ENVIRONMENTAL ASSESSMENT
PASSION FRUIT CROP PROJECT - ALTERNATIVE DEVELOPMENT OF FARMING IN THE DEPARTMENT OF HUILA, COLOMBIA

Raquel Duque, Jorge Caicedo, et al.

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Colombia Alternative Development Project

Chemonics International Inc.
1133 20th Street, NW
Washington, DC 20036
Telephone (202) 955-3300
Fax: (202) 955-7540

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ENVIRONMENTAL ASSESSMENT (EA) OF THE PASSION FRUIT CROP PROJECT - ALTERNATIVE DEVELOPMENT OF FARMING IN THE DEPARTMENT OF HUILA, COLOMBIA

FINAL REPORT

BOGOTÁ D. C., NOVEMBER 13, 2003

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SECTION 1 EXECUTIVE SUMMARY

1.1 PROJECT OBJECTIVES

The main objective of this study is to analyze the physical, biotic and socioeconomic aspects in the area of influence of Passion Fruit plantations for the purpose of identifying and evaluating the impacts caused by the implementation and operation of the project. The study establishes environmental, monitoring and management measures to guarantee sustainable development of the project, both during the development phase and upon termination of activities. The objective of the Study includes a comprehensive discussion of the consequences of the implementation and management of the productive characteristics of passion fruit plantations and their repercussions on the environment, to assist project officers in decision making processes.

1.2 PROJECT DESCRIPTION

1.2.1 Project Location

The project is located in the department of Huila, Colombian, in the municipalities of Algeciras, Teruel, Palermo, Baraya, Tello, Colombia, La Plata and Nátaga. Passion fruit plantations in the municipalities above are located in 67 "*veredas*" or rural divisions, as follows :

- Algeciras : Bellavista, Sandias, El Pomo, Satias, Pinares, San Francisco, Lagunilla, El Kiosco and el Quebradón.
- Nátaga : La Cascajosa, La Primavera, El Socorro and El Triunfo.
- La Plata : El Carmelo, Lindosa, Fátima, Camarrocines, El Tablón, San Isidro, El Salado, Cabuyal, La Azufrada, Bajo Moscapán and Bajo Retiro.
- Teruel : La Castilla, Almorzadero, Portachuelo, Sinaí, La Cañada, La Primavera, Calarca, Beberrecio, La Espiga, Cafuchal and La Pradera.
- Palermo : San Genaro, San Juan, El Diamante, Bajo Nilo, San José, Fátima y Moyitas.
- Baraya : La Unión – Arizona and La Siria.
- Tello : Pedregales, San Isidro, La Esperanza, El Romero, Altagracia, Mesa del Trapiche, Cucuana, La Sierra, Sierra del Gramal, El Espejo and El Balcón.
- Colombia : Ariari, El Boquerón, Santa Bárbara, Horizonte and San Antonio.

The area of the farming plots average one hectare, although some may be up to 6 ha. Planting density averages 1,200 plants per ha. Crop planting has been done in sloping, previously idle fields, in some cases over 50% slopes. The plots have good drainage, most are adjacent to secondary roads, near watersheds.

1.2.2 PROJECT ACTIVITIES

Farming

Passion fruit crop farming includes the following activities:

Tracing planting rows: A length of rope is used to plot rows spacing 1.5 to 2.0 m long, following contour lines. The place occupied for each plant is marked along the rows at a distance ranging from 1.5 to 2.0 meters.

Digging holes to plant seedlings: Is done with tools such as plainest, augers and shovels. The dimensions of the hole are 0.3 by 0.3 meters, dug out soil is piled up next to the hole to be reused in planting seeds, mixed with 2 kg of organic matter, (chicken manure).

Staking: poles are placed in hole simultaneously with the plot tracing, to avoid damage to seedlings.

Seedlings are planted in the receiving hole when they reaches a height of 30 to 40 cm and sprouts two or three pairs of leaves. The most common planting or tutoring systems are the pergola, also called *espaldera*. This system is common in flat areas; it has advantages, such as longer duration and better ventilation of the plantation, easier sanitary control and better conditions for harvesting. Single *espaldera* allows for greater number of plants per hectare and the possibility of blending the plantation with others.

Passion fruit plants start producing between after of 7 to 10 months, depending on weather, especially temperature. Ripeness and harvesting is done when the fruit falls from the tree to the ground.

Harvesting has to be done frequently especially during the rainy season, to prevent putrefaction of the fruit, and in dry season to prevent sun exposure rendering the skin brittle. Once fallen, the fruits quickly loose weight. Harvesting is done manually, preferably placing the fruit harvesters to walk along rows.

1.3 DEMAND FOR NATURAL RESOURCES

- **Water Resources**

Plantations are relatively resistant to dry spells, however, if the dry season extends over time, plant development and flowering is delayed and serious defoliation may happen resulting in late or lost flowering affecting production because lack of pollinizing. The parcels chosen for cultivation must have adequate access to water sources to compensate for low rainfall periods.

- **Vegetative resource – Biomass**

Demand for wood stakes is relatively high, more than 640 stake supports and 300 bamboo reinforcements per ha are required to provide stability to *espaldera*.

- **Soil resources**

Passion fruit plant need deep soil root penetration and fertile and well drained soils. Heavy soils with low permeability are undesirable cultivation of passion fruit because they facilitate *fusiarosis*, or putrefaction of the root neck.

1.4 DESCRIPTION OF THE SURROUNDING ENVIRONMENT

1.4.1 Definition of the Project Area of Influence

The Indirect Area of Influence includes areas planted with illegal crops, these zones are the main project social component. However, it must be taken into account that other municipalities have voluntarily joined the project to plant passion fruit in non-illegal crop areas, this may affect in some way primary project objectives. The Direct Influence Area is delimitated by plantation boundaries and a 100 meter perimeter margin, including the watersheds receiving plantation drainage flows.

1.4.2 Geology and Geomorphology

The municipalities of the project are located in a Northeast-Southwest, (NE-SW), morpho-structural unit along the Magdalena river valley, surrounded by the flanks of the eastern and central branches of the Colombian Andes. The entire region is formed by a nucleus of pre-cambric and paleozoic rocks above which there is a dense mezzo-paleozoic sedimentary sequence originated in platform and continental marine environments, (Cenozoic). Regarding geomorphology, slopes range between 0% and 5% in flat areas and 15% to 50% in the more abrupt zones. Some passion fruit cultivation zones with steeper slopes were identified in the hillside areas in the municipalities of Algeciras and Teruel, in the western and eastern flanks of the Eastern and Western Andean *cordilleras*.

1.4.3 Climate

The area of the study has a predominantly dry and very dry tropical climate. The average annual temperature ranges between 27° C in the lowest areas to 23° C in the highest. Precipitation averages between 923 mm and 2,008 mm with two rainy seasons that extend from March to May and from October to December, and two dry seasons in between. The average values of relative humidity vary between 65% in the dry seasons and 85% in the more rainy months.

1.4.4 Hydrology

The municipalities involved in the passion fruit project are located within the great hydrological valley of the Magdalena river. The rivers and valleys on which plantations are located arey: Neiva River, (Algeciras), Pedernal River, (Teruel), Cabrera River and Venado Rivers, (Baraya y Colombia), La Plata River, (La Plata), Páez River, (Nátaga), Baché River, (Palermo), and Villa Vieja River, (Tello). All these rivers originate in the mountains with slopes equal or greater than 20%. In general, the river waters analyzed present no problems related to presence of organic matter, nitrogen or phosphorus compounds.

1.4.5 Soils

According to lab tests done on several parcels of the project, the soils are generally loam sandy, pH between 5.6 and 6.5, deficient in organic matter, nitrogen, phosphorus, boron and ammonium ion, with low contents of potassium, magnesium, copper and zinc, medium contents of sodium, calcium and magnesium, and high to excessive contents of iron and aluminum in some cases. Most parcels are located in hillsides with slopes between 12 and 50%. Lower slopes are slightly more fertile and have greater contents of organic material and clay, albeit affecting drainage.

1.4.6 Biotic Component

Bioclimatically, passion fruit plantations corresponds to dry tropical forest formations, (bs-T); however, some plantations are located within the humid pre-mountainous forest, (bh-PM) classification, located at a slightly higher altitude. The original native vegetation in these formations has been substantially altered by man, deforestation, making room for extensive pastures for cattle raisin, as well flooding for rice, coffee and cottage crops. The underlying characteristics of the vegetation in the project area is pastures. The tree and brush vegetative cover is scant.

Due to the low density of forest biomasses, native fauna is only important at a regional level,(near streams and rivers). Wildlife may access plantation sites, but will not remain because of threats from hunters, farm dogs and the like.

1.4.7 Social Component

Farmers are mostly of mestizo origin, resulting from the mixture between the white populace and the indigenous Paez ethnical group. Education level is low among the farmers, with 16.3% of the surveyed population having finished primary education, 6.8% with secondary schooling, and just 1% with access to technical schools. Access to health services is fair, 84.60% of the population receive healthcare.

In regards to public utilities, the telephone coverage and quality of service is critical as people have no other communication options. Sewerage coverage is minimal, the survey indicate that 15.4% of homes have no sanitary installations, the main alternative is open

ground. Electric power supply and access to potable water is less critical, 60% of homes have access to potable water, the remaining population has contaminated water, the only available way to treat water is boiling.

Housing conditions are characterized by the predominance of "*bahareque*" or waddle, pressed mud use in house construction, along with cement floors and galvanized roofing. This problem becomes critical if more than one family inhabits the house.

The most important economic activity is agriculture, represented by small plots of coffee, beans, corn, tomatoes and vegetables as a self-sustenance alternative. On average, the extension of the farming plots is 2 ha. Raising poultry and pigs is also common.

1.5 IDENTIFICATION OF ENVIRONMENTAL IMPACT

1.5.1 Methodology

The methodology used in identification of environmental impacts is based on a well-known system called the Leopold Matrix, this matrix analysis factor that will otherwise alter the environment and establishes correlation with every phase of project activities. The resulting interpretation, represents a project graded impact identification matrix. Impacts could be adverse when project activity alters natural resources negatively, or it may be positive if impacts favors the natural resource analyzed. The criteria used to determine the natural resources environmental assessment, include: nature of the impact, type of impact, duration, scope, tendency, synergy, and probability of occurrence and magnitude.

1.5.2 Results

Based on the matrix, project activities are classified in a vertical pattern according to the degree of negative effects generated on the environmental components under review. Farming activities, including cultivation and processing, are categorized from low to high negative affectations, as follows:

In regards to crop installation and assembling phases, preparation of seedlings accounts for the greatest negative values, followed by chemical weed control and disease management. The construction of stakes has a negative interaction. In this phase of the project interactions show positive results like germination, transplantation, manual and mechanical weed control, irrigation and fertilization, granular and spray.

In the production phase of passion fruit crop farming, only beneficial/positive interactions occur, i.e., during harvest. The activities showing higher interaction values require a complete monitoring and follow up package within the Environmental Management Plan (EMP), at a later phase.

Horizontal assessment of the matrix determines which environmental components are the

most affected by activities in the project installation and production phases, as follows:

Air : Interactions indicate effects of lesser magnitude than other effects on resources. The impact of greatest relevance is air pollution registered during cleaning of the soil and application of chemicals, followed by offensive smells effects of lesser magnitude, brought about by application of agrochemical products, gaseous emissions resulting from operation of equipment, particulate suspended particles, annoying sound levels and noise during the harvesting phase.

Water resources : The greatest impact is the reduction of flow of water in rivers, followed by physicochemical contamination of water sources by run offs, dirty water from washing equipment, and alteration of drainage.

Soils : The most important effect is scour; formation of gullies, and drainage channels, followed by the loss of soil due to improper cultivation practices, and contamination of soils with agrochemicals.

Biotic environment : The highest negative interaction is related to deforestation, followed by migration of fauna species, and possible contamination of farm workers from pesticides.

Socioeconomic environment : The interactions reflect beneficial/positive characteristics of the project. The most significant are generation of employment and income, and transfer of technical knowledge. The negative value is reported by lack of environmental follow up and control systems.

1.6 ENVIRONMENTAL ASSESSMENT MATRIX

1.6.1 Methodology

The environmental assessment is made considering the passion fruit's project conditions, together with other ecological and environmental conditions in the department of Huila, utilizing criteria based on analysis of information of geographical location, orography, climate, hydrography, public service infrastructure, productivity, and land aptitude. The values related to quality and quantity of effects, are established by means of environmental quality parameters, and rated through environmental qualification indicators, (EQ).

1.6.2 Results

- **BIOTIC ENVIRONMENT**

The deforestation effect, due to cutting trees to provide for holding-stakes is rather significant, albeit reversible impact. The impacts related with flora are synergic, while those related with fauna are not. The probability of occurrence is greater in impacts related to chemical use than in others. These impacts are mainly caused during preparation of terrain (cleaning of weeds), during the phases of control of pests, (use of insecticides, fungicides and herbicides) and during the post-harvesting period.

1.7 PHYSICAL ENVIRONMENT

The lowest environmental qualification values are related to soil contamination by agrochemicals, an alteration of medium magnitude rating. The resulting negative impact is deterioration of water quality at water from preparation of seedlings, drainage and the application of agrochemical products, as well as landslides in areas with step slopes. The Environmental Alteration generated by the project in these areas is medium low.

Water resource is the principal environmental component affected by project activities due to possible influx of waters contaminated by pesticides employed in plague and weed control in streams and other natural drainage in the plantation area.

1.8 SOCIOECONOMIC ENVIRONMENT

The impacts on the socioeconomic environment are mainly positive with the exception of lack of a follow up system and environmental control. In general, all impacts generated and identified by the productive project will produce positive impacts in the long-run on the direct area of influence of the project; these benefits are rated as moderate to high, and have a large probability of occurrence if the recommended operating conditions of the project are maintained. Coverage of the impacts is local, although some effects can reach beyond the project area, particularly those related to marketing and transportation. In the future, the impacts become synergic because they are prime motivators of social welfare.

1.9 ENVIRONMENTAL MANAGEMENT PLAN

Environmental Guidelines

The Environmental Management Plan, EMP, contains programs and measures related to specific factors that generate environmental effects, as well as mitigation measures to minimize the impacts, and strategies to carry out the monitoring of activities. Each measure is defined by: type, objectives, impacts to control, spatial coverage and location, designs, description of the measure(s), schedule, and costs.

The measures established within the EMP that must be executed throughout the development of the project, according to the results of the matrix analysis, are:

Table 1. Environmental Measures to be Applied to Passion Fruit Crops

PROGRAM	FORM No.	MEASURE
SOIL MANAGEMENT	1	CULTURAL PRACTICES
	2	AGRONOMIC PRACTICES
	3	PESTICIDE AND WEED CONTROL AND MANAGEMENT
	4	WEED CONTROL
	5	ORGANIC AND BIOLOGICAL AGRICULTURAL PRACTICES
	6	EROSION CONTROL
WATER RESOURCES MANAGEMENT	7	WATER QUALITY CONTROL
	8	WATER CONTROL IN INDUSTRIAL PROCESSING
	9	SOIL CONSERVATION BY SOLID WASTE DISPOSAL
AIR MANAGEMENT AND CONTROL	10	CLEAN TECHNOLOGIES FOR SOIL PREPARATION
MANAGEMENT AND CONTROL OF FLORA AND FAUNA	11	VEGETATIVE COVER MANAGEMENT BY FLORISTIC COMPENSATION
	12	FAUNA MIGRATION CONTROL
	13	GENERATION OF LIVE FENCES AND PLANTATION OF VEGETATIVE COVER
ECOSYSTEM PROTECTION	14	CONSERVATION OF NATIVE ECOSYSTEMS
SOCIAL MANAGEMENT	15	STRENGTHENING OF THE SENSE OF BELONGING
	16	ENVIRONMENTAL EDUCATION
	17	INDUSTRIAL SAFETY

These measures complement one another, soil resources will affect watersheds and inversely, any impact could rebound on other elements. Each measures is included the Environmental Assessment as a technical card, that identifies the magnitude of the measure required and the costs involved.

1.10 ENVIRONMENTAL MONITORING AND FOLLOW-UP PLAN - EMFP

The Environmental Monitoring and Follow-up Plan -EMFP- is part of the environmental management plan –EMP- and constitutes a management tool with detailed programs and mechanisms, including impact identification all the way to components that allow for verification, vigilance and assessment of the actions and activities of the project before, after and during its execution.

The EMPF establishes in detail the indicators and the places where the monitoring should take place, as well as the methodologies recommended in particular for sampling and verification, including periodicity of sampling, duration, type of analysis, forms of assessment, costs and financing of the activities. The EMFP includes recommendations regarding the form for presenting periodic reports, with argumentation of the periodicity of reporting and will establish the extent of advances on aspects such as: physical and

chemical monitoring of intervened watersheds, reforestation programs and erosion control, biological control, solid waste and social welfare management.

1.11 ENVIRONMENTAL LEADERSHIP PLAN

Environmental policy provides the necessary planning information and is designed taking into account the results of the Environmental Assessment. It is necessary to create an organizational structure for defining program direction, coordination and execution system and to provide economic and physical resources, to generate procedures, communication flows and operational controls.

The follow-up phase corresponds to verification of the effectiveness and efficiency of the environmental measures adopted. It is supported on actions such as monitoring and determination of the characteristics of the operations and of the key activities that cause environmental impacts, as well as definition of responsibilities and instruments required to handle, investigate and correct nonconformities, keeping environmental registers to probe the fulfillment of objectives and goals and carrying out environmental auditing in order to determine if the EMP has been correctly implemented and meets planned objectives.

It is suggested that an Environmental Management Unit is created to implement the Environmental Administration System. This unit would be responsible for supervising the environmental management measures executed and the EMFP, in accordance with the recommendations given in this study.

1.12 COSTS

Costs for the EMFP have been estimated according to the methodology proposed in the Technical Cards of the EMP. This means that the EMFP adds costs to each EMP activity. The costs of the EMFP included are those related to sampling and laboratory analysis of water and soil quality, the direct costs of photographic records and the elaboration of reports. The Environmental Management Plan costs are COL$ 39,500,000 (US$ 14,108).

1.13 ALTERNATIVES FOR FUTURE DEVELOPMENT OF THE PROJECT

Establishing the behavior of the environment into the future is the first step in assessing sustainability over the life of the project. For this purpose, three alternatives were analyzed to evaluate the character, magnitude and time within which alterations are caused over each one of the environmental elements, considering or not the implementation of the emp in the productive project and the no-action. This analysis considers three possible options:

- No-Action, whereby the project should not be developed due to its impacts
- Preferred action, whereby the EMP is applied on the project
- No-Action, whereby the project is not carried out.

This section deals with the assessment and performance of the natural resources during the execution of the project with and without the implementation of the measures of the EMP.

An analysis of trends and behavior of the different environmental elements associated with the Passion Fruit Project is included as a complement of the assessment, based on the requirements and recommendations contained in Regulation 216 applicable to projects entirely or partly financed with AID funds, if the proposed actions are not taken. The diagnosis of alternatives is based on the conditions presented in the initial reference status, which were identified and documented in the Environmental Description of the Project area of influence (See sections 4.6 to 4.9, Diagnosis Report). A final analysis is added at the end of each section on environmental vectors, specifying environmental trends or environmental behavior in the absence of the proposed project.

1.13.1 Methodology

The same method of matrix assessment that was used to run the environmental assessment of the project is used to simulate behavior of the different impacts identified during the activities of the project over time, as indicated in the three alternatives below:

ALTERNATIVE 1*:* This alternative describes the behavior of environmental resources as the productive project is implemented parallel to implementation of the measures established in the EMP.

ALTERNATIVE 2: This alternative considers the behavior of resources towards the future, considering that the project continues to develop under the same natural conditions that exist today, with the prevailing social realities and no specific environmental measures applied to ensure project sustainability.

ALTERNATIVE 3: This alternative considers the behavior if the project is not carried out.

Once the basic alternatives that permit the assessment are known, it is possible to choose a scale to determine the magnitude of the impacts, allowing for carrying out the environmental assessment, as follows:

- Character: Positive, (Beneficial), or Negative, (Adverse), according to the type of consequences that can be derived in absence of the measure.
- Incidence: related to the way in which an action of the EMP is carried out or not, acting over the resource through the identified impact**,** graded as High, Medium, or Low.
- Duration: related to time elapsed between the application or no application of the measure, and the moment in which the impacts are likely to affect the resource, adversely or beneficially. The values of this parameter correspond to three period ranges: Long-term, (if greater than three years), Medium-term, (between 1 and 3 years), and Low-term, (below 1 year).
- Scope: Determines if the action is applied to the direct area of influence of the project (local), or a larger or regional area (regional).

The scale below allows for subjective grading according to the criteria of annalists, employees and management, as indicated below:

Table 2. Scale for quantifying the conditions of the different alternatives analyzed

CRITERIA FOR CLASSIFICATION	QUALITATIVE VALUATION	QUANTITATIVE VALUATION
Character of Impact	Positive	+
	Negative	-
Incidence	High	3.0
	Medium	2.0
	Low	1.0
Duration	Short	1.5
	Medium	1.0
	Large	0.5
Scope	Local	0.40
	Extensive	0.60

The definition of criteria was carried out jointly with the specialists participating in the study at joint meetings, to establish the scales for assessment of future conditions of the project according to the different environmental resources affected in each of the Alternative's Analysis described. For each alternative, the Assessment results from the addition of the qualifications of the different impacts, to obtain the corresponding measurement of environmental quality, (EC), as follows:

$$EC = I + P + A \qquad (1)$$

Once the EC values are calculated for each alternative, the value of EC to the future is computed by adding these qualifications with those obtained for the present condition of the project, (figure 5.1), as indicated by equations (2) and (3). In order to establish the relation between values of Environmental Qualification, "EC", and Environmental Alteration levels, (EA), the same range of values of EA, which can be related both for positive and negative impacts by entering the amounts of EC as absolute values.

$$EC_{future} = EC_{present} + EC_{with\ EMP} \qquad (2)$$

$$EC_{future} = EC_{present} + EC_{without\ EMP} \qquad (3)$$

$$EC_{future} = EC_{present} + EC_{without\ Project} \qquad (4)$$

1.13.2 Method for Calculation

The addition, according to Equation (1) above, applies to the impact caused by generation of gases due to operation of equipment graded as (2), landslides in sloping zones, graded as (10), and provision of technical assistance, graded as (40), due to project activities are quantified as in the following table:

Table 3. Example of Quantification of Identified Impacts

IDENTIFIED IMPACTS		PROJECT WITH EMP								WITHOUT PROJECT (PROJECT WITHOUT EMP)								ENVIRONMENTAL QUALIFICATION EC		
		INCIDENCE			DURATION			SCOPE		INCIDENCE			DURATION			SCOPE		WITH EMP	WITH OUT EMP	WITH OUT PROJ.
		3.0	2.0	1.0	0.5	1.0	1.5	0.4	0.6	3.0	2.0	1.0	0.5	1.0	1.5	0.4	0.6			
Generation of gases due to operation of equipment (1)	2			1.0		1.0		0.4		-3.0		-1.0			-1.5 -1.5	-0.4	-0.6	2.4	-2.9	-5.1
Landslides in sloping zones (2)	10		2.0			1.0		0.4		-3.0	-2.0				-1.5 -1.5	-0.4	-0.6	3.4	-3.9	-5.1
Provision of Technical Assistance (3)	40		2.0			1.0		0.4		-3.0 -3.0					-1.5 -1.5	-0.4	-0.6	3.4	-4.9	-5.1

1.14 FINAL RESULTS

Table 4. Summary of Assessments

AFFECTED ENVIRONMENTAL RESOURCE	PRESENT CONDITION	ALTERNATIVE WITH EMP	ALTERNATIVE WITHOUT EMP	ALTERNATIVE WITHOUT PROJECT
Soil	-0.86	1.7	-4.0	-7.7
Water	-2.76	0.2	-5.7	-7.8
Air	-2.62	0.3	-5.7	-5.9
Flora	-2.94	-0.1	-6.4	-8.0
Fauna	-1.96	0.1	-5.1	-7.0
Social	4.18	7.9	0.4	-0.9

According to table 4, above, the environmental resource that is most affected by the actions of the project without the EMP measures is flora (-6.4); and even if the environmental measures are applied, the flora resource is not fully recuperated, due in particular to the impacts generated by activities such as land clearing and construction of stakes. The resources that follow in alteration are water and air (-5.7), due to the deterioration of water quality from seedling preparation, drainage and application of agrochemicals; application of agrochemicals affects the soil (-4.0). Fauna registers a negative impact of (–5.1) mostly due to the risk of impacts caused by application of agrochemicals, affecting the disappearance of natural ecosystems, as well as continuous traffic and presence of workers in the area.

Impacts produced on the social component have the least grading when the actions in the EMP are not put to action, due to the very nature of the project, which seeks to mitigate a social problem with the substitution of illicit cultivation through an agricultural activity that

allows for the subsistence of the community and an improvement in their living conditions, an objective that can easily been reached even without the implementation of an EMP. All the same, it is evident that the benefits of the EMP (7.9) are in this aspect of greater impact, since they constitute a tool to ensure sustainability of natural resources and their continued exploitability towards the future.

Insecure conditions in the area cause a decrease of agriculture and cattle production and in other economic sectors, as well as migration of *campesino* population away prom the project zone. Large numbers of farmers and their families, as well as farm laborers flee the region, migrating to other areas in search of employment in the coca fields, albeit the conditions in these areas are risky as well. This phenomenon also diminishes investment in traditional agriculture, cattle and forestry sectors.

The ratings of the impacts if the project is not implemented are least (all are negatives) due to the opportunity of legitimate development of agriculture and ecological use of the soil will be lost. Presence of state authorities in the region is scant, although significant efforts are being carried out to restore police depots throughout the municipalities. This will assist in controlling illicit crop activity and allow for licit employment opportunities.

Erosion affected areas abound throughout the Department, caused by improper agricultural practices, creating runoffs and eolic affectation.

Another opportunity that would be lost if the project is not carried out, is improvement of farm parcels. Moreover, the economy of the region will continue to be dependent on illicit crops, a condition compounded by lack of licit opportunities and motivation of the community. In addition, technical assistance in better farming practices provided by the project would also be lost, affecting sanitation, potable water supply, and improper disposal of solid and liquid waste that contribute to pollution of watersheds and soil.

An important impact, as shown above, is the potential for natural deterioration due to the use of agrochemicals, especially pesticides. Regulation 216 requires that a PERSUAP be carried out for each chemical used, or to possibly be used; as a follow through, an Integrated Pest Management Plan (IPM) was incorporated for each chemical, so that natural, non-chemical means of pest control can be viable options for the farmers. Due to the fact that the pesticide analysis is a full chapter, a summary is presented below that defines some of the main objectives, however the IPM options will not be discussed here, but can be found in the PERSUAP section of this study.

- Products not registered in the US and Colombia or in PIC[1] list. NOT TO BE USED UNDER ANY CIRCUMSTANCE: captafol, isazofol, methyl parathion and methamidophos.

- Products not yet registered in the US or Colombia. Although a microbial product, the first, and a plant extract, the second, they are NOT TO BE USED

[1] 'PIC List' is the Prior Informed Consent List of the Rotterdam Convention, led by UNEP and FAO, that applies to the international shipment of the most hazardous chemicals.

UNTIL REGISTERED in at least Colombia: *Baculovirus spodopterae* and *Swingla* (extracts).

♦ Products not registered in Colombia. NOT TO BE USED UNDER ANY CIRCUMSTANCE: endosulfan.

♦ Products not registered with USEPA. NOT TO BE USED UNDER ANY CIRCUMSTANCE: benzimidazole, hexaconazole, kasugamicine, monocrotophos, and ofurace.

♦ Products not registered w/USEPA. But registered in Colombia. APPROVED TO BE USED: extracts of *Glyricidia sepium*, because the resource (*Glyricidia*), the crop (vanilla) and the pest (*Cylsia*), are not present in the US; *Paecilomices liacinus*, because the crop (heart of palm) and the pest (*Leptopharsa*) are not present in the US and the pesticide is a microbial insecticide with unlikely environmental or health impact; and *Trichogramma pretiosum* and *Verticillium lecanii*, are both microbial insecticides with unlikely environmental or health impact.

♦ Products are RUP with USEPA. NOT TO BE USED: aldicarb, cyalothrine (lambda) cyfluthrin, chlorothalonil, chlorpyrifos, copper oxychloride, cypermethrine, methomyl, paraquat, profenofos

♦ Products are RUP[2] with USEPA. USE ONLY CERTAIN FORMULATIONS to reduce health or environmental risk: carbofuran (pellets/tablet), and picloram (Tordon 101R).

[2] RUP: Restricted Use Pesticide.

SECTION 2 PURPOSE

2.1 INTRODUCTION

Among the different operative sectors of the project for Alternative development in Colombia (PNDA), is the Preservation and Improvement of Natural Resources and the Environment. To fulfill this goal, USAID and the Government of Colombia are looking to implement ways in which the programs for alternative crop development can adapt with none or minimum impact on the Environment.

In order to verify the environmental quality generated during the development of the project, Chemonics Foundation of Colombia hired ESTUDIOS Y ASESORIAS, Consulting Engineers Ltd., of Bogotá to ran an environmental assessment of the project for the Alternative Development of farming in the Department of Huila. Within the general scope of work is the elaboration of the Environmental Diagnosis of the zone the project; the identification and assessment of the environmental impacts caused by the project, and finally the development of recommendations for the management and environmental monitoring en order to prevent, control, compensate o mitigate the impacts identified before. The work was accomplished between August and October of 2002, with the participation of an interdisciplinary professional group, in order to cover all the required aspects included in the Terms of Reference, and the contractual clauses.

The execution of the project followed the methodology used by the Consultant in similar studies in Colombia and the guidelines of the Chemonics Foundation of Colombia, as well as those of the Natural Resources and Environmental section of USAID. Initially, the Consultants reviewed the existing information and performed the site visits to obtain a characterization of the present condition in the area of influence of the project, trying to involve as much as possible the community, by visiting their houses and citing them to meetings with them and the local operative agencies and community organizations which will benefit from the project, as well as some of the land owners en the area.

The present Environmental Impact Study was accomplished within the terms of Norm 216-c of the USAID and the present environmental legislation of Colombia. The study has also contemplated the politics and guidelines of the municipal development in each one of the municipalities that will benefit from the project, according to the Plans for Territorial Ordering, (P.O.T.), which were frequently consulted during the study.

The present document corresponds to the Final Report of the Project for Alternative Development for the farming, located in the municipalities of La Plata, Nátaga, Algeciras, Teruel, Palermo, Tello, Baraya y Colombia, in the department of Huila, within the National Plan for Alternative Development, PNDA of Colombia.

2.2 OBJECTIVES

The main objective of this study is to analyze the physical, biotic and socioeconomic aspects in the area of influence of Passion Fruit plantations for the purpose of identifying and evaluating the impacts caused by the implementation and operation of the project. The study establishes environmental, monitoring and management measures to guarantee sustainable development of the project, both during the development phase and upon termination of activities. The objective of the Study includes a comprehensive discussion of the consequences of the implementation and management of the productive characteristics of passion fruit plantations and their repercussions on the environment, to assist project implementing agencies in decision making processes.

2.3 SCOPE

The scope of the project include the following aspects:

- Elaboration of an environmental diagnosis, which will include relevant specific aspects of the current operation, and projections for the implementation of plantations in different municipalities.
- Elaboration of an environmental assessment, according to the methodology of the Leopold Matrix, which will identify the different impacts, valuate the degree of damage and propose adequate environmental management measures.
- Formulation and description of preventive, mitigating, corrective and/or compensatory measures required to harmonize the physical, biotic and socioeconomic environment with the cultivation of . These measures will include aspects such as objectives, goals, expected results, design criteria, typical blueprints, human resources, execution timetable, budget and responsibilities.
- Elaboration of a biophysical and social monitoring and follow up program, in agreement with the alterations occurred as a result of actions and processes developed during the operation of the passion fruit cultivation project.

2.4 METHODOLOGY

The study was developed on the basis of the methodology accepted by the state environmental organizations and basically include the following aspects: Identifying areas of direct or indirect influence; Technical description of the prospective project; characterization of the environmental base line on the physical, biotic, social, cultural and economic aspects; on site identification of the impacts generated by the project. Contact with the community was maintained during the field work, through direct involvement with the population working in the project, and the participation of community organizations, which were contacted permanently to maintain a high level of approval for the project.

The work included field activities involving the gathering of primary information and office activities involving processing and analysis of primary and secondary information related to the area of study. The information was employed in the identification and impact assessment stages of the project and in the formulation of environmental monitoring and follow up plans.

SECTION 3 ALTERNATIVES INCLUDING THE PROPOSED ACTION

As a complement of the assessment phase of the agricultural project, it is necessary to establish the behavior of the environment into the future, in order to be able to determine its sustainability. For this purpose, three alternatives were analyzed to assess the character, magnitude and time within which alterations are caused over each one of the environmental elements, and looking into the future, considering or not the implementation of the EMP for the project. This is equivalent to performing a Diagnostic of Environmental Alternatives for implementing the Project. A final analysis of the environmental elements is added at the end of each section, specifying environmental trends and environmental behavior if the project is not carried out. This Section deals with project assessment considering the three alternatives, with and without the implementation of the measures contained in the EMP, as follows:

ALTERNATIVE 1 *:* This alternative describes the behavior of environmental resources as the productive project is implemented parallel to the execution of the measures established in the EMP.

ALTERNATIVE 2 *:* This alternative considers the behavior of resources towards the future, considering that the project continues to develop under the same natural conditions that exist today, with the prevailing social realities and no specific environmental measures applied to ensure project sustainability.

ALTERNATIVE 3 : This alternative describes the behavior of environmental resources if the project is not carried out.

Once the basic alternatives that permit the assessment are known, it is possible to choose a scale to determine the magnitude of the impacts, allowing for carrying out the environmental assessment, as follows:

- Character: Positive, (Beneficial), or Negative, (Adverse), according to the type of consequences that can be derived in absence of the measure.
- Incidence: related to the way in which an action of the EMP is carried out or not, acting over the resource through the identified impact. It has been graded as High, Medium, or Low.
- Duration:: as related to time elapsed between the application or no application of the measure, and the moment in which the impacts are likely to affect the resource, adversely or beneficially. The values of this parameter correspond to three period ranges: Long-term, (if greater than three years), Medium-term, (between 1 and 3 years), and Low-term, (below 1 year).
- Scope: Determines if the action is applied in the direct area of the project (local), or if it encompasses a larger or regional space (regional).
- Determines if the action is applied to the direct area of influence of the project (local), or a larger or regional area (regional).

The scale below allows for subjective grading according to the criteria of annalists, employees and management, as indicated below:

Table 5. Scale for quantifying the conditions of the different alternatives analyzed

CRITERIA FOR CLASSIFICATION	QUALITATIVE VALUATION	QUANTITATIVE VALUATION
Character of Impact	Positive	+
	Negative	-
Incidence	High	3.0
	Medium	2.0
	Low	1.0
Duration	Short	1.5
	Medium	1.0
	Large	0.5
Scope	Local	0.40
	Extensive	0.60

The definition of criteria was carried out jointly with the specialists participating in the study at joint meetings, to establish the scales for assessment of future conditions of the project according to the different environmental resources affected in each of the Alternative's Analysis described. For each alternative, the Assessment results from the addition of the qualifications of the different impacts, to obtain the corresponding measurement of environmental quality, (EC), as follows:

$$EC = I + P + A \qquad (1)$$

Once the EC values are calculated for each alternative, the value of EC to the future is computed by adding these qualifications with those obtained for the present condition of the project, (figure 5.1), as indicated by equations (2) and (3). In order to establish the relation between values of Environmental Qualification, "EC", and Environmental Alteration levels, (EA), the same range of values of EA were used as defined in table 4.6, which can be related both for positive and negative impacts by entering the amounts of EC as absolute values.

$$EC_{future} = EC_{present} + EC_{with\ EMP} \qquad (2)$$
$$EC_{future} = EC_{present} + EC_{without\ EMP} \qquad (3)$$
$$EC_{future} = EC_{present} + EC_{without\ Project} \qquad (4)$$

The relation between values of Environmental Qualification, "EC", and Environmental Alteration levels (EA), and the range of values for the EA component are shown below:

Table 6. Absolute Values and Environmental Alteration Rating

Absolute Value of Environmental Quality	Environmental Alteration
>10.0	**Very High**
8.0-10.0	**High**
6.0-8.0	**Medium High**
4.0-6.0	**Medium**
3.0-4.0	**Medium Low**
1.0-3.0	**Low**
<1.0	**Very Low**

Table 7. Summary Assessment of Identified Interaction for Implementation of EMP of Air Resources in the Cultivation of Passion Fruit - (Department of Huila)

	PRESENT CONDITION		ALTERNATIVE WITH EMP		ALTERNATIVE WITHOUT EMP		ALTERNATIVE WITHOUT PROJECT		DESCRIPTION OF QUALIFICATION
	CA	AA	CA	AA	CA	AA	CA	AA	
	-0.86	Very Low	1.7	Low	-4.0	Medium	-5.9	Me-dium	At present this element does not present critical Alteration; it is in fact very low, produced mostly by particle generation during cultivation, implementation of EMP will permit the minimization of effect on this component. Continuation of the project without implementation of EMP will clearly contribute to deterioration of air quality at each of the cultivation sites.

Increased gas emissions will result if the project is not implemented, as pollution controls will not be available, uncontrolled burnings will be rampant, and inadequate farming practices will continue contributing to dust generated by soil improper management leading to erosion.

If the project is not implemented, illicit crops will warrant generation of state control measures such as aerial spray and forceful eradication of illicit crops, which have resulted in lack of motivation among farmers to abandon illicit crops (See Section 4.7 – Cultural Aspects). The presence of illicit crops generates serious environmental impacts, in addition to other impacts related to state intervention in forceful eradication of illicit crops.

Table 8. Summary Assessment of Identified Interaction for Implementation of EMP of Water Resources in the Cultivation of Passion Fruit - (Department of Huila)

	PRESENT CONDITION		ALTERNATIVE WITH EMP		ALTERNATIVE WITHOUT EMP		ALTERNATIVE WITHOUT PROJECT		DESCRIPTION OF QUALIFICATION
	CA	AA	CA	AA	CA	AA	CA	AA	
WATER	-2.76	Low	0.2	Very Low	-5.7	Me-dium	-7.8	Me-dium High	This component at present in the zone shows low Alteration. The implementation of the control and mitigation measures in the EMP will turn this variable into a beneficial impact, almost totally mitigated. The condition towards the future without the implementation of the EMP will make deterioration more critical due to the effects on water quality of seedling preparation and application of Agrochemicals. It is worth noting that water treatment proposed in the EMP do not totally control water pollution, although the quality of the waste water will fulfill the existing environmental legislation (Decree 1594/94 for water utilization).

In general, the quality of water in rivers present no problems related to presence of organic matter, nitrogen or phosphorus compounds. However, if the project is not undertaken, alternatives related to community participation will not exist, as well as income generation opportunities and establishment of social grass-roots required for effective project management. Furthermore, watersheds will continue to deteriorate due to indiscriminate use of agrochemicals in illicit crops that ultimately flow into rivers and streams causing severe contamination. Air contamination will also continue, affecting air quality and water.

Table 9. Summary Assessment of Identified Interaction for Implementation of EMP of Soil Resources in the Cultivation of Passion Fruit - (Department of Huila)

	PRESENT CONDITION		ALTERNATIVE WITH EMP		ALTERNATIVE WITHOUT EMP		ALTERNATIVE WITHOUT PROJECT		DESCRIPTION OF QUALIFICATION
	CA	AA	CA	AA	CA	AA	CA	AA	
SOIL	-2.62	Low	0.3	Very Low	-5.7	Medium	-7.7	Medium High	The soil component presents so far low environmental Alteration. With the implementation of the EMP this effects are is mitigated, resulting in beneficial impacts. If the measures included in the EMP are not applied, the alteration factor will increase to Medium. The improvement in soil conditions due to application of the EMP will increase productivity, although it is worth noting that at present, the impact on soils is due to uncontrolled use of agrochemicals. Another factor which presents incidence in soil deterioration is related to land slides in steep areas, as uncontrolled farming activities result in severe morphological changes and erosion problems. Lack of implementation of the EMP will generate significant increase in soil deterioration, which will be reflected in rapid loss of soil production capacity, affecting crop development in the region.

There are not significant evaluations of productivity losses due to soil degradation caused by use of conventional farming systems to prepare the soil. Nevertheless, there exist technical assessments indicating that in the majority of traditional agricultural production systems, the soil is subject to high levels of pressure. Soil is continuously used, there are not rest periods, the soil is not allowed to rest or rest periods are far apart. There are not reliable farming practices available to prevent soil degradation processes. Another negative factor is the increased tendency to use soils in the region for cattle grazing, contributing to soil deterioration, expensive recuperation and erosion. Two distinct farming practices are identified:

- High level of topsoil removal, which is characterized by intensive and inadequate preparation, removal of large portions of the soil, and loss of structure.
- Localized removal of the topsoil under practices that may include long cycles (every 10 to 30 years).

Table 10. Summary assessment of identified interaction for implementation of EMP of Flora Resources in Passion Fruit farming - (Department of Huila)

	PRESENT CONDITION		ALTERNA-TIVE WITH EMP		ALTERNA-TIVE WITHOUT EMP		ALTERNA-TIVE WITHOUT PROJECT		DESCRIPTION OF QUALIFICATION
	CA	AA	CA	AA	CA	AA	CA	AA	
FLORA	-2.94	Low	-0.1	Very Low	-6.4	Medium High	-8.0	High	At present, alteration of this resource is low, and mostly related to the elimination of vegetative cover, an activity that is indispensable in the cultivation activities. With the implementation of the measures of the EMP this effect is significantly mitigated, although it can not be totally eliminated as most land has been subject to severe anthropic intervention. Continuing the project without implementation of the measures in the EMP will contribute greatly to the deterioration of the resource, transforming the alteration from low to medium high.

The native vegetation has been substantially altered by human intervention, giving way to pastures and cattle rising, as well as rice, coffee and food-crops causing superficial erosion. The remaining tree and bush cover is very low. If the project is not undertaken, anthropic intervention will continue to cause air, water and soil pollution, contributing to further deterioration of environmental resources. In view of the fact that there are few economic alternatives, population will continue to move away from project-designed zones, turning to forests and bus areas in search of whatever little vegetation is available, selling it for fuel or lumber, followed by burnings to clear land for illicit crops, or licit crops, causing severe deterioration of the soil. Parallel to soil loss, the flora resource is also affected due to absence of proper agricultural and farming practices and other alternatives.

Table 11 . Summary Assessment of Identified Interaction for Implementation of EMP of Fauna Resources in Cultivation of Passion Fruit - (Department Of Huila)

	PRESENT CONDITION		ALTERNATIVE WITH EMP		ALTERNATIVE WITHOUT EMP		ALTERNATIVE WITHOUT PROJECT		DESCRIPTION OF QUALIFICATION
	CA	AA	CA	AA	CA	AA	CA	AA	
FAUNA	-1.96	Low	0.1	Very Low	-5.1	Me-dium	-7.0	Me-dium High	At present time, fauna alteration is relatively low. However, lack of implementation of the measures in the EMP will make impacts on fauna even more critical, reaching a rating of medium. One of the factors causing higher impact is the risk of contamination caused on farm workers and animals due to the use of pesticides. Implementation of the EMP will generate beneficial impacts on fauna, changing from low to very low environmental effect. It is worth noting that the proposed measures in the EMP are focused on industrial safety for farm workers.

The native fauna is not an important resource, as traditional farming systems have been used since the early 90s and before.

If the project is not undertaken, an opportunity for generate beneficial changes in fauna will be lost. Forests relicts will also continue to deteriorate, as well as fragile ecosystems nearby, for the same reasons affecting flora, as explained before. Lack of economic opportunities should the project not be undertaken, will probably result in increased hunting for food or sale of species, a practice that will severely affect wildlife.

Table 12. Summary assessment of identified interaction for implementation of EMP of Socioeconomic Resources in Passion Fruit farming - (Department of Huila)

	PRESENT CONDITION		ALTERNATIVE WITH EMP		ALTERNATIVE WITHOUT EMP		ALTERNATIVE WITHOUT PROJECT		DESCRIPTION OF QUALIFICATION
/ /	CA	AA	CA	AA	CA	AA	CA	AA	
SOCIOECONOMICS	4.18	Medium	7.9	Medium High	0.4	Very Low	-0.9	Very Low	The objective of the original productive project is improving the quality of life of marginal social groups that would result from application of State agricultural policies that would benefit, in theory, farmers dedicated to illicit crop cultivation as a means to survive in absence of licit opportunities.. The influence of the project in the socioeconomic element is therefore beneficial. The parallel development of the EPM will bring added benefits both to the socioeconomic element and to the environment. Not applying the measures of the EMP will result in depletion of environmental resources, affecting project sustainability over time, as well as survival of the community.

If Passion Fruit or any other legitimate alternative farming options is not implemented, the economy of the region will continue to slide further into illicit coca and poppy crops as a source of income. At the present time, illicit crops and lack of licit alternatives foster coca and poppy farming.

If the project is not implemented, economic opportunities will be lost as well as the opportunity to provide technical assistance in improving attitudes related to soil and liquid waste management among *campesino* populations, contributing to recuperation of affected watersheds. Family nuclei would also continue to deteriorate, as incomes from illicit activities will generate widespread violence, together with loss of moral values and abandonment of traditional farming lands in favor of other sites apt for illicit crop cultivation, away from the reach of the law. The remaining individuals who would not benefit from the project, and probably would continue to live in institutional secrecy, as illicit activities chosen by these groups would preclude them to opt for access to licit employment and private and institutional opportunities.

3.1 METHOD OF CALCULATION

The addition according to Equation (1) applied to the impact of Generation of gases due to operation of equipment, graded as *(2);* Landslides in sloping zones, graded as *(10),* and Provision of Technical Assistance, graded as *(40)*, corresponding to project activities quantified as in the following table:

Table 13. Example of Quantification of Identified Impacts

IDENTIFIED IMPACTS		PROJECT WITH EMP								WITHOUT PROJECT (PROJECT WITHOUT EMP)								ENVIRONMENTAL QUALIFICATION EC		
		INCIDENCE			DURATION			SCOPE		INCIDENCE			DURATION			SCOPE		WITH EMP	WITH OUT EMP	WITH OUT PROJ.
		3.0	2.0	1.0	0.5	1.0	1.5	0.4	0.6	3.0	2.0	1.0	0.5	1.0	1.5	0.4	0.6			
Generation of gases due to operation of equipment (1)	2			1.0		1.0		0.4		-3.0		-1.0			-1.5 -1.5	-0.4	-0.6	2.4	-2.9	-5.1
Landslides in sloping zones (2)	10		2.0			1.0		0.4		-3.0	-2.0				-1.5 -1.5	-0.4	-0.6	3.4	-3.9	-5.1
Provision of Technical Assistance (3)	40		2.0			1.0		0.4		-3.0 -3.0					-1.5 -1.5	-0.4	-0.6	3.4	-4.9	-5.1

3.2 RESULTS

Table 14. Summary of Assessments

AFFECTED ENVIRONMENTAL RESOURCE	PRESENT CONDITION	ALTERNATIVE WITH EMP	ALTERNATIVE WITHOUT EMP	ALTERNATIVE WITHOUT PROJECT
Soil	-0.86	1.7	-4.0	-7.7
Water	-2.76	0.2	-5.7	-7.8
Air	-2.62	0.3	-5.7	-5.9
Flora	-2.94	-0.1	-6.4	-8.0
Fauna	-1.96	0.1	-5.1	-7.0
Social	4.18	7.9	0.4	-0.9

According to table 14, above, the environmental resource that is most affected by the actions of the project without the EMP measures is flora (-6.4), and even with the measures in place, the flora resource is not fully recuperated, considering the impacts generated by activities like land clearing and construction of stakes. The resources that follow in alteration are water and air (-5.7), particularly due to the deterioration of water quality from preparation of seedlings, drainage

and application of agrochemicals; and the soil, due to application of agrochemicals registering (-4.0). Fauna has a total effect of (–5.1) mostly due to the risk of chemicals and disappearance of natural ecosystems, as well as the continuous movement of workers.

Impacts produced on the social component have a low rating when the actions in the EMP are not implemented, due to the very nature of the project which seeks to mitigate a social problem by substituting illicit crops through licit agricultural activities that allows for the subsistence of the community and improvement of their living conditions, an objective that can easily been reached even without the implementation of EMP. All the same, it is evident that the benefits of the EMP (7.9) are in this aspect of greater impact, since they constitute a tool to ensure sustainability of natural resources and their continued exploitability towards the future.

Impacts produced on the environmental resources if the project is not carried out are least due to:

- The opportunity of legitimate development of agriculture and ecological use of the soil will be lost.
- Erosion affected areas caused by improper agricultural practices, creating runoffs and eolic affectation.
- The economy of the region will continue to be dependent on illicit crops, a condition compounded by lack of licit opportunities and motivation of the community.
- Watersheds will continue to deteriorate due to indiscriminate use of agrochemicals in illicit crops that ultimately flow into rivers and streams causing severe contamination.
- Soil is continuously used, there are not rest periods, the soil is not allowed to rest or rest periods are far apart.
- Anthropic intervention will continue to cause air, water and soil pollution, contributing to further deterioration of environmental resources.
- Lack of economic opportunities will probably result in increased hunting for food or sale of species, a practice that will severely affect wildlife.
- Family nuclei would also continue to deteriorate, as incomes from illicit activities will generate widespread violence, together with loss of moral values and abandonment of traditional farming lands in favor of other sites apt for illicit crop cultivation, away from the reach of the law.

SECTION 4 THE AFFECTED ENVIRONMENT

4.1 DEFINITION

The project was made possible by the National Alternative Development Plan, (PNDA), as part of a strategy for substitution and prevention of illegal plantations (poppy), in Huila. Within the Environmental Assessment (EA) study, two phases were considered:

Phase one *:* Assessment of agricultural, commercial, technical, social, environmental, legal and financial viability of the establishment and development of a Passion fruit plantation in Huila and its commercialization as a substitute crop and preventive plantation within a sustainable strategy for otherwise illegal crop farmers.

Phase two *:* Structuring the fiduciary business scheme and the operating unit, to guarantee the promotion of the project, and organization of farmers, the technical and administrative assistance, support for the entrepreneurial-partner action, marshalling financial resources, establishment and development plantations and assuring product commercialization through forward contracts (future sales contracts).

Once the project determined viable, funding was assigned by USAID and Chemonics. PNDA, selected the Foundation for Agricultural and Social Development (FUNDASET), as the project operator in charge of project implementation. Fiduciaria Popular S.A was chosen as grant the administrator, through the constitution of an Autonomous Patrimony. Once the project operator and the resource manager were selected, the execution phase began in November 1, 2001.

4.2 PLANTATION SITES

The project is located in the department of Huila, Colombian, in the municipalities of Algeciras, Teruel, Palermo, Baraya, Tello, Colombia, La Plata and Nátaga. Passion fruit plantations in the municipalities above are located in 67 "*veredas*" or rural divisions, as follows :

Algeciras *:* Bellavista, Sandias, El Pomo, Satias, Pinares, San Francisco, Lagunilla, El Kiosco and El Quebradón.

Nátaga *:* La Cascajosa, La Primavera, El Socorro and El Triunfo.

La Plata *:* El Carmelo, Lindosa, Fátima, Camarrocines, El Tablón, San Isidro, El Salado, Cabuyal, La Azufrada, Bajo Moscapán and Bajo Retiro.

Teruel *:* La Castilla, Almorzadero, Portachuelo, Sinaí, La Cañada, La Primavera, Calarca, Beberrecio, La Espiga, Cafuchal and La Pradera.

Palermo : San Genaro, San Juan, El Diamante, Bajo Nilo, San José, Fátima y Moyitas.

Baraya : La Unión – Arizona and La Siria.

Tello : Pedregales, San Isidro, La Esperanza, El Romero, Altagracia, Mesa del Trapiche, Cucuana, La Sierra, Sierra del Gramal, El Espejo and El Balcón.

Colombia : Ariari, El Boquerón, Santa Bárbara, Horizonte and San Antonio.

The area of the farming plots average one hectare, although some may be up to 6 ha. Planting density averages 1,200 plants per ha. Planting has been done in sloping, previously idle fields, in some cases over 50% slopes. The farms have good drainage, most are adjacent to secondary roads, near watersheds.

4.3 PROJECT ACTIVITIES

Passion fruit crop farming includes the following activities:

Tracing planting rows: A length of rope is used to plot rows spacing 1.5 to 2.0 m long, following contour lines. The place occupied for each plant is marked along the rows at a distance ranging from 1.5 to 2.0 meters.

Digging holes to plant seedlings: Is done with tools such as plainest, augers and shovels. The dimensions of the hole are 0.3 by 0.3 meters, dug out soil is piled up next to the hole to be reused in planting seeds, mixed with 2 kg of organic matter, (chicken manure).

Staking: poles are placed in hole simultaneously with the plot tracing, to avoid damage to seedlings.

Seedlings are planted in the receiving hole when they reaches a height of 30 to 40 cm and sprouts two or three pairs of leaves. The most common planting or tutoring systems are the pergola, also called *espaldera*. This system is common in flat areas; it has advantages, such as longer duration and better ventilation of the plantation, easier sanitary control and better conditions for harvesting. Single *espaldera* allows for greater number of plants per hectare and the possibility of blending the plantation with others.

Passion fruit plants start producing between after of 7 to 10 months, depending on weather, especially temperature. Ripeness and harvesting is done when the fruit falls from the tree to the ground.

Harvesting has to be done frequently especially during the rainy season, to prevent putrefaction of the fruit, and in dry season to prevent sun exposure rendering the skin brittle. Once fallen, the fruits

quickly loose weight. Harvesting is done manually, preferably placing the fruit harvesters to walk along rows.

Once the seedlings reach a height of 30 to 40 centimeters and has two to three pairs of permanent leaves, it is planted in its final site. The most common planting or tutoring systems are the pergola, also called tablecloth type, and simple *Espaldera*. The first system is common in flat areas and presents certain advantages, such as longer duration and providing for better ventilation of the plantation, easier sanitary control and better conditions for harvesting. Simple *Espaldera* allows a greater number of plants per hectare and the possibility of intercalating the plantation with others.

During the technical visit, consultants observed that farming activities were implemented without minimal security and handling requirements on the part of the farmers. They did not wear recommended protective gear such as masks, gloves, boots and overalls. These conditions can eventually cause intoxication and eye and nasal mucous irritation, which can develop into more serious lung and skin problems.

The trees begin producing fruit at age 7 to 10 months depending on the weather, especially the temperature. Ripeness is achieved when the fruit falls from the tree onto the ground, where harvesting is done. Harvesting has to be done frequently, especially during the rainy season, to prevent putrefaction of the fruit and in dry seasons to prevent sun exposure, which renders the skin brittle. Once fallen, the fruits quickly loose weight. Harvesting is done manually and preferably in straw or fiber sacks to allow the adequate movement of the collector.

Optimal Conditions for Planting

Generally, the fruit grows and develops in warm climates. In more temperate climates growth is normal but production is delayed.

Optimal temperature ranges from 24 to 28° C. In areas with higher temperatures growth is accelerated but the plant production is diminished due to dehydration of the stigmatic liquid, which makes flour fecundation impossible.

Constant high wind zones make the plant conduction on the espalderas or the support structure systems more difficult and expensive.

Soils are generally loam- sandy, with pH ranging from 5.6 to 6.5 and deficient in organic matter, nitrogen, phosphorus, boron and the ion ammonium. They also have low contents of potassium, magnesium, copper and zinc, medium contents of sodium, calcium and magnesium and high to excessive contents of iron and aluminum in some cases.

Drainage ranges from good to excessive, water retention capabilities ranges from low to deficient. Most of the parcels are located on hillsides with slopes between 12 and 50%. Areas with lower

slopes are slightly more fertile and have higher contents of organic matter and clay, making drainage imperfect or deficient.

4.4 DEMAND OF NATURAL RESOURCES

- **Water Resources**

Plantations are relatively resistant to dry spells, if dry conditions extend longer plant development and flowering is delayed and serious defoliation may follow. Heavy rain periods during flowering do not favor production because polinization is almost nil and pollen grains are affected by humidity.

In general, the plots chosen for cultivation have adequate access to water sources to compensate for low rainfall periods.

- **Plant resources - Biomass**

Demand for wood to make stakes is high, one ha requires 640 wooden supports and 300 bamboo reinforcements to guarantee the stability of the stake.

- **Soil Resources**

Passion fruit farming requires deep soils, fertile and well drained. Heavy soils with low permeability are undesirable for the cultivation because they may lead to fusiarosis, or putrefaction of the root neck.

In soils with a high content of clay, drainage must be provided to prevent accumulation of rain or irrigation water in the plant's neck. Optimal soils should have good water retention and a pH between 5.5 and 7.0, although plants are resistant to salinity.

4.5 ORGANIZATION

The actors involved in the structuring or entrepreneurial project scheme include:

FUNDACION CHEMONICS COLOMBIA, in charge of administration of grant resources provided by USAID for National Plan for Alternative Development, (PNDA) illicit crop substitution programs. Grants are given to farmers associations according to Grant Agreement No. 024–01 through the Autonomous Patrimony Trust "Chemonics de Colombia – Passion Fruit Project in the Department of Huila".

FUNDAMAR ONG: Acts as a second level organization conformed by the 16 associations of farmers that signed the Grant Agreement with CHEMONICS. It provides administrative support to

the Autonomous Patrimony Trust "Chemonics de Colombia – Passion Fruit Project in the Department of Huila", ad technical and operational support for Fundación Para el Desarrollo Agrícola, Social y Tecnologógico (FUNDASET), contracted to act as Operation Unit Manager, (project operator), during the first 24 months of the cycle.

At the start of the second cycle, FUNDAMAR ONG will be in charge of project administration and management. It is important to point out that FUNDAMAR is supported by the fiduciary agent and FUNDASET. FUNDAMAR represents the 16 associations and administers and manages funds received in trust from CHEMONICS grants to farmers associations.

The project Management Unit acts as project operator through a civil service contract between the Fiduciaria Popular S.A, the administrator of the Autonomous Patrimony, and the FUNDASET.

4.6 ENVIRONMENTAL DESCRIPTION OF THE PROJECT AREA OF INFLUENCE

4.6.1 Regional Indirect Area of Influence of the Project

Since the project involves planting crops in eight municipalities in the department of Huila, a regional indirect area of influence was considered by the Consultant. Project socioeconomic components extend beyond the direct area of influence to the indirect area of influence, given the magnitude of project capital investments. Areas of illegal plantations are included in the indirect area of influence, as these are part of the project's main social objective. Other municipalities are developing passion fruit plantations that will, somehow, affect the project.

4.6.2 Local Direct Area of Influence of the Project

Since the Passion fruit project is an agricultural enterprise of an associative nature, it is impossible to establish a unique, consolidated area of direct influence Instead, several areas receiving direct project influence have been defined, these are located within plantation limits and extend beyond a 100 meter perimeter, including the rivers and streams that receive efluentes from plantations.

4.6.3 Abiotic Component

- **Geology and Geomorphology**

The municipalities of the project are located in a Northeast-Southwest, (NE-SW), morpho-structural unit along the Magdalena river valley, surrounded by the flanks of the eastern and central branches of the Colombian Andes. The entire region is formed by a nucleus of pre-cambric and paleozoic rocks above which there is a dense mezzo-paleozoic sedimentary sequence originated in platform

and continental marine environments, (Cenozoic). Regarding geomorphology, slopes in the municipalities La Plata, Nátaga, Teruel and Palermo, along the oriental flanks of the central cordillera, and others along the western flank of the eastern cordillera, such as Algeciras, Tello, Baraya and Colombia, range between 0% and 5% in flat areas and 15% to 50% in the more abrupt zones. Some passion fruit cultivation zones with steeper slopes were identified in the hillside areas in the municipalities of Algeciras and Teruel, in the western and eastern flanks of the Eastern and Western Andean *cordilleras*.

The stratigraphic units of the area correspond to volcanic rock, (ignimbritas, riodacites, dacites, riolitas_and agglomerates) of Triassic era and Jurassic igneous rocks. Other Cretaceous rock formations include deposits over volcanic strata and in faults adjacent to igneous rocks. This Cretaceous litological sequence give way gradually to a series of tertiary sediments represented by sandstones, clays and conglomerates that cover the preceding. Quaternary alluviums stand out filling river valleys and streams. Coluvial deposits represented in mud fluxes and debris fluxes, are generally localized near the hillsides.

- **Climate**

The area of the study has a predominantly dry and very dry tropical climate. The average annual temperature ranges between 27° C in the lowest areas to 23° C in the highest. Precipitation averages between 923 mm and 2,008 mm with two rainy seasons that extend from March to May and from October to December, and two dry seasons in between. The average values of relative humidity vary between 65% in the dry seasons and 85% in the more rainy months.

- **Hydrology**

The municipalities involved in the passion fruit project are located within the great hydrological valley of the Magdalena river. The rivers and valleys on which plantations are located arey: Neiva River, (Algeciras), Pedernal River, (Teruel), Cabrera River and Venado Rivers, (Baraya y Colombia), La Plata River, (La Plata), Páez River, (Nátaga), Baché River, (Palermo), and Villa Vieja River, (Tello). All these rivers originate in the mountains with slopes equal or greater than 20%. In general, the river waters analyzed present no problems related to presence of organic matter, nitrogen or phosphorus compounds.

In regard to groundwater, the flat area of the Magdalena river valley is being used for irrigation in rice plantations, given the scarcity of superficial water. Use of water in the hills is restricted due to high farming demand in the zone.

- **Water Quality**

Water quality analysis performed from selected sources to determine the status of initial indicator references in passion fruit farm areas are as follows:

The biochemical oxygen demands indicate that water present no problems regarding concentration on organic matter. The DQO of the Neiva River in Algeciras and Palermo show a small presence of chemicals that could proceed from agrochemicals employed in other plantations elsewhere.

Total choliforms are high in the Neiva River, (Algeciras), these may originate in liquid and solid waste from stables dumped in the river.

Oxygen value is high considering the altitude of the project zone and water temperature, the latter being and important factor related to self-depuration capacity of streams. Other parameters are within the established norms for any use. In general, the analyzed streams present acceptable optical qualities, insofar as they are transparent, with the exception of Baraya, where solid contents are three times above readings in other sources.

The Baraya river has the greatest salt concentration, and is the heaviest of all the waters analyzed. This is probably due to the fact that the river passes through carstic geological formations. Anthropic contamination is discarded as the DQO is low.

In general, waters from analyzed streams present no problems related to presence of nitrogen or phosphorus compounds, and indicate normal amount of rotting organic matter and no detergent. The results of the laboratory tests are shown below.

Table 15. Water Quality Results for the Project's Direct Influence Area

VARIABLE	UNIT	SAMPLING SITES					
		Q. Pedernal TERUEL	R. Baché PALERMO	C. Venado BARAYA	R. Neiva ALGECIRAS	Q. La Perdíz ALGECIRAS	NORMA COLOMBIANA
Chlorides	mg Cl/lt.	1.3	1.4	1.5	0.5	0.9	250 *
Fecal Coli Bacteria	NMP/100 ml	80	23	500	900	30	2.000 *
Total Coli Bacteria	NMP/100 ml	2400	1400	2400	5000	1700	20.000 * 1.000 **
Conductivity	uS/cm	89	129	388	85	93	-
DBO5	mg O2/lt.	<1	<1	<1	<1	<1	**** [3]
DQO	mg O2/lt.	3	6	3	6	2	No aplica
Total Hardness	mg CaCO3/lt.	68.52	53.88	230.3	56.61	45.68	No Aplica
Total Phosphorus	mg P/lt.	0.125	0.07	0.039	0.091	0.122	No
Nitrogen Ammonia	mg NH4-N/lt.	0.12	0.14	0.18	0.21	0.13	1,0 *
Nitrates	mg NO3-N/lt.	<0,05	<0,05	<0,05	<0,05	<0,05	10,0 *
Nitrites	mg NO2-N/lt.	<0,006	<0,006	<0,006	<0,006	<0,006	2,0 *
Orthophosphates	mg P/lt.	0.015	0.011	<0,006	0.019	<0,006	No
Dissolved Oxygen	mg O2/lt.	7.34	7.48	7.38	7.22	7.25	> 4,0 ***
pH	Units	8.06	8.43	8.39	7.64	7.88	6,5 – 8,5 * 4,5 – 9,0 ***
Total Solids	mg/lt.	85	84	304	148	84	No
Sulfates	mg SO4/lt.	2.4	5.4	50.9	13.9	6.3	400 *
Organichlorinated Pesticides	µg/lt.	<0.2	<0.2	<0.2	<0.2	<0.2	-

Soils

Use of soil in project zones are as follows: 55% of the area corresponds to natural grasses, controlled grasses and weed grasses. Vegetative accounts for 20% of total soils, 11% forests, 10% coffee, 2% rice, 1% cocoa and 1% eroded areas.

[3] Mc Kee, J.E & H. W. Wolf (1973).

Algeciras municipality: Presents mountain soils, temperate climate between 1,200 m and 2,200 m over sea level, classified as type I soil. These soils are for cattle rising and present erosion processes, due over-grassing.

Baraya municipality : The soils are classified as 1|) mountain soils in dry and temperate climates of sedimentary rock origin, exhibiting irregular terrain with forest relicts in canyons; 2) Mountain soil of hot - dry climate located in superficial to moderate hills; 3) hillside soils of hot dry ad very dry climate located under 1,000 over sea level, near the flanks of the cordillera in an intermediate position in respect of the Magdalena valle; and 3) mountain and alluvial soils in dry or very dry climate valleys, located at less than 1,000 m over the sea level. Currently, the use of the soil in project areas is characterized by rice, coffee, cocoa, plantain and fruit trees plantations, as well as multipurpose cultivations of sugar cane, corn and yucca, and natural grasses, grasses, debris and forests.

Colombia municipality : In this municipality, cordillera lands range from strongly undulated to very sheer with slopes ranging from 25 to 50% and higher. In localized places there are flat or undulated lands. The soil is composed of sedimentary materials, volcanic ash or heterogeneous materials and are superficial to moderately profound. These soils have good drainage and low fertility due to erosion processes.

La Plata municipality: According to soil studies from 1,000 m to 1,200 m over the sea level, and up, soils are classified as unsaturated, acidic and advanced evolution and strong alteration in materials as well as a caolinitic clay neoformation.

Nátaga municipality: In general soils range from deep to superficial and from medium to low natural fertility. There is light, localized erosion, and moderate textures with thicker intrusions.

Palermo municipality: This soil is characterized as being located in the cracked relief on the warm thermal floor in the eastern sector of the block. The soil is moderately evolved and superficial between 500 m and 1,000 m over sea level. Soils are saturated, featuring a humidity deficiency for plants during long periods throughout the year, and are moderately eroded.

Tello municipality: The soil of this municipality between 400 m and 900 m over sea level, are loam, sandy and of a moderate fertility, exhibiting a pH from 5.4 to 6.6 and low organic matter content. Soils between 900 m and 1800m over sea level have a low fertility, pH between 5.5 and 6.5 and an organic matter content of 2.5 to 4.5.

Teruel municipality: The municipality of Teruel exhibits superficial to moderately deep soils in valleys and terraces. Natural fertility is low in the sub valley of the Negro de Narvaez River, (Páez River), and the low and medium part of the Pedernal River, (Yaguará River). Erosion is moderate in this last one and medium texture present themselves in the terrain while in the Narvaez river it

presents thick inclusions..

According to lab tests done on several plots, soils are generally loam sandy, pH between 5.6 and 6.5, deficient in organic matter, nitrogen phosphorus, boron and the ion ammonium. Low contents of potassium, magnesium, copper and zinc, medium contents of sodium, calcium and magnesium and high to excessive contents of iron and aluminum in some cases.

Most of the parcels are located in hillsides with slopes between 12 and 50%. Those with lower slopes are slightly more fertile and have greater contents of organic material and clay, making drainage imperfect or deficient.

4.6.4 Biotic Component

The description of the biotic component in the direct influence area of the project includes the characterization of native flora and fauna, endangered species and critical, vulnerable, sensible and environmentally important ecosystems, that require special treatment for the duration of the operation of the project.

Bioclimatically, the project corresponds to the formation dry tropical forest, (bs-T), however some of plantations are located within the humid pre-mountainous forest, (bh-PM).

The original native vegetation of these formations has been substantially altered by man giving way to pastures and cattle rising, as well as rice, coffee and food-crops. The native forest can only be seen in few spots at higher altitude and in steep slopes, sometimes greater than 100%, surrounding watershed, (streams and creeks), and in plant structures called “galleries”.

The predominant vegetation found in the project area are pastures with clear signs of superficial erosion and some light brush in drainage ditches in a plantation near the Palermo municipality. The tree and bush cover is very low.

- **Native Wildlife**

Due to the low density of forest masses that exist in the designated area for the cultivation of , the native fauna is not an important resource in this agro-ecosystems that have been utilized for a long time to cultivate even in the early 90s. This means that wildlife is only important at the regional level, (near streams and rivers). Some animals may venture in farm areas, but will not remain there as they are hunted by dogs and humans alike for food or sport.

- **Mammals**

Mammals are the most vulnerable species to human intervention and require excellent habitat to survive and reproduce. The project area lacks the kind of habitat required by many species, although some, such as chiroptera, (bat), carnivores and rodents enter the area sporadically in search of food.

- **Birds**

As opposed to the mammals, birds have a greater adaptation capacity to new environments, although some species must search for preferred habitats. Few birds were sighted in the project area, however, this may have been on account of the time of day when the sightings took place.

The species observed directly in passion fruit plantation areas were: *Egretta Tula, Coragyps Atratus, Vanellus Chilensis, Zenaida Auriculata, Brotogeris Jugularis, Crotophaga Ani, Galbula Ruficauda, Elaenia sp. Tyrannus Melancholicus, Sturnella Magna, Thraupis Episcopus*. None of these species have been reported as being endangered or in peril of extinction.

Of the reported species for the higher areas of the cultivation zone, (regional distribution has been affected by deforestation), only sis individuals were sighted: one hawk, four parrots and one hummingbird. These species must be protected, preventing capture and preserving habitats.

- **Reptiles**

Reptile species diminish in higher altitude zones; however, reptiles have not been suited at all in the project area.

The reptile species, (lizards, serpents and turtles), that can be found in the region and could be in the area are : *Basiliscus Basiliscos, Hemidactylus sp., Gonatodes sp., Iguana, Anolis sp., Anolis Auratus, Mabouya Cabuya, Cnemidophorus sp., Oxyrhopus Petola, Liophis sp., Spilotes Pullatus, Gochelone Carbonaria.*

- **Amphibians**

Amphibians form a distinct group, diversity and abundance of amphibians is in direct relation with the type of ecosystem, lentic or lotic. It was only possible to obtain information on the following species: *Bufo granulosus, Bufo marinus, Hyla crepitans, Eleutherodactylus achatinus*. No endangered species reported.

- **Aquatic Biota**

The aquatic biota is part of the sub-basins and micro-basins that drain in the Magdalena river. In general, waters are transparent. However, many streams and rivers serve as natural sewers transporting untreated sewage.

Bentonic organisms (macrofits and macro invertebrates), plankton (fito and zooplankton), perifitics (micro seaweeds adhered to river substrates) and nectonics (fish) live well in rivers in the project direct and indirect zone of influence. Each one of these groups present a population structure that allows for diagnosis of water quality through biotic indexes that must be established for each particular watershed.

Bentonic organisms have been identified by CAM in the Upper Magdalena river watershed: Platelmints, Aneloidae, mollusks, arthropods (including crustaceans and insects). Plankton are either microscopic algae belonging to the Clorofíceas, Cianofíceas y Diatomeas, or invertebrate larvae that grow in benthos or nekton. The perifiton is composed by the same micro algae found in plankton but in sessile form, adhered to a substrate. Nektonic organisms correspond to fish. In warm areas, (bellow 1,500 m over the sea level), Loricáridos, (cuchas), Carácidos, (bocachico), Pimelódidos, (nicuros), and Ciclidos, (native mojarras), are found in temperate climates (between 1,500 m and 2,500 m over the sea level). Pygídidos and Astroblepidos live in old climates such as creek trout, a non native specie to the area, which has displaced other species of Astroblepidos.

4.6.5 Protected or Special Care Natural Areas

None of the project sites in the 8 beneficiary municipalities are in conflict with any protected natural areas, located within indigenous community territories or in forest reservations, private or public.

Protected natural areas located in the project municipalities not directly related with passion fruit plantations, subject to deforestation for human intervention looking for wood to manufacture stakes and illegal crop planting, are being closely watched by project operators

Table 16. Protected Natural Areas in the Region

MUNICIPALITY	NATIONAL SYSTEM OF PROTECTED AREAS			
	PNN	BUFFER ZONES	STRATEGIC ECOSYSTEMS AND FOREST RESERVES	
			PRIVATE	ESTATE
ALGECIRAS[4]				La Siberia and Miraflores Mountain
BARAYA			Projected Reforestation Hacienda Pennsylvania	Watershed R. Guaroco and Q. La Nutria (Drinkingwater)
COLOMBIA		PNN Sumapaz		

[4] The Cartón de Colombia private natural reserve is located between 1,200 to 2,400 m over the sea level

MUNICIPA-LITY	NATIONAL SYSTEM OF PROTECTED AREAS			
	PNN	BUFFER ZONES	STRATEGIC ECOSYSTEMS AND FOREST RESERVES	
			PRIVATE	ESTATE
LA PLATA	Puracé	PNN Puracé	Merenberg[2]	Las Minas Range[1]
ÍQUIRA		PNN Huila Volcano		
NÁTAGA				Nieves Range[1]
PALERMO			La Pita Farm, (Headwaters Q. La Guagua - Drinkingwater)	
TELLO				Headwaters Rivers Villavieja and Fortalecillas
TERUEL		PNN Huila Volcano		Nieves Range[1]

4.6.6 Social Component

The description of the socioeconomic and cultural aspects of the project includes the regional and the local aspects. The project regional zone is conformed by the 8 municipalities, while the local zone include areas inhabited by project beneficiaries.

4.6.7 Regional Context

The area of the project is conformed by the municipalities of Algeciras, Baraya, Colombia, La Plata, Nátaga, Teruel, Tello and Palermo.

- **Urban and rural population of the project**

The rural and urban population of the project is indicated in table below, including data from 1993, last census year, and projections to 2005 according to the the National Department of Statistics, DANE.

Table 17. Population Growth in Project Municipalities 1.993 – 2005 - (Inhabitants)

Municipality	1993			2000			2005		
	Total	Nucleus	Periphery	Total	Nucleus	Periphery	Total	Nucleus	Periphery
Algeciras	19.758	8.742	11.016	22.959	10.079	12.880	23.788	10.794	12.994
Baraya	8.092	3.801	4.291	9.035	4.203	4.832	9178	4.401	4.777
Colombia	9.336	1.942	7.394	10.259	2.247	8.012	9.993	2379	7.614
Nátaga	5.171	1.596	3.575	6.233	1.945	4.288	6785	2.235	4.550
La Plata	36.240	16.226	20.014	41.389	18.380	23.009	41.967	19.253	22.714
Teruel	6.737	3.429	3.308	7.499	3.774	3.725	7.567	3.921	3.646
Tello	13.187	3.559	9.628	15.594	4.305	11289	16.584	4870	11714
Palermo	17.893	8.004	9.799	20.641	9.203	11.438	21.510	9.905	11.605
TOTAL	**116.414**	**47.299**	**69.025**	**133.609**	**54.136**	**79.473**	**137.372**	**57.758**	**79.614**
Percentage	**100**	**40,6**	**59,3**	**100**	**40,5**	**59,5**	**100**	**42,0**	**58,0**

Source : DANE – National Population Statistics – Census 1993

The results found can be summarized as follows:

1. It is predicted that the total population of the project will increase from 116,324 to 137,372 inhabitants within the reference period, i.e., 1.40% annual growth rate.
2. The majority of the population will continue living in rural areas. In 1993 rural population represented 57.96% of total, this treat will continue through 2005. The growth rate of this population is 1.20%

- **Public utilities**

Health services in the urban areas are insufficient in both infrastructure, personnel and physical means, represented by the Urban Health Centers level I, hospitals. In rural zones, the service is supplied by Health Posts staffed with nurses, providing scarce coverage in spite of efforts carried out by the Service to Health Beneficiaries, (SISBEN), to cover people in economic strata I and II. Diseases of the intestinal tract, skin and teeth are prevalent, along with malnutrition.

Education level is low among the farmers, with 16.3% of the surveyed population having finished primary education, 6.8% with secondary schooling, and just 1% with access to technical schools.

Electric power is supplied by the Huila electric company, covering 90% of urban areas and 70% of rural zones. Telephone service is supplied by Telecom in the urban areas, rural service is limited.

Basic sanitation, including potable water, sewerage and garbage collection, is available in urban centers, although limited I regards to water treatment (fluoridation is applied). There are no technically adequate sanitary landfills, liquid waste is poured into rivers and creeks. The major

sanitary limitation in rural areas consists in inadequate installations for sewage disposal, (septic tanks and latrines), and in some places limited water treatment. A large number of population in the project zone do not have access to basic infrastructure.

According to the 1993 census, poverty levels in the project zone range between 38% in the Palermo municipality and 66.8% in the municipalities of Colombia and Nátaga; below-poverty levels range from 13.5% to 43.8%. Overcrowding, school absenteeism, inadequate services and high economic dependence are common.

- **Regional Economic Activities**

Agriculture is the most important activity, most of the project zone population depends on farming and agricultural related activities. In 2000, farming area in the project's municipalities accounted for approximately 36,500 ha (Yearly Statistics Book of the department of Huila), distributed in: transition plantations, (21%) including rice, beans, corn, fruits and vegetables; annual crops like plantain, yucca and cocoa plantations, (38%); and coffee as a permanent crop, (49%). The high participation of coffee indicates low-incomes due to lower coffee market prices in the last five years.

Other activities, such as cattle rising, are exploited extensively in flat areas and in hillsides. Fisheries are common in the region providing for "Mojarra", Carp, "Cachama" and trout.

Mining activities include oil exploitation, which has been greatly reduced in recent years due to insecurity, and the non-industrial exploitation of marble and lime in the Palermo municipality.

The secondary (industrial) sector is affected by reduced low level of products transformation activities. Most semi-industrial activities in the region relate to mechanic shops, bakeries and small-shops, which have no significant importance as industrial processes or income generation.

The tertiary sector (goods and services) include financial services, food retail, drug stores transportation, health and education services etc. This activity is complemented by micro industries of local production and consumption.

4.7 CHARACTERISTICS OF THE DIRECT AREA OF INFLUENCE OF THE PROJECT

- **Social Aspects**

A survey conducted by Fundaset in early 2002 provided consultants with basic information on socioeconomic aspects. Farmers are mostly of mestizo origin, resulting from the mixture between whites and the indigenous Páez ethnical group. The typical family nucleus is usually six individuals. Groups of two families averaging 15 individuals, have been observed. Gender composition of the population, registers a higher participation of women.

Children under the age of 14 constitute 38% of the total population. Working age population, between 15 and 59 years old, represents 54%, and 60 year olds represent 8% of the total population. Education level is low among the farmers, 16.3% of the surveyed population completed primary education, 6.8% complete secondary school, and 1% technical school. No higher education cases were reported. Access to health services is acceptable, 84.60% of the population have some healthcare coverage.

Telephone coverage and quality of service is critical as people have no other communication options. Sewerage options are minimal, the survey indicates that 15.4% of homes have no sanitary installation, the main alternative is open ground. Electric power supply and access to potable water are less critical; 60% of homes have access to drinking water, the rest of the population has water but it is at risk of contamination because they use only boiling as a purification measure.

Housing conditions are characterized by the predominance of "*bahareque*" or waddle, pressed mud use in house construction, along with cement floors and galvanized roofing. This problem becomes critical if more than one family inhabits the house.

- **Economic Aspects**

The average area of passion fruit plantations is 2 ha. Farmer-owned plots may be larger, containing more than one crop. 53.50% of the lands are rented and 46.5% are being worked by owners. The predominance of rented land is explainable because some people are waiting for project outcomes before buying land.

Project agricultural activities include small areas of coffee, beans, corn, tomatoes and vegetables as a self-sustenance alternative. Cattle raising is low, with the exception of the municipalities of Palermo and Tello, where beef cattle thrives. Presence of minor species such as poultry and pigs is common. Access roads to the parcels are either good (56.5%), regular (28.2%) or inadequate (15.3%).

Most of the rural population survive on agriculture and, to a lesser degree in cattle herding activities. The daily wage is CP$12,000, a little over $4.00/day. 15.4% of the population receive CP$100,000/mo ($39/mo), other 15.4% earns CP$150,000/mo ($58/mo), 30.80% make CP$200,000/mo ($77/mo) and 38.40% earn over CP$201,000/mo.

Most farmers participate in the project through Farmers Associations, affiliated to FUNDAMAR, a requirement to access project funding through fiduciary arrangements provided by the Fund for Agrarian Development, (FINAGRO), and grants from Chemonics. FUNDASET, the project operator, provides permanent technical assistance to Farmers Associations. 53.80% of the farmers are members of the Communal Action Boarinof their *vereda,* while 46.20% have no part in such organizations. The Municipal Technical Assistance Units (UMATAS) are the main municipal entities provide complementary technical assistance services to farmers.

- **Cultural Aspects**

Pressure Over Natural Resources and Conflict Resolution: The use of chemical products and deforestation affects the surface of the soil, the latter contributes to the erosion processes. This problem is significant as the project area is under the indirect influence of nearby Andean snow and glaziers ecosystems, and natural parks. Water resources are affected by inadequate disposal of coffee plantation residues.

The major conflict in passion fruit environmental aspects, is poor soil condition and compounded action of deforestation. Another significant socio environmental impact is spraying of illegal plantations, which affects small farms. In the first case, The Regional Corporation of the Upper Magdalena intervenes in the project area but its action is limited. The second problem can only be addressed by the government.

Resistance to Change and Sense of Belonging: farmers are optimistic in regards to project results, they trust FUNDAMAR organizational inputs and technical support provided by FUNDASET, that operates in close contact with the farmers associations, who in turn, are in contact with farmers. These expectations are vital to farmers who understand the importance of cultivating the land, live in it and work in it. They long to achieve security again, the major obstacle faced by rural communities.

4.8 PEST AND PESTICIDE PROBLEMS IN PASSION FRUIT CROP

Management of pests and related pesticide control in passion fruit farming may cause possible negative effects on the environment, these challenges need special care and must be dealt with to protect human life as well as natural resources.

This section discusses passion fruit crop pests issues and proposes management controls and measures, including toxic and eco-toxic analyses of pesticides used in passion fruit crops, as well as options for an Integrated Pest Management (IPM) program that would minimize the use of agrochemicals.

An important environmental impact is the potential for natural deterioration due to the use of agrochemicals, especially pesticides. Regulation 216 requires that a PERSUAP be carried out for each chemical used, or to possibly be used; as a follow through, an Integrated Pest Management Plan (IPM) was incorporated for each chemical, so that natural, non-chemical means of pest control can be viable options for the farmers. The following section presents a study of the pests of the crop and their management, including toxic and eco-toxic analyses for the main pesticides used, as

well as the existing options for an IPM program that allow for a continuous decrease in the altogether use of agrochemicals[5].

4.9 IMPORTANT FINDINGS AND GENERAL RECOMMENDATIONS

4.9.1 The Colombia Alternative Development (CAD) Program

The Colombia Alternative Development (CAD) program, funded by USAID in the context of Plan Colombia, supports farmers, farmers' families and farming communities that have been involved in production of illicit crops, such as coca and poppy, to switch voluntarily to licit crop production. Working with communities, community associations, and municipalities in the departments of Bolivar, Cauca, Caqueta, Huila, Nariño, Norte de Santander, Putumayo, and Tolima, the program is creating licit economic opportunities to generate income, improve the quality of life, protect the environment, and support ethnic and cultural values for peaceful coexistence. The program uses an open-bid approach to call for proposals from farmers' organizations in support of basic staple crops ('*cultivos de pan cojer*') as well as 'industrial' crops targeted to internal or external markets, many of them with associated industrial processing and transformation.

So far, most crops supported by CAD have been of low input agricultural systems, ecologically appropriate, with an integrated, if not an ecological or organic, approach to crop production and pest management (see "Pest in Passion Fruit Farming and Management Guide"). This is the type of alternative development that, by protecting the health of Colombians and their environment not only maximizes the chances of becoming sustainable in the long term but also, by diversifying the production system it reduces production and marketing risks for the farmers.

<u>Recommendation No. 1</u>: CAD should continue with this eco- friendly approach to promote alternative crops, leading into sustainable development, to benefit Colombian eco-environment and health of participant farmers and their families, as well as of consumers.

[5] The detailed requisites for pesticides in Reg. 216.3.(a).10.(b).(1).(i).(a) – (l), being literals (a) through (l) will be presented as numerals 1 to 4.2 plus the subsequent explanatory tables 1 through 8.

4.9.2 Insect Pest Infestation and Diseases

CAD is actually taking crops from traditional cropping areas to new ones in the Colombian territory. Although, the majority of these crops are not really foreign, to the country or to the regions where CAD is operating, they have been grown, if at all, only in very reduced areas.

<u>Recommendation No. 2:</u> In order to prevent the dissemination of contaminated crop seed with pathogens, insect pests, and weed propagators. CAD should establish a strict plant sanitation-quarantine system based on international agreed and Instituto Colombiano Agropecuario (ICA) certification procedures and quarantines for the movement of plant materials into the country as well as from one region to another within Colombia.

4.9.3 Pesticide Use

There is no clear evidence of abuse or misuse of pesticides in CAD project crops. Two issues of concern, however, need to be mentioned. The first issue relates to the mentality of farmers that will participate in alternative development programs. Illicit crop farmers, such as those dealing with coca and poppy, are used to abundance of inputs to produce highly marketable and economically valuable illicit crops. Due to the extremely high prices paid for coca and poppy, the economic and action thresholds for pest control, as traditionally used in Integrated Pest Management (IPM), are so low that they become totally irrelevant for rationalization of use of pesticides. As such, pesticides as well as other agricultural production inputs are used in large quantities, subject to abuse and misuse. The tendency to use pesticides as the main, or even the sole, resource for pest management is one of the major challenges facing CAD in order to 'rationalize' pest management programs in alternative development farming.

The second issue is distribution of pesticides in Colombia. This is done through large- and medium-size distributors located in Bogotá, Cali, Medellín, and in other major cities in Colombia, continuing through mid- to small-size pesticide dealers located closer to the final users. During the visits carried out by the consultants to distributors, at all levels, we perceived (1) full compliance of Colombia manufacturers and importers with international codes regarding labeling and packaging of pesticides; (2) adequate size of pesticide packages as reported by the final users; (3) good degree of cleanness and organization in all stores visited; (4) no evidence of re-packaging of pesticides; and (5) a relatively good level of knowledge about pesticides, their toxicity and labeling by store attendants. A problem, although not directly observed but heard of in the field, seems to be illegal distribution of smuggled foreign pesticides, including products cancelled and prohibited in Colombia. Given the general insecurity situation of the rural areas where CAD operates, Colombian authorities are limited in their capacity to fully control this illegal traffic of pesticides.

In summary, due to extremely favorable cost/benefit ratio on the use of pesticides in illicit crops, CAD farmers overuse pesticides in licit crop production as well, without the benefit of rigorous health or environmental analysis. Many of the products used are highly toxic and many are

environmental hazards[6]. The well-controlled legal pesticide market is offset by illegal trading of pesticides that are difficult to control. These are major challenges that both, the Government of Colombia (GOC) and CAD, face in promoting environmentally friendly and sustainable alternative development.

<u>Recommendation No. 3</u>: CAD should follow a strategy that (a) supports project operators to make farmers, and their families, fully aware of the health hazards of pesticides; (b) supports project operators, civil society and government authorities to make farmers, their families, and the larger Colombian community aware of environmental hazards, and social costs, related to pesticide abuse and misuse; and (c) provide technical assistance to project operators for Safer Use of Pesticides (SUP) and Integrated Pest Management (IPM), based on the principles of economic loss, action levels and thresholds[7].

4.9.4 Pesticide Assessment

The review of passion fruit pesticides, presently used by farmers, recommended by technical institutions and/or so far requested by project operators for their productive activities (can be seen below in the tables that follow). Most of these pesticides were cleared based on the review of the 12 points of *22 CFR 216.3(b)(1)*. However, some of them do not fully comply with USAID environmental requirements for development projects. Of the total, only 7 active ingredients were selected, to be further studied as possible pesticides to be used in passion fruit crop pest management (see table No. 23). These pesticides were then subjected to the more complete 'risk analyses, discussed and shown in a table No. 25.

<u>Recommendation No. 4</u>: Some of the pesticides being presently requested and or purchased by CAD operators are to be *phased out* following the subsequent timeline. (a) In order to allow time for the search of alternative products, preferably non-chemical, while still protecting the crops, the insecticides: carbofuran, chlorpyrifos, and profenofos, and the fungicides: chlorothalonil and copper oxychloride should be phased out in the medium term (1-1.5 years). (b) Due to higher than accepted health and environmental risks, and the availability of pest management alternatives to these molecules, the fungicides: benzimidazole, captafol, hexaconazole, kasugamicine and ofurace, and the insecticides: methomyl, cyfluthrin, cyalothrine (lambda) and cypermethrine should be phased out in the short term (0.5-1 year). (c) The highly toxic and easily replaceable insecticides: monocrotophos, metamidophos, aldicarb, isazophos, and methyl parathion and the herbicide: paraquat should be phase out immediately. (d) And finally, and additionally to this, no product listed in the prohibited pesticides category in the US or Colombia, should ever be used in this project.

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[6] More than 30 commercial pesticides are regularly used in Putumayo. Thirty percent of local farmers use paraquat at least once a month and 14% regularly use metamidophos, among other products (US Embassy, 2001).

[7] IPM programs may use economic injury thresholds, e.g. when pest populations reach high numbers causing economically 'significant' damages, and/or action thresholds, e.g. the population density or the damage level require application controls to prevent the pest to reach the economic injury threshold.

4.9.5 Safer Use Practices

Colombia is one of the most advanced countries in Latin America in regards to pesticide registration, regulation and control, as well as in agronomy and associated disciplines. Colombia has adopted state of the art pesticide registration procedures, including international standards and codes for pesticide labeling and a follow-up system to control pesticide manufacturing and distribution, albeit limited by security issues during the past 25 years. Most technicians working in Colombia in pest and pesticide management have solid knowledge and understanding of IPM and safer use of pesticide procedures. However, there is room for improving interventions on Safer Use of Pesticides (SUP). The majority of farmers participating in CAD projects do not use the 'best practices' approach in dealing with SUP: less than 10% use some type of personal body protection in handling and product applications, and 70% of those directly exposed to pesticide spills do nothing, not even cleaning up or decontamination procedures (US Embassy, 2001).

Recommendation No. 5: Considering the traditional attitudes and practices of participant farmers regarding use of pesticides, as well as the limited GOC official presence in isolated, and conflictive, areas where CAD is operating, it is recommended that a strong SUP program be implemented. Such program should (a) be based on the pre-existing training offer already available in Colombia; (b) attempt to raise 'awareness' of health and environmental pesticide hazards, as well as to teach 'good practices' on SUP; and (c) include parallel training in 'ecological agriculture' and IPM, to prevent SUP to become a false panacea.

4.9.6 Pest Management Approaches

Most Colombian professional agronomists have been exposed to, trained in and has an understanding, if not a full knowledge of IPM. This has become, not only the 'official' approach to pest management at the state-government institutional level (ICA), but also it has taken root in para-statal (Corpoica) institutions, in charge of pest and pesticide R&D, as well as in private R&D organizations. This is the case of grower associations, such as Cenipalma, Cenicafé, Cenicaña, and Fedecacao. Moreover, Colombia is the headquarters for the well reputed CIAT, a centre for tropical agricultural research that has conducted pioneer research on IPM of insect pests and diseases in various crops, foremost among them cassava. Relevant to this PERSUAP, we highlight the availability of IPM programs for oil palm, cacao, plantain, sugar-cane, rice, and timber plantations.

As shown in the tables below, Colombia is well advanced in the production of bio-inputs for pest management, such as microbial pesticides, entomopathogen fungi, bacteria and viruses, as well as nematodes and parasitic wasps. These bio-inputs are produced and sold in the country by a variety of small, mainly national, industries (see tables below). The important issue, from an IPM perspective, is that these products become a readily available, much healthy an environmentally

friendly option to the chemical pesticides. As per an expert entomologist and IPM practitioner, "Colombia is better positioned than the US for the supply of bio-pesticides to agriculture".[8]

<u>Recommendation No. 6:</u> CAD is encouraged to disseminate, among project operators, both of the below lists of bio-pesticides (Table 18) and enterprises producing bio-products (Table 19) in an effort to promote their use in substitution of the more toxic and environmentally hazardous chemical pesticides.

As per a Reg 216 requirement, and as stated previously, in order not to transmit the false idea that pesticides, used safely, could be the sole solution to pest problems, SUP should not be promoted in isolation but rather in the context of a larger, more comprehensive approach to pest management, that of Integrated Pest Management, or IPM. Colombia is well ahead in IPM research and development as well as in IPM training. Additionally to the pesticide analysis, a considerable amount of effort in the preparation of this PERSUAP has been allocated to the development of IPM matrices that summarise the available tactics to manage the major crops pests and provide the user with additional references to the subject as well as main contacts for technical support and their Management in this section. This is to the benefit of the CAD project operators that can find in these tables guidance for the avoidance of the most toxic pesticides as well as non-chemical options for pest management.

<u>Recommendation No. 7</u>: In spite of the good technical level of the field technicians working within CAD and the CAD project operators, technical support in IPM should be strengthened. This may take the form of (a) crop specific field demonstrations on the use of non-chemical pest control methods; and (b) provision of support to the technical staff of the operators for training-of-trainers as well as for direct farmers training in crop-specific IPM programs.

[8] Dr. Anthony Bellotti, Cassava IPM Leader, CIAT, personal communication.

Table 18. Main Biological Inputs Produced in Colombia*

Entomo-pathogen fungi	**Fungi bio-fungicides**	PARASITOIDS	PREDATORS	**Entomopatho-gen bacteria**	**Entomopatho-gen viruses**
Beauveria bassiana	*Trichoderma harzianum*	*Trichogramma exigumm*	*Chrysoperla externa*	*Bacillus thuringiensis*	Nuclear Polyhydrosis Virus (NPV)
Metarhizium anisopliae	*T. lignorum*	*T. pretiosum*	-	-	*Baculovirus ello*
Paecilomyces fumosoroseus	*T. viridae*	*T. atopovirilia*	-	-	-
Nomuraea rilely	*Gliocadium spp.*	-	-	-	-
Paecilomyces lilacinus, minense	-	-	-	-	-
Verticillium lecanii	-	-	-	-	-

* Table courtesy of Dr. A. Bellotti, CIAT.

Table 19. Main Enterprises Producing Biological Inputs in Colombia*

Enterprise	**Inputs = Organisms**
Agricultura Biológica (Buga-Valle del Cauca)	Entomopathogen fungi, Parasitoids, Predators, Bio-fungicides
Agrobiol (Buga-Valle del Cauca)	Parasitoids
Bioecológicos (Palmira-Valle del Cauca)	Entomopathogen fungi, Parasitoids, Predators, Bio-fertilisers
Biocontrol (Palmira-Valle del Cauca)	Entomopathogen fungi
Productos Biológicos Perkins (Palmira-Valle del Cauca)	Entomopathogen fungi, Parasitoids, Predators
Productos Biológicos El Bolo (Palmira-Valle del Cauca)	Parasitoids
Laverlam (Cali-Valle del Cauca)	Entomopathogen fungi and viruses
Orius (Villavicencio-Meta)	Entomopathogen fungi
Biogarden (Bogotá-Cundinamarca)	Entomopathogen fungi
Biocaribe (Medellín-Antioquía)	Entomopathogen fungi
Live System Technology-LST (Bogotá-Cundinamarca)	Entomopathogen fungi, Bio-fungicides

* *Table courtesy of Dr. A. Bellotti, CIAT*

4.10 PERSUAP, BACKGROUND

4.10.1 CAD Environmental Compliance

CAD is undertaking full compliance of USAID environmental regulations in Colombia. Previous Initial Environmental Examinations (IEE) have been completed for most CAD projects and related activities, as per LAC-IEE-99-38 and LAC-IEE-00-35. A Programmatic Environmental Assessment (PEA) was completed for CAD and approved in June 2003. USAID required CAD to regularize environmental compliance, including preparation of a full study on pesticides used in alternative crops promoted by CAD. To this effect, Chemonics International commissioned the present Pesticide Assessment Report and Safer Use Action Plan (PERSUAP) for crop projects supported by CAD to date.

4.10.2 PERSUAP

This PERSUAP has been prepared to achieve the dual purpose of (a) complying with USAID environmental regulations, and (b) providing CAD project operators with practical tools for better and safer management of pests affecting their crops. The PERSUAP not only analyses pest and pesticide issues in crops supported by CAD, but also addresses broader issues related to pest and pesticide management in CAD and in Colombia, such as GOC regulatory and institutional frameworks, agro-ecology of areas of intervention, training and technical capacity strengthening, and provides guidelines for SUP and IPM, as well as identifying project opportunities in Colombia. Future commodities, pests and pesticide products to be considered under CAD, are covered in this document.

During preparation of the PERSUAP, visits were made to the Instituto Colombiano Agropecuario (ICA), the Colombian pesticide authority, and to major Colombian and international technical institutions offering pest management technology and training, such as Cenipalma, Fedecacao, IICA, Corpoica, Centro de Excelencia en Fitoprotección (Aphis, USDA, IICA, ICA, USAID), CONIF; universities (Nacional) and training centers (SENA); private sector (Bayer CropScience, ANDI, BioEcológicos, SEG, pesticide dealers); and environmental consultant companies (Tres Elementos, CAEMA). The consultant traveled to Norte de Santander (Cúcuta) and Putumayo (Puerto Asís), to meet CAD project operators, technical staff and conduct project observations on-site.

4.11 PESTICIDE ASSESSMENT REPORT AND SAFER USE ACTION PLAN ANALYSIS

4.11.1 Pesticide Registration Statuses in Colombia and with US-EPA: 22 Cfr 216.3 (b)(1)(i)(a)

Close to 55 pesticide active ingredients were screened for their registration status with the Colombian authority, the Instituto Colombiano Agropecuario (ICA)[9], and with US Environmental Protection Agency (USEPA)[10] This list of pesticides was compiled from that sent by CAD operators to Chemonics requesting purchase clearance, in June 2003, and other pesticides following the recommendations of Colombian state and private technical institutions[11].

Recommendation No. 8: The list of pesticides to be purchased by CAD operators should be screened by the CAD Natural Resources and Environment (NRE) team, based on the pesticide lists included in this PERSUAP. Pesticides not mentioned in this PERSUAP should be subjected to a screening process. Products not registered with Colombia-ICA and with US-EPA should not, in principle, be approved (see exceptions discussed below).

Recommendation No. 9: The summary of the pesticide analysis with the associated recommendation is:

- **Products not registered in the US and Colombia or in PIC[12] list. NOT TO BE USED UNDER ANY CIRCUMSTANCE: captafol, isazofol, methyl parathion and methamidophos.**
- **Products not yet registered in the US or Colombia. Although a microbial product, the first, and a plant extract, the second, they are NOT TO BE USED UNTIL REGISTERED in at least Colombia: *Baculovirus spodopterae* and *Swingla* (extracts).**
- **Products not registered in Colombia. NOT TO BE USED UNDER ANY CIRCUMSTANCE: endosulfan.**
- **Products not registered with USEPA. NOT TO BE USED UNDER ANY CIRCUMSTANCE: benzimidazole, hexaconazole, kasugamicine, monocrotophos, and ofurace.**
- **Products not registered w/USEPA. But registered in Colombia. APPROVED TO BE USED: extracts of *Glyricidia sepium*, because the resource (*Glyricidia*), the crop (vanilla) and the pest (*Cylsia*), are not present in the US; *Paecilomices liacinus*, because the crop (heart of palm) and the pest (*Leptopharsa*) are not present in the US and the pesticide is a microbial insecticide with unlikely environmental or health impact; and**

[9] For this, an updated "Chemical Pesticide, Bio-inputs and Generics" database was obtained courtesy of ICA authorities.

[10] For this, EPA databases were consulted at its web site.

[11] Sources for technical information were the official ICA or Corpoica, Colombia government recommendations, the growers associations or research centres, international research centres and literature references applicable to Colombian conditions, with solid technical and scientific background.

[12] 'PIC List' is the Prior Informed Consent List of the Rotterdam Convention, led by UNEP and FAO, that applies to the international shipment of the most hazardous chemicals.

***Trichogramma pretiosum* and *Verticillium lecanii*, are both microbial insecticides with unlikely environmental or health impact.**

- **Products are RUP with USEPA. NOT TO BE USED: aldicarb, cyalothrine (lambda) cyfluthrin, chlorothalonil, chlorpyrifos, copper oxychloride, cypermethrine, methomyl, paraquat, profenofos**
- **Products are RUP[13] with USEPA. USE ONLY CERTAIN FORMULATIONS to reduce health or environmental risk: carbofuran (pellets/tablet), and picloram (Tordon 101R).**

Table 20. Summary of Pesticides to be Phased Out by CAD

To be phased out immediately:			TO BE PHASED OUT IN 6-12 MONTHS		
Technical Name	Trade Name	Uses	Technical Name	Trade Name	Uses
Monocrotophos	Azodrin	Heart of palm	Benzimidazole	Benomyl+	Requested by operators
Methamidophos	Tamaron	Various crops	Captafol	Difolatan	Cassava
Aldicarb	Temik	Potato	Cyfluthrin	Bulldock	Requested by operators
Isazofos	Miral	Potato	Hexaconazole	Anvil	Requested by operators
Methyl-parathion	Methyl-parathion, etc.	Rice	Methomyl	Lannate	Requested by operators
Paraquat	Gramoxone	Various crops	Kasugamicine	Kasumin	Potato

To be phased out in 12-18 months			**To be phased out in 6-12 months**		
Technical Name	Trade Name	Uses	Technical Name	Trade Name	Uses
Carbofuran	Furadan	Cassava,Rubber, Plantain, Nurseries	Ofurace	Grolan	Requested by operators
Copper oxychloride	Agrotox	Cassava	Cyalothrine, lambda	Karate, Terminex	Potato
Chlorpyrifos	Lorsban	Plantain, Oil Palm, Cassava, Rubber, Forest Plantations	Cypermethrine	Saat Pop, Agroper, Cipermetrina	Rice
Profenofos	Curacron	Rubber	----------	----------	----------
Chlorothalonil	Bravo	Rubber	----------	----------	----------

[13] RUP: Restricted Use Pesticide.

4.11.2 Basis for Selection of Pesticides: 22 Cfr 216.3 (b)(1)(i)(b)

The main reason for selecting these pesticides is availability, efficacy and cost. This is typically the case of products such as chlorpyrifos and carbofurán that, although both are RUPs, they are some of the most effective, and cheapest, insecticides and nematocides, as well as preferred products for ant control.

A criterion usually overlooked in the selection of pesticides is pesticide formulation. A simple way to reduce exposure risk to certain pesticides, such as chlorpyrifos, is to switch to formulations like granules or pellets not subject to dangerous spills and drift. The same criteria may be applicable in reducing environmental impacts caused by certain pesticides, such as picloram, an herbicide, by injecting this product in bushy weeds, instead of spraying; this helps in reducing the volume of the product applied on the target and the area impacted. Care must be exercised, however, because granular or pellet formulations, a more attractive method, are toxic to birds. In summary, the potential health and environmental impacts inherent to one or more formulations available in the market should always be considered, checked and analyzed in selecting a pesticide.

Recommendation No. 10*:* CAD should implement training in SUP for operator's technical staff on pesticide selection. Other variables such as product toxicity (using color-coded labels), potential environmental impact, and product formulation should be considered in selecting pesticides, in addition to efficacy, availability and cost.

4.11.3 Pesticides in the Context of Integrated Pest Management Programmes: 22 Cfr 216.3 (b)(1)(i)(c)

"Integrated pest management … is USAID policy because it is the most effective, economical, and safest approach to pest control. IPM attempts to control pests in an economically and environmentally rational manner; the emphasis in non-chemical tactics which cause minimal disruption of the ecosystem"[14]. Pesticides should be used as the last resource for pest management after all other options have proven ineffective. Genetic (plants tolerance or resistance), biological (natural enemies), ethological (naturally occurring chemical disrupters), cultural (production practices), and mechanical (physical removal) are all preferred tactics to be used before resorting to chemical control (pesticides).

The general introduction on IPM possibilities for passion fruit crop is shown in Table No. 23; the list of various possible pest problems of the crop, the management options available, the specific pesticides for the pest and some of the potential problems with the control options discussed.

[14] *USAID/AFR Guidance: Preparing PERSUAPs for Pesticide Programmes in Africa.*

Finally, they list some technical support offers at the level of institutions and individuals and sources of information such as literature references and web sites.

<u>Recommendation No. 11:</u> No crop should be promoted without first establishing an IPM program. CAD should install at least one crop specific IPM demonstration field in each of the intervention areas. To this effect CAD should work with the local UMATAS (Municipal Agronomic Technical Assistance Unit) and request the technical support of the institutions and individuals listed in the pest management offers.

4.12 METHOD OF APPLICATION: 22 CFR 216.3 (b)(1)(i)(d)

Although a few farmers may have access to stationary-pump spraying systems, a common device in illicit crop zones, most pesticide applications are done with back-pack sprayers. Using sprayers often result in: (a) poor maintenance causing leaks and significant exposure of the applicator to pesticides, and/or (b) inappropriate nozzle settings not responsive to pesticide specifications (insecticides, fungicides or herbicides). Pesticide mixing is also an issue; more often than not, farmers do not follow precautionary measures, high product concentration or undiluted mixes increases the risk of exposure. Often enough, women and children in project areas participate in mixing operations or stay close to mixing sites, or near spraying equipment being cleaned or maintained. Finally, cleaning and disposing of surplus pesticides and product containers should follow strict safety regulations, to minimize human and environmental risks.

<u>Recommendation No. 12:</u> CAD SUP program must include support for three essential components: (a) a comprehensive training program on "best practices" in SUP (see 3.11); (b) locally, climatically and technologically appropriate[15] protective clothing and equipment (gloves, masks, boots, etc.); and (c) maintenance and repair of spray equipment.

4.13 POSSIBLE TOXICOLOGICAL HAZARDS TO HUMANS OR TO THE ENVIRONMENT: 22 CFR 216.3 (b)(1)(i)(e)

A pesticide risk analysis was done on 9 products that passed the first screening test (see Table 25.). This analysis included identifying acute and chronic toxicity of selected pesticides on humans, eco-toxicity and potential for water contamination. As a result, recommendations were drawn in regards to general and specific mitigation activities to be conducted in order to prevent and/or reduce the potential health and/or environmental impact hazard of pesticides used in program activities. These mitigation activities are all included within the comprehensive risk-mitigation SUP and IPM programs.

[15] This means adequate for the local climate (temperature and humidity) and possibly adapted from local materials (plastic bottle masks, plastic bags-gloves, etc.) instead of imported clothing materials.

<u>Recommendation No. 13</u>: CAD should socialize and share with project operators the results of the risk analysis of the pesticides and assure the full implementation of the mitigation measures recommended.

4.14 PESTICIDE EFFECTIVENESS: 22 CFR 216.3 (b)(1)(i)(f)

Recommendations for pesticide and other pest management tactics to be used in project crops have been drafted and/or double-checked with authorized agricultural R&D institutions in Colombia. Additionally, technical literature references and relevant websites were consulted. It should be noted that CAD has access to many institutions that can provide technical information and support, as well as training in pest and pesticide management.

4.15 COMPATIBILITY OF PESTICIDES WITH TARGET AND NON-TARGET ORGANISMS: 22 CFR 216.3 (b)(1)(i)(g)

The pesticide risk analysis mentioned above, and described in this section, discuses the main risks the pesticides pose to non-target organisms in the environment, as well as some potential impact on target organisms, such as the likelihood of encouraging the development of pest resistance. Also mentioned in the table are some of the main direct mitigation measures to prevent and reduce the potential impact of the various pesticides to non-target organisms. The more general approaches to prevent and mitigate the health and environmental impacts of pest management activities, discussed elsewhere in this PERSUAP, are SUP and IPM.

4.16 CONDITIONS UNDER WHICH THE PESTICIDE WILL BE USED: 22 CFR 216.3 (b)(1)(i)(h)

Large portions of Colombia are plains, located below 500 meters above sea level (m.a.s.l.). The country could be roughly divided into six great geographical regions: the Andean zone, including three mountain ranges and the "inter-Andean" valleys; two coastal regions, the Caribbean and the Pacific; the plains of Antioquia; the Amazonian forests; and finally, the insular region.

CAD is being implemented in southeastern Colombia, in the Departments of Putumayo, Huila, Cauca, Nariño, Caquetá, and in the department of Norte de Santander, in northeastern Colombia. Illicit crops, coca and poppy, abound in these departments.

Colombia's climate is tropical with weather patterns strongly influenced by the Andes. They are normally classified as: (a) hot zones covering close to 84% of the territory, reaching up to 1,000 m.a.s.l. with average temperature of 24º C; (b) temperate zones, at altitudes between 1,000 to 2000 m.a.s.l., with average temperature of 17.5º C; and (c) cold zones, with average temperature of 12º C, and altitudes of 2,000-3,000 and over m.a.s.l..

Ecologically, Putumayo, Caquetá, Norte de Santander, and Huila have predominant pre-mountainous humid forests (Bh-pm) with close to 1,000-2,000 mm/yr, 18-24˚C, to low mountainous forest (Bh-mb) 2,000-2,500 m.a.s.l. 12-18˚C. Cauca, Nariño and Tolima have predominance of pre-mountainous to mountainous forests with a variable levels of humidity and temperate to cold climate.

4.17 AVAILABILITY AND EFFECTIVENESS OF OTHER PESTICIDES AND OF NON-CHEMICAL CONTROLS: 22 CFR 216.3 (b)(1)(i)(i)

The use of pesticides in CAD projects will be inserted into comprehensive IPM programs. The "Decision Making Tree for IPM & a Guideline for SUP", discussed above, should help in making decisions in regards to pesticide use. Matrices shown in this section present available pesticide options and pest management tactics for crops and pests in question. There are, however, some problems with certain recalcitrant pests, such as ants, that are ubiquitous and pose a serious threat to certain crops, such as young trees, rubber, oil palm and heart of palm. Ants are not easy to control, and tend to draw to some of the most toxic chemicals, such as carbofuran and chlorpyrifos. Non chemical options are being suggested and proposed in the pest and pest management matrices for some crops.

1.1.1 An example of a non-chemical approach to a recalcitrant pest:

1.1.2 the case of ants

- Atractive bait
- Nest destruction early on their development
- Prevention of the emergence of winged ants with covers
- Applying cal to change pH and destroy the fungi that is used as a food by ants
- Seeding castor bean (*Ricinus communis*) in rotation or inter-cropped (inhibits ants)
- Plough-in green manure (organic matter attracts them away from crop)

4.18 CAPABILITY AND CAPACITY OF COLOMBIAN INSTITUTIONS TO REGULATE AND CONTROL PESTICIDE USE: 22 CFR 216.3 (b)(1)(i)(j)

As stated above, Colombia is one of the most advanced countries in Latin America with respect to pesticide registration, regulation, and control. Colombia has very modern registration procedures, applies international standards and codes for pesticide labeling and has a system to follow up and control pesticide manufacturers and distributors that is only limited by the insecurity situation that

the country has been living in for the past 25 years. The Instituto Colombiano Agropecuario, ICA, in charge of pesticide regulation, has taken more than 30 actions to ban hazardous pesticides or groups of pesticides, among which DDT, methyl bromide, canfechlor, captafol, all organochlorides, and toxaphene. Moreover, ICA requires that all Class IA and IB pesticides sold in the country have a back up 'prescription' written by a professional agronomist. Undoubtedly, the widespread insecurity in the majority of the rural territory of the country, and more specifically in the areas where CAD is active, limits the enforcing capacity of the GOC institutions. Although, the degree and effectiveness of controls in these areas is somehow limited and less than desirable, during the preparation of this PERSUAP we had first hand evidence of on going inspections to pesticide dealers in the Department of Putumayo, one of the most affected by the conflict.

Colombia pesticide regulations fits within its larger environmental framework, as per law 99 of 1993, "Fundamentals of the Colombian Environmental Policy". This law created the Ministry of Environment and the National Environmental System and established the "Environmental License" further regulated by decrees 1728 of 2002 and 1180 of 2003.

The modernization of Colombia's legislation related to pesticides begins with a major law, No. 09, approved by the National Congress in January 1979, regulating "hazardous substances, pesticides, and pyrotechnic articles". This law was followed by decree No. 1843, from 1991, that further "regulates the use and management of pesticides". This decree defined and clarified terms and elements for the registration of pesticides, such as "efficacy", "contamination", "fumigation", "residue limits", "risk" and "toxicity", and officially adopted the four-classes WHO hazard classification of pesticides[16]. The same decree further regulated the manufacture and distribution of pesticides in the country.

More recently, Colombia has fully adopted the regional norms that derive from the actions taken by the 'Andean Community" (Comunidad Andina, CAN), to which Colombia is a signatory. The CAN, a result of the integration of Bolivia, Colombia, Ecuador, Peru and Venezuela, began activities in 1997 and in 1998, the 'Andean Norm for the Registration and Control of Chemical Pesticides for Agricultural Use" (Decision 436) was enacted. In this regulation, the five Andean countries committed themselves to a normative towards a common system for registration, control and use of pesticides. CAN decision No.436 established, among other things, (a) the requirements for pesticide registration; (b) norms for labeling and packaging; (c) maximum residue tolerances; and (d) norms for product efficacy research. Later, according to resolution 532, of August 2001, CAN adopted the 'Technical Manual for the Registration and Control of Chemical Pesticides for Agricultural Use", which was fully developed and published in June 2002, in Resolution 630. This is very comprehensive manual, including detailed instructions to register chemical pesticides, with all the information requirements on the technical as well as the formulated material, as they relate to efficacy, human and eco-toxicology, residues, labeling, packaging, risks and the environmental

[16] The WHO classification: IA (extremely hazardous), IB (highly hazardous), II (moderately hazardous), III (slightly hazardous), and 'U' (improbable of presenting an acute risk in normal use). The LD_{50} used for chronic toxicity is either oral (O) o dermal (D). Colombia uses the same classification but classes are numbered I-IV.

management plan. Finally, ICA, as the GOC institution in charge of registration and control of pesticides, fully executes the application of the CAN decrees internally to Colombia, in its resolution No. 00770 of March 2003.

Given this comprehensive and detailed pesticide regulation framework, again, the capacity of Colombia to regulate and control pesticides is only restricted by the general situation of the country, with somewhat weak institutional presence in certain isolated areas. This, however, does not preclude, as we reported above, that ICA authorities are still enforcing some of the pesticide rules and regulations.

4.19 PROVISIONS FOR TRAINING IN SUP AND IPM: 22 CFR 216.3 (b)(1)(i)(k)

The CAD supported SUP training program should focus on risk reduction rather than on safe use of pesticides. In other words, instead of sending the message that pesticides could be used safely, the main goal of the training program should be to reduce the risk of farmers and their families by the careful analysis, and management, of the variables that affect the components of risk:

Risk = toxicity x exposure

This means that the "safer use", through risk reduction, begins before the "use" of the product, during its selection and preparation, and continues well after its use, in the field where the product is applied[17].

SUP training could be sub-contracted with Bayer CropScience or with the Servicio Nacional de Aprendizaje-Asociación Nacional de Industriales (SENA-ANDI). The former, a chemical company, runs a program called "Agrovida" that focuses on SUP for farmers or farmer's families. Since women and children are in the higher vulnerability group, and women are often involved in storing pesticides as well as in cleaning farmer's clothes, they are an audience of extreme importance to be reached with messages of risk reduction. The second is a joint program between a GOC agency, SENA, and the Association of Industrialists, offerings two options, a two-day user targeted training course, and a 5-day training-of-trainers event. CAD should consider training a few 'trainers', from the operators' staff, in each one of the regions where it operates.

The contents of the training program may need to be adjusted to attend to various audiences, but nevertheless, it should include the themes listed in the training program attached, such as risk management, toxicology, labels, transporting, storage, mixing, spraying, cleaning, discarding, container management, applicators protection, etc.

[17] For more details see in section 5.3 the Power Point presentation "A Practical Guide: Reducing Pesticide Risk", in Spanish.

<u>Recommendation No. 14:</u> Training on SUP should (a) focus on risk reduction; (b) reach the various important audiences: pesticide dealers, farmers, farmer families (women and children), staff of CAD project operators (trainers); (c) use the already available training offers in Colombia, such as the 'Agrovida' program sponsored by Bayer CropScience, for farmers and their families (women and children), and/or the SENA-ANDI joint training program for farmers and trainers.

As stated previously, in order not to transmit the false idea that pesticides, used safely, could be the sole solution to pest problems, SUP should not be promoted in isolation but rather in the context of a larger, more comprehensive approach to pest management, that of Integrated Pest Management, or IPM. Moreover, training in ecological and organic agricultural concepts and practices may always help CAD project operators to better understand, and even search for and experiment with, non-chemical options for pest control

<u>Recommendation No. 15</u>: CAD should promote a holistic agro-ecological approach, not only to pest management but also to crop production. Training, as well as technical support, offers in topics such as IPM, organic or ecological agriculture, are available in Colombia from various institutions. A list of the possible technical partners that CAD could resort to in the search for technical support follows.

Table 21. Possible technical agreements for CAD

Institution	Crop	Theme
CIAT	Cassava, dry-beans, vanilla	Pest & crop management
Fedecacao	Cacao	Pest & crop management
Cenicaña	Sugar-cane	Pest & crop management
Cenipalma	Palm oil, heart of palm	Pest & crop management
Centro de Excelencia en Fitoprotección (CEF)	Tree tomato, lulo, maracuja, tomatoes, Amazonian fruits	Quarantine, pest management, pest risk analyses
Corpoica	Various	IPM in general; training
CONIF	Forest plantations, nurseries	Pest & crop management
IICA	Various	Ecological agriculture
IPGRI	Various	Quarantine & plant introductions
ICA	Various	Pesticides: registration & control; training
SENA	Various	IPM & organic agriculture; SUP; training
ANDI	Various	SUP training
Bayer CropScience	Various	SUP training: Agrovida
SGS / BioTrópico	Various	Certifications

4.20 MONITORING EFFECTIVENESS AND USE OF THE PESTICIDES: 22 CFR 216.3 (b)(1)(i)(l)

CAD is working with farmers associations and enterprises that have a relatively good level of organization. Most have very well trained field technicians that are regularly monitoring the pest management problems and the effectiveness of pest management methods being used. Open and regular reporting lines exist within CAD project operators and Chemonics to communicate issues such as new pests appearances as well as failures of the standard methods being used. Moreover, the Natural Resources and Environment group of Chemonics has the capacity for, and it is taking a lead role in, monitoring the most significant environment related variables of the project, including the effectiveness of pesticides.

4.21 ENVIRONMENTAL COMPLIANCE

Monitoring

A set of compliance indicators and recommendations of this PERSUAP, grouped by major themes is being proposed and presented in the table below.

Table 22. Monitoring Plan for PERSUAP Recommendations

Monitoring Theme	Recommendation	Indicator/s	Special Requirements
Sustainable alternative development	1	♦ Poly-cropping promoted & adopted by farmers ♦ System approach to alternative development in place, promoted & being implemented	Re-asses promotion of crops versus systems
Phytosanitary system for movement of plant materials	2	♦ ICA certification in place for internal movement of plant materials ♦ Quarantine in place for foreign materials	Establish links with ICA
Safer Use of Pesticides: hazard awareness, pesticide phase out, pesticide screening, training programme, equipment support, risk analysis	3, 4, 5, 8, 9, 10, 12, 13	♦ Operators aware of colour band meaning in products & using info for selecting pesticides ♦ Operators pesticide request list regularly checked by CAD-NRE[18] team ♦ Trend for decreased 'red & yellow' band pesticides request lists ♦ No monocrotofos & paraquat by Dec '03 ♦ No methomyl & others by Aug 04 ♦ No chlorpyrifos, carbofuran & others by Aug 05 ♦ SUP KAP changed ♦ Parts & repairs offered for spray equipment	Training programmes contracted & courses offered. Financial resources from CAD allocated for training & equipment
Integrated Pest Management: training (IPM, Eco), bio-pesticides, field demos	6, 7, 11, 14	♦ Ecological agriculture & IPM training contracted, offered, finished & KAP[19] monitored ♦ IPM demo fields installed & monitored for all crops ♦ Operators aware of & using bio-pesticides ♦ Operators using a wide range of pest management practices (more than 3 per pest)	Training programmes contracted & courses offered. Financial resources allocated for IPM demos
Sustainability of Environmental Compliance	16	♦ Market-led environmental compliance through: organic agriculture, EurepGap, Illicit-to-Licit or other type of certification in place, or ♦ A third party system installed for auditing environmental compliance	Contacts made, bids open, resources allocated to initiate / catalyse both processes

4.22 LONG TERM SUSTAINABILITY

Environmental compliance with Regulation 216, vis-à-vis pesticide issues, could be assured through the auditing role of Chemonics NRE group. This group could possibly check the pesticide lists that CAD project operators regularly submit to Chemonics for approval and screen the pesticides appropriately. It may also field check project operators to inspect pesticide storage buildings, follow up some field operations and check on pesticide selection, mixing and use. [This has already been

[18] Natural Resources and the Environment
[19] KAP: Knowledge, Attitude and Practices.

proposed in Recommendation No. 8]. However, since this monitoring is based mainly on a 'policing' approach to compliance, its sustainability is somewhat questionable. Although, an important 'educational' component, on SU and IPM, has been included in this PERSUAP, farmers may 'comply' with environmental regulations only and as long as the policing pressure is maintained. And this will only happen as long as USAID and Chemonics continue with the funding and implementation of CAD. But it may end right after that …

A fundamentally similar approach, but one that promotes a more direct participation, and so appropriation of environmental compliance issues, by the Colombian civic society, is that of allocating the 'policing' role to a 'third party' local NGO, or consultant. The profile of this auditor may be similar to the NGOs or consultants that Chemonics NRE group has already contracted to do the environmental studies of CAD productive activities. The local, Colombian, NGOs and consultant companies visited have demonstrated the capacity and the interest to undertake such work. Based on the table above, and on the 16 recommendations of this PERSUAP, CAD could develop a more detailed monitoring plan, agreed to among USAID, Chemonics, and the CAD operators, and assign a third party agency its verification following a system of open bids, as it is normally done in CAD.

A more sustainable path to environmental compliance may be that of a 'market-led' mechanism. If the market rewards an environmentally sound, clean, ecological or whatever the label is, produce then farmers will have to comply with certain production norms in order to be able to access and receive that reward. Third party certification is the key to this and not necessarily has to take the form of purely 'organic' production. Some of the Colombian certifying agencies contacted, such as *Biotrópico,* are working on organic produce certification, with the support of IFOAM, but also certify other producers. Among the latter are the coffee growers associated in COSURCA, exporting 'fair trade' coffee to the US market, in a project funded by USAID and UNDP. Other enterprises, such as the Swiss SGS, are certifying aromatic plant producers for EurepGap norms as well as Colombian flower exporters. Finally, the fruit growers association ASPROME, based in Cali, is exporting 'organic marmalades' to Europe, certified by Naturland-IFOAM, from fruits produced in a project funded by GTZ, the German Government and the European Community. The certification system is so simple as to work out a detail set of agreed rules, and corresponding indicators to track them, between producers, donors, project implementers and the certifying agency. The rules could easily be those established as environmental compliance requirements in Regulation 216, tracked by indicators such as pesticides registered with Colombia-ICA and US-EPA, no RUP pesticides, no class IA and IB products, etc. Again, the table 22 and the 16 recommendations could be used as the basis for a framework for certification of USAID environmental compliance.

<u>Recommendation No. 16</u>: CAD is encouraged to seek a sustainable mechanism for pesticide environmental compliance. This could take the form of (a) a third party independent auditor of the use and management of pests and pesticides by project operators; and/or (b) a market lead environmental (vis-à-vis pesticides) compliance mechanism through a third party, independent, certification agency that assures 'organic', 'EurepGap', 'low-intensity pesticide usage', 'IPM-based', or Regulation 216-based … agricultural production.

4.23 TRAINING AND BEST AGRICULTURAL PRACTICES PLAN (BPA).PURSUANT TO RECOMMENDATIONS IN THE PESTICIDE ASSESSMENT REPORT AND SAFE USE ACTION PLAN PERSUAP[20]

Insect Pest[21] are one of the principal problems affecting agricultural production and crops, decreasing productivity and/or product quality, resulting in important economic losses. Moreover, improper management and abuse of pesticides utilized in plague control may also lead to severe economic losses and negative environmental impacts (air pollution, contamination of soil and water resources) as well as loss of biodiversity and other negative effects. The combination of the negative factors mentioned above also cause the worst of all affectations i.e., the health of agricultural workers, their families and even, the health of consumers of agricultural products, is threatened.

CAD complies fully with USAID's provisions, the grantee agency, established in USAID's regulation 216. CAD has already carried out detailed environmental assessments of productive agricultural and transformation activities that are being or will be supported by the project. Such studies are known as Environmental Assessments (EA) and include, normally, an environmental diagnosis of the project site, a study of potential impacts caused by project activities and an environmental management plan that proposes prevention and mitigation measures of possible environmental impacts caused by development activities.

Specifically, CAD just completed phase 1 of a detailed study no pesticides currently used in more than 20 productive projects, including alternative methods to replace the use of pesticides available in Colombia for agricultural plague management. CAD is presently implementing phase 2 of this study covering almost 40 additional crops. This study, called "Pesticide Assessment Report and Safer Use Action Plan", or PERSUAP, follows closely the requirements stated in Regulation 216 of the United States Government applicable to each type of pesticide that may or will be used in CAD projects, planned or recommended, for crop plague management, as called for in 12 sections of Regulation 216, including:

[20] Draft No. 3, 29 October 2003

[21] The term Plague utilized through this document refers to its broad generic meaning, including insects, other arthropods and invertebrates, several pathogens, weeds and vertebrates.

1. Status of registration of pesticides in Colombia and with USEPA;
2. Basis for selection of pesticides for any particular application; why was such pesticide selected?
3. To which extent is pesticides part of Integral Plague Management systems?
4. Methods of application, including availability and use of appropriate equipment for application of pesticides and protective measures;
5. Acute long-range risks to humans and the environment, associated to proposed use of pesticides and available measures to reduce dangers thereof;
6. Efficacy of selected pesticides to meet expected results;
7. Compatibility of pesticides with natural ecosystems within their main objectives or other project objectives proposed;
8. Conditions under which pesticides will be used, including weather, flora, wildlife, geography, hydrology and soils;
9. Availability and effectiveness of other pesticides and/or non-chemical methods to control target plague(s);
10. Capability of operators and project implementers throughout Colombia to regulate or controlling distribution, storage, use and final disposal of pesticides;
11. Provisions for training of pesticide users and operators;
12. Provisions for effective monitoring, use and efficacy of pesticides.

The study mentioned above includes a list of (a) **banned pesticides**, prohibited in Colombia and in The United States (the donor country) or in both countries; (b) **products not approved,** or restricted in The United States, or products potentially harmful to human health or the environment in Colombia. A process of substitution of these products within a 0.5 – 1 year timeframe has been established; and (c) **approved products** that may be utilized in CAD projects. Beyond the strict control measures exerted by CAD on the use of pesticides in CAD projects, there is a commitment to promote the Best Agricultural Practice (BPA) production activities, including Integrated Plague Management (MIP) and Safe Use of Chemical Pesticides (USP), to contribute to sustainable alternative development. With this in mind, CAD developed a far-reaching training plan in support of BPA, MIP and USP.

4.24 OBJECTIVES

The Training Plan follows-up the application of PERSUAP recommendations. Its general objective is **to develop technical capacity within CAD project operators, at the technical and production levels, to implement clean environmental production systems contributing to minimize hazardous risks on producers and consumers health.** This plan was developed to assure that CAD not only complies with PERSUAP recommendations, but also will meet program indicators and goals listed in the Monitoring Plan, in regards to use of pesticides and agricultural plague management activities carried out by project operators.

Specifically, the Training Plan aims to develop particular and broad technical skills in (a) **safer use of pesticides in agriculture**, such as appropriate approaches: ecological, economical and social; (b) **integrated management of agricultural Pest**, applying appropriate technological, economic and social systems approach; (c) **ecological or organic agricultural production**, if such approach is economically feasible within a production methodology context applicable to protection of the environment and human health. The proposal aims towards offering general training and specific training to technicians to strengthen their capability, thus enabling technicians to offer productive options to participant farmers, including social, economical and environmentally acceptable elements.

Table 23. Pest in Passion Fruit Crop (*Passiflora edulis* f. *flavicarpa*) and Management Guide

General Comments: formation of passion fruit trees is carried through crossed pollens by insect intervention. Because of this characteristic, control methods recommended include cultural control based on clearing, pruning, collection of buds and affected fruit, and weed control.

Plague(s)	Control Methods	Pesticides[22]	Problems
Diseases:			
Alternaria sp (Brown stain)	Cultural: Clearing pruning, collection of buds and affected fruit, and weed control.		Attacks foliar areas.
	Chemical:	Cu oxichloride	
Colletotrichum (freckle)			Attacks stems, floral buds and leaves.
Cladosporium herbarum (*Roña* or scab)	Chemical:	Cu sulfate + lime	Attacks fruit.
Phitophthora (*yaga*)			Attacks radicular system
Fusarium (dry rot)	Cultural: plant in well-drained soil. Irrigate corridors between tree rows, not tree lines.		Attacks secondary roots and root neck.
	Chemical:	Cu sulfate + lime	
Arthropods:			
Tetranichidae (red little spider)	Chemical: use contact or ingest insecticides		Attacks fruit
Dasiops sp or *Lonchea* sp. (ovarian fly)	Biologic: release parasitoid insects to control ovarian fly.		Attacks flowers
	Chemical: last resource.	Use Vapona in the morning (gas)	
	Physical: pick up infected floral buds from soil and eliminate (breaks cycle)		

[22] Pesticides in this Table are not necessarily recommended for CAD projects. Check pesticides Tables.

Plague(s)	Control Methods	Pesticides	Problems
Arthropods:			
Defoliants (*Diabrótica, Agraulis*) and Lepidoptera and carriage worm (*Agraulis*)	Physical: manual removal of larvae.		
	Biological: natural: several depredators and parasitoids.	*Bacillus thuringiensis*	
	Chemical: systemic insecticides.		
Ceroplastes sp. (little turtle scales)			Do not use chemicals, they are ineffective.
Thrips	Foliar application of biological insecticides to control larvae and sucker insects. Chemical: last resource		Sucker insects attack primordial branches affecting grow.
Leptoglossus spp (big foot Chinche)	Foliar application of biological insecticides to control larvae and sucker insects. Chemical: last resource	*Bacillus thuringiensis*	Attacks fruits

Technical assistance sources, training and contacts:

1. **Fundaset.** Roberto de Valencia Trías, Director, Fundaset@reymoreno.net.co
2. **Pasicol.** Juan Carlos Arrollave. Chinchiná, Caldas. Phone 096 8507575, jcarrollave@passicol.com

Principal Bibliographic References:

1. Ruggiero, C. 1991. A Cultura do Maracujá No Brasil. Photocopy available at Chemonics.
2. Ruggiero, C. et al. 1998. Simpósio Brasileiro sobre a Cultura do Maracujazeiro. Anais do 5o. Simpósio. FAPESP. Photocopy available at Chemonics.
3. SIESA. S/f. Database in Chemonics central computer, Bogotá.

Table 24. Basis for the selection of CAD Pesticides
[Addresses Reg. 216 point (b)]

Pesticide		Uses		Basis for Selection
Technical Name or Active Ingredient	**Trade or Commercial Name in Colombia**	**Crop**	**Pest**	
Bacillus thuringiensis	Xentari, Ecotech-Pro, Turilav, Thuricide, Javelín, Batón, Dipel	Oil palm & rubber	*Loxotoma elegans* & *Erinnys ello*	Effectiveness; No health & environmental impacts
Copper sulfate + lime (Bordeaux mixture)	Bordeaux mix	Heart of palm, oil palm Vanilla Nurseries	*Pestalopsis sp. Colletotricum sp.* *Fusarium oxysporum & Phytophthora sp.* Damping off	Effectiveness. Limited health & environmental impacts. Easiness to prepare.
Copper oxychlor-ide	Agrotox, Coper-pro, Coperflow, Cuprene, Oxiclor, Oxicloruro de Cu	Cassava	*Xanthomonas axonopodis pv.* Manihotis	Cost. Availability. Effectiveness.
Dichlorvos	Vapona	Passion fruit	*Dasiops* sp.	Cost. Availability. Effectiveness.
Gliphosate	Roundup	Cacao Oil palm, Heart of palm, Rubber, Plantain, Forestry plantations	Cacao plants affected by *Rose-llinia pepo* Weeds in general	Effectiveness. Reduced health & environmental impacts. Cost. Availability.
Trichoderma	Tricobac, Mycobac, Tricodex, Tricho	Heart of palm Oil Palm	*Phythophtora palmarum*	Effectiveness. No health & environmental impacts
Trichograma pretiosum	Trichogramma	Various	Various	Effectiveness. No health & environmental impacts

Table 25. Passion Fruit CAD Pesticides[23]
Registration, Problem Analysis & Preliminary Decision [Reg. 216 point (a)]

Pesticide			CROP/S	PEST / S	Type of Problem, if any	Recommenda-tions & alternative/s
Tech. Name[24]	**TRADE NAME[25]**	**Type & Tox Class[26]**				
Bacillus thuringiensis	Xentari, Ecotech-Pro, Turilav, Thuricide, Javelín, Batón, Dipel	Microbial insecti-cide: bacteria. WHO TC: not available; Colombia TC: U.	Oil palm, rubber, potato	*Loxotoma elegans* & *Erinnysello Tecia solanivora*		**Approved.**
Copper sulfate + lime [Copper, sulfate + Lime (calcium carbonate)]	Bordeaux mix	Cu sulfate: fungicide, algaecide, moluscicide. WHO TC II.	Heart of palm, oil palm Vanilla Nurseries	*Pestalopsis sp. Colletotricum sp.* *Fusarium oxysporum & Phytophthora sp.* Damping off	Bordeaux mix is not registered with USEPA but Cu sulphate & Ca carbonate yes, each separately.	**Approved.**
Copper oxychloride (cobre, oxicloruro)	Agrotox, Coper-pro, Coperflow, Cuprene, Oxiclor, Oxicloruro de Cu	Fungicide. WHO TC III; Colombia TC III.	Cassava	*Xanthomonas axonopodis pv.* Manihotis	RUP with USEPA.	**Should not be used. Phase out in 24 months**
Dichlorvos	Vapona	Fumigant insecticide. WHO TC: Ib; Colombia TC: I	Passion fruit	*Dasiops* sp.	In 'Bad Actor' list of PAN for acute toxicity, carcinogenic, cholinesterase inhibitor. Organophosphate.	**Approved.** But pending re-registration with USEPA in 2003.

[23] Includes the pesticides being mentioned for the passion frut crop, requested by CAD Project operators and/or recommended as part of pest management programmes for these crops.
[24] Generic name or active ingredient.
[25] Name under which is sold in Colombia.
[26] Type of action: fungicide, insecticide, herbicide, etc. As per WHO classification: IA (extremely hazardous), IB (highly hazardous), II (moderately hazardous), III (slightly hazardous), and U (improbable of presenting acute risk in normal use). The LD_{50} used for chronic toxicity is either oral (O) o dermal (D). WHO TC is that of the active ingredient. Colombia TC is that of the formulated product available in the country.

Pesticide			CROP/S	PEST / S	Type of Problem, if any	Recommenda-tions & alternative/s
Technical name	**Trade name**	**Type & tox class**				
Gliphosate (glifosato)	Roundup	Herbicide. WHO TC U; Colombia TC III ó IV	Cacao Oil palm, Heart of palm, Rubber, Plantain, Forestry plantations	Cacao plants affected by *Rosellinia pepo* Weeds in general		**Approved.**
Trichoderma sp. (harzianum y lignorum)	Tricobac, Mycobac, Tricodex, Tricho	Microbial fungicide: antagonistic fungi. WHO TC not available; Colombia TC III ó IV	Heart of palm Oil Palm	*Phythophtora palmarum*	*T. lignorum* is not registeterd with USEPA. However, both crop & pest do not exist in the USA. *T. harzianum* is registered with USEPA.	**Approved**. Microbial product with unlikely environmental impact. Similar species registered
Trichogramma pretiosum	Trichogramma	Biological antagonist of insects: parasitoid wasp. TC not available.	Various	Various	Registered in Colombia. Not yet with USEPA	**Approved**. Microbial product with unlikely environmental impact

Table 26. Passion Fruit Pesticides – Risk Analysis

Pesticide[23]	Acute Tox Class[24]	Type	Chronic Toxicity	Eco-toxicity	Groundwater Contamination Potential	Mitigation of risks / Comments[25]
Bacillus thurin-giensis	WHO: not vaila-ble. Colom-bia: III	Micro bial insecti cide: bac-teria	Unlikely to cause any effect. No indication of reproductive, teratogenic & carcinogenic effects. Possible some mutagenic effects in plants.	Bio-product with unlikely environmental impact. Not toxic to fish, birds & other animals.	No evidence for potential ground water contamination.	Repeated applications over extended periods may promote the development of resistance. Rotate products.
Copper sulfate + clime (Borde aux mix.)	WHO: II Colom-bia: not available	Fungi cide	No evidence for chronic effects in humans is available.	No evidence for adverse effects on the environment.	No evidence for potential for water contamination.	
Copper oxychlor-ide	WHO: III; Colombia III	Fungi cide	Acute effects include irritation of eyes & skin. Chronic toxicity includes hepatic cirrhosis & brain damage.	No evidence for adverse effects on the environment.	No evidence for potential for water contamination.	RUP To be used with caution because of its possible human health impacts.
Diclorvos	Vapona	Insec-ticide fumi-gant.	**Affects liver & accumulates in lungs. Possible carcinogenic, not teratogenic, not mutagenic. Cholinesterase inhibitor.**	**Highly toxic to birds, not toxic fish but toxic to bees.**	**Possible water contaminant: does not bind to soils & stays in solution.**	**In IRED-03. Revise registration status in 2003. Manage with care because acute toxicity. Do not use close to water bodies. Special care with birds & bees.**
Gliphosate	WHO U; Colom-bia: III-IV	Herbi-cide	No evidence of any carcinogenic, teratogenic, mutagenic effects.	Slightly toxic to birds, non toxic to fish & bees.	Unlikely due to soil adsorption.	

Pesticide[27]	Acute Tox Class[28]	Type	Chronic Toxicity	Eco-toxicity	Groundwater Contamination Potential	Mitigation of risks / Comments[29]
Tricho-derma	WHO: not availa-ble; Colom-bia: II-IV.	Biolo-gical anta-gonist: micro-bial fungi-cide.	Unlikely to cause any effect. No indication of carcinogenic, teratogenic, reproductive or mutagenic effects.	Bio-product with unlikely environmental impact.	Unlikely contaminant.	Some spp. not yet registered with USEPA but the genus Trichoderma is.
Tricho-grama pretiosum	WHO & Colom-bia: not availa-ble.	Biolo-gical anta-gonist: parasi-tic wasp.	Unlikely to cause any effect. No indication of carcinogenic, teratogenic, reproductive or mutagenic effects.	Bio-product with unlikely environmental impact. No adverse effects in animals. Naturally occurring in soils.	Unlikely contaminant.	Not yet registered with USEPA.

[27] Technical name or active ingredient.

[28] As per WHO classification: IA (extremely hazardous), IB (highly hazardous), II (moderately hazardous), III (slightly hazardous), and U (unlikely to present acute hazard in normal use). The LD_{50} used for acute toxicity is either oral (O) or dermal (D). Colombia uses the same scale but classes numbered I-IV.

[29] General mitigation tactics to (a) reduce human exposure risks: protective clothing (mask, hat, glasses, long sleeves shirt, long pants, boots, gloves or plastic bags, washing clothing, no food, no drink, no smoking, no re-entry to fields, etc.) and (b) reduce environmental risks (mix exact amounts, no spray close to water bodies, to bee hives, to bird nesting areas, avoid windy days, etc.) are part of a more general SUP.

Table 27.
BANNED PESTICIDES
Pesticides PIC, Prohibited, Restricted or Cancelled
In Colombia and/or in the USA[30]

Pesticide[27]	PIC List[28]	Registration status in[29]	
		Colombia	United States
ALDRIN	Yes	P (1974 in tobacco), C (1988)	No
BHC		P (1974 in tobacco), P (1978 in coffee), P (1993)	No
Methyl Bromide		P except for quarantine (1996)	RUP
Canphechlor		P (1978 in coffee), C (1988), P (2000)	No
Captafol	Yes	P & C (1989)	No
Chlorinated in tobacco		P (1974)	No
Chlordane		P (1974 in tobacco), C (1988), P (1993)	No
Chlordimeform		P (1987), C (1988)	No
DBCP (di-bromo-chloro-propane)		P (1982)	No
DDT		P (1974 in tobacco), P (1978 en café), P except in health (1986), P (1993)	No
Dicofol		P (1993)	Yes
Dieldrin		P (1974 in tobacco), C (1988), P (1993)	C
Dinoseb		P (1987)	C
Dodecachlor (Mirex)		P (1993)	C
2,4,5-T & 2,4,5-TP		C (1979)	C
Endosulfan		P except for coffee borer (1993 & 1997)	RUP
Endrin		P (1974 in tobacco), P (1985)	No
Ethylene di-bromine (EDB)		P (1985)	No
Fonofos		P (1992)	No
Fosfamin		C (1997)	RUP
Mercury Fungicides		C (1974)	No
Heptachloro		P (1974 in tobacco), C (1988) P (1993)	No
Isazofos		C (1996)	No
Leptofos (Phosvel)		C 1977	No
Lindane		P (1978 in coffee), C (1993), P except in health (1993), P (1997)	RUP
Maneb		C (1989), P (1993)	Yes
Metamidophos	Yes	Yes	Yes
Monocrotophos	Yes	Yes	Yes

[30] It is not an inclusive list for the US or PIC. It is based on Colombian prohibited products.

Pesticide[31]	CIP List[32]	Registration status in[33]	
		Colombia	United States
Organochlorines in general		P (1974 in tobacco), P (1978 in coffee)	No
Paraquat		P aerial application (1989)	RUP
Parathion & methyl-parathion	Yes	R only for cotton & rice (1991)	RUP
Pentachlorophenol (PCP)		P (1993)	GUP & RUP (treatment of wood)
Posphamidon	Yes	No	No
Toxaphene		P (1975 in tobacco), P (2000)	No
Zineb		P (1993)	No

[31] Technical name.

[32] The list of products for '**Previous International Consent**', or '**PIC**' (1998), of the United Nations Environment Programme (UNEP) and the Food and Agriculture Organisation (FAO). FAO leads in relation to pesticides. Alow importing countries to better know the potentially hazardous products that may be sent.

[32] '**P'** = '**Prohibited**' = '**Banned**" = the uses of the product are not permitted in the country, by explicit

[33] '**P'** = '**Prohibited**' = '**Banned**" = the uses of the product are not permitted in the country, by explicit decision of the regulatory agency. '**R**' = '**Restringido**' = '**Restricted**' = in the sense of the USEPA, it is a pesticide that can only be applied by a certified applicator. '**C**' = '**Cancelado**' = '**Cancelled**' = registration cancelled without a specific prohibition. **No:** not registered.

SECTION 5 ENVIRONMENTAL CONSECUENCES

5.1 OVERVIEW

Although the potentially adverse impacts generated by the Passion fruit project in the department of Huila do not have the dimensions that this cultivation would have in an ecosystem untouched by man, this portion of the report shows the actions and mechanisms focused to control, mitigate, prevent, correct or compensate the impacts that the fruit farming might have on the environment.

The environmental management measures that should be implemented during the cultivation can be preventive (to avoid the impact from happening), corrective (those that may modify the original impact source and hence prevents it from happening), mitigating or ameliorating of the impact, or compensational when the impact is impossible to prevent, correct or mitigate and so requires an additional effort to deter further impacts.

5.2 METHODOLOGY

Each program or mitigating measure, contains in detail the specific factors that can generate environmental effects, the mitigating measures provided, and strategies to monitor the activities. In general, each measure has the following content :

- **Type of Measure**

Establishes the nature of the mitigating measure insofar as prevention, mitigation or compensation is concerned, depending on the magnitude of the impact.

- **Objectives**

Defines the final goal of the measure, to be expected from the execution of the program.

- **Impacts to Control**

Consists of a list of the different impacts and/or environmental effects that have to be mitigated when the measures are executed.

- **Spatial Coverage or localization**

Defines the space where the measure or program is to be applied.

- **Designs**

Contains the technical considerations and designs over which the measure is conceived.

- **Description**

Corresponds to the description of the actions to be carried out in each of the activities for purposes of diminish, mitigate or keep the predicted effects from happening.

- **Schedule**

Indicates the moment when the proper measures are to be implemented.

- **Costs**

Contains the costs incurred by the use of resources necessary for the implementation of the measure.

For the purpose of being consequent with the proceedings involved in the environmental identification and assessment, the measures or management cards have been grouped according to the environmental component they affect.

With the purpose of establishing quantitatively the magnitude of the interaction that occurs between the project activities and the identified impacts, valuation scales have been established depending on the relevance of each activity in relation to the others of the same phase. The process begins with the counting of beneficial, (B), and negative, (A), impacts; the sum of both is affected by the importance given to each activity; then, an arithmetic balance is calculated between the positive (+) and negative (-) results; an overall negative result indicates that for an specific activity the impact is adverse, while a positive one would mean the opposite; this balance is depicted graphically at the bottom of the matrix. The identification analysis was also made for the rows, to find the value of the interaction of the impacts identified for each resource, which are defined according to the following equation :

$$VI = RA * (\sum_{i}^{n} B_i - \sum_{i}^{n} A_i)$$

Where :

VI = Value of the Interaction
Bi = Beneficial Effect
RA = Relevance of the activity, (1to 10 for columns, and 1 to 5 for rows)
Ai = Adverse Effect
i = Number of order of Impact
n = Total number of Impacts

It is worth noting that the evaluation of impacts included those existing previous to the implementation of the productive project. For the environmental evaluation, the following criteria were used and classified in another Leopold matrix as shown in Figure 4.2 :

Nature of the impact: Positive, (beneficial), or Negative, (adverse), in relation to the consequences of its occurrence.

Type : Direct or indirect; the impact is direct if it occurs by itself, and indirect if it is brought by another medium such as wind rain a vehicle, people, etc.

- Duration: Temporal or Permanent.
- Scope: Local or extensive. Whether it occurs solely in the direct area or not.
- Tendency: Reversible or irreversible, which measures the possibility of controlling or

reversing the impact through management measures.

- Synergy : Yes or no. Refers to the chain reaction of other impacts.
- Probability of occurrence: High or low.
- Magnitude: Classifies the impact area of effect and power in relation to other occurrences as high, low or medium.

Recommended management measure: The possibility of recommending the most adequate management measure is considered. The purpose of these measures tends to be to correct, mitigate, compensate or prevent the impact.

5.2.1. Impact Identification Matrix

For the columns –where the project activities are located, the scale of importance of RA, are in the range from 1 to 10; this value was assigned considering the relevance of each activity in relation to the others. Table 28 presents the values of RA that were established for passion fruit cultivation.

Table 28. Values of Environmental Relevance for the Activities in the Cultivation of Passion Fruit

PHASE	ACTIVITY		NUMBER	DESCRIPTION	RA
INSTALLATION AND ASSEMBLING PHASE	GREEN HOUSE	Germination	A	Seeding and seedlings preparation	10
		Seedlings	B	Transplantation from seedlings to individual plants	10
	LAND PREPARATION	Hole Digging	C	Excavation for seeding and stake implantation	8
		Implementation of Drainage	D	Preparation of Water Supply System	6
	CULTIVATION	Trasplantation	E	Transplantation of Seedlings	5
		Construction of Stakes	F	Preparation and Installation of stakes	4
		Pest Control	G	Application of Pest Control Chemicals	5
		Manual Weed Control	H	Elimination of unwanted weeds and plants	5
		Mechanical Weed Control	I	Elimination of unwanted weeds and plants	5
		Sickness Management	J	Application of compounds to prevent sicknesses	5

PHASE	ACTIVITY		NUMBER	DESCRIPTION	RA
		Irrigation	K	Construction and maintenance of irrigation tools	4
		Application of Leaf Fertilizers	L	Application of compounds to help plant growth	4
		Granular Fertilizers	M	Application of soil products to enhance plant growth	4
		Chemical Weed Control	N	Chemicals to control unwanted weeds and plants	4
PRODUCTIVE PHASE	Harvesting and Post-Harvesting	Harvesting - Recollection	O	Activities to hoard products	7
		Management of Harvesting and Post Harvesting	P	Actions after harvesting is performed	4
		Hoarding and Transportation,	Q	Hoarding of products and transport to storage	4
		End of the Cycle and Control of Residual Roots	R	Activities related to Management of residues, and preparation of new cycle	6
TOTAL					100

The value of environmental relevance for the rows where the Impacts are located is in the range from 1 to 5. These values were assigned considering which one showed greater susceptibility during the development of project activities. Table 29 presents the values of RA considered for each one of the environmental reference aspects.

Table 29. Values of Environmental Relevance for the Different Reference Aspects

ELEMENT	COMPONENT	NUMBER	ASPECT OF REFERENCE	RA
PHYSICAL ENVIRONMENT	AIR	1	Air pollution for land cleaning and application of Agrochemicals	1
		2	Generation of gases for Equipment operation	1
		3	Generation of particulate matter	1
		4	Generation of odors due to Agrochemicals	1
		5	Sound pressure and noises in hoarding and transportation	1

ELEMENT	COMPONENT	NUMBER	ASPECT OF REFERENCE	RA
	WATER	6	Water quality deterioration due to seedling preparation, drainage and agrochemical application	3
		7	Physicochemical contamination due to equipment washing and run-off	3
		8	Drainage Alteration	3
		9	Discharge Reduction at the rivers	3
	SOILS	10	Landslides in step areas	4
		11	Geomorphological Alteration	4
		12	Alteration of microflora and microfauna due to the use of pesticides	4
		13	Diminishing agrological characteristics of soils due to poor cultivation practices	4
		14	Soil scouring in gullies and channels near cultivated areas.	4
		15	Soil contamination due to agrochemicals	4
		16	Accumulation of large quantities of materials	3
		17	Alteration of physicomechanical and chemical conditions of the soil	3
BIOTIC ENVIRONMENT	FLORA	18	Toxicity to agrochemicals	1
		19	Deforestation of the land	2
		20	Damages for application of chemicals	1
		21	Landscape Alteration	1
	FAUNA	22	Toxicity to fauna due to agrochemicals	1
		23	Migration of fauna due to the activities of the project	1
		24	Risk to workers for contamination with chemicals	2
		25	Alteration of vital cycles due to application of chemicals	1
	ECOSYSTEMS	26	Aquatic communities	1
		27	Vulnerable	1
		28	Critical	1
		29	Protected	1
SOCIAL ECO	SOCIAL	30	Generation of Employment	4
		31	Recuperation of Social Values	3

ELEMENT	COMPONENT	NUMBER	ASPECT OF REFERENCE	RA
		32	Strengthening of sense of belonging	4
	ECONOMIC	33	Generation of income	4
		34	Economic Activities	4
	CULTURAL	35	Redistribution of Family work	3
		36	Improvement of Cultural Practices	3
		37	Modification of social landscape	3
		38	Strengthening of communal living	3
	INSTITUTIONAL	39	Lack of a system of environmental monitoring	4
		40	Technical Assistance	4
TOTAL				100

Based on the matrix, the activities can be ordered vertically according to the degree of negative affectation that they generate on the different components considered. The order of activities, including cultivation and processing, is categorized in this manner, from the one with the most negative impacts to the one with the least, as follows:

For the installation and assembling phases, the activity of seedling preparation has the greatest negative values, (-110), followed by the chemical weed control and disease management, (-48 and –50). The activity of construction of stakes has a negative interaction, (-4). In this phase of the project there are interaction of benefic results like germination, transplantation, manual and mechanical weed control, irrigation and fertilization, both granular and leaf, (+20, +40, +10, +28, +8, and +28).

In the production phase of passion fruit, only beneficial interactions are presented; the most significant is related to harvesting and recollection, with a value of +56.

The activities with higher interaction values will require a more complete monitoring and follow up package within the Environmental Management Plan in a later phase.

Evaluating the matrix in a horizontal direction, it is possible to determine which environmental components are the most affected by the group of activities developed both for the installation and production phases and the productive phase. The order is as follows:

For air, the interactions indicate effects lesser than the those to other resources; the impact of greatest relevance is the air pollution during the cleaning of the soil and during the application of chemicals, (-7), followed by a scarce difference by the poor smell brought about by chemical agro products, (-6), generation of gases by the application and operation of equipment, particulate matter generation, sound pressure and noise from the recollection phase, (-6, -5, -5, -3).

The greatest impact on the water resources, is the reduction of water in the rivers, (-27), followed by physicochemical contamination of water sources by run off, dirty water from the washing of equipment, and alteration of drainage, (-21).

For the soils, the most important effect is scour; formation of gullies, and drainage channels, (-28), followed by the loss of soil due to improper cultivation practices, and contamination of soils with agrochemicals, (-20 and –12). Other impacts show interactions between –8 and –3.

For the biotic environment, the most negative interaction deals with deforestation, (-14), followed by migration of fauna species, and the possible contamination by workers with pesticides, (-8), while other impacts are within a –6 to –1 range.

In the socioeconomic environment, the interactions reflect the beneficial character of the project, since most of the balances yielded positive values. The most significant of them are generation of employment and income, and technical training, (+68, and +72). The values of interaction on the other impacts oscillates between +3 and +54 with the exception of the lack of an environmental follow up and control system, which resulted in a negative interaction value, (–72). Tables 30 and 31 present the values of the interaction reported both for columns, (project activities), and for rows, (environmental aspects) :

Table 30. Values of Interactions Registered for Different Phases of Cultivation

PHASE	ACTIVITY		No.	Quantification of Environmental Interaction			Value of Interaction
				A	B	Innocuous	
INSTALLATION AND ASSEMBLING PHASE	GREEN HOUSE	Germination	A	3	5	32	20
		Seedlings	B	20	9	11	-110
	LAND PREPARATION	Hole Digging	C	12	8	20	-32
		Implementation of Drainage	D	12	7	21	-30
	CULTIVATION	Trasplantation	E	2	10	28	40
		Construction of Stakes	F	9	8	23	-4
		Pest Control	G	15	8	17	-35
		Manual Weed Control	H	8	10	22	10
		Mechanical Weed Control	I	8	10	22	10

PHASE	ACTIVITY		No.	Quantification of Environmental Interaction			Value of Interaction
				A	B	Innocuous	
		Sickness Management	J	17	7	16	-50
		Irrigation	K	6	13	21	28
		Application of Leaf Fertilizers	L	8	10	22	8
		Granular Fertilizers	M	6	13	21	28
		Chemical Weed Control	N	20	8	12	-48
PRODUCTIVE PHASE	Harvesting and Post-Harvesting	Harvesting - Recollection	O	2	10	28	56
		Harvesting and Post Harvesting	P	4	7	29	12
		Transportation	Q	5	7	28	8
		End of the Cycle and Control Residual Roots	R	5	8	27	18
Total				162	158	400	720

Table 31. Values of Interactions Registered for Different Reference Environmental Aspects

Component	No.	Environmental Aspect of Reference	Quantification of Interaction			Value of Interaction
			A	B	Innocuous	
AIR	1	Air pollution for land cleaning and application of Agrochemicals	7	0	11	-7
	2	Gases due Equipment operation	5	0	13	-5
	3	Generation of particulate matter	5	0	13	-5
	4	Odors due to Agrochemicals	6	0	12	-6

Component	No.	Environmental Aspect of Reference	Quantification of Interaction			Value of Interaction
			A	B	Innocuous	
	5	Sound pressure and noises in hoarding and transportation	2	0	16	-2
Sub-Total			25	0	65	
WATER	6	Water quality deterioration due to seedling preparation, drainage and agrochemical application	1	0	17	-3
	7	Physicochemical contamination due to equipment washing and run-off	7	0	11	-21
	8	Drainage Alteration	7	0	11	-21
	9	Discharge Reduction at the rivers	9	0	9	-27
Sub -Total			24	0	48	
SOILS	10	Landslides in step areas	5	3	10	-8
	11	Geomorphological Alteration	2	0	16	-8
	12	Alteration of microflora and microfauna due to the use of pesticides	1	0	17	-4
	13	Diminishing agrological characteristics of soils due to poor cultivation practices	6	1	11	-20
	14	Soil scouring in gullies and channels near cultivated areas.	7	0	11	-28
	15	Soil contamination due to agrochemicals	5	2	11	-12
	16	Accumulation of large quantities of materials	2	0	16	-6

Component	No.	Environmental Aspect of Reference	Quantification of Interaction			Value of Interaction
			A	B	Innocuous	
	17	Alteration of physicomechanical and chemical conditions of the soil	6	5	7	-3
Sub-Total			34	11	99	
FLORA	18	Toxicity to agrochemicals	3	3	12	0
	19	Deforestation of the land	10	3	5	-14
	20	Damages for application of chemicals	5	0	13	-5
	21	Landscape Alteration	9	4	5	-5
Subtotal			27	10	35	
FAUNA	22	Toxicity to fauna due to agrochemicals	5	0	13	-5
	23	Migration of fauna due to the activities of the project	8	0	10	-8
	24	Risk to workers for contamination with chemicals	4	0	14	-8
	25	Alteration of vital cycles due to application of chemicals	5	0	13	-5
Sub-Total			22	0	50	
ECOSYSTEMS	26	Aquatic Communities	6	0	12	-6
	27	Vulnerable	1	0	17	-1
	28	Critical	1	0	17	-1
	29	Protected	1	0	17	-1
Sub-Total			9	0	63	
Social	30	Generation of Employment	0	17	1	68
	31	Recuperation of Social Values	0	17	1	51
	32	Strengthening of Sense of Belonging	1	4	13	12
Sub-Total			1	38	15	

Component	No.	Environmental Aspect of Reference	Quantification of Interaction			Value of Interaction
			A	B	Innocuous	
Economic	33	Generation of Income	0	17	1	68
	34	Economic Activities	0	11	7	44
Sub-Total			0	28	8	
Cultural	35	Redistribution of Family Work	0	14	4	42
	36	Improvement of Cultural Practices	0	18	0	54
	37	Improvement of Eating Diet	2	3	13	3
	38	Strengthening of Communal Participation	0	18	0	54
Sub-Total			2	53	17	
Institutional	39	Lack of a System of Environmental Monitoring	0	22	0	-72
	40	Technical Assistance	12	0	10	72
			0	22	0	
Sub-Total			12	44	10	

5.2.2. Environmental Evaluation Matrix

The environmental evaluation matrix is an interdisciplinary analytical process which tries to obtain an objective judgment regarding the consequences brought about by the impacts derived from the execution of the activities of a project, by means of the identification and evaluation of the modifications introduced on a given set of prefixed environmental indicators. The defined quantification for these evaluation criteria are as follows:

CRITERIA FOR CLASSIFICATION	QUALITATIVE VALUATION	QUANTITATIVE VALUATION
Character of Impact	Positive	+
	Negative	-
Type	Direct	0.70
	Indirect	0.30
Duration	Temporal	0.20
	Permanent	0.80
Scope	Local	0.40
	Extensive	0.60
Tendency	Reversible	0.30
	Irreversible	0.70
Synergy	YES	0.80
	NO	0.20
Probability of occurrence	HIGH	0.50
	MEAN	0.30
	LOW	0.20
Magnitude	HIGH	0.50
	MEAN	0.30
	LOW	0.20

The equation that relates impacts with respect to their value and from which one obtains the Environmental Quality CA is as follows :

$$CA = CI * PB\left[\alpha\left(DR * TD * MG\right) + \beta\left(SG * AL * TP\right)\right]$$

Where :

CA = Environmental Quality
CI = Character of Impact, + or - pending of its adverse or beneficial nature
TP = Type
PB = Probability of occurrence
TD =Tendency
DR = Duration of the Impact
AL = Scope
□ = Coefficient of importance (For DR, TD y MG = 60)
MG = Magnitude
□ = Coefficient of importance (For SG, AL y TP = 40)
SG = Synergy

In this manner, an “Environmental Categorization, “EC” has been established, which can be related to an “Environmental Alteration” level as follows:

ENVIRONMENTAL CALIFICATION EC	ENVIRONMENTAL ALTERATION (EA)
>10.0	**VERY HIGH**
8.0-10.0	**HIGH**
6.0-8.0	**MEAN - HIGH**
4.0-6.0	**MEAN**
3.0-4.0	**MEAN - LOW**
1.0-3.0	**LOW**
<1.0	**VERY LOW**

The values of the preceding table can be related both for positive and negative impacts by entering the value of EC as the absolute value. The most relevant affectations on the environment that can be generated by the project can be summarized as follows:

5.2.3. Biotic Environment

Without doubt, the impacts of the passion fruit cultivation project on the biotic medium are, in general, adverse. However, the environmental qualification on most of them is of less than 3, which means the project generates an environmental alteration between low and very low.

The worst environmental qualification found was (–6.2), for the impact classified as "Risk of contamination of the workers with pesticides", which means the environmental alteration in this respect is medium high. The second more negative value was (-5.7), for "Deforestation" or removal of the vegetative cover. All other values were below this one.

These impacts occur in an indirect and local fashion, in the majority of cases and on a temporal basis, over the area of direct influence. The possible deforestation effect, due to the exploitation of vegetal material for the construction of holding stakes is an irreversible impact. The impacts related with flora are synergic, while those related with fauna are not. The probability of occurrence is greater for those impacts related with the application of chemicals than for others.

These impacts are mainly caused during the preparation of the terrain, (cleaning of weeded terrain), during the phases of control of pests and weeds, (because of the use of insecticides, fungicides and herbicides), and during the post harvesting period.

5.2.4. Physical Environment

The physical elements are also affected in an adverse manner; the lowest environmental qualification values are related to soil contamination by agrochemicals, (-5.7), an alteration of medium magnitude. The following negative impact was the deterioration of water quality at the sources, by the preparation of seedlings, drainage and the application of

agrochemicals, (-3.8), and landslides in areas with step slopes, (3.8). The Environmental Alteration generated by the project in these areas is medium low. In all other areas, the environmental ratings are below 3.0, so the alteration is medium low to very low. It can be observed, that most of the negative environmental impacts originate in the application of agrochemicals, requiring handling in the EMP.

The duration of these impacts is temporary over water and air, while they tend to be of a more permanent nature in relation to soil. The extent tends to be local with reversible effects for the majority of impacts, except for those related with drainage, the quantity of water, and erosion of zones where cultivation cannot progress or that have inadequate management. Impacts are not synergic when they are related to air, but are so when related to water and most aspects of soil. The probability of occurrence is very high or almost certain for all the impacts, while the magnitude is low for those related to air, moderate for water and moderate to low soils.

The water resources are the principal components affected by the activities of the productive project due to the possible influx of waters contaminated by the pesticides employed in plague and weed control in the surface currents that drain the plantation area. However it has been classified as having low magnitude, since the application of these substances is manual and plant by plant, which prevents overdoses that would increase the likelihood of the contaminant reaching the water.

The substances that may enter the water bodies are of the organic-phosphorated type, (chemical organic compounds derived from phosphoric acid which are not persistent in the medium and are destroyed by hydrolysis-action of water, leaving no ostensible residues nor any long term ones), carbamates, (In the evolution of the synthesis of new pesticides, after the organic chlorated and the organic phosphorated a new family of organic insecticides was introduced, the carbamic derivates.

This group is found in different forms, conferring each substance a different function : the ditiocarbamates are fungicides, the fenilcarbamates herbicides, and the metilcarbamates insecticides; their main advantage is their low toxicity to humans and domestic animals, and piretrines, (extracted from the flower pelitre, *Chrysantemum cinaerifolium*); It has been known for some time but only since the 1930´s was it commercialized – it is still used, being effective for the control of flies and mosquitoes - they are very toxic in the aquatic medium.The first two have toxicity between high and moderate, (I and II); the volumes that will reach the water are minimal.

This impact is adverse and repeats itself in cycles, since it happens when pesticides are applied; it can be mitigated building barriers that will prevent the direct influx of the substances to the water. It would be worthwhile for the agronomists and technicians of the project to test biological pesticides, such as those derived from the NIM tree, (*Azadirachta indica A. Juss*), which would eliminate the toxicity and residual nature of the current products. Regarding restrictions from EPA :

PRODUCT	Restriction USAID	
	YES	NO
Malathion		X
Rambler		X
Piriviex		X
Curater		X
Furadan		X
Vitavax		X

5.2.5. Socioeconomic Environment

The impacts over the socioeconomic environment are, in general, positive with the exception of the lack of a follow up system and environmental control, which is adverse with an environmental qualification of -3.28, showing a medium low environmental alteration.

Most impacts generated and identified by the project have a future projection that is beneficial, (>5.0), and applies mostly to the direct area; they are of a temporary duration, moderate to high magnitude, and have a large probability of occurrence if the operating conditions of the project are maintained. Coverage of the impacts is local, although some effects can be produced outside of the project area, particularly those related to marketing and transportation of the products. Towards the future, the impacts are synergic because they are prime motivators of social welfare.

5.2.6. Summary of Qualification

Table 33 presents a summary of all the values of environmental qualification and alteration for each one of the resources identified, for the project of cultivation of passion fruit. In order to determine the value of environmental qualification of each one of the resources, an arithmetic mean of the values obtained for CA in each one of the impacts identified was.

Table 33. Summary of Values of Environmental Quality Obtained for the Different Resources

RESOURCE	VALUE OF EC	ENVIRONMENTAL ALTERATION (EA)
Air	-0.86	VERY LOW
Water	-2.76	LOW
Soil	-2.62	LOW
Flora	-2.94	LOW
Fauna	-1.96	LOW
Social	+4.18	MEAN

As it can be inferred from the average of the different EC values reported in each of the identified impacts, the resource that presents the most adverse environmental alteration,

(EA), is flora, mostly as related to deforestation and loss of vegetative cover in the preparation of stakes; for this reason, the Environmental Management Plan addresses this problem with Form No. 1, "Cultural Practices", and Form No. 10, "Protection and Control of the Consumption of Vegetal material, and Form No. 11, "Management of Vegetative Cover by Means of Areas of Floristic Compensation".

With regard to Soil, third in the order of magnitude of Environmental Alteration, (-2.62), the impact causing the largest alteration is the contamination with agrochemical compounds, for which the EMP has created Form No. 3, "Management and Control of Plaguisides. For the control of landslides, the EMP proposes Form No. 1 Cultural Practices".

In relation to Fauna, where alteration is minor, (-1.96), the impact with greater influence is the risk of contamination of workers with pesticides, for which Form No. 3 and also Form No. 17, "Industrial Safety", propose specific means of management and control.

In regard with Air pollution, where the minimum alteration is observed, (-0.86), the generation of particulate matter during the activities of land preparation is the greatest concern. This impact is dealt with in Form No. 1, "Cultural Practices".

Other alterations to the environmental quality in the area are also considered in the formulation of the EMP, in order to obtain an integral form of management of all resources, physical and biotic, presently affected by the project.

The beneficial alteration of the project is exercised over the socioeconomic environment, in which most of the positive EC values were reported. The average of the EC values registered at +4.18, corresponding to a medium environmental alteration. In order to supplement these benefic aspects of the project in the social environment, the EMP proposes Forms No. 15,"Strengthening of the Sense of belonging"; Form 16, "Environmental Education", and Form 17, "Industrial Safety".

When the mean values of EC, are independently calculated for negative and positive effects, and the values are then added arithmetically, one can estimate the average environmental alteration produced is in general of a positive nature, albeit of low incidence in the project area.

It can be said that the environmental evaluation analysis of the different phases that conform the project in the Department of Huila, shows that although some of these activities are producing impacts on the environment, the affectation can be diminished with the implementation of the EMP, which considers the measures needed to counter these effects and increase the social benefits that are being produced. In this manner, it is expected that the Environmental Quality will improve with the implementation of the EMP, with a corresponding increase on the social benefits from the project towards the community and the environment.

5.3 RESULTS

The following table summarizes all the measures established within the environmental management plan to be executed throughout the development of the Passion fruit Cultivation Project.

Table 34. Environmental Measures to be Applied to Passion Fruit Crops

PROGRAM	FORM No.	MEASURE
SOIL MANAGEMENT	1	CULTURAL PRACTICES
	2	AGRONOMIC PRACTICES
	3	PESTICIDE AND WEED CONTROL AND MANAGEMENT
	4	WEED CONTROL
	5	ORGANIC AND BIOLOGICAL AGRICULTURAL PRACTICES
	6	EROSION CONTROL
WATER RESOURCES MANAGEMENT	7	WATER QUALITY CONTROL
	8	WATER CONTROL IN INDUSTRIAL PROCESSING
	9	SOIL CONSERVATION BY SOLID WASTE DISPOSAL
AIR MANAGEMENT AND CONTROL	10	CLEAN TECHNOLOGIES FOR SOIL PREPARATION
MANAGEMENT AND CONTROL OF FLORA AND FAUNA	11	VEGETATIVE COVER MANAGEMENT BY FLORISTIC COMPENSATION
	12	FAUNA MIGRATION CONTROL
	13	GENERATION OF LIVE FENCES AND PLANTATION OF VEGETATIVE COVER
ECOSYSTEM PROTECTION	14	CONSERVATION OF NATIVE ECOSYSTEMS
SOCIAL MANAGEMENT	15	STRENGTHENING OF THE SENSE OF BELONGING
	16	ENVIRONMENTAL EDUCATION
	17	INDUSTRIAL SAFETY

5.4 ENVIRONMENTAL MONITORING AND FOLLOW UP PLAN

5.4.1 Overview

The Environmental Monitoring and Follow up Plan -EMFP- is a part of the Environmental Management Plan –EMP- and constitutes a tool in which the detailed programs, from the activity of impact identification all the way to the measures proposed are incorporated, to allow verification, vigilance and assessment of the actions and activities of the project before, after and during its execution.

The environmental monitoring and follow up program will also have as an objective the attainment of environmental information necessary to determine and describe the behavior of the plantations and their processing; to give elements of judgment, and to ease the

decision-making of predictable and unpredictable situations alike; it will also serve to minimize the adverse character of environmental effects and guarantee the technical soundness of the analysis and solution of eventual conflicts between peasants, the operator of the project and the environmental control authority with respect to the interpretation of environmental topics related to the cultivation of Passion fruit.

5.4.2 General Objective

To offer the environmental authority and the community, the Chemonics Foundation and USAID a technical basis for the verification of the adequate development of the project.

5.4.3 Specific Objectives

The EMFP will establish the activities that are necessary to implement, and the responsibilities for verifying, supervising and evaluating the actions of the Environmental Management Plan. It will establish the indicators, the sampling points and the places where the monitoring should take place, as well as the methodologies recommended in particular for sampling and verification, including periodicity of sampling, duration, type of analysis, forms of assessment, costs and financing of the activities. The sampling points, will be established taking as a basis those that were used for the Environmental Assessment in the EA, in order to increase the confidence on the results and run comparative assessments with the original data.

The Plan will include recommendations regarding the form for presenting periodic reports, with argumentation of the periodicity of reporting, and will establish the extent of advances on the following aspects:

- Physical and Chemical Monitoring on Intervened Water Bodies
- Revegetation and Erosion Control programs
- Biological Control programs
- Solid Residue Management programs
- Social Welfare Management programs

The present report should present the Chemonics Foundation, USAID and the Environmental Authority a proposal for implementation of an EMP and an EMFP, considering the following aspects :

- Environmental Components to Monitor
- Impacts to Monitor
- Scheduling of Check ups
- Types of Monitoring Measures

5.4.4 Summary of Activities

For the purpose of making the Monitoring and Follow up Plan a project activity of easy execution and verification by the environmental authority and the USAID, it has been determined to present it as a chart that includes all aspects of the Project that will have to be controlled and followed up within the Plan, referred to each of the activities proposed in the EMP.

The Standard Forms for Monitoring and Follow up that have been proposed, and that can be modified according to the particular circumstances of the different properties and the different indicators to investigate, are shown in Appendix 1 of the Spanish version of the EA.

5.4.5 Costs

Costs for the EMFP have been estimated according to the methodology proposed in the Forms of the EMP; this means that the EMFP induces costs for each one of the activities of the EMP. It is to be noted, that the personnel in charge of the activities of Monitoring and follow-up, corresponds to the same personnel referred to in the EMP, which conforms the Environmental Management Group, described later in this report; for this reason, the costs of the EMFP are only related to the costs required for the sampling and the laboratory analysis of water and soil quality, the direct costs of photographic records and the elaboration of reports.

5.4.6 Chronograms

In order to demonstrate the parallel behavior in the execution of the activities of the EMP and the EMFP, a bar diagram of the Gant type has been designed, indicating the time for each measure, and the corresponding activity of monitoring, follow-up or assessment that is needed.

5.5 ENVIRONMENTAL LEADERSHIP PLAN

Environmental Policy is a group of basic rules that have to be taken into account during the formulation and the execution of the project, in order to fulfill the purposes of conservation of the natural environment, the efficient recovery of the resources, the augmentation of the productivity and the fulfillment of the environmental norms. Environmental policy has been designed taking into account the results of the environmental assessment, from which it draws the basic information.

System for Environmental Leadership

The system for environmental leadership is supported by the principles of compromise and internal conviction that permit to make an auto assessment and to improve in an objective manner the different phases of the project, in order to empower the positive actions and

minimize the negative actions which can have a significant influence in the deterioration of the environment.

Good environmental management does not just serve to implement the measures of the EMP, but serves also as a tool to optimize the resources used, allowing the cultivator to be more competitive and to be able to contribute better towards the sustainability of the project.

To obtain the maximum benefit it is necessary that producers understand the importance of environmental management and develop the actions and programs of the EMP inside their organizations at the level of farm, communal land or association so that the people working there give adequate treatment to the natural resources that are in danger of being negatively affected.

It is fundamental to take into account that in order to minimize the negative environmental impacts, the producer/farmer must have an incentive to use clean technology, besides improving his productive processes, according to his possibilities in order to gradually come to comply with the requisites stipulated.

The implementation and development phase of the EMP, corresponds to the application of the environmental measures and the productive processes that can be implemented as a part of a proposal for sustainable development. In order to accomplish the execution of these measures, it will be necessary to take into the account the following :

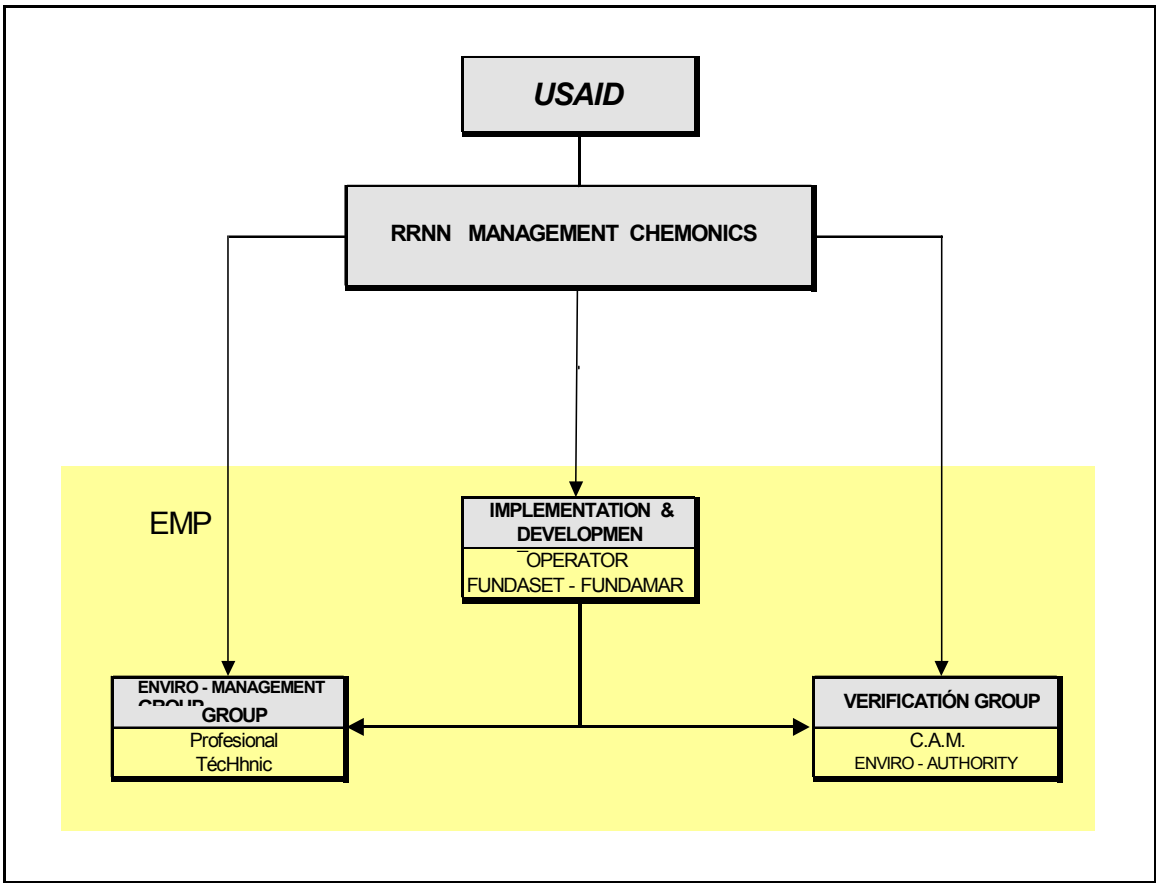
- To create an organization structure that consists of a director, coordinator and executor of the system of environmental management, and the people to fill the positions.
- To assign resources, create procedures, communication networks and operational controls.
- Provide the system with the human resources, the physical resources and the financial means to obtain the proposed benefits.
- To support the provision of resources, based on the activities and requirements of personnel, materials, equipments, and other inputs.

The phase of follow-up corresponds to the verification of the efficacy and efficiency of the environmental measures executed, supported by the following actions :

- Measure and monitor the characteristics of the operations and activities that cause environmental impacts.
- Define responsibilities and authority to manage, investigate and correct inconformities.
- Maintain the environmental records needed to corroborate the fulfillment of the proposed objectives and goals.
- Perform periodically environmental audits to determine if the management system has been correctly implemented and maintained according to plan.

5.6 ENVIRONMENTAL MANAGEMENT GROUP

In order to implement the Environmental Management Plan, it has been considered pertinent to conform a group of environmental leadership, in charge of supervising the measures and implementation of the EMF, so that all activities are executed in accordance with the recommendations of this study.



SECTION 6 LIST OF PREPARERS

The work group for this study included the following professionals :

- **RAQUEL DUQUE R.** Civil Eng., M. Sc. in Environmental Engineering and Water Resources. Coordinator of the Study.

- **JORGE CAICEDO B.** Economist. Specialist in Economic Development and Transportation and in Cultural management. In charge of socioeconomic aspects of the project.

- **GERMAN CAMACHO** Biologist. In charge of biotic aspects in the project, (flora, fauna), water quality and the formulation of environmental management measures in this area.

- **RICARDO CAICEDO** Agronomist. In charge of the technical aspects of the project, soil use, production, etc.

- **FABIAN CERON** Civil Eng., M. Sc. Environmental Engineering. Field engineer, and support for the characterization of the physical baseline and the formulation of management ideas.

For water quality tests, the consultants used the laboratories of DAPHNIA Ltd., of Bogotá, a recognized center with equipment and personnel well versed in the required analysis.

SECTION 7 APPENDIX

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