Chapter 10 Introduction of conservation and environment-friendly farming techniques

10.1 Objectives and procedural outline

The objective of introducing conservation and environment-friendly farming techniques is primarily to change the farmers' traditional methods of extensive agriculture and accomplish the goals of watershed conservation and improving inhabitants' quality of life. This process basically consists of the following elements:

Table 10-1 Significance of each element for conservation and farming

Elements	Significance
1. Selecting the appropriate techniques	● In order to improve soil and water conservation and at the same time increase farm productivity, it is very important to make a rational decision on how to use each plot and how to select the different techniques to be introduced in the respective plots. The reason is that plots have different vegetation cover and slopes even within the same farm. ● Based on the conservation and farming criteria, an orientation given on how to select the appropriate techniques that would promote environment-friendly farming.
2. Practicing the selected techniques in regular assistance	● In order to achieve an efficient extension of the conservation and environment-friendly farming techniques selected by farmers, the project personnel needs to demonstrate them techniques by practicing them on the farms when farmers are not familiar with the techniques. ● An explanation is made of the project's methods and procedures for giving technical assistance, including the management of invested material.
3. Providing special training as needed	● In order to help the farmers' assimilation of the techniques, to transfer techniques that are not available on the farms or to achieve a more effective transfer, training sessions can be offered to the farmers in addition to the regular technical assistance given on the group farmland. However, this is not obligatory. ● Establishing a demonstration farm and holding work exchanges between groups are also important alternative methods for achieving technical extension. ● Orientation is given on how to plan a series of training sessions and develop their curriculum based on a careful analysis of needs, effect and costs.

Regarding the management of the farming process and the practice of bookkeeping for the purpose of developing the group's economic sustainability, these issues are explained in Chapter 11.

10.2 Selecting the appropriate techniques

The conservation and environment-friendly production techniques can be classified in the following manner: (1) Basic preparation, (2) Soil and water conservation, (3) Improved productivity, (4) Tree planting [1] and (5) Others. This classification does not include common tasks such as clearing the farmland, tool maintenance and installing the basic infrastructure. It also does not include the techniques for growing specific crops or raising specific animals.

Table 10-2 gives a list of environment-friendly farming techniques and the order of importance, supposing a recently organized group with no previous experience in this area. Some techniques are results of grouping similar technical elements[2]. This Guideline does not give the details of each technique. Annex 2 can be referred to for a "List of available guidelines and manuals on conservation and environment-friendly farming techniques".

In general, the techniques are introduced in the following order: (1) basic preparation, (2) soil and water conservation, (3) improving productivity, (4) tree planting and (5) others. Most basic and important techniques for the conservation of watershed must be transferred to the farmers. However, the order of priority may be changed according to the situation of each farm, because some techniques are not applicable or are unnecessary in certain circumstances. Therefore, Table 10-2 also indicates the three levels of general importance, namely:

- High (applicable and necessary in most cases);
- Medium (recommended for the advanced stage);
- Optional (recommended for only certain circumstances).

[1] Refer to the Annex 7.2 for an explanation of the tree-planting techniques. It should be mentioned that in addition to having the ability to care for planted trees, the farmers will often require some type of an incentive mechanism to motivate them to actually care for the planted trees.

[2] For example, the "silvopastoral system in cattle farms" has a combination of different technical elements for overcoming this problem. A detailed explanation of this system can be found in other existing publications (see Annex 2). Cattle farms, especially the pastures used for extensive cattle farming, are considered to be a threat to watershed conservation due to their vast area, rapid expansion and consequent deforestation.

Table 10-2 Classification of techniques and their importance

Techniques	Importance
Basic preparation	
Preparation of soil (manual preparation; draft animal; use of cultivator)	High
Germination seedbed	High
Reproduction and conservation of seeds	High
Appropriate irrigation methods	High
Fence with live plants	High
Preparation of beds or furrows	Medium
Soil and water conservation	
Making and using the "A Level"	High
Planting on a level line (and three pins)	High
Contour planting	High
Erosion barriers (live barriers; inert barriers)	High
Alley cropping	High
Agroforestry and cultivation under tree shade	High
Terraces (individual terrace; narrow terrace; bench terrace; etc.)	Medium
Ditches / trenches / drainage canals for water seepage	Medium
Minimal tilling	Medium
Live or dead vegetation cover	Medium
Taungya system agroforestry	Optional
Gully restoration (vegetation wall, fill in with rocks, etc.)	Optional
Improved productivity	
Crop rotation	High
Associated crops	High
Intercalated crops	High
Making and applying organic fertilizer (bokashi; earthworm cultures; plant compost; etc.)	High
Incorporation of green fertilizer (mucuna; canavallia; mani forrajero (*arachis pintoi*); balo; etc.)	High
Making and applying natural insect repellents (extraction from preventive plants; etc.)	High
Improved fallow	High
Integrated pest management (control of insects, leaf-cutter ants, nematodes, weeds, fungi, etc.)	Medium
Greenhouse cultivation	Medium
Crop diversification (non-traditional and profitable crops; improved varieties)	Medium
Making and applying wood vinegar	Optional
Rice paddy cultivation	Optional
Managing fruit trees (pruning; grafting; etc.)	Optional
Small animal husbandry or Animal cage (iguana; rabbits; quail; fish; etc.)	Optional
Tree planting	
Establishing a nursery	High
Producing tree seedlings	High
Planting tree seedlings	High
Caring for the planted trees	High
Collecting seeds from trees	Optional
Others	
Silvopastoral system in cattle farms (using tree species inside and around the farm; protein bank; rotation of pastureland; making a drinking trough and saltlick; etc.)	High
Reducing canal grass (using mucuna; using guandu (*cajanus cajan*); planting trees; etc.)	Medium
Home gardens	Medium
Windbreak	Optional
Improving pasture and forage species on cattle farms	Optional

The soil and water conservation techniques that will be introduced in the different plots of a group farmland should be selected by using the same criteria (Table 10-3) that were applied to the "Farmland Use Plan", basically by taking into account the plot's slope and type of vegetation cover.

Table 10-3 Selecting the soil and water conservation techniques

Current land use		Recommended future use	Applicable Techniques Applicability: (+++) very high, (++) high, (+) average
Slope	Slope		
Gentle 0% - 15%	Forest	Forest	Preserve the existing forest
	Canal grass	Forest	Plant trees
		Crop production / Agroforestry	Reduce the Canal grass; Agroforestry cultivation under the shade of trees / Taungya
		Livestock	Silvopastoral system
	Production use (crop, livestock)	Crop production / Agroforestry	(+++) Level planting or planting along the contour line (++) Erosion barriers; Alley cropping (+) Terraces; Drainage ditches; Vegetation cover; Agroforestry cultivation under the shade of trees / Taungya system
		Livestock	Silvopastoral system
Medium 15% - 25%	Forest	Forest	Preserve the existing forest
	Canal grass	Forest	Plant trees
		Agroforestry	Reduce the Canal grass; Agroforestry cultivation under the shade of trees / Taungya
		Livestock	Silvopastoral system
	Production use (crop, livestock)	Agroforestry	(+++) Erosion barriers; Alley cropping; Vegetation cover (++) Level planting or planting along contour lines; Erosion barriers, Terraces; Drainage ditches; Agroforestry cultivation under the shade of trees / Taungya system
		Livestock	Silvopastoral system
Steep 25% - 40%	Forest	Forest	Preserve the existing forest
	Canal grass	Forest	Plant trees
		Agroforestry	Reduce the Canal grass; Agroforestry cultivation under the shade of trees / Taungya
	Production use (crop, livestock)	Agroforestry	(+++) Level planting or planting along the contour line (++) Erosion barriers; Alley cropping (+) Terraces; Drainage ditches; Vegetation cover; Agroforestry cultivation under the shade of trees / Taungya system
Very steep Over 40%	Forest	Forest	Preserve the existing forest
	Other	Forest	Plant trees

The selection of techniques from the other classifications such as "basic preparation" and "improved productivity" can be done under the guidance of the project's technical personnel in discussion with the group members. After selecting the techniques to be applied on the group farmland, you can program the work and technical assistance to be given on the plots of the group farmland.

10.3 Methodology

10.3.1 Establishment of group farmland

The first step in giving technical assistance is to establish a group farmland; this should be done before beginning the selection of the techniques to be introduced. The size of the farmland is decided in relation to the number of group members in order to avoid having an oversized area and a shortage of workers, which could lead to not fulfilling the planned activities and an incomplete assimilation of the techniques being taught.

The group farmland is the place for members to learn the appropriate techniques, and is also the base for group's farm production. Therefore, the farmland needs the basic infrastructure for applying a variety of farming techniques and also for the protection of crops. The infrastructure should include the following:

Table 10-4 Basic infrastructures for group farmland

Infrastructure	Function
Fences (barbed-wire fences, live-fences (hedges))	To mark the boundaries of the land and protect the crops.
Irrigation system (intake, water pipes, storage tanks, application apparatus, pumps if needed)	To have available water and insure continual farm production during the entire year.
Storage shed	To keep the group's farm tools and other material.
Meeting house	A neutral area for the group to meet, discuss and make decisions.
Kitchen (improved stove) & toilet	Convenience of members when activities require longer time.
Shed for fertilizer, Earthworm culture box	To make and store organic fertilizer and its components.
Nursery and seedbed area	To produce crops and tree seedlings.
Access path and bridge (optional)	To insure a safe access for people and transportation of material.
Sign (optional)	To show the group farmland and their activities to the public.

It is important to establish an agreement between the group and the landowner or land-user (in some cases this would mean the government) about the right to use the land, infrastructure, harvest and profits, which should

also include basic clauses about the time period, recovery from damages, method for changes, and resolution of conflicts (see Annex 9).

10.3.2 Practice of the techniques through regular assistance

Among the seven basic learning methods (see Table 8-2), the most effective method for practicing the selected techniques is the "regular activities on the group farmland". Organizing special training sessions, such as a workshop, educational tour, work exchange or a combination of these methods, can also beneficial. The methodology to use for the regular activities on the group farmland is explained below. See section 10.3.3 for other methods of giving technical assistance.

1) Determination of techniques to be introduced

During the establishment of group farmland, the group and the extension staff jointly analyze the conditions of the land in order to determine the techniques to be introduced, in parallel with the making of farmland use plan (see section 10.2 and Chapter 7).

2) Regular technical assistance on group farmland

The extension staffs of technical field visit the group farmland with regular frequency (basically, each week) to offer technical assistance in implementing the selected techniques and to deliver the requested inputs.

It is recommendable to teach all the techniques marked as "high importance" in Table 10-2 during the first year (one farming cycle, including a dry season and a rainy season). But to do this, one must calculate the labor needed, the group's learning capacity, the appropriate seasons for the different crops and the time it takes for certain techniques to show results so that they can be adjusted to each group's situation. From the second farming cycle, the techniques marked as "medium" or "optional" importance may be introduced, all the while strengthening group members' skills in the techniques taught during the first year.

Normally, one extension staff serves one group a day from Tuesday to Friday, making a maximum of 4 groups per week. Monday is generally dedicated to internal coordination meetings, making reports and acquiring supplies. It would be recommendable to practice rotating the extension workers among the groups in order to avoid the appearance of paternalism (or favoritism) toward certain groups or persons in particular

Regular technical assistance on group farmland is given by the following procedure:

- *1.* The extension worker visits the group farmland at the day and hour previously agreed upon with the group members and provides technical assistance. It is important that the technical personnel always visit the group farmland on the day and hour agreed upon in order to build a relationship of trust with the group.
- *2.* If the group lacks certain material or basic equipment for doing farm work (machetes, hoes, shovels, wheelbarrow, etc.), the project provides these to the groups at the beginning of the activities. In such case, it is important to clearly decide who will be responsible for the tools and where they will be kept before delivering them to the group. The group members should also be reminded that the tools do not belong to any one person in particular but to the entire group.
- *3.* The technical assistance can now begin by following the Annual Activity Plan, the Farmland Use Plan, and the priority for introducing the selected techniques. At the start of each day for technical assistance, the project's technical personnel should take the time to discuss with the group the significance and purpose of the activities that will be done that day.
- *4.* At the end of each technical assistance day, the group members together with the technical personnel decide on what inputs will be necessary for the next activity and they fill out the corresponding request form (see Figure 10-1). They also discuss and agree upon the date and hour for the next technical assistance.
- *5.* The extension worker should fill out and turn in to his/her superiors the "Extension Sheet" (see Annex) in order to inform them of the advances made and any problems encountered in the activities, and to monitor the group's progress.
- *6.* The material and tools needed for the next technical assistance day should be obtained in time.
- *7.* Return to step 3 and continue the technical assistance on group farmland.

2) Providing and managing the necessary inputs

To develop activities on the group farmland, the project will need to make a certain initial investment of material supplies to the group. Each project should decide on the materials that are eligible for project support, the budgetary limit, the methods for requesting, obtaining, and delivering the material to a group, the division of responsibility between the group and the project and the rules for managing the delivered material.

Eligible materials could be different according to the project's policy. In case of Alhajuela Project, the inputs that were provided to the groups were restricted to those that would be used together on the group farmland (basic tools, building materials, plant inputs, etc.) and did not include goods for personal use nor payment for daily labor.

Regarding the budgetary limit, a maximum amount per group should be established taking into consideration the average size of group farmland and prices of foreseen materials. The amount of investment must be

reduced every year in order to encourage the groups' self-management ability and sustainability. Table 10-5 shows the cases of PROCCAPA and Alhajuela Project (see Annex 9 for some basic costs for a group farmland).

Tabla 10-5 Ejemplo del presupuesto de inversión a cada grupo

Year	Limit (B/.)	Principal use
First year	2,500	Basic tools, Infrastructures of group farmland
Second year	2,000	Plant inputs, Materials for fertilizers and repellents
Third year	1,500	Materials for value addition and environmental business
Fourth year and thereafter	0 - 500	Nothing (or contingency budget)

The process of material supply begins with consensus building between the group and the project team on the necessary materials, especially those things which are difficult to acquire in the community, to carry out planned activities on group farmland. Afterwards, the "material request form" is filled out and signed by both sides. Once the project team gives approval, the requested materials can be procured. The group should sign on the same form when the extension worker delivers the material (see Figure 10-1).

Proyecto de Desarrollo Comunitario Participativo y Manejo Integrado de la subcuenca del Lago Alhajuela (ANAM- JICA)

Solicitud de Materiales (No.)

Nombre del Grupo: BOQUERON ARRIBA Fecha: 03 de JUNIO de 2010

No.	Materiales	Cantidad	Precio Unitario	Total	Lugar de uso de materiales solicitados	Firma de Solicitantes (Coordinadores de actividades)	Aprobación
1	CEMENTO	10 u	7.50	75.00			
2	Tubos de PVC 4"	5 u	16.00	80.00			
3	FREGADOR (2 TINAS)	1 u	38.00	38.00			
4	ARENA	½ Yda	11.00	11.00			
5	PEGAMENTO DE PVC (ch)	1 u	2.75	2.75			
6	Varilla ½"	4 u	9.50	38.00			
7							
Gran Total		B/ 244.75					

El grupo solicita los materiales mencionados. Firma de Presidente(a): José Santana.

Firma de Secretario(a): Yarineth Quintero

Firma del (la) extensionista encargado(a):

Comentarios: ESTO ES LA PETICIÓN DEL GRUPO PARA CONSTRUIR UN INVERNADERO FIJO el cual servirá para aumentar la producción en cualquier época del año dentro de la parcela el MISTERIO.

La solicitud ha sido aprobada.

Firma de contraparte: Firma de Experto:

Monto aprobado: $ 244.75 Balboas

Fecha de aprobación: 14 de 06 de 2010

Comentarios:

Recibo de Materiales (No.)

El grupo recibió conforme los materiales mencionados.

Firma de Presidente(a): José Santana.

Firma de Secretario(a): Yarineth Quintero

Fecha de recepción: 1 de Julio de 2010

Comentarios:

Figure 10-1 Example of a request of materials

The project should be responsible to maintain transparency and to keep an administrative record of the entire process of providing the material supplies to the groups. The maintenance and control of the delivered material, on the other hand, are the responsibility of the groups. It is important to keep an updated list of suppliers and unit prices. The extension worker should gradually transfer the work of purchasing supplies to the group members providing them with information about the suppliers and the procedure for making purchases.

Administrative record of the supplied materials by the project should be kept in a calculation sheet like EXCEL (see Table 10-6) to make it easier to maintain the account updated and manage the budget adequately.

Table 10-6 Example of administrative record of supplied materials

Date	Description	Quantity		Unit Price (B/.)	Total (B/.)
29/04/2010	block of 6"	140	units	0.60	84.00
29/04/2010	cement	12	sacks	7.50	90.00
29/04/2010	roof-top metal for meeting house	15	feets	1.25	18.75
29/04/2010	sand	1	yards	22.00	22.00
29/04/2010	gravel	2	yards	20.00	40.00
05/04/2010	nail of 4"	2	pounds	1.00	2.00
05/04/2010	wire for reinforcement	10	pounds	1.25	12.50
05/04/2010	seed of ginger	1	sacks	7.00	7.00
17/05/2010	seed of ñame paleta	1	sacks	9.50	9.50
02/06/2010	seed of cucumber	1	oz	3.30	3.30
02/06/2010	seed of corn	3	pounds	1.35	4.05

Reproduction and coservation of seeds

In order to guarantee the sustainability of group activities, the groups will also need to have a regular plan for obtaining the seeds for their next farming cycle. When giving technical assistance to the groups on how to produce and conserve crop seeds, it is also necessary to explain to them that the project will not continue providing them with seeds forever.

First option is to teach how to leave part of their crops in the group farmland to produce seeds for the next sowing. Second alternative is to sell the products and reinvest a part of income in buying the seeds. The project should avoid introducing hybrid varieties that are difficult to reproduce or crops whose seeds are expensive because this will become a hindrance to the sustainability of the group activities. In the Annual Activity Plan (see Chapter 12) the need for seeds should be determined in terms of crop, quantity, season and way of acquisition.

3) Control of materials by group

Each group should create an inventory of all the inputs it receives from the project. The group will be responsible for controlling the use, care and maintenance of the tools, infrastructure and other material according to its internal rules and the group's consensus. Furthermore, a mutual checking system should be set up whereby the group checks the quality and quantity of the material at the moment of its delivery, and the extension workers monitor to see that the material provided is being used adequately and has not be lost, sold or used for other unrelated purposes.

10.3.3 Practice of the techniques through special training

Besides the regular technical assistance given on the group farmland, it can be beneficial to also provide special training sessions such as workshops, educational tours, work exchanges or a combination of these methods. Although not obligatory, they are an appropriate method for teaching certain techniques that are not available or are difficult to implement on the group farmland. They are even more effective if the project has a demonstration farm.

1) Workshop, study tour, exchange

These activities are useful for teaching certain techniques requiring special conditions (i.e. to practice pruning you need fruit trees with a certain maturity; growing rice in paddies requires a stable water source and favorable terrain; terrace fields do not apply on level ground, etc.). When a group has difficulty learning such techniques on their group farmland, a workshop can be held or a tour taken to another place, or to another group farmland in the form of a work exchange.

In addition, these activities allow the groups to observe different applications of the same techniques in different places. As most variable techniques according to the situation, we can mention the following: appropriate irrigation method, erosion barrier, agroforestry and cultivation under tree shade, crop rotation, associated crops, integrated pest management, small animal husbandry, etc.

2) Intensive seminar

An intensive seminar lasts several days and offers a mixed training with lectures, workshops, tours and field practice. The participants can learn in a focused environment and can also exchange their experiences with other groups and farmers they may not have known.

The seminar's curriculum should be established in accordance with the farmers' needs and technical demands. Extension workers analyze the technical weakness of the groups, and if necessary, conduct a questionnaire survey to reveal what kind of technical demands exist among the farmers. Once the issues for the seminar are determined, the next step is to program the logistics based on a careful analysis of costs and effects.

Normally, a small number of representatives are invited from each group, and after they return to their community, they should transfer the knowledge they gained to the other members of their group. In order to make this transfer of knowledge more effective, the project can support them with guides and some material on the days for the regular technical assistance or in the monthly meeting (see Chapter 12).

It is generally recommendable to include a tour and some dynamic practices in the seminar to make maximum use of the facilities and the special environment. Also, the seminar may cover not only technical themes, but may also deal with issues relating to social development, environmental awareness and economic development.

3) Establishing a demonstration farm

It is very advantageous to have a demonstration farm near the project headquarters because it can be a permanent base for receiving visits from farmers and for demonstrating and practicing the different conservation and farming techniques. The technical personnel can grow different crops, both annual and perennial, on the demonstration farm and thereby eliminate any empty period during the farming year. This farm can also serve as a center for distributing fertilizer, insect repellents, seedlings and seeds, likewise as a storage site for machinery that is used in common.

10.3.4 Verifying the results

The results of introducing the environment-friendly techniques are verified in two ways: the farmers' mastery of the techniques and the accomplishment of the goals (conservation works, farm production, sales, reinvestment) according to the Farmland Use Plan and the Annual Activity Plan. In this section we focus on verifying the members' level of mastery of the techniques. See Chapter 12 for the monitoring and evaluation of the fulfillment of the plans.

1) Verification on the individual level

Every so often, preferably within every 6 months, the extension worker makes and updates a list of all the techniques that were introduced to the group up to that moment. This serves as an instrument for knowing which techniques the farmers have mastered or have not mastered. The extension worker carefully observes

each member during the regular assistance on the group farmland to make a note of those techniques that the member has mastered. This review is done in a constant manner so that the extension worker may modify the intensity and methodology of his/her assistance to the farmers according to the results.

It should be remembered that there are various levels of assimilating or mastering an introduced technique, as indicated below:

(1). The farmer has heard of the technique, or only has knowledge of the technique, but has never put it into practice.
(2). The farmer learns the technique with the help of the extension worker and wants to use it.
(3). The farmer practices the technique one time by himself.
(4). The farmer applies the technique repeatedly by herself (more than once).

On occasion, however, motivated farmers may not practice or continue the introduced techniques because they cannot obtain the necessary materials or labor force required for intensive works. In other cases, the farmers may think that they are applying the techniques correctly, but in reality there may be certain technical errors when the extension worker observes them. Therefore, the extension worker's observation must be as objective as possible in order to distinguish if the farmer has really "mastered" a certain technique or if he/she still needs more practice.

2) Verification on the group level

When considering a group's mastery of techniques, it is not necessary that all the members achieve mastery of all the techniques. Normally, if the majority of a group has mastered a technique, the rest of the members can learn it without much difficulty through internal technical transfer. Each project can establish the criteria (or percentage of members) for deciding if a group as a whole has reached the level of mastering a technique or not.

It is important to also distinguish between new techniques that are introduced by the project and those that existed in the group from before. As an option, the group members may do a self-evaluation of the group's level of technical mastery in the semiannual and annual workshops (see Chapter 12).

10.4 Inputs needed

Activity	Personnel	Time	Material and Cost
Selecting the appropriate techniques	1 extension worker of technical field for each group	1 to 3 months (during the establishment of group farmland)	• FUP as reference
Practice of the selected techniques (in case of regular assistance on group farmland)	1 extension worker of technical field for each group	(Project) 1 day per week, and more if necessary (Group) 1 day per week at least, and more depending on the necessity and intention.	• Budget for inputs according to the defined annual limit • Forms of record • Material request form • Extension sheet
Technical training (in case of intensive seminar)	2 to 3 project staffs, Lecturers, Facilitators	(Preparación) 1 semana (Implementación) 3 a 5 días	• Allowance for lecturers • Allowance and food for participants • Lodging for participants • Printed materials, Office utensils • Equipment for presentation