THE REPUBLIC OF CAPE VERDE
THE STUDY ON THE INTEGRATED RURAL DEVELOPMENT
IN WATERSHED ON SANTIAGO ISLAND

FINAL REPORT
(MAIN REPORT)

November 2010

GENERAL DIRECTORATE OF AGRICULTURE,
FORESTRY AND LIVESTOCK (MADRRM)
THE REPUBLIC OF CAPE VERDE

THE STUDY ON
THE INTEGRATED RURAL DEVELOPMENT
IN WATERSHED ON SANTIAGO ISLAND
OF
THE REPUBLIC OF CAPE VERDE

FINAL REPORT
(MAIN REPORT)

December 2010

JAPAN INTERNATIONAL COOPERATION AGENCY

NTC INTERNATIONAL CO., LTD.

SNO
JR
10-008

GENERAL DIRECTORATE OF AGRICULTURE,
FORESTRY AND LIVESTOCK (MADRRM)
THE REPUBLIC OF CAPE VERDE

THE STUDY ON
THE INTEGRATED RURAL DEVELOPMENT
IN WATERSHED ON SANTIAGO ISLAND
OF
THE REPUBLIC OF CAPE VERDE

FINAL REPORT
(MAIN REPORT)

December 2010

JAPAN INTERNATIONAL COOPERATION AGENCY

NTC INTERNATIONAL CO., LTD.

Compsition of Final Report

MAIN REPORT

ANNEXES

PREFACE

In response to a request from the Government of the Republic of Cape Verde, the Government of Japan decided to conduct The Study on the Integrated Rural Development in Watershed on Santiago Island and entrusted the study to the Japan International Cooperation Agency (JICA).

JICA dispatched a study team, headed by Mr. Shigeru Nakata of NTC International Co., Ltd., to the Republic of Cape Verde from January 2008 to December 2010.

The team held discussions with the officials concerned of the Government of Cape Verde and conducted a series of field surveys in the studied area. Upon returning to Japan, the team conducted further studies and prepared this final report.

I hope that this report will contribute to the sustainable agricultural development in the Republic of Cape Verde and to the enhancement of friendly relationship between our two countries.

Finally, I wish to express my sincere appreciation to the officials of Government and those concerned in the Republic of Cape Verde for the close cooperation they had to the study.

December 2010

Eiji Hashimoto
Vice President
Japan International Cooperation Agency

December 2010

Mr. Eiji Hashimoto
Vice President
Japan International Cooperation Agency

Letter of Transmittal

Dear Sir,

We are pleased to submit to you the final report on "The Study on the Integrated Rural Development in Watershed on Santiago Island of the Republic of Cape Verde". This report presents the outcome of the Study which was conducted both in Cape Verde and Japan during a total period of 36 months from January 2008 to December 2010.

Targeting the watersheds of Santiago Island located at the south of Cape Verde, "the Action Plan of the Integrated Rural Development", with the effective use of natural resources in the watersheds contributing to operable and sustainable agriculture and soil and water conservation, was drawn up in this Study, aiming at the income generation of the rural population. Additionally, "the capacity building of the counterparts: Ministry of Environment, Rural Development and Marine Resources (MADRRM), the farmers' associations and the concerned agencies" was attempted through the Pilot-projects with participation of the farmers. The Study process and its analysis, and the result of the formulation of the Action Plan have been compiled in this document.

Since a movement has been occurring among the farmers in the study area to reorganize themselves for a better life, we would like to sincerely request that continuous Japanese aid and follow-up in the Study Area. By doing so, we are sure that the friendly relationship between Japan and Cape Verde will be further reinforced.

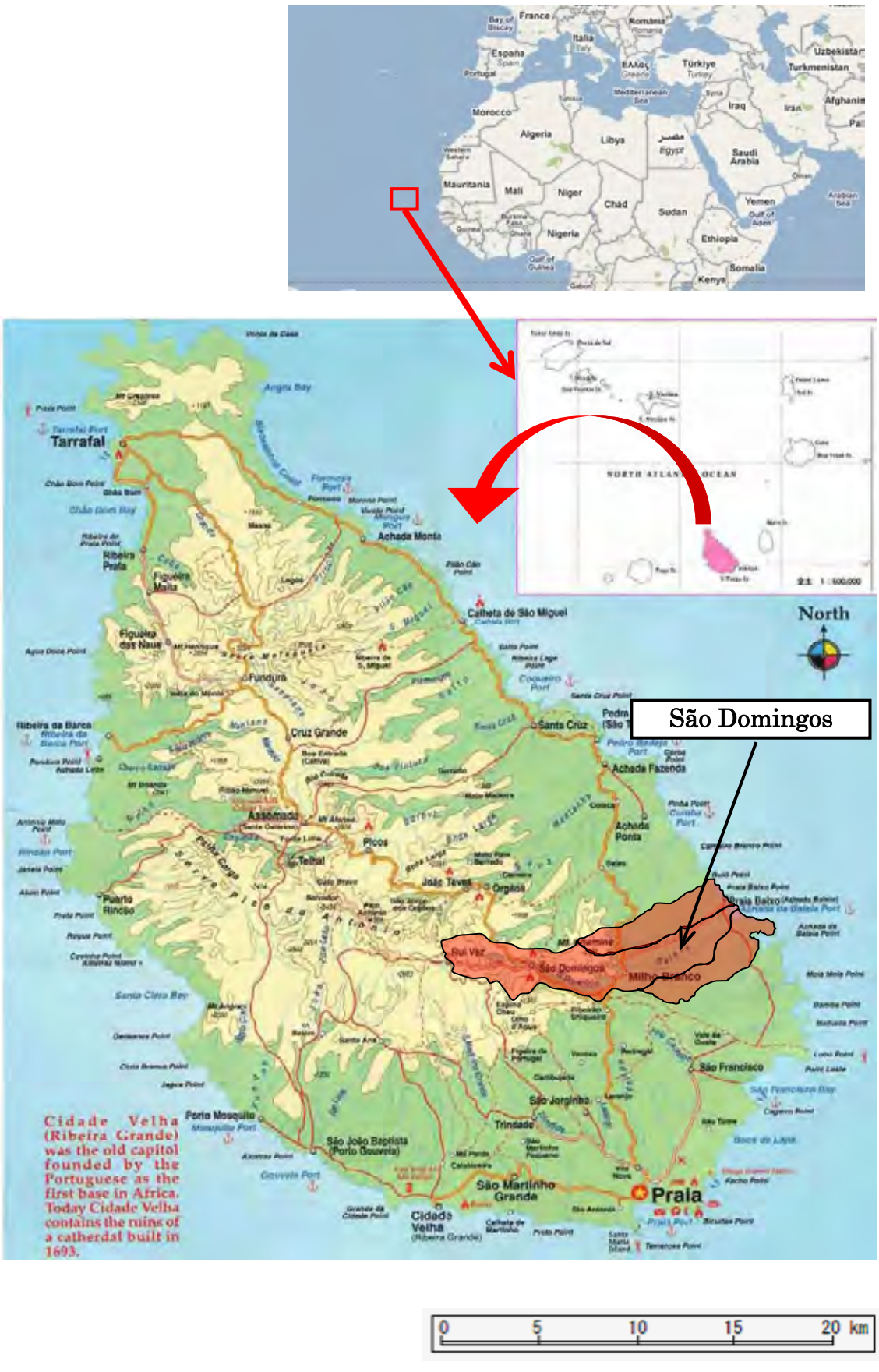
In submitting this report, we would like to express our heartiest appreciation for substantial cooperation and advice provided during the Study period by officials of the Japan International Cooperation Agency, the Ministry of Foreign Affairs and the Ministry of Agriculture, Forestry and Fisheries.

During the field study, we were also received thoughtful cooperation and support from the administrative institutions of Cape Verde including the MADRRM, General Directorate of International Cooperation (Ministry of Foreign Affairs, Cooperation and Communities), National Institute of Agricultural Development and National Institute of Water Resource Management. Besides, JICA Senegal Office, the Embassy of Japan in Senegal and other related institutions provided us with valuable advice and support. In writing this, we would like to express our sincere gratitude to them for the helpful advice, cooperation, and support.

Very truly yours,

Shigeru Nakada
Team Leader
The Study on the Integrated Rural Development
in Watershed on Santiago Island
of the Republic of Cape Verde

Location Map of The Study Area



Photographs

Landscape of Dry Season in Santiago Island

Landscape of Rainy Season in Santiago Island

Situation of River (ordinary time)

Situation of River (in flood)

Tanker for Selling Water

Catchment of Spring Water (Gallery)

Inside of Gallery

Catchment Dike of Undercurrent Water

Lower Reservoir of Catchment Dike of Undercurrent Water

Dam Constructed by Cooperation of China (Seca Watershed)

Landscape of ZAE I

Landscape of ZAE II

Landscape of ZAE III

Landscape of ZAE IV

Selection of Pilot-Project by Workshop

(São Domingos Agricultural Local Office)

Selection of Pilot-Project by Workshop

(Lui Vaz)

Stone Masonry Work

(Soil and Water Conservation)

Crescent Filling Works

(Soil and Water Conservation)

Collection of Runoff Rainfall by Catchment Facilities (Water-harvesting)

Cultivation of Cactus in Banquet (Water-harvesting)

Catchment of Effluent Water in Flood by Diversion facilities (Leaching of Salt Damaged Farm)

Construction of Small Scale Dike (Small-scale Water Resources Development)

Construction of Reservoir (Small-scale Water Resources Development)

Completed Dike (Small-scale Water Resources Development)

Reservoir Independently Painted by Farmer's Organization (Small-scale Water Resources Development)

Comparative Experiment of Drip Irrigation and Traditional Irrigation (Water Saving Irrigation/Water Management)

Experimental Farm of Picher Irrigation (Water Saving Irrigation/Water Management)

Cleaning of Forest (Forage Cultivation with Forest Conservation)

Cultivation of Pasture Grass (Forage Cultivation with Forest Conservation)

Cooking of Tomato Paste (Agricultural Produce Processing)

Collective Marketing
(Rationalization of Market Distribution)

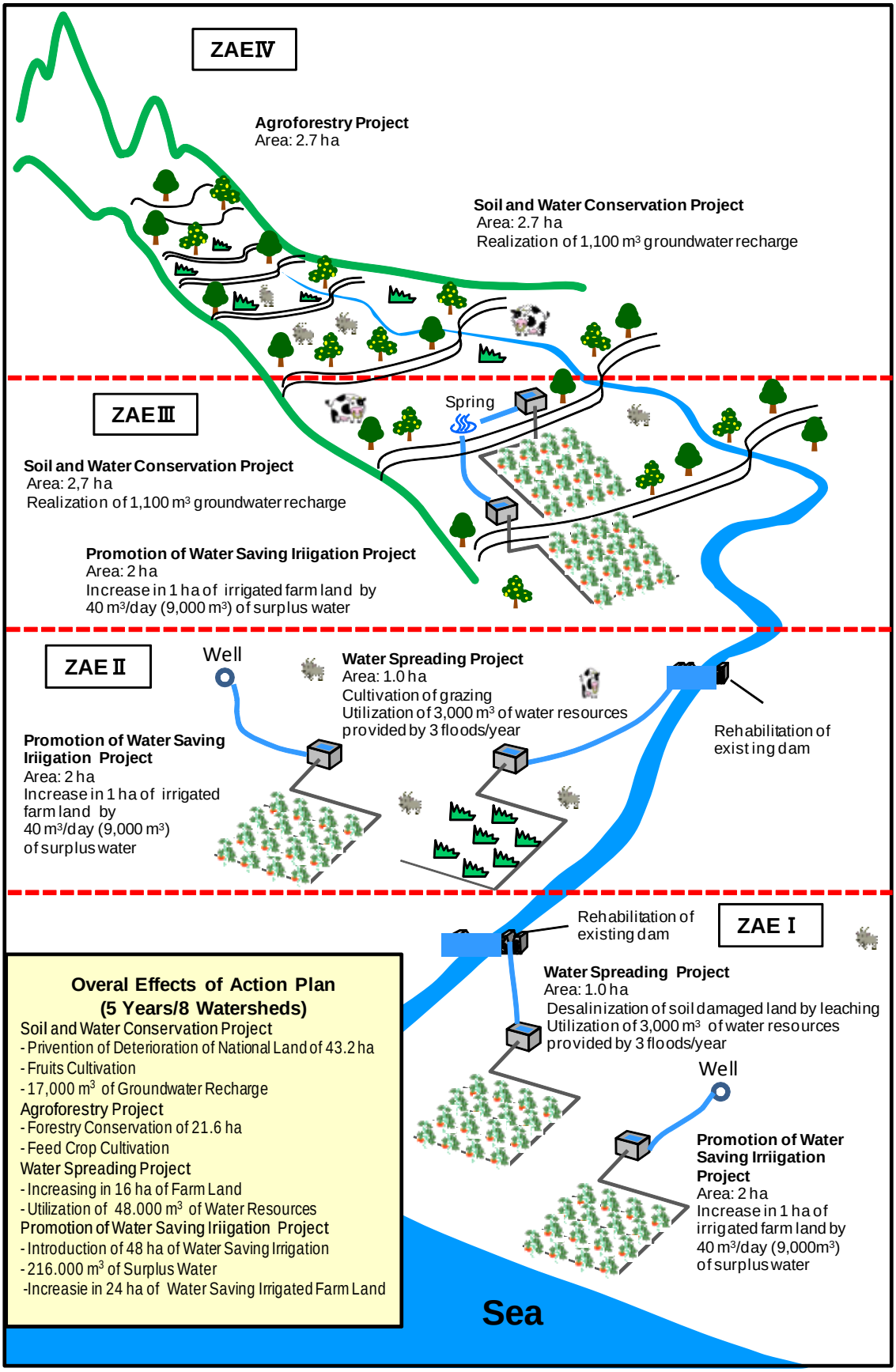
Group Leaders Meeting
(Group Leaders Training)

Visit of Advanced Agricultural Areas
(Extension among Farmers)

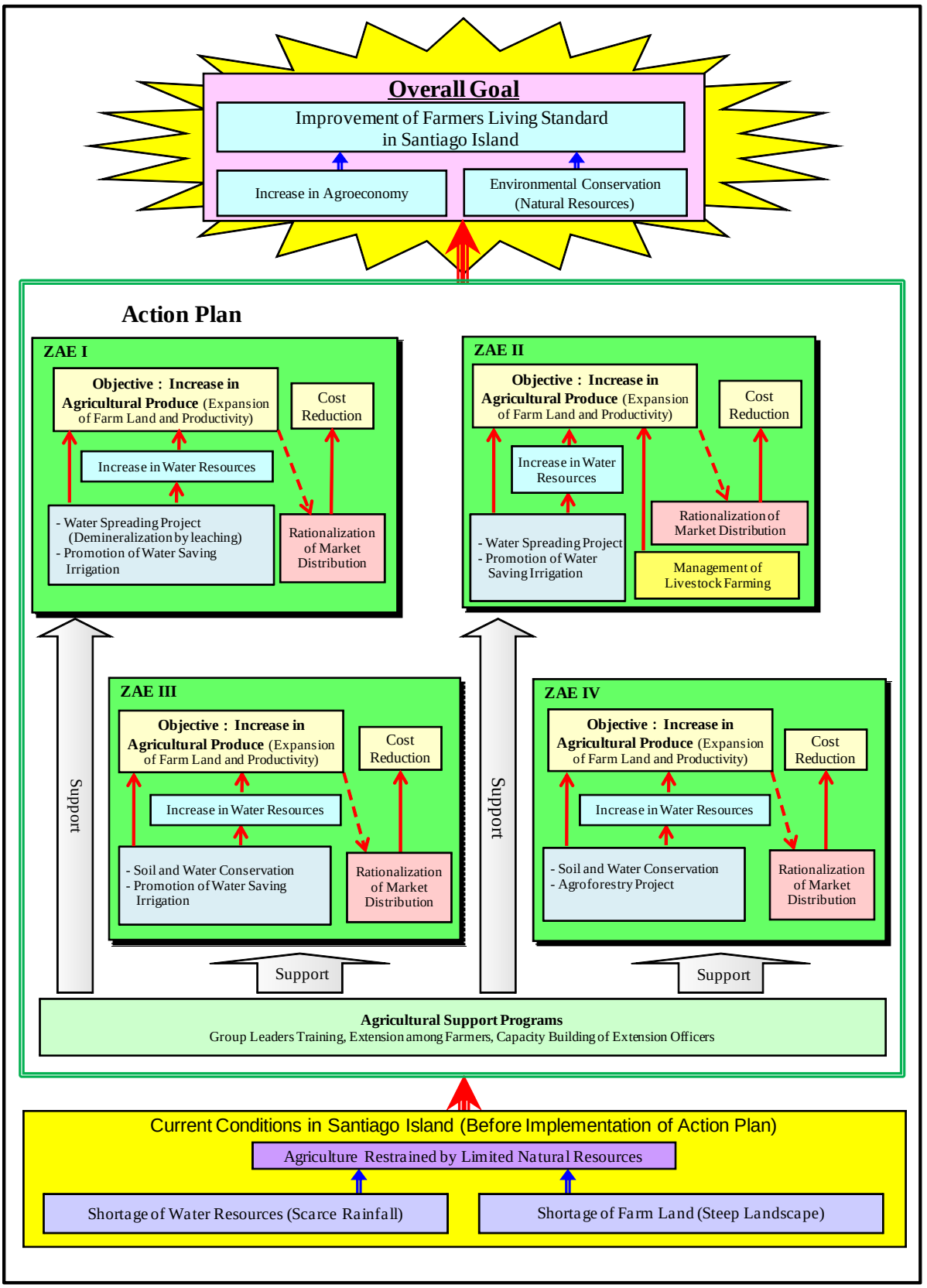
Training for the Extension Officers
(Improvement of Extension System)

Report of Project by TV Program
(Extension of the Pilot Project
to the Other Watersheds)

Final Seminar



Conceptual Image of Action Plan
Model of Utilization of Natural Resources by Watershed



Conceptual Image of Action Plan
Model of Integrated Rural Development (each ZAE) of Watershed

Acronyms and Abbreviation

1. Related Agencies

ACB	Community Association Based on a Unit of Village
ACDI/VOCA	Agricultural Cooperative Development International and Volunteers in Overseas Cooperative Assistance
AECID	Spanish Agency of International Development Cooperation
ANSA	National Agency and Food Security
ASDIS	Association for Solidarity for Development in Santiago Island
AfDB	African Development Bank
ABEDA	Arabic Bank for Economic Development in Africa
CM	Municipal Board
CMSD	Municipal Board of São Domingos
DEGI	Department of Statistics and Information Management (DGASP)
DEPC	Department of Research, Planning and Cooperation (DGASP)
DGA	General Directorate of Environment
DGASP	General Directorate of Agriculture, Forestry and Livestock Breeding
DGCI	General Directorate of International Cooperation
DGPOG	General Directorate of Planning and Budgetary Control
DSAP	Department of Agriculture and Stockbreeding (DGASP)
DSAGRH	Department of Administration and Human Resources Management (DGASP)
DSER	Department of Rural Engineering (DGASP)
DSS	Department of Forestry (DGASP)
DSSA	Department of Food Security (DGASP)
EMPA	Empresa Pública de Abastecimento (Public Supply Company)
ETER	Technical Team for Rural Extension
FAIMO	Program for the Emplooyment of the Poor
FAO	Food and Agriculture Organization
GTM	Municipal Technical Offices
ICASE	Institute of Cape Verdean Student Welfare
INE	Natioal Institute for Statistics
INERF	National Institute for Rural Engineering and Forestry
INGRH	National Institute for Water Resource Management
INIDA	National Institute for Agricultural Development
INMG	National Institute for Meteorology and Geography
JICA	Japan International Cooperation Agency
KfW	Kreditanstalt für Wiederaufbau
MADRRM	Ministry of Environment, Rural Development and Marine Resources
MNECC	Ministry of foreign affair, cooperation and community
MOAVE	Empresa Pública de Moagem de Cabo Verde (Public Grinding Company of CV)
MORABI	Association of Women Development Support
NIC	National Institute for Cooperatives
OAF	Organization of Associations for Fogo
OADISA	Organization of Associations in Santo Antão Island
OASIS	Organization of Farmers and Breeders in the Santiago Island

AU	African Union
EU	European Union
WTO	World Trade Organization

2. Glossaries

CNIDA	National Agricultural Information Center
EC	Electrical Conductivity
ECV	Cape Verde Escudos
EDA	Strategy for Agricultural Development
ENSA	National Strategy for Food Security
GDP	Gross Domestic Product
GIS	Geographic Information System
GDI	Gender Development Index
HDI	Human Development Index
IPM	Integrated Pest Management
LDC	Least Developed Country
M/M	Minutes of Meeting
NDPs	National Development Plans
NGO	Nongovernmental Organization
NEPAD	New Partnership for Africa's Development
PEDA	Strategic Plan for the Agricultural Development to 2015 and Action Plan from 2005 to 2008
PNIMP	Nacional Program for middle term Investment
PNSA	National Food Security Program
PRSP	Poverty Recuction Strategy Paper
S/W	Scope of Work
ZAE	Agro-Ecologivcal Zones

Exchange Rate of Foreign Currency

Euro $1.^{00}$ = CV Escudos $110.^{265}$

(Dec, 2010)

Summary

Chapter 1 Introduction

1.1 Background of the Study

The Republic of Cape Verde (hereinafter referred to as CV) belongs to Sahel zone with approximately 200 to 500 mm annual rainfall. Steep mountains cover almost half the country, with only 11.0 percent of the territorial land occupied by the cultivated land. For these reasons, food self-efficiency ratio marks as little as 10-15 percent, and agricultural sector only takes 8.0 percent of GDP.

1.2 Objectives

Objectives of this Study are described as follows:

(1) to formulate action plan(s) for the integrated rural development by the study of Watersheds on Santiago Island with promoting the effective utilization of natural resources as well the identification and implementation of pilot projects, and

(2) to enhance the institutional capacity of national counterpart personnel through on-the-job training in the course of the Study.

1.3 Study Area

This Study will cover entire areas of Santiago Island and targeted Watersheds.

1.4 Counterpart Organizations

Counterpart organizations are in the Ministry of Environment, Rural Development and Marine Resources (hereinafter referred to as MADRRM):

Administrative organization: General Directorate of Planning and Budgetary Control (DGPOG)
Implementing organization: General Directorate of Agriculture, Forestry and Livestock Breeding (DGASP)

1.5 Scope of the Study

This Study is implemented based on the Scope of Work (S/W) and Minutes of Meeting (M/M) agreed and signed on the 9th of February 2007 by DGPOG, MADPRM which is a counterpart organization.

Chapter 2 Profile of Cape Verde and its Agricultural Sector

2.1 Profile of Socio-economic Situation in Cape Verde

Area: 4,033 km^2, Population: 500,000, Language: Portuguese (Official)

Economic Situation: With the stable politics and free economy, CV has marked moderate economic development. CV has graduated from the Least Developed Country (LDC) at the end of 2007 and it attempts to tackle approaches for the smooth economic transition.

2.2 Profile of Organizations Involved

Ministry of Environment, Rural Development and Marine Resources (MADRRM): Ministry of Environment, Rural Development and Marine Resources (MADRRM)), which is the counterpart of this Study, is composed of three General Directorates (General Directorate of Planning and Budgetary Control: DGPOG; General Directorate of Agriculture, Forestry and Livestock: DGASP; and General Directorate of Environment: DGA). MADRRM administrates four Independent Administrative Agencies (National Institute of Water Resource Management: INGRH; National Institute of Agricultural Development: INIDA; National Institute of Rural Engineering and Forestry: INERF; and National Institute of Meteorology and Geography: INMG). Regarding others, there are 11 Agricultural Local Offices as external organizations of MADRRM.

General Directorate of Planning and Budgetary Control (DGPOG): DGPOG, coordination body of this Study, is a directorate which administrates planning budget for the projects implemented by the MADRRM.

General Directorate of Agriculture, Forestry and Livestock Breeding (DGASP): DGASP, which is responsible for the agricultural sector and its dissemination in CV, is the counterpart organization of this Study.

National Institute of Agricultural Development (INIDA): INIDA has been engaged in various activities in agriculture and environment, studying agricultural science and natural resources sector.

National Institute of Water Resource Management (INGRH): The contents of duties of INGRH include planning, coordination, and integrated management of water resources.

2.3 Profile of Agricultural Sector

Agriculture in Cape Verde: In the area of national land of CV, only 43,943 ha, which corresponds to 11% of the total land, is the cultivable lands. Among the areas, those with the irrigation facilities accounts for 3,236 ha, whereas the rain-fed cultivation is practiced in other 40,317 ha. 68% of total population habituates in the rural areas, and 60% of the total population lives relying on agriculture.

Supreme Plans of the Study: the important supreme plans in elaborating this Study are extracted as follows,:

(1) Strategy for Economic Development and Poverty Reduction: DECARP (2004)
(2) Strategy for Agricultural and Rural Development- PEDA-
(3) Profile of Investment Plan
(4) National Action Plan for Convention to Combat Desertification

Cooperation with Other Donors: In CV, FAO, the Government of Austria, AfDB (African Development Bank), ABEDA (Arabic Bank for Economic Development in Africa); KfW (Kreditanstalt fur Wiederaufbau), MCC (USA), etc implement unique programs and projects in agricultural development sector, including watershed management and improved agricultural productivity.

Rural Communities in CV: People in CV have been afflicted with the harsh and historical pressure (harsh droughts, slavery system, and arrogant politics by Portuguese for 500 years), feeling that they had been betrayed after the consecutive years of independence. Consequently, individualism seems to pervade among people in CV.

Chapter 3 Study Area

3.1 Santiago Island

Santiago Island, which is the study area of this Study, is the largest island (with an area of 991 km^2) located in the southern part of Cape Verde. It has the largest population among the islands (277 thousands, or 55% of total population: 2007), and its capital, Praia, is located in the far south.

3.2 Social Condition

Administrative Division: Santiago Island is composed of nine counties as administrative division, namely: Tarrafal, Santa Cruz, Santa Catarina, São Miguel, São Domingos, São Salvador do Mundo, São Lourenço do Órgãos, Praia and Ribeira Grande-Santiago.

Land Ownership: There are many landless farmers in Cape Verde, who practice sharecropping and tenant farming.

Gender: More and more women in CV have been participating in nation development through the contribution to industry, agriculture, science, culture, education and public sanitation at local level.

Poverty: The results of "Inquiry for Family Income and Expenditure (FIDA 2001/2002)" by National Institute for Statistics (INE), 37% of total population is in poverty and 20% is in extreme poverty.

3.3 Natural Conditions and Agriculture

Zone of Agro-Ecology (ZAE) and Precipitation: The territory of CV is classified into Agro-Ecological Zones (ZAEs) according to rainfall and altitude, underlining the potential for each of the agricultural areas.

Zone of Agro-Ecology (ZAE)	I	II	III	IV	V
	Coast ZAE	ZAE Sub-Interior	ZAE Interior	Highland ZAE	Zone of Irrigation
Climate	Arid	Semi-arid	Semi-humid	Humid	
Altitude (m)	0 to 600 m	200 to 1,400 m	200 to 2,500 m	1,000 to 1,750 m	
Annual Precipitation (mm)	< 200 mm	200 to 400 mm	400 to 600 mm	> 600 mm	
Agriculture	Rain-fed Agriculture				Irrigation
		Corn Kidney beans Cucumber Feijão Fradinho	Pigeon Pea Rootstock/ Tuber Horticulture Fruit	Café Pigeon Pea Horticulture Fruit Rootstock/ Tuber	Sugar Cane Horticulture Banana Rootstock/ Tuber Fruit
Livestock	Goat (Extensive Cultivation)		Goat (Intensive Cultivation)		
Capacity for Cattle Breeding UBT: Tropical Cattle Unit (1 UBT = 250 kg)	0.02 UBT/ha	0.09 UBT/ha	0.35 UBT/ha	0.91 UBT/ha	1.01 UBT/ha

Condition of Soil Conservation: Soil conservation facilities found in the valleys, hills and mountain streams are rubble works, planting works, debris barriers (gabions or stone), and terraces.

Use of Water: In CV, residents are accustomed to pay for water to some extent, since it is considered as a major priority for their daily lives.

Agriculture: In Santiago Island, agriculture is practiced on family base, and most of the farmers practice rain-fed agriculture (22,128 ha). On the other hand, irrigated agriculture mainly by ground water is practiced in a part of the areas (1,220 ha).

Livestock Breeding: In Santiago Island, most of the farmers are engaged in livestock breeding. The main livestock animals are cattle, goats, sheep, pigs and chickens.

Forestry: As a result of 25 years of intensive forestation, tree-planting activities have been expanded to utilize 20 % of forest land, only 1% of which used to be afforested.

Distribution System: As for the distribution of agricultural produce in Santiago Island, there is no wholesale market. Local collective retailers are mainly purchasing vegetables by farmers with relatively large productivity. Sometimes, they buy agricultural produce from small-scale farmers and far-reached rural areas.

Processed Agricultural Produce: The most practiced food processing in Santiago Island is the manufacture of brandy known as grog.

Community Associations: Community associations based on a unit of village (zone association) (hereinafter referred to "ACB", popular name: "Associação") are basically organized in each zone. OASIS (Organization of Farmers and Breeders in Santiago Island) consisting of several ACBs, was established in 1995, and has been in operation until now.

Rural Extension: DGASP in MA DRRM is responsible for agricultural development and its dissemination in CV. MADRRM operates 4 Agricultural Local Offices in Santiago Island, and

technical engineers and extension officers are engaged in the extension services.

3.4 Target Watersheds

Screening of Target Watersheds: Santiago Island harbors more than 100 watersheds in total. This study conducted screening 10 highly prioritized watersheds agreed upon the Terms of Reference, and selected the watersheds to be studied for the elaboration of Action Plan.

In screening the watersheds, five criteria were set for selection of watersheds in negotiation with the executing organization, and discussed according to the criteria described below. As a result of this, 7 out of 10 watersheds were selected: 1) São Domingos; 2) Boa Estrada/Santa Cruz; 3) São Martinho Grande; 4) São João Baptista/Santa Ana; 5) Charco; 6) Cumba; and 7) Ganchemba/Ribeira da Barca.

Study of Selected Watersheds: The study team conducted rural social appraisal on selected 7 watersheds.

3.5 Classification of Watersheds and Selection of Model Watershed

Classification of Watersheds: It is not feasible to classify seven watersheds neither by the cobweb chart analysis nor the characteristics of precipitation. Hence, this study has decided to recognize the whole seven watersheds as one classification.

Selection of Model Watershed: Among the remaining 4 watersheds, only São Domingos and Ganchemba/Ribeira da Barca include ZAE IV. As a result, São Domingos has been selected as a model watershed due to its large number of associations.

3.6 Model Watershed

Profile of São Domingos Watershed is shown below:
Areas: 44.3 km^2
Length of basin: approximately 16 km (Altitude of the highest peak: 813 m)
Annual Precipitation: Approximately 360 mm
Population : 5,048 habitants (Poverty ratio: 52.6%)
Number of Associations: 12
Number of Communities: 10
Cultivated Areas: 694 ha (Rain-fed agriculture: 594 ha; Irrigated agriculture: 100 ha)

Quality of Water (EC and pH)

In accordance with the chronological changes of EC of the wells, it could be estimated that EC in the ground water of Santiago Island was originally high. Water is categorized in alkali in terms of pH.

EC and pH of Soil in Watersheds

As for pH, irrigated soils show more than pH 8, which might be correlated to the value of pH 8 of the irrigation water.

Chronological Changes in Annual Precipitation

It cannot be proved that the annual precipitation in São Domingos has been decreasing during the 20 years.

Agriculture in Model Watershed

(1) ZAE IV

Most of the farmers are highly depending on the rain-fed agriculture, due to the limited ground water for agriculture and the moderate amount of rainfall in ZAE IV located in the highest altitude of the Watershed.

(2) ZAE III

In ZAE III, which is the second highest zone after the ZAE IV, irrigated vegetable cropping using spring water and shallow wells at the bottom of the valleys are popular in addition to the rain-fed agriculture on the slopes.

(3) ZAE I and II

Since precipitation and spring water are limited, ground water and small rainfall are the major sources for agriculture.

Chapter 4 Development Constraints

4.1 Development Constraints, Measures and Strategies in Supreme Plan

In elaborating action plan, 'Strategic Plan for the Agricultural Development to 2015 and Action Plan from 2005 to 2008 (PEDA)' and 'National Program of Medium Investment Plan (PNIMP)' shall be under consideration to create concrete action plan for integrated rural development in watersheds in Santiago Island.

Development Constraints and Measures in Watersheds: PEDA states "development constraints and measures to be taken to realize integrated rural development on sustainable agriculture utilizing natural resources and soil and water conservation". The followings are the items to be concerned strikingly.

Lack of Water Resources (water saving irrigation, recharge of groundwater, water resources development, human resources training), Salinization (species capable of resisting sale damage, saving irrigation, regeneration of groundwater), Degradation of Pasture (livestock varieties resistible against draughts, intensive livestock breeding, new varieties of forage), Low Agricultural Production (water saving irrigation, livestock management, farm management)

Rural Development Strategies in Watersheds: PEDA elaborates sectoral strategies for agricultural development, considering the hindering factors described.

Vegetable **(**integration of agriculture, forestry and livestock breeding, hydroponics, value-addition to agricultural produce), Livestock Breeding (integrated, intensive, diversified and value-added livestock breeding), Forestry (sustainable forest management, agro-forestry, value-addition to forestry), Water Resources (reappraisal and understanding of present situations of watersheds, water resources management, irrigated agriculture management, integrated development of water resources), Rural Activities (management of community environment, promotion of local handicraft industry, diversification of production, development of rural tourism)

4.2 Development Constraints in Model Watershed

Lack of Water Resources: Although rainfall in the rainy season (August to October) enables rain-fed agriculture in the upper stream of the river (ZAE IV and III), yields of crops and vegetables are restricted due to the limited and precarious precipitation (average annual precipitation is about 360 mm). Available water resources are limited to the spring and ground water, since it scarcely rains during the 9 months of dry season.

In the current situation, rainwater in the upper stream of the river directly flows into the ocean without benefitting ZAE I and II. There is a possibility of utilizing the final effluent.

Salt Damaged Land: Since ZAE I is located along the coast, the salt damage is observed, and there is a lot of agricultural land with little yield or abandoned fields scattered in the area. It is required to study the possibility of yield restoring and crop cultivation in the salt damaged land.

Inappropriate Management of Infrastructure: Water leakage from pipeline is observed here and there. Proper management of infrastructure can prevent the wasted consumption of water resources.

Inappropriate Management of Natural Resources: The lack of consciousness of local residents towards the management of natural resources leads to the inadequate integrated management of natural resources.

Soil erosion should be restricted by soil conservation works such as terraces. As mentioned before, the rainfall directly flows to the ocean. Construction of soil conservation works limits the runoff ratio of rainfall and recharge of the ground water at the same time.

Devastation of Pastoral Land: Due to the scarce and erratic rainfall, forage as the feed is insufficient. In addition to this, extensive grazing and uncontrolled livestock breeding cause devastation of the pastoral land, this, in consequence, leads to the chronic shortage of fodders. It also causes soil erosion. Therefore, it is necessary to keep cow, pigs and chickens in the pens, instead of the extensive breeding of cows and goats.

Surplus of Agricultural Produce: Supply to the market is concentrated between the rainy season and the beginning of dry season, when agricultural produce are at their peak. Hence, the market price decreases in this particular season, and the average grade goods loose their value and are wasted. Therefore, by processing such produce, they can serve as storage food for security, and the increase in the income of farmers can be expected by selling the processing goods.

Fragility of Commercialization Structure for Agricultural Produce: Producers are apt to be disadvantaged in negotiation with middlemen and retailers amid the absence of public services for market information of agricultural produce. Implementation of cooperative shipping system by the agricultural associations is required for producers to take advantage of the system.

Social Problems: People in CV feel that they have been discriminated in the historical agony (heavy droughts, slavery, despotism by Portuguese for 500 years), and have been betrayed by the government ever since the independence. There are a lot of female headed households, since significant numbers of

people are emigrated overseas, most of which are consisted by men.

Landless Farmers: Landless farmers account for 65% of all the farmers practiced in Santiago Island.

Problems of ACBs: Community associations（ACBs）in Santiago Island, considerably different from the ones generally referred to, have been formed as umbrella organizations which used to implement subsidiary projects (FAIMO) for the purpose of supporting the people in need.

Insufficient Agricultural Extension Services: Since knowledge and numbers of the extension officers are limited, it is difficult to discuss that farmers can gain full-fledged techniques and knowledge from the extension services currently.

Chapter 5 Draft Action Program

5.1 Elaboration of the Draft Action Plan

This study extracts the constraints for integrated rural development in São Domingos Watershed which is the model watershed, clarifies the problems, and elaborates the Draft Action Plan (Development Plan) as their solutions.

5.2 Basic Policy for Development

The biggest obstacle in this studied area lies in the lack of agricultural water with limited rainfall, and the shortage of arable lands because of the steep landscape. Therefore, this Action Plan attempts to develop plans for efficient use of water resources and soil and water conservation, with the preparation of the extension services to realize the main objective, and awareness creation of rural residents. Additionally, measures for salt damage and rationalization of market distribution shall be included. Capacity building of the government officials including extension officers in rural communities is also the clue for the realization of this project. Development of human resources shall be included in the Action Plan.

On the other hand, farmers themselves must recognize the importance of this project and take responsibility of managing the projects in order to prove sense of sustainability. Therefore, this project actively promotes the involvement of rural population to grasp the needs of farmers. It employs participatory methods to hear ideas and inquiries from farmers to reflect the project from project making till its execution.

Use of Natural Resources in Watersheds

(1) The model shall consider entire watershed as a unit of water resources and enable distribution of water resources in the upper stream to other ZAEs.
(2) This study will not consider the possibility for expansion of the arable lands by exploitation of groundwater.
(3) This plan shall not include infrastructure development which requires high initial investment, since it attempts to implement sustainable development project with low cost techniques.
(4) This model attempts to increase the irrigable lands by surplus water from introduction of water-saving irrigation, in terms of good use of limited agro-water, which is the biggest

concern.

(5) This model shall introduce agro-forestry development in order to efficiently use forests which are necessary for soil conservation and groundwater recharge.

Support for Agriculture: This project aims at capacity building and awareness creation of the rural residents through Group Leaders Training and Capacity Building and Awareness Creation of Community. It attempts to strengthen the capacity of extension officers and the awareness of farmers by Extension among Farmers and Improvement of Extension System, and to extend the projects to other ZAEs in the other watersheds.

5.3 Selection of Draft Action Programs

Problems and Solutions: The study team extracted the development constraints through reviewing existing documents, social survey, field study conducted by the study team and consecutive interviews; clarified the problems faced by each ZAE for elaborating the Action Plan; and sorted out the Action Programs.

ZAE I: Problems: Lack of Water Resources; Salt Damaged Lands; Devastation of Pasture Lands

Solutions: Introduction of Water Saving Irrigation; Water Saving Irrigation Training; Measures of Salt Damaged Farm Recovery; Management of Adequate Pasturage

ZAE II: Problems: Lack of Water Resources; Devastation of Pasture Lands

Solutions: Introduction of Water Saving Irrigation; Water Saving Irrigation Training; Small-scale Water resources Development; Management of Adequate Pasturage

ZAE III: Problems: Lack of Water Resources; Inappropriate Management of Natural Resources; Devastation of Pasture Lands

Solutions: Introduction of Water Saving Irrigation; Water Saving Irrigation Training; Small-scale Water resources Development; Soil and Water Conservation; Management of Adequate Pasturage

ZAEIV: Problems: Lack of Water Resources; Inappropriate Management of Natural Resources; Devastation of Pasture Lands

Solutions: Small-scale Water Resources Development; Soil and Water Conservation; Agro-forestry; Management of Adequate Pasturage

Entire Watersheds: Problems: Surplus of Agricultural Produce: Fragility of Shipment System of Agricultural Produce; Problems of ACBs; Inappropriate Agricultural Services

Solutions: Processing of Agricultural Produce; Rationalization of Market Distribution; Group Leaders Training; Capacity Building and Awareness Creation of Community; Extension among Farmers; Improvement of Extension System

Two Models: This Study elaborates the Action Plan based on two models.

i) Natural resources (especially water) management model applicable to other watersheds: **Model 1**

ii) Model of integrated rural development for each Zone of agro-ecology (ZAE) applicable to other watersheds: **Model 2**

Programs Composing Draft Action Plan: The following is the profile of the programs that are the selected components of the Draft Action Plan.

Action Programs	ZAE	Model	Contents
Integrated Rural Development in Watersheds			
Sustainable Use of Natural Resources			
1. Soil and Water Conservation	III, IV	1, 2	To restore land by various conservation works
2. Small-scale Water Resources Development	II, III, IV	1, 2	Water-harvesting : facilities to capture rainwater Water-spreading : facilities to capture invalid effluent water
3. Measures of Salt Damaged Farm Recovery	I	1, 2	To restore arable land through desalinization
4. Agro-forestry	IV	1, 2	To cultivate pasture by cleaning bottom of forest
5. Introduction of Water Saving Irrigation	I, II, III	1, 2	To increase the volume of production per unit of water by introducing water saving irrigation
6. Management of Adequate Pasturage	I, II, III, IV	1, 2	To prevent pasture land by pig breeding in pens
7. Water Saving Irrigation Training	I, II, III	1	To introduce various techniques for water-saving irrigation and train for implementation methods
Storage and Processing of Agricultural Produce			
8. Processing of Agricultural Produce	I, II, III, IV	2	Processing and sales of surplus or second grade agricultural produce
9. Rationalization of Market Distribution	I, II, III, IV	2	Stability of sales price by collective marketing
Agricultural Support Services			
Farmers Associations and Communities			
10. Group Leaders Training	I, II, III, IV	1, 2	Awareness creation as group leaders Acquisition of basic techniques as group leaders
11. Capacity Building and Awareness Creation of Community	I, II, III, IV	1, 2	Reinforcement of capacity building and awareness creation of community
Extension System			
12. Extension among Farmers	I, II, III, IV	1, 2	Extension by farmers to other watersheds
13. Improvement of Extension System	I, II, III, IV	1, 2	Preparation of agricultural manual and extension agricultural techniques by the manual

5.4 Environment

Legal Framework of Environmental Impact Assessment in CV: The government of CV declares that the "the government shall always implement environmental impact assessment, endorses the diversity of the organism species, and conserve characteristics of eco system, not only for the conservation of indispensable natural heritage, but also for qualitative improvement of health and livelihood of each community", based on the Order of Environmental Impact Assessment, endorse the Council on 6 of March, 2006, No. 29.

Scoping of Environmental Impact Assessment: The scoping to identify potential impact for natural and social environment, and to propose mitigation measures of the impacts was conducted.

Chapter 6 Pilot Project

6.1 Objectives of Pilot Project

The objectives of the Pilot Project lies in the confirmation of the feasibility of each Action Program proposed in the Draft Action Plan drawn up and the verification of concrete development methods of the watersheds. To perform these objectives, the small projects of the Programs shall be implemented, the output of the implementation shall be reflected to the Draft Action Plan and the feasible final Action Plan shall be drawn up.

6.2 Selection of Pilot Project Components

Pilot Project Components were selected out of the Action Programs proposed in the Draft Action Plan, through workshops with target farmers to figure out their needs and counterpart meetings, in consideration of the following conditions: 1) that the projects shall be small enough to obtain the outcome within the study period (2 years): 2) that the validity of implementation of the projects can be secured: and 3) that the problems to be solved are included.

Relation between the Draft Action Programs and Pilot Project Components are shown below;

Action Programs / Pilot Project Components		Soil and Water Conservation	Water-harvesting	Leaching of Salt Damaged Farm	Small Scale Water Resource Development	Water-saving Irrigation/Water Management	Forage Cultivation with Forest Conservation	Agricultural Produce Processing	Rationalization of Market Distribution	Group Leaders Training	Extension among Farmers	Improvement of Extension System
1	Soil and Water Conservation Project	○								△	△	△
2	Small-Scale Water resources Development Project		○	○	○					△	△	△
3	Project for the Measures of Salt Damaged Farm Recovery			○						△	△	△
4	Agro-forestry Project						○			△	△	△
5	Project for the Introduction of Water-saving Irrigation					○				△	△	△
6	Project for the Management of Adequate Pasturage		△				△			△	△	△
7	Training for Water-saving Irrigation Project					○				△	△	△
8	Project for Storage and Processing of Agricultural Produce							○		△	△	△
9	Project for Rationalization of Market Distribution								○	△	△	△
10	Project for the Group Leaders Training									○	△	
11	Project for Awareness Building of the Communities									△	△	
12	Project for Extension among Farmers									△	○	△
13	Project for Improvement of Extension System										△	○

○: Indicates the direct relationship between the action programs and the components of Pilot Project.

△: Indicates the implicit relationship between the action programs and components of Pilot Project.

6.3 Implementation Organization of Pilot Project

The implementation organization of the Pilot Project is composed of following three committees:

- Local Coordination Committee
- National Organization Committee (National Government Level)
- Steering Committee

6.4 Project Component: Soil and Water Conservation

In order to evade natural devastation due to soil erosion and to conserve arable lands, soil and water conservation project was implemented at the upstream area of river. The project team observed the conservation effects of the works, corresponding to the national policy where the conservation of national land was promoted. Moreover, this project can contribute to the farmers' income earning via cultivation of fruit and beans and is environmentally necessary. Hence, the Study Team concluded that it is a high-priority project.

6.5 Project Component: Water-harvesting

This project attempts to make good use of rain water, most of which directly flows into the sea, capturing it before it enters into rivers by water-harvesting. The surface water which flows over the road was successfully restored in the reservoirs. However, stored water in this season was not used at the final evaluation, since abundant rainwater in this rainy season did not require supplementary irrigation. As for the growth of pasture grass, this study confirmed that rainfall was enough for the growth expected in this rainy season. Although the project itself is not prioritized, the Study Team places a high-priority on the cultivation of pasture grass.

6.6 Project Component: Leaching of Salt Damaged Farm

The study team implemented leaching to desalinize the salt damaged soil, using the flood river water which was diverted by the constructed facilities. It confirmed that the salt damaged land had been recovered and the efficiency of this project. Hence, the Study Team concludes that it is a high-priority project with the additional consideration that the project has the possibility of fertilizing the farm land.

6.7 Project Component: Small-scale Water Resources Development

This project aims at effective use of spring water which currently flows down without any good use due to insufficient facilities, capturing it before it enters into rivers, for the irrigation water in the downstream area. Since the demand for the supplementary irrigation was limited owing to the abundant rainfall in this wet season, the stored water was not used adequately. Besides, even after the dry season came, most of the water was not used, since the ACB was waiting for DGASP to provide ACB with the drip irrigation equipment for its demonstration farm using the water in the reservoir. Therefore, the result of this project has not been assessed, and the high priority cannot be placed on this project as the action programs for the final Action Plan. However, this project still has possibility to bring about its excellent result by the continuous support by the Government of CV. After obtaining the excellent result, this project shall be included into the Action Plan.

6.8 Project Component: Water Saving Irrigation/Water Management

The water saving irrigation experimental farm was set and its various techniques were introduced and implemented in this project. Also, the training on the water saving irrigation was carried out for proper management of the water resources. Since the water saving irrigation is rather new in CV, its method has not been fixed, and the basic data in implementing the water saving irrigation is not available. Through the implementation of the water saving irrigation experiment, more rational water saving will become possible and the data of water saving irrigation which have not been accumulated in CV will be collected. The data collected will promote the water saving irrigation which is described in the supreme plan. Good use of these basic data will realize the introduction of the water saving irrigation by farmers and it will contribute to the increase in farmer's living standard. Hence, the Study Team concluded that it is a high-priority project.

6.9 Project Component: Forage Cultivation with Forest Conservation

The project attempted both to conserve the forests and to secure the pasture grass as dried plants,

by means of cleaning them and sawing the pastoral grass for cultivating the pastoral lands. As a result of the implementation of this project, it was confirmed that pasture grass production in the conserved forest was possible and participation in livestock breeding by it would contribute to increase in farmer's living standard. Additionally, it was judged that this project was necessary for the environmental aspect, appropriate for the aspect of forest management and possible to be extended to the other watersheds. Hence, the Study Team concluded that it is a high-priority project.

6.10 Project Component: Agricultural Produce Processing

Generally, retail price of agricultural produce are decreasing, and low quality secondary produce lacks marketability, in the busiest agricultural season. This project aims at the value addition of the agricultural produce by processing vegetables and fruits. However, it became clear that the continuous implementation of this project by the farmers themselves was not easy due to financial difficulty and difficulties of material procurement, even its usefulness and the effectiveness were acknowledged. This project, therefore, does not meet the high-priority needs.

6.11 Project Component: Rationalization of Market Distribution

In the absence of public service on the market information, this project attempts to establish cooperative system and strengthen bargaining power in order not to be damaged in the sales of agricultural produce. The implementation of corrective collection and shipment of vegetables made its cost apparently low compared with it of individual shipment. Moreover, in the area where the collective action had not functioned due to mutual distrust, its possibility was acknowledged through the implementation of this project. The technical assistance from the administrations shall be required, since this project is a new attempt in CV and the farmers and ACB will compose the implementers in the coming project. The Study Team places a high-priority on this project.

6.12 Project Component: Group Leaders Training

This pilot project aims to cultivate awareness creation as leaders and to provide training on the basic knowledge in instructing group activities. Group leaders meetings were organized in line with the trainings. This project targeted 11 ACB group leaders in total in São Domingos Watershed. This project requires clear commitment by the Agricultural Local Offices to the group activities, and the necessity of the training on this sector is acknowledged. The Study Team places a high-priority on this project.

6.13 Project Component: Extension among Farmers

This project invited farmers to advanced rural areas, introduced newly developed techniques of production, conservation and marketing and provided opportunities to discuss the problems they face in the agricultural activities. Communication skill with local entrepreneurs and renovation of traditional cultivation techniques through the visit were fruits of this project. The Study Team places a high-priority on this project.

6.14 Improvement of Extension System

This project shall implement extension trainings necessary for the capacity building of them. Also, elaboration of manual for agricultural technologies will be required which farmers can refer to all the

time for new technologies. This project elaborates the technical manual to improve extension system. Participants considered that the project provided appropriate forum in transmitting good techniques to farmers. They also favorably evaluated that it gave ample knowledge to deal with social and technical interests of them. The Study Team places a high-priority on this project.

6.15 Extension of Pilot Project to Other Watersheds

The Action Plan elaborated in this study is not specifically applied to this model watershed of São Domingos, but it is applicable to other watersheds in Santiago Island. In CV, ETER of DGASP, responsible departments for rural extension, is in charge of confection of programs on agriculture and fisheries and broadcast them on TV or through the radio. This project attempted to use these information programs to disseminate the contents of this project, the contents of implementation schedule and outcome, to entire people in CV. Also, extension seminar was organized to disseminate the contents of implemented pilot projects and its efficiency to farmers in other watersheds of Santiago Island.

Chapter 7 Action Plan

7.1 Elaboration of Final Action Plan

In accordance with the lessons learned and experiences obtained through the implementation of pilot projects, the final Action Plan shall be drawn up. The action programs to be proposed in the Final Action Plan shall be selected from the projects with high priority, since the programs were implemented and their priorities were assessed as pilot projects.

7.2 Priority Action Programs

Reflecting the lessons learned and experiences from the implementation of the pilot projects, the priority action programs were selected as follows. The Final Action Plan is to be drawn up with these priority action programs.

- Soil and Water Conservation Project
- Agro-forestry Project
- Water-spreading Project
- Promotion of Water Saving Irrigation Project
- Management of Livestock Farming Project
- Rationalization of Market Distribution Project
- Group Leaders Training Project
- Extension among Farmers Project
- Capacity Building of Extension Officers Project

The followings are the programs which were not currently proposed as priority action programs.

- Small-scale Water Resources Development Project
- Processing of Agricultural Produce Project
- Capacity Building and Awareness Creation of Community Project

7.3 Action Plan

7.3.1 Model 1: Natural Resources (Especially Water) Management Model Applicable to Other Watersheds

This model focuses on the sustainable use of limited resources, chiefly both the lack of agricultural water caused by limited rainfall, and the lack of agricultural lands due to steep landscape. (The model of use of natural resources is described in the frontispiece "Conceptual Image of Action Plan - Model of Utilization of Natural Resources by Watershed".)

Soil and Water Conservation Project (ZAE III, IV): The scale of the facilities shall be 2.7 ha, considering the capacity of ACBs observed in the pilot project.

Agro-forestry Project (ZAE IV): Estimated targeted area is 2.7 ha, considering the capacity of ACBs observed in the pilot project.

Water-spreading Project (ZAE I, II): Targeted area shall be set as 1.0 ha at maximum in each ZAE from the experiences of the pilot project. If the depth of inundation is estimated as 100 mm, required volume of water shall be 1000 m^3. Considering that the floods continue 2.0 hours on average, and that setting maximum velocity of flow of the earth canals is as 0.6 m/s, required section of canals shall be 0.27 m^2, taking freeboard into account.

Promotion of Water Saving Irrigation Project (ZAE I, II, III): This project shall plan to expand the irrigated areas by introducing 2 ha of drip irrigation in each of the ZAEs. Regarding the irrigation facilities, other than equipments for drip irrigation and pipelines, collection pits in the upstream and regulating pits will be required. As for the experimental water saving irrigation farm, this project continuously experiments water saving irrigation in the experimental farm which was set during the pilot project in Acheda Baleia for the time being.

Group Leaders Training Project (ZAE I, II, III, IV): Training for leaders shall be implemented twice in each of the watershed area during the Action Plan (The first session: four days: the second session: two days). Group leader conferences shall be held in every four months.

Extension among Farmers Project (ZAEI, II, III, IV): Reflecting the lessons learned in the pilot project, the study team drew up following schedule targeting at each of the watersheds: set up of the tour; and organization of meting sessions (four days shall be allocated to each of the activities in the four zones).

Capacity Building of Extension Officers Project (ZAEI, II, III, IV): The training for extension officers will be organized twice (the first session: 5 days; the second session: 3 days) in each of the watersheds.

7.3.2 Model 2: Model of Integrated Rural Development for Each Zone of Agro-Ecology (ZAE) Applicable to Other Watersheds

This model aims at development of the integrated rural development in each ZAE to contribute to increase in agro-economy. (The model of integrated rural development is described in the frontispiece

"Conceptual Image of Action Plan - Model of Integrated Rural Development for (each ZAE) of Watershed".)

ZAE I: "Water-spreading Project" restores the salt damaged lands with desalination by leaching. "Promotion of Water Saving Irrigation Project" aims to augment the irrigation areas. Their implementation increases the agricultural produce. "Rationalization of Market Distribution Project" enables the decrease in the farmer's expenses alleviating the shipping cost of the cultivated agricultural produce. Thus, increase in agricultural produce and control of managing cost will profit agro-economy and bring about realization of increase in living standard. Three agricultural support programs are to be carried out for smooth implementation of the Action Plan.

ZAE II: "Water-spreading Project" enables cultivation of pasture grass. "Promotion of Water Saving Irrigation Project" aims to augment the irrigation areas by conveying the excess water in downstream area. "Management of Livestock Farming Project" realizes the promotion of livestock farming. Their implementation increases the agricultural produce. "Rationalization of Market Distribution Project" enables the decrease in the farmer's expenses alleviating the shipping cost of the cultivated agricultural produce. Thus, increase in agricultural produce and control of managing cost will profit agro-economy and bring about realization of increase in living standard. Three agricultural support programs are to be carried out for smooth implementation of the Action Plan.

ZAE III: "Soil and Water Conservation Project" shall be executed to conserve national lands and maintain ecosystem and to contribute to the recharge of the groundwater. Thus, the increase in the volume of spring water is expected in the downstream area. Combination of fruit cultivation shall generate income out of the sales of fruits. "Promotion of Water Saving Irrigation Project" aims to augment the irrigation areas. Their implementation increases the agricultural produce. "Rationalization of Market Distribution Project" enables the decrease in the farmer's expenses alleviating the shipping cost of the cultivated agricultural produce. Thus, increase in agricultural produce and control of managing cost will profit agro-economy and bring about realization of increase in living standard. Three agricultural support programs are to be carried out for smooth implementation of the Action Plan.

ZAE IV: "Soil and Water Conservation Project" shall be executed to conserve national lands and maintain ecosystem and to contribute to the recharge of the groundwater. Thus, the increase in the volume of spring water is expected in the downstream area. Combination of fruit cultivation shall generate income out of the sales of fruits. "Agro-forestry Project" shall be implemented in the protected forests to conserve recharging forests and to prevent the devastation of national land. It enables the production of forage crops. Their implementation increases the agricultural produce. "Rationalization of Market Distribution Project" enables the decrease in the farmer's expenses alleviating the shipping cost of the cultivated agricultural produce. Thus, increase in agricultural produce and control of managing cost will profit agro-economy and bring about realization of increase in living standard. Three agricultural support programs are to be carried out for smooth implementation of the Action Plan.

7.3.3. Implementation Plan of Action Plan

Implementation Plan of Action Plan shall be elaborated as an entire plan in one watershed, considering the watershed as one unit, integrating the Model 1 and Model 2 which are the fundamental elements of the Action Plan. Since it might be unrealistic to draw up the Plan for all the watersheds in Santiago Island considering there are more than 100 watersheds there, this Action Plan shall be drawn up in eight watersheds for five years.

Implementation Schedule: The Action Plan shall be implemented according to the following procedure:
Securement of Financial Resources → Selection of Target Watersheds and Elaboration of General Plan → Commencement of Extension Officers Training → Agreement with ACBs → Elaboration of Detailed Plan → Commencement of Group Leaders Training → Implementation of Action Programs → Monitoring and Evaluation

Estimated Cost: The cost of the Action Plan estimated in unit of watershed amounts to €175,867.-. Since the Plan will be implemented in two watersheds a year, the annual cost for the Plan amounts to €351,734.-. however, the total annual cost amounts to €368,022.-, adding €16,288.- of annual operating cost for continuous operation of the water saving irrigation experiment. Therefore, the total cost for the five years Plan amounts €1,488,000.-. (€368,022 x 4 years + €16,228 x 1 year).

Effects of the Project (5 years/8 watersheds): Major estimated effects by implementing the Action Plan are as follows.
Soil and Water Conservation Project: 43.2 ha of protected national land from being devastated and fruit trees growing, 17, 000 m^3 of the groundwater are estimated to be recharged
Agro-forestry Project: 21.6 ha of forest conservation and forage crops cultivation
Water-spreading Project: Increase in 16 ha of arable land and efficient use of 48,000 m^3 of water resources
Promotion of Water Saving Irrigation Project: implementation of 48 ha of water saving irrigation, 216,000 m^3 of excess water and increase in 24 ha of water-saving irrigated land

Project Implementation Organization: Local Coordination Committee, National Coordination Committee and Steering Committee compose the Project Implementation Organization.

Chapter 8 Conclusion and Recommendations

8.1 Conclusion

(1) This Study aimed to draw up the Action Plan for integrated rural development which contributes to feasible and sustainable agriculture and soil and water conservation, through good use of natural resources in the watersheds in Santiago Island. Based on the results of the projects, 9 feasible action programs which composed the Action Plan were proposed finally.

(2) Most of the action programs do not require high degree techniques and the staff members of the Government of CV are able to handle them with their technical level. Since the benefit in natural

environment and contribution to increase in farmers' living standard are anticipated and due to easy techniques, the implementation of the Action Plan is judged to be justified.

(3) The basic conditions for attaining the objectives of the Action Plan are provision of effective agricultural support programs, centering on human resources capacity building and proposed in the Action Plan by the Government of CV. To fulfill them, the Government shall not only mobilize competent local human resources but also obtain technical assistance from advanced countries, including assignment of specialists.

(4) The Action Plan follows exactly the policy of CV which sets forth the objectives of "promotion of soil and water conservation", " preservation and effective use of water resources", " measures against salt damage", "sustainable natural resources management", "reinforcement of marketing and inauguration by farmers' group", "reinforcement of human resources" and so forth.

(5) This project apparently improved technical and institutional capacity of counterparts and brought change in awareness of them. The study team invested its energy to interaction with farmers. As for the project of extension among farmers, it stimulated 101 farmers. As such, one of the objectives of the Study "capacity building of the government staff and the residents through the execution of the Study" was achieved. However, the technical assistance by the government of CV shall be continuously carried out.

8.2 Recommendations

Implementation of Action Plan: Nine programs proposed are commonly applicable to watersheds in Santiago Island and efficient for sustainable use of natural resources and integrated rural development for every ZAE. Hence, the Government of CV shall put his effort on promoting and extending the Action Plan.

Acquisition of the Budget: This study recommends the Government of CV to actively secure budget for the implementation of the Action Plan. Budgetary resources shall be primarily from the Government, and the counterpart fund of Japanese KR can be a suitable fund for the Action Plan.

Promotion of Water-saving Irrigation: One of the major obstacles in this Study Area lies in the lack of agricultural water with limited rainfall. It is strongly recommended to the Government of CV to focus on the promotion and expansion of water saving irrigation, as its introduction is efficient for enlargement of irrigation farmland of CV. The establishment of subsidy system as the means to promote its realization is also required for purchasing the equipment.

Continuation of Rationalization of Market Distribution: The initial purposes of this project were achieved during the implementation of the Pilot Project. As for its continuation, though ACB shall carry out it independently, it is needed to assist them not to loose their will to continue which has finally started to grow. Therefore, the awareness creation for this project to the extension officers who will be a driving force of the project shall be made.

Strengthening of Extension System: The famers came to feel the administration familiar through the

extension officers, and mutual trust between them has been strengthened. It is recommended that the relationship shall be enhanced and the sector shall be further strengthened.

Utilization of Manuals: In the Study, three manuals, namely "Rural Extension Manual" for capacity building of the extension officers, "Water Saving Irrigation Manual" to introduce the water saving irrigation smoothly and "Agricultural Produce Processing Manual" showing methods for agricultural produce processing. It is strongly recommended that the persons in charge to make good use of these manuals. Therefore, it is recommended that the priority shall be given to the extension officers who exceedingly need the manuals for receiving the manuals. The revision of the manuals shall be carried out by ETER of DGASP.

THE REPUBLIC OF CAPE VERDE
THE STUDY ON THE INTEGRATED RURAL DEVELOPMENT
IN WATERSHED ON SANTIAGO ISLAND

FINAL RPORT

TABLE OF CONTENTS

Table

Chapter 5 Draft Action Plan

Chapter 6 Pilot Project

Figure

Chapter 7 Action Plan

Chapter 1 Introduction

1.1 Background

The Republic of Cape Verde (hereinafter referred to as CV), situated in the 500 kilometer west of Senegal, 4,033 km^2 of the total land, is the insular country with 10 islands and 8 islets derived from a volcano with the population of some 0.5 million. The country extends from 14.8 to 17.2 degrees in the north latitude, and from 22.7 to 25.4 degrees in the west longitude; the climate belongs to Sahel zone with approximately 200 to 500 mm annual rainfall. Steep mountains cover almost half the country, with only 11.0 percent of the territorial land occupied by the cultivated land. For these reasons, food self-efficiency ratio marks as little as 10-15 percent, and agricultural sector only takes 8.0 percent of GDP (World Bank, 2008). GNI (Gross National Income) per capita is 3,130 U.S. dollars (World Bank, 2008) and Human Development Index of the Cape Verde ranks 121 out of 182 countries (2009), which indicate relatively high standard of living among the Sub-Saharan countries; however, remittances from the migrating workers occupies considerable amount of their income, and not only rural area, but also urban areas experience economic disparities between the rich and the poor. The ratio of impoverished people accounts for 37 percent of total population (the ratio of people under national poverty line[1], 2002), and most of them habituate in the rural areas.

In rural areas, farmers cultivate: sugarcanes, vegetables, fruits and food corns (national staple food), and beans by rain-fed cultivation. Little and unstable precipitation and unsuitable cultivation techniques cause smaller yields of production than the national demand, which limits the increase in the number of people engaged in the large-scale farming. Therefore, diversification of the agriculture, production of value-added agricultural produce, commercialization of agriculture, and diversification of income earning are of great importance in improving livelihood of farmers.

For these reasons, as mentioned above, the government of CV formulated 'Strategy for Economic Development and Poverty Reduction' in 2004 to put agriculture and rural development as political agenda, and has attempted to tackle the issue according to 'Strategic Plan for the Agricultural Development to 2015 and Action Plan from 2005 to 2008:PEDA (2004)'.

Santiago Island, the Study Area in this paper, 991 km^2 of island area, is home to a population of some 0.277 million people (2007). The capital city of Praia is situated in the southern part of the island. Annual average precipitation is less than 400 mm, and 74 percent of the island is categorized as arid or semiarid land. Stock breeding and rain-fed cultivation are mainly conducted in the slope land and the plain ground. In some parts of the Island, catchment and impounding facilities and terraced fields are equipped and small farmers are engaged in horticulture by means of drip irrigation. Yet, Santiago Island as a whole suffers lack of water resources and land runoff due to the climate and geographical features. Moreover, overgrazing and deforestation cause vegetation disturbance, which make it more difficult to use land and water resources. Therefore, efficient use of water resources, such as surface stream water, measures for land conservation, realization of sustainable agriculture through efficient use of limited natural resources have become urgent issues to solve.

[1] Annual living cost amounts less than 43,250 ECV.

In this background, the government of CV requested the government of Japan to conduct the development study on the sustainable integrated rural development in Santiago Island. In response to this, Japan has dispatched pre-study team in February, 2002, and agreed and signed Scope of Work (S/W) and Minutes of Meeting (M/M) in the 9th of February in the same year.

1.2 Objectives

Objectives of this Study are described as follows:

(1) to formulate action plan(s) for the integrated rural development by the study of Watersheds on Santiago Island with promoting the effective utilization of natural resources as well the identification and implementation of pilot projects, and

(2) to enhance the institutional capacity of national counterpart personnel through on-the-job training in the course of the Study.

1.3 Study Area

This Study covers entire areas of Santiago Island and targeted Watersheds.

1.4 Counterpart Organizations

Counterpart organizations are in the Ministry of Environment, Rural Development and Marine Resources (hereinafter referred to as MADRRM):

Administrative organization: General Directorate of Planning and Budgetary Control (DGPOG)

Implementing organization: General Directorate of Agriculture, Forestry and Livestock Breeding (DGASP)

1.5 Scope of the Study

This Study is implemented based on the Scope of Work (S/W) and Minutes of Meeting (M/M) agreed and signed on the 9th of February 2007 by DGPOG, MADPRM which is a counterpart organization.

Therefore, this Study shall take the following points stipulated in M/M into consideration:

i) Objectification of the contents of 'PEDA' and 'National Program of Medium Investment Plan: PNIMP as the action plan on the integrated rural development in Watersheds of Santiago Island;
ii) Proposal of natural resources (especially water) management model applicable to other watersheds. (Model 1)
iii) Proposal of integrated rural development applicable to other Watersheds in each unit of Zone of Agro-Ecology (ZAE); (Model 2)

This Study will conduct pilot projects for the purpose of interrogating the efficiency of action

plan and of capacity development of relevant counterparts in each unit of ZAE. Duration of this entire study is 32 months from January 2008 to August 2010 as four-year project. This study is composed of two phases. As shown below, analysis of present conditions of the Study Area and formulation of Draft Action Plan shall be executed in Phase 1; implementation of the Pilot Project, monitoring and evaluation are conducted in Phase 2, and all of which are reflected to the drawing up of the final action plan.

PHASE 1

① Execution of analysis of present conditions through various studies in each watershed and categorization of the watersheds;
② Selection of a model watershed out of categorized ones;
③ Formulation of the Draft Action Plan;
④ Preparation for the Pilot Projects.

PHASE 2

① Implementation of the Pilot Projects;
② Monitoring and evaluation of the Pilot Projects;
③ Confirmation of the methods to extend the actions of the Pilot Projects to other watersheds;
④ Reflection of the outcomes of the Pilot Projects into the Draft Action Plan, and formulation of the Final Action Plan.

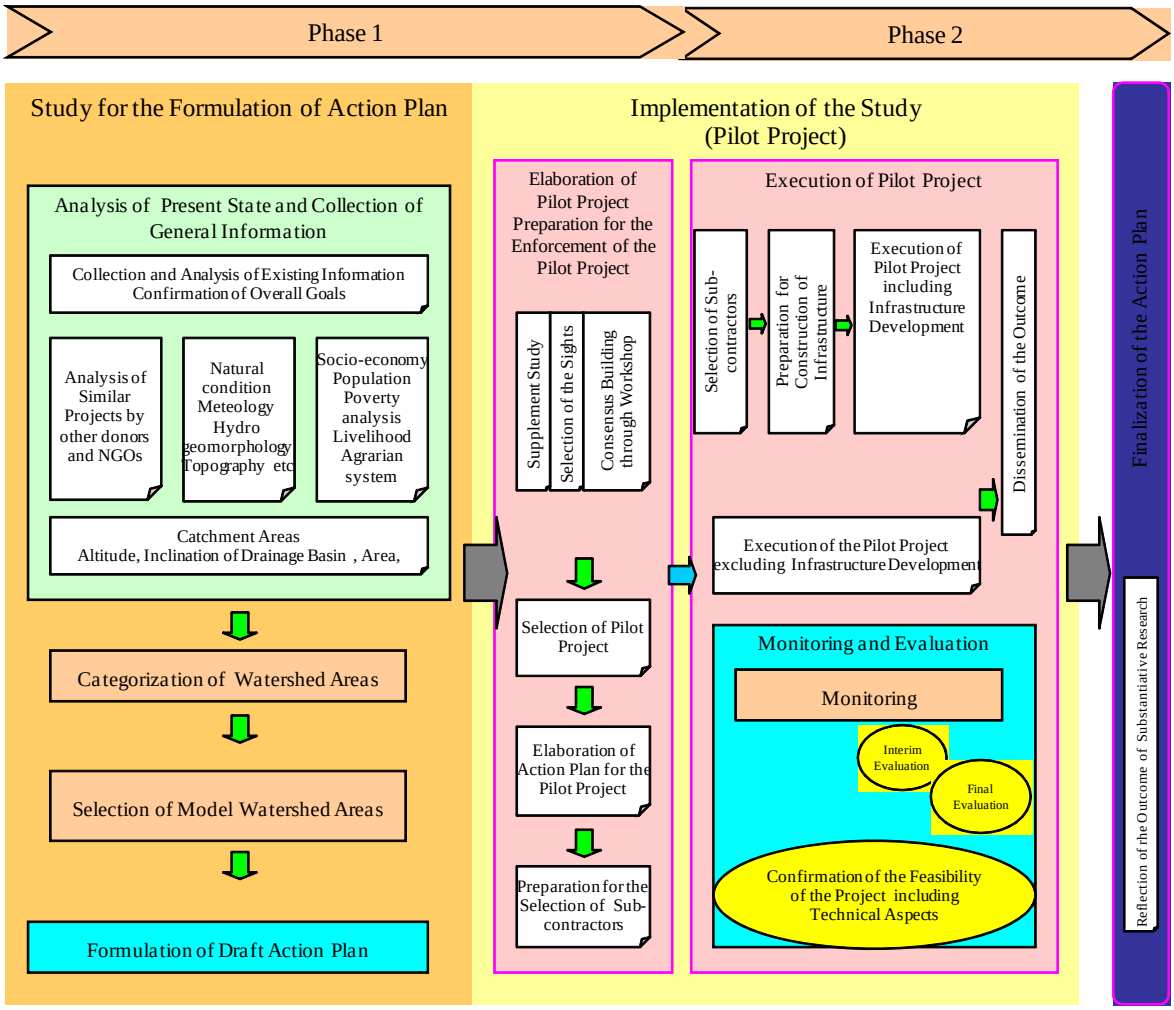


Figure 1.5.1 Framework of the Study

Chapter 2 Profile of Cape Verde and its Agricultural Sector

2.1 Profile of Socio-economic Situation in Cape Verde

General Profile of socio-economic situation in CV is explained below:

Table 2.1.1 Profile of Socio-economic situation in CV

General Profile	
1. Area	4,033 km^2
2. Population	500,000 (World Bank, 2008)
3. Capital city	Praia
4. Ethnicity	Descendents of Portuguese and African (70%)
5. Language	Portuguese (Official) and Cape Verdean Creole
6. Religion	Roman Catholic (98%)
7. History	XV Century Arrival of Portuguese shipment (Inhabited island in this era) 1963 Became external province of Portugal July/1975 Independence from Portugal December/1985 National election (3 mandates of Pres. Pereira) September/1990 Revision of Constitution (Transition to multi-party system) February/1991 Presidential Election (Elected: Pres. Monteiro) February/1996 Presidential Election (Elected: Pres. Monteiro) February/2001 Presidential Election (Elected: Pres. Pires) February/2006 Presidential Election (Elected: Pres. Pires)
8. Political Aspect	1. Since the independence (1975), monopoly of African Party of Independence of Cape Verde (PAICV) had continued; yet multi-party system had been introduced in September 1990, not only because the government considered state building (institutional building) had been completed, but also because of the external and internal political situation. In January 1991, public saw the first parliamentary election under the multi-party system, and Movement for Democracy (Movimento para a Democracia: MpD) obtained majority. Candidate Monteiro took office in the same year of February. In the next election in December, 1995, MpD won a landslide victory and Mascarenhas Monteiro was reelected in the presidential election in February, 1996. 2. However, in the parliamentary election of January, 2001, PAICV controlled the cabinet after the interval of many years. In the end, candidate Pires became the prime minister. PAICV, which was indulged in the opposition party, became ruling party for years of interval, and enjoyed the triumph in 2006. 3. Current Government of PAICV is the technocrat cabinet led by Dr. José Maria Neves who was the youngest prime minister in the history of CV.
Economic Condition	
1. Principal Industry	Agriculture (Banana and sugar cane); Fishery (Tuna and Lobster)
2. RNB	USD 1,560 million dollars (World Bank, 2008)
3. RNB per Capita	USD 3,130 dollars (World Bank, 2008)
4. Economic Growth	6.0% (World Bank, 2008)
5. Inflation ratio	5.4% (World Bank, 2008)
6. Gross Export	Export: USD 105.3 million dollars (EIU, 2008) Import: USD 883.7 million dollars (EIU, 2008)
7. Principal Trading Commodities	Export: fish, fishery products, garments and shoes Import: consumer products, intermediate products, investment products and petroleum
8. Principal Trade Partners	Export: Spain, Portugal, Holland, Morocco and The United Kingdom Import: Portugal, Holland, Spain, Italy and Republic of Cote d'Ivoire

9. Currency	Cape Verde Escudo (CVE) 1 EURO = 110.265 CVE
10. Economic Situation	With the stable politics and free economy, CV has marked moderate economic development. As an overall economic policy of the government, it aims finance improvement through decrease in public deficit; implementation of the tax benefits to the major industry; macro-economic stability; promotion of the Foreign Direct Investment (FDI), and improvement of social service. CV has graduated from the Least Developed Country (LDC) at the end of 2007 and it attempts to tackle approaches for the smooth economic transition.

Cited from the Ministry of Foreign Affairs, Japan

2.2 Profile of Organizations Involved

2.2.1 Ministry of Environment, Rural Development and Marine Resources (MADRRM)

Ministry of Environment, Rural Development and Marine Resources (MADRRM)), which is the counterpart of this Study, is composed of three General Directorates (General Directorate of Planning and Budgetary Control: DGPOG; General Directorate of Agriculture, Forestry and Livestock: DGASP; and General Directorate of Environment: DGA). MADRRM administrates four Independent Administrative Agencies (National Institute of Water Resources Management: INGRH; National Institute of Agricultural Development: INIDA; National Institute of Rural Engineering and Forestry: INERF; and National Institute of Meteorology and Geography: INMG). Regarding others, there are 11 Agricultural Local Offices as external organizations of MADRRM.

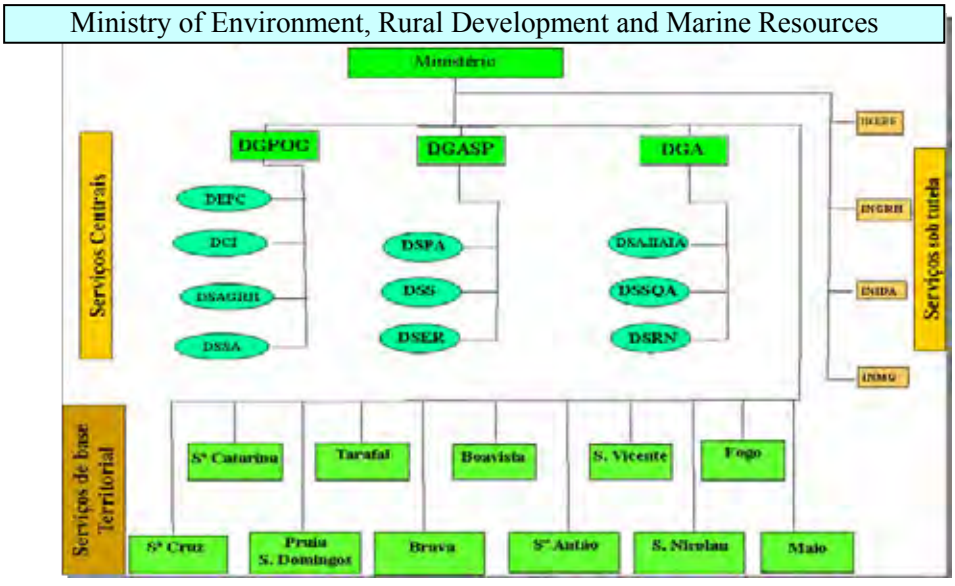


Figure 2.2.1 Organization Chart of MADRRM

2.2.2 General Directorates of MADRRM

In this section, this paper will show the brief introduction of organizations directly concerned for this Study: General Directorate of Planning and Budgetary Control (DGPOG) and General Directorate of Agriculture, Forestry and Livestock (DGASP).

(1) General Directorate of Planning and Budgetary Control (DGPOG)

DGPOG, coordination body of this Study, is a directorate which administrates planning budget for the projects implemented by the MADRRM. The principal activities are as follows:

1) Proposal of the basic design of rural development, agricultural policy, annual plan and interim plan;
2) Administration of the projects planned by MADRRM and preparation and administration of implementation of the national plan regarding agricultural sector;
3) Formulation of investment plan regarding agricultural sector, administration of the implementation of the plan, and elaboration of annual implementation plan;
4) Development of the statistics regarding agricultural sector in cooperation with the Bureau of Statistics and publication of the products;
5) Administration and international cooperation activities regarding agricultural sector;
6) Activities regarding food security.

(2) General Directorate of Agriculture, Forestry and Livestock (DGASP)

DGASP, which is responsible for the agricultural sector and its dissemination in CV, is the counterpart organization of this Study. DGASP is composed of three departments; Department of Agricultural and Stockbreeding (DSAP), Department of Forestry (DSS) and Department of Rural Engineering (DSER). Engineering officers and extension officers are dispatched to Agricultural Local Offices of MADRRM and carry out activities of agricultural extension. Principal activities are shown below;

1) Decision of the national policy regarding the agriculture, livestock-breeding and forestry;
2) Participation in the implementation of the project plans on agriculture, forestry, livestock breeding, rural development, agricultural research and development of watersheds;
3) Proposal of the legal regulations regarding agriculture, livestock-breeding and forestry, and effective promotion of the regulations;
4) Promotion of activities regarding the branding, improvement and protection of agricultural and livestock products;
5) Maintenance of the information provisional system with regards to the agricultural development techniques and budgetary assistances;
6) Implementation of the environmental protection plan for rural areas represented by the use of agrochemical, forestry management, land and water management, agrochemical management and deforestation.

2.2.3 Independent Administrative Organization of MADRRM

Among the Independent Administrative Organizations of MADRRM, this paper outlines the National Institute of Agricultural Development (INIDA) and the National Institute of Water Resources Management (INGRH) which directly concerns this Study:

(1) National Institute of Agricultural Development (INIDA)

Established as umbrella organization of MADRRM in 1979, 50 percent of the budget of INIDA is financed by the government. INIDA has been engaged in various activities in agriculture and environment, studying agricultural science and natural resources sector. Dissemination activities extend agriculture, forestry, livestock-breeding and environment aspects. Laboratories are placed for water, soil, Integrated Pest Management (IPM), anatomy cultivation, irrigation, horticultural seeds, Geographic Information System (GIS). National Agricultural Information Center (CNIDA) has been set up in corporation with Holland and information on agriculture in CV is collected. On establishment of the center, GIS is installed for a trial with assistance of Holland and has collected GIS information on population, roads, soil distribution map, and land use map surrounding watershed areas in Seca. With regards to other watersheds, information was considered to develop and collect with the ownership of CV; however, it remains untouched, due to the budgetary cut back.

(2) National Institute of Water Resource Management (INGRH)

INGRH, under the National Water Resources Committee chaired by the Minister of MADRRM, is responsible for water management in Cape Verde. The contents of duties of INGRH include planning, coordination, and integrated management of water resources. Also, the issue of certificates for water resources development and the levy of water intake allowance tax from the entire water intake facilities (deep wells, catchment dams, galleries, and shallow wells). However, the ratio of its levy is as little as 12%.

Operation and management of the facilities such as catchment dams, galleries, deep wells, are the mandate of INGRH. However, DGASP is the lead office in water resources in the watersheds and the Agricultural Local Offices are responsible for their management.

2.3 Profile of Agricultural Sector

2.3.1 Agriculture in Cape Verde

In the area of national land of CV, only 43,943 ha, which corresponds to 11% of the total land, is the cultivable lands. Among the areas, those with the irrigation facilities accounts for 3,236 ha, whereas the rain-fed cultivation is practiced in other 40,317 ha. 68% of total population habituates in the rural areas, and 60% of the total population lives relying on agriculture. Numbers of households engaged in agriculture account for 44,450, among which 22,461 households (50.5 %) are headed by women. In the entire country, 43% of the households engaged in agriculture have other professions than agricultural work.

Panorama of Agricultural Sector and Food Security

Although agricultural sector in CV creates 21 % of the domestic employment, contribution of agricultural sector to the GDP accounts for only 8.0%. As for the trade balance, export of goods and commodities amounts to 12 million USD (2003); on the other hand, 305 million USD of import indicates the extreme import surplus. Among the import, 34% (2001) of it accounts for food items.

Although domestic products of agricultural commodities vary greatly year by year, data in 2003 shows 18% of food sufficient rate based on the calorie and as little as 11% of self-sufficiency in grain. Annual consumption of corn (prime food) per person is more or less than 80 kg (excluding the feed grains), and that of polished rice and grains accounts for some 50 kg. Compared to the shift in the consumption of grains in the first half decade of 1970, difference in the consumption among three gradually diminished, as a result of the increase in the consumption of polished rice and cereals in 1990. Domestic production of rice and cereal crops is close to zero and the country depends on import. Corns are affected by unstable rainfall, which causes low food sufficient rate as a whole.

Although potatoes, sweet potatoes and cassavas are produced domestically, volume of production of potatoes does not meet the internal demand, hence CV depends largely on the import from Europe.

High yields of horticultural products in CV are tomatoes, leaf vegetables, onions, mangoes bananas, coconuts and papayas. Consumption of tomatoes has been increasing for these two decades, and domestic production has been increased to the amount that exceeds the amount of import as well. On the other hand, local production of onions has not been grown substancially; increased domestic demand is met by the import. Also, banana used to be an important source of foreign exchange, the current amount of production is not sufficient for export anymore. As for other horticultural products, few fresh fruits, mainly processed vegetables and fruits, are imported from Portugal; yet most of the horticultural foods are originated from Europe and South America.

Regarding the livestock products, production of meats of cows, goats, sheep grow at a sluggish pace, due to limited domestic supply of forage for the livestock products, which leads to the situation where animal protein derived from these animals does not satisfy the domestic demand; whereas import of processed meats, milk (including powdered milk) and chickens has been increased.

CV has officially become a member of World Trade Organization (WTO) in January 2008. This follows the tax reform, including trade tax in the beginning of 2004. Import tax (Direitos de Importação) has been reduced greatly in almost entire goods and 9% of tariffs (Emolumentos Gerais Aduaneiros) being levied to almost all goods were abandoned. Consumer tax (Imposto de Consumo) was also reconsidered, hence Value-Added Tax (hereinafter VAT: Imposto sobre o Valor Acrescentado) and Special Consumer Tax (herein after referred to SCT: Imposto sobre Consumos Especiais) had been adopted. VAT is set as 15 % (excepted for hotels and restaurants taxed by 6%), corns, rice, wheat, potatoes, beans, vegetables, fruit, meat, dairy products, eggs and medical care, education and recreation and agricultural related facilities are nontaxable. As for SCT, limited goods, such as luxury goods, fuel, old cars are taxable (varies from 10~150%). Although consumer index has been dropped with the decrease in the import tax, national coffers are required to break out of the dependence onto the tariffs.

Cape Verde has controlled national economy by establishing numerous public companies since the independence in 1975. Regarding agricultural distribution, two public companies were engaged in the circulation: EMPA (Empresa Pública de Abastecimento) is responsible for corns, rice, beans, sugar and milk and; MOAVE (Empresa Pública de Moagem de Cabo Verde) managed supply chain from procurement to distribution of wheat. In 1998, privatization of government corporations started, when review of all the public companies was conducted. Simultaneously, distribution of wheat has become

open to private sector which led to the liberalization of free market. Yet, situation of dependency on import of most of the food products continued, and National Agency for Food Security (Agência Nacional de Segurança Alimentar: ANSA) was set up to undertake national food security in exchange that two governmental corporations were privatized and demised. This agency is responsible for monitoring and advisory to the government on the upper limit of the price of staple food.

As a policy of food security, National Food Security Program (Programa Nacional de Segurança Alimentar PNSA 2006-2010) was formulated. This is based on the National Strategy for Food Security (Estratégia Nacional de Segurança Alimentar: ENSA 2015) and Strategy for Agricultural Development (Estratégia de Desenvolvimento Agrícola: EDA 2015) and Poverty Reduction Strategy Paper (PRSP 2004-2007).

2.3.2 Supreme Plans of the Study

Among the supreme plans concerned this Study, the most important objectives are described as follows:

(1) Strategy for Economic Development and Poverty Reduction- DECARP- (2004)

The government of Cape Verde elaborates DECARP which outlines poverty reduction through economic development. Most prominent policy concerns of this document are as follows:

① Economic development and stability;
② Decentralization;
③ Employment;
④ Development of agricultural sector;
⑤ Maximization of the impact of industrial sector;
⑥ Distribution of wealth and social protection;
⑦ Protection of environment.

The forth policy concern of "development of agricultural sector" indicates as follows:

① Promotion of sustainable agriculture based on efficient use of natural resources, such as water and soil, and the optimization of agrarian output (agricultural and extra-agricultural activities) for the betterment of the livelihoods of farmers;
② Promotion of agro-forestry-pastoral activities by adopting stable irrigation, intensive and verified agriculture and producing value-added agricultural products.

(2) Strategy for Agricultural and Rural Development - PEDA -

Ministry of Environment, Agriculture and Fishery (transformed into MADRRM in 2008) elaborates PEDA in 2004, in cooperation with FAO. Five items of priorities in PEDA are as follows:

① Access and Sustainable Management of Natural Resources
Utilization of water, land, biological community, and marine resources by strengthening agricultural infrastructure and sustainable management capacity;

② Improvement of Value-added Agricultural and Marine Products

Strengthening of storage, fabrication and distribution of agricultural and marine products; development of suitable infrastructure; and improvement of entrepreneurial capacity of private sector and farmer's association;

③ Reform of Agricultural Technical Services

Activation of participatory agricultural study for dissemination/development of appropriate technology;

④ Establishment of Favorable Socio-economic Environment for Development

Promotion of roles of public sector and rural associations; development of human resources in rural areas, and decentralization;

⑤ Actions for Counter-Famine and Malnutrition

Realization of emergency activities to assist sustainable development (adaptation of FAIMO[1])

As for the program reflecting priorities, two programs are proposed regarding agro-forestry and pastoral industries. Assistances from other donors are implemented in line with this concept:

Program 1: "Organization of Watersheds and Integrated Rural Development"

This program is important in the sense that it intimately relates to the development of human resources, in an environmentally conscious manner, in management of natural resources, society, economy and technology. The program permits communities to cultivate awareness for the transformation for new type of agriculture, and for sustainable use of natural resources gradually.

Program 2: "Utilization of Rural Resources for Agro-Forestry-Pastoral Development"

This is the development program in ZAEs of CV based on the characteristics of natural geology, topography, type of soil, and, living organism, and climate, according to the potential for development in each unit of ZAE to assist initiatives of local people for agricultural development. Components of this program are: ① development of locally managed infrastructure for the purpose of participatory land organization, and for multi-purpose use of superficial and ground water; ② economic technical assistance for producers by research and dissemination.

[1] FAIMO is the employment program for those who are suffering from poverty to include public jobs. The program not only conserves soil and water, but also gives opportunities for income generation of impoverished family. Especially, the program is efficient in year when droughts hit agricultural products. Dividend resources for the fee are accrued from the food assistances by international community.

Zone of Agro-Ecology (ZAE) of Cape Verde

Zone of Agro-Ecologies (ZAEs), related to the land use, are established in CV as follows:

Table 2.3.1 Agro-ecological Zones (ZAE)

Zone of Agro-Ecology (ZAE)	I	II	III	IV	V
	Coast ZAE	ZAE Sub-Interior	ZAE Interior	Highland ZAE	Zone of Irrigation
Climate	Arid	Semi-arid	Semi-humid	Humid	
Altitude (m)	0 to 600 m	200 to 1,400 m	200 to 2,500 m	1,000 to 1,750 m	
Annual Precipitation (mm)	< 200 mm	200 to 400 mm	400 to 600 mm	> 600 mm	
Agriculture	Rain-fed Agriculture				Irrigation
		Corn Kidney beans Cucumber Feijão Fradinho	Pigeon Pea Rootstock/ Tuber Horticulture Fruit	Café Pigeon Pea Horticulture Fruit Rootstock/ Tuber	Sugar Cane Horticulture Banana Rootstock/ Tuber Fruit
Livestock	Goat (Extensive Cultivation)		Goat (Intensive Cultivation)		
Capacity for Cattle Breeding UBT: Tropical Botanic Unit (1 UBT = 250 kg)	0.02 UBT/ha	0.09 UBT/ha	0.35 UBT/ha	0.91 UBT/ha	1.01 UBT/ha

Cited from: 'Strategic Plan for the Agricultural Development to 2015 and Action Plan from 2005 to 2008"

(3) Profile of Investment Plan

The Government of CV elaborates "Profile of Investment Plan" (2005), per unit of ZAE, as a guideline for development plan based on "Comprehensive Program for Agricultural Development in Africa: AU/NEPAD". Profile of Investment Plan aims at the environmental friendly, sustainable integrated rural development. Forestry and pastoral development in ZAE I and II and Agro-forestry development in ZAEs III and IV are deployed as policies, and preservation of water and soil, verification of agricultural products, and capacity development for farmer's associations comprise the components of the plan.

(4) National Action Plan for Convention to Combat Desertification

CV has been suffering from lack of water resources and landslide as chronicle problems, due to the climate and inappropriate management of natural resources. Also, vegetation disturbance due to overgrazing and deforestation makes it difficult to use limited water and lands. Cape Verde signed United Nation Convention to Combat Desertification, elaborating "National Action Plan" (2000) in order to engage in rural development for conservation of soil and water resources.

2.3.3 Cooperation of the Other Donors

In CV, FAO, the Government of Austraria, AfDP (African Development Bank), ABEDA (Arabic Bank for Economic Development in Africa); KfW (Kreditanstalt fur Wiederaufbau), MCC (USA), etc implement unique programs and projects. Concrete activities are illustrated as follows;

Table 2.3.2 Activities of Other Donors

Organization	Activities
FAO	FAO assisted elaboration of PEDA (2004). It also assisted formulation of "National Interim Investment Program" and "Profile for Project of Investment Plan" of Cape Verde, based on "Comprehensive Program of African Agricultural Development" supported by African Union (AU) and The New Partnership for African Development (NEPAD).
Austria	Austria implemented the "Integrated Project in Watershed in Ribeireta (2003-2005)", for the purpose of holistic management of water resources and farm land. This project is targeted at the farmer's associations in the watershed. It includes 1) Capacity development for holistic management of water resources; 2) Improvement of agricultural production technology and marketing promotion; 3) Water resources management; e 4) Improvement of sanitary environment. Based on the experiences of this project, "Plan for Integrated Development in Santiago Island (2006-2008)"is implemented in the watersheds of São Miguel, Saltos and Tarrafa for the purpose of capacity development of rural people, organization of water facilities verification/intensification of agricultural and livestock industries.
AfDB, ABEDA	These institutions co-finance "Project for Organization of Watersheds in Picos and Engenhos (2006 -)", targeted at Watershed in Picos, East Central part of the island, and Engenhos, West Central part of the island. The objective of this project is restoration of the soil by introducing soil conservation works (planting works and stonewalling works), construction of water facilities for water resources development, increase in the salary by augmented output of agricultural production. Implementation structure of this project is as follows: rural agricultural offices take charge of implementing and managing the pilot project: and technical officers and diffusers support of activities of ACBs in each farmer's organization. Rural Agricultural offices are responsible for coordination and implementation of the pilot projects.
KfW	PRNF elaborates projects financed by KfW and GTZ, for conservation of water and soil and improvement of agriculture and livestock breeding in cooperation with farmers' associations by means of participatory approach. In this project, Kfw assisted formulation of "Management Plan for National Park in Fogo" in elaboration of development approaches and strategies both for conservation of National Park in Fogo and for sustainable development. This management plan is currently utilized as an introductory text for elaboration of policy in national preservation districts.
USA – MCA Millennium Challenge Account (MCC)	As a part of watershed management and agricultural assistance programs, 47 weirs in total and 7 catchments are constructed in Mosteiros and Paúl. Also, 4 exhibitions of agricultural fields are established in the watersheds of Fajã in São Nicolau Island and of Paúl in Santo Antão Island. In Santo Antão Island, this program financed acquisition of equipments for laboratories of INIDA, whose purpose is to disinfest myriad of thousand leggers, in order to deactivate intermission of agricultural cropping in the island. Moreover, MCC supplied training for 800 farmers, planning of protection centers and technical assistance for implementation of drip irrigation of 111 ha of lands.
Others	EU and Canada implement food security programs; Suisse and Italy assist development of agricultural statistics (2003-2006); China constructs Poilão na Ilha dam in Santiago and Luxemburg supplies food assistances.

2.3.4 Rural Society in Cape Verde

Although society in CV is experiencing urbanization due to population explosion typical in the West Africa, in terms of demographic distribution, economic resources for subsistence, it still continues to be categorized as essentially a rural society. Rural society in CV is not the society which is homogeneous, isolated and less susceptible to the environment. In CV, the interplay between the

nature and history consists of the complex society. Complex society, here, externally indicates the society integrated into global economy, while internally means social and economic disparities within and between the islands. Diversified climate (especially droughts), slavery, and colonial rule by Portugal cause the formation of complicated society historically. This harsh reality characterizes rural community in Cape Verde and created the historically accumulated system based on the disparities.

Portuguese started to migrate to CV in the middle of the 15th century. Extremely harsh natural environment hinders agricultural development, initially indulging in the complimented position to the flourished commercial industry. The slavery trade directly and inherently affected the social formation of CV. For instance, mix-blood children with slavery women were accepted, becoming normalized. Children with mixed breed with other tribes (Crioulo), and black people who are not slavery, are in the middle of the social strata, where white men are ranked as the top and slavery are at the bottom.

In the beginning of the 19th century, Portugal imposed a limited policy of the exclusive trade within the trade area which was appointed by the government to dominate the wealth. Economy of the then colonized country was gradually shrinking, and the trade dwindled as well. Suspension of merchandized activities by the pressure of Portugal drove the colony heavily rely on agriculture. In this circumstance, slaves were exploited as tillers of the farms.

In the advent of the 19th century, supply of slaves for agricultural labor was shrinking, due to the increased external pressure for the elimination of slavery system. Also, most of the slaves escaped to Santiago Island and the remote area in other islands to start small-scaled own farming. Land owners were suffering from the financial difficulty, because they had to employ more expensive labor force due to the escape of the slavery, and numerous droughts attacked them. Multiple burdens, chiefly droughts and lack of labor force, caused the distribution of the large lands into small unit of agricultural farms, in the form of sales of the lands to wealthy family, or of sharecropping for those who were former slaves and Crioulo. These historical processes formed intensive land owning system by a small number of large landowners. Consequently, extremely dispersed landless farmers, who were composed of those who practiced the sharecropping and tenant farming, had existed.

As has been discussed, transformation from production system based on the slavery system to that of small-scale farming and share-cropping caused the decay of agro-economy of CV. Also, periodical heavy droughts which nullify the agricultural activities are part of the reasons for the economic decay.

Periodically occurring droughts have been affecting not only o the development of agriculture in CV, but also on the formation of agro-society. A record indicates that initial critical drought occurred in the 1500s. The drought in 1773, which caused the largest damage of the recorded case, 44 percent of the population died of extreme famine. Even in 1946, 18 percent of the population died because of it. In the colonial period, the government of Portugal had rarely implemented easing measures. The damaged was lessen by international assistances in the following droughts.

The most conspicuous influence by the drought in CV is the migration for foreign countries, due to the droughts and the fear for the famine. Migration to other countries became the principal economic measure for those families which cannot secure food for survival. Migration population is inclined to increase in the year when the drought occurs. Also, there are many households headed by

women, since most of the migrants are consisted of young men.

Food assistances by international organizations, remittances for families by migrant workers of CV, assistances by international organizations with respect to the health and sanitary management increased the population. As a result, pressure for the population increase to fragile lands which cannot be broke in any more is the threat to decrease the production capacity of resources. In other word, population and resources became to get imbalance, excessive burdens are imposed on the agricultural resources, such as the use of outskirt lands which force rural farmers to live with extremely cheap income. Also, planting of the slope which frequently causes soil erosion and excessive use of ground water which surpasses the complementation by rain water further devastates the agricultural resources. As has been seen above, pressure of population increase triggers vicious cycle for the devastation of agricultural resources which decrease the volume of agricultural output and farmers' income.

On the other hand, as a consequence of the independence from Portugal, one-party governance continued up until 1990. However, as it was nearly the monopoly which was undemocratic and deprived people of freedom, the criticisms by the people were swollen to introduce multiparty system in 1990. Consequently, Movement for Democracy, a newly established party, won the majority in the election, and the president of the party had the office in 1991. However, people were not satisfied with the governance by this president, since he tried to avoid the control by people and took office in a way that limited numbers of people could gain benefit from it. Consequently, former party in the independence took his office again in 2001 and as of today.

People in CV have been afflicted with the harsh and historical pressure (harsh droughts, slavery system, and arrogant politics by Portuguese for 500 years), feeling that they had been betrayed after the consecutive years of independence. Consequently, individualism seems to pervade among people in CV.

Chapter 3 Study Area

3.1 Santiago Island

Santiago Island, which is the study area of this Study, is the largest island (with an area of 991 km^2) located in the southern part of Cape Verde. It has the largest population among the islands (277 thousands, or 55%of total population: 2007), and its capital, Praia, is located in the far south. 54% of the households are engaged in agriculture, only 10% of which practices irrigated agriculture. Among rural households, 59% of its population is engaged in agriculture. Households are primarily headed by women (57%), and 54% of the population of farmers are also women.

3.2 Social Condition

3.2.1 Administrative Division

Santiago Island is composed of nine counties as administrative division, namely: Tarrafal, Santa Cruz, Santa Catarina, São Miguel, São Domingos, São Salvador do Mundo, São Lourenço do Órgãos, Praia and Ribeira Grande-Santiago. Land area and population of each county are shown in the table below:

Table 3.2.1 Areas and Population of Counties in Santiago Island

Administrative Division	Area (km^2)	Population				
		Man (hab.)	Women (hab.)	Total (hab.)	Urban (%)	Rural (%)
1. Tarrafal	112.40	9,611	12,215	21,826	33.4	66.6
2. Santa Cruz	100.30	13,308	15,192	28,500	37.4	62.6
3. Santa Catarina	211.90	20,732	25,349	46,081	26.1	73.9
4. São Miguel	90.70	7,471	9,676	17,147	33.3	66.7
5. São Domingos[1]	137.60	6,790	7,348	14,138	14.3	85.7
6. São Salvador do Mundo	31.00	4,632	5,749	10,381	13.1	86.9
7. São Lourenço do Órgãos	49.00	4,122	4,690	8,812	19.3	80.7
8. Praia	94.10	58,495	61,607	120,102	97.9	2.1
9. Ribeira Grande-Santiago	164.00	4,493	5,155	9,648	14.6	85.4
Total	991.00	129,654	146,981	276,635	57.7	42.3

Cited: DGASP (2007)

3.2.2 Land Ownership

There are many landless farmers in Cape Verde, who practice sharecropping and tenant farming. The yield of rain-fed crops is small and unstable, and fixed rents and payment in kind causes heavy burdens for small farmers. Moreover, the absence of landowners (due to emigration) and the lack of registration of land have represented obstacles to the processing of land issues. The following table shows the situation of land holding of farmers in Santiago Island.

[1] Since São Domingos County includes not only São Domingos Watershed but also other watersheds around, the values here are different from the values of São Domingos Watershed described after.

Table 3.2.2 Situation of Land Possession for Farmers in Santiago Island

	Possession	Sharecropping	Tenant Farming	Others	Total
Rain-fed Farmland	34%	15%	46%	5%	100%
Irrigated Farmland	38%	19%	34%	9%	100%

Cited：Agricultural Census 1988

3.2.3 Gender

Issues related to discrimination against women have been one of the major concerns for successive governments since independence of the Republic of Cape Verde. Currently, the country is employing legal, administrative and educational means to eliminate all forms of discrimination against women, and to protect the rights and special interests of them. As a result, more and more women in CV have been participating in nation development through the contribution to industry, agriculture, science, culture, education and public sanitation at local level.

The political will of successive governments in promoting women is the result of full compliance with recommendations of international conferences which took place in the early 90s, reflected in various National Development Plans (NDPs). Recognizing the role of women in economic development of the country and eliminating all the discrimination against them, there was the need to strengthen the legal system to suit the strategic objectives of the Beijing Declaration (1995) and Platform for Action adopted at the Fourth World Conference on Women.

In accordance with the Human Development Report (HDR) issued by UNDP in 2009, the Gender Development Index (GDI) Cape Verde was 0.701 in 2007 standing 101st in 155 countries. On the other hand, the Human Development Index (HDI) was 0.708 standing 121st in 182 countries. Consequently, the ration of GDI to HDI was 99%, and it was improved 1% in 9 years compared with the ratio of 98% (GDI: 0.675, HDI: 0.688) in 1998.

Women are considered as the poorest among the people in CV. Women represent large stratum of agricultural population: they work more than men per week: and often are the chief of the families who are directly responsible over children. Women in the County of São Domingo are no exceptional.

Since men work away from home, women naturally become essential workforce. Hence, women are increasingly valued in the perspective of development. For example, they provide the main manpower in reforestation against desertification. They, along with their children, are responsible for the gathering and water supply, and are very active in the use of rainwater for agriculture, besides that they also have played an important role in childcare.

3.2.4 Poverty

The results of "Inquiry for Family Income and Expenditure (FIDA 2001/ 2002)" by National Institute for Statistics (INE), 37% of total population is in poverty and 20% is in extreme poverty. 62% of the poorest segment of population, and 68% of total population who suffer severe poverty live in rural areas. Also, 51% of the total population is women. Poverty profiles in CV and Santiago Island are shown in the table below;

Table 3.2.3 Profile of Poverty

	Population	Poverty Population	%	Population of Extreme Poverty	%
Cape Verde	470,687	172,727	37	92,828	20
Urban	259,321	64,782	25	29,739	11
Rural	211,366	107,945	51	63,089	30
Santiago Island	255,974	95,026	37	50,329	20
Praia	106,595	21,637	20	8,246	8
Excluding Praia	149,379	73,389	49	42,083	28

Cited: FIDA 2001/2002 (Poverty: Annual Income of less than 43.250 ECV; Extreme Poverty: Annual Income of less than 28.833 ECV.)

Table 3.2.4 Poverty and Gender

	Poor Population					
	Men		Women		Total	
Cape Verde	83.858	49%	88.869	51%	172.727	100%
Santiago Island	45.350	48%	49.676	52%	95.026	100%
Praia	10.180	47%	11.457	53%	21.637	100%
Excluding Praia	35.170	48%	38.219	52%	73.389	100%

FIDA 2001/2002

3.3 Natural Conditions and Agriculture

3.3.1 Zone of Agro-Ecology (ZAE) and Precipitation

The territory of CV is classified into Agro-Ecological Zones (ZAEs) according to rainfall and altitude, underlining the potential for each of the agricultural areas (See table in Chapter 2). For example, in 1999, "Chart of Zone of Agro-Ecology and Vegetation" of the island was elaborated. According to this chart, regions corresponding to the conditions of ZAE IV in Santiago Island are highly restricted, which are dispersedly distributed in the second highest Mt. Malagueda (1,069m) and Mt. Antónia (1,394 m) located in the south-central part of the island. Therefore, there are numerous watersheds without ZAE IV in Santiago Island.

It is worthwhile noting that annual rainfall in the region of the Mt. Antónia is as little as 450mm. Considering the level of precipitation, pure sense of ZAE IV (zones where annual precipitation is over 600 mm) does not exist around the Mt. Antónia. Contour chart of precipitation in Santiago Island is shown in the next page.

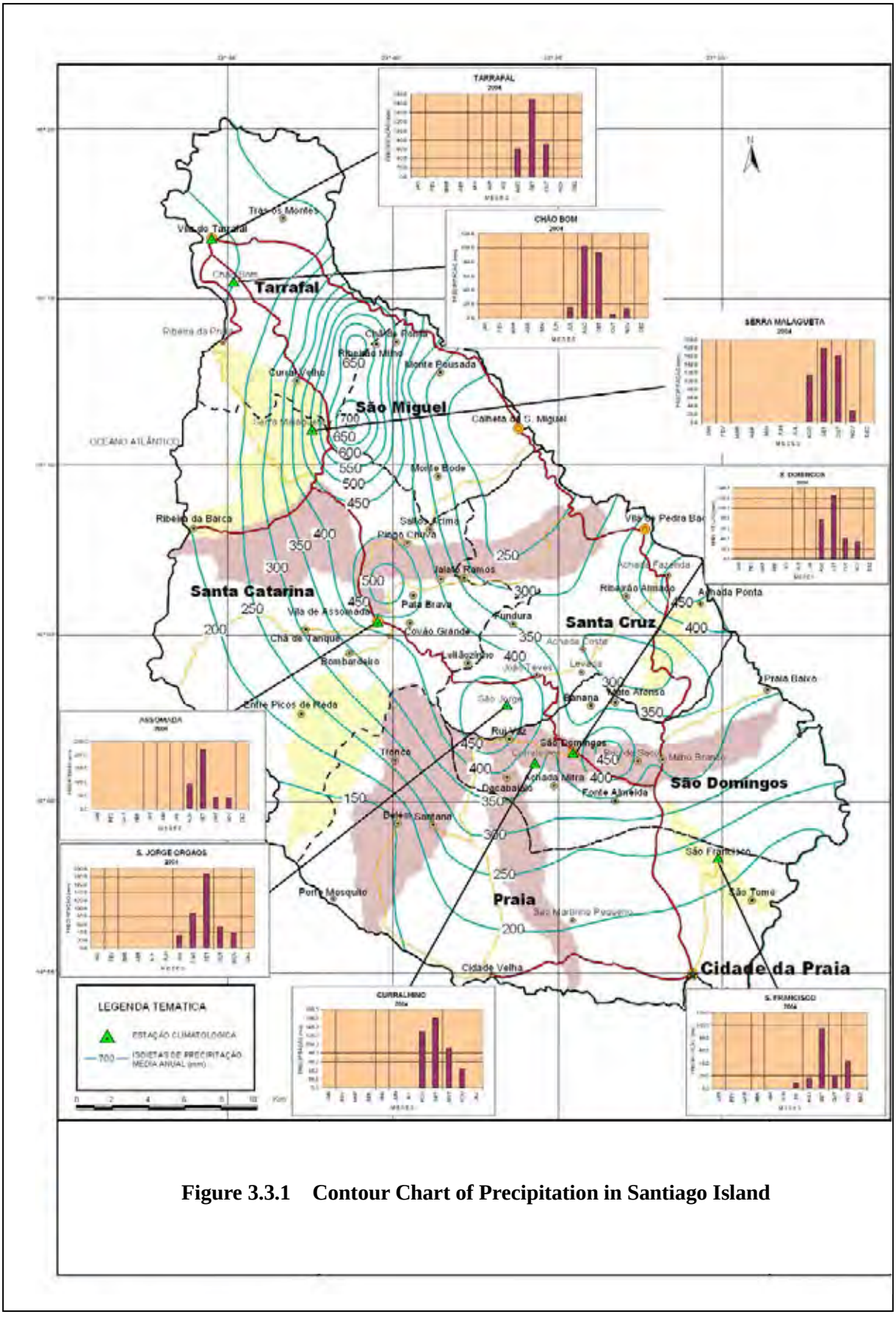


Figure 3.3.1 Contour Chart of Precipitation in Santiago Island

3.3.2 Condition of Soil Conservation

Soil conservation facilities found in the valleys, hills and mountain streams are rubble works, planting works, debris barriers (gabions or stone),and terraces. In areas where vegetation is flourished and soil conservation facilities are working, significant losses of soil are not observed. However, in places where soil conservations have not been set up, the topsoil has been erased. Also, sites where drainage catches for the catchment of superficial water is employed in valleys rarely exist. Most of the soil conservation facilities bring function about not only minimizing the movement of soil during rain, but also function of water recharge by infiltrating rainfall in soils.

Most of the planting works are normally crescent formed embankment works. Aloe and sisal located in the slopes of the mountain are working as planting works for soil conservation. Terraces are a kind of works in which embankments are made as furrows along the contour. Also, masonry or gabion sand prevention dams are constructed in the entire basin areas, valleys, and swamps.

3.3.3 Use of Water

Cultivation of coconuts and bananas by ground water irrigation has started in the ZAE I located in the lower stream of watershed, in addition to the rain-fed cultivation of corns and beans in the rainy season. Later, residents began to rise upstream in search of water resources, and rural activities started focusing on agriculture and livestock, using spring water both for domestic use and agriculture. Galleries for stable catchment of spring water and dikes for catchment of undercurrent water in the dry season were constructed in 1950s, and the water from these facilities has been used for the domestic use and agricultural use since then.

In CV, residents are accustomed to pay for water to some extent, since it is considered as a major priority for their daily lives. Considerable population in the county of Praia obtains major part of the domestic use water from tankers but through running water. Part of the water is supplied from water sources in other regions or desalination plants. In Praia, even moderate households possess 9 m^3 of water-tanks, and purchase high-priced water which is as expensive as 900 ECV/m^3 (some 8.18 euro). In rural areas, it is normal for residents to purchase water where wells and spring water do not exist. For example, in Rui Vaz, water from deep wells is sold at a price of 250 ECV/m^3. In other word, socio-economic situation based on high priced water has been established.

Currently, there are very limited sites suitable for installation of the galleries and the dikes to capture water; hence excavation of deep wells and desalination of seawater are major solutions for development of new water resources in CV. As for irrigation, it is encouraged to cultivate cash crops by excavating deep wells and introducing drip irrigation. Such irrigated agriculture can be viable due to the high cost water. Also, improvement of food sufficiency rate seems not to be the policy concern for the government of CV, and farmers are promoted to actively produce value-added vegetables and fruit to buy food grain out of the benefit from them.

Recently, irrigated agriculture depends on ground water, and irrigation areas are concentrated in the valleys. Farmers irrigate farmlands through open channels and pipelines from galleries and catchment dikes in steep hollows and small plane lands. In this case, loss of water due to the poor maintenance of water supply system greatly reduces the efficiency of irrigation. Regarding the

methods, traditional way of irrigation (furrow and basin irrigation) account for 90% of total irrigated areas, whereas drip irrigation accounts for the remaining 10% of irrigated areas. Efficiency rate of traditional irrigation method is estimated from 33 to 66%. Drip irrigation was introduced in 1993, and was spread immediately. There is other irrigation method for compensation, which is to grow the nursery seedlings during the last dry periods and leave them in the rainy season. In this case, the plants are transplanted at the beginning of the rainy season. After the end of the rainy season, the nursery seedlings are raised with water stored during the rainy season, extending the cultivation period and allowing two crops of vegetables a year.

3.3.4 Agriculture

In Santiago Island, agriculture is practiced on family base, and most of the farmers practice rain-fed agriculture (22,128 ha). On the other hand, irrigated agriculture mainly by ground water is practiced in a part of the areas (1,220 ha). Mixed cropping of corns and beans is the mainstream for farmers engaged in rain-fed cultivation. As for beans, farmers cultivate kidney beans, lima beans, Egyptian beans, black eyed peas and pigeon beans. Cultivable lands for root vegetables, peanuts and cucumbers are restricted. Agro-products and Agro-centro, which are the two major firms, are controlling 95% of market share in the supply of agricultural equipment, and are supplying chemical fertilizer, irrigation facilities, pumps, seeds and pesticides. Particularly, agricultural materials and equipment are supplied by import. The volume of horticultural produce is small: according to the statistics in 2001, the yields of corns and beans are 0.81 t/ha and 0.22 t/ha respectively. Small amount of rainfall, seasonal and geographical bias in precipitation, non-use of fertilizer, bad choice of crops, soil and breed variety, use of local varieties, insufficient use of pesticide and insecticide all cause the decrease in the yield of agricultural produce.

Regarding vegetables, farmers cultivate lettuce, tomatoes, cucumbers, watermelons, cabbages, onions and gourds. Seeds from European are utilized. The amount of papayas (European baby papayas), have been grown. Cultivation of bananas represents the highest volume of output, most of which are cultivated by irrigation. Bananas were the only one fruit product which had been exported until 1993 from the colonial period. However, due to the salinization of soils caused by improper watering, the volume of production has decreased in some areas of ZAE I, not being possible to export from mid-1990. Sugar canes are the traditional cultivation grown without fertilizers. They are used primarily in the production of spirits.

3.3.5 Livestock Breeding

In Santiago Island, most of the farmers are engaged in livestock breeding. The main livestock animals are cattle, goats, sheep, pigs and chickens. In traditional farming, farmers practice extensive cultivation, where animals are set off in the mountains, forests and plains, and seek their food on their own. Despite that the livestock animals are resistant to the lack of pasture, adaptable to the local environment and easy to nurture, the productivity is low. Most of the varieties are created domestically, although some of them are imported and modified domestically. Livestock farming is combined with agricultural production, representing a large part of household income, being the basis for improving

the economic security of rural families. Livestock farming not only is the main source of cash income, but also serves as a defence of food safety and a symbol of social status of the peasant.

Almost all varieties of poultry are traditional. In the traditional method of rearing chickens, the loss due to disease, lack of rations, etc. are large. Due to the entry of imported frozen poultry meat, domestic poultry has lost market share. As a result of this, most part of the creation of chickens has been ruined.

Pig breeding is practiced traditionally for subsistence. Two thirds of the farmers practice the pig farming. They are grown in pig pens in the vicinity of the house, and fed by the leftover, bran of corns, crops stubbles and crop residue. The pig breeding in the pig pens is concentrated in the outskirts of towns, and the floor of pen is made mostly of the concrete. Technical services to farmers are poor; in the study conducted by FAO in 2004, only 0.5% of rural families who are engaged in livestock farming received the extension services.

The form of ruminant animal breeding, such as goats and sheep, depends on the crop residue, (natural grass and leftover of corns), remaining unchanged. The forms of livestock breeding can be divided into three groups: 1) The first group is the type of subsistence in which most farmers belong to. In this type, livestock animals are released in fields near the residence or are tied. In the dry season, they are given crop residue: 2) The second type is the group in which groups of animals are set off on the ground, without human accompaniment. Therefore, it often causes friction with farmers practicing other types of cultivation. The third group is the intensive farming in pens.

Livestock farming faces enormous structural, socio-economic and financial constraints. One of the most negatively affected sectors is livestock farming which is practiced by people with limited educational attainment (they are less receptive to technological innovations). Also, the absence of prophylactic measures and lack of feed are considered to be other constraints. Despite the constraints indicated above, it holds some potential, such as the use of livestock animals well adapted to genetic environment. However, the potential needs to be scientifically assessed, introducing new technology, to support the implementation of breeding programs.

3.3.6 Forestry

As a result of 25 years of intensive forestation, tree-planting activities have been expanded to utilize 20 % of forest land, only 1% of which used to be afforested. American acacia called Prosopis Juliflora is the most planted variety in the entire land of CV. This specie is resistant to droughts and poor soils, and the exuberance in ZAE III and IV can be expected. However, strong ability against water resources prevent farmers and livestock breeders from using it, since, this acacia does not produce crop feed. Hence, there is the pressing need to study biology of these plant species.

Economic value addition of timber and non-timber production is an important vehicle in the development of forestry. For efficient implementation, farmers are encouraged to manage and maintain forestry, which used to be managed by the government, at their own initiatives and responsibility. For the purpose of realizing the objective, problem finding and elaboration of solutions for the issue around forestry are required.

Issues and characteristics around current forestry are described as follows: 1) gradual reduction of

funding to the sector, either external or internal, in particular funding from external cooperation bilaterally, 2) the decrease in potential areas and annual rate of forestation, whereas the increase in the agro-forestry in ZAEs III and IV; 3) the increase in consumption, especially self consumption of firewood and fodder resources, with the consequent decrease in forest resources; 4) progressive involvement into the management and planning of the development of forestry through local community associations, and 5) increasing sectoral synergies with agriculture, livestock, water resources, energy, tourism and crafts.

Although policies regarding forestry have been shifted, the government is always involving with restoration and conservation of vegetation with moderate fruitful outcome. As a result of this, forestation and soil conservation projects are formulated, although further revision of policies is required.

3.3.7 Distribution System

(1) Structure of Agricultural Distribution System

In principle, distribution system of agricultural commodities in Santiago Island is simple: Small farmers usually sell the surplus of domestic consumption to the intermediaries in the backyards, or go to cities to negotiate with retailers, and so do the large scale farmers. In production regions, local consumers purchase the agricultural produce directly.

Despite that numerous farmers' associations exist, the practice of collective marketing of agricultural produce is the rare case. However, there are some new movements; for example, youth sub-groups in the farmers' associations are attempting to pickup and shipment agricultural produce collaboratively.

Cape Verde, where food sufficient rate is low, depends on import of various foods. However, in the business of importing food produce, which were once held exclusively by public enterprises, several private firms, have been entering into the business nowadays. Moreover, there are cases in which large retailers import agricultural produce by themselves.

(2) Public Market

In Santiago Island, harbors, marine bases, and cities and villages in the strategic points of transportation have been constructed since the colonial period of Portugal. Public commercial markets by each municipality are established near the cities, and farmers sell crops, beans, fruits and vegetables, livestock animals and marine products. Generally, women are engaged in the retail businesses, although some of the retailers for meat are men.

In the market of Praia, producers from all part of the Island and local sellers start to bring fruits and vegetables in the streets as early as 6 o'clock in the morning. Retail merchants purchase the produce from them by negotiation transactions, and bring them into the market at approximately 6:30 when the market opens. Retail merchants pay utilization tax to municipal government every day. Vending for ordinary consumers starts at 7:00, and retailers pay the tax according to the annual benefit they earn.

In the case of distribution of commodities in Santiago Island, wholesale markets are not functioning. Local collecting merchants purchase produce from the large scale farmers who can deal with the yields, and rarely get in those from small farmers and low accessed cultivation areas. Small farmers generally go to the public markets on their own by using the tractors and HIACE (wagon cars), in order to sell the surplus of the produce to the retail merchants.

For producers, transaction in markets near the capital city, where the rich population is concentrated and high demand for produce is expected, is highly attractive, since they can shortcut time and cost for transaction. Hence, it is likely that farmers prefer to bring their produce into the market in the cities which is time and cost consuming. In reality, each producer transacts in the capital city, benefitting from the size of island, without depending upon the cooperative pick-up and shipment, storage facilities and intermediate facilities, despite that the transportation facilities are not necessarily in good conditions.

(3) Structural Components of the Market

Due to the absence of the groups of people who are engaging in the collective marketing, farmers' associations which buy the agricultural produce, associations for intermediate merchants and wholesale market, the structure of the market is very simple being composed of producers, middlemen, food processing traders, retail merchants, traders and consumers.

(4) Infrastructure of Transportation

Transportation of agricultural produce within Santiago Island is mostly covered by taxies and on foot (Transportation infrastructure here indicates roads and bridges). Major pavements are all-whether roads with stone pavements, the branches of which are unpaved. Unpaved roads interfere smooth transportation after the rainfall.

Central highways are mountain roads which connect to the south north of the island (66 km) and marine roads which connect with both the south bank and the east bank of the island (85 km). Most of the roads are stone pavements. Yet, asphalt pavements are employed in the heavy-trafficked areas. There are numerous farms and farm fields where cars cannot reach, since hilly lands and steep valleys are scattering in the Island.

(5) Import of Agricultural Produce

Cape Verde presents a low rate of food self-sufficiency, therefore it depends on imports of various foods. Situations of import of agricultural produce in Santiago Island are described in this section.

There are two trading ports in CV: trading port of Praia, in Santiago Island, and that of Mindelo, in São Vicente Island. Imported goods are transported both within the islands and to the other islets. The port of Praia is larger in the volume of landing of the two. Data below shows the volume of imported produce examined in the port of Praia. However, it is noted that those goods are spreading to consumers in other islands than Santiago Island.

1) Fresh Fruit

Major imported commercial produce are shown in Table 3.3.1. Apples, citrus fruits and pairs account for large part of the import in quantity. Most of the imported fresh fruits are shipped from Portugal, and import from other countries is supplementary. Also, fresh fruit is stably imported throughout the year with seasonal changes. The volume of production of bananas, formally the main exported goods of CV, has decreased and export of bananas suspended recently; however, it seems there is no need to import bananas, since domestic demand is satisfied internally.

Table 3.3.1 Situation of Import of Fresh Fruits in the Port of Praia

(Unit : Tons)

Year Agricultural Produce	2002	2003	2004	2006	Country(ies) of Provenance*
Citrus	351	303	322	530	Portugal
Grape	46	30	35	42	Portugal
Pair	116	56	81	142	Portugal
Kiwi	12	7	9	12	Portugal, Italy
Apple	616	540	463	777	Portugal
Plum	12	9	3	19	Portugal
Melon	8	7	12	15	Portugal, Spain, Belgium
Peach	6	6	7	26	Portugal
Mango	2	1	7	1	Brazil, Portugal
Papaya	1	0	0	0	Brazil, Portugal

* Countries of provenance indicate main import partners, which does not necessarily equivalent to the producing countries.

Referenced : DSSP, DGASP, MAA

2) Dry Fruit

Fruits of baobab are imported from Senegal every year. Also, coconut flakes (codo Ralado) and dates are imported from Portugal and Tunisia, respectively.

3) Vegetables

Imported vegetables are important commercial produce for local farmers. Root vegetables which are easy to transport and store, such as onions, garlic and carrots, are imported substantially (see Table 3.3.2). At the same time, numerous farmers in CV cultivate these root vegetables. As for fruit market and leaf market, domestic produce dominate the retail market, since market for imports of these vegetables is small. No extensive statistic data are available for frozen vegetables and processed produce imported.

Table 3.3.2 Situation of Import of Vegetables in the Port of Praia

(Unit : Tons)

Year / Produce	2002	2003	2004	2006	Country(ies) of Provenance*
Onion	906	772	960	1,100	Holland, Portugal
Garlic	255	274	340	354	Holland, China
Carrot	109	105	109	219	Portugal, Holland
Tomato	3	9	2	10	Portugal
Green Pepper	3	2	0	4	Portugal
Hot Pepper	0	0	2	3	Portugal, Senegal
Egg Plant	0	0	0	1	Portugal
Cucumber	1	0	0	1	Portugal
Pumpkin	0	0	0	4	Portugal
Baby Corn	1	2	0	1	Portugal
Field Peas	1	4	0	1	Portugal, Holland
String Beans	1	3	0	2	Portugal, Holland
Cabbage	3	7	8	16	Portugal
Broccoli	3	1	1	2	Portugal, Holland
Spinach	0	1	0	0	Portugal

* Countries of provenance indicate main import partners, which does not necessarily equivalent to the producing countries.

Referenced : DSSP, DGASP, MAA

4) Cereals and Potatoes

Staple foods in CV are rice and maize. Also, varieties of beans and potatoes are consumed. In CV, rice consumed in the country is entirely imported, and the government of Japan provides food assistance rice, since no paddy crops, including dry rice, are cultivated. Entire amount of wheat is imported as well. Although maize, potato, cassava and beans are main produce in Santiago Island, the yields do not meet the requirement for food sufficiency; hence, food for the people is covered by import and development assistances. Regarding the import countries of horticultural crops, as mentioned above, predominant amount of the crops are imported from Portugal. However, importing countries of crops and potatoes, from the relationship with the producing sights and transferability, extend as far as South and North America and Asia (see Table 3.3.3).

Table 3.3.3 Situation of Import of Crops and Potatoes in Porto of Praia

(Unit : Tons)

Year / Production	2002	2003	2004	2006	Countries of Provenance*
Rice	11,642	21,689	37,418	14,655	Vietnam, Thailand
Maize	14,535	13,707	8,153	17,997	Argentina, USA
Potato	4,617	5,182	5,235	4,515	Holland, Portugal
Cassava	-	92	67	38	Portugal
Beans	2,318	6,386	1,469	2,271	USA, Peru, Canada
Flour	-	414	248	926	Belgium
Mayes	552	772	412	597	Pakistan, Portugal
	18	2	25	20	Brazil, Portugal

* Countries of provenance indicate main import partners, which does not necessarily equivalent to the producing countries.

Referenced: DSSP, DGASP, MAA

5) Price of Agricultural Produce

Price of agricultural produce varies according to seasons and imported produce. The former is rather predictable; on the other hands, for the latter, it is difficult for producers to predict the price change due to the manmade commercial activities as long as they had some prior information. Yet, domestic produce are popular for its freshness, and are transacting with higher price than imported produce.

In order to analyze the price variation, outcome of existed data of study has been obtained for price of commodities from 2006 to 2007 in Praia. Here, the outcome in 2006 is used instead, since it is inappropriate to employ data in 2007 to discuss the seasonal changes. This is because appreciation of the price of commodities is conspicuous due to the rising price for crops and crude oil in 2007 (see Table 3.3.4).

Compared to the crops and beans whose annual variation range from 0 to 6%, conservable fresh vegetable ranges from 50 to 80%, and fresh fruit, which is less conservable, varies as much as from 75 to 300%. As for fresh fruit, annual fluctuation range for citrus and apple, which is almost entirely imported, and banana and papaya which are domestically produced on annual base varies from 20 to 60%.

Table 3.3.4 Maximum and Minimum Price of Cereals, Vegetables and Fruits in Praia (2006)

Produce	Highest Price		Lowest Price		Fluctuation Range (in multiple)	Annual Median (ECV/kg)
	ECV /kg	Month	ECV /kg	Month		
Cereals						
Rice	60.36	AUG.	57.93	APR.	1.04	58.98
Imported Corn	29.67	-	29.67	-	1.00	29.67
Wheat	46.33	OCT,NOV	45.50	SEP.	1.02	45.86
Beans						
Fava beans	261.67	JUN.	230.00	DEC.	1.14	248.85
Gram	163.75	JUL,AUG	157.50	SEP.	1.04	161.43
Pigeon beans	200.06	JAN.	188.16	JUN.	1.06	193.60
Vegetable						
Onion	162.50	NOV.	90.00	JAN.	1.81	119.08
Garlic	360.00	APR.	211.00	MAR.	1.71	261.76
Carrot	272.50	FEB.	175.00	AUG.	1.56	217.88
Potato	136.67	NOV.	79.00	JAN.	1.73	109.64
Sweet Potato	182.50	SET.	110.00	MAR.	1.66	142.99
Cassava	335.00	AUG.	225.00	MAR	1.49	276.03
Lettuce	490.00	AUG.	150.00	MAR	3.27	302.71
Collad Green	161.25	NOV.	83.33	DEC.	1.94	119.13
Cabbage	302.50	NOV.	75.00	OCT.	4.03	157.43
Tomato	343.75	DEC	94.17	MAY.	3.65	171.63
Pumpkin	308.33	AUG.	121.25	NOV.	2.54	213.23
Green Pepper	200.00	JAN.	86.67	OCT.	2.31	152.78
Cucumber	167.50	AUG.	95.00	DEC.	1.76	136.15
Fresh Fruit						
Orange	40.00	FEB~JUL DEC.	30.00	SEP.	1.33	36.81
Lemon	40.00	FEB	25.00	AUG~DEC.	1.60	28.64
Apple	251.25	FEB.	206.00	NOV	1.22	234.44
Banana	140.00	JUL.	108.75	JAN, FEB.	1.29	123.40
Papaya	175.00	JAN, FEB.	131.67	NOV	1.33	147.85
Mango	31.75	AUG.	26.75	JUN, JUL	1.19	29.75

3.3.8 Processed Agricultural Produce

The most practiced food processing in Santiago Island is the manufacture of spirits known as grog[2]. It is originally the indigenous product in Cidade Velha[3], the southern part of the island. However, production sights are moving and scattering in other islands, due to the securement of raw materials caused by the decrease in the planting of sugar cane because of the small precipitation, and

[2] This is clear distilled liquor that is made from sugar cane, such as rum, and that is not aged in barrels but is bottled immediately after distillation. There is also a byproduct called "punch" which is a liquor made from the grog.

[3] The oldest town in CV, where a Portuguese, António de Noli, landed in 1462.

the increasing importance as export commodities. Processing firms are generally running with small numbers of staffs and livestock. In some progressive firms, however, diesel engine processing machineries are implemented, instead of the power by livestock.

Principal produce in the irrigated lands are vegetables, and brassicaceous green vegetables, tomatoes and carrots are the main produce. These produce are sold as fresh vegetables, and are not usually processed. Take tomatoes for example; demand for tomato is high, although they are highly priced in market and cultivated in nearly full ripeness, thanks for the close distance between the producing sources and consuming sights. Therefore, there is no raw product remaining for processing. Also, it could be said that processing industry has not been grown, since processed produce made by highly priced domestic tomato cannot compete with imported produce.

Most of the processed produce, such as juice, jam, dry fruits circulated in market are imported from Brazil and other European countries, given the high demand and price for fresh fruits. There is a famous shop for pig sausage close to Joan Teves, heading from Praia to Assomada. However, production scale is very limited; house wives sell the produce in their own house individually, and it does not reach the scale for shipping to the retail shops in towns.

The production of meat from ruminants, such as those of cattle, goats, and birds has almost been increasing due to shortage of feed. On the other hand, the provision of pork has increased. Therefore, it is expected that conservative processing is highly valuable.

Principal dairy produce are non-matured fresh cheese made from goat milk. Using gastric acid from kid goats and rennet in the forth stomach are used to make cheese with adding salt. Producers make fresh cheese with limited facilities in small-scale production system in the same way as the production of pig sausages mentioned above, with demand surplus, and do not have the production capacity for selling in towns. Goats are suitable for livestock breeding in Santiago Island, since they are resistant to droughts and the steep topography. However, some preventive measures for newly planted trees in forestation areas should be required, since goats have greater mobility than the sheep and prefer to eat leaves and shoots of shrubs such as food.

Peppers as spice are widely consumed in CV. Fresh peppers are sold in markets, whereas processing produce, whether as paste or preserved in jars, are imported. According to WHO, the major cause of deaths is cardiovascular disease. From this fact, it appears that there is a likelihood of relationship with the preference of the salty food. Therefore, it is presumed to be valid, from the point of view of public health, to develop and diffuse some kind of processed peppers, substituting the salt in diet.

In Santiago Island, aloe vera is planted for the purpose protection from soil runoff and ornamental purpose. However, it is solely used as medicine in limited number of households in some occasions, and no family are using it for diet. However, thanks for implementation of new medicated variety in other islands, farmers in other islands have started to export high medicinal aloe vera and herbal medicines recently. It might be an upcoming subject to implement this variety and employ this for processing ingredients.

It is worth while noting that, in each agricultural industry, although individually running small enterprises are seen frequently, there seems no group activity cooperated with each other. Some rare

associational activities are run by family or relatives (kinship). They have a strong resistance to the group operation in cooperation with several families, although external assistance and participation to the establishment and operation of associations are permissible. Therefore, every agricultural processing industry is confined to domestic industry.

3.3.9 Community Associations

(1) History of Evolution of Community Associations

Data from the Ministry of Environment and Agriculture shows the history of community associations could be traced through three periods:

1) Portuguese Colonization Period

The first community association in Cape Verde was formed in this period. However, these were created forcibly by ruling country and dwindled due to the financial difficulties. The rest of them were the community based traditional complementary associations.

2) From Independence Year (1975) to 1990

After independence, political leaders employed policies which stressed the need for associations for rural development. Some 300 associations for production and circulation of primary commodities were established in between 1975 and 1990. This policy led the establishment of National Institute for Cooperatives (NIC) and National Foundation for Cooperatives (FENACOOP). In order to solve discrepancies within the communities, in-village parliament system, which was considered to represent the society, was adopted in this period. The parliament selected the participants for Program for Employment of the Poor (FAIMO), putting through the message for people in the rural areas. Members of the parliament are determined by the appointment of leader in controlling party.

3) After 1991

In 1990, movement for democratization has been growing, and the first democratic election under the multiple parliament system was conducted in 1991. As a result, a new party defeated the old regime. However, due to this administrative change, the power of associational activities declined. Especially, rural areas were affected by this change severely. Cooperative associations were controlled in the hands of few executives, and there were few opportunities for other members to participate in operation.

Residents' commissions were dismantled by new government in 1991, as the commissions were considered as the remnants of previous government.

New community associations resumed with local initiative and the strong assistance from American NGO, Agricultural Cooperative Development International and Volunteers in Overseas Cooperative Assistance (ACDI/VOCA) in 1993/94. This assistance started as a contract with local associations on the project for maintenance of infrastructure represented water and soil conservation and forestation. These farmers' associations have been formulated and have developed their activities similar to FAIMO through INERF.

(2) “Grass Roots” Community Associations

Community associations based on a unit of village (zone association) (hereinafter referred to “ACB”, popular name: “Associação”) are basically organized in each zone. After 1993, the number increased to the extent that a third of residents participate in the associations. There are 72 ACBs in total in Santiago Island, of which 65% of members are composed of women (2002). Registration for the establishment of new ACB shall be applied for the Ministry of Justice. ACBs chiefly consist of farmers and peasants, and are required to pay entrance fees (500 to 1,000 ECV) and annual fee (50 to 100). ACBs are democratically operated; they are structured by executive office, auditor and plenary assembly, and representatives are elected by election.

ACB conducts projects for soil conservation and maintenance for water facilities within the local community, it sometimes conduct activities in other communities. Most of the projects which accounted for the ACB activities were projects financed by ACDI/VOCA. ACDI/VOCA provides financial assistance for 60 to 70 ACBs, with annual averages amount of aid is approximately 6,000 US dollars. The benefit yielded by the projects is used as follows;

- Assistance for ACB members
- Purchase of instruments and facilities
- Local costs for public infrastructure construction from the government and assistance organizations (nursery schools and community centers, etc.)

Planning and execution of the projects which ACDI/VOCA assists are decided through the processes shown below:

- Activities from each ACB are commissioned to the plenary assembly. Proposal for these projects are created by diffusers in extensive offices of MADRRM.
- Candidate activities are absorbed to superior organizations of ACB and adjustment for the requirements of ACDI/VOCA are executed when necessary.
- Superior organizations put in a proposal of candidate activities to the delegation of MADRRM or to DGASP which serve for ACDI/VOCA.
- DGASP, regional delegates of extended rural offices and technical engineers of ACDI/VOCA shall conduct pre-feasibility study on the candidate project, and consider relevancy and possibility of the projects.
- Projects are amended when necessary, and are approved or declined.

ACDI/VOCA shall suspend its assistances under these reasons below:

- Weak organizational capacity of ACB
- Fail in the financial management
- Lack of capacity for executing projects
- When ACB has become sustainably autonomous and/or it can receive assistances for other donors. It enable ACDI/VOCA to assist newly organized ACBs

It is not mandatory that projects by ACB pass through the superior organizations or MADRRM: in some cases, ACBs can contract with the donors directly. In this case, processes vary according to the donors.

Recently, more and more donors have been assisting activities of ACB. Donors, such as KfW, Oxfam Novib (Holland NGO), INGRH, European Union, COSPE (Italian NGO), the Ministry of Health, municipal governments, FAO etc. Some ACBs receive assistances from two or more donors.

(3) Organization of Community Associations

OASIS (Organization of Farmers and Breeders in Santiago Island) consisting of several ACBs, was established in 1995, and has been in operation until now. Actually, there are only two other associations than that of Santiago Island in Cape Verde. OADISA (Organization of Associations in Santo Antão Island) in Santo Antão created in 2000 and OFA (Organization of Associations of Fogo) in Fogo created in 1999 are corresponded to these organizations.

OASIS is consisted by General Assembly (GA), Directorial Board (DB) and managerial committee. General Assembly is composed of the delegates (2 to 4 representatives) who are members of ACB. Members of DB and managerial committee are selected by election in the GA.

OASIS is the organization of 72 ACBs in Santiago Island, whose mandate is sustainable operation of ACBs. OASIS grants opportunities for the training for monitoring and development of each area.

Objectives of OASIS are shown below:

- Representation of all ACBs to assist cash management in elaborating action plans for the purpose of development of local communities.
- Provision of technical assistance and training for ACB leaders, and the technical assistance for watershed management.
- Supervision for management of available resources and execution of projects.
- Assistance for ACB in relation to the finding, elaboration and execution of projects regarding water and soil conservation, agriculture, livestock, construction and integrated rural development.
- Procurement of resources, and instruction with regards to sales of agricultural produce.

Also, as a measure for agricultural finance in OASIS, internal organization for OASIS and ASDIS (Association for Solidarity for Development in Santiago Island: founded in 1999) are organized to facilitate the access to micro credit for the poor.

3.3.10 Rural Extension

DGASP in MADRRM is responsible for agricultural development and its dissemination in CV. MADRRM operates 4 Agricultural Local Offices in Santiago Island, and technical engineers and extension officers are engaged in the extension services.

On the other hand, MADDRRM set up Technical Team for Rural Extension (Equipe Técnica da Extensão Rural: ETRR) which undertook the reform of agricultural extension system under the

instruction of DGASP in 2006.

This task force has been rebuilt in Sept. 2007 following various staff reduction, which had drastically altered its initial structure and affected its performance as observed by DGSAP since May 2007. It now includes 6 staff members; one coordinator, one trainer, one in charge of associations and three communication staffs. The ETER should:

- Coordinate and participate in the planning and execution of rural extension, communication and community development programs at the national level;
- Promote the sensitization of the rural population in agricultural development through activities of extension, communication and information in line with the agricultural policy and the strategic development plan;
- Propose and implement with the Directorate General a communication system with the rural area - RURAL EXTENSION LINE-, through which a permanent coordination between organizations producing information for agricultural development and points for the diffusion of the information to the rural area are ensured;
- Revitalize the radio/television program HÀ MA RH À TERRA, into new forms and formats, with more frequent diffusion of the information and a better schedule;
- Promote public relations and the synergy with the diverse services, central, regional and municipal, in the execution of the DGASP programs.
- Serve as a link between research and extension.
- Elaborate and execute an annual plan of communication and training ;
- Elaborate an annual plan of activities.

3.4 Target Watersheds

3.4.1 Screening of Target Watersheds

Santiago Island harbors more than 100 watersheds in total. This study conducted screening 10 highly prioritized watersheds agreed upon the Terms of Reference, and selected the watersheds to be studied for the elaboration of Action Plan.

In screening the watersheds, five criteria were set for selection of watersheds in negotiation with the executing organization, and discussed according to the criteria described below. As a result of this, 7 out of 10 watersheds were selected: 1) São Domingos; 2) Boa Estrada / Santa Cruz; 3) São Martinho Grande; 4) São João Baptista/Santa Ana; 5) Charco; 6) Cumba; and 7) Ganchemba/Ribeira da Barca.

(1) Criteria for Selection of the Areas

In order to promote the integrated rural development, several preconditions exist in order to realize the development. In selection of the target watersheds, basic five criteria necessary for the integrated rural development in the watersheds are elaborated:

Table 3.4.1 Criteria for Selection

	Criteria	Reasons why the criteria contributes to the potential development of the areas
A	Potential Water Resources	Success of rural development, chiefly agricultural development, highly depends on the potential volume of water resources. If the potentiality is high, the chances are that it contributes the rural development.
B	Population (Especially the poor stratum)	Since the assistance is mainly targeted for the poor, the ratio of the population which suffers poverty needs to be addressed. Also, in order to promote efficient rural development, some extent of the significance of the number of beneficiaries is required. This is the precondition for setting priority.
C	Community Associations	For smooth and sustainable rural development, solidarity of the community associations needs to be enhanced and nurtured in the project. Therefore, the existence or absence of community associations shall be under consideration for setting the priority.
D	Past Initiative of Rural Development	It is imperative that all the residents in the target areas gain some benefit from the projects, as the project is implemented by the government. The fact that similar rural development projects underwent the communities shall be criteria for priority.
E	ZAEs and Basin Areas	Action Plan should be elaborated in a way that can extend to other potential watersheds (not confine to specific targeted areas). Therefore, it is desirable to select comparatively large watersheds with 4 ZAEs.

This study employs point rating system to define priorities. In rating the project areas, Item A and B, which are important criteria among the items, are rated between maximum score of 5 and minimum score of 1. As for other items, maximum score and minimum score are set as 4 and 2 respectively.

Table 3.4.2 Points for Criteria

	Criteria for selection	Point per Criteria
A	Potential Water Resources	5：High 4：Upper middle; 3：Middle; 2：Lower middle; 1：Low
B	Population（Especially the poor stratum）	5：Ratio of poor population is 55% or higher; 4：Ratio of poor population is more than 50% and less than 55% with more than 2,000 habitants; 3：Ratio of poor population is more than 50% and less than 55% with less than 2,000 habitants; 2：Ratio of poor population is less than 50% with more than 2,000 habitants; 1：Ratio of poor population is less than 50% with less than 2,000 habitants
C	Community Associations	4：4 associations or more ; 3：1 to 3 associations; 2：None
D	Past Initiative of Rural Development	4：Nearly non conducted; 3：Rarely conducted 2：Conducted to some extent
E	ZAEs and Basin Areas	4：4 ZAEs and 40 km^2 or more 3：4 ZAEs with less than 40 km^2 2：3 ZAEs

(2) Profile of Watersheds

Profiles of each watershed are shown below:

São Domingos

This watershed is located in the south eastern part of Santiago Island, with the highest peak of 813 m in altitude. Strictly speaking, it is difficult to define that this area includes ZAE IV in terms of the altitude; however, this area can be corresponding to the area with 4 ZAEs according to the "ZAEs and vegetation map" discussed before. Potentiality of water resources is ranked as intermediate: areas of ZAE IV and III in the upper stream of catchments are relatively small with limited amount of catchment. Population of this area is 5,048, the ratio of poor population being 52.6%. There are 11

community associations existed in the area, and basin area is 44.3 km^3. No integrated rural development project is implemented. In the latter half of 1980, small scale rural development was executed as a project for agricultural development and soil and water conservation, targeted at the entire island of Santiago with the assistance of the U.S.

Boa Entrada/Santa Cruz

This watershed is located in the central part of Santiago Island with the highest peak of 648 m in altitude. In terms of both the altitude and precipitation, this area does not include ZAE IV. Therefore, the amount of basin is the sum of three ZAEs. ZAE III, located at the lower stream of second largest city, Assomada, is limited in the amount of basin. Hence, the potentiality of water resources is rated as the upper intermediate level. Population of the area is 5,228, with the ratio of population who suffers from poverty being 54.6%. There is a community association existed in the area. Basin area is 44.3 km^3. A rural development project was conducted in 1990s; however, the project was mainly targeted at the technical improvement, which was not conducted in the participatory method in consideration with the entire watershed.

São Martinho Grande

This watershed is located in the southern part of Santiago Island with the highest peak of 1,065 m in altitude. Potentiality for development of water resources is high, as it harbors ZAE IV. Population of the area is 1,060, of which 54.3% is categorized as the poor. There is a community association, and basin area is 34.4 km^2. Project for the excavation of the galleries, which expected spring water of 2,000 m^3/day in the 1980s, failed, as it only produced 5 m^3/day of spring water.

São João Baptista/Santa Ana

This watershed is located in the western part of Santiago Island, with the highest peak of 1,394 m in altitude and 4 ZAEs. Potential for development of water resources is intermediate: it entails ZAE IV, yet located in the western part where precipitation is small. Population of this area is 2,011 with 59.0% of population being poor. There are two community associations with 58.1 km^2 of basin area. As for the agricultural project, technical development assistance was implemented in 1980s.

Charco

This watershed is located in the west central part of the Island, with the highest peak of 719 m in altitude and three ZAEs. Potential for water resources development is ranked as high despite the absence of ZAE IV. Population is 7,022 with 45.0% of the poor population. There are four community associations. Basin area is 35.6 km^2. Regarding the past project, maintenance of catchment dam and accessory facilities are reconstructed in 1980s

Cumba

This watershed is located in the central east part of the Island, with 529 m peak in altitude and 3 ZAEs. Potentiality for water resources is intermediate, given the limited rainfall. Population of the watershed is as little as 441, and 59.9% of its population is suffering from poverty. A community association exists in this area, and basin area is 13.7 km^2. No rural development project has been

implemented.

Santa Clara

This watershed is located in the western part of Santiago Island, with the highest peak of 1,036 m in altitude and 4 ZAEs. Potentiality for water resources development is high, although it is located in the western part. However, water resources specifically for the development seem to be scarce, since significant volume of water resources is drawn to Praia. Population of Santa Clara is 1,195, 56.7% of which is impoverished. There is no community association. Basin area is 38.1 km^2. Development of small scale water catchment facilities and that of forestation are operated.

Ganchemba/Ribeira da Barca

This watershed is located in the northern part of Island. The peak of basin is 976 m in altitude, with 4 ZAEs. Potentiality for the basin is high as there is ZAE IV. Population is 4,384, with 48.4% of which is suffering from poverty. There is one community association. Basin area is 25.4 km^2. No rural development project has been implemented.

Cuba

Cuba watershed is located in the east central part of Santiago Island with the highest peak of 976 m and 4 ZAEs. Potentiality for water resources development is high with ZAE IV. Population is as little as 481, and 45.1% of the population is suffering from poverty. There is no community association. The basin area is 37.0 km^3. As for agricultural project, no concrete development has been implemented and only deep wells were excavated.

São Francisco

This watershed is located in the south eastern part of the Island. The highest peak is 305 m in altitude, and three ZAEs exist within the area. Potential for water resources development is lower intermediate. Population in this basin is only 194, 60.5% of which suffers poverty. There is no community association. Basin area is 27.4 km^2. No rural agricultural development project has been implemented but random small projects.

(3) Result of Analysis

Result of the analysis is shown below:

Table 3.4.3 Result of Analysis

Criteria for Selection	A	B	C	D	E	Total	Priority
São Domingos	3	4	4	4	4	23	1
Boa Entrada/Santa Cruz	4	4	3	4	2	17	4
São Martinho Grande	5	3	3	4	3	18	3
São João Baptista/Santa Ana	3	5	3	4	4	19	2
Charco	5	2	4	3	2	16	6
Cumba	3	5	2	4	2	16	6
Santa Clara	1	5	2	4	3	15	8
Ganchemba/Ribeira da Barca	5	2	3	4	3	17	4
Cuba	5	1	2	3	3	13	10
São Francisco	2	5	2	4	2	15	8

3.4.2 Study of Selected Watersheds

Rural social study was conducted with regards to the 7 selected watersheds. Result of the analysis is presented below.

(1) Demography

Population, Population Density, Number of Households and Poverty Incidence

Table 3.4.4 Population, Population Density, Households and Poverty Incidence

Zone	Population	Population Density (n/km^2)	Families (n)	Poverty Incidence (%)
São Domingos	5,048	114	935	52.6
Boa Entrada/Santa Cruz	5,227	125	1,029	54.6
São Martinho Grande	1,060	31	194	54.3
São João Baptista/Santa Ana	2,011	35	546	59.0
Charco	7,022	197	1,432	45.0
Cumba	411	30	77	59.9
Ganchemba/Ribeira da Barca	4,384	173	823	48.4

Cited from CENSO 2000 and IDRF 2002

Distribution of Gendered Population and Gender of the Head of the Households

Female population exceeds male population in the region, as same as the inclination in the entire nation.

Households headed by female consist of more than 40% of the population. More than 60% of the households are headed by female in Charco and Gamchemba/Ribeia da Barca. It is presumed that this ratio is highly related to the population outflow to other regions.

Table 3.4.5 Distribution of the Population and Head of the Family (%)

Zone	Distribution of Population		Gender of the Head of the Family	
	Male	Female	Male	Female
São Domingos	47.8	52.2	55.3	44.7
Boa Entrada/Santa Cruz	46.4	53.6	41.8	58.2
São Martinho Grande	49.3	50.7	53.6	46.4
São João Baptista/Santa Ana	46.7	53.3	42.5	57.5
Charco	45.0	55.0	36.8	63.2
Cumba	45.0	55.0	43.2	56.8
Ganchemba/Ribeira da Barca	45.1	54.9	38.9	61.1

Cited: CENSO 2000 e RGA 2004

Age Structure of the Population

The table below shows that majority of the population is consisted of the young aged residents in every watershed, and more than half of the population is in the age of workforce, which means the age of 15 to 64 years old.

Table 3.4.6 Age Structure of the Population (%)

Watersheds	0 to 4	5 to 14	15 to 24	25 to 44	45 to 64	More than 65
São Domingos	8.6	31.2	24.8	21.2	8.4	5.8
Boa Entrada/Santa Cruz	9.3	33.3	23.1	17.7	8.8	7.8
São Martinho Grande	8.9	30.4	25.3	20.2	10.6	4.6
São João Baptista/Santa Ana	8.7	35.1	21.7	16.7	10.5	7.3
Charco	8.5	35.3	21.3	17.3	8.7	8.9
Cumba	7.6	33.5	28.2	19.8	6.6	4.3
Ganchemba/Ribeira da Barca	8.8	34.9	22.4	17.8	8.8	7.3

Cited from: RGA 2004

Educational Level

Educational level of the population is extremely low: however, there is a considerable variation in the uneducated ratio by the watersheds. The uneducated ratio is the highest in São João Baptista/Santana Ana, and the lowest in São Domingos.

Table 3.4.7 Population by Educational Level (%)

Watersheds	No Education Received	Literacy	Nursery School	Elementary School	Secondary School	Post Secondary
São Domingos	10.7	2.9	7.8	52.5	24.7	1.4
Boa Entrada/Santa Cruz	17.7	3.6	5.6	55.5	17.2	0.4
São Martinho Grande	16.3	1.6	5.4	58.7	17.6	0.4
São João Baptista/Santa Ana	26.7	2.5	6.3	55.4	9.0	0.1
Charco	21.1	4.1	5.1	49.2	19.4	1.1
Cumba	13.1	0.5	5.1	65.9	15.4	0.0
Ganchemba/Ribeira da Barca	22.5	2.9	7.8	51.4	14.1	1.3

Cited from RGA 2004

(2) Agriculture

Cultivated Area

Table 3.4.8 Cultivated Area

Watersheds	TOTAL	Rain-fed Cultivation		Irrigative Cultivation	
		Ha	%	ha	%
São Domingos	694	594	85.6	100	14.4
Boa Entrada/Santa Cruz	1,131	1,088	96.2	43	3.8
São Martinho Grande	40	36	90.0	4	10.0
São João Baptista/Santa Ana	427	379	88.8	48	11.2
Charco	1,001	980	97.9	21	2.1
Ganchemba/Ribeira da Barca	708	702	99.2	6	0.8

Cited: RGA 2004

Percentage of Agricultural Households out of the Total Households

More than 60% of households in the watersheds are engaged in agriculture and livestock

activities. Especially, it is worth mentioning that more than 96% of families in Boa Entrada/Santa Cruz and Cumba are engaged in the agricultural sector. The ratio is the lowest in São Domingos.

Table 3.4.9 Percentage of Agricultural Households out of the Total Households

Watersheds	Number of Households	Total Agricultural Households	Agricultural Households (%)
São Domingos	935	564	60.3
Boa Entrada/Santa Cruz	1,029	990	96.2
São Martinho Grande	194	153	78.9
São João Baptista/Santa Ana	546	459	84.1
Charco	1,435	1,155	80.5
Cumba	77	74	96.1
Ganchemba/Ribeira da Barca	823	568	69.0

Cited from RGA 2004

Form of Cultivated Land

The number of the share cropping and tenant land exceeds owner farmers, despite that they are unstable methods of cultivation which prevents new investment and new agricultural techniques. The number of owner farmers is the lowest in Cumba.

Table 3.4.10 Forms of Cultivated Land (%)

Watersheds	Forms of Cultivated Land				
	Individual	Share Cropping	Tenant Land	Usufruct Land	Loan for Use Land
São Domingos	46.4	8.5	41.3	3.5	0.3
Boa Entrada/Santa Cruz	46.3	8.9	40.9	3.5	0.3
São Martinho Grande	46.1	9.5	40.5	3.5	0.4
São João Baptista/Santa Ana	46.9	6.4	43.0	3.6	0.1
Charco	46.3	8.9	40.9	3.5	0.3
Cumba	39.4	35.6	19.2	2.9	2.9
Ganchemba/Ribeira da Barca	46.3	8.9	40.9	3.5	0.3

Cited from RGA 2004

Types of Agricultural Activities

High percentage of households in surveyed areas is engaged in the rain-fed agriculture and livestock activities. In São Domingos and São João Baptista/Santa Ana, the ratio of households engaged in irrigated agriculture is the highest (34.0% and 39.2% respectively). The percentage of households engaged in livestock activities is the lowest in Cumba. The ratio practicing irrigated agriculture is the lowest in Ganchemba/Ribeira da Barca, so as the rain-fed agriculture in São Martinho Grande.

Table 3.4.11 Types of Agricultural Activities

Watersheds	TOTAL	Rain-fed Agriculture		Irrigative Agriculture		Livestock Activities		Agro-Forestry	
		Nº	%	Nº	%	Nº	%	Nº	%
São Domingos	564	435	77.1	192	34.0	533	94.5	0	0.0
Boa Entrada/Santa Cruz	990	967	97.7	225	22.7	921	93.0	18	1.8
São Martinho Grande	153	74	48.4	21	13.7	152	99.3	0	0.0
São João Baptista/Santa Ana	459	423	92.2	180	39.2	441	96.1	0	0.0
Charco	1,155	1,097	95.0	128	11.1	1,035	89.6	0	0.0
Cumba	74	71	95.9	13	17.6	48	64.9	0	0.0
Ganchemba/Ribeira da Barca	568	492	86.6	44	7.7	517	91.0	0	0.0

Cited from RGA 2004

Types of Irrigation

New irrigation methods, represented as drip irrigation, have been rarely employed in the regions except São Domingos where drip irrigation accounts for 14.7%. Although basin irrigation is the most familiar method, some farmers use combination of both the basin and drip irrigation.

Table 3.4.12 Types of Irrigation (%)

Watersheds	Basin Irrigation	Drip Irrigation	Basin and Drip Irrigation	Others
São Domingos	77.1	14.7	5.8	2.4
Boa Entrada/Santa Cruz	92.9	4.6	2.1	0.4
São Martinho Grande	83.3	4.2	8.3	4.2
São João Baptista/Santa Ana	94.5	4.1	1.4	0.0
Charco	95.4	2.0	2.6	0.0
Cumba	100.0	0.0	0.0	0.0
Ganchemba/Ribeira da Barca	90.9	0.0	9.1	0.0

Cited from RGA 2004

Origins of Irrigative Water

There are varieties of the origin of water for irrigation. Ground water from the wells is the main resources in São Domingos and Boa Entrada/Santa Cruz Watersheds. As for other areas, springs are the major origins of water for irrigation.

Table 3.4.13 Origins of Irrigative Water

Watersheds	Shallow Well	Deep Well	Gallery	Spring	Others
São Domingos	25.4	70.3	1.0	2.9	0.4
Boa Entrada/Santa Cruz	55.1	4.5	2.0	23.5	14.9
São Martinho Grande	12.5	12.5	6.3	68.7	0.0
São João Baptista/Santa Ana	6.3	11.4	17.7	52.0	12.6
Charco	9.2	0.8	4.6	82.3	3.1
Ganchemba/Ribeira da Barca	9.5	0.0	0.0	90.5	0.0

Cited from RGA 2004

Soil Conditions

The survey shows that chlorination of the soil significantly occurs in the regions of São Domingos and Cumba. Only 30.4% of the soil is not degraded in Ganchemba/Ribeira da Barca. Ratio of soil containing rocks shall be described in the table below.

Table 3.4.14 Soil Conditions (%)

Watersheds	Non Degraded Soil	Salt Content	Corrosion	Stony Soil	Stony and Corroded Soil	Salinity and Stony Soil
São Domingos	56.0	3.7	7.4	31.2	1.6	0.1
Boa Entrada/Santa Cruz	59.4	1.2	9.1	23.4	6.9	0.0
São Martinho Grande	44.4	2.5	8.7	42.5	1.3	0.6
São João Baptista/Santa Ana	40.2	2.7	3.7	48.0	5.2	0.2
Charco	59.4	0.8	12.7	19.5	7.6	0.0
Cumba	53.8	3.8	6.8	34.6	1.0	0.0
Ganchemba/Ribeira da Barca	30.4	0.7	32.8	23.5	12.6	0.0

Cited from RGA 2004

(3) Others

Type of Expected Development Activities

Agricultural water and electricity are the most expected areas for development marking more than 20% respectively, and daily domestic water comes to the next marking 17.9%. The following is livestock activities marking 7.7%. Agricultural credit is especially expected in Ganchemba/Ribeira da Barca.

Table 3.4.15 Types of Expected Development Activities

Watersheds	Type of Activities									
	Electricity	Livestock Activities	Roads	Education	Health	Agricultural Credit	Tele-phone	Daily Domestic Water	Agricultural Water	Others
São Domingos	37.5	4.2	4.2	0.0	0.0	0.0	0.0	4.2	20.8	29.1
Boa Entrada/ Santa Cruz	8.3	0.0	4.2	8.3	0.0	4.2	0.0	33.3	33.3	8.4
São Martinho Grande	25.0	4.2	0.0	0.0	0.0	0.0	0.0	41.7	25.0	4.1
São João Baptista/ Santa Ana	12.5	8.3	8.3	4.2	0.0	4.2	8.3	29.2	25.0	0.0
Charco	29.2	8.3	0.0	16.7	8.3	4.2	4.2	8.3	16.7	4.1
Cumba	12.5	12.5	0.0	4.2	16.7	0.0	0.0	0.0	12.5	41.6
Ganchemba/ Ribeira da Barca	16.7	16.7	4.2	12.5	4.2	20.8	0.0	8.3	12.5	4.1
Total	20.2	7.7	3.0	6.5	4.2	4.8	1.8	17.9	20.9	13.0

Cited from Inquiries for Watersheds 2008

Natural Conditions

(Area of Watershed, Length of Watershed, Volume of Precipitation and Alluvial Areas)

Table 3.4.16 Natural Conditions

Watersheds	Area of Basin (km^2)	Length of Basin (km)	Volume of Precipitation (m^3/km^2)	Alluvial Area (%)
São Domingos	44.3	16.3	363,000	9.3
Boa Entrada/Santa Cruz	41.9	15.4	338,000	7.2
São Martinho Grande	34.4	14.9	289,000	3.6
São João Baptista/Santa Ana	58.1	14.0	252,000	2.8
Charco	35.6	10.3	312,000	10.0
Cumba	13.7	7.3	361,000	3.7
Ganchemba/Ribeira da Barca	25.4	7.8	268,000	2.5

3.5 Classification of Watersheds and Selection of Model Watershed

3.5.1 Classification of Watersheds

From the data collected in seven selected watersheds, the cobweb chart analysis was conducted in order to obtain their characteristics. It attempts to categorize seven watersheds from the similarities of distribution profile.

The items below that are highly correlated to hindering factors and potentials of integrated rural development in each watershed were selected for the analysis.

Rural Social Situation:	population density, number of households engaged in agriculture, number of community associations, numbers of owner farmers, poverty ratio, ratio of male out of the total population, number of workforce (15 to 64 years old), and the number of graduates from elementary schools.
Natural Conditions:	Areas of basins, length of watersheds, volume of precipitation, soil destruction, alluvial areas, and salt damage
Agricultural Activities:	irrigation and livestock activities.

The results of analysis are shown below:

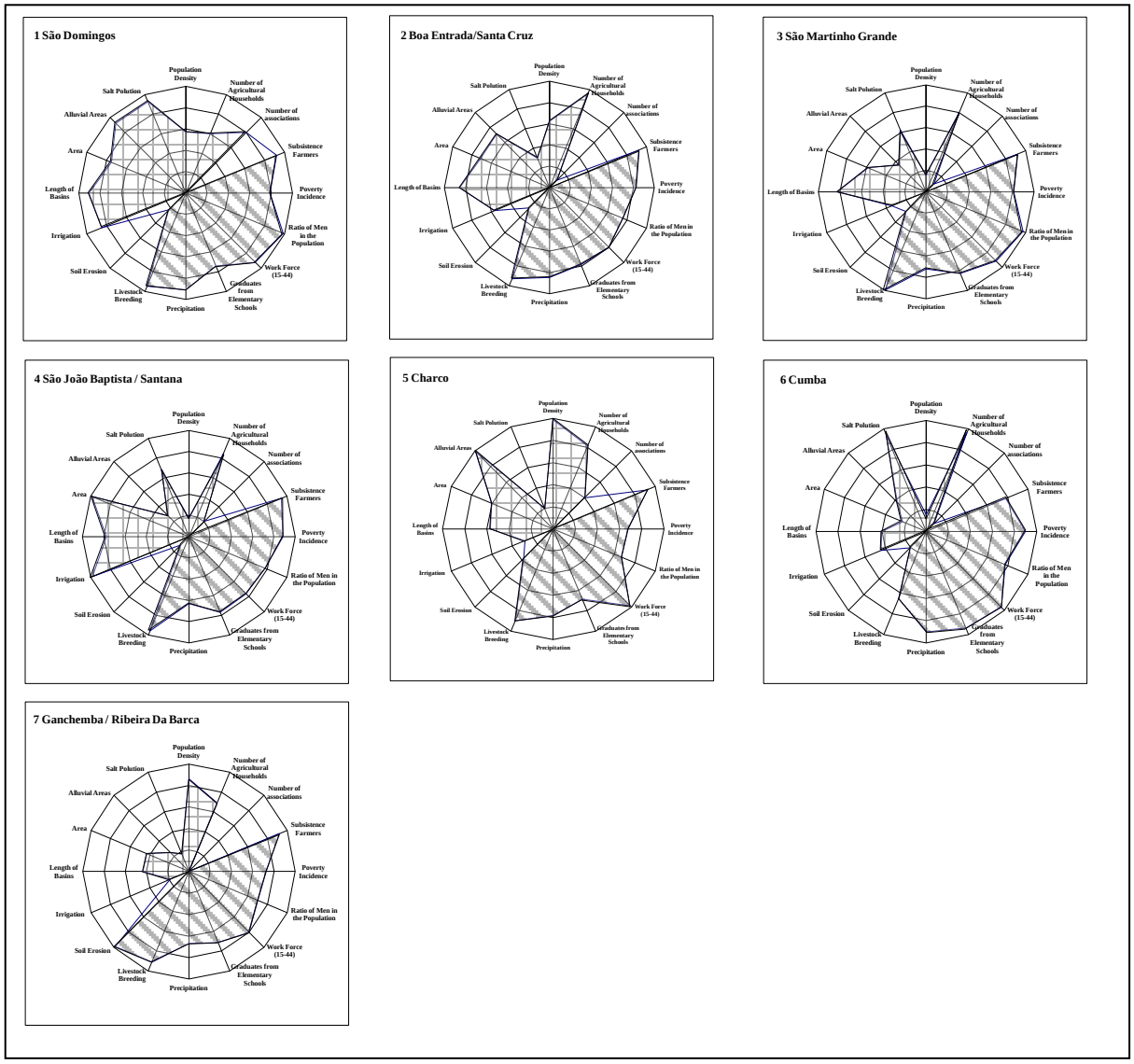


Figure 3.5.1 Result of Analysis by Cobweb Chart

As can be observed from the results, seven watersheds show almost the similar distribution profile in the owner farmers, the poverty ration, the ratio of men in population, the number of work force (15 to 44 years old), the number of graduates from elementary schools, the volume of precipitation, the livestock breeding and the soil corrosion (shown as diagonal line), excluding the soil erosion in Cumba. However, no categorical similarities can be seen in other items.

The challenge in this study is the efficient utilization of rainfall in Santiago Island where water resources are restricted. Therefore, this study attempted to create new categorization, placing the rainfall conditions in the areas as foremost important variable.

The hypothesis of the categorization was that 'Annual rainfall in the watersheds with ZAE I to IV is larger than that of the watersheds with ZAE I to III'. If the hypothesis can be employed, it might be possible to categorize the areas into two, based on the volume of precipitation, which are the precious natural resources. This study estimated the annual volume of rainfall, collecting the data on areas at

each contour rainfall level in each watershed. The results are shown below.

Table 3.5.1 Annual Volume of Precipitation in Watersheds (mil m^3/km^2)

	São Domingos	Boa Entrada/Santa Cruz	São Martinho Grande	São João Baptista/ Santana	Charco	Cumba	Ganchemba/ Ribeira da Barca
ZAE IV	Exist	Absent	Exist	Absent	Absent	Absent	Exist
Precipitation	363	338	289	252	312	361	268

The result showed that it appeared that the existence of the basin ZAE IV did not define the characteristics of precipitation. Therefore, it revealed that the classification of the seven watersheds based on the existence of ZAE IV was not feasible.

As it was not feasible to classify seven watersheds neither by the cobweb chart analysis nor the characteristics of precipitation, it was decided to recognize the whole seven watersheds as one classification for drawing up the Action Plan.

3.5.2 Selection of Model Watershed

Based on this information, the study team tried to choose the model watershed, as all the conditions originally have been established in this study. The patterns of selection of watershed model will be presented in Table 3.5.2 below.

1) Population density: calculated from the result of rural social survey
2) Potential of circulative use of water in the entire watershed
   (The study differentiated Cumba, due to the relative size of the area.)
3) Cooperative behavior of the residents: the ratio of population who has will to participate in rural development was calculated from the survey
4) Number of the cooperative associations: derived from the result of the survey

Table 3.5.2 Characteristics of the Watersheds

Name of the Basin	Population Density (Person /km^2)	Circulative Use of Water	Collaboration of Farmers	Numbers of Associations	Watershed Area Model
São Domingos	114	○	91.7%	12	○
Boa Entrada/Santa Cruz	125	○	100.0%	1	○
São Martinho Grande	31	○	83.3%	1	×
São João Baptista/Santa Ana	35	○	91.7%	2	×
Charco	197	○	95.8%	4	○
Cumba	30	△	91.7%	1	×
Ganchemba/Ribeira da Barca	173	○	91.7%	1	○

There seems no large gap among the seven watersheds, as for the coordination of the residents. Three watersheds are excluded, due to the limited population density. Therefore, Sao Domingos, Boa Estrada/Santa Cruz, Charco and Ganchemba/Ribeira da Barca were selected as the candidates for the model watersheds.

On the other hand, as mentioned in the categorization, it is difficult to discuss the existences of ZAE IV controls the characteristics of precipitation; however, the study does not deny the importance of ZAE IV.

According to the 'Strategic Plan for the Agricultural Development to 2015 and Action Plan from 2005 to 2008(PEDA)', farmers continue to cultivate root vegetables by rain-fed cultivation in ZAE IV in Santiago Island. However, the government recognizes the necessity for maintenance of basins, and attempts to augment agricultural production, with the ZAE IV remaining as conservation areas by implementing agro-forestry. More than 4,000 ha of cultivating areas existed in ZAE IV in Santiago Island. The areas have started to shrink since 2000, due to the public policy which reduced the yields of corns and beans by traditional method. PEDA predicts the 5 percent increase in the yields of crops in ZAE IV by 2015 at national level. Santiago Island has large cultivation areas in ZAE IV. Therefore, in selecting model Watersheds, the existence of ZAE IV, which serves development model for natural resources management, should be taken into consideration.

Among the remaining 4 watersheds, only São Domingos and Ganchemba/Ribeira da Barca include ZAE IV. As a result, São Domingos has been selected as a model watershed due to its large number of associations.

3.6 Model Watershed

This Development Plan (Action Plan) attempts to propose measures in which rural residents sustainably use and conserve ecology of the watershed in Santiago Island, in terms of medium and long-term development, and to propose integrated development model for the watersheds which contributes to improve the livelihood of rural population practicing agriculture with limited natural resources. As mentioned above, Draft Action Plan is to be elaborated in Sao Domingo Watershed which was selected as the model watershed area.

3.6.1 São Domingos Watershed

Profile of São Domingos Watershed is shown below:

Areas: 44.3 km^2

Length of basin: approximately 16 km (Altitude of the highest peak: 813 m)

Annual Precipitation: Approximately 360 mm

Population : 5,048 habitants (Poverty ratio: 52.6%)

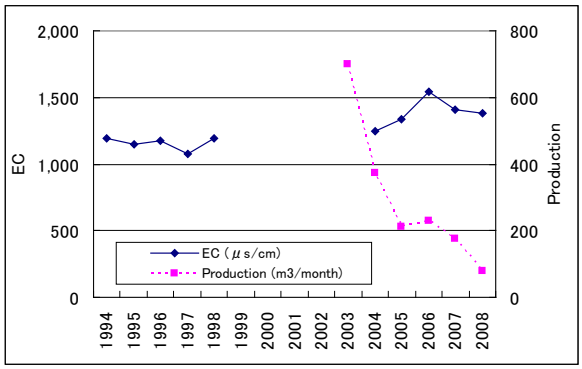
Number of Associations: 12

Number of Communities: 10

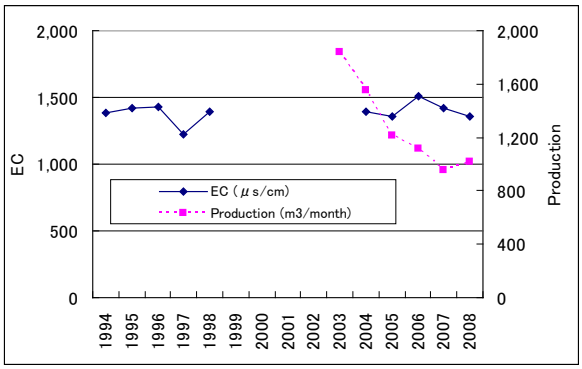
Cultivated Areas: 694 ha (Rain-fed agriculture: 594 ha; Irrigated agriculture: 100 ha)

3.6.2 Quality of Water (EC and pH)

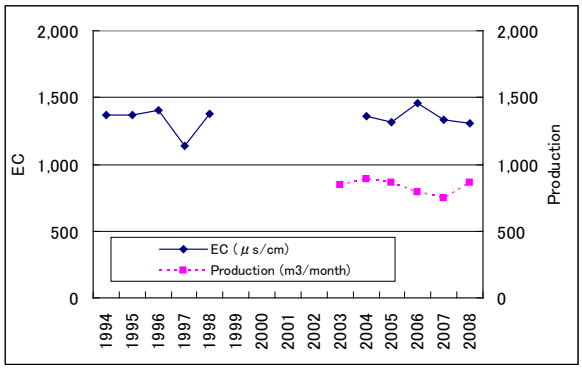
Chronological changes in the Electrical Conductivity (EC) and monthly average production of water of wells under the management of National Institute for Water Resources Management (INGRH) are shown below. (Data from 1999 to 2002 are lacking.)



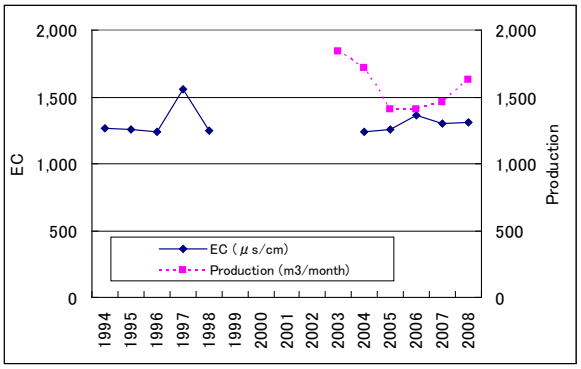
FT81 (ZAE II)



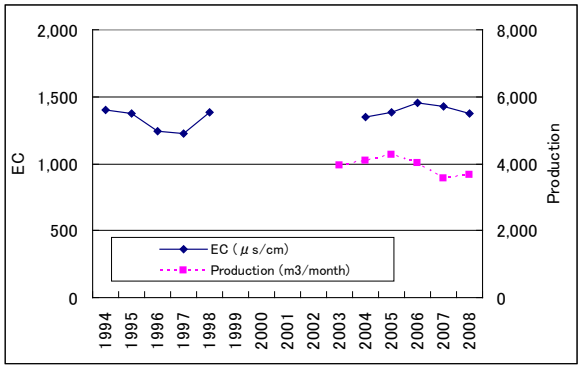
FT42 (ZAE I: Achada Baleia)



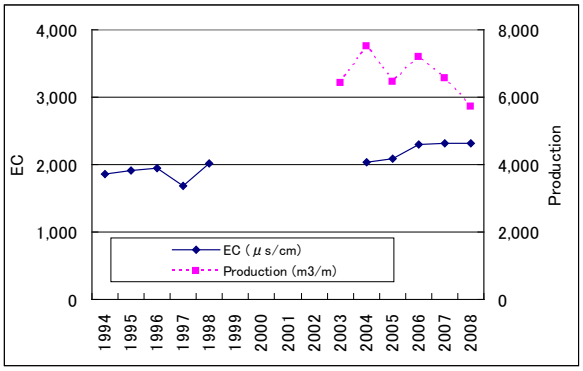
FT25 (ZAE I: Achada Baleia)



FT26 (ZAE I: Achada Baleia)



FT40 (ZAE I: Achada Baleia)



FT44 (ZAE I: Baia)

Figure 3.6.1 Chronological Changes in EC and Monthly Average Production

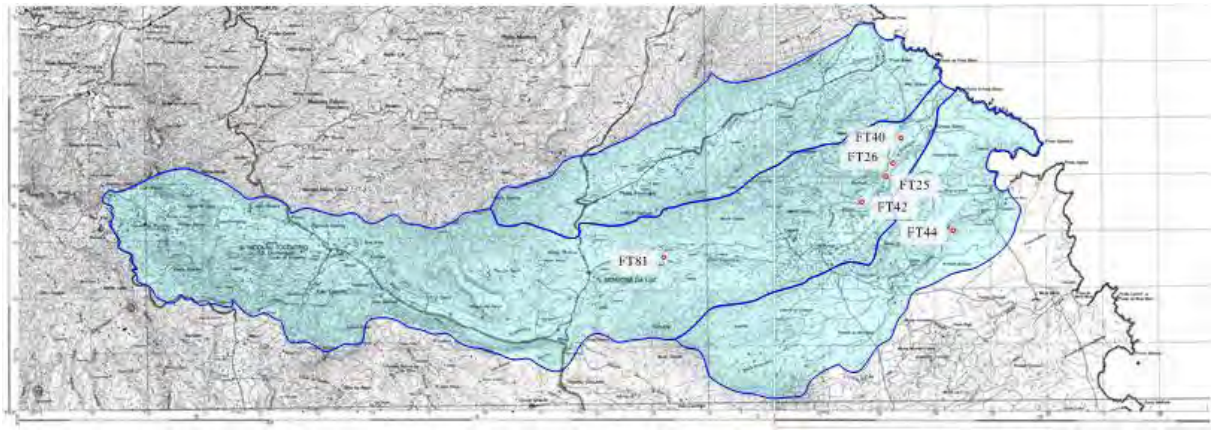


Figure 3.6.2 Locations of Examined Wells

Formally, it was thought that excessive water pumping brought about high level of salt concentration in the ground water, which turned out to be wrong from observation of the chronological changes, excepted FT81 where concentration of salt rises according to the decrease in the yields.

Considering thoroughly these data, it could be estimated that EC in the ground water of Santiago Island was originally high. Hence, the study team carried out the measurement of the quality of ground water (EC & pH) in the Watershed. The results are shown below:

Table 3.6.1 EC & pH of Ground Water in São Domingos Watershed

Lugar	①	②	③	④	⑤	⑥	⑦	⑧	⑨	⑩	⑪	⑫	⑬	⑭
	Rui Vaz	Rui Vaz	Água de Gato	Água de Gato	Lagoa	Praia Formosa	Praia Formosa	Portal	Achada Baleia	Achada Baleia	Achada Baleia	Baia	Baia	Baia
	Furo	Reservatório de Dique	Fonte 1	Galeria	Fonte 2	Poço 1	Reservatório Grande	Poço 2	Furo FT40	Poço 3	Poço 4	Furo FT44	Poço 5	Poço 6
EC (μs/cm)	405	716	515	449	439	1,277	961	1,190	1,454	5,200	13,070	2,370	6,160	7,260
pH	8.45	8.81	8.18	8.25	8.26	7.03	8.84	7.60	8.09	7.61	7.61	8.18	7.23	7.20

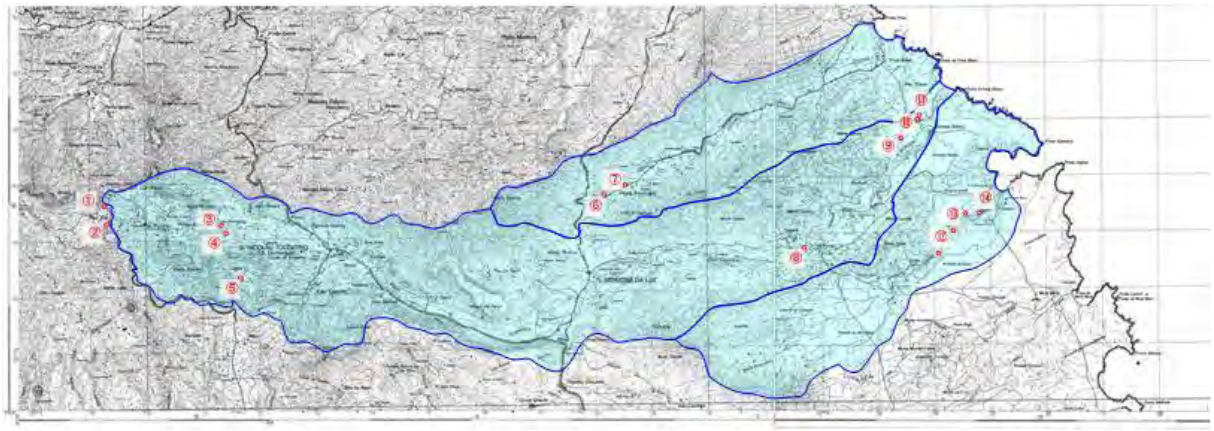


Figure 3.6.3 Location of Measured Water Sources

With regard to FT40 and FT44, the study team obtained almost the same scores as those of INGRH. EC of the spring water including galleries is 500 μs/cm. Regarding the wells, those of the middle stream of the basin values around 1,200 μs/cm, while the downstream of the basin values of 5.000 μs/cm or more. Also, almost entire water in the Watershed is categorized as alkaline pH, 7.0 to 7.6 in shallow wells, and 8.0 or more in others. (Ministry of Agriculture, Forestry and Fisheries of Japan sets less than 200 μs/cm for EC and 6.0~7.4 for pH as ideal barometers of the irrigation water for growing paddy rice).

3.6.3 EC and pH of Soil

EC and pH of soils in São Domingos Watershed are measured. The results are shown below:

Table 3.6.2 EC & pH of Soils in São Domingos Watershed

Lugar		①	②	③	④		⑤	⑥	⑦					⑧
		Praia Formosa	Praia Formosa	Achada Baleia	Achada Baleia	Achada Baleia	Achada Baleia	Achada Baleia	Baia	Baia	Baia	Baia	Baia	Baia
		Agricultura de sequeiro (Milho)	Rega (Quiabo)	Rega (Pimentão)	Campo Experimental 1	Campo Experimental 2	Rega (Tomate)	Alqueive	Alqueive	Rega (Cebola)	Rega (Pepino)	Alqueive	Rega (Tomate)	Rega (Cana de Açúcar)
EC (μs/cm)	Solo Superficial	111	109	1,034	233	247	246	827	2,067	615	996	3,365	631	710
	Solo Baixo	185	56	742	175	453	547	1,801	2,920	487	644	2,863	665	286
pH	Solo Superficial	7.21	8.23	8.01	8.04	8.48	8.42	7.81	7.12	8.42	8.57	8.07	8.21	7.97
	Solo Baixo	7.14	8.11	8.12	8.45	8.48	8.20	7.74	7.62	8.65	8.97	8.19	8.45	8.19

Solo Superficial (0～20 cm) Solo Baixo (20～40 cm)

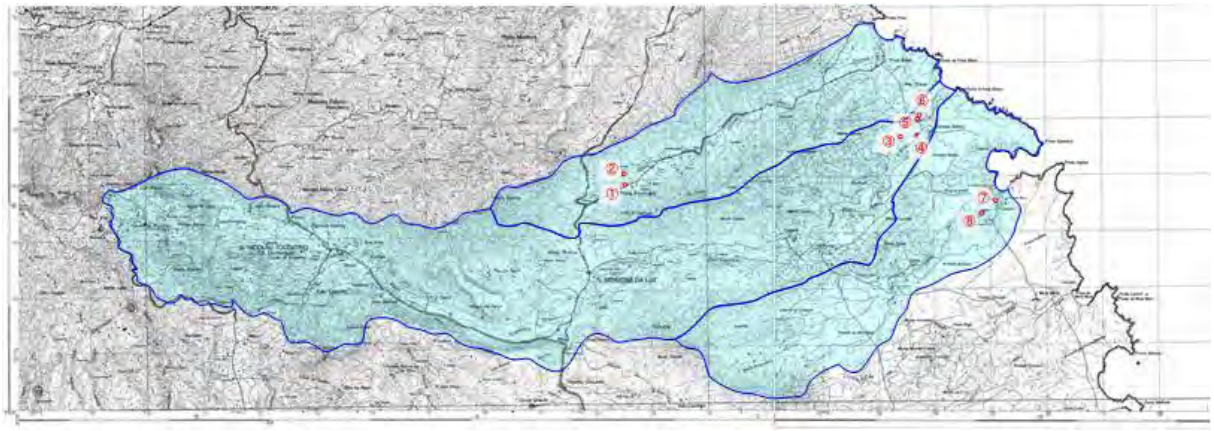


Figure 3.6.4 Locations of Sample Collection Points

These results indicate the moderate figures in terms of the EC of soils in the Watershed. However, in Baia, bank protections along the rivers were destroyed due to the flood in September, 2008, which potentially desalinized the cultivated lands. As for pH, irrigated soils show more than pH 8, which might be correlated to the value of pH 8 of the irrigation water.

3.6.4 Chronological Changes in Annual Precipitation

The figure below shows the chronological changes in annual precipitation at four points in São Domingos Watershed (São Domingos, Rui Vaz, Milho Branco and Ribeirão Chiqueiro).

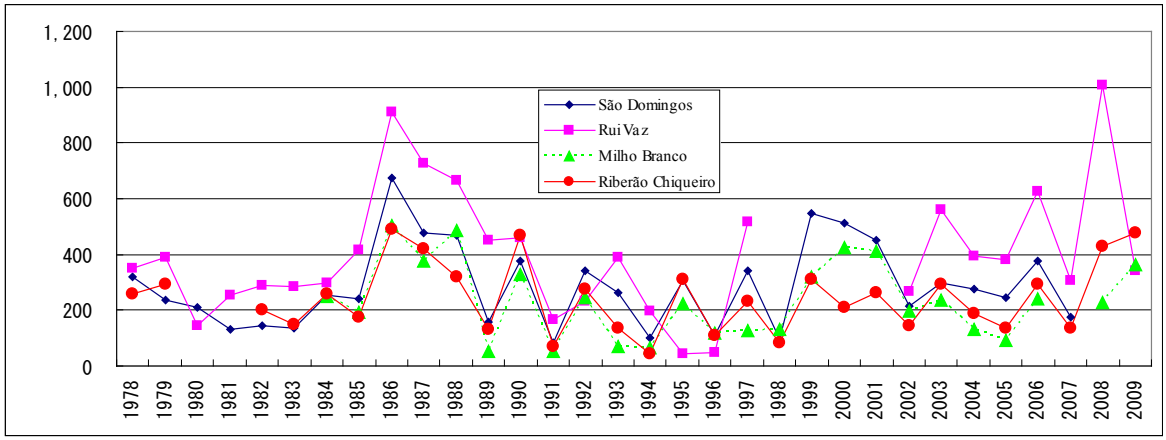


Figure 3.6.5 Chronological Changes in Annual Precipitation in São Domingos Watershed

Normally, it is said that there used to be considerable amount of rainfall 20 years ago and the annual precipitation has been gradually decreasing afterwards. However, as far as the data is shown, it might be difficult to prove the annual precipitation in São Domingos Watershed has been decreasing during the 20 years, although large amount of rainfall was marked in 1986, 1987 and 1988.

3.6.5 Agriculture in Model Watershed

São Domingos Watershed extends from the 800 m of mountain areas to the ocean areas, and various agricultural activities are practiced according to the natural and social conditions. Agricultural characteristics in the Watershed are shown below.

(1) ZAE IV

Most of the farmers are highly depending on the rain-fed agriculture, due to the limited ground water for agriculture and the moderate amount of rainfall in ZAE IV located in the highest altitude of the Watershed. Main crops are corns, beans (e.g. Egyptian beans) and sweet potatoes. Taking advantage of the cool climate, cultivation of green vegetables (cabbage) and gourds by supplemental irrigation from water tanks and water reservoirs can be seen in the limited cultivated areas. Farmers are practicing unstable agriculture due to precarious climate, and cropping season is restricted in the rainy season, although they can enjoy rather abundant rainfall compared to other ZAEs. In order to utilize such limited cropping season and farm lands, some farmers go to neighbouring cities to purchase nursery plants of vegetables. Livestock breeding using agricultural residue is also practiced; however, numbers of livestock animals are limited, since most of the lands other than cultivated areas, houses and roads are forest conservation areas or are covered by steep bare rocks.

(2) ZAE III

In ZAE III, which is the second highest zone after the ZAE IV, irrigated vegetable cropping using spring water and shallow wells at the bottom of the valleys are popular in addition to the rain-fed agriculture on the slopes. Corns, beans, ground nuts, sweet potatoes, and sugar canes are mainly cultivated with rain-fed cultivation, and tomatoes and carrots can be seen in some areas. As for

irrigated agriculture, ZAE III is the major supply center of green vegetables (lettuce, cabbage and parsley) and fruit vegetables (tomatoes, cucumbers and kidney beans) and root vegetables (carrots) circulated in Praia market. Farmers generally start to plant vegetables, other than green vegetables which can be cultivated in rather short period, in the end of rainy season (i.e. September and October), since it is rather difficult to manage crop diseases in rainy season (i.e. from July to October). Cool climate is suitable for vegetable cropping with abundant amount of spring water. The timing is also favourable in terms of distribution and marketing, when both the demand by the market and price become surge. Even during the dry season, vegetable cropping is popular in the regions where farmers can have access to the spring water. Spring water and water from wells are also utilized for daily domestic water. Although the water is free to use, there is the risk of seasonal fluctuation of availability of water. Vegetable cropping by rain-fed cultivation mentioned above is practiced on the slopes of the valleys where disease and insect damages are relatively small. Fruits cropping such as mangoes and papayas can be seen in some parts of the farm lands. Few residents practice livestock breeding, due to the geographical limitation (steep landscape). Consequently, quite a number of farmers purchase cow dung as manure from other zones, due to its insufficiency there. On the contrary, some farmers sell the crop residue to other farmers in other districts, due to small numbers of livestock animals.

(3) ZAE II and ZAE I

In ZAE II and ZAE I, rather undulating lands appear in exchange for the steep landscape as in the upper and middle stream. It seems, therefore, apparently, suitable for cropping. However, since precipitation and spring water are limited, ground water and small rainfall are the major water sources for agriculture.

There are several similarities between the two ZAEs without big differences. It highly depends on the land conditions on which whether ground water is available or not, rather than the characters of ZAEs where the precipitation is quite few. In the cultivated land where ground water is available, commercial crops (e.g. tomatoes, onions, green peppers, cucumbers, egg plants, water melons, and pumpkins) are cultivated almost without exception, regardless of the water from deep wells or shallow wells. Theses irrigated lands are also the major distribution center to the Praia market as in ZAE III. Sweet potatoes are cultivated in this area as nutrient source, since yields of corns (staple food[4]) have decreased recently. Farmers cultivate sweet potatoes not only for self-consumption, but also for commercial use, due to the limited preservative quality compared to grain crops. On the other hand, corns are equally planted in the rain-fed farms where ground water is not available. However, the yields of corns have been dramatically decreasing, and the farmers rarely enjoy cultivation of corns in consecutive years. Stems and leaves of uncultivated corns can be utilized as forages. Yet, there are some draughts-sicken areas where baby corns die out right after the germination. For these reasons,

[4] Rice, corns, wheat, and potatoes rank in this sequence, in terms of the importance of the starchy food. Corns, sweet potatoes and cassavas are produced domestically. Although there are some acreages of potatoes, consumption are mostly depended on import produce. As for rice and wheat, all of the consumption is covered by import. Nowadays, trade of these staple foods is operated by the private sector, although national institutes used to manage trade activities.

farmers who cannot irrigate the lands depend on the livestock breeding and commercial benefit other than agricultural production, instead of food securement and income earning by crop yield. Also, there are some farmers in ZAE I who rent the highland areas outside the communities where more rainfall can be expected.

Comparing the two ZAEs, there seems to be a little gap in rainfall; mixed cropping of corns and Egyptian beans are practiced in rain-fed cultivated lands in ZAE II where annual precipitation exceeds a bit more than that in ZAE I. However, there is not yet a big difference in the sense that there may be little or no harvest if it does not rain enough.

(4) Other Findings

The yields of corns, beans and potatoes which account for major cropping areas in Santiago Island are mainly for self-consumption, and the surplus are distributed for commercial use. Commercial crops are limited to vegetables, peanuts, fruits, and sugar canes.

Most people in CV believe in Catholic, and demand for the commercial crops will increase in the Christmas and the Carnivals (annually changes between the latter half of February and the first half of March) before the Lent (fasting of livestock and fish). Therefore, the yields of commercial crops adjusted to the timing might be favourable for farmers.

It seems rather familiar to farmers to use agrichemicals (pesticide and fungicide), chemical fertilizers (PNK and urea), compared to those in other Sub-Sahara African countries, and various import goods are put on the shelves in the shops selling agricultural materials.

Chapter 4 Development Constraints

4.1 Development Constraints, Measures and Strategies in Supreme Plan

In elaborating Action Plan, 'Strategic Plan for the Agricultural Development to 2015 and Action Plan from 2005 to 2008 (PEDA)' and 'National Program of Medium Investment Plan (PNIMP)' shall be under consideration to create concrete Action Plan for integrated rural development in watersheds in Santiago Island.

4.1.1 Development Constraints and Measures in Watersheds

The supreme plan of PEDA states "development constraints and measures to be taken to realize integrated rural development on sustainable agriculture utilizing natural resources and soil & water conservation". The followings are the items to be concerned strikingly.

Development Constraints and Measures in ZAE I, ZAE II, ZAE III and ZAE IV

1) Lack of Water Resources

Constraints

During the 9 months of dry season, water resources for irrigation are limited to the scarce groundwater. Even the rain-fed agriculture is applicable in the wet season, yields are unstable and small due to the little rainfall.

Measures

- Introduction of irrigation through wells where the groundwater is exploitable. (development of water-saving irrigation)
- In the long run, recharge of groundwater through awareness creation of rural residents and integrated water resources management.

2) Salinization

Constraints

Excessive water pumping for groundwater irrigation brought about intrusion of seawater into the groundwater, and thus, brings about dense salty irrigation water causing serious damage in irrigation land.

Measures

- Introduction of species capable of resisting salt damage;
- Introduction of saving irrigation;
- In the long run, regeneration of groundwater through awareness creation of irrigation farmers and monitoring of water resources in watersheds.

3) Degradation of Pasture

Constraints

Chronicle lack of grazing grass due to unstable rainfall, and devastation of pastoral lands caused

by extensive livestock breeding and overgrazing are major constraints. They are causes of low production of livestock animals.

Measures

- Use of livestock varieties resistible against draughts;
- Promotion of intensive livestock breeding in warehouses;
- Introduction and increase of new varieties of forage.

4) Low Agricultural Production

Constraints

Small and unstable precipitation, traditional agricultural techniques, low irrigation efficiency, limited arable lands and lack of water resources bring about law agricultural production.

Measures

- Development of irrigated agriculture where ground water is exploitable;
- Introduction of water saving irrigation;
- Reduction of unmanaged livestock;
- Implementation of new technologies for farm management.

Development Constraints and Measures in Irrigation Zones

1) Lack of Irrigation Water

Constraints

Water resources for irrigation are highly limited to the scarce ground water during the 9 months of dry season. However, irrigation water development has been delayed and the farmers irrigate lands with flexible use of limited water. In addition to this, lack of irrigation facilities and farmers' lack of awareness for water resources management are considerable.

Measures

- Water resources development for intensive irrigated agriculture;
- Improvement of water resources management by farmers;
- Introduction of modern irrigation techniques;
- Definition and clarification of responsibilities of related organizations on water resources;
- Execution of integrated and environmentally friendly water resources management;
- Efficient use of existing water resources developed;
- Participation of farmers and rural residents for sustainable use of irrigation facilities;
- Training of human resources necessary for water resources development.

4.1.2 Rural Development Strategies in Watersheds

PEDA defines sectoral strategies for rural development activities in consideration of the constraints and their measures listed below.

1) Vegetable Cultivation

As for vegetable cultivation, this study aims at the reformation of agriculture, focusing on sustainable use of natural resources by adopting new production methods to potential of each ZAE, according to the following strategies mentioned below:

(i) Integration of agriculture, forestry and livestock breeding considering the potential of each ZAE;
(ii) Promotion of value-added technologies in irrigated agriculture including hydroponics;
(iii) Application of PPI (Integrated Production and Protection) and reinforcement of counter emergency measures;
(iv) Value-addition to agricultural produce by conservation, processing and commercialization.

2) Livestock Breeding

Integrated development strategies in livestock breeding are listed below:

(i) Improvement and diversification of integrated livestock breeding by family;
(ii) Promotion of intensive and industrialized livestock breeding;
(iii) Diversification and value-addition to the livestock breeding industry.

3) Forestry

Promotion of participatory forestry oriented by agriculture, forestry and livestock breeding are with the strategies below:

(i) Sustainable management of forest resources along the socio-economic situation of each ZAE;
(ii) Promotion of participatory and sustainable forest management by residents;
(iii) Integration of agricultural production system and forestry;
(iv) Gradual transfer of responsibilities to local residents by participatory land management;
(v) Protection of preserving areas by settlement with local residents;
(vi) Value-addition to forestry including fruit plants in both public and private areas.

4) Water Resources

Sectoral strategy for water resources development are listed below:

(i) Reappraisal and understanding of present situations of watersheds according to characteristics of each ZAE;
(ii) Water resources management (increase in the available amount of water resources, monitoring of ground water aquifers and reasonable use of water for agriculture);
(iii) Irrigated agriculture management in each ZAE;
(iv) Integrated development of water resources in each ZAE considering the balance of environment, ecology and biodiversity.

5) Rural Activities for Income Generation

For the purpose of improvement of income generation at individual and association levels, the strategies listed below are required for rural activities promotion:

(i) Management of community environment;
(ii) Gathering of available information on social and cultural activities and education etc.;
(iii) Promotion of consistent services in the production sector;
(iv) Installation, maintenance, management services for reservoirs and irrigation facilities;
(v) Promotion of local handicraft industry;
(vi) Diversification of production represented by ornamental flowers, ornamental cultivation, fruits and traditional medical plants, etc.;
(vii) Development of rural tourism.

4.2 Development Constraints of Model Watershed

Development constraints for the realization of development plan (Action Plan) in São Domingos Watershed were examined. The analysis was carried out by the outcome of filed study, such as review of existing data, rural social survey, observation by the study team and hearing.

The development constraints of each ZAE in the Watershed clarified by the analysis are shown below:

4.2.1 Lack of Water Resources

Although rainfall in the rainy season (August to October) enables rain-fed agriculture in the upper stream of the river (ZAE IV and III), yields of crops and vegetables are restricted due to the limited and precarious precipitation (average annual precipitation is about 360 mm). Available water resources are limited to the spring and ground water, since it scarcely rains during the 9 months of dry season.

Although irrigated agriculture using ground water is practiced in the downstream of basins, the absolute amount of water is insufficient, and irrigated area is rather small because of the availability of water from wells. Also, concentration of the salt in ZAE I near the seashores in terms of EC shows 1,200~2,000 μs/cm which is comparatively high for irrigation water. These figures have not changed significantly for these decades, and EC of the ground water in the downstream is estimated to be relatively high[1]. There are some areas suffered by salt, since farmers have used rather highly sanitized water for a long period. Therefore, it might be unrealistic to expand the irrigable land with development of ground water in the current situation.

Also, there are some wells where the decrease in the level of ground water appears before the rainy season extremely restricts the cultivated areas, affected by the seasonal variation in the absolute amount of water. This infers the basin lifts up water from the first aquifer, assuming from the fact that the level of ground water varies by rainfall. Therefore, it might be possible to increase the amount of pumping at the lower stream, by means of water resources recharged in the upper and middle stream.

On the other hand, in the current situation, rainwater in the upper stream of the river directly flows into the ocean without benefitting ZAE I and II. There is a possibility of utilizing the final

[1] This has not been actually assessed in 'Study for Ground Water Development in the Santiago Island' conducted by JICA in 1993. In order to clarify the estimation, large scale study on the ground water is required. Therefore, this study does not interrogate this point due to the scope of this project.

effluent.

Annual precipitation in the upper stream of ZAEs III and IV, which is 400~500mm, exceeds the average annual rainfall of the entire Watershed. Hence, rain-fed agriculture in the rainy season is possible there, despite the unstable crop yields due to the limited and precarious rainfall. Therefore, some sights introduce supplemental irrigation in vegetable cropping. It utilizes the water-harvesting in order to storage rain water from the shelves and roads into the small tanks. Farmers use the remaining water stored during the last rainy season, (purchased water unless water remains in the tanks) in order to start planting nursery plants. They conduct transplantation before the rainy season, and cultivate crops using rain water. Supplemental irrigation with stored water is conducted, in case rainfall does not meet the required amount for cropping. Second cropping, after the yields of the first cropping, is conducted utilizing the water stored in the tanks after the dry season.

In ZAE IV, supplemental irrigation by drip irrigation system, using water of well of which the price is rather high is practiced in some parts of the region; however, this is the exceptional case.

Consumption amount of irrigation water is rather high in the cropping of ZAE III in the dry season, since farmers mostly conduct traditional irrigation (small basin irrigation and furrow irrigation), utilizing spring water and well water. It infers that surplus water might appear by substituting traditional irrigation with the water saving irrigation. Considering the water resources of the entire Watershed, conveying this surplus water to the lower stream enables the expansion of irrigation areas where irrigation water is lacking. It, however, requires initial investment to the drip irrigation and the construction of the ditches which convey the water to the lower stream. It might be unreasonable for residents in ZAE III who enjoy rather abundant water to be burdened by purchasing drip irrigation facilities and construction of water facilities which are beneficial for farmers in the lower stream. Therefore, beneficiaries (farmers in the lower stream in this case) shall cover the cost for this project. However, considering the scale of the project, the government of CV should consider the future policy for maximum use of limited water resources[2].

4.2.2 Salt Damaged Land

ZAE I is located along the coast, and the salt damage is observed, due to the fact that farmers use high saline concentrated water for irrigation for a long time. Therefore, there is a lot of agricultural land with little yield or abandoned fields scattered in the area.

It is required to study the possibility of yield restoring and crop cultivation in the salt damaged land, by means of introduction of salt resistible crops and the salt damaged lands recovery by desalination with leaching.

4.2.3 Inappropriate Management of Infrastructure

Water leakage from pipeline is observed here and there. Accumulation of the leakage in the entire region amounts large quantity, even if each of the leakage is tiny. Proper management of infrastructure

[2] As a result of the calculation of water-saving in the shift from the traditional irrigation to drip irrigation, it can save 5,000 m^3/year per hectare of water in three cropping cycles. This is corresponding to the consumption of water for some 0.57 ha by drip irrigation in three cropping cycles in the lower stream of river.

can prevent the wasted consumption of water resources.

4.2.4 Inadequate Management of Natural Resources

The lack of consciousness of local residents towards the management of natural resources leads to the inadequate integrated management of natural resources. In addition, soil erosion occurs in several places due to the geographical features, such as steep slopes, and the high rainfall intensity even though amount of rainfall is small. In consequence, cultivated lands are devastated. Provided that this situation is left as such, soil erosion would be worsen at an accelerated pace, which deteriorates the decrease in the cultivated areas. Therefore, the promotion of the project of soil and water conservation is required to prevent soil erosion. In order to realize the sustainable conservation in well balanced with the regional society, coordination of the government and the associations in the communities are required to manage natural resources.

Local residents have cultivated corns and beans (stable food) with rain-fed cultivation. Productivity of these vegetables is low due to the limited and precarious rainfall, and cultivation on the slopes often causes soil erosion. The government of CV is encouraging the shift of irrigation methods from extensive cultivation of corns on the steep slopes to intensive crop cultivation utilizing water saving irrigation. However, this movement is running late due to the lack of consciousness of local residents, and to the fund shortage.

Soil erosion should be restricted by soil conservation works such as terraces. As mentioned before, the rainfall directly flows to the ocean. Construction of soil conservation works limits the runoff ratio of rainfall and recharge of the ground water at the same time. In addition, as for supplementary irrigation for staple food cultivation, the project should be implemented carefully, since large irrigative areas make it difficult to control water due to shortage of irrigation water[3].

4.2.5 Devastation of Pastoral Land

Due to the scarce and erratic rainfall, forage as the feed is insufficient. In addition to this, extensive grazing and uncontrolled livestock breeding cause devastation of the pastoral land, this, in consequence, leads to the chronic shortage of fodders. It also causes soil erosion. Therefore, it is necessary to keep cow, pigs and chickens in the pens, instead of the extensive breeding of cows and goats.

4.2.6 Surplus of Agricultural Produce

Supply to the market is concentrated between the rainy season and the beginning of dry season, when agricultural produce are at their peak. Hence, the market price decreases in this particular season, and the average grade goods loose their value and are wasted. Therefore, by processing such produce, they can serve as storage food for security, and the increase in the income of farmers can be expected by selling the processing goods.

---

[3] The increment of ground water recharge was calculated to assess effect of ground water development in the case of forestation for the soil conservation works. As a result, it shows that some 400 m^3 of ground water can be exploited by 1 hector of forestation.

4.2.7 Fragility of Commercialization Structure of Agricultural Produce

In São Domingos Watershed, producers are selling their agricultural produce in retail shops almost exclusively; hence, there seems to be no cooperative shipping system in the country. Individual shipment by each farmer diminishes work efficiency, which results in pushing up distribution cost. Producers are apt to be disadvantaged in negotiation with middlemen and retailers amid the absence of public services for market information of agricultural produce. Implementation of cooperative shipping system by the agricultural associations is required for producers to take advantage of the system.

4.2.8 Social Problems

People in CV feel they have been discriminated in the historical agony (heavy droughts, slavery, despotism by Portuguese for 500 years), and have been betrayed by the government ever since the independence. This leads to the situation that people cannot believe others but their own family, having mutual distrust strongly in mind compared to other countries, and thereby individualism is considered to pervade throughout the country.

Also, emigration has been accelerated due to the fear for famine, owing to the harsh droughts. On the other hand, this enhances the migrant economy by oversees remittances. Fortunately, harsh situation of the house budget of poor household have been alleviated by the remittance. Reflecting the situation, there are a lot of female headed households, since significant numbers of people are emigrated overseas, most of which are consisted by men.

The role of women in the society is of importance, since female headed households account for significant part. It indicates that rather significant numbers of women participate in the society. In planning and implementing the project, therefore, more than half of the participants shall be taken up by female.

4.2.9 Landless Farmers

Landless farmers account for about 65% of all the farmers practiced in Santiago Island. They borrow lands from land owners as contract of sharecropping or tenet cropping, with several years of guarantee for land usage right.

4.2.10 Problems of ACBs

Community associations（ACBs）in Santiago Island, considerably different from the ones generally referred to, have been formed as umbrella organizations which used to implement subsidiary projects (FAIMO) for the purpose of supporting the people in need. Therefore, they are more responsible for subcontracting and implementing projects, such as construction of small community infrastructure (soil conservation, water facilitation, and road construction) and forestry, than promoting agricultural activities. Hence, they originally do not inaugurate business without the economic resources from the outside organizations. They are, in a sense, the organizations seeking for profits of the associational members.

Hence, as for the projects with infrastructure construction, ACBs conclude the contract of the

project, and utilize money to implement the activities for farmers. However, capacity building as leaders shall be required, since its organizational power and implementation capacity are insufficient for implementing independently initiated projects.

4.2.11 Insufficient Agricultural Extension Services

There are 17 extension officers registered in the agricultural local office of São Domingos. However, they administrate other watersheds, which include as many as 4,000 agricultural households, than that of São Domingos Watershed. It indicates that most of the farmers cannot gain profit from the extension services. Also, as for the water-saving irrigation promoted as a national policy, the outcome of the training for water-saving irrigation implemented in the pilot project proved that the extension officers instruct farmers without understanding of the necessity of water-saving irrigation. Since knowledge and numbers of the extension officers are limited, it is difficult to discuss that farmers can gain full-fledged techniques and knowledge from the extension services currently.

Chapter 5 Draft Action Plan

5.1 Elaboration of Draft Action Plan

This study extracts the constraints for integrated rural development in São Domingos Watershed which is the model watershed, clarifies the problems, and elaborates the Draft Action Plan (Development Plan) as their solutions. It is also noteworthy that the contents of the Draft Action Plan shall be implemented, and the result gained from the pilot projects shall be reflected to the feasible final Action Plan.

In elaborating the Plan, the objective has been set out as follows.

Objective of the Action Plan

Based on the sustainable conservation of precious ecosystem in the watersheds;

By virtue of efficient use of limited natural resources represented by agricultural water and lands;

By improving the agricultural productivity restricted by limited natural resources;

To generate income of farmers in Santiago Island.

5.2 Basic Policy for Development

In order to achieve the objective, São Domingos Watershed was selected as a model watershed in order to elaborate the model action plan applicable to other watersheds.

In the watershed of São Domingo, average annual precipitation is 360 mm, and water for cultivation is limited. Arable lands are also restricted, due to the steep landscape close to the coast lines. In addition to the harsh landscape, the deterioration of nature caused by soil erosion because of overgrazing and deforestation has brought about decrease in vegetation causing use of the limited water and land difficult. Moreover, agricultural productivity is low due to the dependence on traditional cultivation with unstable rainfall.

In this situation, to achieve the objective, it is required to elaborate the plans for sustainable agriculture and soil and water conservation utilizing natural resources, such as limited water resources. In order for the planned projects to be feasible and sustainable, community needs-based projects considering the development potentiality for the targeted areas shall be required.

The biggest obstacle in this studied area lies in the lack of agricultural water with limited rainfall, and the shortage of arable lands because of the steep landscape. Therefore, this Action Plan attempts to develop plans for efficient use of water resources and soil and water conservation, with the preparation of the extension services to realize the main objective, and awareness creation of rural residents. Additionally, measures for salt damage and rationalization of market distribution shall be included. Capacity building of the government officials including extension officers in rural communities is also the clue for the realization of this project. Development of human resources shall be included in the Action Plan.

On the other hand, farmers themselves must recognize the importance of this project and take responsibility of managing the projects in order to prove sense of sustainability. Therefore, this project actively promotes the involvement of rural population to grasp the needs of farmers. It employs

participatory methods to hear ideas and inquiries from farmers to reflect the project from project making till its execution.

In elaborating the project, this development plan shall carefully consider the social and environmental impacts for the targeted area, since it aims at the sustainable integrated rural development harmonized with ZAEs. It attempts to produce exclusively positive impacts on the targeted areas, mitigating the potential negative impacts.

5.2.1 Use of Natural Resources in Watersheds

This model aims at elaboration of environmentally friendly natural resources model in sustainable use and conservation of precious ecosystem with water management, for medium and long term development in the watersheds of Santiago Island. The followings are the basic directions for it.

(1) The model shall consider entire watershed as a unit of water resources and enable distribution of water resources in the upper stream to other ZAEs by mitigating the negative impacts onto the downstream of basin.

(2) In terms of Electric Conductivity (EC), the concentration of salt of well water in ZAE I represents the value of 1,200~2,000 μs/cm, which is rather high for irrigation water. No conspicuous change in salt level over past ten years infers that level of salt of the ground water in the downstream is originally high. Salt damage could be observed in numerous sights, due to the fact that farmers have used such salt damaged water for a long period. This study will not consider the possibility for expansion of the arable lands by exploitation of groundwater.

(3) It is difficult to utilize surface water of the river since most of it directly flows into the ocean. In order to prevent effluent of rainfall to the ocean, big-scale infrastructure development, such as storage reservoirs, might be an effective plan. However, this plan shall not include infrastructure development which requires high initial investment, since it attempts to implement sustainable development project with low cost techniques.

(4) This model attempts to increase the irrigable lands by surplus water from introduction of water-saving irrigation, in terms of good use of limited agro-water, which is the biggest concern.

(5) This model shall introduce agro-forestry development in order to efficiently use forests which are necessary for soil conservation and groundwater recharge.

5.2.2 Support for Agriculture

Smooth execution of this project requires various assistances from the outside stakeholders. The role of 'extension officers" who play a part in the linkage between the outside stakeholders and rural residents is the clue for the success of the project. Capacity building of extension officers is of importance, in order to implement and utilize various knowledge and techniques, such as development

outcomes from the various study institutes, good practices accepted by farmers in the previous projects, organization and facilitation capacities accumulated in NGOs. Also, sustainability of the farmers' group activities depends on the awareness of the group members on the necessity of grouping. This indicates the importance of capacity of group leaders.

This project aims at capacity building and awareness creation of the rural residents through Group Leaders Training and Capacity Building and Awareness Creation of Community. It attempts to strengthen the capacity of extension officers and the awareness of farmers by Extension among Farmers and Improvement of Extension System, and to extend the projects to other ZAEs in the other watersheds.

5.3 Selection of Draft Action Programs

This study selected Draft Action Programs as components of the Draft Action Plan, as follows:

5.3.1 Problems and Solutions

The study team extracted the development constraints through reviewing existing documents, social survey, field study conducted by the study team and consecutive interviews; clarified the problems faced by each ZAE for elaborating the Action Plan; and sorted out the Action Programs.

(1) ZAE I

Lack of Water Resources:

In this ZAE, scarce precipitation, limited water flow of the rivers even in the rainy season, rivers from which the water flows directly in to the sea at the flood time where the flood occurs several times a year and highly salt affected ground water, bring about lack of agricultural water.

The problem lies in the measures to secure water resources applicable for irrigation under these conditions. Followings are the Action Programs for the solution of the problems proposed by the study team. They were drawn up, taking in to consideration the basic directions where the expansion of irrigable lands by ground water development and large-scale infrastructure construction are not included.

Introduction of Water Saving Irrigation

This project attempts to replace the surface water irrigation, which is traditionally practiced, to water saving irrigation such as drip irrigation. It is expected that some 1.5 times more farm lands can be irrigated than ever by the same amount of irrigation water. Hence, it enlarges agricultural productivity per unit of water and contributes to improve income of farmers. Arable lands shall be rented by land owners as forms of sharecropping or tenant, and the project shall be targeted at the landless tenant farmers. Since their rights of use of the lands are guaranteed in several years, the study team presumes that the facilities will not promote the gap between the rich and the deprived.

Water Saving Irrigation Training

Problem in introducing water saving irrigation is the shortage of functionaries with specialties on water saving irrigation due to short history on practicing the water saving irrigation in CV. In order to promote it, it might be required to organize training of water saving irrigation for the functionaries involved. In the training, they will acquire various techniques for water saving irrigation and water management measures. Introduction of water saving irrigation by functionaries with expertise in such irrigation can smoothly promote the project, since they will be able to solve the problems, such as water leakage from the water pipe due to inappropriate management.

Salt Damaged Lands:

ZAE I is located along the coast, and salt damage has been observed due to the fact that farmers have used high saline concentrated groundwater for irrigation. Therefore, agricultural lands with little productivity or abandoned fields scattered in the area are observed.

In this situation, it is required to study the possibility of restoring the yields or recovery of the salt damaged lands. If severity of salt damage does not leach the fatal level, introduction of the salinity tolerant crops shall be an effective measure. On the other hand, when severity is rather high, desalination by leaching will be required to desalinize the arable lands.

Measures of Salt Damaged Farm Recovery

Introduction of salinity tolerant crops enables cultivation in the areas where salt damage occurs. The leaching is planned to recover the salt damaged farm lands as well. In this case, securement of leaching water will be an issue to be solved. In ZAE I, the river is flooded several times a year, and the flowing water goes down straight to the Sea, without providing the zone with benefit. Using this water for the leaching, 1.0 ha of salt damaged farm land is recovered every year. The water to be used for the leaching is 3,000 m^3, and this amount of water is efficiently used.

Devastation of Pasture Lands:

In Santiago Island, due to the scarce and erratic rainfall, the grass for forage are insufficient. Additionally, over livestock breeding ignoring economical aspect, damages to agricultural produce and forests caused by free cattle grazing, and so forth bring about devastation of pasture. As a result, the grass is chronically lacking.

In this situation, the problem lies in the measures how to recover the pastoral land and increase feed crops. In order to recover the pastoral land and increase feed crops, the following programs are proposed.

Management of Adequate Pasturage

In order to protect devastation of forests, natural conservation areas with fence are to be set. For instance, reduction of extend breeding of goats and promotion of pig-breeding in pens will stabilize the stock farming, which eventually will increase farmers' income. Considering installation of the natural conservation areas as an example, some 400 m of fence shall be required to embark 1 ha of the conservation areas, providing with some 10 ton of grass.

(2) ZAE II

Lack of Water Resources:

Similar to ZAE I, people in this ZAE are suffering from the shortage of agricultural water; therefore, the study team shall take the same measures. Since the precipitation is rather larger than that of ZAE I, project for the small-scale water resources development is considered.

Introduction of Water Saving Irrigation

Same as that of ZAE I.

Water Saving Irrigation Training

Same as that of ZAE I.

Small-scale Water Resources Development

In the project for small-scale water resources development, the study team attempts to develop new water resources by water-harvesting and water-spreading[1].

Water-harvesting is a technique having been employed in the arid areas from old days and is efficient for securing stable agricultural production, in addition to the soil and water conservation. This project attempts to catch surface water before it enters into rivers derived from rain most of which directly flows to the Sea, and to efficiently use it. By utilizing the water for supplementary irrigation, farmers can expect stable agricultural production, even at the time of rainfall shortage. Also, in years with abundant precipitation, the water can be used for planting after the wet season, which leads to the improvement of land productivity. On the other hand, in the areas with limited precipitation, farmers will cultivate forages by digging many holes in the forage forests to supply water directly.

Water-spreading is a technique which catches a portion of flood water of river to moisten the lands surrounding the river. It is also expected fertility of soil by the flood water. Moreover, livestock breeding with cultivation of deep routed forage crops promises increased farmers' income.

Devastation of Pasture Lands:

Devastation of pasture land is a concern as in ZAE I, and the study team shall take the same expected measures.

Management of Adequate Pasturage

Same as that of ZAEI.

(3) ZAE III

Lack of Water Resources:

In this zone, irrigation water is provided from the spring which is the mainstream of water resources. However, the absolute quantity of agricultural water is insufficient. The irrigated land in

[1] Waters-harvesting is a technique which catches surface water before it runs into rivers. Water-spreading is the one to catch flowing water caused by floods.

the upstream of the zone is small, since the land is located in the valleys.

Mostly, the measures of the problems are similar to ZAE II. However, regarding the project for introduction of water saving irrigation, in the upstream area where the irrigated land is located in the valley, there is no space to secure lands necessary for good use of surplus water derived from the introduction of water saving irrigation. Considering these circumstances, this project shall introduce water saving irrigation conveying surplus water to the areas where shortage of irrigation water forces farmers to practice rain-fed agriculture.

As for small-scale water resources development, it is difficult to implement the water-spreading, since the rise of river cannot be expected due to small catchment area. Therefore, only the water-harvesting is to be introduced.

Introduction of Water Saving Irrigation

The traditional irrigation system is to be replaced by the water saving irrigation system as in ZAE I. In the upstream area where securing the farm land for good use of surplus water is difficult, the water shall be conveyed to the downstream to enlarge water-saving irrigation land so that the water resources shall be utilized in entire watershed.

Water Saving Irrigation Training

Same as that of ZAE I.

Project for the Small-scale Water Resources Development

Only the water-harvesting is to be introduced as in ZAE II.

Inappropriate Management of Natural Resources:

In Santiago Island, soil erosion triggered by steep landscape and flash flood in the rainy season devastate natural conditions. Although rural residents are interested in natural resources, such as water and forest, they lack awareness towards management of it. Consequently, the integrated natural resources management has not been properly conducted, and it devastates arable lands. Soil erosion will advance at an accelerating pace, unless the proper measures are taken, and spur the decrease in arable lands.

The problems, therefore, lie in how to prevent devastation of nature due to soil erosion and decrease in the arable lands. The followings are the programs for addressing problems facing.

Soil and Water Conservation

In order to prevent devastation of nature by soil erosion and to restore lands, this study implement various soil and water conservation works so that the devastated lands are restored and further soil erosion can be prevented. This study attempts to enlarge farm land by restored lands to improve yields of agricultural products.

Devastation of Pasture Lands:

Although the volume of rainfall is not so limited as in ZAE I and II, it is still faced with the devastation of pasture lands. The same solution is proposed as in ZAE I.

Management of Adequate Pasturage

Same as that of ZAE I.

(4) ZAE IV

Lack of Water Resources:

In this zone, springs do not exist due to its high altitude, and concerning the ground water, irrigated agriculture is nearly impossible as there is only a deep well for domestic use water. Compared to other regions, rather abundant volume of precipitation enables farmers to practice rain-fed agriculture. However, unpredictable precipitation pattern prevents them from practicing stable rain-fed cultivation. Hence, the problem is how the stable agricultural activities can be practiced in the season without rain.

Small-scale Water Resources Development

As in ZAE III, only water-harvesting is implemented. This project attempts to store rain water before it flows to the river and the stored water is to be used for the supplementary irrigation. It aims at stable cropping in order to increase the yields of agricultural products.

Inappropriate Management of Natural Resources:

Devastation of nature by soil erosion occurs as in ZAE III. As for the possible solution, the study team employed the soil and water conservation project.

Adding to it, there are protected forest which plays important role as recharging forest, but rural residents do not manage forest properly, since forestry is not considered as the main industry. For the purpose of managing forest properly, this study team has shaped Agro-forestry project described below.

Soil and Water Conservation

Same as that in ZAE III.

Agro-forestry

This project aims to secure pasture grass for forage by cleaning bottom of the forest, sawing seed, and creating artificial pasturage in inappropriately treated protected forest. It enables production of forage, and thereby motivates rural residents to manage forest for conservation. Implementing 1 ha of forest, some 10 tons of grass can be produced.

Devastation of Pasture Lands:

Devastation of pasture land is a concern as in ZAE III, and so is the expected measures.

Project for Adequate Pasture Lands

Same as that in ZAE III.

(5) Entire Watershed

Surplus of Agricultural Products:

Supply of agricultural products is concentrated during the wet season and the beginning of dry

season. Hence, the market price decreases, and the second grade products become unfit for market.

This study, therefore, verifies measures to increase commercial values of surplus of agricultural products and second grade agricultural products. The following program is proposed as solution.

Processing of Agricultural Products

The surplus crops and second grade agricultural products can be marketable by processing of them. If they lose marketability in competition with imported processing products, preserved food contributes to food security for the farmers' households at the time of food shortage. Although livestock processing industry is influenced by seasonal change in marketability, innovative methods can sustain manufacturing throughout the year to add value and to create work opportunities.

Fragility of Shipment System of Agricultural Products:

As there has been no good practice on collective marketing, each farmer are selling their products individually. This is because, as has been discussed in "Social Problems" in Chapter 4, people have mutual distrust strongly in mind compared to other countries, and thereby individualism is considered to pervade throughout the country. Hence, inefficient sales of the agricultural products are carried out individually, which causes the increase in market distribution cost.

While there is no service on marketing information of agricultural products, farmers often take disadvantages in transaction between intermediaries and retailers.

This study attempts to address the measures to resolve mutual distrust to implement collective marketing and dissolve the disadvantages in the transaction. In order to solve these problems, the study team draws up the following project.

Rationalization of Market Distribution

To perform collective marketing, the farmers' association necessarily form the system for it. Therefore, workshops will be conducted to educate participating groups about the project, where dissolution of the mutual distrust between the participants shall be attempted. The project aims at achieving the reduction of the cost of market distribution through the formation of the system for the collective marketing, so that producers are able to take advantage in transaction with buyers.

Problems of ACBs:

Community associations (ACBs) in Santiago Island, considerably different from the ones generally referred to, are more responsible for subcontracting and implementing projects, such as construction of small community infrastructure and forestry, than promoting agricultural activities. Hence, they originally do not inaugurate business without credible economic resources from the outside organizations. Therefore, capacity building as leaders shall be required, since its organizational power and implementation capacity are insufficient for implementing independently initiated projects. In addition to this, it might be important to cultivate awareness for the active involvement to development projects. In order to address these problems, the study team proposed

programs described below. These programs are the agricultural support programs for the purpose of implementing the Action Plan smoothly, and shall be executed in the entire watershed.

Group Leaders Training

Success of the group activities depends on the capacity of leaders. Since most of the projects in this Action Plan are implemented through community associations, this project attempts to implement project for training of group leaders. Generally, sustainable associations have following things in common; 1) clear organizational objective 2) eligible leaders who have strong will and capacity to lead the organizations involved 3) fair and accountable operation. For this purpose, trainings for capacity building regarding the practical work of group projects, awareness building of leaders, the relationship building between administration and farmers are organized. It might be required to organize periodical meetings of group leaders, for the purpose of information sharing and the study of constraints to be solved as well. The awareness of trainees as leaders are to be created through this group leaders meeting.

Capacity Building and Awareness Creation of Community

Most of the implementers of these action programs in this Action Plan are farmers' associations which compose communities. In implementing programs, capacity building and awareness creation of the recipient communities are required, since even though functionaries of the government have good capacity, that alone is not sufficient. Hence, this project shall enhance the capacity of communities.

Extension among Farmers

Even this Action Plan is drawn up for the model watershed of São Domingos, since this development project targets the watersheds in entire Santiago Island, it will be required to extend to the other watersheds. Consequently, this program will attempt to extend the action programs to other watersheds. To that end, the action programs will be executed in the model watershed, and the farmers who experience and are trained in the execution of the programs shall instruct other community members. This ensures the understanding and a sense of intimacy for farmers in other watersheds for transmission of techniques and awareness. By sharing information and techniques with farmers in advanced agricultural areas, incentives of unpracticed farmers will be improved. Also, it might be efficient for farmers in other watersheds to visit the farmers who have experienced in the execution to gain various knowledge.

Inappropriate Agricultural Services:

There are 17 extension officers registered in the agricultural local offices of São Domingos. However, they administrate other watersheds, which include as many as 4,000 agricultural households, than that of São Domingos Watershed. It indicates that most of the farmers cannot gain profit from the extension services. Knowledge and numbers of the extension officers are limited at this moment. Hence, it might be difficult to discuss that farmers can gain full-fledged techniques and knowledge from the extension services.

In these circumstances, the study team investigated how to extend the capacity of extension

officers and to improve extension system. This study attempts to search for measures to improve extension officers and to improve the extension system.

Improvement of Extension System

Capacity of agricultural extension officers influences the successful agricultural development. Hence, it is essential for extension officers to acquire knowledge on up-to-date agricultural technologies and transmit it to farmers. In executing the Action Plan, it is required to improve the capacity of them to successfully implement the Plan.

This study shall implement the trainings of extension officers for the capacity building. As for the contents of the training courses, it focuses on the capacity building for the participatory approach, since most of the components of this Action Plan will be conducted by farmers groups. Additionally, management of the sustainable and integrated development in the Watersheds shall be considered.

In addition, elaboration of manual for agricultural technologies will be required which farmers can refer to all the time for new technologies. This project elaborates technical manual to improve extension system, since there is no such manual in CV. As for the elaboration of the manual, technical assistance from agricultural engineers and study centers, represented by INIDA, responsible for planning the farmers training curriculums, shall be provided.

The agricultural manual will be elaborated in the Action Plan in the model watersheds. The manual elaborated shall be utilized in implementing the Action Plan in watersheds other than the model Watershed. The manual shall be revised by assessing the defects in the process of its utilization. This program is agricultural support program for the programs aforementioned.

5.3.2 Two Models

This Study elaborates the Action Plan based on two models according to the minutes of meeting.

i) Natural resources (especially water) management model, a watershed as a unit, applicable to other watersheds: **Model 1**

ii) Model of integrated rural development applicable to other waterrsheds in each unit of Zone of Agro-Ecology (ZAE): **Model 2**

5.3.3 Model 1: Natural Resources (Especially Water) Management Model, a Watershed as a Unit, Applicable to Other Watersheds

The following table shows the summary of the Draft Action Plan (Model 1).

Table 5.3.1 Model 1: Natural Resources (Especially Water) Management Model Applicable to Other Watersheds

Inhibiting factors	Problems		Programs	Contents	Outcomes	Purposes
Lack of water resource	ZAE I	Increased salt density in ground water and the cultivated lands	1.Soil and Water Conservation	Restoration of lands by various conservation works	Restoration (expansion) of lands	The project aims to sustainably use and conserve watershed areas, which are essential ecosystem
	ZAE II	Decrease in the volume of irrigated water in shallow wells at the end of the dry season			Short/long term cultivation of water	
	ALL	Effluent of surface water to the ocean	2. Small-scale Water Resources Development	Water-harvesting: facilities to capture rain water, Water-spreading: facilities to catch effluent water	Appropriate management of water resource	
		Lack of absolute amount of water				
Improper management of facilities	ZAE I、II、III	Leak of water from pipes for irrigation	3. Measures of Salt Damaged Farm Recovery	Restoration of lands by desalinizing salt damaged farms	Restoration (expansion) of lands	
					Efficient use of water resource	
Inappropriate management of natural resources	ZAE III、IV	Decrease in the lands by soil runoff	4.Agro-forestry Development	Cleaning of the bottom of the forests and cultivation of pasture	Maintenance/management of forestry	
	ZAE III、IV	Improper forest management	5. Introduction of Water Saving Irrigation	Increase in the yields per unit of volume of water by introducing water saving irrigation	Appropriate management of water resources	
	ZAE III、IV	Soil runoff by inappropriate cultivation				
Devastation of pasture lands	ALL	Soil runoff due to the excessive pastoral activities	6. Management of Adequate Pasturage	Prevention of devastation of pasture lands by pig breeding in	Protection of forest resources	
			7. Water Saving Irrigation	Introduction of techniques for water saving irrigation, and training for implementing	Short/long term cultivation of water resources	

5.3.4 Model 2: Model of Integrated Rural Development for Each Zone of Agro-Ecology (ZAE) Applicable to Other Watersheds

The table in the next page shows the summary of the Draft Action Plan (Model 2).

5.3.5 Agricultural Support Programs for Integrated Rural Development in Watersheds

The followings are the Agricultural Support Programs to successfully carry out the Action Plan based on two models.

(1) Reinforcement of Farmers Associations (Group Leaders Training, Capacity Building and Awareness Creation of Community)
(2) Reinforcement of Extension Officers, Extension to Other Areas (Improvement of Extension System)
(3) Awareness Creation of Farmers, Extension to Other Areas (Extension among Farmers)

Table 5.3.2 Model 2: Model of Integrated Rural Development for Each Zone of Agro-Ecology (ZAE) Applicable to Other Watersheds

Inhibiting Factors			Programs	Contents	Outcomes	Purposes	Supreme Objectives
ZAE I							
Salt damage	Increased salt content in the		3. Measures of Salt Damaged Farm Recovery	Restoration of lands by desalinating salt damaged lands	Restoration (expansion) of lands	Increased production of agricultural products	Contribution to the improvement of livelihood of farmers
Lack of water resources	Saline concentration in the ground water			Introduction of varieties resistible against the salt damage			
	Lack of the absolute amount of water		5. Introduction of Water Saving Irrigation	Increase in the yields per unit of volume of water by introducing water saving irrigation	Expansion of lands by the surplus water		
Devastation of pastoral lands	Soil runoff due to the excessive pastoral activities		6. Management of Adequate Pasturage	Prevention of devastation of pasture lands by pig breeding in pens	Stabilization of pastoral activities		
Surplus agricultural products	Decrease in the commodity		8. Agricultural Produce Processing	Processing and Sales of surplus or second grade products			
Fragile shipment system	Unfairly set price		9. Rationalization of Market Distribution	Securing the price of collective marketing	Improvement of productivity	Increased production of agricultural products	
ZAE II							
Lack of water resource	Effluence of surface water to the ocean		2. Small-scale Water Resources Development	Water-harvesting: facilities to capture rain water	Expansion of lands by increases water resources	Increased production of agricultural products	Contribution to the improvement of livelihood of farmers
				Water-spreading: facilities to catch effluent water			
	Lack of absolute amount of water		5. Introduction of Water Saving Irrigation	Increase in the yields per unit of volume of water by introducing water saving irrigation	Expansion of lands by the surplus water		
Devastation of pastoral lands	Soil runoff due to the excessive pastoral activities		6. Management of Adequate Pasturage	Prevention of devastation of pasture lands by pig breeding in pens	Stabilization of pastoral activities		
Surplus agricultural products	Decrease in the commodity		8. Agricultural Produce Processing	Processing and Sales of surplus or second grade products			
Fragile shipment system	Unfairly set price		9. Rationalization of Market Distribution	Securing the price of collective marketing	Improvement of productivity	Increased production of agricultural products	
ZAE III							
Improper Management of	Land slide		1. Soil and Water Conservation	Restoration of lands by various conservation works	Restoration (expansion) of lands	Increased production of agricultural products	Contribution to the improvement of livelihood of farmers
Lack of Water Resources	Effluence of surface water to the ocean		2. Small-scale Water Resources Development	Water-harvesting: facilities to capture rain water	Expansion of lands by increases water resource		
				Water-spreading: facilities to catch effluent water			
	Lack of absolute amount of water		5. Introduction of Water Saving Irrigation	Increase in the yields per unit of volume of water by introducing water saving irrigation	Expansion of lands by the surplus water		
Devastation of pastoral lands	Soil runoff due to the excessive pastoral activities		6. Management of Adequate Pasturage	Prevention of devastation of pasture lands by pig breeding in pens	Stabilization of pastoral activities		
Surplus agricultural products	Decrease in the commodity		8. Agricultural Produce Processing	Processing and Sales of surplus or second grade products			
Fragile shipment system	Unfairly set price		9. Rationalization of Market Distribution	Securing the price of collective marketing	Improvement of productivity	Increased production of agricultural products	
ZAE IV							
Improper Management of	Soil runoff of the lands		1.Soil and Water Conservation	Restoration of lands by various conservation works	Restoration (expansion) of lands	Increased production of agricultural products	Contribution to the improvement of livelihood of farmers
Lack of Water Resources	Effluence of surface water to the ocean		2. Small-scale Water Resources Development	Water-harvesting: facilities to capture rain water	Expansion of lands by increases water resource		
	Lack of absolute amount of		4.Agro-forestry	Cleaning of the bottom of the forests and cultivation of	Securing pasture		
Devastation of pastoral lands	Soil runoff due to the excessive pastoral activities		6. Management of Adequate Pasturage	Prevention of devastation of pasture lands by pig breeding in pens	Stabilization of pastoral activities		
Surplus agricultural products	Decrease in the commodity		8. Agricultural Produce Processing	Processing and Sales of surplus or second grade products			
Fragile shipment system	Fragile shipment system		9. Rationalization of Market Distribution	Securing the price of collective marketing	Improvement of productivity	Increased production of agricultural products	

5.3.6 Programs Composing Draft Action Plan

The outlines of the selected programs composing the Draft Action Plan are described in the following table.

The contents of each Draft Action Program are described in the tables attached at the end of this Chapter.

Table 5.3.3 Programs Composing Draft Action Plan

Action Programs	ZAE	Model	Contents
Integrated Rural Development in Watersheds			
Sustainable Use of Natural Resources			
1. Soil and Water Conservation	III, IV	1, 2	To restore lands by various conservation works
2. Small-scale Water Resources Development	II, III, IV	1, 2	Water-harvesting : facilities to capture rainwater Water-spreading : facilities to capture invalid effluent water
3. Measures of Salt Damaged Farm Recovery	I	1, 2	To restore arable lands though desalinization
4. Agro-forestry	IV	1, 2	To cultivate pasture by cleaning bottom of forest
5. Introduction of Water Saving Irrigation	I, II, III	1, 2	To increase the volume of production per unit of water by introducing water saving irrigation
6. Management of Adequate Pasturage	I, II, III, IV	1, 2	To prevent pasture lands by pig breeding in pens
7. Water Saving Irrigation Training	I, II, III	1	To introduce various techniques for water-saving irrigation and train for implementation methods
Storage and Processing of Agricultural Products			
8. Processing of Agricultural Products	I, II, III, IV	2	Processing and sales of surplus or second grade agricultural products
9. Rationalization of Market Distribution	I, II, III, IV	2	Stability of sales price by collective marketing
Agricultural Support Services			
Farmers Associations and Communities			
10. Group Leaders Training	I, II, III, IV	1, 2	Awareness creation as group leaders Acquisition of basic techniques as group leaders
11. Capacity Building and Awareness Creation of Community	I, II, III, IV	1, 2	Reinforcement of capacity building and awareness creation of community
Extension System			
12. Extension among Farmers	I, II, III, IV	1, 2	Extension by farmers to other watersheds
13. Improvement of Extension System	I, II, III, IV	1, 2	Preparation of agricultural manual for extension by it

5.4 Environment

5.4.1 Legal Framework of Environmental Impact Assessment in CV

The government of CV declares that the "the government shall always implement environmental impact assessment, endorses the diversity of the organism species, and conserve characteristics of ecosystem, not only for the conservation of indispensable natural heritage, but also for qualitative improvement of health and livelihood of each community", based on the Order of Environmental

Impact Assessment, endorse the Council on 6 of March, 2006, No. 29. No. 3 in the Order of Council articulates the implementation of Environmental Impact Assessment (EIA) and management of the impact of the projects compatible for the components below.

a) Human beings, fauna and flora;
b) Surface soil and subsoil;
c) Water, air and light;
d) Climate and landscape;
e) Natural resources, natural and cultural heritage;
f) Interrelation among the components above.

5.4.2 Scoping of Environmental Impact Assessment

According to Article 5 of Order of Council, with respect to the small-scale projects with moderate or small impacts on the elements pointed out above, it is stipulated that EIA is exemptible. DGASP, the counter organization and the executing body of this Study, agrees that EIA is not needed, as the programs proposed by the Action Plan are small-scaled ones. Therefore, instead of conducting EIA, the scoping to identify potential impact for natural and social environment, and to propose mitigation measures of the impacts was conducted. The followings are the results of the scoping.

(1) Construction of a Reservoir, 2 Drainage Tanks and Pipelines (ZAE II)

1) Adverse Effects onto the Environment during and after the Construction

- Movement of soil in the excavation stage to set up PCV tubes on the roads. However, the impacts can be insignificant;
- Soil erosion by the wind erosion during/ after the construction;
- Increase in the ratio for utilization of water by farmers;
- Conflict among farmers over the water usage.

2) Positive Social and Economic Impact during the Implementation of the Projects

- Creation of temporary employment;
- Increase in the price of local labor force;
- Strengthening of the community associations and communities.

3) Positive Social and Economic Impact after the Implementation of the Projects

- Decrease in the loss of water and accretion of sand;
- Increase in the soil cover area;
- Augment of the available irrigated water for farmers;
- Replacement from rain-fed lands to irrigated lands;
- Augment of agricultural production;
- Reduction of poverty in the rural areas;
- Reduction of farm leavers;
- Diversification of community activities;

- Reduction of pressure to the natural resources (ground water river sand, etc.).

4) Measures for Impact Alleviation

It is not necessary to conduct EIA, if the impact of the construction is minimal. However, management plan for facilities (water, canal, drainage tanks and reservoirs) should be implemented on the agreement with farmers, in order to efficiently use water.

(2) Construction of a Reservoir and Open Channel in the Salt Damaged Lands (ZAE I)

1) Adverse Effects onto the Environment during and after the Construction
   - Movement of soil in the excavation stage to set up open canals. However, the impacts can be insignificant;
   - Soil erosion by the wind erosion during/ after the construction;
   - Partial loss of the lands in constructing open canals;
   - Conflict over the land usage rights against the land lords.

2) Positive Social and Economic Impact during the Implement the Projects
   - Creation of temporary employment;
   - Increase in the quality of local labor force;
   - Reinforcement of capacity of Associate members and communities.

3) Positive Social and Economic Impact after the Implementation of the Projects
   - Alleviation of Salt Damage of Soil and Water;
   - Augment of volume of water for rural residents and improvement of the quality of water;
   - Re-evaluation of lands;
   - Augment of production;
   - Reduction of the farm leavers and employment of farmers;
   - Improvement of diversity (fauna and flora);
   - Improvement of food security;
   - Increase in the land area and the decrease in the evaporative rate;
   - Minimization of water erosion and air erosion;
   - Reduction of misemployment rate.

(3) Utilization of Curralinho Forest Area in the district of Rui Vaz (ZAE IV)

1) Short-term Adverse Effect on the Environment
   - Elimination of vegetation;
   - Loss of soil by water erosion;
   - Augment of evaporation rate;
   - Loss of habitants for some species, such as avian species;
   - Change of the landscape.

2) Middle/ Long-term Adverse Effect on the Environment
   - Pathogeny of diseases due to increased numbers of animals;

- Conflict with community associations and forest managers.

3) Middle/Long-term Positive Impact on the Environment
   - Reduction of destruction of ecosystem;
   - Improvement of biological diversity (Fauna and flora);
   - Soil fixation due to the root system;
   - Prevention of soil covering and erosion.

4) Middle/Long-term Positive Impact on the Social Environment
   - Augment of production of forages;
   - Improvement of the quality of forage;
   - Increase in the production of milk and cheese;
   - Diversification of income resources;
   - Increase in the employment of local residents;
   - Food security;
   - Enforcement of community associations;
   - Conservation of community environment and improvement of knowledge on the soil erosion;
   - Reinforcement of the collaboration with the community associations and the government organizations (DGASP).

5) Measures for Impact Alleviation
   - In order to evade conflict against community associations and forest administrative organization, target areas shall be strictly demarcated before the operation;
   - Creation of conditions for cultivation, collection and storage of the forages and seeds;
   - Creation of conditions for the purpose of reduction of damages caused by animals in farms and forest surrounding areas;
   - Reinforcement of the capacity of livestock breeders to prevent diseases of animals.

(4) Recommendation and Concerns in Implementing Project

There seems no large risk against surrounding environment and deep-seated issues in the planned components of this project. The following is the concerns in implementing this project below.

1) Construction of a Reservoir and Open Canals in ZAE I

The impact of the construction of reservoir (20m in length and 4-5 m in width) and open canals (1km) is minimal, rather easy to alleviate. The only one concern which can occur is regarding the land ownership in the places which trespasses open canals. It is essential to identify land owners who will be affected by the projects, and to gain agreement with them thorough conversation/explanation, in order to solve such social problems. Note that continuous monitoring on the salt density shall be conducted in addition to before and right after the reaching to assess the shift in the salt density in the targeted areas.

2) Construction of a Reservoir, Two Drainage Tanks and Tubes in ZAE II

Potential problems caused by this project will cause enormous environmental problems for neither long term nor short term. After 1975, CV has executed several similar projects, providing strongly positive impacts on environment, society and economy without any environmental damages. It is worthwhile noting that preservation of slopes on the upstream of the reservoir, chiefly protection of vegetation, in order to certify resistance of reservoirs and to prevent sand accretion.

3) Use of Curralinnho Forest Surrounding Areas in Rui Vaz (ZAE VI)

According to Article 32, of Forest Law 48/V/98, part of the national lands can be utilized for agricultural activities and live stock breeding with permission from the department of forestry in national lands targeted by Forest Law, provided that such activities do not undermine the purposes of submitted application form to the Forestry Law.

Table 5.3.4 Action Program (Integrated Rural Development in Watersheds) (1/13)

Development Theme	Sustainable Use of Natural Resources
Program	Soil and Water Conservation Project
Targeted Group	ACBs (ZAE III, IV)
Background and Purpose: In the Santiago Island, natural environment is devastated because of the precipitous landscape and soil erosion caused by flash flood. Although various soil conservation works have been implemented currently, the effects by them is still insufficient. This project attempts to conserve soil through constructing masonry works, crescent filling works and terraces by ACBs.	
Activities: ① Interview with ACBs, extraction of devastated lands, and preparation of the list ② Study and selection of the counter measures ③ Elaboration of the Plan of Operation (P/O) ④ Implementation of the soil construction ⑤ Monitoring and evaluation executed by farmers	
Implemented Organizations: (1) DGASP (2) Rural Agricultural Office	Input: (1) Agricultural equipments, (2) External advisors (3) Extension officers
Duration (in each watershed areas): Two fiscal years	
Expected Outcomes: ① Prevention of the arable lands from soil erosion ② Enlargement of agricultural lands by conservation	

Table 5.3.5 Action Program (Integrated Rural Development in Watersheds) (2/13)

Development Theme	Sustainable Use of Natural Resources
Program	Small-scale Water Resources Development Project
Targeted Group	ACBs (ZAE II, III, IV)
Background and Purpose: Limited precipitation inhibits the agricultural cropping in the Santiago Island. Adding to it, precarious rainfall morphology is another concern in the Santiago Island, where sporadically heavy rain is so strong that the water directly runoffs to the ocean. Under these conditions, farmers are practicing irrigative agriculture with limited water resources. This project attempts to develop new small-scale water resources by water-harvesting and water-spreading. The facilities shall capture the surface water by water harvesting, before it effluents to the ocean. Water-harvesting can increase the numbers of cropping. It is also expected to improve the land productivity per unit. Water-spreading is the techniques in order to capture the flow water during the floods, and to moisten the increase in the income of farmers. Forage crops with deep roots will be cultivated to realize them by cattle breeding.	
Activities: ① Interview with ACBs, elaboration of P/O by counterparts and related organizations ② Study and selection of suitable lands and varieties of work in the workshops with ACBs ③ Topographical survey of the sites, designing, cost estimation and elaboration of the construction process, implementation of the facilities ④ Implementation of the project using facilities for water resources development ⑤ Monitoring and evaluation conducted by farmers	
Implemented Organizations: (1) DGASP, (2) Rural Agricultural Office	Input: (1) Construction equipments (2) Work force and External advisors (3) Extension officers
Duration (in each watershed areas): Two fiscal years	
Expected Outcomes: ① Efficient use of water resources ② Implementation of efficient irrigation ③ Increased production of agricultural products	

Table 5.3.6 Action Program (Integrated Rural Development in Watersheds) (3/13)

Development Theme	Sustainable Use of Natural Resources
Program	Measures of Salt Damaged Farm Recovery Project
Targeted Group	ACBs (ZAE I)
Background and Purpose: This project enables the cultivation of salt damaged lands by introducing crops resistible against the salt damage near the outfall of each river in the Santiago Island. It shall also use water-spreading for leaching water by means of irrigating captured water to the salt damaged lands near the coasts. This project attempts to mitigate and prevent salt damage and to maintain irrigative agriculture with high production.	
Activities: ① Soil survey (salt damaged lands, variety and distribution of salt damage, distribution and volume of water, and required volume of water for desalination) ② Desalinized measures, salt resistible crops, cultivation methods to reduce salt damage, study of economical efficiency ③ Implementation of desalinated treatment (leaching utilized by water- spreading) ④ Introduction and planting of salt-tolerant crops, marketing and distribution ⑤ Monitoring and evaluation	
Implemented Organizations: (1) DGASP (2) Rural Agricultural Office	Input: (1) External advisors (soil, irrigative drainage water, crops, and management) (2) Leaching facilities and the maintenance of drainage (3) Extension officers
Duration (in each watershed areas): Two fiscal years	
Expected Outcomes: ① Conservation of agricultural lands ② Increase in the production of crops ③ Increased income of farmers	

Table 5.3.7 Action Program (Integrated Rural Development in Watersheds) (4/13)

Development Theme	Sustainable Use of Natural Resources
Program	Agro-forestry Project
Targeted Group	ACBs (ZAE IV)
Background and Purpose: There are numerous forests in the national parks at the upstream of watershed areas, and some forestation projects had been implemented. However, since forestry is not recognized as a major industry, farmers do not manage forestry in a proper manner. Weeds and bushes are covering the bottom of the forest. This project shall conserve forests and secure fried plants by cleaning the bottom of the forests, sawing seeds and creating artificial pasture lands.	
Activities: ① Selection and measurement of arable lands with ACBs through workshops ② Elaboration of P/O ③ Cleaning of bush weeds, seeding and cropping of pasture ④ Organization of evaluation workshop for counterparts and farmers ⑤ Organization of seminars to extend the output of farmers in other areas	
Implemented Organizations: (1) DGASP (2) Rural Agricultural Office	Input: (1) Equipments for cleaning of weeds (2) Seeds of the pasture (3) External advisors
Duration (in each watershed areas): Two fiscal years	
Expected Outcomes: ① Proper management of forest ② Cultivation of the pasture	

Table 5.3.8 Action Program (Integrated Rural Development in Watersheds) (5/13)

Development Theme	Sustainable Use of Natural Resources
Program	Introduction of Water Saving Irrigation Project
Targeted Group	Landless farmers, ACBs (ZAE I, II, III)
Background and Purpose: In the Santiago Island, the government of CV attempts to employ policy on the promotion of the water saving ir rigation b y r eplacing tr aditional b asin ir rigation which r epresents lo w a pplicable r ates f or experimental farms, to more efficient water saving irrigation (e.g. drip irrigation). By introducing water saving irrigation, this project can improve the agricultural productivity per unit of water and expand the crop acreage with surplus water. If water saving irrigation shall be set up in the upstream/ middle stream of the river, surplus water will be pumped to the irrigative lands at the downstream of river, enabling the distribution of limited water within the watershed areas.	
Activities: ① Elaboration of P/ O with related functionaries ② Selection of irrigation schemes（drip irrigation, pitcher irrigation, tank farming, water saving by malting method） ③ Designing of irrigation plan/ execution of construction process plan and cost estimation ④ Establishment of water saving irrigation facilities by ACBs ⑤ Monitoring and evaluation by farmers	
Implemented Organizations: (1) DGASP (2) Rural Agricultural Office	Input: (1) Irrigative equipments, (2) Work force, external advisors (3) Extension officers
Duration (in each watershed areas): Two fiscal years	
Expected Outcomes: ① Increase in the yields of crops per volume of used water ② Efficient use of water resources	

Table 5.3.9 Action Program (Integrated Rural Development in Watersheds) (6/13)

Development Theme	Sustainable Use of Natural Resources
Program	Management of Adequate Pasturage Project
Targeted Group	ACBs (ZAE I, II, III, IV)
Background and Purpose: There are numerous problems in the Island of Santiago, namely: excessive livestock breeding ignoring the effects of economic factors; damage to crops and forests due to extensive cattle breeding; and the absence of the system of land registration, unclear boundaries, and lack of conflict resolution system over the land issues. This project shall confirm the land ownership, rights of use and boundaries of lands; attempts to conserve ownership rights; and confirms the appropriate numbers of livestock animals (carrying capacity per cow day) suitable for the forage productivity of the pasture lands. In addition, in order to prevent devastation of forests, it creates the barriers and set the natural protection areas.	
Activities: ① Understanding of the activists in the rural areas ② Confirmation of the participated rural settlement ③ Understanding of the current situations in land ownership and usage of participated communities, understanding of situation for the breeding of livestock animals ④ Confirmation of land registration including national lands and land owner-tenant relationship ⑤ Understanding of carrying capacity, normalization of the numbers of livestock animals, establishment of the system on the conflict resolution in land use ⑥ Monitoring and evaluation by farmers	
Implemented Organizations: (1) DGASP (2) Rural Agricultural Office	Input: (1) Estimation (identification of the boundaries of lands and piling), (2) External advisors for rural community, (3) External advisors for land tenant, (4) External advisors for forage crop and livestock breeding
Duration (in each watershed areas): Two fiscal years	
Expected Outcomes: ① Conservation of soil, water resources, forest and arable lands ② Protection and promotion of cropping of agricultural crops ③ Protection of land ownership and usage ④ Promotion of livestock breeding	

Table 5.3.10 Action Program (Integrated Rural Development in Watersheds) (7/13)

Development Theme	Sustainable Use of Natural Resources
Program	Water Saving Irrigation Training Project
Targeted Group	Counterparts, functionaries, irrigation farmers (ZAE I, II, III)
Background and Purpose: As has been mentioned in the Project for Introduction of Water Saving Irrigation, the government of CV attempts to employ policy on the promotion of the water saving irrigation by replacing traditional basin irrigation to more efficient water saving irrigation (e.g. drip irrigation). However, functionaries have not acquired adequate knowledge on the water saving irrigation. Therefore, in order to promote water saving irrigation, trainings should be organized for the functionaries of government organizations. Participants shall be introduced to various techniques of water saving irrigation, and will learn implementation methods. This project attempts to promote appropriate plan, implementing water saving irrigation plan by trained functionaries.	
Activities: ① Elaboration of Plan of Operation ② Follow-up study for trainees ③ Implementation of the trainings ④ Evaluation	
Implemented Organizations: (1) DGASP (2) Rural Agricultural Office	Input: (1) Training cost (2) External advisors (3) Extension officers
Duration (in each watershed areas): Two fiscal years	
Expected Outcomes: ① Capacity building of water-saving irrigation of related functionaries ② Efficient use of water resources	

Table 5.3.11 Action Program (Integrated Rural Development in Watersheds) (8/13)

Development Theme	Storage and Processing of Agricultural Products
Program	Processing of Agricultural Products Project
Targeted Group	ACBs (ZAE I, II, III, IV)
Background and Purpose: Sales of the agricultural products concentrate on the period of wet season and the beginning of the dry season, which causes the clash of market price with average goods becoming the loss. Processing these agricultural goods adds commodity value and added value. Even if the processed products do not entail competitiveness against import products and marketability under competition, they contribute to food security for farmers during the season which lacks food. Since papayas can be cultivated yearly, jellies making out of them not only gives added value, but also creates employment in the island with high unemployment rate. Adding to it, processing industries of livestock products is possible throughout a year with seasonal shift.	
Activities: ① Construction of processing place ② Teaching on the food sanitation ③ Training on the processing products (tomato pasted, papaya jelly, and sausages etc.) ④ Training on the marketing of products ⑤ Monitoring and evaluation by farmers	
Implemented Organizations: (1) DGASP (2) Rural Agricultural office	Input: (1) Construction equipments (2) Training (3) Operational cost (4) Advisors (5) Extension officers
Duration (in each watershed areas): Two fiscal years	
Expected Outcomes: ① Improved income of farmers ② Creation of work force ③ Food security	

Table 5.3.12 Action Program (Integrated Rural Development in Watersheds) (9/13)

Development Theme	Storage and Processing of Agricultural Products
Program	Rationalization of Market Distribution Project
Targeted Group	ACBs (ZAE I, II, III, IV)
Background and Purpose: In CV, there has been no good practice on the collective marketing; thereby farmers sell their agricultural products individually. In the absence of public service on the market information, farmers are inclined to lose benefit in the transaction between intermediaries and retailers. This project attempts to establish cooperative production system and strengthen bargaining power in order not to be damaged by the sales of agricultural products. Also, accumulation of agricultural products enables diversification to the processing industry.	
Activities: ① Stakeholder workshop ② Construction of shipment place ③ Formulation and publicity of simple standards (grade, class, and size) ④ Practice of the operation and accounting record ⑤ Monitoring and evaluation by farmers	
Implemented Organizations: (1) DGASP (2) Rural Agricultural Office	Input: (1) Construction agricultural equipments (2) Trainings (3) Advisors (4) Extension officers
Duration (in each watershed areas): Two fiscal years	
Expected Outcomes: ① Improved farmers' income ② Understanding of the necessity for formulating standards of agricultural products	

Table 5.3.13 Action Program (Agricultural Support Service) (10/13)

Development Theme	Farmers' Association and Community
Program	Group Leaders Training Project
Targeted Group	Group leaders of ACBs (ZAE I, II, III, IV)
Background and Purpose: Most of the projects in this Action Plan are implemented through community associations. Success of the group activities depends on the capacity of leaders. Generally, sustainable organizations have following things in common; 1)clear organizational objective 2) eligible leaders who have strong will and capacity to take lead the organizations involved 3) fair and accountable operation. For this purpose, this pilot project aims to organize trainings for capacity building regarding the practical work of group projects, awareness building of leaders, the relationship building between administration and farmers. It might be required to organize periodical skull practice meetings of group leaders, for the purpose of information sharing and the study of constraints to be solved as well. This project shall cultivate the awareness of trainees as leaders through this group meeting.	
Activities: ① Training of group leaders (Principles of democratic organizations, elaboration of group rules and standing rules. Maintenance of accounting and records of activities/ elaboration of the report/ reporting of accounting/explanation of gender related issues/ extension of the information on the marketing price) ② Organization of group leaders' conference (Information exchange of problems each groups face and ideas for implemented development, introduction of activities conducted by each groups)	
Implemented Organizations: (1) DGASP (2) Rural Agricultural office	Input: (1) Cost for seminars (2) Conference room (3) Presenters: three days (4) Functionaries of DGASP, and field offices (5) Group leaders
Duration (in each watershed): Two fiscal years (Leaders' meetings shall be organized in every four months)	
Expected Outcomes: ① Improvement of managing capacity of group leaders ② Improved thinking ability of group leaders ③ Democratic group organization	

Table 5.3.14 Action Program (Agricultural Support Service) (11/13)

Development Theme	Farmers' Association and Community
Program	Capacity Building and Awareness Creation of Community Project
Targeted Group	ACBs (ZAE I, II, III, IV)
Background and Purpose: Most of the implementers of this Development Project in this Action Plan are community associations which compose communities. In implementing programs, capacity building and awareness building of the recipient communities is required, since capacity of functionaries of the government is inadequate. Hence, this project shall enhance the capacity of communities.	
Activities: ① Implementation of trainings for the communities (Improvement of soil for the increased productivity, importance of agro-forestry, water-saving irrigation, agricultural products, protection of environment) ② Implementation of seminars for extension of the outcome for farmers in other areas	
Implemented Organizations: (1) DGASP (2) Rural Agricultural Office	Input: (1) Cost for the training (2) Lecturers (3) Functionaries of DGASP and field office (4) 33 group representatives
Duration (in each watershed areas): Two fiscal years	
Expected Outcomes: ① Awareness creation on the intended development ② Participation of groups invited	

Table 5.3.15 Action Program (Agricultural Support Service) (12/13)

Development Theme	Extension System
Program	Extension among Farmers Project
Targeted Group	ACBs (ZAE I,II,III,IV)
Background and Purpose: This pilot project originally attempts to introduce extension among farmers in São Domingos. Yet, since this development project targets the entire watershed areas in the Santiago Island, it will be required to extend the project to other watershed areas. This study will execute programs in the targeted areas, and trained farmers shall instruct other community members. This ensures the understanding and a sense of intimacy for farmers in other watershed areas for transmission of techniques and awareness. By sharing information and techniques with farmers in advanced agricultural areas, incentives of unpracticed farmers shall be improved. Also, it might be efficient for farmers in other watershed areas to visit farmers who have experienced the Pilot Project to gain various perceptions.	
Activities: ① Farmers conduct survey the advanced agricultural areas ② Farmers report the result of survey	
Implemented Organizations: (1) DGASP (2) Rural Agricultural Office	Input: (1) Transportation cost (2) Facilitators of INIDA (3) Functionaries of DGASP and field office (4) 33group representatives
Duration (in each watershed areas): Two fiscal years	
Expected Outcomes: ① Farmers are motivated by the trainings. ② Trained farmers can extend the knowledge in their communities.	

Table 5.3.16 Action Program (Agricultural Support Service) (13/13)

Development Theme	Extension System
Program	Improvement of Extension System Project
Targeted Group	Counterparts, Extension officers

Background and objective:

Capacity of agricultural extension officers depends on the successful agricultural development. Hence, it is essential for extension officers to acquire knowledge on up-to-date agricultural technologies and transmit it to farmers. In executing Action Plan, it is required to improve the capacity of them to the successfully implement the project.

Hence, this study shall implement the trainings of extension officers for the capacity building. As for the contents of the training courses, it focuses on the capacity building for the participatory approach, since most of the components of this Action Plan will be conducted by farmers groups. Also, the study team should consider the sustainable and integrated development in the watersheds.

In addition, elaboration of manual for agricultural technologies will be required which farmers can refer to all the time for new technologies. This project elaborates the technical manual to improve extension system, since there is no such manual in CV. As for the elaboration of the manual, DGASP shall receive technical assistance from agricultural engineers and study centers, represented as INIDA, responsible for planning training curriculums for farmers.

The agricultural manual will be elaborated in the Action Plan of the model watershed areas. Designed manual shall be utilized in implementing Action Plan in watershed areas other than model watershed area. The manual shall be revised by assessing the defects in the process of utilization of manual. This project is the agricultural support development program described above.

Activities:

① Manual useful for improvement of agricultural system and extension system shall be drawn up by DGASP ETER and INIDA training schools.

② Extension officers shall take training on the participatory methods, and assist the local government to improve its capacity. Contracted sociologist participates in the activities.

Implemented Organizations:	Input:
(1) DGASP (2) Rural Agricultural Office	(1) Tools and manual (2) Experts dispatched from INIDA and external advisors for the participatory development method (3) DGASP (ETER), Field office, Extension officers

Duration (in each watershed areas): Two fiscal years

Expected Outcomes:

① Extension officers shall improve technical knowledge.

② Extension officers shall obtain advanced information on the participatory development and its extension methods.

Chapter 6 Pilot Project

6.1 Objectives of Pilot Project

The objectives of the Pilot Project lies in the confirmation of the feasibility of each Action Program proposed in the Draft Action Plan drawn up and the verification of concrete development methods of the watersheds. To perform these objectives, the small projects of the Programs shall be implemented, the output of the implementation shall be reflected to the Draft Action Plan and the feasible final Action Plan shall be drawn up. Consequently, the objectives of the Pilot Project include acquisition of useful information to formulate the Action Plan and confirmation of the effectiveness of activities to be implemented for the extension of the projects.

Moreover, technical transfer is also held to the counterparts and rural residents, which is one of the objectives of this study, in implementing the Pilot Project.

6.2 Selection of Pilot Project Components

Pilot Project Components were selected out of the Action Programs proposed in the Draft Action Plan, through workshops with target farmers to figure out their needs and counterpart meetings, in consideration of the following conditions: 1) that the projects shall be small enough to obtain the outcome within the study period (2 years): 2) that the validity of implementation of the projects can be secured: and 3) that the problems to be solved are included.

6.2.1 Workshops

In principle, beneficiaries shall actively participate in the Pilot Project. Hence it is essential for rural residents to have the consciousness that the project is the one which is made by themselves, not given by others. Therefore, this study organized workshops for beneficial farmers in order to promote understanding, and to absorb their needs, in selecting the components. Workshops were organized in selecting the components of the Pilot Project.

(1) First Workshop: on the 22nd of July 2008

The first workshop was held for the discussion with three representatives from each of the 11 farmers associations (ACBs) of São Domingos Watershed, functionaries of DGASP (MADRRM) and Agricultural Local Office. Objectives of the workshops are described as follows:

1. Notification of the draft Action Plan and the research on pilot projects to functionaries of MADRRM in the Agricultural Local Office and representatives of the farmers;
2. Information exchange on the smooth implementation of the Study;
3. Selection of prioritized projects based on the farmers' needs and on the problems they face.
4. Information collection from the representatives of farmers by questionnaires.

The interviews from farmers in the first workshop revealed that they recognized the following items as priority problems to be solved; the lack of agricultural water in the entire watershed, the

salt damaged soil and water in ZAE I and the lack of water and soil conservation facilities in both ZAEs III and IV. This is because farmers understand that scarce agricultural water due to limited precipitation and lack of arable lands caused by steep landscape are the major obstacles in the targeted Watershed. Therefore, they perceive that solutions for these issues are prerequisite for agricultural management projects. Also, people in all the ZAEs regard project for the capacity building as a priority project.

(2) Second to Fifth Workshops: organized from 25th to 29th of July 2008

The second to the fifth workshops, divided into each of four ZAEs, were held for selection of components with the association members, in addition to the representatives, based on the action programs prioritized by the representatives of ACBs discussed in the previous workshop. Agendas of the workshops were consisted of as follows;

1. Explanation of the elaborated Action Plan and the Pilot Project to ACB members
2. Explanation of the outcomes of the first workshop
3. Presentation of the candidate projects based on the priorities of the action programs selected by the representatives of ACBs
4. Attainment of the opinions, critics, and inquiries on the candidates pilot projects
5. Achievement of consensus of the farmers on these pilot projects

(3) Sixth Workshop: Organized on 23rd of October 2008

The components of the Pilot Project to be implemented and the target Zones were selected at the previous five workshops mentioned above. After the approval of those components and Zones by the advisory committee in Japan, the natural conditions and technical feasibilities of the projects were reviewed with the counterparts, and the components and the locations were decided as follows;

Table 6.2.1 Target Locations for the Components of Pilot Project

	ZAE I			ZAE II				ZAE III			ZAE IV
	Baía	Praia Baixo	Achada Baleia	Milho Branco	Portal	Achada Lama	Praia Formosa	Água de Gato	Lagoa	João Garrido	Rui Vaz
Soil and Water Conservation									○		○
Water-harvesting					○			○			
Leaching of Salt Damaged Farm	○										
Small-scale Water Resources Development				○							
Water Saving Irrigation/Water Management			○								
Forage Cultivation with Forest Conservation											○
Agricultural Produce Processing								○	○	○	
Rationalization of Market Distribution										○	
Group Leaders Training	○	○	○	○	○	○	○	○	○	○	○
Extension among Farmers	○	○	○	○	○	○	○	○	○	○	○
Improvement of Extension System	○	○	○	○	○	○	○	○	○	○	○

The sixth workshop was held to gain the agreement of this decision from the target farmers. Local facilitators explained each project mentioned above and target ACBs in the workshop. Overall, agreement was accorded after the discussion with ACB members in each ZAE.

6.2.2 Draft Action Programs and Pilot Project Components

Components of the Pilot Project are implemented to reflect their outcome to the Action Programs proposed in the Draft Action Plan, in order to elaborate the final Action Plan. Relationship between the Action Programs and the Pilot Project Components are shown below.

Table 6.2.2 Draft Action Programs and Pilot Project Components

Action Programs \ Pilot P roject Components		Soil and Water Conservation	Water-harvesting	Leaching of Salt Damaged Farm	Small Scale Water Resources Development	Water-saving Irrigation and Water Management	Forage Cultivation with Forest Conservation	Agricultural Produce Processing	Rationalization of Market Distribution	Group Leaders Training	Extension among Farmers	Improvement of Extension System
1	Soil and Water Conservation Project	○								△	△	△
2	Small-Scale Water Resources Development Project		○	○	○					△	△	△
3	Project for the Measures of Salt Damaged Farm Recovery			○						△	△	△
4	Agro-forestry Project						○			△	△	△
5	Project for the Introduction of Water-saving Irrigation					○				△	△	△
6	Project for the Management of Adequate Pasturage		△				△			△	△	△
7	Training for Water-saving Irrigation Project					○				△	△	△
8	Project for Storage and Processing of Agricultural Produce							○		△	△	△
9	Project for Rationalization of Market Distribution								○	△	△	△
10	Project for the Group Leaders Training									○	△	
11	Project for Awareness Building of the Communities									△	△	
12	Project for Extension among Farmers									△	○	△
13	Project for Improvement of Extension System										△	○

○:Indicates the direct relationship between the action programs and the components of Pilot Project.

△: Indicates the implicit relationship between the action programs and components of Pilot Project.

6.3 Implementation Organization of Pilot Project

The implementation organization of the Pilot Project is planned as follows and is composed of three committees.

- Local Coordination Committee
- National Coordination Committee (DGASP Level)

- Steering Committee

Since all the activities concerning the Pilot Project implementation are supported or instructed by the extension officers in DMDRRM-SD (Agricultural L ocal O ffice in S ão D omingos), t he L ocal Coordination C ommittee composed o f the e xtension of ficers a nd ACBs is organized and DMDRRM-SD coordinates the operation of the Pilot Project in ACB level. The Local Coordination Committee secures t he t ransparency o n t he issues ar ound the benefit derived f rom t he na tural resources o f the W atershed so as to resolve them i n a d emocratic m anner. In ot her w ords, this Committee i s the forum w here rural r esidents d iscuss an d se ek so lutions o n t he i tems w hich w ere decided exclusively by the functionaries of the Government before. Group leaders meetings are used for the regular meetings of the Local Coordination Committee, where each of the ACBs reports their achievements i n t he P rograms as w ell as ACBs discuss t he po ints of c oncerns r aised by t hem one another.

The N ational C oordination Committee i s e stablished in D GASP and interacts w ith the o ther related organizations on the management of natural resources in the Watershed to share information on the water resources in the Watershed. The monitoring of the implementation of the Pilot Project shall be appropriately carried out taking into consideration the information.

The Steering C ommittee works a s the h ighest de cision m aking body w hich d eals w ith v arious issues in the processes of implementation.

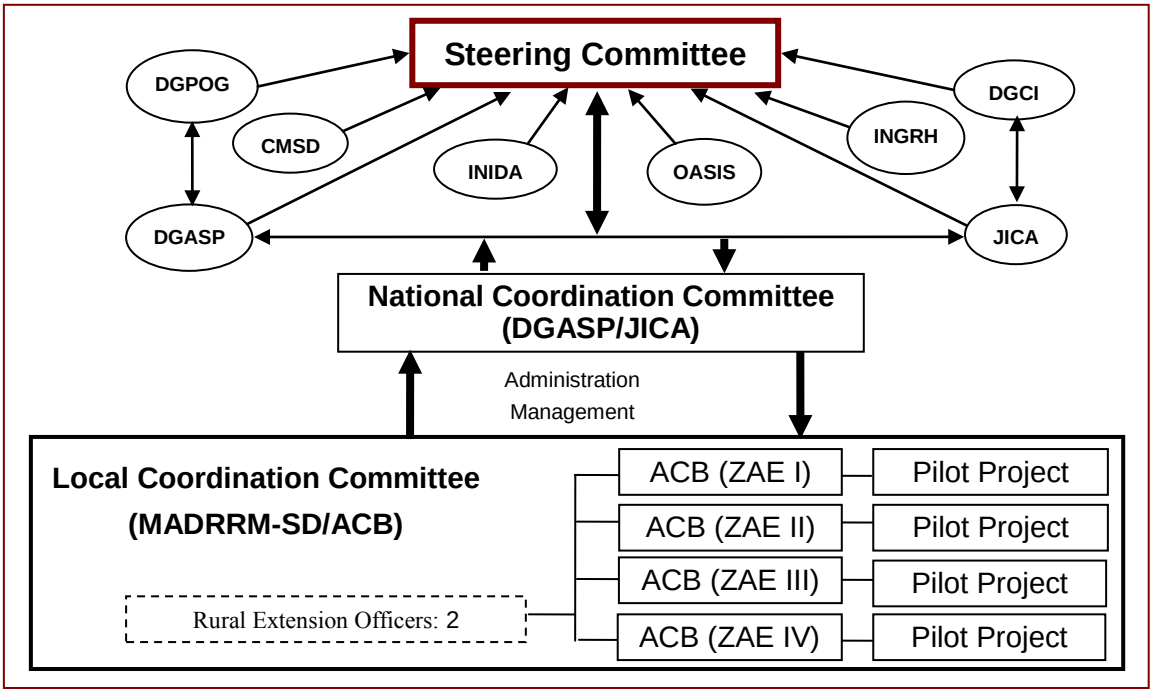


Figure 6.3.1 Implementation Organization Chart of Pilot Project

In implementing the Pilot Project, responsible officials of DGASP, the counterpart organization, for each component of the Project were assigned as follows.

Soil and Water Conservation:	(Engº Augusto Andrade)
Water-harvesting:	(Engº Eugénio Barros)
Leaching of Salt Damaged Farm:	(Engª Ângela Moreno)
Small-scale Water Resources Development:	(Engº Eugénio Barros)
Water Saving Irrigation/Water Management:	(Engª Ângela Moreno)
Cultivation of Forage with Forest Conservation:	(Engª Mina Jaglal, Eng.º Augusto Andrade)
Agricultural Produce Processing:	(Engª Eneida Rodrigues, Eng.ª Mina Jaglal)
Rationalization of Market Distribution:	(Engª Eneida Rodrigues, Eng.ª Mina Jaglal)
Group Leaders Training:	(Engº Alberto Salazar Silva, Eng.ª Mina Jaglal)
Extension among Farmers:	(Engº Alberto Salazar Silva, Eng.ª Mina Jaglal)
Improvement of Extension System:	(Engº Alberto Salazar Silva, Eng.ª Mina Jaglal)

6.4 Process and Evaluation of Project Component: Soil and Water Conservation

6.4.1 Profile and Objectives

In Santiago Island, devastation of soil occurs due to the soil erosion caused by flash flood in the rainy season, in addition to the steep landscape. Uncontrolled soil erosion causes the shrinking irrigation land at an accelerating pace.

In the Soil and Water Conservation Project in the Action Plan, various water and soil conservation works are proposed to restore arable land and to prevent the devastation of the nature. Although numerous works of soil and water conservation have been implemented in CV, no numerical data seem to verify the effectiveness of the projects. Also, while local residents are interested in the management of natural resources, such as water and forest, they seem to lack the consciousness of the management which restricts the integrated management of natural resources. Therefore, this project attempts the numerical verification of effectiveness of soil and water conservation, and the validation of the possibilities for self management of natural resources by awareness building in the communities.

6.4.2 Activities

This project was implemented in Rui Vaz, located in ZAE IV, and in Lagoa, which is a part of ZAE III. The achievement of activities is shown in the following table.

Table 6.4.1 Activities: Soil and Water Conservation

Activities	Expected Results	Schedule	Responsible Officials	Input
		2008 o n d / 2009 j f m a m j j a s o n d / 2010 j f m a		
1-1 Elaboration of the implementation plan in coordination with the extension officers and rural residents under the instruction of experts on irrigation	Implementation Plan	▪	Counterparts External Advisers	CV: Functionaries and ACB JICA: Members of the study team and external advisers
1-2 Selection of implementation methods	Selected methods of implementation	▪	Counterparts External advisers	CV: Functionaries and ACB JICA: Members of the study team, external advisers, and the cost for measurement
1-3 Designing of facilities, Planning of the Processes, and Estimation of the cost	Design book, Construction schedule report, and Cost estimation report	▪	Counterparts External advisers	CV: Functionaries and ACB JICA: Members of the study team, external experts, and the cost for the architectural drawing
1-4 Participation of ACB in the construction of infrastructure	Infrastructure	▬	Counterparts External advisers	CV: Functionaries and ACB JICA: Members of the study team, external experts, construction materials, irrigation facilities, etc.
1-5 Monitoring by extension officers and ACB	Monitoring	▬	Counterparts	CV: Functionaries and ACB JICA: Members of the study team
1-6 Organization of the seminars for the purpose of disseminating the outcomes to the rural residents.	Rural residents who acquired knowledge on the soil and water conservation	▪	Counterparts	CV: Functionaries and ACB JICA: Members of the study team

The contents of the project had been discussed with counterparts, ACBs and rural residents, and the design of the facilities was commissioned to local consultants and made. As a result of selection of contractors, each of the ACBs was contracted as contractors, and implemented construction works.

Rui Vaz (ZAE IV)

In the middle of June, sub-contract with the ACB in Rui Vaz was made and the construction was embanked. It continued at a good pace until the middle of July; however, retard in the progress was observed after that time due to overlap with the busiest cultivation season before the rainy season. Consequently, completion of the construction was delayed till the end of September.

As for the facilities, since the wall of masonry stones could not leave a required space for plant cultivation, it ended up higher than the planned wall (H＝0.5→0.9m). Considering the entire increase in the work loads (masonry and backfilling), the length of masonry works was reduced from 1,904 m to 1,000 m. Outline of the facilities is shown below:

The profile of the facilities is shown below:

Targeted Areas: A = 0.6 ha

Masonry Works (H = 90 - 100 cm): 1,000 m

Planting of Fruit Trees: 110 plants

Cultivation of Beans: A = 0.6 ha

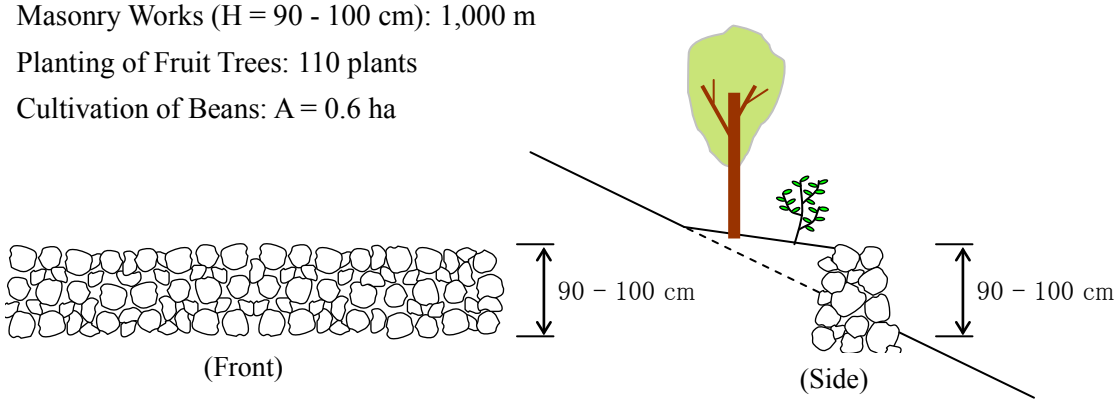


Figure 6.4.1 Stone Masonry Works (Rui Vaz)

《Monitoring》

The objective of this project lies in the prevention and restoration of devastated land due to soil erosion, by constructing soil conservation works (stone masonry works). This monitoring study focused on the evaluation of effects for the prevention of soil erosion, as well as of conditions of plant growing by assessing both conditions of erosion in the sloping surface and the grounds.

Progress:

・Erosion of Soil in the Sloping Surface

The study observed condition of soil erosion on the slopes and compared it with one in the similar surrounding farms. However, conspicuous soil erosion damages was not observed. It is worthwhile noting that, as can be observed in the right picture, during the weed mowing for corn cropping, soil erosion caused by disturbance of surface soils and tread power (densification of soil structure → decrease in the water permeability → increase in soil washed away by the runoff of the surface water) was sporadically observed.

Stone masonry in this area contributes to deceleration of soil runoff and intrusion/storage of rainwater. The figure below represents the diagram of the project site in Rui Vaz. As can be seen from the diagram, there are small pits around the planted fruit trees. These holes infiltrates and penetrates the surface water from river upstream, as well as rain water (since the slope length reaches less than 10 m, the normal rainfall in the rainy season does not exert a force of intense erosion). On the other hand, in case that moisture in the soil advances by rainfall in the rainy season, the gradual evaporation of moisture in the soil is promoted in the boundary of the soil

layer adjacent to the interior wall of stone masonry in the downstream. Therefore, moisture damage was not observed in the planted nursery fruit plants. This is confirmed by the baseline survey (some 1 percent of nursery plants died in 1.5 months after the planting).

As corns and beans planted in the uphill of the planting works grow, the surrounding water consumption increases. Therefore, the local farmers weed around the crops and attempt to restrict the loss of water in evaporation and the growth of weeds covering the weeded grass around the holes (the figure below). Cultivation environment as soil and water conservation was completed, regarding the areas where nursery fruit trees are planted.

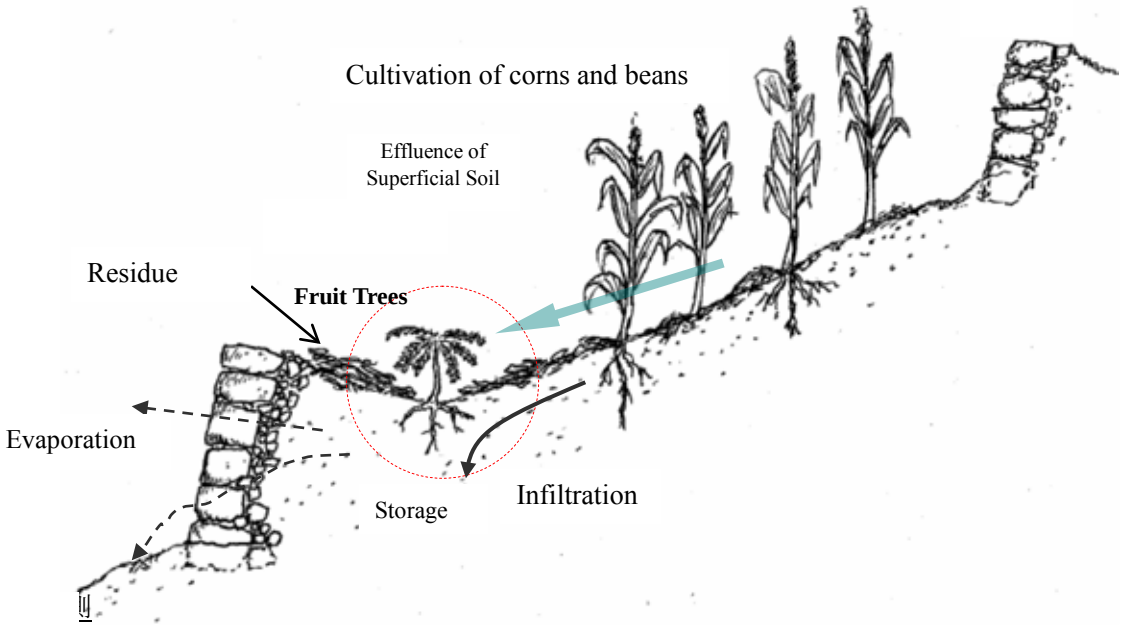


Figure 6.4.2 Diagram of Cross Sectional Area for Slopes of Project in Rui Vaz

・Growth of Planted Trees

This sturdy selects five samples out of the planted fruit trees, calculating the height and the shape of trunk of trees. Three months later in December 2009, and four months later in January 2010, it carried out measurement again and observed growth conditions. There was almost no difference in the figures in December and in January. This apparently indicates that lack of water brings about the delay in growth of plants at the advent of the dry season. Variation of growth speed can be observed according to the kinds of fruit. This is because of the difference in adaptability to the environment (altitude, climate, hours of daylight, precipitation). Lemons and mangoes grew at a sluggish pace. Baseline figures and that of four months later are shown in the following table:

Table 6.4.2 Growth Conditions of Planted Trees in Rui Vaz

Project sites: Rui Vaz

Plants	Height (cm)		Diameter of Trunk (mm)	
	Baseline	4months	Baseline	4months
Avocados （Persea americana）	58.8	76.6	1.36	1.80
Azalea （Phyllanthus acidus ozelea）	53.4	90.4	1.552	2.26
Guava	41.0	70.4	0.90	1.40
Lemon （Citrus limonia）	43.2	47.8	1.01	1.04
Mango （Mangifera indica）	29.0	36.6	0.66	0.74
Papayas （Carica papaya）	31.0	58.6	0.58	1.02

Lagoa (ZAE III)

In the middle of June, sub-contract with the ACB in Lagoa was made and the construction was embanked. It continued at a good pace until the middle of July; however, retard in the progress was observed after that time due to overlap with the busiest cultivation season before the rainy season. Consequently, completion of the construction was delayed till the middle of September.

With regards to the facilities, construction was conducted rather smoothly except the requirement of changes in the height of the stone masonry works, as it was proved that the works did not meet the required height of the contract.

The profile of the facilities is shown below:

Targeted Surface Areas: A = 2.7 ha

Crescent Filling Works (2.5 m x 2.5 m, H = 35 cm): 489

Stone Masonry Works (H = 100 - 120 cm): L = 246 m

Planting of Fruit Trees: 489 plants

Cultivation of Beans: A = 1.7 ha

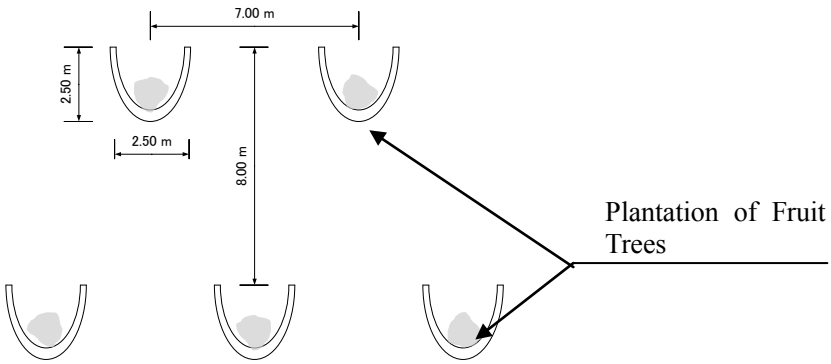


Figure 6.4.3 Crescent Filling Works