire damage 2002: 8 Mz 2003: 0Mz 	<ul style="list-style-type: none"> • Formulation of community rules on forest fire prevention • Formation of a fire brigade • Forest fire prevention activities targeting neighbouring communities (seven times) • Firebreaks (140 km, including natural forest management) • Number of forest fires 2002: 7 2003: 4 	<ul style="list-style-type: none"> • Formulation of community rules on forest fire prevention • Forest fire prevention campaigns (twice) • Forest fire prevention activities targeting neighbouring communities (twice) • Firebreaks (38,600 Vrs, including natural forest management) • Number of forest fires 2002: 20 2003: 2 	<p>Versalle</p> <ul style="list-style-type: none"> • Formulation of community rules on forest fire prevention • Formation of a fire brigade (second time; 15 members) • Forest fire prevention campaign (once) <p>Apastepe</p> <ul style="list-style-type: none"> • Forest fire prevention campaign (once) • Another forest fire prevention campaign jointly by the two communities in 2002 • Forest fire damage 2002: 200 Mz 2003: 0 Mz 	<ul style="list-style-type: none"> • Formation of a fire brigade • Formulation of community rules on forest fire prevention • Forest fire prevention campaigns (twice) • Forest fire prevention campaign targeting neighbouring communities • Education for forest fire prevention targeting local residents and primary school pupils • Firebreaks (180 Mz, for natural forest management) • Number of forest fires 2002: 0 2003: 0

Community		Palermo	Los Tololos	Urroces	Versalle-Apastepe		El Cacao
Environmental Education		<ul style="list-style-type: none"> Environmental education on forest fire prevention Reforestation campaign by introduction of the Tree Day 	<ul style="list-style-type: none"> Environmental education on forest fire prevention 		<ul style="list-style-type: none"> Forest fire prevention campaign together with environmental education 		<ul style="list-style-type: none"> Forest fire prevention campaign together with environmental education Performance of a short play
Livelihood Improvement		<ul style="list-style-type: none"> Improved stoves: 11 Planting of grafted fruit trees (supplied graft) 2002: 268 2003: 167 Production of fruit tree seedlings 2003: 1,710 (out of which 1,400 have already been planted) Production of organic pesticide and compost 	<ul style="list-style-type: none"> Home gardens (13 Mz) Planting of grafted fruit trees (supplied graft) 2002: 144 2003: 124 Production of fruit tree seedlings: 2,710 	<ul style="list-style-type: none"> Planting of grafted fruit trees (supplied graft) 2002: 140 Home gardens: 78 Mz 	<ul style="list-style-type: none"> Home gardens Production of grafted fruit tree (out of the fruit tree seedlings produced) 2003: Versalle – 300 2003: Apastepe – 120 Vegetable cultivation (in Versalle, surplus vegetables were sold) Planting of fruit trees (seedlings) 2003: Versalle - 2,610 2003: Apastepe - 830 Planting of grafted fruit trees (supplied graft) 2003: 408 for the two communities 	<ul style="list-style-type: none"> Planting of coffee seedlings 2002: 6,500 2003: 5,950 Planting of grafted fruit trees (supplied graft) 2003: 400 Home gardens Preservation of vegetable seeds Production of manure Production of organic pesticide 	
Strengthening of Organization		<ul style="list-style-type: none"> Lecture meeting on the management of an organization (four times) 	<ul style="list-style-type: none"> Lecture meeting on the management of an organization (three times) 	<ul style="list-style-type: none"> Lecture meeting on the management of an organization (four times) 	<ul style="list-style-type: none"> Lecture meeting on the management of an organization 		
Number of Participants	Start	36 (28 men/8 women)	27 (18 men/9 women)	26 (25 men/1 woman)	Versalle 20 (11 men/ 9 women)	Apastepe 12 (7 men/ 5 women)	13 (8 men/5 women)
	End	24 (16 men/8 women)	19 (15 men/4 women)	21 (20 men/1 woman)	Versalle 20 (12 men/ 8 women)	Apastepe 9 (5 men/ 4 women)	16 (12 men/4 women)

Table 2-1-3 Outline of Activities (2)

Community		La Sandino	El Pajarito-Las Brisas	Las Mercedes	El Charco
Forest Improvement	Nursing	<ul style="list-style-type: none"> • Number of seedlings produced 2002: 5,220 2003: 5,680 (forestry species: 4,580; fruit trees: 1,100) 	<ul style="list-style-type: none"> • Number of seedlings produced (total for the two communities) 2002: 1,910 2003: 24,140 (forestry species: 8,910; fruit trees: 250; coffee trees: 14,980) 	<ul style="list-style-type: none"> • Extension of a water tank • Number of seedlings produced 2003: 7,630 (entire forestry species) 	<ul style="list-style-type: none"> • Number of seedlings produced 2003: 6,990 (forestry species: 6,650; fruit trees: 340)
	Reforestation	<ul style="list-style-type: none"> • Number of seedlings planted 2002: 5,220 (partly for live fences) 2003: 3,290 (partly for live fences) 	<ul style="list-style-type: none"> • Number of seedlings planted (total for the two communities) 2002: 1,450 2003: 1,160 • Planting in headwater areas: 460 • Protective fencing around afforestation sites: 3,500 Vrs • Firebreaks around reforestation sites: 2,300 m • Live fencing around reforestation sites: 990 m 	<ul style="list-style-type: none"> • Number of seedlings planted 2003: 1,190 • Firebreaks: 1,030 m • Protective fencing around reforestation sites: 2,450 m • Weeding 	<ul style="list-style-type: none"> • Number of seedlings planted 2003: 1,060 • Firebreaks: 1,100 m • Protective fencing around reforestation sites: 1,400 Vrs • Weeding
	Natural Forest Management	<ul style="list-style-type: none"> • Enrichment: 2,390 seedlings 	<ul style="list-style-type: none"> • Protective fencing around natural forests: 300 Vrs • Enrichment: 1,440 seedlings • Planting of coffee trees: 14,980 seedlings • Firebreaks around natural forests 	<ul style="list-style-type: none"> • Protective fencing around natural forests: 7,350 Vrs • Pruning, improvement cutting and climber cutting: 12 Mz • Firebreaks: 1,750 m • Live fences: 2,130 m • Enrichment: 2,150 seedlings 	<ul style="list-style-type: none"> • Protective fencing around natural forests: 4,550 m • Pruning, improvement cutting and climber cutting: 12 Mz • Firebreaks: 2,170 m • Live fences: 60 m • Surviving seedlings for enrichment: 1,170

Community	La Sandino	El Pajarito-Las Brisas	Las Mercedes	El Charco
Slash and Burn Farming Control/Soil Conservation	<ul style="list-style-type: none"> • New earth ridges 2002: 2,070 m • Repair of existing earth ridges 2002: 270 m 2003: 600 m • New rock ridges 2002: 10 m • Repair of the existing check dam 2003: 1 • Live fences 	<p>Cultivated land</p> <ul style="list-style-type: none"> • Live fences: 2,980 m • Contour hedgerows: 6,910 m • Rock ridges: 2,840 m • Earth ridges: 730 m • Check dams: 334 m • Ditches: 730 m • Use of green manure • Production of organic pesticide: 624 litres • Production of compost: 421 qq • Planting of grafted fruit trees: 390 <p>Pasture</p> <ul style="list-style-type: none"> • Live fences: 3,300 m • Creation of meadows: 2.5 Mz • Planting on pasture: 1,490 seedlings • Firebreaks: 6,520 m 	<p>Cultivated land</p> <ul style="list-style-type: none"> • Live fences: 1,710 m • Contour hedgerows: 4,510 m • Rock ridges: 4,590 m • Check dams: 230 m • Ditches: 100 m • Use of green manure: 10 Mz • Production of organic pesticide: 624 litres • Production of compost: 44 qq • Planting of grafted fruit trees: 150 <p>Pasture</p> <ul style="list-style-type: none"> • Surviving fodder trees: 1,350 • Live fences: 940 m • Pruning at pasture: 8 Mz • Firebreaks: 7,230 m 	<p>Cultivated land</p> <ul style="list-style-type: none"> • Live fences: 1,900 m • Contour hedgerows: 5,570 m • Rock ridges: 11,280 m • Check dams: 140 m • Ditches: 150 m • Earth ridges: 100 m • Use of green manure: 7 Mz • Production of compost: 230 qq • Surviving trees of forestry species: 1,570 • Surviving fruit trees: 130 <p>Pasture</p> <ul style="list-style-type: none"> • Surviving fodder trees: 960 • Live fences: 1,570 m • Pruning at pasture: 8 Mz • Firebreaks: 6,240 m • Grass cutting: 3 Mz
Forest Fire Prevention	<ul style="list-style-type: none"> • Forests fire prevention campaigns (twice) • Formulation of community rules • Forest fire damage 2002: 400 Mz 2003: 200 Mz 	<ul style="list-style-type: none"> • Forest fire prevention campaign • Formation of a fire brigade (18 members) • Firebreaks: 15,330 m (including those created under soil conservation/ agroforestry) • Undergrowth clearance: 80 Mz • Forest fire damage 2001: 200 Mz 2002: 7 Mz 2003: 0 Mz 	<ul style="list-style-type: none"> • Study meeting on forest fire prevention with INAFOR, municipal authority and the police • Formation of a fire brigade • Education of neighbouring community on forest fire prevention • Firebreaks: 14,010 m (including those created under soil conservation/ agroforestry) • The number of forest fires is showing a declining trend • Fewer farmers are engaged in burning cultivation 	<ul style="list-style-type: none"> • Formulation of community rules on forest fire prevention • Formation of a fire brigade • Installation of forest fire prevention information boards • Firebreaks: 11,590 m (2002) and 9,510 m (2003) (including those created under soil conservation/ agroforestry) • Number of forest fires 2002: 0 2003: 0 • Fewer farmers are engaged in burning cultivation

Community		La Sandino	El Pajarito-Las Brisas	Las Mercedes	El Charco
Environmental Education		<ul style="list-style-type: none"> • Environmental education on forest fire prevention (three times) 	<ul style="list-style-type: none"> • Formation of a pupils' environment squad (30 pupils) • Environmental protection activities (posters, information boards and cleaning of community land) • School garden • School nursery (commended by MECD) 	<ul style="list-style-type: none"> • Environmental education for primary school pupils • Planting at the school and church by primary school pupils 	<ul style="list-style-type: none"> • Formation of a women's environment group • Formation of a school pupils' environment group • Environmental protection activities (posters, information boards and cleaning of community land)
Livelihood Improvement		<ul style="list-style-type: none"> • Use of compost and organic pesticide • Cultivation of vegetables at a communal garden (one site; 0.75 Mz) • Cultivation of vegetables at home gardens 2003: marketing of surplus vegetables and preservation of seeds) • Planting of grafted fruit trees (supplied graft) 2003: 454 	<ul style="list-style-type: none"> • Home gardens • Planting of forestry species: 350 • Planting of coffee seedlings: 14,980 • Planting of fruit trees (supplied) 2002: 90 2003: 530 • Use of organic pesticide (125 litres) • Improved stoves: 13 	<ul style="list-style-type: none"> • Home gardens: sale of surplus vegetables within the community and reduction of the vegetables purchased • Live fences: planting of 560 seedlings • Chicken raising (three families) • Improved stoves: 9 • Planting of fruit trees (supplied seedlings) 2002: 374 • Production of compost 	<ul style="list-style-type: none"> • Home gardens • Planting of fruit trees (supplied seedlings) 2002: 126 2003: 112 • Chicken raising (13 families) • Production of compost
Strengthening of Organization			<ul style="list-style-type: none"> • Lecture meeting on the management method of an organization and leadership 	<ul style="list-style-type: none"> • Gender study meeting 	<ul style="list-style-type: none"> • Meeting of the executive board • Formulation of rules for the executive board • Gender study meeting
Number of Participants	Start	29 (3 men/26 women)	45 (39 men/6 women)	25 (23 men/2 women)	51 (21 men/30 women)
	End	24 (5 men/19 women)	45 (39 men/6 women)	24 (22 men/2 women)	34 (19 men/15 women)

2.2 Changes in the Communities

In this section, the results and process of the series of activities under the P/S are analysed in order to clarify changes of the indigenous development capability of the community and challenges for future activities.

(1) Technical Capability

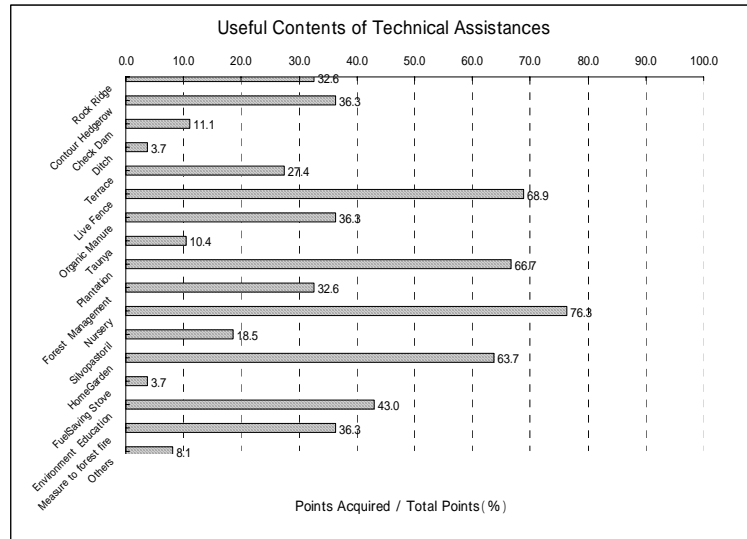
1) Changes on Technical Capability

Indicator	Observation
Past experience of activities	<p><u>Communities without experience (Palermo, Urroces)</u> Thanks to the detailed training by the technical team, it can be said that the participants have acquired basic skills of forestry management and soil conservation. However, all the participants are unsure how to put the skills into practice without the support of experts (Palermo).</p> <p><u>Communities with some experience which has not been applied (Los Tololos, Versalle-Apastepe, El Pajarito-Las Brisas, El Cacao, El Charco, Las Mercedes)</u></p> <ul style="list-style-type: none"> • As a result of OJT, including the alternative use of necessary materials and raising of the awareness of the importance of forestry resources, awareness of the necessity for activities has been raised and some stagnant activities have been revived. (Apart from Versalle – Apastepe. Only a few participants in El Charco) • Misunderstood techniques regarding the use of stakes, soil conservation work and planting holes have been corrected through OJT. • Exchanges of opinions and experiences inside/outside community have encouraged the active participation of participants. <p><u>Communities with some experience, some of which has been applied (La Sandino)</u></p> <ul style="list-style-type: none"> • Thanks to the experience of nursery management, nursing was conducted with a minimum of training (La Sandino).
Ability to apply techniques/ skills	<p>Before starting the P/S, most of the participants lacked the ability to apply the techniques learned during training apart from a few innovative farmers. As a result of a series of activities, the level of knowledge and capability to apply techniques have improved as described below.</p> <ul style="list-style-type: none"> - Regarding nursery practices, around 80% of participants say that they can manage by themselves without any assistance (results of final monitoring survey). - It appears that basic knowledge and skills have been acquired by the participants. However, most of them believe that it may not be possible for them to cope with problems without assistance and 100% of the respondents of the final monitoring survey requested continuous support. - The understanding of production cycle techniques is not good enough to put the learned techniques into practice.
Ability to implement activities in a planned manner	<p>Before starting the P/S, the most of the participants lacked the experience to conduct planning and monitoring except for a few innovative farmers. As a result of a series of activities, the capacity to implement the planned activities has reached the level described below.</p> <ul style="list-style-type: none"> - The concept of the activity cycle (plan- implementation – monitoring – evaluation) has been understood through practice. - Only a few innovative farmers among the participants know their resources and prepare a future plan. For example, the plan scale is too large compared to the possible labour force or too ambitious, not reflecting the technical capability in place (Palermo). - There are many participants who could not estimate the necessary work volume, particularly in the case of the transport of nursery stock. Moreover, they failed to come up with ideas to reduce the work volume. - Monitoring and recording were conducted using the form prepared by the technical team. This method did not suit the participants as many of them had difficulties due to illiteracy (common to all communities).

2) Favoured Method of Technical Guidance and Its Contents

According to the results of the final monitoring survey, more than 90% of the respondents point out that “the acquisition of new techniques” is the best aspect of participation in the P/S.

The most useful techniques learned are as follows. The required techniques differ depending on the characteristics of the community. Around 76% of the participants feel that they have acquired nursery management skills, which could be fundamental technique for forestry-related activities. This could be viewed as a sign for the continuation of the activity. Live fencing appears to be the easiest and most effective way to plant trees as planting can be conducted regardless of the land conditions and size.



While the participants believe that they are more or less confident of having acquired the required knowledge and skills, all of the participants hope to receive continuous training as they think that their technical expertise is still inadequate. The main subjects for further learning are (1) extermination of harmful insects, (2) forestry management and plantation techniques, (3) home gardens, (4) construction of improved stoves and (5) fruit tree grafting techniques. Based on these requests, it is analysed that the participants have a stronger interest in those activities through which they can obtain benefits in a short period and these activities may continue to motivate the participants to continue forestry-related activities. The contents of the necessary training differ from one community to another as the techniques acquired in each community vary. Technical guidance should, therefore, be provided taking the experience and needs of the participants into consideration and should not be uniformly provided.

(2) Organization Capability

1) Changes of Organization Capability

Indicator	Observation
Organization according to need	<p><u>General</u></p> <ul style="list-style-type: none"> For the implementation of the P/S, an implementation body was organized in each community, comprising a coordinator, leaders and their assistants of each activity group. This body functioned as a liaisoning body with the technical team in half of the communities. Follow-up support is necessary to make the body function as a forest committee of the community. <p><u>Communities without existing organization (Palermo, Urroces)</u></p> <ul style="list-style-type: none"> In Palermo, a community committee existed in name only prior to the P/S. In the process of activities, the efficiency of cooperative work was recognized and a sense of solidarity developed. As a result, a forest fire prevention campaign was conducted, for example, with the cooperation of community people. The committee can be expected to act as the central body to ensure the continuation of activities. Neighbourhood groups were formed in accordance with area, making the activities smooth. In Urroces, the function of the community committee is still weak. As the individualism-oriented style is suitable for the local culture, positive results were achieved with the implementation of the P/S activities in a manner respecting the local culture. <p><u>Communities with little functioning of community committee (Los Tololos, Versalle –Apastepe, El Pajarito-Las Brisas, El Charco)</u></p> <ul style="list-style-type: none"> In Los Tololos, many external support schemes are in progress. In the first year, these schemes were not well harmonized, affecting the progress of the P/S. However, adjustments including all activities in the community were made after the interim evaluation and multiplication effects were achieved. In the communities where housing areas are scattered, the participation rate was generally low. Considering this, activities were implemented by dividing the community into dwelling areas and the problem of participation was mitigated (Los Tololos, Urroces, Palermo). However, in El Pajarito which had the same problem, active participation was not observed due to the lack of communication among villagers. <p><u>Communities with active committee since before (La Sandino, El Cacao, Las Mercedes)</u></p> <ul style="list-style-type: none"> The community committee members and implementation body members overlap in La Sandino, El Cacao and Las Mercedes. Due to this reason, the participation rate for the series of meetings and training was quite high and even voluntary meetings were held. The sustainability of activities can, therefore, be expected in these communities.
Existence of leading persons	<ul style="list-style-type: none"> Progress of the activities and idea results can be achieved depending on the presence of leaders and people's trust in them. <ul style="list-style-type: none"> Communities with the presence of leaders: Palermo, El Cacao, Las Mercedes, La Sandino Communities without leaders: Versalle-Apastepe, Urroces. However in the case of Urroces, negative effects on such absence on activities were not found due to the flexibility of the activities to respect individualism. In communities where the members of the community committee and implementation body are the same or those which have frequent communication, a forest fire prevention campaign and environmental education were activity conducted. On the other hand, in communities which did not secure the cooperation of the community committee, all activities were generally not active. <ul style="list-style-type: none"> Communities with active cooperation: Palermo, Los Tololos, Las Mercedes, El Cacao, La Sandino Communities without active cooperation: El Charco, Versalle-Apastepe There are communities with a co-called "promoter" nominated by other projects (Los Tololos, El Pajarito-Las Brisas, El Charco, Las Mercedes). However, none of them functioned after the completion of the assistance. During the P/S, it was attempted to find potential promoters and to request their cooperation. However, it was found that extension work by a promoter without incentives was not feasible and that the activities would be limited to providing advice when requested (Palermo, Las Brisas, El Cacao, El Charco).

2) Individual Work and Joint Work

In the target area, the entire land is owned by individuals and individualism is quite strong. Considering this, the proposed activities are assumed to be individually implemented while joint work will be conducted for nursery management to ensure better efficiency and to compensate for the disadvantageous conditions of certain communities. Regarding the forest fire prevention campaign and environmental education, it is assumed that these were conducted at the community level with the participation of all community members. These assumptions were found to be appropriate under the P/S. As described next, the experience of nursery management shows that it is easier for people to work individually once they have acquired the necessary techniques because of the local cultural tradition of individualism as well as convenience.

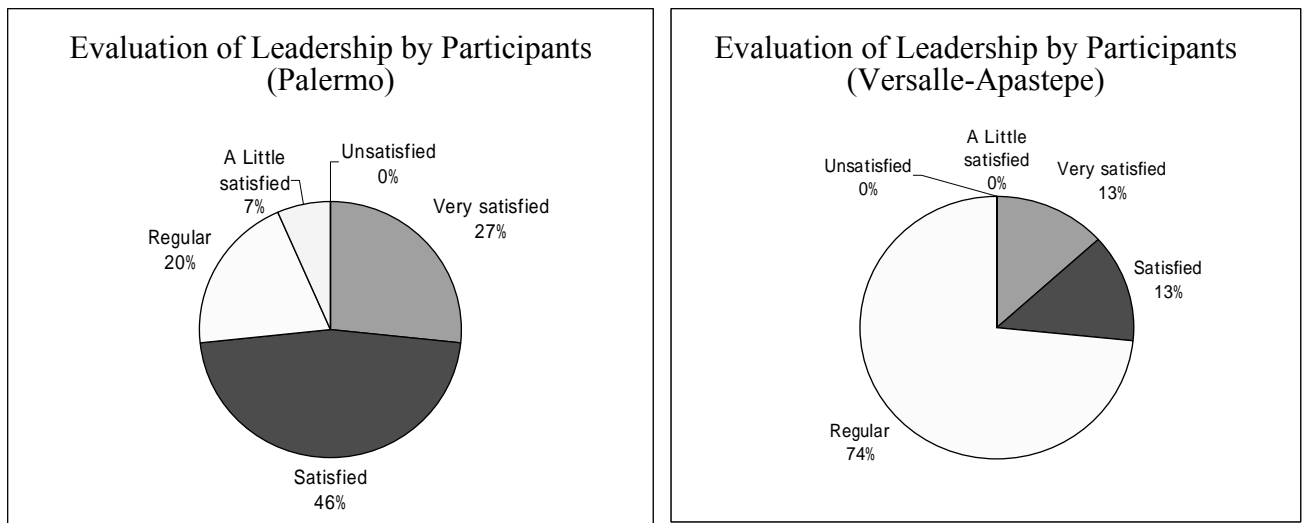
Observation of the nursery management activities found that all communities would prefer individual management regardless of their experience, ranging from such communities with strong individualism as Urroces, El Pajarito-Las Brisas and Mercedes to those with a strong sense of solidarity, such as Palermo and Los Tololos. Most of the participants say that they will continue seedling production individually from now on. The reasons for the preference or non-preference are listed below.

Reasons for Preferring Joint Work		Reasons for Not Preferring Joint Work	
1	Reduction of the work burden	1	Easy to work individually
2	Effective exchange of knowledge and skills	2	Long distance to the communal nursery and complicated nature of joint work
3	Efficiency of the work	3	Fear of an unfair amount of work and distribution of the benefits
4	Access to tools and water sources	4	Long distance to plantation area
5	Sense of assurance	5	Knowledge and skills already learned

In La Sandino, people will continue the communal nursery basically because they have confidence in this method after three years of experience, apart from those who believe that they have acquired enough skills and prefer to work individually. In El Charco, people also plan to work communally because of the limited water sources. In short, the percentage of people preferring a communal nursery has decreased from 64% to 22% in the P/S period while that of people preferring an individual nursery has increased from 36% to 78%.

3) Impacts of Organization Capability on Activities

Here, the impacts of the organization capability on the effectiveness of activities are discussed, comparing the case of Palermo where the leadership ability is highly evaluated with the case of Versalle-Apastepe where the leadership ability evaluation result is low. The results of the evaluation by community people of the leadership of the P/S implementation body in these two communities are: around 73% of the participants in Palermo believe that the leadership was sufficient while only 26% of the participants in Versalle-Apastepe gave the leadership a good evaluation.



No remarkable differences are observed in the outcomes of the planting or soil conservation activities as most of these activities were implemented at individual farmland. However, differences can be observed in the participation rate in communal activities: 73% of the community participated in the P/S activities in Palermo in contrast to 36% in Versalle-Apastepe (data as of October, 2003). Such a participation rate is in proportion to the strength of the leadership.

A difference is also observed in terms of the communal nursery. In Palermo, more nursery stocks than originally planned were produced with active cooperation among the participants. In contrast, only half of the stocks survived in the nursery in Versalle due to the failure of rotative management.

Meanwhile, the degree of satisfaction among the participants regarding environmental education and forest fire prevention (fire extinguishing activities), both of which are themes to be dealt with by all participants or the entire community, shows a difference between the two communities. In Palermo, 80% of the participants are very satisfied with these activities and 20% are satisfied. In comparison, only 20% are very satisfied, 73% are satisfied and 7% are a

little satisfied in Versalle-Apastepe. These results indicate that the extent of communal solidarity affects the degree of satisfaction among the participants.

Environment education and forest fire prevention should be conducted not only by interested people but by all people in the community. Therefore, the capability to organize these activities is important for their success.

Other types of activities to be conducted at individual farmland do not have to be jointly conducted as there is no direct link between the organization capability and outcomes of these activities. A “loose organization” may be appropriate in the form of group training to ensure the efficiency of technical guidance or the collective exchange of skills and opinions for the purpose of solving technical problems or facilitating the work.

(3) Resources Procurement Capability

1) Changes of Resources Procurement Capability

Indicator	Observation
Ability to utilize resources in the community	<ul style="list-style-type: none"> • The general tendency observed is dependency on external support. In the P/S, while guidance was provided to encourage self-reliance, it was not easy to change the custom in those communities with several experiences of external support, particularly of food for work (Versalle-Apastepe, El Pajarito-Las Brisas, El Charco, etc.) • There is not enough knowledge or capability of using internal resources as alternatives for necessary materials and tools. • Most of the participants cannot afford to invest in forestry-related activities as all of the targeted communities face a food shortage problem. Home gardens were promoted in the P/S and enjoyed a good reputation among the participants. Most of the products, however, are for self-consumption and those participants who are able to sell them for extra income is limited to 10% (final monitoring survey results). • There was a labour shortage problem during the off-season as many residents temporary leave the community for waged labour. However, the result of the family followed up the activities. In communities with many people (especially young people) working outside the community throughout the year, such as El Charco, Los Tololos, Las Mercedes, the labour shortage negatively affected the progress of the forest-related activities.
Ability to utilize resources outside the community	<ul style="list-style-type: none"> • The intention to utilize external resources, such as government agencies and NGOs, is quite high. A peculiar case was observed in El Pajarito: the people reported the result of a rock ridge to the WFP and received food as a reward for their contribution to forest and soil conservation. • Meanwhile, there is a general tendency to wait for an approach by an external agency. Local residents lack the experience of conducting voluntary activities to solve a problem or requesting external support for a plan which they have prepared themselves. Moreover, both the means of acquiring the necessary information and knowledge of the types of information required are insufficient. • There are some communities which have experience of applying for assistance to the municipal authority, mainly for the improvement of such infrastructure are the construction of a health centre, rounds by doctors, water supply system, road rehabilitation and electrification. However, most have not materialized. During the P/S, a doctor visited La Sandino and electrification was achieved in El Charco.

2) Emergence of Sense of Self-Reliance

The participants feel the following differences as a result of the P/S. A majority of people feel that they have acquired new techniques and skills, particularly regarding tree planting, forest improvement, farmland improvement and livelihood improvement, coinciding with the objectives of the P/S. Other perceived changes, including good work by themselves, enhanced solidarity of the community and growing personal confidence, could be interpreted as a changing awareness on the part of the participants with positive implications for the sustainability of activities.

	Changes in Daily Life as a Result of the P/S	Palermo	Los Tololos	Uroces	Versa-Apast	El cacao	La Sandino	Pajar-Brisa	Las Mercedes	El Charco	Total
1	Acquisition of new knowledge and techniques	7	8	2	5	8	2	5	6	6	49
2	More knowledge of tree planting and forest improvement	1	1	4	0	3	8	1	0	0	18
3	Improvement of farmland	0	1	1	4	3	4	0	3	2	18
4	Increased work volume/worked hard	0	0	7	2	2	0	0	0	1	12
5	Livelihood improvement	0	1	5	3	0	0	0	0	2	11
6	Improvement of diet	0	0	0	4	0	4	0	3	0	11
7	Enhanced solidarity of the community	1	3	0	0	1	0	0	1	2	8
8	Increased sense of responsibility among individual participants	0	0	3	0	3	0	2	0	0	8
9	Acquisition of property	1	0	0	1	0	0	0	2	1	5
10	Improvement of farm	1	1	0	0	0	0	1	1	1	5
11	Possession of home garden and fruit trees	0	1	0	1	0	3	0	0	0	5
12	Growing confidence	0	0	0	0	1	0	1	2	1	5
13	No more slash & burn farming/no more burning in fields	0	0	0	0	0	2	2	0	0	4
14	Clarification of land boundaries	1	1	0	0	0	0	0	0	1	3
15	Growing of trees with affection	0	0	0	0	0	2	1	0	0	3
16	Obtaining of tools and materials which were absent before	0	0	0	0	0	0	3	0	0	3
17	Improved awareness of environmental conservation	0	0	0	0	0	0	0	0	3	3

*Source: Final Monitoring Survey. The number shows the points acquired multiply.

At the final monitoring survey stage, the strong tendency towards dependency on external support was still observed and is believed to be the main cause of the stagnation of activities. However, the fact that the participants are now aware of their newly acquired knowledge and skills, their hard work and increased sense of responsibility as major changes appear to suggest the emergence of a sense of self-reliance to continue activities without external support using their own resources.

Technical assistance which can strengthen the potential for self-reliance, including livelihood improvement, may still be necessary in the coming years together with an external approach which will not spoil the newly emerging sense of self-reliance.

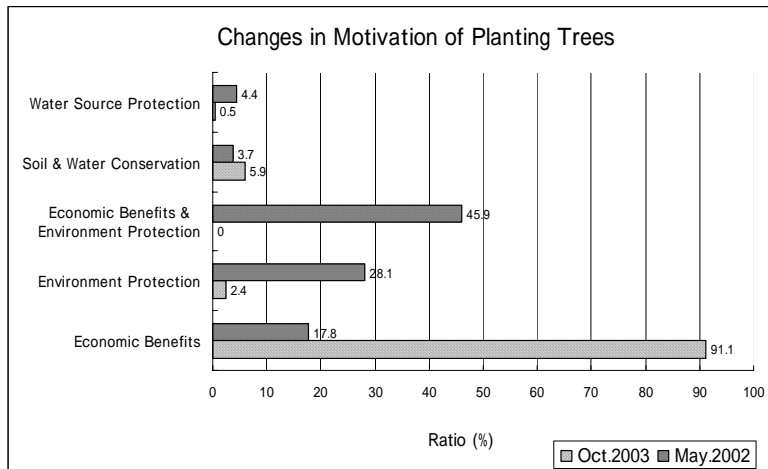
(4) Willingness to Initiate Activities

1) Changes of Willingness to Initiate Activities

Indicator	Observation
Marketability of forest products	<ul style="list-style-type: none"> • Most of the communities, apart from Urroces, do not have the potential to sell forest products. • In Urroces, people have realized that forest products (timber and firewood) can act as alternative cash crops and actively planted eucalyptus. There are communities which have started to create firewood forests in the hope of the future marketing of firewood (Palermo, La Sandino, Apastepe). • There are communities which have realized the profitability of coffee production and the sale of fruit (Los Tololos, El Pajarito, El Cacao, Urroces, Versalle-Apastepe). Some examples have been observed of surplus products (especially vegetables) being sold inside/outside the community by individual growers.
Understanding of the benefits of activities	<ul style="list-style-type: none"> • It was clearly understood that people can enjoy economic benefits from such activities as reforestation for firewood, planting of fruit trees and the taungya system as they saw quick earnings from these activities. In contrast, soil conservation activities of which the direct effects could not be seen in the short-term despite the heavy work were not easily accepted and little progress was made. • Study tours were effective to enhance people's interest as they could confirm the results of activities with their own eyes and exchange experiences. Activities observed during such tours were then spread afterwards (Palermo, Urroces, Los Tololos, La Sandino, El Cacao). • The necessity for orderly burning in the field is generally recognized. It is said that most people introduce firebreaks and notify their neighbours of their intention to conduct burning. Simultaneously, the negative impacts of burning on the yield is newly recognized. • Rules on forest fire prevention were prepared in most communities. This may be a sign of a change of awareness of the people. The remarkable effects of these rules were confirmed in La Sandino, Palermo, El Cacao and Las Mercedes.
Sense of purpose	<ul style="list-style-type: none"> • The total number of participants of the P/S in all target communities changed from 284 (F101,M183) at the beginning to 236(F71,M165)in Oct., 2003. The main reasons for withdrawal was differences between the purpose of participation and the type of support provided. The number of withdrawals citing the lack of material assistance was particularly large in Los Tololos and El Charco. • In the case of Versalle-Apastepe, El Charco and El Pajarito-Las Brisas, many participants remain members in expectation of certain material assistance in the future. However, they are not currently active. Little progress is observed when people have only an expectation of material assistance. • Active participants have their own clear purposes. Activities with a clear purpose, such as livelihood improvement and the improvement of agricultural production, appear to quickly move forward compared to activities with a vague purpose, such as protection of the environment.
Leeway in daily life	<ul style="list-style-type: none"> • Such basic human needs as food, water and sanitation are not met in the target communities. Under these circumstances, it is difficult for the residents to think about long-term issues. • The direct impacts on livelihood improvement of the introduction of agroforestry and fruit trees have not yet appeared although several positive impacts are observed in the case of home gardens and crop diversification. For example, around 10% of the participants earned 100 – 7,500 C\$ through the sale of surplus products. Other positive changes are also observed, i.e. enrichment of the diet and reduction of expenses. • Many improved stoves were constructed in Palermo and the effects were confirmed. The firewood consumption volume was reduced by 30 – 50% and the cooking time was also reduced by 30 – 50%. The decrease of the cooking time may have created extra time to contribute to other forest-related activities.

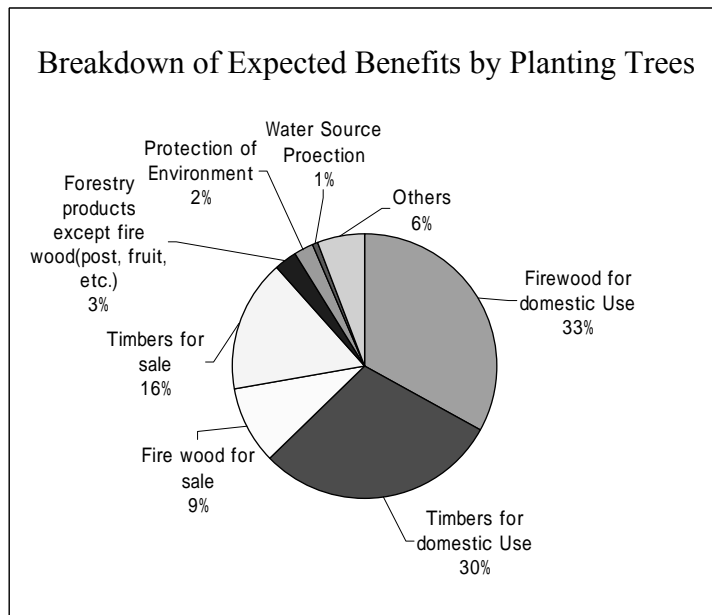
2) Changes of Awareness of the Necessity for Soil Conservation and Reforestation

At the beginning, more participants believed “economic benefits” and “conservation of the



environment” to be the purposes of reforestation. However, at the end of the study, more importance was placed on “economic benefits”. This change shows that the participants began to have a specific motivation for activities, such as the ownership of trees, instead of participating for a vague

purpose. At the same time, the ratio of people whose motivation for planting was soil and water conservation slightly increased. It can be interpreted that awareness of the importance of soil conservation by planting trees was also recognized.



The figure on the left shows the benefits which people associate with the planting of trees. As they lack experience of selling forest resources apart from firewood, they have greater expectations for domestic use rather than earning money through their sale. However, approximately 30% of the participants expect to sell products in the future. Considering this expectation, the provision of guidance on the marketing potential of forest

products and the creation of added value is recommended.

Meanwhile, 86.7% of the participants say that the best aspect of participating in soil conservation activities is “the improvement of soil in the field” although the effects in terms of the yield and disaster prevention are not yet visible. The appropriate type of soil conservation work depends on the characteristics of each community. In El Cacao, Las Mercedes and El Charco, 60 – 87% of the participants say that they intend to continue to build

rock ridges. Around 80% of the entire participants point out that they are willing to conduct to plant more contour hedgerows. These figures suggest that the effects of and necessity for soil conservation work are recognized.

The ratio of people who burn to dispose of crop waste and for land preparation dropped from 72% (May, 2002) to 3% (October, 2003). Around 65% of people now return the crop waste to the soil or utilize it as animal feed. This change shows the positive outcome of the activity.

3) Effects of Home Garden

The participants feel the following changes with the introduction of home gardens which aim at improving the livelihood and living environment.

	Changes With Introduction of Home Gardens	Point
1	Diversification of diet	92
2	Decrease of expenditure for vegetables and fruit	74
3	Acquisition of the skills to grow vegetables	69
4	Confirmation of the growth of fruit trees despite the harvest being some time aware	34
5	Sale of surplus products	13

*Source: Final Monitoring Survey (Oct., 2003). Questionnaire with 121 participants.

In the communities apart from Palermo, Los Tololos and Urroces, vegetables have been introduced as well as fruit trees. People can, therefore, already benefit from them. The diet in the area mainly consists of kidney beans, tortillas and coajada (cheese) and vegetables are consumed less often. In this context, the participants recognize that diversification of the diet is the biggest change of the introduction of home gardens.

The expenditure for vegetables has been reduced and around 10% of the participants now sell some of the products. Earnings vary from 100 to 7,500 C\$ depending on individual farmers. On average, sales contribute to increased income by less than 1,000 C\$. Based on the experience of a home garden in the first season of the P/S, one farmer increased his income in the second season from 700 to 3,000 C\$ by changing the products from kidney beans to green peppers in a field of 1.5 Mz. Similarly, farmers who have achieved a remarkable income increase appear to have introduced crop diversification. This livelihood improvement effect is quite high considering the average annual income of 7,500 to 19,000C\$²⁶⁾ in the target area.

26) Source: Baseline Survey, May. 2002

Moreover, around 97% of participants are said to have secured seeds for next season. It can be said, therefore, that the participants are now motivated to continue the activity having seen the results.

In Versalle-Apastepe, the number of farmers selling their products is particularly large (around 90% of the participants of the final monitoring survey). Its close location to the market may well be the reason for the active marketing of products.

Among the communities which planted grafted fruit trees, some were already harvesting lemons and other fruit in the second season, stimulating anticipation of a greater among the participants.

(5) Willingness to Continue Activities

According to the results of the final monitoring survey, all of the participants say that they are basically willing to continue the work. Around 90% say that they are confident of continuing the work by themselves while the remainder think that this may be difficult due to (1) lack of tools and capital, (2) shortage of labour and (3) lack of land. The respondents who are rather pessimistic, citing a lack of tools and capital, are only found in Las Mercedes and El Charco. This may indicate that the issue of tools is more crucial in those communities which require heavier work, such as the construction of rock ridges.

In all, the willingness to continue activities appears to be quite high given the facts that 90% of the participants have confidence to continue the work by themselves and that concrete activity plans for the following season were prepared in the final evaluation workshop.

(6) Others

1) Participation

It is generally observed that those participants who found a clear purpose and motivation to participate in the work continued the activities while others left due to different interest and lack of land, etc. Another observation is that there was more active participation in El Cacao, La Sandino and Palermo where the average income is lower than other places. Particularly in the case of Palermo, it is inferred that the assistance from outside encouraged people to participate as this community has previously received hardly any external assistance.

There are differences in the degree of participation depending on the guidance theme and contents and the meaning of “active participation” differs depending on the person. The conditions which people recognize as active participation are (1) active participation in

meetings, (2) active participation in joint work and (3) execution of an activity as planned. As forest fire prevention measures, environmental education and some nursery activities are individually conducted, condition (3) can be understood as a sense of satisfaction of the accomplishment of work planned by oneself.

Meanwhile, according to the evaluation by leaders of the implementation body of the participation of local people, around 80% of the leaders believe that they had sufficient participation in general, apart from Versalle-Apastepe, El Charco and El Pajarito-Las Brisas where the ratio of leaders making a positive evaluation is less than 50%.

2) Degree of Satisfaction and Difficulties in Activities

According to the results of final monitoring survey, around 90% of the respondents are satisfied with the results of their own activities.

The positive aspects pointed out are: (1) acquisition of new techniques, (2) improvement of soil conditions, (3) recognition of the importance of and necessity for forestation and (4) vitalization of the community. These aspects for a consistent flow from the acquisition of knowledge and techniques to the improvement of farmland, meaning that the satisfaction of the participants is compatible with the objectives of the M/P.

On the other hand, the following difficulties regarding the implementation of activities are pointed out by the respondents.

	Difficulties in Implementation of Activities	Points
1	Time constraints	70
2	Adjustment with other daily work	53
3	Too heavy a work volume	35
4	Shortage of labour	35
5	Lack of tools	24
6	Communication among participants	6
7	Heavy work	4
8	Participation in a series of meetings and joint work	3
9	Difficult techniques	3

*Source: Results of final monitoring survey. Questionnaire with 121 participants. Multiple answers are permitted.

Difficulties No. 1 through No. 4 may be attributable to the large amount of work to be conducted in a limited time or inadequately planned work volumes without proper reference to the existing capacity. These difficulties were mitigated in the second season by revising the plans. An excessive burden makes it difficult for people to conduct continuous forest management activities. Therefore, appropriate work volumes should be carefully planned. A

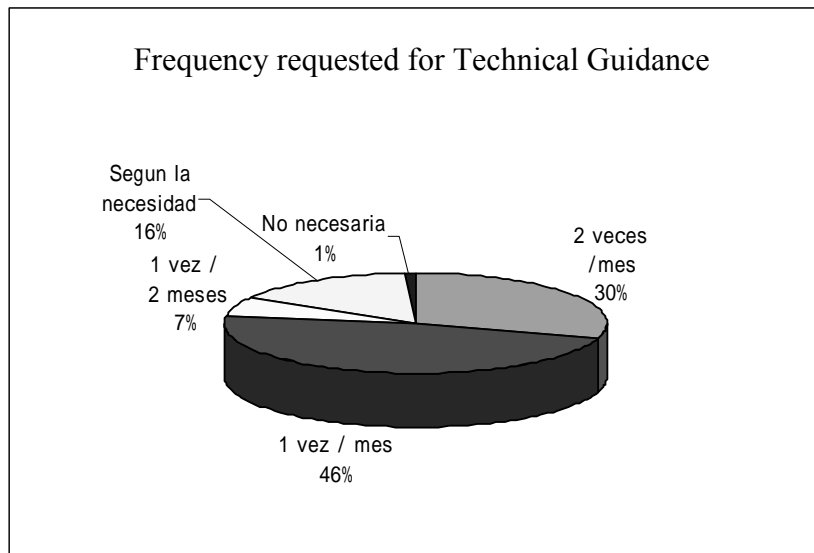
lack of tools is also pointed out as a constraint for activities. As the use of tools can improve the efficiency of activities, possibly solving difficulties No. 1 through No. 4, the provision of tools as part of external assistance is important.

The final monitoring survey included a survey on aspects of the assistance/activities under the P/S which failed to meet the expectations of the participants. This survey did not receive any response, presumably because the participants hesitated to make comments which could be interpreted as criticism of the external support.

(7) Necessary Follow Up

The most effective technical assistance mentioned by the participants is (1) individual guidance (63%), (2) group guidance (54%) and (3) visits to model farms (39%)²⁷⁾. While it is obvious that individual guidance is effective, the effective exchange of experiences and opinions between farmers and visual confirmation of positive outcomes can be ascertained by the fact that 40% of the participants believe that these activities are very useful.

The frequency of technical guidance as a follow up activity requested by the participants is shown in the figure below. A majority prefer to have technical guidance once a month. Judging from other preferences, such as “once every two months” or “not periodically but depending on the need”, the continual provision of detailed assistance for those communities which now have the foundations to continue by themselves is unnecessary. Updating of the techniques and the provision of information will be effective for this type of community. In general, periodic visits to communities, even at a low frequency, will be helpful for the people.



²⁷⁾ It shows the data points acquired / total points.

2.3 Lessons Learned

Many projects similar to the present Study have been and are being implemented in the Study Area (Table 2-3-1). The knowledge obtained from these projects and the lessons learned through the experience of the P/S are described in this section.

Table 2-3-1 Outline of Similar Projects

Project Title or Name of NGO	Implementation Body/ Nicaraguan Counterpart Organization	Implementation Period	Main Activities
POSAF	IDB /MARENA	1996 -	Nationwide project; promotion of the sustainable use of water and natural resources and environmental management, etc. in drainage basins in poor areas
Manual López	IBIS (Danish NGO)/ MINSA, MECD, El Sauce and UNAG, etc.	1990 – 1999	Implemented in the municipality of El Sauce; integrated rural development by means of education/training, organization and technology transfer
PROCHILEON	GTZ/IDR	1999 -	Implemented in 10 municipalities in the northern parts of the Chinandega and León Departments; improvement of the self-management capability of municipal authorities, natural resources management, environmental conservation and economic development, etc.
Pikín Gerrero	NORDA (Norway)/ Chichigalpa, Chinandega, MINSA and NGO, etc.	1988 - 1998	Implemented at the feet of Mt. Chonco, Mt. San Cristobal and Mt. Casita; diversification of products and sustainable natural resources management, etc.
Los Maribios	FAO/IDR	1990 – 1999	Implemented in the Los Maribios Mountain Range area; improvement of the living standard of farmers based on the sustainable and rational management of natural resources and the environment
FONDOSILVA	ASDI (Sweden)/IRENA	1988 – 1998	Implemented in the Chinandega and León Departments; subsidies for reforestation (timber and firewood) and forest operation and management
PROFOR	World Bank/MAGFOR	1999 -	Nationwide project; technical assistance for the private forest sector, assistance for the organizational reform of the forest sector, a pilot project and a project relating to project management
PRODISA	IBIS (Danish NGO)/ CODISA	1997 – 2001	Implemented in the municipality of Santa Rosa del Peñón; diversification of crops; environmental improvement; livelihood improvement; health and sanitation and organization of local residents, etc.
PROLEÑA	As left	1996 -	Project for the development and efficient use of firewood resources
UNAG	As left	1981 -	National union of small and medium size farmers and stock farmers; extension of agricultural and stock raising techniques and provision of micro-credit
INTA	As left	1993 -	Extension relating to agriculture, stock raising and agroforestry

(1) Needs of Local Residents and Forest/Environment Projects

In general, while forest/environment-related problems are recognised by local residents to a certain extent, the priority of dealing with these problems is relatively low because of their lack of urgency. The POSAF is trying to develop a situation in which local residents can participate in forest/environment-related activities with an assured mind by means of responding to the needs of local residents to solve problems which are not related to forests or the environment as much as possible within the scope of the menu provided by a project instead of ignoring such problems.

A proper response to those problems which are not forest/environment-related problems but must be solved as a matter of priority is a major challenge for the M/P. Therefore, the development of a situation in which local residents can participate in various activities is essential, taking possible coordination or mutual complementation with other projects into consideration.

(2) Provision of Incentives ²⁸⁾ and Project Sustainability

There are many examples in the Study Area of the labour provided by local residents for a project being rewarded with the provision of food as payment in kind through an agreement with the World Food Programme (WFP). These examples are not restricted to emergency aid or infrastructure development projects. The provision of food constitutes important assistance for the lives of local residents in view of the current situation of a food shortage. However, the fact that the strongest motivation for local residents to participate in a project is to obtain food has often led to the termination of their activities once a project is completed.

In consideration of the present situation of the Study Area, some types of incentives are assumed to be required to promote soil and water conservation activities. What is important is the careful examination of the nature of incentives designed to stimulate the self-reliance of local residents or a suitable approach. The provision of such incentives as part of the technical guidance may be a good idea.

Another important point is clear indication of what local residents and the project side are expected to do at the beginning of a project. Given the facts that the M/P assumes the continuation of activities by local residents on their own initiative and that forest management will not end on a set date, the injection of a large amount of financial support per local resident is undesirable.

28) In Nicaragua, an incentive generally means the provision of some kind of aid in the form of materials, equipment or food, etc. for the participants.

(3) Selection of Target Groups

It is said that the number of participants in the PROCHILEON Project drastically declined as soon as the project side explained what local residents could get free of charge. Meanwhile, this huge decline of prospective participants led to the selection of truly willing participants. In the case of the PROCASITAS Project, the number of participants was restricted from the beginning as its purpose was to increase employment opportunities for local residents as an emergency assistance measure.

In view of their character, it is more realistic for forest/environment-related projects to aim at gradually spreading the positive results of the voluntary activities of some residents to the entire community rather than forcing local residents who are not interested to participate.

The neighbourhood extension effect is weak if only a small number of residents of a community are engaged in an activity with special assistance. In contrast, working together gives everyone some assurance and makes it easier for everyone to participate. Group activities also have a better effects in terms of neighbourhood extension. Nevertheless, joint work should not be forced. Even though technical guidance and study meetings are likely to take the form of group activities, it may be easier for local residents to accept work which can be individually conducted.

(4) Viewpoints of the Community and Individual Residents

As most land in a community is private land, activities will be conducted on private land. Given the purposes of the M/P, however, it is essential to take the public character of such activities as forest fire prevention campaigns, creation of headwater forests on private land and the construction of erosion control facilities into consideration. The strength of unity among community residents, leadership of community leaders and strength of the motivation to participate are crucial factors to successfully proceed with joint work for these activities.

One lesson learned from the POSAF Project is that activities to benefit the public were not sufficiently conducted as the project was principally implemented on the basis of plans formulated by individual participants featuring individually-owned farmland despite this project being a watershed management project.

In view of such lessons learned, when planting at private land is required to conserve or create a headwater forest to benefit the public, the community committee must negotiate with the relevant landowner to determine how to work at the identified site, who should conduct the actual work and who the planted trees should belong to.

(5) Implementation System at the Resident Level

In some cases, two neighbouring communities were combined for the P/S. However, activities did not smoothly proceed in these cases because of the problem of travelling to meetings or training sessions and also because of the different situations of the communities. In view of the limited budget and limited support staff for the implementation of the M/P, it is desirable to make each community an implementation unit while not trying to increase the number of target communities at any cost.

A proper understanding of the project by community leaders is essential for the smooth implementation of any project. When a project is implemented by a group of volunteers without coordination with the community committee, the project contents are often not conveyed to non-participants. As the lack of such coordination could lead to misunderstandings, coordination with the community committee from the planning stage of the activity plan is necessary.

The Manual López Project conducted in El Sauce for a period of some 10 years is a successful example of organizing a community. Under this project, education and training to enable local residents to think for themselves and to solve problems have been provided by means of introducing literacy education and a self-enlightenment and education system for local residents. In the end, residents' organizations have been established at different levels, ranging from the community to the district and municipality, firmly establishing a system whereby local residents themselves formulate an implementable activity plan and are capable of conducting the necessary actions to request external assistance. This kind of comprehensive implementation system is essential to ensure the sustainability of activities and the development of a local area.

(6) Necessity for Reasonable Plan

Some local residents participating in the P/S came up with an ambitious plan to immediately improve their land taking the opportunity provided by the P/S. There was, however, concern that the resulting excessive work volume would be unsuitable for the intended sustainable forest management. When preparing a plan for an individual participant, appropriate guidance should be provided so that the participant can imagine a feasible work volume and work area, etc. in a concrete manner for the purpose of preparing a plan with an appropriate scale.

(7) Effective Study Tours and Direct Guidance in the Field

The most effective way of strengthening the incentive for local residents to participate in an activity is for local people to actually see "visible results". Accordingly, the transfer of

technologies/techniques through practice and study tours, etc. for all aspects of a project are more effective than the teaching of theories or discussions. There were many examples in the P/S of activities reflecting things which were learned during study tours.

(8) Technologies to be Used

One important ingredient for the sustainability of activities appears to be the employment of technologies which are not based on a unilateral judgement by technicians but which are examined and accepted by local residents themselves with the assistance of technicians. It is important for these technologies to have the following characteristics: (i) they are useful to solve the problems of farmers, (ii) they are unlikely to fail, (iii) the materials and equipment required can be locally procured, (iv) they can produce visible effects in a short period of time, (v) they have an economic benefit, (vi) they are marketable and (vii) they are easy to understand and apply. As the repetition of detailed guidance is essential for the accurate transfer of technologies, demonstration by technicians and trial by local residents are important in addition to verbal explanation.

(9) Sufficient Capability and Attitude of Technicians to Discover Problems

In the P/S, the abilities of the technicians were found to vary from one technician to another. Technicians providing direct technical guidance to local residents must have sufficient technical capability, experience and facilitation skills to motivate local residents. If individual technicians lack such skills, it is necessary for them to provide guidance as a team. As the targets of technical guidance, farmers often have more actual experience than technicians from urban areas even though they do not know new technologies or technical terms. This suggests the importance of the attitude of technicians of providing guidance while learning what local residents really need instead of adopting a posture that “local residents do not know anything”.

(10) Product Marketing Requiring Careful Planning

Most communities find access to markets for agricultural and forestry products difficult and, therefore, their opportunity to earn cash income is often limited. This makes any plan for the marketing of local products attractive to local residents whose expectations may be raised by such a plan. However, many problems are associated with the development of a new market. On the one hand, the quick development of a market, even if successful, is likely to be only temporary. On the other hand, failure to develop a market causes great disappointment on the part of the participants. Even though it is important to actively explore marketing opportunities, the careful study and examination of a marketing plan, including the project schedule, are essential for the formulation of a concrete marketing plan.

(11) Linkage with Teachers is Effective for Environmental Education

One major impact of the P/S was the establishment of linkage between environmental education activities and school education. Various materials were provided for schools through tie-ups with educators, leading to such activities as lectures for pupils, the greening of school premises and the creation and putting up of posters. The positive effects of these activities are evident as their impacts have been felt by adults as well as municipalities.

The key to successful environmental education appears to lie with the introduction of capable and highly motivated teachers to a project at an early stage. As the required inputs are relatively small, it is highly desirable for communities where a suitable teacher can be found to actively seek the implementation of environmental education activities.

(12) Relationship with Municipal Authority and Other Related Administrative Organizations

The activities of many projects adopt a direct approach to the targeted communities without any attempt to coordinate with the municipal authorities. On their part, municipal authorities cannot afford to treat forest administration as an independent administrative issue, partly because of their inability to assign a sufficient number of officials due to financial constraints. As municipal authorities cannot properly respond to projects, they do not have a full picture of the project implementation in each community under their jurisdiction.

In consideration of the public character and broad perspective of the M/P, strengthening of the organization of the INAFOR is essential to enable the formulation of suitable policies for reforestation and forest improvement. In addition, municipal authorities which are the closest administrative bodies to local residents must develop their organizational strength to act as the leading bodies for various activities. Moreover, strengthening of the cooperation system with the MARENA and other related organizations is essential to back up municipal authorities.

As the INAFOR and the MARENA used to be a single organization, some of their policies overlap. Despite this, there have been few occasions of their coordination for the implementation of similar policies or projects. It is important for the INAFOR and the MARENA to coordinate their work and to exchange opinions through the establishment of a cooperative relationship in order to improve their administrative efficiency and also to mutually complement their shortcomings.

(13) Support for Work to Authorise Community Rules

During the P/S, community rules on forest fire prevention were formulated under the forest fire prevention activities. While these rules incorporate provisions on coordination with

neighbouring communities and penal provisions for local residents in and outside the community, they must be authorised by such related organizations as the municipal authority, the Police, the INAFOR and the MARENA, etc. in order for them to become valid. In reality, the work to authorise these community rules takes a long time and some communities have been waiting for authorisation for more than a year.

It is clearly necessary to facilitate the work to authorise community rules in order to shorten the required authorisation period. The use of the municipal environment committee is judged to be appropriate for this purpose and it is hoped that the INAFOR will perform a leadership role in coordination with the municipal environment offices to facilitate the work to authorise community rules.

(14) Follow-Up System for Activities

The implementation of participatory monitoring and evaluation is important to ensure the continuation of project activities. The participation of local residents in the monitoring and evaluation processes will not only enable them to check the details of the activities conducted but will also strengthen their ownership of the activities. The evaluation of activities has not been conducted by many projects in the past because of their short implementation period of only several months. Forest/environment-related projects, however, involve activities which are implemented over a long period of time and it is important that these projects emphasise the monitoring and evaluation processes.

APPENDICES

APPENDICES

Appendix 1	List of the Team Members and Their Dispatch Periods.....	A-1
1.1	Field Monitoring Team.....	A-1
1.2	Full-Scale Study Team.....	A-2
1.3	Subcontractors in Nicaragua.....	A-5
Appendix 2	Study Schedule.....	A-6
Appendix 3	Initial Environmental Examination.....	A-7
Appendix 4	Area by Land Use and Forest Type.....	A-9
Appendix 5	Design Quantities.....	A-10
5.1	Table of Planned Forest Improvement Area.....	A-10
5.2	Table of Planned Project Volume.....	A-11
5.3	Table of Estimated Project Cost.....	A-13
5.4	Planned Number of Erosion Control Facilities.....	A-15
5.5	Unit Project Cost.....	A-16
5.5.1	Natural Forest Management.....	A-16
5.5.2	Reforestation.....	A-17
5.5.3	Agroforestry.....	A-18
5.5.4	Silvopastoral.....	A-22
5.5.5	Erosion Control Facilities.....	A-24
5.5.6	Livelihood Improvement.....	A-25
Appendix 6	Materials and Equipment Provided by the Pilot Study.....	A-28

APPENDIX 1 LIST OF THE TEAM MEMBERS AND THEIR DISPATCH PERIODS

1.1 Field Monitoring Team

< First Field Study >

Name	Area of Responsibility	Organization	Dispatch Period
Mikihiro Inoue	Overall Supervision	Forestry Agency	13/01/2001 - 21/01/2001
Kimiaki Jin	Work Supervision	JICA	09/01/2001 - 21/01/2001
Machiko Kamiya	Study Supervision	JICA	09/01/2001 - 21/01/2001

< Third Field Study >

Name	Area of Responsibility	Organization	Dispatch Period
Yukihide Katsuta	Overall Supervision	JICA	14/01/2002 - 24/01/2002
Takako Tamai	Study Supervision	JICA	14/01/2002 - 02/02/2002

< Fourth Field Study (II) >

Name	Area of Responsibility	Organization	Dispatch Period
Yasukuni Yanagihara	Overall Supervision	Former JICA Senior Adviser	03/11/2002 - 11/11/2002
Hiroaki Asaoka	Study Supervision	JICA	03/11/2002 - 11/11/2002

< Fourth Field Study (III) >

Name	Area of Responsibility	Organization	Dispatch Period
Masahiko Hori	Overall Supervision	Forestry Agency	16/02/2003 - 24/02/2003

< Fifth Field Study (Second Half) >

Name	Area of Responsibility	Organization	Dispatch Period
Hiroaki Asaoka	Study Supervision	JICA	05/11/2003 - 16/11/2003

< Sixth Field Study >

Name	Area of Responsibility	Organization	Dispatch Period
Toshio Ogawa	Leader	JICA	21/7/2004 - 30/7/2004
Kazuo Shiono	Forest Management	JICA	21/7/2004 - 30/7/2004

1.2 Full-Scale Study Team

< First Field Study >

Name	Area of Responsibility	Organization	Dispatch Period
Noriyuki Anyoji	Leader	JAFTA	09/01/2001 - 07/02/2001
Akinori Nishio	Reforestation/Forest Management Plan	JAFTA	09/01/2001 - 07/02/2001
Tsutomu Januma	Community Forestry	JAFTA	09/01/2001 - 07/02/2001
Sumio Ichikawa	Agroforestry/Work Arrangement	JAFTA	09/01/2001 - 07/02/2001
Hiroki Tohmiya	Land Use	JAFTA	09/01/2001 - 07/02/2001
Kouta Shimokawa	Vegetation	JAFTA	09/01/2001 - 07/02/2001
Izumi Okata	Rural Society	Sanyu Consultants	09/01/2001 - 07/02/2001
Atsushi Suzuki	Participatory Development and Extension	JAFTA	09/01/2001 - 05/02/2001
Masami Sugita	GIS	JAFTA (Kokusai Kogyo)	22/01/2001 - 05/02/2001
Rie Kembo	Interpreter	JDS	09/01/2001 - 07/02/2001

< Second Field Study (First Half) >

Name	Area of Responsibility	Organization	Dispatch Period
Noriyuki Anyoji	Leader	JAFTA	13/03/2001 - 16/04/2001
Akinori Nishio	Reforestation/Forest Management Plan	JAFTA	13/03/2001 - 21/05/2001
Tsutomu Januma	Community Forestry	JAFTA	13/03/2001 - 21/05/2001
Sumio Ichikawa	Agroforestry/Work Arrangement	JAFTA	13/03/2001 - 11/04/2001 12/04/2001 - 11/05/2001
Hiroki Tohmiya	Land Use	JAFTA	13/03/2001 - 11/05/2001
Kouta Shimokawa	Vegetation	JAFTA	13/03/2001 - 11/05/2001
Izumi Okata	Rural Society	Sanyu Consultants	13/03/2001 - 11/05/2001
Atsushi Suzuki	Participatory Development and Extension	JAFTA	13/03/2001 - 09/05/2001
Rie Kembo	Interpreter	JDS	13/03/2001 - 11/05/2001

< Second Field Study (Second Half) >

Name	Area of Responsibility	Organization	Dispatch Period
Noriyuki Anyoji	Leader	JAFTA	19/06/2001 - 03/07/2001 24/07/2001 - 01/09/2001
Akinori Nishio	Reforestation/Forest Management Plan	JAFTA	19/06/2001 - 01/09/2001
Tsutomu Januma	Community Forestry	JAFTA	19/06/2001 - 01/09/2001
Sumio Ichikawa	Agroforestry/Work Arrangement	JAFTA	29/06/2001 - 23/08/2001
Takashi Januma	Erosion Control/Watershed Management	JAFTA	29/06/2001 - 23/08/2001
Izumi Okata	Rural Society	Sanyu Consultants	19/06/2001 - 01/09/2001
Atsushi Suzuki	Participatory Development and Extension	JAFTA	19/06/2001 - 30/08/2001
Shohei Natsuda	Project Evaluation	Sanyu Consultants	08/07/2001 - 21/08/2001
Rie Kembo	Interpreter	JDS	19/06/2001 - 01/09/2001

< Third Field Study >

Name	Area of Responsibility	Organization	Dispatch Period
Noriyuki Anyoji	Leader	JAFTA	11/01/2001 - 15/03/2002
Akinori Nishio	Reforestation/Forest Management Plan	JAFTA	11/01/2002 - 15/03/2002
Tsutomu Januma	Community Forestry	JAFTA	11/01/2002 - 15/03/2002
Izumi Okata	Rural Society	Sanyu Consultants	11/01/2002 - 15/03/2002
Atsushi Suzuki	Participatory Development and Extension	JAFTA	11/01/2002 - 13/03/2002
Masami Sugita	GIS	JAFTA (Kokusai Kogyo)	27/01/2002 - 10/02/2002
Rie Kembo	Interpreter	JDS	11/01/2002 - 15/03/2002

< Fourth Field Study (I) >

Name	Area of Responsibility	Organization	Dispatch Period
Noriyuki Anyoji	Leader	JAFTA	20/05/2002 - 13/06/2002
Akinori Nishio	Reforestation/Forest Management Plan /Community Forestry	JAFTA	20/05/2002 - 13/07/2002
Atsushi Suzuki	Participatory Development and Extension	JAFTA	30/05/2002 - 11/07/2002

< Fourth Field Study (II) >

Name	Area of Responsibility	Organization	Dispatch Period
Noriyuki Anyoji	Leader	JAFTA	03/11/2002 - 06/12/2002
Akinori Nishio	Reforestation/ Forest Management Plan Community Forestry	JAFTA	16/10/2002 - 06/12/2002
Izumi Okata	Rural Society	Sanyu Consultants	29/10/2002 - 06/12/2002
Atsushi Suzuki	Participatory Development and Extension	JAFTA	16/10/2002 - 04/12/2002

< Fourth Field Study (III) >

Name	Area of Responsibility	Organization	Dispatch Period
Noriyuki Anyoji	Leader	JAFTA	14/02/2003 - 06/03/2003
Akinori Nishio	Reforestation/Forest Management Plan /Community Forestry	JAFTA	14/02/2003 - 24/03/2003
Atsushi Suzuki	Participatory Development and Extension	JAFTA	14/02/2003 - 22/03/2003

< Fifth Field Study (First Half) >

Name	Area of Responsibility	Organization	Dispatch Period
Noriyuki Anyoji	Leader	JAFTA	01/06/2003 - 30/06/2003
Akinori Nishio	Reforestation/Forest Management Plan /Community Forestry	JAFTA	01/06/2003 - 30/07/2003
Atsushi Suzuki	Participatory Development and Extension	JAFTA	01/06/2003 - 28/07/2003

< Fifth Field Study (Second Half) >

Name	Area of Responsibility	Organization	Dispatch Period
Noriyuki Anyoji	Leader	JAFTA	28/10/2003 - 06/12/2003
Akinori Nishio	Reforestation/Forest Management Plan /Community Forestry	JAFTA	04/10/2003 - 06/12/2003
Izumi Okata	Rural Society	Sanyu Consultants	28/10/2003 - 06/12/2003
Atsushi Suzuki	Participatory Development and Extension	JAFTA	04/10/2003 - 04/12/2003
Shohei Natsuda	Project Evaluation	Sanyu Consultants	30/10/2003 - 23/11/2003
Rie Kembo	Interpreter	JDS	07/11/2003 - 06/12/2003

< Sixth Field Study >

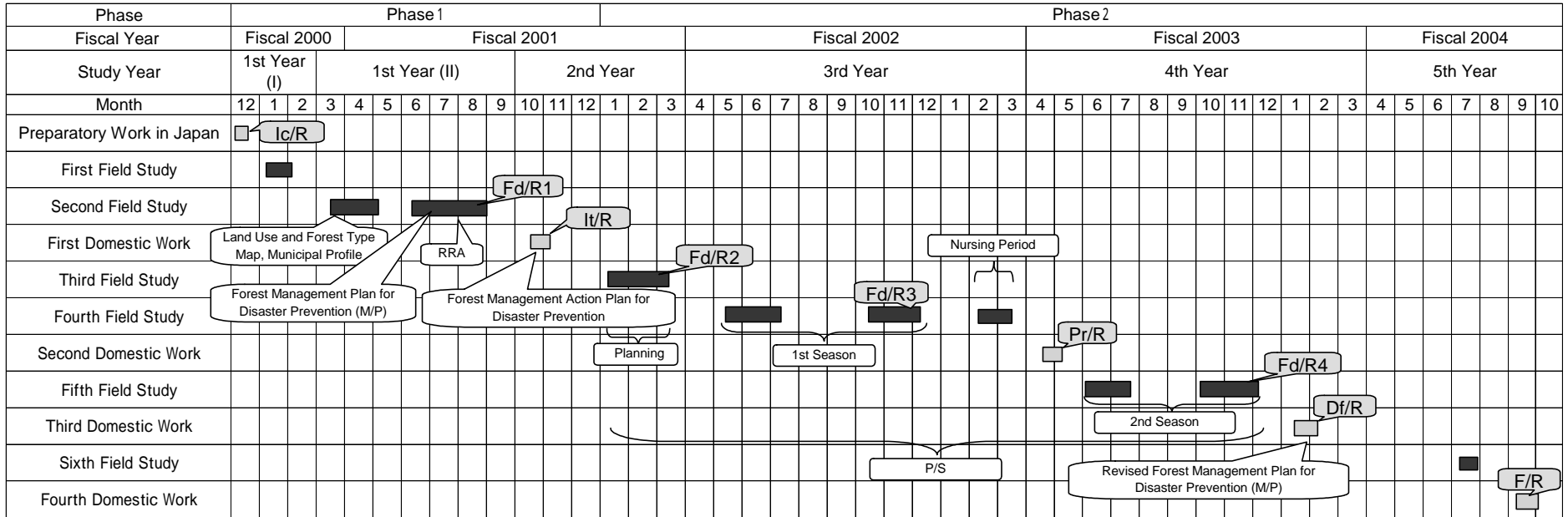
Name	Area of Responsibility	Organization	Dispatch Period
Noriyuki Anyoji	Leader	JAFTA	14/7/2004 - 30/7/2004
Akinori Nishio	Reforestation/Forest Management Plan	JAFTA	14/7/2004 - 30/7/2004
Atsushi Suzuki	Participatory Development and Extension	JAFTA	14/7/2004 - 28/7/2004
Rie Kembo	Interpreter	JDS	14/7/2004 - 30/7/2004

1.3 Subcontractors in Nicaragua

Name	Address/Telephone No.	Subcontracted Work	Timing of Implementation
CESADE	Estatua de Montoya 2c al Este, 1/2c al Sur, Casa No. 7, Colonia Pereira, Managua Tel: 0268-7249	Municipal Profile Study	Second Field Study (First Half)
APRODESA	Mansion Teodolinda 1c al Oeste, 1/2c al Norte, Managua Tel: 0266-7028	RRA	Second Field Study (Second Part)
FORESTAN	Colonial los Robles Costada sur de la Shell Plaza el Sol, 1c, al Sur, 1c Abajo, 200 m, al Sur, Managua Tel: 0278-8613	Planning of Pilot Study	Third Field Study
		First Season of P/S	Fourth Field Study (I - II)
ADESA	Colonia Nicorao J 574 de la Antique Farmacia Gonzales 3c, al sur 10varas Abajo, Managua Tel: 0248-4618	Nursing Period of Second Season of P/S	Fourth Field Study (III)
		Second Season of P/S	Fifth Field Study (First Half - Second Half)

APPENDIX 2 STUDY SCHEDULE

A-6



■ : Field Study Period
 ■ : Work in Japan
 Ic/R : Inception Report
 It/R : Interim Report
 Pr/R : P/S Progress Report
 Df/R : Draft Final Report
 F/R : Final Report

Fd/R1 ~ Fd/R4 : Field Report 1 - 4

APPENDIX 3 INITIAL ENVIRONMENTAL EXAMINATION

The Forest Management Plan for Disaster Prevention (M/P) to be formulated by the Study aims at preventing sediment disasters and mitigating floods by means of improving the soil and water conservation functions of forests while attempting to enhance the livelihood of local residents. While the Plan itself will lead to improvement of the environment, it may cause negative impacts, making the introduction of measures where necessary to avoid, lessen or improve such negative impacts.

There is no statutory requirement in Nicaragua to conduct an environmental impacts assessment regarding reforestation or agroforestry to be conducted by individual farming households or the construction of small-scale erosion control facilities, all of which are planned under the Study. Accordingly, the initial environmental assessment for the Study was conducted based on the Environmental Assessment Guidelines for Development Studies (Forestry) of the JICA.

As the following table shows, the assessment concluded that favourable impacts would occur with many environmental items and that no serious negative impacts would occur. However, in the case of the item of “land ownership”, problems may occur in connection with the implementation of reforestation, natural forest management and agroforestry and also with projects relating to land use because of the ambiguity of local land ownership. For this reason, the desirability and feasibility of the activities proposed under the M/P must be carefully judged, bearing in mind that problems of land ownership could arise at individual target sites.

As it is practically impossible to solve the problems relating to land ownership and land registration within the framework of the M/P, it is hoped that these problems will be solved as soon as possible by means of suitable actions by the relevant administrative organizations.

General Conclusions of the Initial Environmental Examination

Item	Assessed Grade	Likely Impacts	Reflection on the M/P
Change of lifestyle	P	The introduction of improved stoves will reduce the time required to collect firewood due to the reduction of firewood consumption and the smoke damage caused by cooking, producing such positive impacts as the creation of free time and improvement of health.	The wide use of improved stoves which are inexpensive and easy to make is planned.
Change of social structure due to organization	P	Such resident groups as reforestation groups and agroforestry groups will be created. These groups will function favourably in terms of the extension of new techniques and the improvement of existing techniques, producing positive impacts.	Grouping based on local residents involved in the same activities is planned. In addition, study tours to observe advanced examples are planned.
Land ownership	B	The implementation of reforestation, natural forest management and agroforestry and activities relating to land use may cause problems originating from land ownership.	The careful consideration of land ownership is required in the selection of the target sites for various activities to avoid problems.
Reform of existing systems/ customs	P	The change from traditional exploitative forest use to sustainable forest use with tending will produce positive impacts on forest resources.	Planting to produce firewood and posts, etc. and the improvement of natural forests will enhance forest resources. The promotion of forest restoration is also planned by means of restricting grazing in forests and preventing forest fires.
Impacts on rare animals and ecosystem	C & P	Positive impacts will occur due to the improved quality and quantity of vegetation by reforestation and natural forest management.	The planned planting species include local species in addition to exotic species.
Impacts on soil and land	C & P	Positive impacts will occur due to the improved soil and water conservation effects of reforestation, natural forest management, agroforestry and newly constructed erosion control facilities.	Judging from the current land use and sloping situation of the land, reforestation and suitable erosion control facilities are planned to reflect the desirable land use.
Impacts on hydrology, water quality and air quality	C & P	Positive impacts will occur due to the improved soil and water conservation effects of reforestation, natural forest improvement, agroforestry and newly constructed erosion control facilities.	As above
Sustainability of forest resources and functions	P	The change from traditional exploitative forest use to sustainable forest use with tending will produce positive impacts on forest resources.	The profitability of forest operation and management will be considered to facilitate the sustainable use of forest resources and the rearing of forests.

B : serious negative impacts may occur

C : no serious negative impacts will occur

P : positive impacts

APPENDIX 5 DESIGN QUANTITIES

5.1 Table of Planned Forest Improvement Area

Unit: ha

Zone	Category	Municipality																		Total
		Chinandega	P. Micozán	Wlanueva	D. Viejo	Chichigalpa	Posoltega	Achuapa	El Sauce	St.R. Perce	El Jicaral	Lameyraga	Telca	Quezaltenango	Leon	L.P. Centro	Naganda	San F.L.		
Steep Sloping	Natural Forest Improvement																			
	Enrichment	210	0	0	1,200	20	100	0	0	0	0	0	170	0	70	240	0	140	2,190	
	Restoration by Permanent Farming	40	0	0	0	0	20	0	0	0	0	0	120	0	40	0	0	40	260	
	Reforestation	20	0	0	0	0	10	0	0	0	0	0	60	0	30	0	0	20	130	
	Agroforestry	100	0	0	0	0	40	0	0	0	0	0	270	0	70	0	0	90	660	
	(Permanent Farming)	20	0	0	0	0	10	0	0	0	0	0	60	0	15	0	0	20	130	
	Silvopastoral	0	0	0	0	0	0	0	0	0	0	0	30	0	0	0	0	0	30	
Sub-Total	390	0	0	1,200	20	190	0	0	0	0	0	790	0	215	240	0	300	3,180		
Mixed Sloping	Natural Forest Improvement																			
	Enrichment	0	130	780	600	0	0	680	2,650	780	550	770	0	0	0	0	200	0	7,440	
	Restoration by Permanent Farming	0	190	960	140	0	0	900	1,320	360	100	50	0	0	0	0	60	0	4,680	
	Reforestation	0	80	580	75	0	0	440	650	180	50	0	0	0	0	0	0	40	2,620	
	Agroforestry	0	420	2,080	300	0	0	1,900	2,780	780	200	100	0	0	0	0	0	150	8,630	
	(Permanent Farming)	0	95	470	75	0	0	450	680	180	50	25	0	0	0	0	0	40	2,940	
	Silvopastoral	0	150	1,550	100	0	0	5,000	3,500	2,500	500	210	0	0	0	0	0	250	13,860	
Sub-Total	0	1,055	6,240	1,500	0	0	8,370	11,980	4,780	1,450	1,155	0	0	0	0	250	0	38,630		
Dense Sloping	Natural Forest Improvement																			
	Enrichment	240	0	0	310	10	70	0	0	0	0	70	110	0	0	460	0	1,410		
	Restoration by Permanent Farming	210	0	0	100	124	152	0	0	0	0	0	284	52	114	94	0	30	1,392	
	Reforestation	300	0	0	50	50	70	0	0	0	0	0	140	20	80	40	0	10	550	
	Agroforestry	440	0	0	210	260	320	0	0	0	0	0	600	110	240	200	0	60	2,440	
	(Permanent Farming)	105	0	0	50	60	70	0	0	0	0	0	140	20	57	47	0	15	580	
	Silvopastoral	60	0	0	70	30	90	0	0	0	0	0	30	300	30	60	200	0	300	1,660
Sub-Total	1,155	0	0	790	548	776	0	0	0	0	100	1,476	228	530	1,020	0	505	6,620		
Sloping Zone Total	Natural Forest Improvement																			
	Enrichment	450	130	780	2,330	30	170	680	2,650	780	550	840	280	0	70	690	200	290	11,000	
	Restoration by Permanent Farming	250	190	940	240	124	172	900	1,320	360	100	50	404	52	154	94	60	70	5,500	
	Reforestation	120	80	580	120	60	80	440	650	180	50	0	300	20	80	40	0	30	2,730	
	Agroforestry	540	420	2,080	510	260	360	1,900	2,780	780	200	100	870	110	310	200	160	140	11,630	
	(Permanent Farming)	125	95	470	120	60	80	450	680	180	50	25	307	20	72	47	40	35	2,750	
	Silvopastoral	60	150	1,550	170	30	90	5,000	3,500	2,500	500	240	280	20	60	200	250	300	15,000	
Sub-Total	1,545	1,055	6,240	3,490	648	898	8,370	11,980	4,780	1,450	1,255	2,241	228	748	1,270	650	665	48,800		
Flat	Reforestation	0	0	580	1,210	720	300	0	0	0	0	400	0	170	1,200	500	0	0	5,090	
	Sub-Total	0	0	580	1,210	720	300	0	0	0	0	400	0	170	1,200	500	0	0	5,090	
Grand Total	Natural Forest Improvement																			
	Enrichment	450	130	780	2,330	30	170	680	2,650	780	550	840	280	0	70	690	200	290	11,000	
	Restoration by Permanent Farming	250	190	940	240	124	172	900	1,320	360	100	50	404	52	154	94	60	70	5,500	
	Reforestation	120	80	1,080	1,320	780	380	440	680	180	50	400	200	180	1,280	540	40	30	2,730	
	Agroforestry	540	420	2,080	510	260	360	1,900	2,780	780	200	100	870	110	310	200	160	140	11,630	
	(Permanent Farming)	125	95	470	120	60	80	450	680	180	50	25	307	20	72	47	40	35	2,750	
	Silvopastoral	60	150	1,550	170	30	90	5,000	3,500	2,500	500	240	280	20	60	200	250	300	15,000	
Sub-Total	1,545	1,055	6,240	4,700	1,208	1,258	8,370	11,980	4,780	1,450	1,655	2,241	228	1,046	1,770	950	665	50,800		

(2) Total

Zone	Category	Municipality																		Total
		Chimandaga	P. Miosazan	Villavieja	El Viejo	Chichigalpa	PasoItza	Achuapa	El Sauce	St. R. Peron	El Jomal	Laminyaga	Telloa	Gozalguas	Leon	L.P. Centro	Nagaria	San F. L.		
Grand Total	Natural Forest Management(ha)	490	130	700	2,330	30	170	890	2,690	780	590	840	280	0	70	890	280	290	11,800	
	Forest Inventory/Formulation of Forest Management Plan	490	130	700	2,330	30	170	890	2,690	780	590	840	280	0	70	890	280	290	11,800	
	Enrichment	490	130	700	2,330	30	170	890	2,690	780	590	840	280	0	70	890	280	290	11,800	
	Introduction of Firebreaks	490	130	700	2,330	30	170	890	2,690	780	590	840	280	0	70	890	280	290	11,800	
	Reforestation (ha)	120	90	1,900	1,330	780	380	440	890	180	50	400	280	190	1,280	540	40	30	7,700	
	Soil Conservation	2,380	1,230	5,844	3,440	645	928	8,876	6,980	4,152	2,164	1,817	2,893	348	1,744	1,890	1,984	2,000	51,847	
	Agroforestry	725	645	4,820	800	382	538	7,350	6,940	3,443	758	305	1,387	198	442	447	580	475	28,358	
	Farmland (ha)	540	400	2,800	510	280	368	1,800	2,780	780	208	100	670	118	318	300	180	148	11,800	
	Permaculture Farming (ha)	125	95	470	120	82	88	450	680	180	58	25	287	28	72	47	40	35	2,750	
	Pasture (ha)	80	150	1,550	170	30	90	5,800	3,580	2,500	508	340	280	20	68	300	350	300	15,800	
	Erosion Control (number)	1,638	588	1,824	2,646	483	360	1,326	2,040	712	1,414	1,452	1,486	198	1,300	1,452	1,484	2,128	23,297	
	Livelihood Improvement																			
	Home Gardens (ha)	12	2	12	16	4	8	19	27	12	8	10	10	2	9	7	6	7	179	
	Improved Stoves (number)	130	20	126	180	40	88	190	370	130	96	100	130	20	96	70	60	78	1,750	
	Simple Irrigation (ha)	80	48	235	80	32	43	225	330	80	25	13	184	13	38	25	20	18	1,375	
Crop Diversification (ha)	110	88	488	180	50	78	380	585	180	48	20	175	28	68	80	30	38	2,318		

5.5 Unit Project Cost

5.5.1 Natural Forest Management

Type of Work	Unit Cost C\$ a	Quantity b	Unit c	Unit Project Cost C\$ d=ab	Facility Size/Calculation Basis
Forest Inventory/Formulation of Forest Management Plan (Per ha)	40.0	3.5	Person-day	140.0	Unit cost is based on the interview results.Examples of POSAF were referred for the quantity. 13.51C\$/US\$
				140.0	
				US\$10.0	
Enrichment (Per ha)	40.0	2.0	Person-day	80.0	Unit cost is based on the interview results.Examples of Programa de Desarrollo Forestal y Ambiental were referred to for the planting of 200 tree/ha and 100 tree/person-day. 13.51C\$/US\$
	1.0	200.0	tree	200.0	
				280.0	
				US\$21.0	
Introduction of Firebreak (Per ha)	40.0	24.36	Person-day	974.4	Unit cost is based on the interview results.Examples of Programa de Desarrollo Forestal y Ambiental were referred to for 1.16 person-days per 400m (perimeter of a plot of 100mx100m) (26 person-days for 18,000m ²) (1.16 person-days/yearx21 years=24.36 person-days). The width of firebreaks is 2m. 13.51C\$/US\$
				974.4	
				US\$72.0	

5.5.2 Reforestation

(/ha)

Paid by	Item	Unit Cost C\$ a	Quantity b	Unit c	Unit Project Cost		Calculation Basis
					C\$ d=ab	C\$/time d/time	
Local Residents	Nursing	1.0	1,332.0	seedling	1,332.0	1,332.0	Unit price is based on the marketing price by PROCASITA, number of planting 1,110seedlings+supplementary planting 20%
	Land preparation	40.0	16.3	person-day	652.0	652.0	Unit cost basen on interview rslt,Quantity:114.4person-hr÷7hr/day
	Planting	40.0	9.5	person-day	380.0	380.0	Unit cost is based on the interview results; quantity1,332seedlings÷140seedlings/person-day
	Fencing	40.0	18.0	person-day	720.0	720.0	Unit cost is based on the interview results; quantity 4.5person-day/100m×400m
	Weeding (5 times)	40.0	57.0	person-day	2,280.0	456.0	Unit cost is based oin; quantity 80 person-hr÷7hr/day×5 times
	Cutting (3 times)	40.0	21.0	person-day	840.0	280.0	Unit cost is based on the interview results; quantity1,110trees÷158 trees/person-day×3times
	Bucking (3 times)	40.0	42.3	person-day	1,692.0	564.0	Unit cost is based on the interview results; quantity1,110 trees÷79trees/person-day×3 times
	Chopping (3 times)	40.0	62.7	person-day	2,508.0	836.0	Unit cost is based on the interview results;quanatity 1,110trees÷53trees/person-day×3 times
	Bud pruning (twice)	40.0	22.8	person-day	912.0	456.0	Unit cost is based on the interview results; quantity 80person-hr÷7hr/day× twice
	Total				11,316.0		
Government	Seed	0.1	1,332.0	seeding equivalent	133.2	133.2	Unit cost is based on the interview results; number of planting 1,110seedlings+supplementary planting 20%
	Vinyl pot	0.1	1,332.0	piece	133.2	133.2	Unit cost is based on the interview results; number of planting 1,110seedlings+supplementary planting20%
	Wooden stake	1.9	200.0	piece	380.0	380.0	Stake of 10cm in diammeter and 2m in length at the unit cost of119C\$/m ³ is assumed; Fencing length of 400mand stake interval of 2m
	Barbed wire	4.6	120.0	10m	552.0	552.0	Unit cost is based on the interview results; Fencing length of 400m×3 lines
	Sub-total				1,198.4		
Total	(C\$)				12,514.4		13.51C\$/US\$
	(US\$)				926.3		

5.5.3 Agroforestry

(/ha)

Type of Work	Paid by	Item	Unit cost C\$ a	Quantity b	Unit c	Unit project cost		Calculation Basis	
						C\$ d=ab	C\$/time d/time		
Live Fence	Local Residents	Nursing	1.0	240.0	seedling	240.0	240.0	Unit cost is based on the sales price of PROCASITA; number of planting 200seedlings+supplementary planting 20%	
		Planting	40.0	1.7	person-day	68.0	68.0	Unit cost is based on the interview results; quantity 240seedlings÷140seedlings/person-day	
		Fencing	40.0	18.0	person-day	720.0	720.0	Unit cost is based on the interview results; quantity 4.5 person-day/100m×400m	
		Cutting (3 times)	40.0	3.9	person-day	156.0	52.0	Unit cost is based on the interview results; quantity 200 trees÷158 trees/person-day×3 times	
		Bucking (3 times)	40.0	7.5	person-day	300.0	100.0	Unit cost is based on the interview results; quantity 200trees÷79trees/person-day×3 times	
		Chopping (3 times)	40.0	11.4	person-day	456.0	152.0	Unit cost is based on the interview results; quantity 200 trees÷53 trees/person-day×3 times	
		Bud pruning (twice)	40.0	2.8	person-day	112.0	56.0	Unit cost is based on the interview results; quantity of planting plan: 11.4 person-day/time ÷1,670seedlings×200seedlings×twice	
		Total				1,332.0		Without fencing	
					2,052.0		With fencing		
		Government	Seeds	0.1	240.0	seedlings equivalent	24.0	24.0	Unit cost is based on the interview results; number of planting 200 seedlings+supplementary planting 20%
			Vinyl pots	0.1	240.0	pieces	24.0	24.0	Unit cost is based on the interview results; number of planting 200seedlings+supplementary planting 20%
			Wooden stakes	1.9	200.0	pieces	380.0	380.0	Unit cost:119C\$/m ³ ; use of posts of 10cm in diameter and 2m in length is assumed; fencing 400mwith 2m interval between posts
			Barbed wire	4.6	120.0	10m	552.0	552.0	Unit cost is based on the interview results; fencing 400m×3 lines
			Total				48.0	48.0	Without fencing
						980.0		With fencing	
		Total	(C\$)				1,380.0		13.51C\$/US\$
			(US\$)				102.1		Without fencing
	(C\$)					3,032.0		13.51C\$/US\$	
	(US\$)					224.4		With fencing	

Type of Work	Paid by	Item	Unit cost C\$ a	Quantity b	Unit c	Unit project cost		Calculation Basis
						C\$ d=ab	C\$/time d/time	
Alley Cropping	Local residents	Nursing	1.0	600.0	seedling	600.0	600.0	Unit cost is based on the sales price of PROCASITA; number of planting 500seedlings+supplementary planting20%
		Planting	40.0	4.3	person-day	172.0	172.0	Unit cost is based on the interview results; quantity 600seedlings÷140seedlings/person-day
		Cutting (3 times)	40.0	9.6	person-day	384.0	128.0	Unit cost is based on the interview results; quantity 500seedlings÷158 seedlings/person-day x 3 times
		Bucking (3 times)	40.0	18.9	person-day	756.0	252.0	Unit cost is based on the interview results; quantity 500seedlings÷79seedlings/person-day x 3 times
		Chopping (3 times)	40.0	28.2	person-day	1,128.0	376.0	Unit cost is based on the interview results; quantity 500seedlings÷53seedlings/person-day x 3 times
		Bud pruning (twice)	40.0	6.8	person-day	272.0	136.0	Unit cost is based on the interview results; quantity of planting plan: 11.4 person-day/time ÷1,670seedlings×500seedlings×twice
		Total				3,312.0		
	Government	Seeds	0.1	600.0	seedlings equivalent	60.0	60.0	Unit cost is based on the interview results; number of planting 500 seedlings+supplementary planting 20%
		Vinyl pots	0.1	600.0	pieces	60.0	60.0	Unit cost is based on the interview results; number of planting 500 seedlings+supplementary planting 20%
		Total				120.0		
	Total	(C\$)				3,432.0		13.51C\$/US\$
		(US\$)				254.0		

Type of Work	Paid by	Item	Unit cost C\$ a	Quantity b	Unit c	Unit project cost		Calculation Basis
						C\$ d=ab	C\$/time d/time	
Contour Hedgerow	Local Residents	Nursing	1.0	600.0	seedling	600.0	600.0	Unit cost is based on the sales price of PROCASITA; number of planting 500seedlings+supplementary planting20%
		Planting	40.0	4.3	person-day	172.0	172.0	Unit cost is based on the interview results; quantity 600seedlings÷140seedlings/person-day
		Cutting (3 times)	40.0	9.6	person-day	384.0	128.0	Unit cost is based on the interview results; quantity 500seedlings÷158 seedlings/person-day x 3 times
		Bucking (3 times)	40.0	18.9	person-day	756.0	252.0	Unit cost is based on the interview results; quantity 500seedlings÷79seedlings/person-day x 3 times
		Chopping (3 times)	40.0	28.2	person-day	1,128.0	376.0	Unit cost is based on the interview results; quantity 500seedlings÷53seedlings/person-day x 3 times
		Bud pruning (twice)	40.0	6.8	person-day	272.0	136.0	Unit cost is based on the interview results; quantity of planting plan: 11.4 person-day/time ÷1,670seedlings×500seedlings×twice
	Total					3,312.0		
	Government	Seeds	0.1	600.0	seedlings equivalent	60.0	60.0	Unit cost is based on the interview results; number of planting 500 seedlings+supplementary planting 20%
		Vinyl pots	0.1	600.0	pieces	60.0	60.0	Unit cost is based on the interview results; number of planting 500 seedlings+supplementary planting 20%
		Total				120.0		
Total	(C\$)				3,432.0		13.51C\$/US\$	
	(US\$)				254.0			
Earth Ridge	Local Residents	Earth ridge	40.0	16.7	person-day	668.0	668.0	Unit cost is based on the interview results; total length 500m÷quantity 30m/person-day
		Maintenance (21years)	40.0	35.7	person-day	1,428.0	68.0	Unit cost is based on the interview results; quantity 50m÷30m/person-day×21years assuming the 10% collapse a year
	Total	(C\$)				2,096.0		13.51C\$/US\$
(US\$)					155.1			

Type of Work	Paid by	Item	Unit cost C\$ a	Quantity b	Unit c	Unit project cost		Calculation Basis
						C\$ d=ab	C\$/time d/time	
Rock Ridge	Local Residents	Rock ridge	40.0	31.6	person-day	1,264.0	1,264.0	Unit cost is based on the interview results; total length 500m÷quantity 15.8m/person-day
		Maintenance (21years)	40.0	67.2	person-day	2,688.0	128.0	Unit cost is based on the interview results; quantity 50m÷15.8m/person-day×21years assuming the 10% collapse a year
	Total	(C\$)				3,952.0		13.51C\$/US\$
		(US\$)				292.5		
Terrace Works	Local Residents	Terrace Works	40.0	53.2	person-day	2,128.0	2,128.0	Unit cost is based on the interview results; total length 1000m÷quantity 18.8m/person-day
		Maintenance (21years)	40.0	111.3	person-day	4,452.0	212.0	Unit cost is based on the interview results; quantity 100m÷18.8m/person-day×21years assuming the 10% collapse a year
	Total	(C\$)				6,580.0		13.51C\$/US\$
		(US\$)				487.0		
Grand Total		(C\$)				20,872.0		13.51C\$/US\$
		(US\$)				1,544.9		Without fencing
		(C\$)				22,524.0		13.51C\$/US\$
		(US\$)				1,667.2		With fencing

5.5.4 Silvopastoral

(/ha)

Type of Work	Paid by	Item	Unit cost C\$ a	Quantity b	Unit c	Unit project cost		Calculation Basis	
						C\$	C\$/time		
						d=ab	d/time		
Live Fence	Local Residents	Nursing	1.0	240.0	number	240.0	240.0	Unit cost is based on the sales price of PROCASITA; number of planting 200seedlings+supplementary planting 20%	
		Planting	40.0	1.7	person-day	68.0	68.0	Unit cost is based on the interview results; quantity 240 trees÷140 trees/person-day	
		Fencing	40.0	18.0	person-day	720.0	720.0	Unit cost is based on the interview results; quantity 4.5 person-days/100m×400m	
		Weeding (5times)	40.0	7.0	person-day	280.0	56.0	Unit cost is based on the interview results; quantity of planting plan: 11.4 person-day/time ÷1,670seedlings× 200 seedlings× 5 times	
		Cutting (3 times)	40.0	3.9	person-day	156.0	52.0	Unit cost is based on the interview results; quantity 200 seedlings÷158 seedlings/person-day x 3 times	
		Bucking (3 times)	40.0	7.5	person-day	300.0	100.0	Unit cost is based on the interview results; quantity 200 seedlings÷79seedlings/person-day x 3 times	
		Chopping (3 times)	40.0	11.4	person-day	456.0	152.0	Unit cost is based on the interview results; quantity 200 seedlings÷53seedlings/person-day x 3 times	
		Bud pruning (twice)	40.0	2.8	person-day	112.0	56.0	Unit cost is based on the interview results; quantity of planting plan: 11.4 person-day/time ÷ 1,670seedlings× 200 seedlings× twice	
		Total					1,612.0		Without fencing
						2,332.0		With fencing	
		Government	Seeds	0.1	240.0	number	24.0	24.0	Unit cost is based on the interview results; number of planting 200 seedlings+supplementary planting 20%
			Vinyl pots	0.1	240.0	number	24.0	24.0	Unit cost is based on the interview results; number of planting 200 seedlings+supplementary planting 20%
			Wooden post	1.9	200.0	number	380.0	380.0	Unit cost:119C\$/m ³ ; use of posts of 10cm in diameter and 2m in length is assumed; fencing 400mwith 2m interval between posts
			Barbed wire	4.6	120.0	10m	552.0	552.0	Unit cost is based on the interview results; fencing 400m×3 lines
			Total				48.0	48.0	Without fencing
			(C\$)				980.0		With fencing
		Total	(US\$)				1,660.0		13.51C\$/US\$
			(C\$)				122.9		Without fencing
			(US\$)				3,312.0		13.51C\$/US\$
			(US\$)				245.2		With fencing

Type of Work	Paid by	Item	Unit cost C\$ a	Quantity b	Unit c	Unit project cost		Calculation Basis
						C\$	C\$/time	
						d=ab	d/time	
Shading Tree	Local Residents	Nursing	1.0	60.0	number	60.0	60.0	Unit cost is based on the sales price of PROCASITA; number of planting 50 seedlings+supplementary planting 20%
		Planting	40.0	0.4	person-day	16.0	16.0	Unit cost is based on the interview results; quantity 60 trees÷140 trees/person-day
		Weeding (5times)	40.0	1.5	person-day	60.0	12.0	Unit cost is based on the interview results; quantity of planting plan: 11.4 person-day/time ÷1,670seedlings×50 seedlings× 5 times
		Cutting (3 times)	40.0	0.9	person-day	36.0	12.0	Unit cost is based on the interview results; quantity 50 seedlings÷158 seedlings/person-day x 3 times
		Bucking (3 times)	40.0	1.8	person-day	72.0	24.0	Unit cost is based on the interview results; quantity 50 seedlings÷79seedlings/person-day x 3 times
		Chopping (3 times)	40.0	2.7	person-day	108.0	36.0	Unit cost is based on the interview results; quantity 50 seedlings÷53seedlings/person-day x 3 times
		Bud pruning (twice)	40.0	0.6	person-day	24.0	12.0	Unit cost is based on the interview results; quantity of planting plan: 11.4 person-day/time ÷1,670seedlings×50 seedlings×twice
		Total				376.0		
	Government	Seeds	0.1	60.0	number	6.0	6.0	Unit cost is based on the interview results; number of planting 50 seedlings+supplementary planting 20%
		Vinyl pots	0.1	60.0	number	6.0	6.0	Unit cost is based on the interview results; number of planting 50 seedlings+supplementary planting 20%
		Total				12.0		
	Total	(C\$)				388.0		13.51C\$/US\$
		(US\$)				28.7		
	Grand Total	(C\$)				2,048.0		13.51C\$/US\$
(US\$)					151.6		Without fencing	
(C\$)					3,700.0		13.51C\$/US\$	
(US\$)					273.9		With fencing	

5.5.5 Erosion Control Facilities

Type of Facility	Item	Unit Cost C\$ a	Quantity b	Unit c	Unit Project Cost C\$ d=ab	Facility Size/Calculation Basis
Dry Masonry Dam (per dam)	Collection & transportation of stones	40.0	2.0	person-day	80.0	Unit cost is based on the interview results; facility size:length(L)=2.0m,height(H)=1.0m,crown width(W1)=0.8m, base width(W2)=1.2m, flood channel length(l)=0.7m, flood channel height (h)=0.3m
	Construction	40.0	4.0	person-day	160.0	
	(C\$)				240.0	
	(US\$)				17.8	
Fence Dam (per dam)	Collection & transportation of logs	40.0	2.0	person-day	80.0	Unit cost is based on the interview results; facility size:length(L)=2.0m, height(H)=0.5m, flood channel length(l)=0.7m, flood channel height(h)=0.3m
	Construction	40.0	3.0	person-day	120.0	
	(C\$)				200.0	
	(US\$)				14.8	
Dry Masonry Works (per works)	Collection & transportation of stones	40.0	2.0	person-day	80.0	Unit cost is based on the interview results; facility size:length(L)=2.0m,height(H)=1.1m,crown width(W1)=0.8m, base width(W2)=1.2m
	Construction	40.0	2.0	person-day	80.0	
	(C\$)				160.0	
	(US\$)				11.8	
Gabion Works (per works)	Assembly, stone filling & construction	270.0	4.32	m ³	1,167.0	Unit cost is based on the interview results; facility size:length(L)=2.0m,height(H)=0.5m,width(W)=1.2m,stone volume(V)=L×H×W×2 lines×2 steps ×0.9=4.32m ³
	(C\$)				1,167.0	
	(US\$)				86.4	
Fence Works (per works)	Collection & transportation of logs	40.0	2.0	person-day	80.0	Unit cost is based on the interview results; facility size:length(L)=2.0m,height(H)=0.5m
	Construction	40.0	3.0	person-day	120.0	
	(C\$)				200.0	
	(US\$)				14.8	
Covering Works (per 20m ²)	Collection of Materials	40.0	2.0	kg	80.0	Unit cost is based on the interview results; facility size:length(L)=10m,height(H)=2m
	Construction	40.0	3.0	person-day	120.0	
	(C\$)				200.0	
	(US\$)				14.8	

A-24

Note 1) In areas where collection of stones is difficult, a fence dam or fence works will be employed.

5.5.6 Livelihood Improvement

A-25

Type of Work	Paid by	Item	Unit Cost C\$ a	Quantity b	Unit c	Unit Project Cost		Calculation Basis
						C\$ d=ab	C\$/time d/time	
Home Garden (0.1ha/household)	Local Residents	Seedlings	14.0	10.0	number	140.0	140.0	Unit cost is based on the sales price of PROCASITA; quantity number of planting 10seedlings/household
		Planting	40.0	0.1	person-day	4.0	4.0	Unit price is based on the interview results; quantity 10 seedlings ÷ 140seedlings/person-day
		Fencing	40.0	3.6	person-day	144.0	144.0	Unit cost is based on the interview results; quantity 4.5 person-days/100m×8m/post×10 posts
		Wooden posts	1.9	40.0	number	76.0	76.0	Unit cost: 119C\$/m ³ ; use of posts of 10cm in diameter and 2m in length is assumed; fencing 80m with 2m interval between posts
		Barbed wire	4.6	24.0	10m	110.4	110.4	Unit cost is based on the interview results; quantity fencing 80m×3 lines
		Harvesting (17years)	40.0	34.0	person-day	1,360.0	80.0	Unit cost is based on the interview results; quantity 2 person-days×17 years
		Management (21years)	40.0	84.0	person-day	3,360.0	160.0	Unit cost is based on the interview results; quantity 4 person-days×21 years
	Total	(C\$)				4,864.0		13.51C\$/US\$
		(US\$)				360.0		Without fencing
		(C\$)				5,194.4		13.51C\$/US\$
(US\$)					384.5		With fencing	
Improved Stoves (per stove)	Local Residents	Stove Production and Installation	40.0	10.0	person-day	400.0	400.0	Unit cost is based on the interview results and quantity are estimated
		Maintenance (21years)	40.0	42.0	person-day	1,680.0	80.0	Unit cost is based on the interview results; quantity annual installation rate of 20% is assumed: 2 person-days×21years
		Total				2,080.0		
	Government	Materials	200.0	1.0	set	200.0	200.0	Unit cost and quantity are based on the interview results.
		Total				200.0		
	Total	(C\$)				2,280.0		13.51C\$/US\$
(US\$)					168.8			

Type of Work	Paid by	Item	Unit Cost	Quantity	Unit	Unit Project Cost		Calculation Basis
			C\$ a	b	c	C\$ d=ab	C\$/time d/time	
Gravity-type Simple Watering (per ha)	Local Residents	Transportation	40.0	6.0	person-day	240.0	240.0	Unit cost is based on the interview results; quantity:2 person-days/time×3 times assumed
		Pipe laying	40.0	10.0	person-day	400.0	400.0	Unit cost is based on the interview results; quantity 500m÷ 50m/person-day
		Water tank work	40.0	8.0	person-day	320.0	320.0	Unit cost is based on the interview results; quantity 4m ³ is assumed
		Maintenance (21years)	40.0	151.2	person-day	6,048.0	288.0	Unit cost is based on gthe interview results; quantity annual oinstallation rate of 30% is assumed: 7.2 person-days ×21years
		Total				7,008.0		per 20Mz
	Government	Pipe(2pul)	168.0	84.0	number	14,112.0	14,112.0	Unit cost is based on the ingterview results; quantity 500m÷6m/pipe
		Joint(2pul)	14.8	84.0	number	1,243.2	1,243.2	Unit cost is based on the ingterview results; quantity is the number of pipes (2 inch)
		Adhesive	99.5	6.7	lit.	666.7	666.7	Unit cost is based on the interview results; quantity (2 inch) 0.08lit.×84 pipes
		Concrete	2,431.8	0.7	m ³	1,702.3	1,702.3	Unit cost is estimated; quantity 14m2×5cm
		Total				17,724.2		
	Total	(C\$)				24,732.2		13.51C\$/US\$
		(US\$)				1,830.7		
		(US\$)				129.7		Per ha
Crop Diversification (per ha)	Local Residents	Opportunity cost (maize,21 years)	127.6	39.9	qq	5,091.2	242.4	Unit cost is based on the statistical book; quantity unit yield of 18.7qq×net profit ratio 10%×21years
		Preparation	500.0	1.0	set	500.0	500.0	Both unit cost and quantity are estimated
	Total	(C\$)				5,591.2		13.51C\$/US\$
Total	(US\$)				413.9			
	(C\$)				37,467.4		13.51C\$/US\$	
	(US\$)				2,773.3		Without fencing	
	(C\$)				37,797.8		13.51C\$/US\$	
					2,797.8		With fencing	

Type of Work	Paid by	Item	Unit Cost	Quantity	Unit	Unit Project Cost		Calculation Basis
			C\$			C\$	C\$/time	
			a	b	c	d=ab	d/time	
Compost Production (per ha)	Local Residents	Pit digging	40.0	3.0	persOn-day	120.0	120.0	Unit cost is based on the ingterview results; quantity is estimated
		Maintenance(21 years)	40.0	180.6	persOn-day	7,224.0	344.0	Unit cost is based on the interview results; quantity 60person-hr÷7hr/day×21years
	Total	(C\$)				7,344.0		13.51C\$/US\$
		(US\$)				543.6		
Improved Grass (per ha)	Local Residents	Seeds(5 times)	168.9	14.5	kg	2,449.1	489.8	Unit cost is given by the INTA; quantity 2kg/Mz(=0.699ha)×5 times
		Seeding(5 times)	40.0	21.5	persOn-day	860.0	172.0	Unit cost is based on the ingterview results; quantity 3 person-days/Mz×5 times
	Total	(C\$)				3,309.1		13.51C\$/US\$
		(US\$)				244.9		

APPENDIX 6 MATERIALS AND EQUIPMENT PROVIDED BY THE PILOT STUDY

First Season

PALERMO

MATERIALES Materials and Equipment		CANTIDAD Quantity	Unidad Unit	
Bomba de mochila	Shoulder pump	6	Unidad	set
Pala	Spade	9	Unidad	number
Barril	Drum	4	Unidad	number
Piocha	Pickax	9	Unidad	number
Balde galbanizado	Bucket	9	Unidad	number
Frutales	Graft fruit tree	268	Plantas	plant
Plantas forestales	Seedlings for forestry species	10,000	Plantas	seedling
Chimenea	Chimney	1	Unidad	number
Cemento etc.	Cement & other plastering materials	1	Unidad	set
Chancha	Sprit spade	9	Unidad	number
Azadón	Hoe	9	Unidad	number
Regadera	Watering can	9	Unidad	number

LOS TOLOLOS

MATERIALES Materials and Equipment		CANTIDAD Quantity	Unidad Unit	
Bomba de mochila	Shoulder pump	6	Unidad	set
Barril	Drum	6	Unidad	number
Plantas forestales	Seedlings for forestry species	9,000	Plantas	seedling
Chancha	Split spade	8	Unidad	number
Azadón	Hoe	8	Unidad	number
Regadera	Watering can	8	Unidad	number
Frutales	Graft fruit tree	144	Plantas	plant

URROCES

MATERIALES Materials and Equipment		CANTIDAD Quantity	Unidad Unit	
Bomba de mochila	Shoulder pump	4	Unidad	set
Pala	Spade	4	Unidad	number
Barril	Drum	4	Unidad	number
Balde galbanizado	Bucket	4	Unidad	number
Palin	Driller	13	Unidad	number
Rastrillo	Watering can	13	Unidad	number
Frutales	Graft fruit tree	140	Plantas	plant
Tijera de podar	Pruner	8	Unidad	number
Azadones	Hoe	8	Unidad	number

VERSALLE-APASTEPE

MATERIALES Materials and Equipment		CANTIDAD Quantity	Unidad Unit	
Bombas de Mochila	Shoulder pump	2	Unidad	set
Palas	Spade	13	Unidad	number
Rastrillos	Rake	13	Unidad	number
Papelógrafos	Paper	400	Unidad	sheet
Marcadores	Permanent marker	5	Unidad	number
Tela para mantas	Cloth (for banner)	6	Unidad	number
Tabla de Campos	Drawing board	3	Unidad	number
Libretas	Notebook	3	Unidad	number
Lápices de grafito	Pencil	1	docena	dozen
Reglas	Ruler	6	Unidad	number
Regaderas	Watering can	11	Unidad	number
Plástico negro	Black vinyl sheet	30	Unidad	number
Semillas variadas de hortalizas	Vegetable seeds	1	Unidad	tin

EL CACAO

MATERIALES Materials and Equipment		CANTIDAD Quantity	Unidad Unit	
Bombas de Mochila	Shoulder pump	4	Unidad	set
Rastrillos	Rake	6	Unidad	number
Cartulinas	Thick paper	100	Unidad	sheet
Marcadores	Permanent marker	2	Caja	dozen
resistol para madera	Wood preservative	1	Galón	galon
Barras	Crowbar	2	Unidad	number
Azadones	Hoe	4	Unidad	number
Carretilla de metal de carpinteria	Wheel barrow	1	Unidad	number

LA SANDINO

MATERIALES Materials and Equipment		CANTIDAD Quantity	Unidad Unit	
Palas redondas	Spade	2	Unidad	set
Piocha	Pickax	4	Unidad	number
Carretillas	Wheel barrow	1	Unidad	number
Palas redondas	Spade	5	Unidad	number
Rastrillos	Rake	2	Unidad	number
Azadones	Hoe	4	Unidad	number
Pintura de aceite	Paint	9	Unidad	tin
Campana	Bell	1	Unidad	number
Marcadores	Permanent marker	5	Caja	dozen
Papelógrafos	Paper	500	Unidad	sheet
Mecates	Rope	240	Yadas	yard
Tela de manta	Cloth (for banner)	66	Yadas	yard
Azadones	Hoe	4	Unidad	number
Palas redondas	Spade	6	Unidad	number
Picos	Pickax	2	Unidad	number
Baldes	Bucket	4	Unidad	number
Regaderas	Watering can	2	Unidad	number
Carretillas	Wheel barrow	2	Unidad	number
Semillas hortalizas	Vegetable seeds	1500	grs	gramme

EI PAJARITO-LAS BRISAS

MATERIALES Materials and Equipment		CANTIDAD Quantity	Unidad Unit	
Rastrillo metal c/mango 14v/b	Rake	23	Unidad	number
Bomba CORPI 20	Shoulder pump	5	Unidad	set
Tomate etc.	Tomato & other Vege. Seeds	300	Gramos	gramme
Pipián etc.	Vegetable seeds	3	Libra	pound
Frutales Injertos	Graft fruit tree	90	Unidad	number
Yuca	Seed cassava	1203	Varas	root
Copia color 11 x17	Pamphlet copies	160	Unidad	sheet
Cartulinas etc..	Thick paper & stationaries	1	Unidad	number
Rollos de 1/2 Politubos	Polyethylene tube	3	rollos	reel
Cemento etc.	Cement & other plastering materials	1	Unidad	set
Bomba EMA	Manual pump	1	Unidad	set

LAS MERCEDES

MATERIALES Materials and Equipment		CANTIDAD Quantity	Unidad Unit	
Cartulinas etc..	Thick paper & stationaries	1	Unidad	set
Copia color 11 x17	Pamphlet copies	96	Unidad	sheet
Bomba CORPI 20	Shoulder pump	3	Unidad	set
Rastrillos metal con mango	Rake	2	Unidad	number
Azadón 3 1/2	Hoe	2	Unidad	number
Piocha 4 lbs	Pickax	28	Unidad	number
Nivel de lienza Stanley	Level	2	Unidad	piece
Cinta métrica 5 mts c/nivel n. America	Tape measure	1	Unidad	reel
Taiwán	Grass	13	Fletes	box
Frijol abono	Bean seeds	259	Libra	pound
Frutales	Graft fruit tree	148	Plantas	number
Yuca	Seed cassava	1665	Varas	root
Tomate etc.	Tomato & other vege. Seeds	200	Gramos	gramme
Pipián etc.	Vegetable seeds	2	Libra	pound
Frutales	Graft fruit tree	226	Plantas	plant
Achiote etc.	Melon,etc.	105	Plantas	plamt
Cemento etc.	Cement & other plastering materials	1	Unidad	set

EL CHARCO

MATERIALES Materials and Equipment		CANTIDAD Quantity	Unidad Unit	
Copia color 11 x 17	Pamphlet copies	160	Unidad	copy
Cartulinas etc..	Thick paper & stationaries	1	Unidad	set
Bomba CORPI 20	Shoulder pump	3	Unidad	set
Rastrillo metal c/mango 14 B.V	Rake	6	Unidad	number
Azadón 3 1/2 tramontina 7213-40	Hoe	6	Unidad	number
Piocha 4 lbs tramontina 7303/40	Pickax	6	Unidad	number
Vetiver	Grass	7660	Bulbos	root
Taiwan	Grass	8.5	Fletes	box
Frijol abono	Bean seeds	204	Libra	pound
Frutales	Fruit graft	551	Plantas	number
Piocha 4 lbs tramontina 7303/40	Pcikax	17	Unidad	number
Nivel de lienza Stanley	Level	2	Unidad	priece
Cinta métrica 5 mts con nivel n. América	Tape measure	1	Unidad	reel
Tomate etc.	Tomato & other vege. seeds	200	Gramos	gramme
Pipián etc.	Vegetable seeds	2	Libra	pound
Yuca	Seed cassava	1435	Varas	root

Nursing Period

PALERMO

MATERIALES Materials and Equipment		CANTIDAD Quantity	Unidad Unit	
Cedazo	Wire net for sieve	10	yarda	yard
Tubo PVC (Llenado de bolsa)	PVC tube	1	unida	yard
Madera 6x3x3	Wood for sieve farame	3	unida	number
Madera 1x2x3	Wood for sieve farame	3	unida	number
Madera 2x2x3	Wood for sieve farame	3	unida	number
Alambre	Barbed wire	3	rollos	reel
Grapas	Clamp	6	libra	pound
Bolsa forestales (millar)	Nursing bag	27,500	unida	bag
Bolsas frutales (millar)	Nursing bag	4,900	unida	bag
Semilla Caoba	Seeds (forestry species)	11	kg	kg
Alambre	Barbed wire	15	rollos	reel
Grapas	Clamp	30	libra	pound

LOS TOLOLOS

MATERIALES Materials and Equipment		CANTIDAD Quantity	Unidad Unit	
Cedazo	Wire net for sieve	10	yarda	yard
Madera 1x6x3	Wood for sieve frame	3	unida	number
Madera 1x2x3	Wood for sieve frame	3	unida	number
Madera 2x2x3	Wood for sieve frame	3	unida	number
Clavos 2"	Nails	2	kg	kg
Clavos 1 1/2"	Nails	2	kg	kg
Alambre	Barbed wire	2	rollos	reel
Grapa	Clamp	4	libra	pound
Compra de bolsas Forestales (Millar)	Nursing bag	12,500	unida	bag
Compra Bolsa Frutales (Millar)	Nursing bag	2,000	unida	bag
Semilla de genizaro	Seeds (forestry species)	12	kg	kg
Tubo PVC	PVC tube	1	unida	number
Alambre	Barbed wire	11	rollos	reel
Grapa	Clamp	22	libra	pound

URROCES

MATERIALES Materials and Equipment		CANTIDAD Quantity	Unidad Unit	
Yarda de sedaso Para saranda	Wire net for sieve	20	yarda	yard
Tablones sarandas 2x2x3	Wood for sieve frame	9	unida	number
Tablones sarandas 1x2x3	Wood for sieve frame	9	unida	number
Tablones saranda 1x6x3	Wood for sieve frame	9	unida	number
Balde Galvanizado	Bucket	13	unida	number
Regadera	Watering can#	13	unida	number
Compra bolsa forestal (millar)	Nursing bag	40,000	unida	bag
Compra de bolsa frutal (millar)	Nursing bag	2,100	unida	bag
200 C\$ C/U Compra de Semilla Eucalipto	Seeds (eucalyptus)	20	kg	kg
Tubo PVC (Llenado bolsas)	PVC tube	1	unida	number
Alambre	Barbed wire	17	rollos	reel
Grapas	Clamp	34	libra	pound

VERSALLE-APASTEPE

MATERIALES Materials and Equipment		CANTIDAD Quantity	Unidad Unit	
Alambre de púa 350 varas	Barbed wire	3	Rollo	reel
grapa galvanizada	Clamp	7	Libra	pound
clavo alambre	Nails	5	Libra	pound
piocha	Pickax	6	Unidad	number
Manguera de polietileno 1 pulgada	Hose	100	Metro	metre
carretilla	Wheel barrow	2	Unidad	number
Cedazo zaranda 6x6	Wire net for sieve	5	Yada	yard
cedazo para zaranda	Wire net	33	Yada	yard
regadera galvanizada	Waterin can	7	Unidad	number
semillas frutales	Seeds (fruit trees & forestry secies)	2	kg	kg
Bolsas para almácigo 6x8	Nursing bag	18,300	Unidad	bag
cal	Lime	2	Unidad	bag
Cemento canal	Cement	28	Unidad	bag
codo de 1 pulgada	Joint	29	Unidad	piece
Válvula gaveta	Valve	2	Unidad	piece
llave stilson	Pipe wrench	2	Unidad	piece
Segueta	Saw	2	Unidad	number
Mecate	Rope	1	Rollo	reel
pala	Spade	2	Unidad	number
Una barra de corneta de 5 pulgadas	Iron bar	2	Unidad	number
Un mazo 4 libras	Mallet	1	Unidad	number
Cinceles 10 pulgadas Tramontina	Cold chisel	6	Unidad	number
Guantes de cuero	Gloves	3	Unidad	number
Respirador Doble	Mask	1	Unidad	number
Ladrillos para pozo	Brick	400	Unidad	piece
Bloque para pila	Block	110	Unidad	piece
Hierro 3/8 Standard	Crowbar	4	Unidad	number
excavación pozo	Well driling set	1	Unidad	set
Alambre de púa 350 varas	Barbed wire	2	Rollo	reel
grapa galvanizada	Clamp	5	Libra	pound

EL CACAO

MATERIALES Materials and Equipment		CANTIDAD Quantity	Unidad Unit	
semilla café	Seeds (coffee)	14	Libra	pound
bolsas para almácigo	Nursing bag	12,000	Unidad	bag
regadera zinc 4 galones	Watering can	5	Unidad	number
piocha	Pickax	2	Unidad	number
pala	Spade	3	Libra	pound
malla galvanizada	Net for sieve	14	Yada	yard
carretilla	Wheel barrow	1	Unidad	number
alambre de puas	Barbed wire	1	Rollo	reel
clavo de una y media pulgada	Nails	3	Libra	pound
Barriles	Drum	4	Unidad	number
Barriles de plástico	Water tank	4	Unidad	number
Bidones plásticos de 15 galones	Box for seedling transportation	8	Unidad	box
grapa galvanizada	Clamp	3	Libra	pound
pintura	Paint	.1/4	Galone	gallon
brocha	Brush	2	Unidad	number
Manguera PE 3/4	Hose	1,400	Metro	metre
aspersor	Sprinkler	2	Unidad	number

LA SANDINO

MATERIALES Materials and Equipment		CANTIDAD Quantity	Unidad Unit	
bolsas para almácigo 6x8	Nursing bag	1,500	Unidad	bag
bolsas para almácigo 4x8	Nursing bag	5,000	Unidad	bag
bomba de mecate	Manual pump	1	Unidad	set
Ladrillos	Brick	400	Unidad	piece
Cemento	Cement	10	Unidad	bag
varillas de hierro	Reinforcing bar	6	Unidad	number
1 rollo de alambre de pua	Barbed wire	1	Rollo	reel
grapas	Clamp	2	Libra	pound
semilla de frutales	Seeds (5 fruit tree species)	2	Libra	pound
semilla de forestales	Seeds (4 forestry species)	1	kg	kg
pala	Spade	2	Unidad	number
piocha	Pickax	2	Unidad	number
azadon	Hoe	2	Unidad	number
rastrillo	Rake	2	Unidad	number
carretilla	Wheel barrow	1	Unidad	number
cedazo	Net for sieve	8	Yada	yard
regadera	Watering can	2	Unidad	number
barriles	Drum	2	Unidad	number
alambre de pua	Barbed wire	2	Rollo	reel
grapas	Clamp	4	Libra	pound

EI PAJARITO-LAS BRISAS

MATERIALES Materials and Equipment		CANTIDAD Quantity	Unidad Unit	
Bolsas para forestales	Nursing bag	2,725	Unidad	bag
Bolsas para café	Nursing bag	25,875	Unidad	bag
Semilla	Seeds	11	kg	kg
Regaderas	Watering can	9	Unidad	number
Bolsas Plásticas	Nursing bag	4,580	Unidad	bag
Semilla	Seeds	1	kg	kg
Rollos de Manguera	Hose	20	Unidad	reel
Cemento	Cement	46	Unidad	bag
Radrillo	Brick	2,000	Unidad	piece
Bomba EMA	Manual pump	3	Unidad	set
Bolsa Plásticas	Nursing bag	3,179	Unidad	bag
Semilla	Seeds	2	kg	kg
Alambres de púas	Barbed wire	4	Rollo	reel
Grapas	Clamp	8	Libra	pound

LAS MERCEDES

MATERIALES Materials and Equipment		CANTIDAD Quantity	Unidad Unit	
Alambres de púas	Barbed wire	9	Rollo	reel
Grapas	Clamp	18	Libra	pound
Cedazos Zaranda	Wire net	7	Yada	yard
Palas	Spade	2	Unidad	number
Regaderas	Watering can	2	Unidad	number
Bolsas Plásticas	Nursing bag	10,000	Unidad	bag
Semilla	Seeds	5	Libra	pound

EL CHARCO

MATERIALES Materials and Equipment		CANTIDAD Quantity	Unidad Unit	
Alambe de púas	Barbed wire	34	Rollo	reel
Grapas	Clampo	68	Libra	pound
Cedazo Zaranda	Wire net	10	Yada	yard
Palas	Spade	4	Unidad	number
Regaderas	Watering can	3	Unidad	number
Azadon	Hoe	4	Unidad	number
Barril para riego	Drum	1	Unidad	number
Rollo de alambre de púas	Barbed wire	1	Rollo	reel
Bolsas Plásticas	Nursing bag	9000	Unidad	bag
Semillas	Seeds	1.8	kg	kg

Second Season

PALERMO

MATERIALES Materials and Equipment		CANTIDAD Quantity	Unidad Unit	
Frutales	Graft fruit tree	167	Injertos	plant
Alambre	Barbed wire	250	Rollo	reel
Grapas	Clamp	225	Libra	pound
Bomba de Mochila	Atomiser	1	Unidad	set
Tijera de podar	Sickle	24	Unidad	number
Serrucho cola zorro	Hand saw	24	Unidad	number
Lima triangular	File	24	Unidad	number
Machete corneta	Machete	24	Unidad	number

LOS TOLOLOS

MATERIALES Materials and Equipment		CANTIDAD Quantity	Unidad Unit	
Frutales	Graft fruit tree	124	Injertos	plant
Alambre	Barbed wire	129	Rollo	reel
Grapas	Clamp	126	Libra	pound
Tijera de podar	Sickle	5	Unidad	number
Serrucho cola zorro	Hand saw	11	Unidad	number
Lima triangular	File	11	Unidad	number

URROCES

MATERIALES Materials and Equipment		CANTIDAD Quantity	Unidad Unit	
Alambre	Barbed wire	38	Rollo	reel
Grapas	Clamp	32	Libra	pound
Machete corneta	Machete	19	Unidad	number

VERSALLE-APASTEPE

MATERIALES Materials and Equipment		CANTIDAD Quantity	Unidad Unit	
Injertos	Graft fruit tree	363	Injertos	plant
Cocos	Coconut (for seedling)	45	Unidad	number
Patrones	Stock for fruit tree graft	26	Unidad	plant
Alambre púas	Barbed wire	10	Rollo	reel
Grapas	Clamp	20	Libra	pound

EL CACAO

MATERIALES Materials and Equipment		CANTIDAD Quantity	Unidad Unit	
Injerto	Graft fruit tree	400	Unidad	plant
Patrones	Stock for fruit tree graft	20	Unidad	plant
Alambre púas	Barbed wire	16	Rollo	reel
Grapas	Clamp	32	Libra	pound
Reglas 30 cm.	Ruler	6	Unidad	number
Tablas con clamp	Drawing board	6	Unidad	number
Block T/C amarillo	Drawing paper	6	Unidad	sheet
Lápices grafito	Pencil	12	Unidad	number
Cintas métricas	Rope measure	6	Unidad	reel

LA SANDINO

MATERIALES Materials and Equipment		CANTIDAD Quantity	Unidad Unit	
Injertos	Graft fruit tree	454	Injertos	plant
Alambre púas	Barbed wire	11	Rollo	reel
Grapas	Clamp	33	Libra	pound

EI PAJARITO-LAS BRISAS

MATERIALES Materials and Equipment		CANTIDAD Quantity	Unidad Unit	
Alambre de puás	Barbed wire	158	Rollo	reel
Grapas 1 1/4	Clamp	316	Libra	pound
Zinc liso	Sheet zinc	7	Unidad	sheet
Clavos	Nails	4	Libra	pound
Pintura	Paint	4	Unidad	tin
Frutales	Graft fruit tree	530	Injertos	plant
Semilla de pasto	Grass seeds	12	kg	kg
Semilla de arbol	Tree seeds	1.25	kg	kg
Ladrillos cuarterón	Bricks	300	Unidad	number
Hierro liso	Reinforcing bars	48	Unidad	number
Alambre de amarre	Wire	12	Libra	pound
Palas	Spade	3	Unidad	number
Piochas	Pickax	3	Unidad	number
Machetes	Machete	3	Unidad	number

LAS MERCEDES

MATERIALES Materials and Equipment		CANTIDAD Quantity	Unidad Unit	
Alambre de puás	Barbed wire	143	Rollo	reel
Grapas 1 1/4	Clamp	286	Libra	pound
Cipermetrina	Insecticide	25	Litro	littre
Semilla de pasto Anglentón	Grass seeds	72	kg	kg
Tubos de 4"	Concrete tube	27	Unidad	number
Anticipo de ladrillos cuarterón	Brick	810	Unidad	piece
Cemento gris	Cement	9	Unidad	bag
Alambre de amarre	Wire	25	Libra	pound
Hierro liso	Reinforcing bar	18	Unidad	number
Zinc liso	Sheet zinc	3	Unidad	sheet
Cemento gris	Cement	18	qq	qq
Aves de corral	Chicken	18	Unidad	number

EL CHARCO

MATERIALES Materials and Equipment		CANTIDAD Quantity	Unidad Unit	
Zinc liso	Sheet zinc	2	Unidad	sheet
Clavos	Nails	4	Libra	pound
Pintura	Paint	4	Unidad	tin
Alambre de puás	Barbed wire	83	Rollo	reel
Grapas 1 1/4	Clamp	166	Libra	pound
Semilla de pasto Brizantha	Grass seeds	33	kg	kg
Naranja	Graft fruits tree	112	Injertos	number
Aves de corral	Chicken	78	Unidad	number