

# Technical Information Kits for Community-Based Natural Resource Management (CB-NRM)



Prepared by

**The Project for Community-Based Sustainable Natural Resource  
Management in the Democratic Republic of Timor-Leste**



From  
the People of Japan



## LIA MAKLOKEK

CB-NRM ka Jestaun Rekursu Naturál ne'ebé Bazeia ba Komunidade mak aproxima ida ba konservasaun natureza liuhusi rekoñese direitu komunidade lokal hodi jere no hetan benefisiu hosi jestaun no uja rekursu naturál ho sustentabel (floresta, rai, bee no biodiversidade) iha area ne'ebé designado. Ida ne'e alternativu ida hodi ha-tun sistema jestaun regulatoriu, ne'ebé mak sedauk nesesáriuamente efetivu iha nasaun balun, especialmente bainhira regulamente ne'e la apropriadu ona ho mudansa iha kontekstu social, kultura no ekonomia iha nasaun ne'e.

Timor – Leste hanesan nasaun foun ida iha mundu no ninia kuadro institucional no rekursu humano sei presija hametin iha area hotu inklui iha seitor floresta. Japan International Cooperation Agency (JICA) implementa ona “ Projetu ba Jestaun Rekursu Naturál ne'ebé Sustentabel Bazeia ba Komunidade (JICA, Projetu CB-NRM)” no ajuda ona Direcção Nacional das Florestas e Gestão Bacias Hidrograficas (DNFGBH) hosi Ministério Agricultura e Pescas (MAP) hari'i kapasidade institucional ba introdusaun no aplikasaun hosi CB-NRM hanesan xave aprosimasaun ida ba jestaun floresta sustentabel iha nasaun ne'e

Susesu ida ne'ebé halo hosi Projetu JICA, CB-NRM mak livro referencia ida ne'e ho titlu “Informasaun Kit CB-NRM”. Livro ida ne'e introdus Tékniku/pratika util lubun ne'ebé demonstra ona iha Timor – Leste no mós iha nasaun Ásia seluk ba protesaun floresta, dezvoltamentu floresta, Agrikultura sustentabel, no dezvoltamentu vida moris. Livro ida ne'e bele ajuda praktikadores terrenu MAP nian (ezemplu, Oficial no coordenador Ekstensaun, oficial floresta municipiu, no guarda floresta) no mós NGO sira ne'ebé servisu iha seitor floresta no agrikultura, especialmente bainhira sira servisu ho komunidade lokal iha area rai lolon ka foho iha Timor – Leste ba Jestaun floresta no rai sustentabel. Iha tempu ne'ebé hanesan, livro ne'e bele sai dokumentu ne'ebé iha valor bo'ot ba peskizador sira, treinadu sira, estudante bacharelatu iha area ne'ebé hanesan

MAP, especialmente DNFGBH, iha intensaun atu ho efetivamente uja dokumentu referencia ne'e liuhusi desimina ba stakeholders lubun atu nune'e pratika konvensional bele uja iha area railolon no foho no neneik-neneik troka ho dalan ne'ebé produtivu no sustentabel liu.

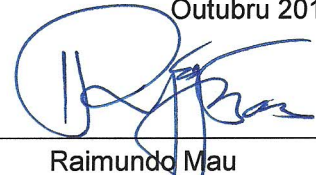


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## Technical Information Kits for CB-NRM

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## **ACRONYMS**

AMCAP	Ainaro, Manatuto Community Activation Project
ARP	Agriculture and Rehabilitation Project
CBFM	Community-Based Forest Management
CBNRM	Community-Based Natural Resource Management
DAC	Dezenvolve Agricultura Comunitária
DENR	Department of Environment and Natural Resources, Government of Republic of Philippines
EM	Effective Micro-organisms
EU	European Union
FAO	Food and Agriculture Organization of the United Nations
FFS	Field Farmer's School
GIZ	German International Cooperation
JFM	Joint Forest Management
JICA	Japan International Cooperation Agency
MAF	Ministry of Agriculture and Fisheries
NDF	National Directorate of Forestry
NGO	Non Governmental Organization
PAC	Public Awareness Campaign
PARCIC	PARC Interpeoples' Cooperation
PERMATIL	Permaculture Timor Lorosa'e
PLUP	Participatory Land Use Planning
PRA	Participatory Rural Appraisal
RDP	Rural Development Programme
UNDP	United Nations Development Programme
USAID	U.S. Agency for International Development
USC-CTL	USC Canada Timor-Leste/RAEBIA





## **Chapter 1 Introduction of Existing Useful CB-NRM Techniques/Practices**

### **1.1 About CB-NRM**

CB-NRM stands for Community-Based Natural Resource Management, which is the concept for sustainable management of natural resources by local communities in a participatory manner. In general, CB-NRM can be applied to all the natural resources, such as forest, coastal/marine, and mining. Nevertheless, CB-NRM in this document targets forest and other forest-related or agricultural resources, which are essential to livelihoods of hilly/mountainous communities in Timor-Leste.

In this context, CB-NRM aims to develop and enhance the capacities of upland communities to protect and manage forest and other forest-related natural resources in their localities. A multi-faceted approach is needed to orient local communities toward a concept of sustainable natural resource management and enable them to view forest and natural resources as their long-term assets, without which the majority have been forced to live at the subsistence level.

In other Asian countries, the concepts of community forestry or community-based forest management, such as JFM (Joint Forest Management) in India, CBFM in Philippines, and Community Forestry in Cambodia, have been introduced with a wide range of techniques and skills to help forest-dependent communities change their lifestyle and livelihood activities to environmentally-sound ones. Furthermore, all the schemes commonly take the following steps to introduce the concept.

- a. Community participation and community organization
- b. Community planning
- c. Introduction and application of several techniques (e.g., forest protection and management, livelihood development, sustainable agricultural development, and other environmentally-friendly techniques)

CB-NRM in Timor-Leste shall also follow a similar process of introducing its concept, though the way of application as well as techniques/skills introduced should be tailored to the situations of Timor-Leste.

After careful review of the past attempts on community forestry and community-based sustainable natural resource management in Timor-Leste as well as the current conditions of hill/mountainous areas, specifically in those in the target river basins, namely Laclo and Comoro river basins, the JICA Project Team judges that the following components would be the keys to the smooth and successful introduction of the CB-NRM concepts in upland communities in Timor-Leste, especially in the target river basins.

1. Community participation
2. Participatory land use planning
3. Forest management and reforestation
4. Agriculture and livestock management
5. Sloping agriculture and agroforestry
6. Livelihood development

## **1.2 Guide to Use of Technical Information Kits for CB-NRM**

This document, Technical Information Kits for CB-NRM, is aimed at helping planners and field workers, such as MAF officers in the central and district offices, NGO staff and anyone involved in a CB-NRM or community-based forest management project, deepen their understanding of techniques/skills effective in introducing the concept of CB-NRM in hilly and mountainous communities in Timor-Leste. All the techniques introduced in this document have been put on trial in Timor-Leste or other Asian countries, and their effectiveness has also been confirmed in the field.

The document is composed of the six (6) technical fields mentioned above. A reader can read through the document from the beginning to the end to have a whole picture of the necessary techniques for CB-NRM, or read any part of the document, which a reader is specifically interested in.

Every topic/case introduced in the document tells: i) the site/village where the technique is/was introduced; ii) objectives of the technique; iii) major activities; iv) procedures for application of the technique; and v) outcome expected to be generated by the techniques, to help a reader get a clear idea on the respective techniques/skills. Further references and possible sources for additional information are also specified in the document so that a reader can study further on any particular topic.

## **Chapter 2      Technical Information Kits**

### **2.1      Community Participation**

Community participation is a core activity overarching all the CB-NRM techniques and skills. Unless local communities are fully involved in CB-NRM activities, it would be difficult to change their conventional practices to the ones that would contribute to sustainable forest and natural resource management. Although many government projects and NGOs as well as donor-funded projects in Timor-Leste had/have involved local communities to a greater or lesser extent, community involvement in some cases appears to be rather temporal, or if anything, just for provision of materials. In such case the sustainability of the community-based collective activities for CB-NRM is often questionable.

Community participation should be maintained not only during the project period but also in the post-project period, to enable local communities to continue practicing CB-NRM techniques/skills to manage forest and other resources in a sustainable manner. By keeping community participation in CB-NRM activities, they can also develop a foundation for sustainable forest and natural resource management in the localities. In other words, community participation should be the essential process to achieve sustainable forest and natural resource management rather than a mere means to implement a forest management project.

After reviewing the past projects implemented in Timor-Leste, such as AMCAP, APR II, pilot projects under the JICA Watershed Management Study, and other projects implemented by the national/international organizations, the following approaches and methods are judged effective in ensuring the community's participation and enhancing their understandings of CB-NRM concepts as well as its associated skills/techniques.

1. Public awareness campaign
2. Participatory assessment
3. Group formation
4. Participatory planning, monitoring, and evaluation
5. Field farmers schools (FFSs) / Hands-on training courses



The above-listed measures should be carried out in the different stages in the project cycle, as they have different aims as outlined below and discussed in five Reference Sheets which follow summarizing techniques in actual case studies.

<b>Measures</b>	<b>Project stage</b>	<b>Aims</b>
1. Public awareness campaign	Pre-implementation and Initial stage of the Project	a. Enhance awareness of the importance and necessity of the project among local communities. b. Attract the interest of local communities about the project.
2. Participatory assessment	Initial stage of the Project	a. Enable local communities to assess the current situations of the village and understand the necessity of the project.
3. Group organization	Initial to end stages of the Project	a. Select local communities who are willing to engage in the project. b. Foster a sense of ownership about the project among local communities.
4. Participatory planning, monitoring, and evaluation	Initial to end stages of the Project	a. Enhance local communities' understanding of the project activities through planning of a work plan. b. Enable local communities to evaluate the effectiveness of the project through a review of their performance and outcomes of the project.
5. Field farmers schools (FFSs)	Middle stage of the Project, especially during the stage for capacity development of local communities	a. Enable local communities to put into practice skills and techniques relevant to CB-NRM in the field. b. Enable local communities to see the effectiveness of skills and techniques relevant to CB-NRM.

### Reference Sheet Community Participation-1

Name of the Technique:	<b>Public Awareness Campaign</b>
Place where the technique is observed	Salamete Village, Lailaco Sub-District, Ermera District
Year of Introduction:	2008-2009
Source of Information	The Study on Community-based Integrated Watershed Management in the Lacro and Comoro River Basins



### Summary of Public Awareness Campaign Techniques

Items	Description
Objectives	Public Awareness Campaign (hereinafter referred to as “PAC”) aims to foster rural communities’ awareness of the importance of sustainable forest and natural resource management and attract their interest in sustainable natural resource management.
Major Activities	<ol style="list-style-type: none"> <li>a. Develop materials for awareness-raising campaigns.</li> <li>b. Identify and select target villages for an awareness raising campaign.</li> <li>c. Conduct a questionnaire or baseline survey to grasp the current awareness level of forest degradation among communities in the target villages.</li> <li>d. Hold a series of workshops with communities in the target villages using the materials developed above.</li> </ol>
Procedures	<ol style="list-style-type: none"> <li>1. Assess the current forest management practices and the major threats to forests in the target area (such as a river basin or district/sub-district) through Participatory Assessment (see Reference Sheet Community Participation-2) or assessment of any existing information.</li> <li>2. Develop informative/outreaching materials for awareness-raising campaigns, such as pamphlets, posters, leaflets, and/or auto-visual media (i.e., picture-story show, movie or drama shows).</li> <li>3. Select the target villages among those located in the target area.</li> <li>4. Hold consultation meetings with village leaders of the target villages to explain the outlines and work schedule of the campaign.</li> <li>5. Conduct a questionnaire survey to evaluate the current awareness level of forest degradation among communities in the target villages.</li> <li>6. Hold a series of workshops in the target villages using the materials developed. The campaign should not treat adults and children in the same way, if anything, should hold the workshops separately for adults and children as their awareness levels are different from each other.</li> <li>7. Conduct a post-evaluation questionnaire survey in the target villages to measure how far the campaign has enhanced awareness of sustainable forest management among communities in the target villages in a sustainable manner.</li> </ol> <div style="display: flex; justify-content: space-around; align-items: center;">  <div style="text-align: center;"> <p><b>Awareness Campaign</b></p> </div>  <div style="text-align: center;"> <p><b>Sample of Informative /Outreaching Materials</b></p> </div> </div>
Expected outputs	<ol style="list-style-type: none"> <li>a. Local communities can recognize the importance of sustainable forest management and use.</li> <li>b. Local communities can be motivated to reconsider their current practices to manage forest and other natural resources in their area.</li> </ol>
Further references	1) Final Report, The Study on Community-Based Integrated Watershed Management in Lacro and Comoro River Basins, March 2009, JICA
Contacts for information	JICA Project Office

## Reference Sheet Community Participation-2

Name of the Technique:	<b>Participatory Assessment</b>
Place where the technique is observed	Fadabloco, Hautoho, Madabeno, Talitu Village
Year of Introduction:	2011
Source of Information	The Project for Community-Based Sustainable Natural Resource Management

### Summary of Participatory Assessment Techniques

Items	Description
Objectives	Participatory assessment aims to enable local communities to i) assess the characteristics of a target village and ii) identify the necessary interventions for introduction of CB-NRM.
Major Activities	<ol style="list-style-type: none"> <li>a. Collect data and information of the target village through several types of PRA (Participatory Rural Appraisal) sessions.</li> <li>b. Typical PRA sessions useful for a situation analysis for a forest management/rural development project are: i) Resource mapping; ii) Transect walk; iii) Trend analysis; iv) Seasonal calendar; v) Group discussions on traditional forest and land management; and vi) Group discussions on existing potential resources and products for livelihood development.</li> <li>c. Analyze the results of PRA sessions to assess the present conditions of the target village.</li> </ol>
Procedures	<ol style="list-style-type: none"> <li>1. Clarify necessary data and information to assess the present conditions of a village.</li> <li>2. Prepare a work plan of the participatory assessment selecting the appropriate PRA tools to be used for data collection.</li> <li>3. Prepare for field workshops procuring necessary materials and mobilizing facilitators and other human resources.</li> <li>4. Fix dates for PRA workshops/meetings in coordination with village leaders of the village and request them to gather communities for the workshops/meetings.</li> <li>5. Hold workshops/meetings with communities in the village for i) Resource mapping; ii) Transect walk; iii) Trend analysis; iv) Seasonal calendar; v) Group discussions on traditional forest and land management; and vi) Group discussions on potential resources and products for livelihood development.</li> <li>6. Compile and analyze all the data and information collected through the PRA sessions.</li> <li>7. Share the results of the PRA sessions with leaders and communities of the village.</li> </ol> <div style="display: flex; justify-content: space-around; align-items: center;">  <div style="text-align: center;"> <p><b>Resource Mapping</b></p> </div>  <div style="text-align: center;"> <p><b>Trend Analysis</b></p> </div> </div>
Expected outputs	<ol style="list-style-type: none"> <li>a. The characteristics of the target village, including the past trend in natural resource management, can be clarified.</li> <li>b. Local communities can recognize the current conditions of their own village.</li> <li>c. Local communities can realize the necessity of external interventions to improve the current conditions of the village.</li> </ol>
Further references	<ol style="list-style-type: none"> <li>1) Annual Completion Report (2011/2012), The Project for Community-Based Sustainable Natural Resource Management, March 2012, JICA</li> <li>2) Methods for Community Participation -A Complete Guide for Practitioners- Somesh Kumar, ITDG publishing (Reference book for PRA)</li> </ol>
Contacts for information	USC Canada Timor-Leste / RAEBIA Halarae Foundation



### Reference Sheet Community Participation-3

Name of the Technique:	<b>Group Organization</b>
Place where the technique is observed	Batara, Samalete, Faturasasa, Fadabloco, Hautoho, Tohumeta, Madabeno, and Talitu Village
Year of Introduction:	2008--2015
Source of Information	The Study on Community-Based Integrated Watershed Management in the Laclo and Comoro River Basins

#### Summary of Group Organization Techniques


Items	Description
Objectives	The aims of the technique are to: i) select local communities who are willing to engage in CB-NRM activities, ii) organize them into a farmers'/beneficiaries' group; and iii) foster their sense of ownership of CB-NRM activities.
Major Activities	<ol style="list-style-type: none"> <li>Select local communities who are willing to engage in CB-NRM activities and/or eligible to take part in a CB-NRM project through consultations and discussions with them</li> <li>Organize those selected as beneficiaries of CB-NRM activities into a farmers'/beneficiaries' group.</li> <li>Select a leader and core members of the farmers'/beneficiaries' group among the selected communities.</li> <li>Help the selected communities determine visions and missions of a beneficiaries' group and roles and responsibilities of the respective members of the group.</li> </ol>
Procedures	<ol style="list-style-type: none"> <li>Prepare eligibility criteria for a member of a farmers'/beneficiaries' group considering the nature of CB-NRM activities.</li> <li>Hold a meeting with communities including village leaders to help them identify and select those who are willing and eligible to be a member of a farmers'/beneficiaries' group.</li> <li>Hold another meeting with communities selected as members of the group and help them i) select a leader, a vice leader, and core members of the group; ii) determine the roles and responsibilities of the respective members of the groups; and iii) determine visions and missions of the group.</li> <li>Prepare by-laws/regulations of the group compiling a list of members, roles and responsibilities of the respective members, and visions and missions of the group based on the results of the meetings mentioned above.</li> </ol>
Expected outputs	<ol style="list-style-type: none"> <li>A farmers/beneficiaries group of local communities will be established with its by-laws.</li> <li>Local communities who engage in CB-NRM activities/a CB-NRM project can understand their responsibilities.</li> <li>A sense of ownership can be fostered among local communities.</li> </ol>
Further references	<ol style="list-style-type: none"> <li>Chapter 21, Improving agricultural extension. A reference manual, 1998, FAO</li> <li>Annual Completion Report (2011/2012), The Project for Community-Based Sustainable Natural Resource Management, March 2012, JICA</li> </ol>
Contacts for information	USC Canada Timor-Leste / RAEBIA Halarae Foundation



## Reference Sheet Community Participation-4

Name of the Technique:	<b>Participatory Planning, Monitoring, and Evaluation</b>
Place where the technique is observed	Batara, Samalete, Faturasa, Fadabloco, Hautoho, Tohumeta, Madabeno and Talitu Village
Year of Introduction:	2008-2015
Source of Information	The Study on Community-Based Integrated Watershed Management in the Laclo and Comoro River Basins



### Summary of Participatory Planning, Monitoring, and Evaluation Techniques

Items	Description
Objectives	The aims of the technique are to deepen local communities' understanding of CB-NRM activities and enhance their ownership of the activities.
Major Activities	<ol style="list-style-type: none"> <li>a. Hold a meeting with members of farmers'/beneficiaries' group prior to the commencement of CB-NRM activities (or a CB-NRM project) to develop a work plan of the extension service on CB-NRM techniques in a participatory manner.</li> <li>b. Hold a meeting with the members in the middle of the whole process of a CB-NRM project/extension service to evaluate their performance and update the work plan in the remaining term.</li> <li>c. Hold a meeting with the members in the end of a CB-NRM project/extension service/project to evaluate its effectiveness and develop a work plan to continue the CB-NRM activities.</li> </ol>
Procedures	<div style="display: flex;"> <div style="flex: 1;"> <p><b><u>A. Participatory Planning</u></b></p> <ol style="list-style-type: none"> <li>1. Draft a work plan of a CB-NRM project or an extension service on CB-NRM techniques with a tentative schedule.</li> <li>2. Hold a two-day workshop/meeting with local communities (or members of a farmers'/beneficiaries' group) who engage in CB-NRM activities to finalize the draft work plan.</li> </ol> <p><b><u>B. Participatory Monitoring</u></b></p> <ol style="list-style-type: none"> <li>1. Hold a two-day workshop/meeting with the same communities/members one year after the commencement of the work to help them: i) evaluate their performance and accomplishments made; ii) find the points that need to be improved to make the work effective; and iii) review and update the work plan in the remaining term.</li> </ol> <p><b><u>C. Participatory Evaluation</u></b></p> <ol style="list-style-type: none"> <li>1. Hold a two-day workshop/meeting with the members and village leaders six (6) months before the end of the work to help them: i) evaluate the effectiveness of a CB-NRM project/extension service; ii) discuss the necessity of continuation of the same; iii) identify the necessary input and supports for continuation; iv) develop a work plan for continuation specifying the responsibilities of the communities, MAF, and other relevant organizations (such as NGOs); and v) make an agreement among the relevant organizations on the implementation of the work plan prepared.</li> </ol> </div> <div style="flex: 1; text-align: center;">  <p style="text-align: center;"><b>Meeting for Planning of a Work Plan</b></p> </div> </div>
Expected outputs	<ol style="list-style-type: none"> <li>a. Local communities can deepen their understanding of CB-NRM techniques.</li> <li>b. Local communities can realize the effectiveness of CB-NRM techniques and extension service on them.</li> <li>c. Local communities can enhance their sense of ownership of the activities.</li> </ol>
Further references	<ol style="list-style-type: none"> <li>1) Participatory assessment, monitoring and evaluation, 1998, FAO</li> <li>2) Final Report, The Study on Community-Based Integrated Watershed Management in Laclo and Comoro River Basins, March 2009, JICA</li> </ol>
Contacts for information	USC Canada Timor-Leste / RAEBIA, Halarae Foundation

## Reference Sheet Community Participation-5

Name of the Technique:	<b>Farmers Field School (FFS)</b>
Place where the technique is observed	Batara, Samalete, Faturasas, Fadabloco, Hautoho, Tohumeta, Madabeno and Talitu Village
Year of Introduction:	2008-2015
Source of Information	The Study on Community-Based Integrated Watershed Management in the Laclo and Comoro River Basins

### Summary of Farmers Field School (FFS) Techniques

Items	Description						
Objectives	The main objective of Farmers Field School (FFS) is to ensure that local communities (or members of a farmers'/beneficiaries' group) who participate in a/n project/extension service can acquire skills and techniques related to a specific subject matter essential to introduction of CB-NRM.						
Major Activities	<ol style="list-style-type: none"> <li>a. Develop a training curriculum for a specific subject matter, e.g., seedling production/afforestation, sloping agriculture, or livelihood development, which is effective in introduction of CB-NRM.</li> <li>b. Locate a venue for FFS as a demonstration plot.</li> <li>c. Arrange/hold a series of hands-on training and on-the-job training (OJT) courses on techniques/skills related to a specific subject matter in the demonstration plot.</li> </ol>						
Procedures	<ol style="list-style-type: none"> <li>1. Break all the techniques/skills related to a specific subject matter down into parts according to the procedures.</li> <li>2. Develop a training curricula composed of a series of FFS courses on the techniques/skills.</li> <li>3. Identify and locate a venue for FFS courses for a farmers/beneficiaries group at sub-village level in consultation with members of the group. In case of agriculture- and/or forest-related skills/techniques, a venue for FFS courses can also be dealt with as a demonstration plot.</li> <li>4. Hold a series of FFS (hands-on and on-the-job training courses) at the demonstration plots. FFS courses should cover all the techniques/skills related to a specific subject matter. The following table shows the training courses to be handled for sloping agriculture and afforestation.</li> </ol> <div style="display: flex; justify-content: space-around; align-items: center;">   </div> <table border="1" style="width: 100%; margin-top: 10px;"> <thead> <tr> <th style="width: 20%;">Subject matter</th> <th>Major training courses</th> </tr> </thead> <tbody> <tr> <td>Sloping agriculture</td> <td>i) compost making, ii) delineation of contour lines, iii) application of soil conservation measures, iv) land preparation with compost application, v) seeding, vi) preparation and application of liquid fertilizer, vii) weeding and pest management, viii) harvesting, ix) post-harvesting including seed storage, and ix) application of green manure.</td> </tr> <tr> <td>Afforestation</td> <td>i) land preparation for a nursery, ii) establishment of a nursery, iii) compost making, iv) mixing soils and filling pots with mixed soils, v) seeding, vi) maintenance of seedlings, vii) land preparation for plantation, viii) sticking, ix) hole digging, x) planting, and xi) tending seedlings</td> </tr> </tbody> </table>	Subject matter	Major training courses	Sloping agriculture	i) compost making, ii) delineation of contour lines, iii) application of soil conservation measures, iv) land preparation with compost application, v) seeding, vi) preparation and application of liquid fertilizer, vii) weeding and pest management, viii) harvesting, ix) post-harvesting including seed storage, and ix) application of green manure.	Afforestation	i) land preparation for a nursery, ii) establishment of a nursery, iii) compost making, iv) mixing soils and filling pots with mixed soils, v) seeding, vi) maintenance of seedlings, vii) land preparation for plantation, viii) sticking, ix) hole digging, x) planting, and xi) tending seedlings
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Expected outputs	<ol style="list-style-type: none"> <li>a. Communities/members of a farmers/beneficiaries group can practice and acquire skills and techniques for CB-NRM through a series of FFS courses.</li> <li>b. They can be role models for other communities who may have interest in the same techniques/skills.</li> </ol>						
Further references	<ol style="list-style-type: none"> <li>1) Final Report, The Study on Community-Based Integrated Watershed Management in Laclo and Comoro River Basins, March 2009, JICA</li> <li>2) Farmer field schools on land and water management in Africa, 2008, FAO</li> </ol>						
Contacts for information	USC Canada Timor-Leste / RAEBIA Halarae Foundation						



## **2.2 Participatory Land Use Planning (PLUP)**

Participatory land use planning (PLUP) is an interactive process/procedure to create an enabling environment for local communities to manage land, forest, and other forest-related natural resources in a sustainable manner. PLUP has been successfully introduced and applied in other Asian countries, such as Philippines, Vietnam, Cambodia, etc., with the aim to help local communities in rural areas protect and wisely use forest resources in their localities.

In the process of PLUP, local communities develop a future land use plan and rules/principles that can guide them toward sustainable natural resource management through a series of dialogues between/among communities and other relevant stakeholders. Owing to its nature, it has been often used as an entry activity of community forestry or community-based natural resource management.

In Timor-Leste, the traditional rules/regulations, called *Tara Bandu*, had widely prevailed and been effective in the protection of natural resources in the Portuguese era. *Tara Bandu* used to be effective in controlling people's activities as it was strongly tied up with the law enforcement of the Portuguese government. Its effectiveness has weakened since the occupation of the Indonesian Government in 1975 when it was separated from the law enforcement. *Tara Bandu* lost its regulatory function along with the introduction of the laws and regulations of the Indonesian Government.

The Government of Timor-Leste as well as national and international organizations have taken the initiative in reviving the traditional rules/regulations to protect and improve the natural environment of rural areas after independence. Unfortunately, most of the interventions just focused on the revival of *Tara Bandu* (e.g., organization of a *Tara Bandu* ceremony) but not on the enhancement of local leaders' capacities; therefore, their effectiveness has often been limited or not sustainable.

The cases introduced in this section are the PLUP activities tailored by the JICA Project for Community-Based Natural Resource Management based on the current conditions of Timor-Leste. The following processes have been demonstrated by the JICA Project in several villages in Aileu District since 2011. The results revealed that the PLUP activities applied by the JICA Project would be effective in and essential to founding the mechanism of community-based sustainable natural resource management on a village level.




1. Future land use planning
2. Formulation of village regulations (*Tara Bandu* regulations) with a traditional ceremony
3. Monthly monitoring of the implementation and enforcement of village regulations

In order to ensure the effectiveness of the PLUP activities as well as *Tara Bandu* regulations developed through the process, the aforementioned activities should be carried out as a package, and not in a piecemeal manner. More details of the activities are shown in the following three Reference Sheets which summarize techniques in actual case studies.

## Reference Sheet PLUP-1

Name of the Technique:	<b>Future Land Use Planning</b>
Place where the technique is observed	Faturasá Village, Fadabloco Village, Hautoho Village, Madabeno Village, Tohumeta Village and Talitu Village
Year of Introduction:	2008-2013
Source of Information	The Project for Community-Based Sustainable Natural Resource Management




### Summary of Future Land Use Planning Techniques

Items	Description
Objectives	The main objectives of the technique are to help local communities in a target village develop an optimum future land use plan with an aim to balance sustainable forest and land management with improvement of their livelihoods.
Major Activities	<ol style="list-style-type: none"> <li>a. Prepare a present land use map.</li> <li>b. Prepare a future land use plan with rules on land use and management.</li> <li>c. Consult with local communities in the target village about the future land use plan and rules.</li> </ol>
Procedures	<div style="display: flex; justify-content: space-between;"> <div style="width: 45%;">  <p style="text-align: center;"><b>Present land use mapping</b></p> </div> <div style="width: 50%;"> <ol style="list-style-type: none"> <li>1. Help village leaders as well as other representatives from sub-villages i) classify the village area into several types of land use using an aerial photo (on a scale of 1:7,500 ~ 1:15,000) covering the target village; ii) classify forests by dominant species and density; and iii) demarcate the boundaries of the respective land use and forest categories.</li> </ol> </div> </div> <div style="display: flex; justify-content: space-between; margin-top: 10px;"> <div style="width: 45%;"> <ol style="list-style-type: none"> <li>2. Help village leaders as well as other representatives from sub-village i) discuss the functions and values of each land use categories; ii) confirm the current management practices; iii) identify the causes of forest and soil degradation in the target village; iv) determine the future use and management of each land use type; and v) develop a future land use map using the present land use map.</li> <li>3. Help village leaders have meetings with communities at sub-village level to i) introduce the future land use plan with its development process; and ii) get a consensus from communities on the future land use plan.</li> </ol> </div> <div style="width: 50%;">  <p style="text-align: center;"><b>Future land use planning</b></p> </div> </div> <div style="display: flex; justify-content: space-between; margin-top: 10px;"> <div style="width: 45%;"></div> <div style="width: 50%;">  <p style="text-align: center;"><b>Future land use plan</b></p> </div> </div>
Expected outputs	<ol style="list-style-type: none"> <li>a. Village leaders and other communities are able to appreciate the values and functions of forests and other natural resources in their locality.</li> <li>b. Village leaders and other communities understand the causes of surface soil erosion and forest degradation in their locality.</li> <li>c. Village leaders and other communities are able to come up with a future land use plan for sustainable management of lands and forests in their locality.</li> </ol>
Further references	<ol style="list-style-type: none"> <li>1) Annual Completion Report (2011/2012), The Project for Community-Based Sustainable Natural Resource Management, March 2012, JICA</li> <li>2) Participatory Land Use Planning in Rural Cambodia, 2004, FAO</li> </ol>
Contacts for information	USC Canada Timor-Leste / RAEBIA Halarae Foundation

## Reference Sheet PLUP-2

Name of the Technique:	<b>Formulation of Village Regulations with a traditional ceremony</b>
Place where the technique is observed	Faturasasa Village, Fadabloco Village, Hautoho Village, Madabeno Village, Tohumeta Village and Talitu Village
Year of Introduction:	2008-2013
Source of Information	The Project for Community-Based Sustainable Natural Resource Management



### Summary of Formulation of Village Regulations with a traditional ceremony Techniques

Items	Description
Objectives	The main objective of the technique is to ensure that local communities in a target village can protect and manage forests and other natural resources in the locality in a sustainable manner on their own initiatives.
Major Activities	<ol style="list-style-type: none"> <li>Review the existing Tara Bandu rules of the target village.</li> <li>Determine rules on management of forest and other natural resources as well as other rules of the target village.</li> <li>Develop a set of village regulations in writing.</li> <li>Organize a traditional ceremony to announce the village regulations to the public.</li> </ol>
Procedures	<ol style="list-style-type: none"> <li>Help village leaders i) enumerate the Tara Bandu rules in the village including those effective in the past; ii) evaluate their effectiveness; iii) select the rules applicable to the current conditions of the village, and iv) discuss necessary revision of the rules for application.</li> <li>Facilitate their discussions on i) rules on use and management of forests and other natural resources; ii) other rules of the target village including social norms; iii) organizational set-up for enforcement of the rules; iv) implementation and monitoring systems; v) fines and penalties; and vi) management of collected fines.</li> <li>Develop a set of draft village regulations in writing based on the discussions made in 2.</li> </ol> <div style="display: flex; justify-content: space-around;"> <div style="text-align: center;">  <p><b>Meeting to review the past rules</b></p> </div> <div style="text-align: center;">  <p><b>Explanatory Meeting at Sub-village</b></p> </div> </div> <ol style="list-style-type: none"> <li>Help village leaders hold meetings with local communities at sub-village level to explain the draft village regulations.</li> <li>Help village leaders hold a traditional ceremony to officially announce the village regulations to local communities in and around the target village.</li> </ol> <div style="text-align: center; margin-top: 10px;">  <p><b>Tara Bandu Ceremony</b></p> </div>
Expected outputs	<ol style="list-style-type: none"> <li>The incidence of forest fire and illegal cutting can be reduced.</li> <li>Communities will be oriented toward sustainable natural resource management.</li> </ol>
Further references	<ol style="list-style-type: none"> <li>Annual Completion Report (2011/2012), The Project for Community-Based Sustainable Natural Resource Management, March 2012, JICA</li> <li>Final Report, The Study on Community-Based Integrated Watershed Management in Laclo and Comoro River Basins, March 2009, JICA</li> </ol>
Contacts for information	USC Canada Timor-Leste / RAEBIA Halarae Foundation

### Reference Sheet PLUP-3

Name of the Technique:	<b>Monthly monitoring of implementation and enforcement of the village regulations</b>
Place where the technique is observed	Faturasa Village, Fadabloco Village, Hautoho Village, Madabeno Village, Tohumeta Village and Talitu Village
Year of Introduction:	2008-2015
Source of Information	The Project for Community-Based Sustainable Natural Resource Management

### Summary of Monthly monitoring of implementation and enforcement of the village regulations Techniques

Items	Description	
Objectives	The main objective of the technique is to enhance the capacity of village leaders to govern a village using the village regulations properly and effectively.	
Major Activities	<ol style="list-style-type: none"> <li>Convene a meeting with village leaders and other representatives from sub-villages on a monthly basis.</li> <li>Hold a meeting with local communities at each sub-village on a bi-monthly/quarterly basis.</li> </ol>	
Procedures	<ol style="list-style-type: none"> <li>Help village leader hold a meeting at village level on a monthly basis to discuss               <ol style="list-style-type: none"> <li>illegal and violating acts found in a village in the previous month;</li> <li>actions taken by village leaders to solve/settle such illegal/ violating acts;</li> <li>any pending issues that have not been settled at sub-village level; and</li> <li>necessary action to be taken to settle such pending issues.</li> </ol> </li> <li>Help village leaders record the discussions in the meeting so that they could enhance the effectiveness of the regulations by supplementing the same with judicial precedents.</li> <li>Help village leaders hold a meeting with communities at each sub-village in a village on a bi-monthly/quarterly basis to enhance the awareness of the village regulations among communities by sharing the information on how village leaders have settled the illegal and violating acts using the village regulations.</li> </ol>	 <p>Monthly meeting at village level</p>  <p>Suggestion by Chef de Village in the meeting at village level</p>
Expected outputs	<ol style="list-style-type: none"> <li>Village leaders as well as other communities can deepen their understanding of the village regulations.</li> <li>Village leaders can enhance their capacities to govern a village using the village regulations.</li> <li>The incidence of illegal acts in a village can be reduced as village leaders enhance their understanding of the village regulations.</li> </ol>	
Further references	1) Annual Completion Report (2011/2012), The Project for Community-Based Sustainable Natural Resource Management, March 2012, JICA	
Contacts for information	USC Canada Timor-Leste / RAEBIA Halarae Foundation	

## **2.3 Reforestation**

Reforestation is one of the core activities to contribute to the achievement of a future land use plan of village, as it could directly convert land use and improve the land productivity by planting valuable trees in the field. Reforestation is also expected to contribute to the change of the prevailing “slash and burn” practice to the way of not burning the field to protect seedlings planted.

As the techniques associated with Reforestation need to be applied by communities on their own initiatives, they should be i) easy-to-apply, ii) attractive enough to local communities, and iii) widely-applicable to the target river basins.

This section introduces the following four key techniques required for Reforestation, namely for seedling production and tree planting, on a village level.

1. Nursery establishment
2. Nursery operations and seedling production
3. Tree planting
4. Tending of young stands

At the same time, the standard plantation designs which local communities can follow when planting seedlings are also introduced in two Reference Sheets in this section as follows:

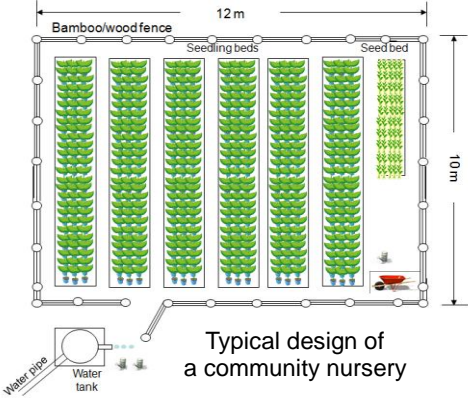
5. Development of tree plantation: i) Home garden, ii) Coffee plantation, iii) Timber wood plantation and iv) Regenerated forest in degraded land



## Reference Sheet Reforestation - 1

Name of the Technique	<b>Nursery Establishment</b>
Place where the technique were introduced	Samalete, Tohumeta, Talitu and Madabeno Villages (Aileu district)
Year of Introduction:	2008 –2015
Source of Information	The Study on Community-Based Integrated Sustainable Watershed Management in Lacro and Comoro River Basins

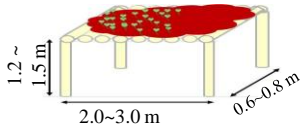
### Summary of Nursery Establishment Techniques

Items	Description																					
Objectives	The main objective of the technique is to enable local communities to establish a small-scale community nursery at sub-village level using locally available resources.																					
Major Activities	<ol style="list-style-type: none"> <li>Select a suitable site for a community nursery.</li> <li>Build a community nursery using locally available resources.</li> </ol>																					
Highlights of the activities	<ol style="list-style-type: none"> <li>Determine the number of seedlings to be produced in the nursery considering 20 % mortality of seedlings.</li> <li>Design the layout of the nursery which encompasses seedlings beds, seedbed, and side paths, based the following specifications <ul style="list-style-type: none"> <li>- Seedbed: 1.2~1.5 m in width</li> <li>- Side path: 0.4~0.5 m in width</li> <li>- Seedbed: 0.6~1 m in width and 3~5 m in length</li> </ul> </li> <li>Select a site with the following conditions for a nursery. <ol style="list-style-type: none"> <li>accessible to a water source;</li> <li>open but less windy;</li> <li>flat or gentle sloping; and</li> <li>accessible to the majority of communities' houses.</li> </ol> </li> <li>Consult with the land owner about the use of the site for a community nursery and make an agreement on the use with the owner.</li> <li>Install a watering system, which consists of a water tank (if necessary), water pipes (using bamboo), and a drum can.</li> <li>Clear and prepare the site for building a nursery.</li> <li>Collect local materials, such as bamboo or wood poles and palm leaves, for props, roof and walls of the nursery. The following table shows the necessary materials for establishment of a nursery as large as 120 m<sup>2</sup> which is good for 5,400 seedlings. <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th>Items</th> <th>Quantity</th> <th>Remarks</th> </tr> </thead> <tbody> <tr> <td>a. Bamboo poles</td> <td>40 pcs</td> <td>For Prop, beams and fence of the nursery</td> </tr> <tr> <td>b. Wood/Bamboo poles (props)</td> <td>12 pcs</td> <td>3-4 m in length and 20 cm in diameter is desirable.</td> </tr> <tr> <td>c. Wood/Bamboo poles (roof frames)</td> <td>20 pcs</td> <td>3-4 m in length and 5 cm in diameter is desirable.</td> </tr> <tr> <td>d. Nalo grasses/palm leaves (roofing)</td> <td>30 bundles</td> <td>-</td> </tr> <tr> <td>e. Nail</td> <td>4 kg</td> <td>7cm in length</td> </tr> <tr> <td>f. Wire</td> <td>3 rolls</td> <td>-</td> </tr> </tbody> </table> </li> </ol>	Items	Quantity	Remarks	a. Bamboo poles	40 pcs	For Prop, beams and fence of the nursery	b. Wood/Bamboo poles (props)	12 pcs	3-4 m in length and 20 cm in diameter is desirable.	c. Wood/Bamboo poles (roof frames)	20 pcs	3-4 m in length and 5 cm in diameter is desirable.	d. Nalo grasses/palm leaves (roofing)	30 bundles	-	e. Nail	4 kg	7cm in length	f. Wire	3 rolls	-
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f. Wire	3 rolls	-																				
	 <p style="text-align: center;">Typical design of a community nursery</p>																					
Expected outputs	<ol style="list-style-type: none"> <li>Local communities can develop a nursery with the proper design using locally available resources/materials.</li> </ol>																					
Further references	Final Report, The Study on Community-Based Integrated Watershed Management in Lacro and Comoro River Basins, March 2009, JICA																					
Contacts for information	1) Halarae Foundation																					

## Reference Sheet Reforestation - 2

Name of the Technique	<b>Nursery Operations and Seedling Production</b>
Place where the technique were introduced	Samalete, Tohumeta, Talitu and Madabeno Villages (Aileu district)
Year of Introduction:	2008 -2015
Source of Information	The Study on Community-Based Integrated Sustainable Watershed Management in Laclo and Comoro River Basins

### Summary of Nursery Operations and Seedling Production Techniques

Items	Description								
Objectives	The main objective of the technique is to produce quality seedlings in a collaborative manner at a small-scale community nursery.								
Major Activities	<ol style="list-style-type: none"> <li>Procure/collect seeds of timber, fruit, and industrial plant species.</li> <li>Pre-treat seeds, particularly those which need pretreatment for smooth germination.</li> <li>Sow seeds in a seed bed, transplant sprouts/germinated seeds into seedling pots/poly bags, and maintain seedlings in a nursery.</li> </ol>								
Highlights of the activities	<p><b>A. Procurement/collection of seeds</b></p> <ol style="list-style-type: none"> <li>Identify and select healthy trees with large and well developed crowns for timber species or with large and quality fruits for fruit species, as mother trees.</li> <li>Collect seeds from mother trees. The timing of seed collection varies by species, e.g., Mar.-Apr. and Sep.-Oct. for Sandalwood, May-Jul. for citrus, Mar.-May for Rambutan, May-Jul. for Longan, Jul.-Sep. for Teak and Jul.-Aug. for Mahogany.</li> </ol> <p><b>B. Pre-treatment of seeds</b></p> <ol style="list-style-type: none"> <li>Pre-treat seeds of Mahogany, Teak, and Sandalwood in the following manners:</li> </ol> <table border="1" data-bbox="379 996 1394 1171"> <thead> <tr> <th>Species</th> <th>Process of pre-treatment of seeds</th> </tr> </thead> <tbody> <tr> <td>a. Mahogany</td> <td>1) Soak the seeds in water for 12 hours.</td> </tr> <tr> <td>b. Teak</td> <td>1) Put the seeds in a rice sack and soak the sack in cool water for 48 hours. 2) After taking the sack from water, spread seeds in a black-colored container. 3) Put it under the sun for at least 2 days to dry them by direct sunlight.</td> </tr> <tr> <td>c. Sandalwood</td> <td>1) Soak the seeds in cool water from 12 to 24 hours</td> </tr> </tbody> </table> <p><b>C. Seedling Production</b></p> <ol style="list-style-type: none"> <li>Make a seedbed: i) prepare a seedbed 2~3 m long, 0.6~0.8 m wide and 1.2~1.5 m high; ii) sow seeds on a bed and pour water on the bed; iii) cover the bed with mulch, and ensure that seeds are protected from chicken.</li> <li>Make the seedling beds flat.</li> <li>Prepare seedling pots by mixing i) top (or black) soils, sands, and manure/compost at a rate of 3:1:2 for timber and fruit trees, and ii) top (or black) soils, sub-soils, and sands at a rate of 1:2:1 for sandalwood.</li> <li>Transplanting sprouts/germinated seeds into the seedling pots filled with media prepared in 3. When transplanting of sprouts of sandalwood, plant host plants, e.g., <i>alternanthera sp.</i> in the pots together with sandalwood since sandalwood is semi-parasite tree.</li> <li>Water seedlings every day, weed grasses in the pots at times, prepare and apply liquid fertilizer every week or every two weeks, and apply natural insecticide (e.g., water mixed with tobacco) whenever finding insect damage on leaves of seedlings.</li> <li>Reduce the frequency of watering one month before planting to adapt the seedlings to the external environment.</li> </ol> 	Species	Process of pre-treatment of seeds	a. Mahogany	1) Soak the seeds in water for 12 hours.	b. Teak	1) Put the seeds in a rice sack and soak the sack in cool water for 48 hours. 2) After taking the sack from water, spread seeds in a black-colored container. 3) Put it under the sun for at least 2 days to dry them by direct sunlight.	c. Sandalwood	1) Soak the seeds in cool water from 12 to 24 hours
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c. Sandalwood	1) Soak the seeds in cool water from 12 to 24 hours								
Expected outputs	a. Local communities can produce quality seedlings.								
Further references	<ol style="list-style-type: none"> <li>Final Report, The Study on Community-Based Integrated Watershed Management in Laclo and Comoro River Basins, March 2009, JICA</li> <li>“Orientation manual technique of Forestry” for the techniques used in the central and temporary nurseries in Timor-Leste, Nov. 2010, MAF-GIZ</li> </ol>								
Contacts for information	<ol style="list-style-type: none"> <li>Halarae Foundation</li> <li>GIZ (RDP IV)</li> </ol>								

### Reference Sheet Reforestation - 3

Name of the Technique:	<b>Tree Planting</b>
Place where the technique were introduced	Samalete, Tohumeta, Talitu and Madabeno Villages (Aileu district)
Year of Introduction:	2008 -2015
Source of Information	The Study on Community-Based Integrated Sustainable Watershed Management in Lacro and Comoro River Basins

#### Summary of Tree Planting Techniques

Items	Description
Objectives	The chief objective of the technique is to plant seedlings in a proper manner so as to ensure high survival of seedlings planted in plantation in the initial years after planting.
Major Activities	a. Prepare a site for plantation. b. Plant seedlings in a site.
Highlights of the activities	<ol style="list-style-type: none"> <li>Select a plot for planting trees according to the following guidelines: i) home garden/permanent farm close to a house for fruit and sandal wood (in the case of sandalwood, there should be host plants/trees, e.g., <i>sesbania grandiflora</i> and <i>leucaena sp.</i> in the plot), ii) periphery of coffee plantations for clove, iii) area used for shifting cultivation for timber species, and iv) open areas/grasslands for leguminous species and casuarina.</li> <li>Clear the plot for plantation.</li> <li>Delineate contour lines at intervals of 1 meter in height using an A-frame as explained in "Reference Sheet Sloping Agriculture and Agroforestry-1" in Section 2.5 of this CB-NRM Information Kit.</li> <li>If the site has steep slopes, apply to the plot the soil conservation measures, such as contour compost, as explained in "Reference Sheet Sloping Agriculture and Agroforestry-3" in Section 2.5 of this CB-NRM Information Kit.</li> <li>Stick stakes at the places where seedlings are planted according to the designs shown in Reference Sheet Reforestation-5 and 6 in this section.</li> <li>Dig pits/holes 40 cm each in depth and diameter for timber species and 45~60 cm each in depth and diameter for fruits and industrial plant species. When digging holes, separate top soils from sub-surface soils.</li> <li>Refill holes by putting back top soils first and overlay the top soils with sub-surface soils mixed with well decomposed compost/manure.</li> <li>Dig planting holes as deep as the height of seedling pots and plant seedlings at the onset of the rainy season.</li> <li>Make the u-shaped micro drainages in upper slope of seedlings to protect seedlings from being damaged by runoff water in the rainy season.</li> </ol> <div style="text-align: center;"> <p>Typical design/practice of small drainage of the spot of planted tree</p> </div>
Expected outputs	a. Local communities can prepare a site for plantation and plant seedling in a proper manner.
Further references	1) Final Report, The Study on Community-Based Integrated Watershed Management in Lacro and Comoro River Basins, March 2009, JICA
Contacts for information	1) Halarae Foundation 2) JICA Project Office

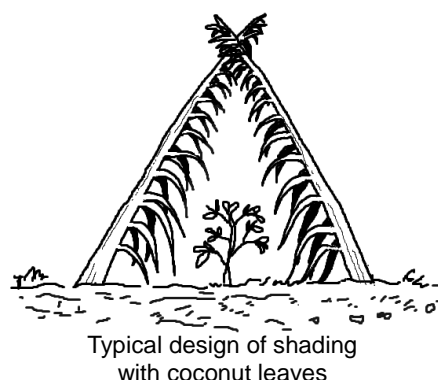


## Reference Sheet Reforestation - 4

Name of the Technique:	<b>Tending of Young Stands</b>
Place where the technique were introduced	Samalete, Tohumeta, Talitu and Madabeno Villages (Aileu district)
Year of Introduction:	2008 -2015
Source of Information	The Study on Community-Based Integrated Sustainable Watershed Management in Lacro and Comoro River Basins

### Summary of Tending of Young Stands Techniques

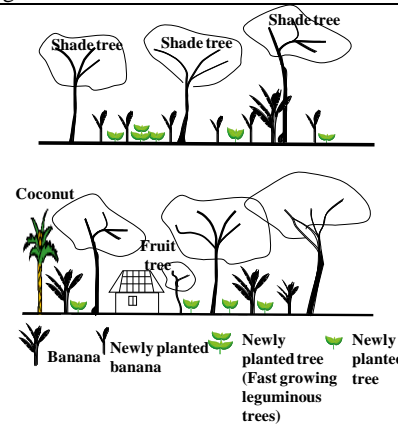
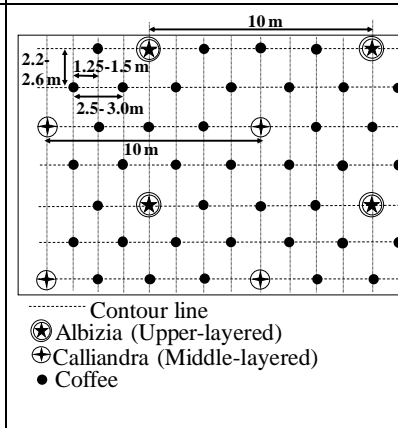
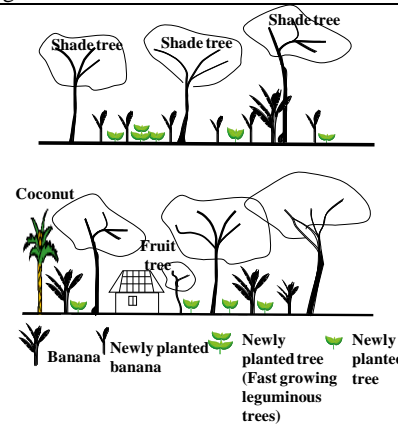
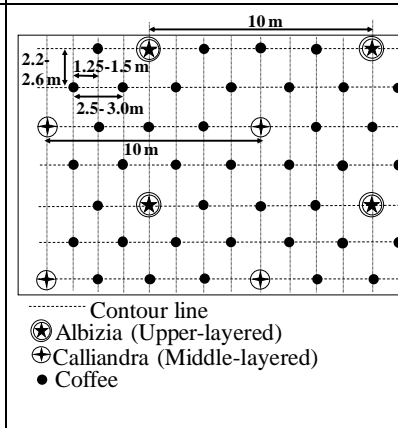
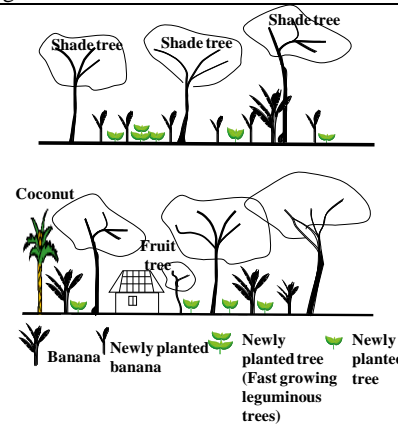
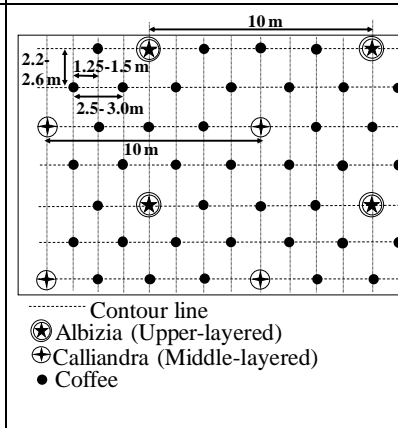
Items	Description
Objectives	The chief objective of the technique is to ensure a high survival rate of the young stands.
Major Activities	<ol style="list-style-type: none"> <li>Weed grasses around seedlings.</li> <li>Apply shades to seedlings if needed.</li> <li>Apply grass mulch at the bases of seedlings.</li> </ol>
Highlights of the activities	<p>To maintain seedlings/young stands in healthy condition and ensure good growth of trees, the following maintenance works shall be regularly carried out for the first three (3) years after planting seedlings.</p> <ol style="list-style-type: none"> <li><b>Weeding:</b> Weed grasses within 0.5 m radius from seedlings every two (2) months during the rainy season to eliminate weeds that compete with seedlings for water, light, nutrition.</li> <li><b>Mulching:</b> Cover the bases of seedlings with grasses weeded as a mulch to maintain moisture contents of soils and prevent the growth of weeds.</li> <li><b>Shading:</b> Apply a temporary shade made of local materials (e.g., coconut leaves) to seedlings that should preferably grow under shade (e.g., rambutan) in the initial growth stage especially during the dry season.</li> <li><b>Fixing:</b> Repair/fix the soil conservation measures applied to the plantation, such as contour bunds and canals.</li> </ol>
Expected outputs	<ol style="list-style-type: none"> <li>Local communities can properly maintain seedlings/young stands planted in plantation and keep seedlings grow well.</li> </ol>
Further references	<ol style="list-style-type: none"> <li>Final Report, The Study on Community-Based Integrated Watershed Management in Lacro and Comoro River Basins, March 2009, JICA.</li> <li>Brochura kona ba oinsa kuda ai mahoni tuir experiensi Halarae - Hau kuda ai mahoni bah au nia oan, 11-8-2009. (A brochure prepared by Halarae Foundation under the support of GIZ and EU)</li> <li>Trees and their management – Agroforestry Technology Information Kit-2, 1992, Department of Environment and Natural Resources, Government of Republic of Philippines</li> </ol>
Contacts for information	<ol style="list-style-type: none"> <li>Halarae Foundation</li> <li>JICA Project Office</li> </ol>



## Reference Sheet Reforestation – 5a

Name of the Technique:	<b>Standard Designs of i) Home Garden and ii) Coffee Plantation</b>
Place where the technique were introduced	Tohumeta and Madabeno Villages (Laurala sub-district, Aileu district) for timber and coffee production, respectively
Year of Introduction:	2008-2009 and 2009-2010 in Tohumeta and Madabeno, respectively
Source of Information	The Study on Community-Based Integrated Sustainable Watershed Management in Lacro and Comoro River Basins (Tohumeta) Field survey conducted in February 2012 (Madabeno)

### Summary of Standard Designs of i) Home Garden and ii) Coffee Plantation Techniques

Items	Description															
Objectives	The main objective of the technique is to develop i) fruit and industrial plant plantation and ii) coffee plantation according to the respective recommendable designs.															
Major Activities	a. Select areas suitable for i) fruit/industrial plant seedlings and ii) coffee seedlings. b. Prepare and develop the selected areas according to the designs.															
Highlights of the activities	<p>1. Select sites suitable for the respective plantations and prepare the same according to the following guidelines/standard designs:</p> <p>Basic conditions of the site by types of plantation</p> <table border="1"> <thead> <tr> <th>Purpose of plantation</th> <th>i. Fruit/industrial plant seedling</th> <th>ii. Coffee production</th> </tr> </thead> <tbody> <tr> <td>Suitable site</td> <td>Home garden or backyard farms with existing standing trees and/or perennial crops such as banana</td> <td>Fallow lands for shifting cultivation or farms close to existing coffee plantation</td> </tr> <tr> <td>Recommendable species</td> <td>- Fruit and industrial plants, such as, rambutan, longan, clove, cinnamon and jackfruits - High value timber species, namely sandalwood - Trees which prefer shady conditions in their initial growth - Leguminous trees as living fence and fodder trees</td> <td>- Coffee - Upper-layered shade trees: Albizia, Casuarina - Medium-layered shade tree: Calliandra</td> </tr> <tr> <td>Intervals between seedlings</td> <td>Random planting between existing trees and perennial crops with following intervals: - Trees: 4 m (e.g., clove)~7 m (e.g., Rambutan) - Perennial crops, e.g., banana: 1~2 m - Leguminous trees: 3~4 m</td> <td>- Coffee: 2.0-3.0 m x 2.0-3.0 m - Upper/Mid-layered shade tree: 10 m x 10 m</td> </tr> <tr> <td>Typical design/ Image of the plantation</td> <td>  </td> <td>  </td> </tr> </tbody> </table> <p>2. Plant seedlings following the procedures described in “Reference Sheet Reforestation-3 and 4” in this section.</p>	Purpose of plantation	i. Fruit/industrial plant seedling	ii. Coffee production	Suitable site	Home garden or backyard farms with existing standing trees and/or perennial crops such as banana	Fallow lands for shifting cultivation or farms close to existing coffee plantation	Recommendable species	- Fruit and industrial plants, such as, rambutan, longan, clove, cinnamon and jackfruits - High value timber species, namely sandalwood - Trees which prefer shady conditions in their initial growth - Leguminous trees as living fence and fodder trees	- Coffee - Upper-layered shade trees: Albizia, Casuarina - Medium-layered shade tree: Calliandra	Intervals between seedlings	Random planting between existing trees and perennial crops with following intervals: - Trees: 4 m (e.g., clove)~7 m (e.g., Rambutan) - Perennial crops, e.g., banana: 1~2 m - Leguminous trees: 3~4 m	- Coffee: 2.0-3.0 m x 2.0-3.0 m - Upper/Mid-layered shade tree: 10 m x 10 m	Typical design/ Image of the plantation		
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Recommendable species	- Fruit and industrial plants, such as, rambutan, longan, clove, cinnamon and jackfruits - High value timber species, namely sandalwood - Trees which prefer shady conditions in their initial growth - Leguminous trees as living fence and fodder trees	- Coffee - Upper-layered shade trees: Albizia, Casuarina - Medium-layered shade tree: Calliandra														
Intervals between seedlings	Random planting between existing trees and perennial crops with following intervals: - Trees: 4 m (e.g., clove)~7 m (e.g., Rambutan) - Perennial crops, e.g., banana: 1~2 m - Leguminous trees: 3~4 m	- Coffee: 2.0-3.0 m x 2.0-3.0 m - Upper/Mid-layered shade tree: 10 m x 10 m														
Typical design/ Image of the plantation																
Expected outputs	a. Local communities can develop plantations of i) fruits and industrial plants and ii) coffee according to the standard designs.															
Further references	1) Final Report, The Study on Community-Based Integrated Watershed Management in Lacro and Comoro River Basins, March 2009, JICA															
Contacts for information	1) Halarae Foundation 2) JICA Project Office															

### Reference Sheet Reforestation – 5b

Name of the Technique:	<b>Standard Designs of iii) Timber Plantation and iv) Regenerated Forest in Degraded Land</b>
Place where the technique were introduced	Samalete Village (Railaco sub-district, Aileu district)
Year of Introduction:	2008 – 2009
Source of Information	The Study on Community-Based Integrated Sustainable Watershed Management in Laclo and Comoro River Basins

### Summary of Standard Designs of iii) Timber Plantation and iv) Regenerated Forest in Degraded Land Techniques

Items	Description															
Objectives	The main objective of the technique is to develop i) timber plantation and ii) regenerated forest in degraded land according to the standard designs.															
Major Activities	a. Select areas suitable for i) timber plantation and ii) regeneration forest b. Prepare and develop the selected areas according to the designs.															
Highlights of the activities	<p>1. Select sites suitable for the respective plantations and prepare the same according to the following guidelines/standard designs:</p> <p>Basic conditions of the plantation site by purpose of the plantation</p> <table border="1"> <thead> <tr> <th>Purpose of plantation</th> <th>iii. Timber production</th> <th>iv. Regenerated forest in degraded land</th> </tr> </thead> <tbody> <tr> <td>Target site</td> <td>Areas for shifting cultivation, especially those with low fertility and/or not suitable for crop production</td> <td>Degraded forests Open area (wasteland/barren land) Grassland</td> </tr> <tr> <td>Recommendable species</td> <td>- Timber wood species, e.g., Teak, Mahogany and other suitable timber species</td> <td>- Fast growing leguminous species, e.g., calliandra, gamal and lamtro (L-19) - Drought tolerant species, e.g., casurina</td> </tr> <tr> <td>Intervals between seedlings</td> <td>- Timber: 3 m x 3 m</td> <td>- Leguminous species: 3 m x 6 m - Drought tolerant species: 3 m x 6 m</td> </tr> <tr> <td>Typical design/ Image of the plantation</td> <td> <p>Contour line delineated using "A-frame"</p> <p>★ Teak ✦ Mahogany</p> </td> <td> <p>Contour line delineated using "A-frame"</p> <p>★ Leguminous species ✦ Drought tolerant species</p> </td> </tr> </tbody> </table> <p>2. Plant seedlings following the procedures described in "Reference Sheet Reforestation-3 and 4" in this section.</p>	Purpose of plantation	iii. Timber production	iv. Regenerated forest in degraded land	Target site	Areas for shifting cultivation, especially those with low fertility and/or not suitable for crop production	Degraded forests Open area (wasteland/barren land) Grassland	Recommendable species	- Timber wood species, e.g., Teak, Mahogany and other suitable timber species	- Fast growing leguminous species, e.g., calliandra, gamal and lamtro (L-19) - Drought tolerant species, e.g., casurina	Intervals between seedlings	- Timber: 3 m x 3 m	- Leguminous species: 3 m x 6 m - Drought tolerant species: 3 m x 6 m	Typical design/ Image of the plantation	<p>Contour line delineated using "A-frame"</p> <p>★ Teak ✦ Mahogany</p>	<p>Contour line delineated using "A-frame"</p> <p>★ Leguminous species ✦ Drought tolerant species</p>
Purpose of plantation	iii. Timber production	iv. Regenerated forest in degraded land														
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Recommendable species	- Timber wood species, e.g., Teak, Mahogany and other suitable timber species	- Fast growing leguminous species, e.g., calliandra, gamal and lamtro (L-19) - Drought tolerant species, e.g., casurina														
Intervals between seedlings	- Timber: 3 m x 3 m	- Leguminous species: 3 m x 6 m - Drought tolerant species: 3 m x 6 m														
Typical design/ Image of the plantation	<p>Contour line delineated using "A-frame"</p> <p>★ Teak ✦ Mahogany</p>	<p>Contour line delineated using "A-frame"</p> <p>★ Leguminous species ✦ Drought tolerant species</p>														
Expected outputs	a. Local communities can develop i) timber plantation and ii) regenerated forest according to the standard designs.															
Further references	1) Final Report, The Study on Community-Based Integrated Watershed Management in Laclo and Comoro River Basins, March 2009, JICA															
Contacts for information	1) Halarae Foundation 2) JICA Project Office															

## 2.4 Agriculture and Livestock Management

### 2.4.1 Agriculture

Agriculture in Timor-Leste, especially in hilly and mountainous areas, is still primitive and highly vulnerable to climate changes; therefore, many communities practice shifting cultivation/rotation farming planting several upland crops in the same plot at the same time to minimize the risk of starvation. By current farming practices, communities can harvest some food crops even under unfavorable weather conditions, although the yields of crops are in general minimal. In other words, such a practice is effective in ensuring food security of communities in hilly and mountainous areas, but at the same time, the practice has kept their livelihood at the subsistent level.

This section introduces nine techniques and practices which can contribute to the stabilization and improvement of agricultural production by using materials and knowledge locally available, so that communities can improve their livelihoods while using the existing farms without any cash investment. The techniques and practices introduced in this section have been proven effective in enhancing the production of staple crops and vegetables in Timor-Leste as well as other Asian countries.




**Techniques/Practices introduced in this Section**

Technique	Outline	Applicability
1. Water saving cultivation method	Preservation of water is essential to the growth of crops, especially at the initial stage. The following techniques shall be introduced in vegetable farming: a) ridge making; b) solid ridge making, and c) application of green mulch.	Vegetable production
2. Application of basal fertilizer	Application of organic matters, such as compost and cow dung, helps improving soil fertility and moisture contents, which can facilitate the growth of crops in the initial stage. Production of compost and its application as basal fertilizer are the major techniques recommended.	Upland crops and Vegetable production
3. Application of additional fertilizer	Application of additional fertilizer on time is a crucial element necessary for enhancing crop yields. Production and application of liquid fertilizer are the major techniques introduced.	Upland crops and Vegetable production
4. Germination technique in cold season or in upland area	Healthy seed germination is critical to satisfactory vegetable production. Stable and moderate temperature is a key to healthy and good germination. A belly germination method is a simple but quite effective technique especially in hilly and mountainous areas.	Vegetable production
5. Nursery making	Likewise, preparation of healthy seedlings is essential to vegetable production. Techniques to prepare an optimum environment for producing healthy seedlings of vegetables are introduced.	Vegetable production
6. Vegetative propagation techniques	Asexual propagation techniques for vegetables and fruits production help saving the cost of seeds and maintaining the quality. Among other things, use of cutting is recommended as a technique suitable for production of planting materials of tomato, cabbage and some fruit trees.	Vegetable and fruit production
7. Crop rotation and mix planting	Repetitive cultivation of the same crop in the same plot causes diseases or makes crops vulnerable to insects. Crop rotation and/or mix planting are indispensable techniques to prevent crops from such damages.	Vegetable and upland crops production
8. Quality seed multiplication	Usage of quality seeds is essential to the increase of production. As the quality of improved seeds is easily deteriorated by planting with other local varieties, a technique to control its quality is introduced.	Upland crops (maize) production
9. Maize seed preservation	Post harvest loss is one of the major issues in rural areas in Timor-Leste. Reduction of seed loss during the storage of seeds contributes to the security of food and stabilization of production. Methods to store seeds using local resources are introduced.	Upland crops

## Reference Sheet Agriculture Management-1

Name of the Technique	<b>Water saving cultivation method</b>
Place where the technique is observed	Lita Village, Russlau Village and Hatoblico Village
Year of Introduction:	2005-2015
Source of Information	PARCIC, Grupo Rae Hato

### Summary of Water saving cultivation method Techniques




Items	Description
Objectives	The main objective of the technique is to preserve soil moisture through introduction of ridge making and green mulching. Such techniques are also effective in protection of soils from surface soil erosion by rains and winds.
Major Activities	<ol style="list-style-type: none"> <li>Make ridges to secure enough space for roots and/or plant Poaceae family on the sides of ridges to make ridges firm and prevent evaporation from surface soils.</li> <li>Apply green mulches in a farm to cover its surface so as to maintain soil temperature and prevent evaporation from the surface.</li> </ol>
Procedures	<p><b>A. Ridge Making and Solid Ridge Making</b></p> <ol style="list-style-type: none"> <li>Cultivate a farm mixing manure as basal fertilizer.</li> <li>Make and form ridges from north to south so that crops can be evenly exposed to sunlight sufficiently.</li> <li>Plant grasses on the sides of ridges to strengthen them and minimize evaporation from the surface soils. (Solid ridge making)</li> </ol>  <p style="text-align: center;"><b>Ridge making</b></p> <p><b>B. Green mulching</b></p> <ol style="list-style-type: none"> <li>Cultivate a farm mixing manure as basal fertilizer.</li> <li>Make ridges/solid ridges according to the procedures described above.</li> <li>Plant vegetables on ridges.</li> </ol>  <p style="text-align: center;"><b>Solid ridge making</b></p> <ol style="list-style-type: none"> <li>Plant cover crops, e.g., daretta, lehe, other fodder crops or medicinal plants) around the vegetables. (Lehe is suitable as a material of green manure.)</li> <li>Use cover crops as by-products.</li> </ol>  <p style="text-align: center;"><b>Ground cover with Daretta</b></p>
Expected outputs	<ol style="list-style-type: none"> <li>Local communities can improve the production of vegetables.</li> <li>Local communities can maintain soil fertility of vegetable farms using local resources (fodder grasses and medicinal plants).</li> </ol>
Contacts for information	PARCIC



## Reference Sheet Agriculture Management-2

Name of the Technique:	<b>Application of basal fertilizer</b>
Place where the technique is observed	Lita Village, Hatoblico Village and Russlau Village
Year of Introduction:	2005-2015
Source of Information	PARCIC, USC Canada Timor Leste/RAEBIA




### Summary of Application of basal fertilizer Techniques

Items	Description
Objectives	The main objective of the technique is to enable local communities to improve/amend soil fertilities, water holding capacity, and soil texture to improve the land productivity.
Major Activities	<ol style="list-style-type: none"> <li>Make compost using locally available materials, such as cow dung, crop residues, and grasses/leaves, to improve soil conditions.</li> <li>Maintain compost for four (4) to six (6) months.</li> <li>Apply compost as basal fertilizer before planting crops and vegetables.</li> </ol>
Procedures	<p><b>A. Production of compost</b></p> <ol style="list-style-type: none"> <li>Dig a pit for piling materials of compost.</li> <li>Collect materials/ingredients of compost, namely, animal dung, agricultural residues, leaves of weed without matured seeds, leaves of leguminous trees, stalks of maize or trunks of banana, black soil, water, ashes, and EM, if possible.</li> <li>Chop vegetative materials into small pieces.</li> <li>Pile up each layer of animal dung, vegetative materials, ashes and black soil, in order in the pit.</li> <li>Pour enough water or water mixed with EM while piling the materials.</li> <li>Stamp firmly on the surface after piling up each ingredient's layer.</li> <li>Repeat activities D to F until the pit is filled.</li> <li>Make a thatch to shade the pit.</li> <li>Stir the materials/ingredients and turn them upside down every three ~ four weeks when the temperature in the compost becomes cool to facilitate the fermentation process.</li> </ol> <p><b>B. Application of basal fertilizer</b></p> <ol style="list-style-type: none"> <li>Apply 2-3 kg of compost per m<sup>2</sup> at least one week before planting. The suitable amount of compost varies with the type of crops ideally.</li> <li>Mix compost with soils well.</li> <li>Apply compost in each planting hole and mix it well with soils for a vegetable farm.</li> </ol>
	 <p style="text-align: center;"><b>Dig a pit</b></p>
	 <p style="text-align: center;"><b>Stamp over the materials</b></p>
	 <p style="text-align: center;"><b>Apply for transplanting hole</b></p>
Expected outputs	<ol style="list-style-type: none"> <li>Local communities can produce quality compost using locally available resources.</li> <li>Local communities can apply compost properly.</li> <li>Local communities can increase the productivity of crops/vegetables.</li> </ol>
Further references	1) Final Report, The Study on Community-Based Integrated Watershed Management in Laclo and Comoro River Basins, March 2009, JICA
Contacts for information	USC Canada Timor Leste / RAEBIA Halarae Foundation, PARCIC

### Reference Sheet Agriculture Management-3

Name of the Technique:	<b>Production and Application of Liquid Fertilizer</b>
Place where the technique is observed	Lita, Hatoblico, Russlau, Faturasa, Fadabloco, Hautoho, Tohumeta, Madabeno and Talitu Village
Year of Introduction:	2005-2015
Source of Information	PARCIC, USC Canada Timor Leste/RAEBIA, Halarae



#### Summary of Production and Application of Liquid Fertilizer Techniques

Items	Description
Objectives	The main objective of the technique is to enable local communities to improve the productivity of crops and vegetables by application of additional fertilizer.
Major Activities	a. Make liquid fertilizer using materials locally available. b. Apply liquid fertilizer as additional fertilizer.
Procedures	<p><b>A. Production of liquid fertilizer</b></p> <ol style="list-style-type: none"> <li>1. Procure and provide one drum can as a container for making liquid fertilizer.</li> <li>2. Collect ingredients of fertilizer: 5-10kg of cow dung or other animal manure, 30-40kg of crop residues or leaves of grasses/trees, micro organism (black soil, tua mutin, tempe or EM), and 200 liter of water.</li> </ol>  <p style="text-align: center;"><b>Put cow dung into sack</b></p> <ol style="list-style-type: none"> <li>3. Put a net sack filled with cow dung into a drum can. If a net sack is not available, put cow dung into a drum can directly.</li> <li>4. Put crop residues and/or leaves of grasses/trees into a drum can.</li> </ol>  <p style="text-align: center;"><b>Cover on top</b></p>  <p style="text-align: center;"><b>Pour water</b></p> <ol style="list-style-type: none"> <li>5. Add micro organisms.</li> <li>6. Pour water until the drum can is filled;</li> <li>7. Cover the top of the can to protect it from insects.</li> <li>8. Stir the contents well for 10 minutes every day for 1~3 weeks to facilitate the fermentation.</li> </ol> <p><b>B. Application of liquid fertilizer</b></p> <ol style="list-style-type: none"> <li>1. Scoop up clear water in the surface.</li> <li>2. Dilute the scooped water (liquid fertilizer) with 20 times of water; and</li> <li>3. Apply the diluted liquid fertilizer to upland crop and vegetable on time.</li> </ol>
Expected outputs	a. Local communities will produce quality liquid fertilizer using local materials. b. Local communities can increase the productivity of crops and improve the quality of vegetables.
Further references	1) Final Report, The Study on Community-Based Integrated Watershed Management in Laolo and Comoro River Basins, March 2009, JICA
Contacts for information	USC Canada Timor Leste/RAEBIA Halarae Foundation, PARCIC

## Reference Sheet Agriculture Management-4

Name of the Technique:	<b>Germination technique</b>
Place where the technique is observed	Lita Village
Year of Introduction:	2008-2012
Source of Information	PARCIC

### Summary of Germination technique Techniques



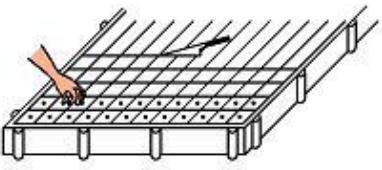

Items	Description
Objectives	The main objective of the technique is to enable local communities to ensure the germination of vegetable seeds.
Major Activities	<ol style="list-style-type: none"> <li>Provide or collect seeds and materials.</li> <li>Put vegetable seeds in a cloth and wrap the cloth in poly bag.</li> <li>Put the wrapped cloth onto belly.</li> <li>Sow germinated seed in pots or farms.</li> </ol>
Procedures	<p><b>A. Provision or collection of materials</b></p> <ol style="list-style-type: none"> <li>Procure and provide vegetable seeds.</li> <li>Provide or collect a cloth for a seedbed and a poly-bag for wrapping.</li> </ol> <p><b>B. Facilitation of germination of seeds</b></p> <ol style="list-style-type: none"> <li>Spread a cloth and put the seeds on it.</li> <li>Spray water on the seeds.</li> <li>Hold the cloth wrapping the seeds.</li> </ol> <div style="display: flex; justify-content: space-around;"> <div style="text-align: center;">  </div> <div style="text-align: center;">  </div> </div> <p style="text-align: center;"><b>Put the seed onto belly</b></p> <ol style="list-style-type: none"> <li>Put the cloth into a poly bag.</li> <li>Put the poly bag on human body,</li> </ol> <p style="text-align: center;"><b>Sow the germinated seed</b></p> <ol style="list-style-type: none"> <li>preferably at berry, for one to two day/s to incubate the seeds.</li> <li>Check every morning and afternoon until the seeds germinate.</li> </ol> <p>This technique is very effective in high elevation areas.</p> <p><b>C. Sowing</b></p> <ol style="list-style-type: none"> <li>If white tips sprout from seeds, sow them in nursery pots or farms.</li> </ol>
Expected outputs	<ol style="list-style-type: none"> <li>Local communities can ensure the germination of vegetable seeds even in cooler areas.</li> <li>Local communities can produce vegetables stably.</li> </ol>
Contacts for information	PARCIC



## Reference Sheet Agriculture Management-5

Name of the Technique:	<b>Nursery making</b>
Place where the technique is observed	Lita Village and Russlau Village, Lequitura Village
Year of Introduction:	2005-2012
Source of Information	PARCIC, USAID/DAI




### Summary of Nursery making Techniques

Items	Description
Objectives	The main objective of the techniques is to enable local communities to produce seedlings of vegetables by making nurseries.
Major Activities	a. Make nursery pots with kontus/banana leaves and sow seeds in the pots. b. Make clay blocks as a nursery bed and sow seeds in the bed.
Procedures	<p><b>A. Nursery pot making with contus/banana leaves</b></p> <ol style="list-style-type: none"> <li>1. Collect kontus or banana leaves and grass stems which can be used as sticks.</li> <li>2. Tear the leaves to the size suitable for nursery pot.</li> <li>3. Make pots rolling up the leaves and pinning them with sticks.</li> <li>4. Fill the pots with soils.</li> <li>5. Sow vegetable seeds in the pots.</li> <li>6. Remove the leaves when transplanting seedlings.</li> <li>7. Incorporate the removed leaves into soils so that they will decompose naturally.</li> </ol>  <p style="text-align: center;"><b>Roll up and pin contus leaf</b></p>  <p style="text-align: center;"><b>Remove the leaves</b></p> <p><b>B. Clay block making as a nursery</b></p> <ol style="list-style-type: none"> <li>1. Make a wooden frame.</li> <li>2. Mix clay soils with humus/compost at a rate of 4:6.</li> <li>3. Fill the mixed soils in the frame.</li> <li>4. Pour enough water and knead it.</li> <li>5. Level the surface of the soils with a trowel.</li> <li>6. After the water infiltrates, divide the soils into blocks with a knife.</li> <li>7. Make a hole in the center of each block and sow seeds in the holes.</li> <li>8. When the seedlings grow at the plantable size, cut out the block with a knife and transplant seedlings in a farm.</li> </ol>  <p style="text-align: center;"><b>How to make clay block</b></p>  <p style="text-align: center;"><b>Cut clay into block</b></p>
Expected outputs	a. Local communities can produce vegetable seedlings using materials locally available. b. Local communities can improve the quality of vegetables and increase the productivity of vegetables.
Further reference	USAID Timor Leste, Private Sector Development 2005-2010/DSF Fact sheet USAID <a href="http://timor-leste.usaid.gov/sites/default/files/DSPfactsheet.pdf">http://timor-leste.usaid.gov/sites/default/files/DSPfactsheet.pdf</a>
Contacts for information	PARCIC USAID DAC Project

## Reference Sheet Agriculture Management-6

Name of the Technique:	<b>Vegetative/Asexual Propagation Techniques</b>
Place where the technique is observed	Lita Village, Hatoblico Village
Year of Introduction:	2008-2015
Source of Information	PARCIC, Rae Hato

### Summary of Vegetative/Asexual Propagation Techniques Techniques

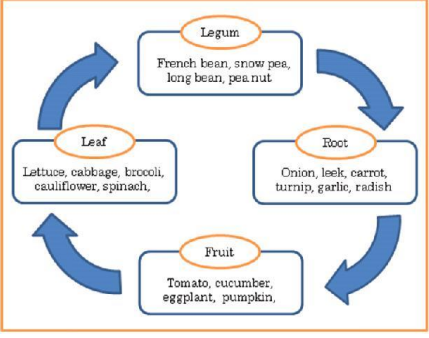


Items	Description
Objectives	The main objective of the technique is to enable local communities to use cuttings of tomato and cabbage for production of seedlings to save the cost for seeds and maintain the quality of vegetables.
Major Activities	a. Propagate seedlings of tomato and cabbage from cuttings
Procedures	<p><b>A. Propagation of tomato</b></p> <ol style="list-style-type: none"> <li>1. Pick 7-8cm long branches out of side buds manually.</li> <li>2. Dip the picked branches into water for 30 minutes to allow them to absorb enough water.</li> <li>3. Put sands/sub-soils in a seedling tray and fill soils up to about 10cm high.</li> <li>4. Cut the branches on a slant and plant them at an angle of 30-60 degree to the soils.</li> <li>5. Cover the branches with mulches (grasses or tree leaves) for 4-5days and gradually expose them for about 10 days so that the branches could develop their root systems in soils.</li> <li>6. Transplant the seedlings in a farm when they open the first flower.</li> </ol>  <p style="text-align: center;"><b>Stick cutting into soil</b></p>  <p style="text-align: center;"><b>Pick the buds up from cabbage</b></p>  <p style="text-align: center;"><b>Remove excess buds</b></p> <p><b>B. Propagation of cabbage</b></p> <ol style="list-style-type: none"> <li>1. Pick the side buds from cabbage and dip them into water for 30 minutes.</li> <li>2. Stick the buds into a nursery bed or farm.</li> <li>3. Cover the buds with mulches (grasses or tree leaves) to protect them from being exposed to direct sunlight for 10 days.</li> <li>4. Transplant them in the field.</li> <li>5. If there are many new buds, select one or two quality bud/s.</li> </ol>
Expected outputs	a. Local communities can produce quality seedlings of vegetables using cuttings. b. Local communities can keep producing quality vegetables.
Further references	-
Contacts for information	PARCIC (or Grupo Rae-Hato) JICA Project Team



## Reference Sheet Agriculture Management-7

Name of the Technique:	<b>Crop rotation and mix planting</b>
Place where the technique is observed	Tohumeta Village, Manelima Village
Year of Introduction:	2004- 2012
Source of Information	USC Canada Timor-Leste/RAEBIA




### Summary of Crop rotation and mix planting Techniques

Items	Description
Objectives	The main objective of the technique is to enable local communities to stabilize the production of vegetables by avoiding crop diseases and keeping soils healthy.
Major Activities	<ol style="list-style-type: none"> <li>Rotate crops in the same area to prevent the incidence of crop diseases or pest infestation caused by continuous cropping of vegetables/crops.</li> <li>Plant several crops in the same area to maintain the soil fertility and reduce the possibility of incidence of crop diseases.</li> </ol>
Procedures	<p><b>A. Crop rotation</b></p> <ol style="list-style-type: none"> <li>Design a cropping pattern to avoid mono cropping or cropping the same family in the same place and keep enough interval periods between the cropping of the same family to avoid continuous cropping.</li> <li>Major families that vegetables belong to are: <ul style="list-style-type: none"> <li><b>Solanaceae family:</b> Tomato, capsicum, eggplant, potato and chili</li> <li><b>Legume family:</b> All beans like French beans, snow pea, long beans, soybean, etc.</li> <li><b>Cucurbitaceae:</b> Pumpkin, cucumber, bitter gourd, bottle gourd, chayote, etc</li> </ul> </li> <li>Incorporate leguminous crops in the rotation to improve soil nutrient.</li> </ol> <div style="text-align: center;">  </div> <div style="display: flex; justify-content: space-around; margin-top: 10px;"> <div style="text-align: center;">  <p><b>Maize and peanut</b></p> </div> <div style="text-align: center;">  <p><b>Maize and contus</b></p> </div> </div> <p><b>B. Mix planting</b></p> <ol style="list-style-type: none"> <li>Plant leguminous crops with nutrition-absorbent crops (e.g.: maize with red beans or soybean) to improve soil fertility.</li> <li>Combine water absorbing crops with water saving crop (e.g.: maize with sesame/kontas) to maintain the soil moisture contents.</li> <li>Combine standing crops with ground cover crops (e.g.: maize with sweet potato) to minimize the potential of surface soil erosion and maintain the soil moisture content.</li> </ol>
Expected outputs	<ol style="list-style-type: none"> <li>Local communities can stabilize the vegetable production reducing the incidence of diseases and pest infestation.</li> <li>Local communities can maintain soil fertility of home gardens.</li> </ol>
Further references	1) Final Report, The Study on Community-Based Integrated Watershed Management in Laclo and Comoro River Basins, March 2009, JICA
Contacts for information	USC Canada Timor Leste/ RAEBIA

## Reference Sheet Agriculture Management-8

Name of the Technique:	<b>Quality seed multiplication</b>
Place where the technique is observed	Futurasa, Fadabloco and Hautoho Villages
Year of Introduction:	2005-2015
Source of Information	USC Canada Timor Leste/RAEBIA




### Summary of Quality seed multiplication Techniques

Items	Description
Objectives	The main objectives of the technique are to multiply and preserve quality seeds (maize).
Major Activities	<ol style="list-style-type: none"> <li>Organize a farmer's group.</li> <li>Develop a demonstration plot.</li> <li>Produce quality maize and preserve quality seeds from harvest.</li> </ol>
Procedures	<p><b>A. Organization of a farmers' group</b></p> <ol style="list-style-type: none"> <li>Identify and select farmers who are willing to participate in the seed multiplication activities.</li> <li>Develop by-laws of the group and a work plan of the activities in a participatory manner.</li> <li>Arrange a study tour for the group.</li> </ol> <p><b>B. Development of a demonstration plot</b></p> <ol style="list-style-type: none"> <li>Select a place for seed multiplication among permanent farms, which satisfy either of the following criteria: <ol style="list-style-type: none"> <li>a farm is separated from other farms at a distance of more than 200 m, or</li> <li>a farm is surrounded by forests and/or coffee plantations.</li> </ol> </li> <li>Apply soil conservation measures if the plot has steep slopes.</li> </ol> <p><b>C. Production of improved variety of crops</b></p> <ol style="list-style-type: none"> <li>Procure/provide seeds of improved varieties of maize.</li> <li>Plant improved seeds in the demonstration plot.</li> <li>Apply improved farming techniques, such as application of compost, and application of additional fertilizer on time.</li> <li>Harvest and dry cobs properly.</li> <li>Select big cobs and shell cobs only in the middle part of the selected cobs.</li> <li>Store cobs in an air tight container or an unglazed jar/bamboo with herbal insect repellent.</li> <li>Assist the group members in replicating the above-mentioned techniques in their own farms.</li> </ol>
	 <p style="text-align: center;"><b>Demonstration Plot</b></p>
	 <p style="text-align: center;"><b>Harvest center</b></p>
	 <p style="text-align: center;"><b>Harvest center</b></p>
Expected outputs	<ol style="list-style-type: none"> <li>Local communities can multiply seeds of improved varieties of maize.</li> <li>Local communities can increase maize production.</li> </ol>
Further references	<ol style="list-style-type: none"> <li>Final Report, The Study on Community-Based Integrated Watershed Management in Laclo and Comoro River Basins, March 2009, JICA</li> <li>Seed of Life</li> </ol>
Contacts for information	Seed of Life USC Canada Timor-Leste/ RAEBIA

## Reference Sheet Agriculture Management-9

Name of the Technique:	<b>Maize seed preservation</b>
Place where the technique is observed	Faturasa, Fadabloco, Hautoho, Talitu, Madabeno, and Tohumeta Villages
Year of Introduction:	2005-2015
Source of Information	USC Canada Timor-Leste/RAEBIA

### Summary of Maize seed preservation Techniques

Items	Description
Objectives	To reduce the damage/loss of maize in the post-harvest period.
Major Activities	<ol style="list-style-type: none"> <li>Dry seeds sufficiently.</li> <li>Store seeds in an airtight container or an/a unglazed jar or bamboo container applying natural insect repellent.</li> </ol>
Procedures	<p><b>A. Seed drying</b></p> <ol style="list-style-type: none"> <li>Dry corn until its moisture content is less than 14%. Corns should be dried as hard as there is no tooth mark on the seed, when being bit firmly.</li> </ol> <p><b>B. Storage of seeds in an airtight container.</b></p> <ol style="list-style-type: none"> <li>Put dried corn seeds in an airtight container, such as jerry can or drum can.</li> </ol> <p><b>C. Storage of seeds in unglazed jar or bamboo container</b></p> <ol style="list-style-type: none"> <li>Collect / prepare an/a unglazed jar or bamboo container.</li> <li>Store maize seeds with maize cob powder (ashes) in the container. <ul style="list-style-type: none"> <li>Burn dried maize cobs after shelling.</li> <li>Collect the ashes after burning.</li> <li>Fill the container with ashes and dried seeds at a rate of 2:8.</li> <li>Cap the container firmly and keep it in cool and dry place.</li> </ul> </li> </ol> <div style="display: flex; justify-content: space-around; align-items: center;"> <div style="text-align: center;">  <p><b>Maize cob</b></p> </div> <div style="text-align: center;">  <p><b>Ai ru</b></p> </div> <div style="text-align: center;">  <p><b>Lantana</b></p> </div> </div> <ol style="list-style-type: none"> <li>Store maize seeds with Ai Ru (<i>Eucalyptus europhylla</i>) dried leaves in the container. <ul style="list-style-type: none"> <li>Spread dried Ai Ru leaves into the container.</li> <li>Put dried maize seeds until the container is filled with the seeds.</li> <li>Put Ai Ru leaves fully covering the surface of the seeds.</li> <li>Cap the container firmly and keep it in cool and dry place.</li> <li>Repeat the above-mentioned process until seeds will be planted to prevent weevil.</li> <li>The appropriate amount of leaves is about 3% of the seeds.</li> </ul> </li> <li>Store maize seeds with Lantana leaves powder in the container. <ul style="list-style-type: none"> <li>Dry Lantana leaves fully and crash them until they become powder.</li> <li>Mix dried maize seeds with the powder.</li> <li>Cap the container firmly and keep it in cool and dry place.</li> <li>Repeat the above-mentioned process until seeds will be planted to prevent weevil.</li> <li>The appropriate amount of powder is about 5% of the seeds in weight.</li> </ul> </li> </ol>
Expected outputs	<ol style="list-style-type: none"> <li>Local communities can reduce the post harvest loss using materials locally available.</li> <li>Local communities can secure their food and seeds for next cropping.</li> </ol>
Further references	1) A Permaculture Guidebook from East Timor, Permatil, 2005
Contacts for information	Permatil Seed of Life

## **2.4.2 Livestock Management**

Livestock management is one of the crucial issues to be addressed in forest and natural resource management in Timor-Leste, especially in hilly and mountainous areas, as free animal grazing is commonly observed in the areas. Free grazing has often caused the forest/grassland degradation and crop damage in the farms. Proper management and control of livestock animals is therefore crucial to sustainable forest and natural resource management on the village level.

Considering the carrying capacity of the land and population pressure in the future, an intensive animal management is one of the directions that local communities can aim at. It is, however, not easy for communities in hilly and mountainous areas to change their practices in a short period of time, as almost all the communities live at subsistent level and also face a shortage of family laborers as well as animal fodder in their localities.

Hence, this section proposes the following three techniques which can help communities protect crops and natural resources from animals while changing their conventional animal raising practice to a semi-intensive one.

1. Introduction of live fence
2. Development of forage/feed bank
3. Introduction of semi intensive animal husbandry

In particular, the semi-intensive livestock management is expected to enable local communities to easily access and use animal manures for farming, which can improve land productivity of the farms and eventually contribute to the increase of production of crops.



## Reference Sheet Livestock Management-1

Name of the Technique:	<b>Introduction of Live Fence</b>
Place where the technique is observed	Russlau Village, Manelima Village, Maumeta Village
Year of Introduction:	2004-2015
Source of Information	USC Canada Timor Leste/RAEBIA

### Summary of Introduction of Live Fence Techniques

Items	Description
Objectives	The main objective of the technique is to enable local communities to protect farms and plantations from livestock animals by vegetative means.
Major Activities	<ol style="list-style-type: none"> <li>Select materials/resources that can be used for live fence.</li> <li>Produce planting materials of live fence.</li> <li>Plant saplings along the borders of an area to be protected from animals.</li> <li>Use live fence for other purposes.</li> </ol>
Procedures	<p><b>A. Selection of materials and design of fence.</b></p> <ol style="list-style-type: none"> <li>Select an area to be protected and identify the boundaries where live fences are required.</li> <li>Identify local resources that can be used for live fence and decide the materials. (Leguminous trees are recommendable from the viewpoint of its usefulness.)</li> <li>Determine the number of saplings required for the total length of fence.</li> <li>Design the fence including a protective measure for saplings in the initial years.</li> </ol> <p><b>B. Production of planting materials</b></p> <ol style="list-style-type: none"> <li>Develop a small nursery to produce saplings.</li> <li>Sow seeds or plant cuttings in the nursery.</li> <li>Maintain saplings until they become the size enough for planting.</li> <li>Collect materials as a measure to protect saplings</li> </ol> <p><b>C. Planting of sapling</b></p> <ol style="list-style-type: none"> <li>Plant saplings in the boundaries where live fences should be developed.</li> <li>Make a protective measure along the saplings</li> <li>Maintain saplings well. In case some saplings get withered or dead, replace them with new ones.</li> <li>Remove the protection measure when saplings grow enough.</li> </ol> <p><b>D. Utilization of live fence</b></p> <ol style="list-style-type: none"> <li>Use live fence materials for other purposes, such as: i) thread, rope and clothes by Sisal fiber, ii) animal feed and firewood by legume trees and grasses, iii) firewood by Ai Anin.</li> </ol>
Expected outputs	<ol style="list-style-type: none"> <li>Local communities can protect farms and plantations from animals using resources locally available.</li> </ol>
Further ref.	1) A permaculture Guidebook from East Timor, Permatil, 2005
Contacts for information	USC Canada Timor Leste / RAEBIA PERMATIL



**Sisal Live Fence**



**Gamal tree fence with replacements**









**Fence of Ai Anin with replacements**

## Reference Sheet Livestock Management-2

Name of the Technique:	<b>Development of Forage/Feed Bank</b>
Place where the technique is observed	Manelima Village
Year of Introduction:	2006-2015
Source of Information	USC Canada Timor Leste/RAEBIA

### Summary of Development of Forage/Feed Bank Techniques

Items	Description
Objectives	The main objective of the technique is to enable local communities to produce animal feed using resources locally available.
Major Activities	<ol style="list-style-type: none"> <li>Select a location for production of forage/fodder trees/crops as a forage/fodder banks.</li> <li>Procure/Collect seeds and produce seedlings of fodder crops/trees.</li> <li>Transplant seedlings in the fodder bank and any areas around farms or homes.</li> </ol>
Procedures	<p><b>A. Selection of plot for a fodder bank</b></p> <ol style="list-style-type: none"> <li>Decide the location and size of plot for a forage/fodder bank based on the number of animals that the bank should feed.</li> <li>Decide and select fodder crops that are palatable for cattle and available in the localities (e.g., Leucaena, Gamal, Sesbania, Calliandra, Moringa, King grasses, etc.).</li> </ol>  <p style="text-align: center;"><b>Legume (Gamal) and grasses</b></p> <div style="display: flex; justify-content: space-around; align-items: flex-end;"> <div style="text-align: center;">  <p><b>Calliandra</b></p> </div> <div style="text-align: center;">  <p><b>Leucaena</b></p> </div> <div style="text-align: center;">  <p><b>Sesbania</b></p> </div> <div style="text-align: center;">  <p><b>Moringa</b></p> </div> </div> <p><b>B. Production of seedlings</b></p> <ol style="list-style-type: none"> <li>Determine the quantity of seedlings needed.</li> <li>Collect seeds and cuttings necessary for production of seedlings.</li> <li>Sow seeds and/or plant cuttings or divided roots to produce seedlings.</li> <li>Maintain seedlings until they become large enough to plant.</li> </ol> <p><b>C. Transplanting of seedlings</b></p> <ol style="list-style-type: none"> <li>Transplant seedlings in the fodder bank and other areas around farms and/or houses. Leguminous trees are also good for live fence.</li> </ol>  <p style="text-align: center;"><b>Transplant divided roots of grasses</b></p>
Expected outputs	<ol style="list-style-type: none"> <li>Local communities can produce animal feed using resources locally available.</li> <li>Local communities can improve the nutrition conditions of livestock animals.</li> </ol>
Further references	1) Final Report, The Study on Community-Based Integrated Watershed Management in Lacle and Comoro River Basins, March 2009, JICA



### Reference Sheet Livestock Management-3

Name of the Technique	<b>Introduction of Semi-intensive Animal Husbandry</b>
Place where the technique is observed	Manelima Village
Year of Introduction	2006-2015
Source of Information	USC Canada Timor Leste/RAEBIA

#### Summary of Introduction of Semi-intensive Animal Husbandry Techniques

Items	Description
Objectives	The main objective of the technique is to enable local communities to rear cattle putting them in a pen/fenced plot in a semi-intensive manner.
Major Activities	<ol style="list-style-type: none"> <li>Establish a plot to produce fodder trees/crops (a feed bank) in a village.</li> <li>Construct a pen/fenced plot with watering place and a manure pit.</li> <li>Conduct training in using cattle for farming.</li> <li>Make compost from residue, feces and urine of cattle.</li> </ol>
Procedures	<p><b>A. Organization of a farmers' group</b></p> <ol style="list-style-type: none"> <li>Select about 10 farmers who are willing to work together and organize them into a group.</li> <li>Make by-laws of the group and a work plan of the group activities.</li> <li>Share the responsibilities for rearing and taking care of animals.</li> </ol> <p><b>B. Establishment of a fodder bank</b></p> <ol style="list-style-type: none"> <li>Procure and provide seeds of fodder crops and leguminous trees in one year advance.</li> <li>Develop a fodder bank near the members' houses or animal pens as described in Ref. Sheet Livestock Management-2 in this section.</li> </ol> <p><b>C. Construction of an animal pen/fenced plot</b></p> <ol style="list-style-type: none"> <li>Collect materials such as bamboo and dried wood for an animal pen.</li> <li>Clear the site for an animal pen.</li> <li>Build an animal pen (set up poles and tie beams/side bars with props).</li> <li>Put up a fence and thatch the roof.</li> <li>Make a watering place.</li> <li>Dig a manure pit near the pen and make a connecting canal from the pen to the pit to collect animal dung and urine at the pit.</li> </ol> <p><b>D. Training on use of cattle for farming</b></p> <ol style="list-style-type: none"> <li>Explain the use of cattle for farming, such as plowing. (If possible, take local communities to some villages which have already used animals for farming.)</li> <li>Procure and provide a tool (attachment) for plowing.</li> <li>Conduct training in plowing a farm using cattle.</li> </ol> <p><b>E. Production of compost</b></p> <ol style="list-style-type: none"> <li>Help the member make compost using animal dung and urine with crop residues.</li> </ol>
Expected outputs	<ol style="list-style-type: none"> <li>Local communities can rear cattle in a semi-intensive manner.</li> <li>Local communities can use cattle for tilling/plowing of a farm.</li> <li>Local communities can make compost using animal manure.</li> </ol>
Contacts for information	USC Canada Timor Leste/ RAEBIA



**Animal Pen**



**Train People and Cattle for Plow**

## **2.5 Sloping Agriculture and Agroforestry Techniques**

Sloping agriculture and agroforestry techniques are essential to sustainable use and management of hilly and mountainous areas for production purposes in Timor-Leste, where most of the national lands have more than 40% slopes. The techniques have been widely introduced and promoted all over the world, as they enable communities to manage sloping farmlands in a sustainable manner by integrating crop production with soil conservation and/or reforestation. In the context of CB-NRM, the techniques are requisite for converting areas currently used for shifting cultivation to more sustainable forms such as plantations, farms with soil conservation measures, and orchards.

In Timor-Leste, many organizations, namely MAF, donor-funded projects, and NGOs, have already introduced and demonstrated sloping agriculture and agroforestry models in the field to promote sustainable upland farming methods. In addition to those promoted by the government and non-government organizations, there are some traditional soil conservation measures that communities used to practice in the Portuguese era.

This section introduces not only the skills and techniques that have been introduced in the country after independence, but also those that had been traditionally practiced by local communities. Among other things, the following seven skills and techniques are judged as effective in sustainable land management and easy-to-apply by communities in Timor-Leste.

1. Delineation of contour lines (making and use of an A-frame)
2. Cover cropping/mulching/laying crop residues along contour lines
3. Contour composting/canalling
4. Bench terracing
5. Contour rock walls
6. Alley cropping/Natural vegetation strips
7. Multistory planting

Moreover, it is advisable to refer the following technical documents to learn about other sloping agriculture and agroforestry techniques, which can be applied to Timor-Leste.

- a. Sustainable Land Management Techniques, UNDP, 2010
- b. Forestry Technology Guideline Book (Forestry Technology Guideline Book), NDF/MAF (Supported by APR II), 2007
- c. A Permaculture Guidebook from East Timor, PERMATIL, 2005
- d. Agroforestry Information Kits, DENR, 1992

## Reference Sheet Sloping Agriculture and Agroforestry-1

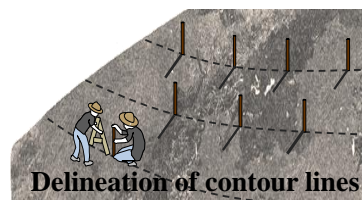
Name of the Technique:	<b>Delineation of contour lines (making and use of an A-frame)</b>
Place where the technique is observed	Batara Village (Laclubar), Umakaduak Village (Laclo), Faturasa, Fadabloco, and Hautoho Village (Remexio), Talitu, Madabeno, and Tohumeta Villages (Laulara)
Year of Introduction:	2008-2015
Source of Information	USC-CTL/RAEBIA

### Summary of Delineation of contour lines (making and use of an A-frame) Techniques

Items	Description
Objectives	The main aim of this technique is to delineate contour lines using a simple and practical instrument, which communities can easily make of locally available materials.
Major Activities	a. Make an A-frame. b. Delineate contour lines using an A-frame.
Procedures	<p><b>A. Making an A-frame</b></p> <ol style="list-style-type: none"> <li>1. Collect the following materials: i) two 2.1 meter-long wooden poles and one 1.2 meter-long wooden pole; ii) sturdy string for tying or nails; and iii) a rock/stone about the size of a fist or any similar heavy object.</li> <li>2. Tie or nail the two longer poles at one end. It is better to make notches on the posts of the contact so that the poles will not slip.</li> <li>3. Spread the legs and brace with the shorter pole to make a figure "A". Tie or nail the crossbar to the middle of the legs (longer poles).</li> <li>4. Tie one end of the string to the point where the two legs of the A-frame are joined.</li> <li>5. Tie the other end of the string to the rock or any object for weight. The rock should be heavy enough not to sway with a wind. The rock should be hang about 20 cm below the crossbar.</li> </ol> <p><b>B. Delineation of contour lines</b></p> <ol style="list-style-type: none"> <li>1. Start in the middle of the slope after cleaning the land. The contour lines will be first taken downwards to the bottom and then upwards to the top to minimize cumulative errors.</li> <li>2. Put the first stake at the edge of the field and position the left leg of the A-frame at the stake.</li> <li>3. Adjust the right leg so that the weighted string passes through the midpoint of the crossbar.</li> <li>4. Put another stake at the right leg of the A-frame to mark the point.</li> <li>5. Move the A-frame to the right by placing the left leg in the spot where the right leg previously was. Adjust the other leg again until the string passes through the midpoint of the cross bar. Again mark the point with a stake.</li> <li>6. Follow this procedure up to the other edge.</li> <li>7. Take another point downward in the slope, which is 1 m bellow in height, using a 1~1.5 meter-long stick or other measurable object. Take steps from 2 to 6 to take the contour line.</li> <li>8. Repeat steps from 2 to 7 until all the contour lines are taken in the plot.</li> </ol>
Expected outputs	a. Local communities can take the contour lines by themselves using local materials. b. Local communities can prepare their farms with soil conservation measures.
Further references	1) Livro Orientasaun Technico Floresta, NDCF, MAF, 2006 2) A Permaculture Guidebook from East Timor, PERMATIL, 2005
Contacts for information	USC Canada-Timore-Leste / RAEBIA NDF



Use of A-frame





Delineation of contour lines

## Reference Sheet Sloping Agriculture and Agroforestry-2

Name of the Technique:	<b>Relay planting, and cover cropping/mulching</b>
Place where the technique is observed	Faturasa, Fadabloco, and Hautoho Village (Remexio), Talitu, Madabeno, and Tohumeta Village (Laulara)
Year of Introduction:	2012 – 2015
Source of Information	USC-CTL/ RAEBIA

### Summary of Relay planting, and cover cropping/mulching Techniques

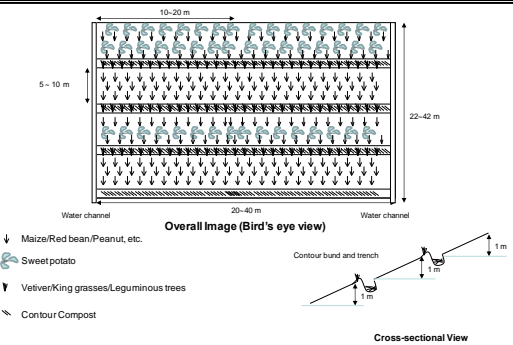
Items	Description
Objectives	The techniques aim to reduce surface soil erosion by applying simple farming management practices to a sloping farmland.
Major Activities	<ol style="list-style-type: none"> <li>Plant several types of crops which have different growing periods, different growth shapes, and crop heights in the same field.</li> <li>Cover a farm with a cover crop or crop residues as mulching during fallow periods.</li> </ol>
Procedures	<p><b>A. Relay cropping</b></p> <ol style="list-style-type: none"> <li>Plant several types of crops, such as maize (erect type crop), sweet potato/squash (creeping type crop), cow pea (climbing type crop), pigeon pea (biennial crop), taro, and cassava (biennial crop), to cover the surface of soils and keep a farm being covered with crops throughout a year.</li> <li>Relay cropping is a common practice found in upland areas in Timor-Leste. The technique has a dual purpose, protection of the farm from erosion and ensuring of food crops even under unfavorable climate conditions.</li> </ol>  <p><b>B. Cover cropping/Mulching</b></p> <ol style="list-style-type: none"> <li>Plant a cover crop, such as lehe, one (1) month before harvesting maize or put/spread crop residues or grasses/leaves after harvesting maize in a farm, especially a permanent farm, protect the surface soils from exposure to direct sunlight, wind, and occasional unseasonal rainfalls during a fallow season.</li> <li>Cover crops or mulching materials should be incorporated into the surface soils during land preparation as organic matters, so as to improve soil structure, fertility, and moisture holding capacity.</li> </ol> 
Expected outputs	<ol style="list-style-type: none"> <li>Local communities can reduce the adverse effect of surface soil erosion.</li> <li>Local communities can maintain soil fertility of a farm, especially a permanent farm.</li> </ol>
Further references	<ol style="list-style-type: none"> <li>Livro Orientasaun Technico Floresta, NDCF, MAF, 2006</li> <li>A Permaculture Guidebook from East Timor, PERMATIL, 2005</li> </ol>
Contacts for information	PERMATIL NDF/MAF



## Reference Sheet Sloping Agriculture and Agroforestry-3

Name of the Technique:	<b>Contour Composting/Canalling</b>
Place where the technique is observed	Batara Village (Laclubar), Faturasa, Fadabloco, and Hautoho (Remexio), Talitu, Madabeno, and Tohumeta Village (Laulara)
Year of Introduction:	2008-2015
Source of Information	The Study on Community-Based Integrated Sustainable Watershed Management in the Laclo and Comoro River Basins

### Summary of Contour Composting/Canalling Techniques

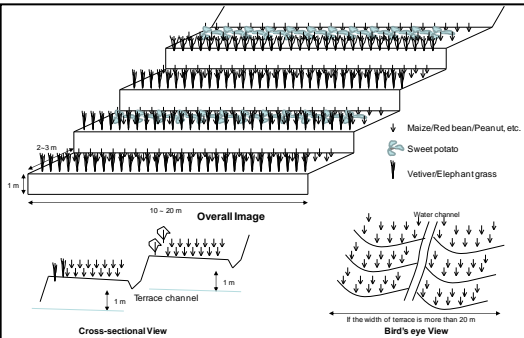
Items	Description
Objectives	The main objective of the technique is to maintain soil fertility of sloping farmland by applying a less-laborious soil conservation measure.
Major Activities	<ol style="list-style-type: none"> <li>Take contour lines using an A-frame.</li> <li>Make small canals with bunds along contour lines.</li> <li>Put crop residues/grasses/twigs in the canals.</li> <li>Make a/ diversion canal/s downwards to the bottom.</li> </ol>
Procedures	<div style="display: flex; justify-content: space-between;"> <div style="width: 45%;">  <p><b>Typical design of contour composting</b></p> </div> <div style="width: 45%;"> <ol style="list-style-type: none"> <li>Take contour lines following the procedures described in Reference Sheet Sloping Agriculture and Agroforestry-1 in this section.</li> <li>Dig a canal at least 50 cm wide and 30 cm deep following each contour line.</li> <li>Place the excavated soils from the canal on the downward edge of the canal.</li> </ol> </div> </div> <ol style="list-style-type: none"> <li>Make bunds on the downward edge of the canals using the excavated soils.</li> <li>Put crop residues/grasses/twigs in the canals.</li> <li>Dig a/ diversion canal/s on the edges of the farm to collect excess water from contour canals and drain them downwards to a nearby gully to prevent the farm from being eroded.</li> <li>Plant grasses and/or leguminous trees on the bunds.</li> <li>At the end of every cropping season, dig the canals again and return the accumulated soils with crop residues/grasses/twigs to the farm, so that a farm can recover and maintain soil fertility.</li> <li>Put crop residues/leaves/twigs in the canals when clearing the farm in land preparation.</li> </ol>
Expected outputs	<ol style="list-style-type: none"> <li>Local communities can minimize soil erosion and maintain soil fertility in sloping farmlands.</li> <li>Local communities can use their permanent farms in a sustainable manner maintaining soil fertility of the farms.</li> </ol>
Further references	<ol style="list-style-type: none"> <li>Final Report, The Study on Community-Based Integrated Watershed Management in Laclo and Comoro River Basins, March 2009, JICA1)</li> <li>Livro Orientasaun Technico Floresta, NDCF, MAF, 2006</li> <li>Agroforestry Technology Information Kit (ATIK), DENR, 1992</li> </ol>
Contacts for information	Halarae Foundation USC Canada-Timor-Leste / RAEBIA



## Reference Sheet Sloping Agriculture and Agroforestry-4

Name of the Technique:	<b>Bench Terracing</b>
Place where the technique is observed	Batara Village (Laclubar), Faturasa, Fadabloco, and Hautoho Village (Remexio), Talitu, Madabeno, and Tohumeta Village (Laulara)
Year of Introduction:	2008-2015
Source of Information	The Study on Community-Based Integrated Sustainable Watershed Management in the Lacro and Comoro River Basins

### Summary of Bench Terracing Techniques

Items	Description
Objectives	The main objective of the technique is ensure that communities can continuously use sloping farmland without reducing soil fertility by preventing soil erosion.
Major Activities	<ol style="list-style-type: none"> <li>Take contour lines using an A-frame.</li> <li>Develop bench terraces one (1) meter high.</li> </ol>
Procedures	<div style="display: flex; justify-content: space-between;"> <div style="width: 45%;">  <p style="text-align: center;"><b>Typical design of bench terracing</b></p> </div> <div style="width: 50%;"> <ol style="list-style-type: none"> <li>Take contour lines following the procedures described in Reference Sheet Sloping Agriculture and Agroforestry-1 in this section. The vertical distance between the lines should not be more than 1.0 meter.</li> <li>Remove surface soils between the two contour lines and put aside the removed surface soils.</li> <li>Cut the upper half of the slope between two contour lines.</li> </ol> </div> </div> <ol style="list-style-type: none"> <li>Place the excavated soils on the lower half of the same slope (Fill the slope with soils).</li> <li>Continue the processes of 2 to 4 until the area are leveled.</li> <li>Put the surface soils n the leveled terraces.</li> <li>Make the front of terraces (the riser) slant back toward the hillside with an angle between 15 and 45 degree depending on the type of soils and height of terrace.</li> <li>Dig a small canal at base of the terraces to protect the terrace from being eroded by excess water during the rainy season.</li> <li>Slope terraces slightly from the edge to the base (or from the valley side to the hill side) so as not to allow excessive rainfall water flow over the terraces.</li> <li>Build small bunds/mounds at the front of the terraces.</li> <li>Plant grasses on the riser and legume hedgerows on the small bunds at the edge of the terraces to reinforce the terraces</li> </ol>
Expected outputs	<ol style="list-style-type: none"> <li>Local communities can use sloping farmlands continuously maintaining soil fertility.</li> </ol>
Further references	<ol style="list-style-type: none"> <li>Final Report, The Study on Community-Based Integrated Watershed Management in Lacro and Comoro River Basins, March 2009, JICA</li> <li>Livro Orientasaun Technico Floresta, NDCF, MAF, 2006</li> <li>Agroforestry Technology Information Kit (ATIK), DENR, 1992</li> </ol>
Contacts for information	Halarae Foundation USC Canada-Timor-Leste / RAEBIA



**Measuring of height for bench terraces**



**Farm with bench terraces**

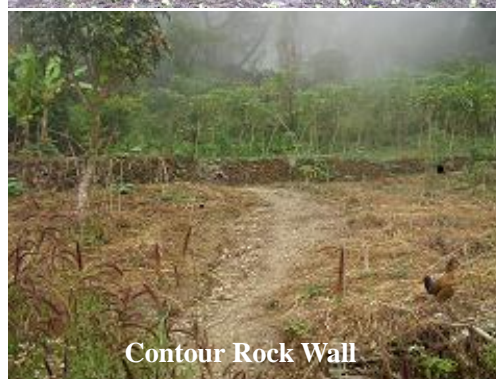
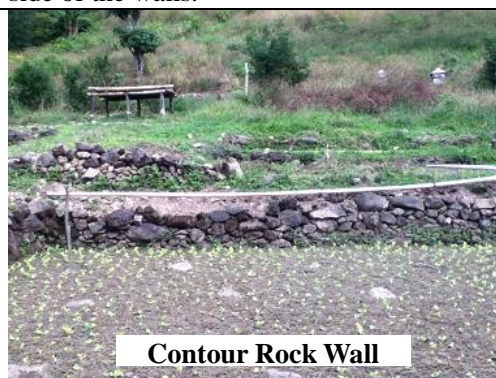


## Reference Sheet Sloping Agriculture and Agroforestry-5

Name of the Technique:	<b>Contour Rock Wall</b>
Place where the technique is observed	Madabeno Village and Talitu Village (Laurala)
Year of Introduction:	Unknown-2015
Source of Information	People in Madaebeno Village and Talitu Village

### Summary of Contour Rock Wall Techniques

Items	Description
Objectives	The main objective of the technique is to prevent soil erosion in sloping stony farmlands using gravel materials in the field.
Major Activities	<ol style="list-style-type: none"> <li>Take contour lines using an A-frame.</li> <li>Collect rocks and stones in the field.</li> <li>Put rocks and stones along contour lines to build rock walls.</li> <li>Plant leguminous trees along and below rock walls.</li> <li>Plant vetiver or king grasses on the upper side of the walls.</li> </ol>
Procedures	<ol style="list-style-type: none"> <li>Take contour lines following the procedures described in Reference Sheet Sloping Agriculture and Agroforestry-1 in this section. The horizontal distance between contour lines is preferably 3 to 5 meters, but the vertical distance between the same should be less than 1.5 m.</li> <li>Excavate 50-100 cm wide and 10-25 cm deep on contour lines as base for rock walls. The base should be inversely sloped to the base (i.e., the base should be sloped from the valley side to the hill side.).</li> <li>Construct a rock wall putting large rocks or stones as a base. Small stones should not be used as a base but used as materials to fill in spaces between large stones.</li> <li>Build one layer at a time and tamp the stones to make the layer firm before starting another layer of the wall. The size of the rock wall may vary with the slopes or availability of stones, but it should be 0.5~1 meter high, 0.5-1.0 meter wide at the base, and 0.5-0.7 meter wide at the top.</li> <li>Make other rock walls along contour lines repeating the activities from 2 to 4.</li> <li>Dig a drainage canal in the upper side of the farm to drain excessive rain water to a nearby gully.</li> <li>Plant leguminous trees or other fast-growing trees below the rock walls (about 10 cm from the walls and 15 to 30 cm apart in a row) to stabilize the rock walls.</li> <li>Plant vetiver/napier/king grasses or other fodder crops in the front of rock walls.</li> </ol>
Expected outputs	<ol style="list-style-type: none"> <li>Local communities can use sloping farmlands continuously maintaining soil fertility.</li> </ol>
Further references	<ol style="list-style-type: none"> <li>Livro Orientasaun Technico Floresta, NDCF, MAF, 2006</li> <li>Agroforestry Technology Information Kit (ATIK), DENR, 1992</li> </ol>
Contacts for information	Halarae Foundation

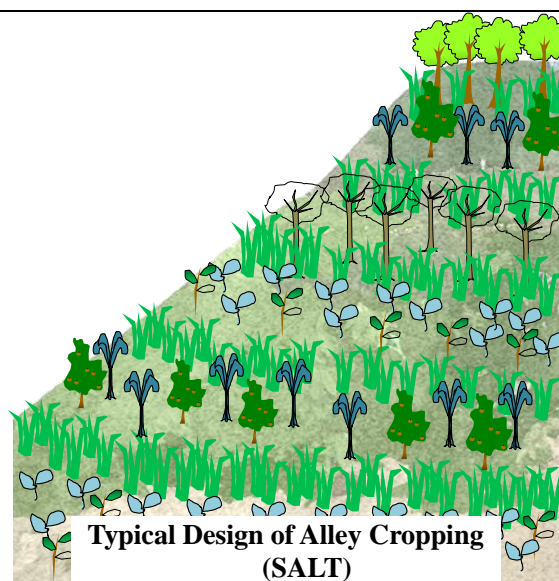


## Reference Sheet Sloping Agriculture and Agroforestry-6

Name of the Technique:	<b>Alley Cropping/SALT Techniques</b>
Place where the technique is observed	Madabeno Village and Talitu Village (Laurala)
Year of Introduction:	2011-2015
Source of Information	Halarae Foundation

### Summary of Alley Cropping/SALT Techniques Techniques

Items	Description
Objectives	The main objective of the technique is to maintain soil fertility of sloping farmland by preventing soil erosion and use the same land for production of multiple crops.
Major Activities	<ol style="list-style-type: none"> <li>Take contour lines using an A-frame.</li> <li>Develop vegetative strips made of leguminous trees or fodder crops, such as kinggrass.</li> <li>Plant perennial/permanent crops/trees and annual/short-term crops between the vegetative strips.</li> </ol>
Procedures	<ol style="list-style-type: none"> <li>Take contour lines using an A-frame following the procedures described in Reference Sheet Sloping Agriculture and Agroforestry-1 in this section. The horizontal distance between two contour lines is preferably 3 to 5 m, but the vertical distance between the same should be less than 1.5 m.</li> <li>Cultivate 1~2 m strips along the contour lines and plant seeds or seedlings of leguminous trees and/or fodder crops (e.g., vetiver/king grasses) on two lines in the cultivated strips. The distance between the lines should be 0.5~1.0 meter.</li> <li>Plant perennial crops (e.g., banana, fruit trees, coffee with shade trees, and other industrial trees) and short-term crops (e.g., maize, beans, sweet potato, cassava, and taro) in the areas between the strips of leguminous trees/grasses separately. The proportion of perennial crops and short-term crops should be one to three. Furthermore, short-term crops should be planted away from tall trees to protect crops from being shaded.</li> <li>Trim leguminous trees to keep their height at 40 cm from the ground one year after planting and keep them at the same size by trimming every 30 to 45 days.</li> <li>Spread and incorporate the cut leaves and twigs in/into the areas for perennial and short-term crops as organic fertilizer.</li> </ol>
Expected outputs	a. Local communities can use steep sloping farmland by minimizing the effect of soil erosion and maintaining soil fertility of the farmland.
Further references	<ol style="list-style-type: none"> <li>Livro Orientasaun Technico Floresta, NDCF, MAF, 2006</li> <li>Agroforestry Technology Information Kit (ATIK), DENR, 1992) Agroforestry Technology Information Kit (ATIK), DENR, 1992</li> </ol>
Contacts for information	CARE International Halarae Foundation



## Reference Sheet Sloping Agriculture and Agroforestry-7

Name of the Technique:	<b>Multistoried cropping</b>
Place where the technique is observed	Talitu Village (Laulara)
Year of Introduction:	1990s
Source of Information	People in Talitu

### Summary of Multistoried cropping Techniques

Items	Description
Objectives	This traditional technique aims to stabilize the farm production and maximize the potential of land productivity by diversifying crops, using space, light and land effectively, and preventing soil erosion.
Major Activities	<ol style="list-style-type: none"> <li>a. Determine the combination of trees and crops.</li> <li>b. Procure planting materials of trees and crops to be planted.</li> <li>c. Plant seeds/seedlings of trees and crops.</li> </ol>
Procedures	<ol style="list-style-type: none"> <li>1. Determine the combination of trees and crops suitable to the site conditions. The following combinations can be found in Timor-Leste.               <ul style="list-style-type: none"> <li>- Shade trees + Coffee + Clove + Pepper</li> <li>- Shade trees + Coffee + Pepper</li> <li>- Shade trees + Coffee + Ginger/Yam</li> <li>- Banana + Cassava + Maize + Yam</li> </ul>               In other asian countries, other combinations have revealed the successful results. Some can also be introduced in Timor-Leste, such as:               <ul style="list-style-type: none"> <li>- Fruit trees + upland crops (initial years)</li> <li>- Fruit trees + Pineapple + Ginger + Yam</li> <li>- Shade trees + Coffee + Pineapple + Ginger/Yam</li> </ul> </li> <li>2. Procure planting materials of trees and crops of the combination</li> <li>3. Plant seeds and seedlings of trees and crops in the rainy season together with maize, cassava, and beans, to use the farm at a maximum. In case of coffee-based combination, coffee seedlings should be planted in the second or third year when shade trees develop their canopies.</li> </ol>
Expected outputs	<ol style="list-style-type: none"> <li>a. Local communities can ensure farm products and earn income from their farms.</li> <li>a. Local communities can produce farm products in a sustainable manner.</li> </ol>
Further references	<ol style="list-style-type: none"> <li>1) A Permaculture Guidebook from East Timor, PERMATIL, 2005</li> <li>2) Agroforestry Technology Information Kit (ATIK), DENR, 1992</li> </ol>
Contacts for information	Permatil Halarae Foundation

## 2.6 Income Generation / Livelihood Development

Income generating / livelihood development technique is one of the crucial techniques for community-based natural resource management as it could directly contribute to the improvement of livelihoods of local communities that have significantly depended on forest and natural resources for their livelihood. The well-designed resource-based income generating/livelihood development can not only lessen the human pressure on forest and natural resources by providing alternative livelihoods to local communities, but also develop a mechanism to encourage local communities to protect and manage natural resources in a sustainable manner on their own initiative.

Utilization of the resources and knowledge available in the localities is one of the keys to the adaptable and sustainable livelihood development. It is also important to utilize the best practices and knowledge which have been proven effective in improving the livelihoods of local communities in hilly/mountainous areas in Timor-Leste.

Given the natural and social conditions of the target river basins, which were clarified by the precedent JICA watershed study<sup>1</sup>, and PRA conducted by the Project, and the experiences that national and international organizations have gained in Timor-Leste, the following eight livelihood development options are judged applicable to the target river basins and effective in improving local livelihoods within the framework of CB-NRM.

<b>IG/LD Options</b>	<b>Type of the Option</b>	<b>Outline of the option</b>
1. Honey purification	Utilization of natural resources	This is to produce quality and long-life honey by purifying and sterilizing honey collected in forests/coffee plantations.
2. Sweet potato chips	Ditto	This introduces a technique to produce a value-added processed product using sweet potato which is one of the crops commonly grown in hilly/mountainous areas.
3. Dried sweet potato	Ditto	Likewise, this aims to introduce a technique to produce long-life processed product (dried sweet potato) that local women can easily produce using sweet potato.
4. Herb tea making	Utilization of indigenous knowledge	People in coffee producing areas, especially in Maubisse District, used to drink a traditional tea made of avocado and coffee leaves. One NGO has modified such a technique and succeeded in producing herb teas for sale.
5. Salted vegetables	Ditto	Salted vegetable is the technique commonly practiced in the country to preserve vegetables. Some improvements are introduced in the section to make the storage life of the vegetable longer.
6. Tais making	Ditto	Tais, which is the traditional cloths of Timor-Leste, is one of the potential commodities that can be sold to the local and Dili markets.
7. Sewing	Others	Clothes making is one of the activities that local women in remote areas are eager to introduce as it can satisfy their instant needs and contribute to saving expenses.
8. Improved Cooking stove	Others	Improved cooking stove has been promoted by national and international organizations to reduce the consumption of firewood as well as the incidence of respiratory diseases caused by smoke.




<sup>1</sup> The Study for Integrated Community-Based Watershed Management in Lacro and Comoro River Basins, JICA, 2005-2009.



## Reference Sheet Livelihood Improvement -1

Name of the Technique:	<b>Honey Purification</b>
Place where the technique is observed	Hatucade Village
Year of Introduction:	2009-2015
Source of Information	PARCIC



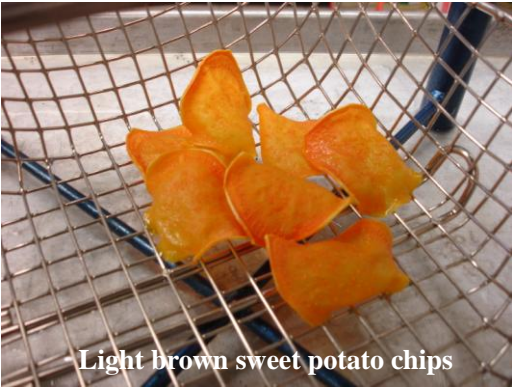
### Summary of Honey Purification Techniques

Items	Description
Objectives	The main objective of the technique is to enable local communities to produce quality-cum-long life honey processing raw honey collected/harvested in forests, so as to earn cash income from the processed honey.
Major Activities	<ol style="list-style-type: none"> <li>Wash and sterilize utensils and materials for bottling.</li> <li>Purify and sterilize raw honey collected.</li> <li>Bottle purified honey into bottles.</li> </ol>
Procedures	<p><u>A. Sanitation</u></p> <ol style="list-style-type: none"> <li>Wash hands well with soap to prevent bacteria's contamination.</li> <li>Put a clean apron and a cap on to prevent the mixture of foreign matters like hair, and strings, with honey.</li> </ol>  <p style="text-align: center;"><b>Sterilization of bottles and tools</b></p> <ol style="list-style-type: none"> <li>Wash bottles/containers, such as recycled bottles of beer, well with clean water.</li> <li>Steam the bottles and utensils for sterilization.</li> </ol> <p><u>B. Purification and sterilization of honey</u></p> <ol style="list-style-type: none"> <li>Filter raw honey collected with a flannel filter to remove foreign/impure matters from honey.</li> <li>Boil water in a large pot.</li> <li>Put honey into a small pot.</li> <li>Put the small pot with honey into the large pot, then heat the large pot to sterilize honey.</li> <li>Skim out the scum in the surface of honey in the small pot.</li> </ol> <p>Using double steaming technique can prevent destroying the taste of honey but stop fermentation of honey.</p> <p><u>B. Packing and labeling</u></p> <ol style="list-style-type: none"> <li>Pour sterilized honey into the bottles sterilized in the process described in A.4 above.</li> <li>Cap the bottles using sterilized caps and a capping tool.</li> <li>Label the bottles with the product information, such as name of item, ingredients, quantity, manufactured date, expiration date, and producer's name.</li> </ol>  <p style="text-align: center;"><b>Sterilization of honey in the hot water</b></p>  <p style="text-align: center;"><b>Bottling</b></p>
Expected outputs	<ol style="list-style-type: none"> <li>Local communities can produce quality and long-life honey which can be sold in markets.</li> <li>Local communities can earn cash income from natural resources collected in their localities.</li> </ol>
Contacts for information	PARCIC JICA Project Team

## Reference Sheet Livelihood Improvement -2

Name of the Technique:	<b>Sweet-potato Chips Making</b>
Place where the technique is observed	Russlau Village, Lita Village and Fadabloco Village
Year of Introduction:	2009-2015
Source of Information	PARCIC, USC Canada Timor-Leste/RAEBIA

### Summary of Sweet-potato Chips Making Techniques




Items	Description
Objectives	The main objective of the technique is to enable local communities to generate cash income by producing sweet potato chips using simple utensils.
Major Activities	<ol style="list-style-type: none"> <li>Slicing sweet potato.</li> <li>Frying and seasoning sliced potatoes.</li> <li>Packing potato chips and labeling the packages.</li> </ol>
Procedures	<p><b>A. Slicing sweet potato</b></p> <ol style="list-style-type: none"> <li>Remove soils from sweet potato by brushing them in water.</li> <li>Remove dirty parts from the potato.</li> <li>Peel the skin with a peeler.</li> <li>Slice sweet potato with a slicer. Keep the same thickness to maintain the quality. It would be difficult to control the quality, if sliced potato is not the same in thickness. The thicker sliced potato is, the longer the frying time should be.</li> </ol>  <p style="text-align: center;">Slicing sweet potato chips</p> <p><b>B. Frying</b></p> <ol style="list-style-type: none"> <li>Heat cooking oil in a big pan.</li> <li>Put sliced sweet potato into a pan. Please do not put many sliced potatoes at once. It reduces the oil temperature and affects the crispiness of chips.</li> <li>Fry well until the color turns light brown.</li> <li>Spread chips on the tray and season with salt, then cool them down.</li> </ol>  <p style="text-align: center;">Frying sweet potato chips</p> <p><b>C. Packing and labeling</b></p> <ol style="list-style-type: none"> <li>Weigh fried chips.</li> <li>Put them into poly-bags.</li> <li>Seal tops of bags with candle.</li> <li>Label the bags with product information, such as item name, ingredients, quantity, the date of manufacture, expiration date and producer's name. Chips should be packed before they absorb moisture. Fried chips are very fragile; therefore, they should be handled carefully.</li> </ol>  <p style="text-align: center;">Light brown sweet potato chips</p>
Expected outputs	<ol style="list-style-type: none"> <li>Local communities can produce value-added processed foods using locally available resources.</li> <li>Local communities can generate cash income from the processed food.</li> </ol>
Contacts for information	PARCIC USC Canada Timor-Leste / RAEBIA



### Reference Sheet Livelihood Improvement -3

Name of the Technique:	<b>Dried sweet potato making</b>
Place where the technique is observed	Madabeno Village, Fadabloco Village
Year of Introduction:	2009-2012
Source of Information	USC Canada Timor Leste/RAEBIA




#### Summary of Dried sweet potato making Techniques

Items	Description
Objectives	The main objective of the technique is to enable local communities to preserve sweet potatoes by processing them into a long-life forms.
Major Activities	<ol style="list-style-type: none"> <li>Wash sweet potatoes and remove dirty part.</li> <li>Steam and slice sweet potatoes.</li> <li>Dry sliced potatoes on a tray for two days (semi dried type) or one week (dried type).</li> <li>Pack dried potatoes into poly bags and label the bags in case of selling.</li> </ol>
Procedures	<p><b>A. Washing and cutting off dirty part</b></p> <ol style="list-style-type: none"> <li>Select round and smooth potatoes. It is essential to use quality sweet potato, as the quality affects the quality/taste of dried sweet potatoes.</li> <li>Wash sweet potatoes well in water to remove soils.</li> <li>Remove dirty parts from sweet potatoes.</li> </ol>  <p><b>B. Steaming and slicing</b></p> <ol style="list-style-type: none"> <li>Steam sweet potatoes in a steamer until they became soft.</li> <li>Peel sweet potatoes by hand when they are still hot.</li> <li>Slice them into 8-9mm thickness after they are cool.</li> </ol>  <p><b>C. Drying</b></p> <ol style="list-style-type: none"> <li>Spread sliced potatoes on a mesh tray.</li> <li>Dry them in the sun until they become leathery.</li> <li>Don't produce dried sweet potatoes in rainy season. Dried sweet potatoes would easily get rotten/moldy.</li> </ol>  <p><b>D. Packing and labeling for selling</b></p> <ol style="list-style-type: none"> <li>Select good ones in terms of shape, color and dried condition.</li> <li>Weigh dried sweet potatoes.</li> <li>Put them into poly-bags.</li> <li>Seal the tops of the bags with candle.</li> <li>Label the bags with product information.</li> </ol>
Expected outputs	<ol style="list-style-type: none"> <li>Local communities can process sweet potatoes into long-life products so that they can save sweet potatoes.</li> <li>Local communities can produce a processed product that could be sold in markets.</li> </ol>
Contacts for information	USC Canada Timor-Leste / RAEBIA

## Reference Sheet Livelihood Improvement -4

Name of the Technique:	<b>Herb Tea Making</b>
Place where the technique is observed	Ruslau, Lita, Fadabloco and Hautoho Village
Year of Introduction:	2009- 2015
Source of Information	PARCIC




### Summary of Herb Tea Making Techniques

Items	Description
Objectives	The main objective of the technique is to enable local communities to generate cash income by producing herb tea using leaves available in the localities.
Major Activities	<ol style="list-style-type: none"> <li>Collect, select, clean, cut leaves of grasses and/or trees.</li> <li>Dry leaves in the sun.</li> <li>Check the quality of the dried leaves, sort and pack them into poly bags with labels.</li> </ol>
Procedures	<p><b>A. Collection, sorting, cleaning and cutting</b></p> <ol style="list-style-type: none"> <li>Collect healthy leaves from trees and grasses which can be used for herb tea making, such as daleta, avocao, an lime.</li> <li>Sort and select good leaves by removing dirty, worm-eaten, diseased and oddly-shaped leaves.</li> <li>Clean leaves washing out dirty matters like soils, sands and worms.</li> <li>Cut leaves to keep them at the uniform size if necessary.</li> </ol>  <p style="text-align: center;"><b>Sorting and cutting</b></p> <p><b>B. Drying</b></p> <ol style="list-style-type: none"> <li>Spread leaves on a mesh net put in a tray.</li> <li>Cover the tray with a black cloth to protect leaves from being directly exposed to sunshine so as to avoid discoloring.</li> <li>Dry leaves in the sun for 1 week.</li> <li>Keep the tray under the roof during night and when it rains</li> </ol>  <p style="text-align: center;"><b>Dry under the sun with black cloth</b></p> <p><b>C. Quality check, packing and labeling</b></p> <ol style="list-style-type: none"> <li>Check the quality of dried leaves, in terms of color, size and dryness of the leaves,</li> <li>Remove disqualified leaves to meet the quality standard for sale.</li> <li>Weigh dried leaves and put them into small packages/poly-bags.</li> <li>Seal the tops of bags with candle.</li> <li>Label the bags with product information, such as item name, ingredients, quantity, manufactured date, etc.</li> </ol>  <p style="text-align: center;"><b>Standard quality</b></p>
Expected outputs	<ol style="list-style-type: none"> <li>Local communities can produce marketable herb tea using leaves locally available.</li> <li>Local communities can generate cash income from the processed herb tea.</li> </ol>
Contacts for information	PARCIC USC Canada Timor-Leste / RAEBIA

## Reference Sheet Livelihood Improvement -5

Name of the Technique:	<b>Salted Vegetable</b>
Place where the technique is observed	Manelima, Fadabloco and Hautoho Village
Year of Introduction:	2009-2014
Source of Information	USC Canada Timor Leste/RAEBIA

### Summary of Salted Vegetable Techniques




Items	Description
Objectives	The main objective of this technique is to enable local communities to preserve vegetables for a long period using a traditional technique and possibly to generate cash income from the products.
Major Activities	<ol style="list-style-type: none"> <li>Wash and dry vegetables.</li> <li>Salt and pickle vegetables.</li> <li>Pack them into poly bags and label the bags.</li> </ol>
Procedures	<p><b>A. Washing and drying</b></p> <ol style="list-style-type: none"> <li>Select fresh vegetables.</li> <li>Cut off their roots and dirty parts.</li> <li>Wash vegetables well with water to remove dirty matters and worms.</li> <li>Dry vegetables for one day to reduce the moisture contents in their leaves.</li> </ol>  <p style="text-align: center;"><b>Mixing rice fragments between vegetable leaves</b></p>  <p style="text-align: center;"><b>Drying for one day</b></p> <p><b>B. Salting and pickling</b></p> <ol style="list-style-type: none"> <li>Procure a container for pickling.</li> <li>Pour water in the container.</li> <li>Put salt into water and stir well to dissolve salt in water.</li> <li>Mix rice fragments with dried vegetables.</li> <li>Soak dried vegetables with rice fragments into the salted water for 2~3 months.</li> </ol>  <p style="text-align: center;"><b>Salted vegetables</b></p> <p><b>C. Packing and labeling for selling</b></p> <ol style="list-style-type: none"> <li>Pick the pickled vegetables from the salted water.</li> <li>Squeeze the vegetables, especially the leaves.</li> <li>Remove rice fragments, especially from the leaves.</li> <li>Weigh the vegetables.</li> <li>Pack the vegetables into packages and label the packages with the information of the product, such as item name, ingredients, quantity, date of manufactured, date of expiration, producer's name.</li> </ol>
Expected outputs	<ol style="list-style-type: none"> <li>Local community can produce a preserved food using traditional techniques and vegetables locally available.</li> <li>Local communities can preserve local products (vegetables) for a long period.</li> <li>Local communities might be able to generate income from the processed food.</li> </ol>
Contacts for information	USC Canada Timor-Leste / RAEBIA



## Reference Sheet Livelihood Improvement -6

Name of the Technique:	<b>Tais making</b>
Place where the technique is observed	Umakaduak Village, Batara Village, Manelima Village
Year of Introduction:	2008-2015
Source of Information	USC Canada Timor Leste/RAEBIA

### Summary of Tais making Techniques

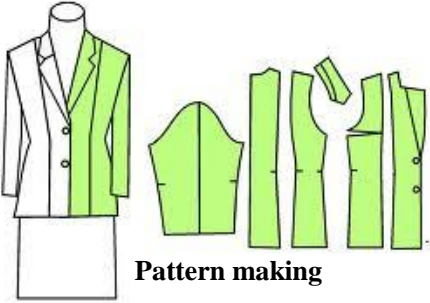




Items	Description
Objectives	The main objective of this technique is to enable local women to produce marketable traditional cloths improving their traditional techniques.
Major Activities	<ol style="list-style-type: none"> <li>Procure materials (threads).</li> <li>Tie and dye threads.</li> <li>Fix the colors of threads.</li> <li>Weave tais.</li> <li>Add finishing if needed.</li> </ol>
Procedures	<p><b>A. Procurement of materials</b></p> <ol style="list-style-type: none"> <li>Design a pattern of Tais (If there are any traditional motifs, apply them.)</li> <li>Procure and purchase threads and dyeing materials.</li> </ol> <p><b>B. Tying and dyeing</b></p> <ol style="list-style-type: none"> <li>Dye thread according to the motif.</li> <li>Use as many natural dyes available in the localities as possible.</li> <li>Tie threads and dye tied threads again.</li> <li>Repeat the activities described in B.3 according to the motif.</li> </ol>  <p style="text-align: center;"><b>Fixation of color</b></p> <p><b>C. Fixation of color</b></p> <ol style="list-style-type: none"> <li>Procure and provide sea water, which can help fixing the color of threads.</li> <li>Dip the threads into sea water.</li> <li>Dry the threads.</li> <li>Reel the threads for weaving.</li> </ol>  <p style="text-align: center;"><b>Reeling of thread</b></p> <p><b>D. Weaving</b></p> <ol style="list-style-type: none"> <li>Set the warp on a loom.</li> <li>Interlace the weft with the warp.</li> <li>Beat up the weft.</li> </ol>  <p style="text-align: center;"><b>Weaving</b></p> <p><b>E. Finishing</b></p> <ol style="list-style-type: none"> <li>Add finishing works, such as making fringes, if necessary.</li> </ol>
Expected outputs	<ol style="list-style-type: none"> <li>Local communities can improve their traditional techniques to quality products (tais).</li> <li>Local communities can generate cash income from their products.</li> </ol>
Further references	1) Progress Report (1), The Project for Community-Based Sustainable Natural Resource Management, November 2011, JICA
Contacts for information	USC Canada Timor-Leste / RAEBIA Alola Foundation



## Reference Sheet Livelihood Improvement -7

Name of the Technique:	<b>Sewing</b>
Place where the technique is observed	Manelima, Fadabloco and Hautoho Village
Year of Introduction:	2009- 2012
Source of Information	USC Canada Timor Leste/RAEBIA

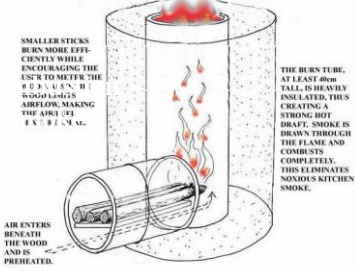
### Summary of Sewing Techniques

Items	Description
Objectives	The main objective of this technique is to enable local women to make clothes using a sewing machine, and eventually earn cash income from making or fixing of clothes.
Major Activities	<ol style="list-style-type: none"> <li>Make a pattern of clothes.</li> <li>Cut cloths.</li> <li>Have a fitting and sewing.</li> </ol>
Procedures	<p><b>A. Pattern making</b></p> <ol style="list-style-type: none"> <li>Make a pattern for clothes (e.g, dress or apron).</li> <li>Trace the pattern on the material with chalk.</li> </ol>  <p><b>Pattern making</b></p>  <p><b>Line drawing along with pattern</b></p> <p><b>B. Cutting</b></p> <ol style="list-style-type: none"> <li>Cut the materials according to the lines of the pattern.</li> </ol>  <p><b>Cutting</b></p> <p><b>C. Fitting</b></p> <ol style="list-style-type: none"> <li>Have a fitting of clothes to make it fit to the size of a client.</li> </ol>  <p><b>Fitting</b></p> <p><b>D. Sewing</b></p> <ol style="list-style-type: none"> <li>Sew the clothes to make a finished product.</li> </ol>  <p><b>Sewing</b></p>
Expected outputs	<ol style="list-style-type: none"> <li>Local communities are able to make clothes using a sewing machine.</li> <li>Local communities are able to generate income from making clothes.</li> </ol>
Contacts for information	USC Canada Timor-Leste / RAEBIA

## Reference Sheet Livelihood Improvement-8

Name of the Technique:	<b>Simple rocket stove</b>
Place where the technique is observed	Maubisse Village
Year of Introduction:	2012
Source of Information	PARCIC

### Summary of Simple rocket stove Techniques

Items	Description
Objectives	The main objectives of the technique are to reduce the consumption of fire wood and reduce
Major Activities	<ol style="list-style-type: none"> <li>Procure and provide materials of a stove.</li> <li>Cut and process the materials.</li> <li>Make a rocket stove and adjust its combustion.</li> </ol>
Procedures	<p><b>A. Provision of materials</b></p> <ol style="list-style-type: none"> <li>Procure and provide a kerosene oil can and a stainless steel plate which is to be used for a burn tube and air enter.</li> <li>Collect and provide ashes or parchment of coffee and sawdust for insulation.</li> <li>Collect stones or bricks and clay, which are to be used for basement of stove.</li> </ol> <p><b>B. Metal works</b></p> <ol style="list-style-type: none"> <li>Make a round hole on the bottom of the kerosene can.</li> <li>Make a tripod stand on the top of the kerosene can.</li> <li>Make a fire tube made of the stainless steel plate.</li> <li>Make an air enter made the steel plate.</li> <li>Fill ash in the space between the kerosene can and the fire tube as an insulation.</li> </ol> <p><b>C. Installation of rocket stove</b></p> <ol style="list-style-type: none"> <li>Set the rocket stove with the air enter on the base made of stones/bricks.</li> <li>Plaster clay at the attachments between rocket stove and stones.</li> <li>Dry the stove for 2 hours.</li> </ol> <p><small>Efficiency: While a wood cooking fire sends heat in all directions, the Rocket Stove concentrates heat into one direction for cooking. This allows the user to boil water or cook with less than half of the wood used by other methods.</small></p>  <p><b>Structure of rocket stove</b></p> <p><i>*The rocket stove is designed by Mr. Mamoru Kuwabara.</i></p>
Expected outputs	<ol style="list-style-type: none"> <li>Local communities can reduce the volume of fire wood used for cooking.</li> <li>Local communities can reduce the incidence of the respiratory disease caused by smoke.</li> </ol>
Contacts for information	PARCIC



## **2.7 Soil and Water Conservation**

Soil and water conservation (SWC) is a crucial technique for sustainable management of lands and forests, as gully erosion often causes severe damage to farms, coffee plantations, forests and other assets of communities in the hilly and mountainous areas in Timor-Leste.

In the context of CB-NRM, soil and water conservation should focus on the protection of existing farms and plantations by applying small-scale engineering/structural works, which can be copied by local communities in their own farms/areas using materials locally available.

This section introduces three relevant techniques on soil and water conservation. Their effectiveness was already proven and confirmed in the field in Timor-Leste.

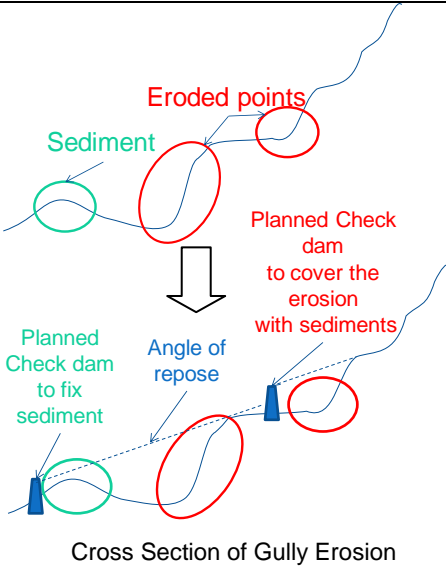
1. Field assessment of gully erosion
2. Brushwood check dam
3. Loose stone check dam

It is noted that the structural techniques introduced in this section need to be combined with vegetative measures (e.g., reforestation of fast-growing trees and strip-planting of grasses which can hold soils) to minimize the risk of surface and gully erosion in the areas.

## Reference Sheet Soil and Water Conservation - 1

Name of the Technique	<b>Field Assessment of Gully Erosion</b>
Place where the technique were introduced	Faturasa Village (Remexio Sub-district, Aileu District)
Year of Introduction:	2008
Source of Information	The Study on Community-Based Integrated Sustainable Watershed Management in Laclo and Comoro River Basins

### Summary of Field Assessment of Gully Erosion Techniques

Items	Description												
Objectives	The main objective of the technique is to identify appropriate locations to install check dams to prevent progress of gully erosion.												
Major Activities	a. Identify the appropriate locations for installation of check dams. b. Determine the adequate size of check dams.												
Highlights of the activities	<p>1. Measure the size of gully erosion (its height, width and length ). In case the height of the gully is more than 1.0 m, the site is not suitable for installation of a check dam built by communities considering the security of communities who engage in the building.</p> <p>2. Identify parts eroded and those where eroded soils deposit in the area.</p> <p>3. Calculate the repose angle (the angle of the stabilized slope) of the area, which should be the same as the surrounding uneroded areas have.</p> <p>4. Identify the locations of check dam, where the dams can i) fix the deposited sediments and/or ii) reduce erosion and fill the eroded part with sediments to stabilize the same.</p> <p>5. Determine the types of check dam according to the following guidelines.</p> <div style="text-align: right;">  <p>Cross Section of Gully Erosion</p> </div> <table border="1" style="margin-left: auto; margin-right: auto;"> <caption>Guidelines for the selection of the type of check dam</caption> <thead> <tr> <th>Type</th> <th>Applicable conditions</th> <th>Effectiveness in soil conservation</th> <th>Disadvantage</th> </tr> </thead> <tbody> <tr> <td>Brushwood check dam</td> <td>- At the small gully heads - At gully with enough depth of soil deposit inside</td> <td>Can hold relatively small particulars</td> <td>Temporary structures</td> </tr> <tr> <td>Loose stone check dam</td> <td>- At the site with relatively rigid foundation</td> <td>Can reduce the velocity of runoff and prevent the progress of gully</td> <td>Not suitable for controlling the small particles</td> </tr> </tbody> </table> <p>6. Determine the designs of the respective types of check dam as described in Reference Sheet Soil and Water Conservation-2 and 3.</p>	Type	Applicable conditions	Effectiveness in soil conservation	Disadvantage	Brushwood check dam	- At the small gully heads - At gully with enough depth of soil deposit inside	Can hold relatively small particulars	Temporary structures	Loose stone check dam	- At the site with relatively rigid foundation	Can reduce the velocity of runoff and prevent the progress of gully	Not suitable for controlling the small particles
Type	Applicable conditions	Effectiveness in soil conservation	Disadvantage										
Brushwood check dam	- At the small gully heads - At gully with enough depth of soil deposit inside	Can hold relatively small particulars	Temporary structures										
Loose stone check dam	- At the site with relatively rigid foundation	Can reduce the velocity of runoff and prevent the progress of gully	Not suitable for controlling the small particles										
Expected outputs	a. Local communities can select appropriate sites for building of check dams and determine the specifications of check dams.												
Further references	1) Final Report, The Study on Community-Based Integrated Watershed Management in Laclo and Comoro River Basins, March 2009, JICA												
Contacts for information	JICA Project Office USC Canada Timor-Leste / RAEBIA												



## Reference Sheet Soil and Water Conservation - 2

Name of the Technique	<b>Brushwood Check Dam</b>
Place where the technique were introduced	Faturasa Village (Remexio sub-district, Aileu district)
Year of Introduction:	2008
Source of Information	The Study on Community-Based Integrated Sustainable Watershed Management in Laclo and Comoro River Basins

### Summary of Brushwood Check Dam Techniques

Items	Description
Objectives	The main objective of the technique is to build and install brushwood check dams in a gully in an appropriate manner
Major Activities	<ol style="list-style-type: none"> <li>Collect materials for building of check dams.</li> <li>Compact the ground of the sites of check dams.</li> <li>Build check dams.</li> <li>Mound soils behind the dams (upper side of the dams) to support the structure.</li> </ol>
Highlights of the activities	<ol style="list-style-type: none"> <li>Collect and prepare materials for check dams, such as woods/poles for vertical posts, branches for horizontal supports, and bamboo splits or branches for waving.</li> <li>Compact the ground of the site where check dam is built.</li> <li>Take the vertical posts in the site burying at least 0.5 m of post in the ground.</li> <li>Weave the horizontal supports in the vertical posts and embed the edges of the supports into the gully banks at least 0.3 m long.</li> <li>Mound soils behind check dam (upward part of the dam) up to the height of the dam.</li> <li>Repeat items 2 to 5 to build brushwood check dams at the locations selected/identified by following the procedures described in Reference Sheet Soil and Water Conservation-1 in this section.</li> <li>Plant grasses/trees, such as king grass, gamal and leucaena, at the both sides of the dams (downward and upward sides) as well as the banks of gully to support the dams.</li> <li>Plant the same in the spaces between check dams, such as banks and bottom of gully, as long as the spaces have a sufficient effective depth of soil.</li> </ol>
	<p style="text-align: center;">Typical Design of Brushwood Check dam</p>
Expected outputs	<ol style="list-style-type: none"> <li>Local communities can properly build the brushwood check dams in a gully to prevent further progress of gully erosion.</li> </ol>
Further references	<ol style="list-style-type: none"> <li>Final Report, The Study on Community-Based Integrated Watershed Management in Laclo and Comoro River Basins, March 2009, JICA</li> <li>FAO watershed management field manual, 1986, FAO</li> </ol>
Contacts for information	JICA Project Office USC Canada Timor-Leste / RAEBIA

### Reference Sheet Soil and Water Conservation - 3

Name of the Technique	<b>Loose Stone Check Dam</b>
Place where the technique were introduced	Fadabloco Village (Remexio sub-district, Aileu district)
Year of Introduction:	2012
Source of Information	The Project on Community-Based Sustainable Natural Resource Management

#### Summary of Loose Stone Check Dam Techniques

Items	Description
Objectives	The main objective of the technique is to build and install loose stone check dams in a gully in an appropriate manner.
Major Activities	<ol style="list-style-type: none"> <li>Collect materials for building of check dams.</li> <li>Prepare the bases of check dams.</li> <li>Build the structure of check dam including an apron.</li> <li>Put or mound soils behind the dams (upper side of the dams) to support the structure.</li> </ol>
Highlights of the activities	<ol style="list-style-type: none"> <li>Collect local materials for building of check dams.</li> <li>Prepare a flat space 0.3 m deep and 0.8~1.0 m long (along the stream) for foundation of check dam in the site where check dam is built.</li> <li>Place stones to lay the foundation for a check dam in the flat space and pile stones at the height of 0.8 m from the gully bottom. The cross section shape of the dam should be concave as shown below.</li> <li>Make an apron made of stones or woods in the front of check-dam (the downward part of the dam) to ensure the stability of the dam and prevent the base from being washed out.</li> <li>Cover the foundation of the check dam and apron with soils and compact the surface.</li> <li>Fill the space behind the check dam with soils up to the height of check-dam.</li> <li>Repeat items 2 to 6 to build loose stone check dams at the locations selected/identified by following the procedures described in Reference Sheet Soil and Water Conservation-1 in this section.</li> <li>Plant grasses/trees, such as king grass, gamal and leucaena, at the both sides of the dams (downward and upward sides) as well as the banks of gully to support the dams.</li> <li>Plant the same in the spaces between check dams, such as banks and bottom of gully, as long as the spaces have a sufficient effective depth of soil.</li> </ol>
	<p>The diagrams illustrate the construction of a loose stone check dam. The <b>Front View</b> shows a cross-section of the dam with a concave shape. It features a 0.3m wide apron at the base, a 0.5m high stone wall, and a 0.3m deep foundation. Seedlings are planted on both sides of the dam. The <b>Side View</b> shows the dam's profile, including the apron, compacted soil, gravel, and the gully bed.</p>
Expected outputs	<ol style="list-style-type: none"> <li>Local communities can properly build the loose stone check dams in a gully to prevent further progress of gully erosion.</li> </ol>
Further references	<ol style="list-style-type: none"> <li>Annual Completion Report (2012/2013), The Project for Community-Based Sustainable Natural Resource Management in the Democratic Republic of Timor-Leste, March 2013, JICA</li> <li>FAO watershed management field manual, 1986, FAO</li> </ol>
Contacts for information	JICA Project Office USC Canada Timor-Leste / RAEBIA

## Chapter 3 Further References

The following references and sources of information could give more insights and clues to study and research the respective topics introduced by this document.

### 1. Community Participation

- Participatory Rural Appraisal for Community Forest Management-Tools and Techniques, Asia Forest Network, 2002  
<http://www.mekonginfo.org/assets/midocs/0001655-environment-participatory-rural-appraisal-for-community-forest-management-tools-and-techniques.pdf>
- Establishment and Maintenance of Farmers' Groups, Southeast Asian Network on Agricultural Extension (SEANAE), 2003  
<http://www.mekonginfo.org/assets/midocs/0001413-farming-establishment-and-maintenance-of-farmers-groups-fgs.pdf>
- Facilitating participatory natural resource management-A toolkit for Caribbean managers, Caribbean Natural Resource Institute, 2011  
[http://www.canari.org/documents/CANARIPNRMToolkitFinalJan2012\\_003.pdf](http://www.canari.org/documents/CANARIPNRMToolkitFinalJan2012_003.pdf)
- The Farmers' Participatory Evaluation (FPE) – A methodological guide to evaluate the effect and impact of technological development, PASOLAC and UNICAM, 2006  
<http://www.poverty-wellbeing.net/en/Home/Resources/document.php?itemID=10597&langID=1>

### 2. Participatory Land Use Planning

- Participatory Land Use Planning (PLUP) in Rural Cambodia-Manual for Government Staff and Development Partner, Ministry of Land Management, Urban Planning and Construction, 2001  
[http://www.iapad.org/publications/ppgis/PLUP\\_in\\_Rural\\_Cambodia.pdf](http://www.iapad.org/publications/ppgis/PLUP_in_Rural_Cambodia.pdf)

### 3. Forest Management and Reforestation

- Guide to Quality Seedlings in Smallholder Nurseries, V Australian Center for International Agricultural Research (ACIAR), 2010  
[http://www.rainforestation.ph/resources/pdf/howto/Gregorio\\_et\\_al\\_2010\\_Guide\\_to\\_Quality\\_Seedling\\_Production.PDF](http://www.rainforestation.ph/resources/pdf/howto/Gregorio_et_al_2010_Guide_to_Quality_Seedling_Production.PDF)
- Good Nursery Practices, World Agroforestry Center, 2008  
[http://teca.fao.org/sites/default/files/technology\\_files/Good%20Nursery%20Practices.pdf](http://teca.fao.org/sites/default/files/technology_files/Good%20Nursery%20Practices.pdf)
- Farmers' Tree Planting Manual – A Practical Guide from Seed to Tree, Department of Forestry and Wildlife, Ministry of Agriculture, Forestry and Fisheries, the Royal Government of Cambodia, DANIDA (Denmark's development cooperation), 2003  
[http://www.treeseedfa.org/tree\\_planting.htm](http://www.treeseedfa.org/tree_planting.htm)
- Grower's guide for sandalwood plantation in Vanuatu, ACIAR, 2012  
[http://aciar.gov.au/files/node/14881/mn151\\_vanuatu\\_sandalwood\\_growers\\_guide\\_for\\_san\\_46020.pdf](http://aciar.gov.au/files/node/14881/mn151_vanuatu_sandalwood_growers_guide_for_san_46020.pdf)

### 4. Agriculture and Livestock Management

- Composting in the tropics II, HDRA-the organic organization, 2001  
<http://www.infonet-biovision.org/res/res/files/497.Compost202.pdf>

- Fertilizer and their use – A pocket guide for extension officers, FAO, 2000  
<http://www.fertilizer.org/ifacontent/download/5483/86528/version/2/>
  - Saving Your Own Vegetables – A Guide for Farmers, The World Vegetable Center, 2005  
[http://203.64.245.61/web\\_docs/manuals/save-your-own-veg-seed.pdf](http://203.64.245.61/web_docs/manuals/save-your-own-veg-seed.pdf)
  - Semi intensive systems (animal husbandry), FAO  
<http://www.fao.org/docrep/S1250E/S1250E15.htm>
5. Sloping Agriculture and Agroforestry Techniques
- How to farm your hilly land without losing your soil – The Sloping Agricultural Land Technology (SALT) Farming System, Asian Rural Life Development Foundation International, 2004  
[http://c.ymcdn.com/sites/www.echocommunity.org/resource/collection/E66CDFDB-0A0D-4DDE-8AB1-74D9D8C3EDD4/SALT\\_1.pdf](http://c.ymcdn.com/sites/www.echocommunity.org/resource/collection/E66CDFDB-0A0D-4DDE-8AB1-74D9D8C3EDD4/SALT_1.pdf)
  - Sloping Agro-Livestock Technology (SALT-2) – Sustainable Agriculture Training Pac, Sommer Haven Ranch International, 1996  
[http://www.sommerhaven.org/prac\\_app/sus\\_ag/t\\_pac\\_salt2.pdf](http://www.sommerhaven.org/prac_app/sus_ag/t_pac_salt2.pdf)
  - Sustainable Agroforest Land Technology (SALT-3) – Sustainable Agriculture Training Pac, Sommer Haven Ranch International, 1996  
[http://www.sommerhaven.org/prac\\_app/sus\\_ag/t\\_pac\\_salt3.pdf](http://www.sommerhaven.org/prac_app/sus_ag/t_pac_salt3.pdf)
6. Income Generating and Livelihood Development
- How to build a simple rocket stove, Ar Livre  
<http://www.cato-projects.org/ArLivre/EN/RocketStove1.htm>
  - The National Bee Keeping Training and Extension Manual, The African Development Bank and Government of Uganda, 2012  
<http://www.agriculture.go.ug/userfiles/National%20Bee%20keeping%20training%20and%20extension%20manual%202.pdf>
  - Income Generating Activities Training Modules for Pre-service and In-service Training – Facilitator’s Manual, Peace Corps Center for Field Assistance and Applied Research, 2008  
[http://www.google.tl/url?sa=t&rct=j&q=&esrc=s&frm=1&source=web&cd=1&cad=rja&ved=0CCcQFjAA&url=http%3A%2F%2Fpctanzania.org%2Frepository%2FEnvironment%2FTech%2520Manual%2FIncome\\_Generation\\_Training\\_manual\\_081.doc&ei=2BhMUuXMJIreyQGizoGIDQ&usq=AfQjCNHSqZNVXmesmuRiVus-e-b--IYFIw](http://www.google.tl/url?sa=t&rct=j&q=&esrc=s&frm=1&source=web&cd=1&cad=rja&ved=0CCcQFjAA&url=http%3A%2F%2Fpctanzania.org%2Frepository%2FEnvironment%2FTech%2520Manual%2FIncome_Generation_Training_manual_081.doc&ei=2BhMUuXMJIreyQGizoGIDQ&usq=AfQjCNHSqZNVXmesmuRiVus-e-b--IYFIw)



