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**ECONOMIC DATA TAKING AND PRACTICAL
ANALYSIS IN AGROFORESTRY SYSTEMS***

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(Translated from Spanish by Michael Major, CATIE)

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1. INTRODUCTION

The study and evaluation of agroforestry systems generally has been focused on the analysis of bio-ecosystemic components. Although there have been advances in studies of characterizing agroforestry systems and distinguishing their advantages, disadvantages and potentials, these have emphasized the physical point of view. In these studies, the need and importance of utilizing the financial and economic analyses to evaluate existing agroforestry systems and the new alternatives, whether developed or not, is evident. Despite their importance, systematic economic analyses, that show the farmers and the institutions that promote the economic advantages and potentials that the agroforestry alternatives yield, are still not included in studies.

Financial and economic analyses of agroforestry alternatives have most probably been omitted due to the lack of quantitative data about costs, prices and revenue derived from the establishment, management and utilization of the alternatives. Its absence also results from the ignorance of simple and practical methodologies that can be used by technicians and professionals who are not economists.

The document presents a summary of the methodological process developed by the CATIE's Firewood Project to obtain data on costs and to economically analyze firewood plantations, which contain agroforestry systems.

2. THE PRODUCTION COST COMPONENT OF THE FIREWOOD PROJECT

Before implementing the Firewood Project, CATIE identified the lack of concrete data as a limiting factor. This data included information on establishment costs, labor requirements, sociocultural acceptability, comparison levels between distinct plantation systems, ecological environments of the firewood species, marketing aspects, prices and the use of firewood in the home and in small industry.

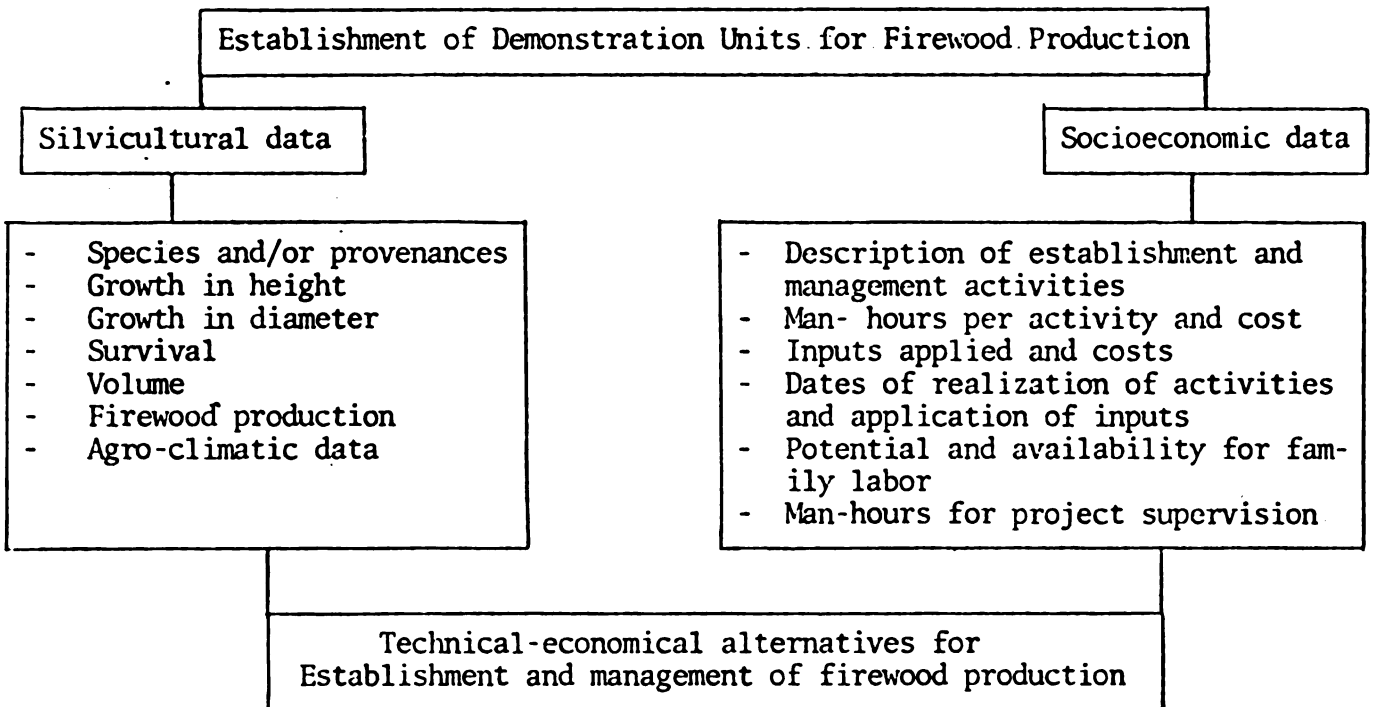
In response to this lack of economic data, CATIE's Firewood and Alternative Energy Source Project has developed a practical and simple methodology to obtain economic data of firewood production alternatives, among them agroforestry systems. The economic data forms a necessary and complementary part

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of silvicultural data that are obtained from experimental and demonstrative units in Central America. The form used to gather the data is simple, although capable of systematically registering all the activities, dates, labor and inputs applied for the establishment and management of these units.

The methodology now being used is being applied with success in the establishment and follow up activities of the firewood production units. The results give a technical description of each activity, the required input and labor and the costs involved in its development. Alternatives and technical recommendations can be designed and supported by this analysis and the silvicultural data.

The schematic relationship between the silvicultural and economic data is presented below:



2.1 Objectives of the costs activity of the Firewood Project

The costs activity attempts to achieve the following objectives:

- a. To carry out a systematic control of the activities and expenditures of the demonstration and experimental units
- b. To adequately record the work done in the unit in terms of dates and type of activity
- c. To establish simple and practical methodologies for the financial analysis of the firewood production units

- d. To develop a methodological application for the financial analysis of the firewood production units
- e. To identify the firewood production alternatives which have the best productivity and financial and economic return according to the agro-climatic characteristics
- f. To serve as basic input to evaluate acceptability, social and economic impact, cost/benefit analysis and as a base to prepare the technical recommendations of the species and firewood production units.

2.2 Requirements and Characteristics

The production costs component has the following general principles and requirements:

- a. The obtainment of costs data must form a necessary and complementary part of the agro-climatic and silvicultural data that are obtained from the demonstration and experimental units
- b. The costs system is simple, but capable of registering activities, dates, labor and input applied for the establishment and management of the firewood production units
- c. The simple outline of the costs system permits a use at different levels of responsibility, assuring that the results are produced rapidly and efficiently.
- d. The system is easy to manage and its use is consistent with the conditions of the small farm, the farmer and the technology generation methodology for planting trees for firewood and agroforestry systems
- e. The data can be incorporated into computers and processed for final interpretation
- f. The economic and financial steps are an aid to orient, adopt and make decisions

2.3 Area and scope of the costs activity

Firewood production cost units are located in Guatemala, Honduras, Nicaragua, Costa Rica and Panamá; areas which the firewood project has identified as critical. The demonstrative firewood production units that are economically analyzed are classified into five types:

- 1) Natural Vegetation Units
- 2) On-Farm Firewood Production Units
- 3) Community forest Units
- 4) Firewood Production for Small Industry Units
- 5) Agroforestry Units

3. FORMS FOR THE DAILY REGISTRATION OF LABOR AND INPUT AND THEIR APPLICATION

One procedure for obtaining costs data which is used particularly by commercial forestry companies is to obtain it from accounting systems, which in many cases is quite complicated. Nevertheless, the Firewood Project is focusing on developing alternatives for small production units and for cost effects that require simple and practical systems.

The project establishes demonstrative units for firewood production below the following modalities:

- a) Formal experiments conducted only with inputs and labor contracted by the project
- b) Demonstration units conducted with labor input of the owner and his family with advice, input, some wages, specially contracted labor and corresponding supervision provided by the project
- c) Community demonstrative units with labor from the community and advice and input supplied by the project.

A simple form has been designed to register the activities and the costs they generate.

3.1 Form CP-1

At the top of the CP-1 form, technicians should note the place and general characteristics of the unit. Below that are columns for dates, activity and input descriptions, number of family and contracted workers and their wages and the prices and costs of inputs.

The column with the day and month is used every time an activity (such as preparing the land, clearing, fertilizing, replanting, etc.) is carried out. The initial starting date and dates of all subsequent activities must be recorded.

In the column listing the description of activities and applied inputs, the technician must note what was done or applied on that day. Rather than writing the technical name of the activity, the technician should use the terms that the farmer would use to describe the activity. This will facilitate communication with the collaborating farmer.

To better organize the field data, it is necessary to separate the activity from the inputs that it requires. For example, the activity "fencing the unit" implies: labor and some materials or inputs such as posts, wire and staples. In the form, this would be recorded as follows:

12 August	Fencing of the unit 4 men-day/family	
12 August	Posts (2m x 6 m)	20 posts at \$ 0.10
12 August	Barbed wire fence (300 m)	2 rolls at \$10.00
12 August	Staples	2 at \$ 2.00

In the example, the first line contains the description of the fencing activity and the labor and daily men-day used.

It is essential that the CP-1 form states "man-day" in the corresponding column. Therefore it must be very clear that the daily man-day vary in number of hours according to the labor legislation, the climatic region and the country. In some localities, the activity may be measured in man/hours of work. In this case, the form must be adjusted to this change by writing family man/hours or and contracted man/hours. The term "contracted" implies that the collaborating farmer did not have a sufficient work force within the family and had to contract workers from outside sources. It is important to record this data separately in the corresponding box. All inputs must be noted by marking the date, name of the material, input or chemical product that is being applied, and the its description, make characteristics, quantity applied and price per unit (e.q. per ounce, kilogram, pound, etc.).

3.2 Applying the CP-1 Form

In order to assure successful in the process of economic data taking. It must be necessary to take into account:

- a) The technician or supervisor of activities must record the data each time that activities are performed
- b. In cases where the farmer and his family participate in the establishment and management of the firewood production demonstration units, the technician can ask the farmer to record the activities he performs and his inputs. In this case, the farmer must be given an explanation and some training. Although this procedure permits the farmer to get more involved, the technician must still periodically visit the unit to collect the data.

During the training or explanation, the technician must clarify to the farmer that the word "input" means materials (posts, staples, etc.) and chemical products (fertilizers, insecticides, herbicides, etc.). Caution must be taken to assure that this data is recorded every time an activity is performed in the unit.

The data obtained must be periodically collected. At times, the collaborating farmer may be illiterate. In this case a member of the family that can write must be trained to record the data. If this is not possible, the technician must visit the unit more frequently to record data and to observe the demonstration unit.

4. LEVELS OF ANALYSIS

The application of the procedure to obtain and analyze production costs requires four phases, each one with its own objectives and specific methodologies:

4.1 First Phase

This is the fundamental phase for the establishment of the production costs of the demonstration units.

Objective:

-To determine dates, description of activities and inputs, family labor, project-contributed labor and value of day's wages and inputs utilized during the establishment and maintenance of the firewood production units or agroforestry system.

Activities:

1. To prepare a sufficient number of CP-1 forms (Appendix 1)
2. To record data about each of the activities and inputs utilized in the demonstrative units. The supervisor or person in charge of the plantation's activities should be responsible for this.
3. In order to record activities not controlled by the supervisor, such as weeding, the technician must ask for the assistance of the farmer or the owner of the demonstration unit and train him to take data using the same form. Afterwards, when the technician visits the unit. He can request this information and transfer it to the master form.
4. In the office, the technician must establish a classification system utilizing a folder for each demonstration unit. The cost data sheet should be files in these folders.
5. The classified information forms the primary source about the progress of the project and the demonstration units.

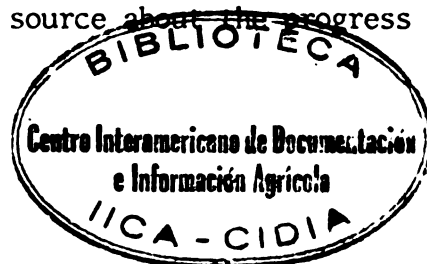
4.2 Second Phase

Objective:

The objective of this phase is to classify and standardize the activities and costs in terms that permit a coding and base for financial and economic analysis.

Activities

1. To prepare Form CP-2 (Appendix 2)
2. Review and classify firewood production demonstrative units
3. Transformation and simple calculations to standardize measurements such as hectares, meters, kilos, etc. and a technical classification of activities by month and year
4. Codification of activities and costs for computer use.



4.3 Third Phase

Objective:

To analyze by electronic calculator or computer the financial and economic feasibility of the firewood production demonstrative unit by region and by country. The yield of the crops and trees of the system and the appropriate discounting rate is required.

Activities:

1. Values of inputs and outputs have to be used over time in a cash flow analysis
2. Set an appropriate discount rate
3. Select a cash flow program in the computer and enter the data as specified in the format.
4. Calculate the investment performance measures, such as
 - a) internal rate of return (IRR)
 - b) net present worth (NPW)
 - c) Benefit/cost ratio
5. Examine the sensitivity of the agroforestry alternative in terms of changes in expenditures, prices, interest rates and other inputs
6. To drawn conclusions for choosing alternatives

4.4 Fourth Phase

Objective:

To prepare a technical and economic description of each feasible alternative.

Activities

1. To prepare a sufficient number of CP-3 forms (appendix)
2. To describe the activity, dates, required labor, materials, equipment and a summarize the activity cost
3. To prepare a technical description by forming a set with the technical and economic description of activities

5. ADDITIONAL FORMS FOR OBTAINING PRODUCTION COSTS

Additional forms were prepared, in order to assure better information on cost of tree production

5.1 Form CP-3 Description of activity and corresponding cost

It was designed for describing each activity, date, labor inputs, and materials required and a summary of the cost of the activity. The combination of these sheets forms a technological package to describe both technical methods utilized and its corresponding cost. For purposes such as programming, planting, planning, and cost assignment, the expenditure for labor and equipment per month is resumed at the bottom of each sheet.

5.2 Form CP-4 General description of the demonstration unit

To obtain a detailed description of the demonstration units for firewood production, a form was designed recently for such purposes (see annex for Spanish version).

5.3 Form CP-5 Determination of productivity and control of activities by sampling:

It is possible to measure the cost of any establishment activity for a demonstration unit or agroforestry plot at any time and under different climatic and topographic conditions. Application of this form is restricted to technicians and researchers.

6. SUMMARY

The development of a system to obtain, classify, and analyze the production cost for demonstration units of the Fuelwood Project forms part of its general objectives. It is simple, however, complete. The economical data together with the silvicultural information will serve as the basis for the analysis and the final design of fuelwood production alternatives for the major sectors of small producers that utilize this resource as principal energy source.

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DAILY RECORD OF LABOR AND INPUTS

Fuelwood Project DGF/CATIE

Sheet No. _____

Activity: Production Cost on Plantation

Owner _____
 Area (m²) _____
 Planting date _____
 Year _____
 Number of trees _____

Place _____
 Type of plot _____
 Code of plot _____
 Name of species and crops _____
 Spacing _____

DATE Month Day	Description of activities or used	Number of men/days		Cost of men/days	Inputs used		
		Family	Contracted by Owner Project		Quantity	Unit prices	Cost of Input

Comments _____
 Price or cost of man/day within the area _____ (use only for calculation of contracted and family man/day)
 Price or cost of man/day to the Project _____

DEPARTAMENTO RECURSOS NATURALES REMOVABLES-CATIE

PROYECTO LEÑA Y FUENTES ALTERNAS DE ENERGIA

Hoja _____

PAIS: _____

UNIDAD: _____

Especie	Actividad	Año:											
DESCRIPCION DE LA ACTIVIDAD													
FECHAS DE REALIZACION													
MANO DE OBRA REQUERIDA													
INSUMOS O MATERIALES REQUERIDOS													
EQUIPO REQUERIDO													
	E	F	M	A	M	J	J	A	S	O	N	D	TOTALES
Mano de obra													
Materiales													
Equipo													
Totales													

OTRAS RECOMENDACIONES/OBSERVACIONES:

Proyecto Leña y Fuentes Alternas de Energía
DGF - CATIE - ROCAP

DESCRIPCION DEL LOTE DE COSTOS

ANOTADOR: _____

- 1.0 Descripción del área - Temperatura promedio anual
- Precipitación promedio anual
- Suelos
- Pedregosidad
- Textura

1.1 Parcela número: _____

1.2 Provincia: _____

1.3 Cantón: _____

1.4 Distrito: _____

1.5 Dueño: _____

1.6 Area (m²): _____

1.7 Pendiente promedio (%): _____

1.8 Relieve: 1 2 3 4 5
plano inclinado ondulado quebrado escarpado

2.9 Elevación (msnm): _____

1.10 Nombre de la especie: _____

2.11 Objetivo: 1 2 3 4 5 6
combustible, postes, protección, aserrío, rompevientos, otros

2.0 Siembra y plantación: _____

2.1 Fecha de plantación: _____

2.2 Uso anterior del sitio: 1 2 3 4
potrero, agricultura, tocotal, charral

2.3 Tipo de unidad: 1 2 3 4 5
UPLF UPLF (ASOCIADO) UAF UPLI UPLI (ASOCIADO)

2.4 Preparación del sitio: 1 2 3 4 5 6
chapia rodajes quema arado rastra otros _____

2.5 Tipo de planta: 1 2 3 4 6
bolsa pseudoestaca directo raíz desnuda otros

2.6 Espaciamiento inicial (dm): _____

2.7 Total de árboles plantados: _____

2.8a Distancia del lugar de descarga de los árboles al sitio de plantación (m): _____

2.8b Relieve: 1 2 3 4 5
 plano inclinado ondulado quebrado escarpado

2.8c Forma de acarreo: 1 2 3 4
 manual animal mecánico otros

Observaciones: _____

?

Form CL (Para uso del Técnico del Proyecto Leña

FORMULARIO PARA CALCULO Y CONTROL DE ACTIVIDADES POR MUESTRA

Proyecto Leña DGF -CATIE

- 1. Fecha: _____
 - 2. Lugar: _____
 - 3. Técnico Anotador: _____
 - 4. Hora: _____
- Nombre de la Actividad a ser controlada: _____
- Topografía: _____

Número de personas para la Muestra	Hora del inicio de la actividad	Hora de finalización de la actividad	Rendimiento o producto logrado en la muestra	Descripción de la Actividad e Instrumentos utilizados

Observaciones u otras anotaciones técnicas; _____
