

**BASELINE ASSESSMENT
OF CAURA/TACARIGUA AND
MARACAS/ST. JOSEPH WATERSHEDS**

Final Report

Submitted to The Cropper Foundation

Beaumont Celestain

July 26, 2010

TABLE OF CONTENTS	Page
1 INTRODUCTION	1
<i>1.1 Objectives of the Project</i>	1
<i>1.2 Baseline Data Collection</i>	1
<i>1.3 Activities of Consultant</i>	1
2 DEMOGRAPHIC CHARACTERISTICS	2
<i>2.1 Caura Tacarigua Watershed Demographic Factors</i>	2
<i>2.2 Maracas/St. Joseph Watershed Demographic Characteristics</i>	2
3 LANDSCAPE CHARACTERISTICS	3
<i>3.1 Landscape Features</i>	3
<i>3.2 Vulnerability in Caura Valley</i>	3
<i>3.3 Vulnerability in Maracas/St. Joseph</i>	4
4 AGRICULTURAL ACTIVITIES	5
<i>4.1 Farming Population</i>	5
<i>4.2 Farm Enterprises</i>	5
<i>4.3 Crop Production</i>	6
<i>4.4 Farming Practices</i>	7
<i>4.4.1 Land Preparation</i>	7
<i>4.4.2 Alternative Farming Methods</i>	8
<i>4.4.3 Cultivation Methods on Slopes</i>	9
<i>4.4.4 Crop Management Systems</i>	9
5 LIVELIHOOD FUNCTIONS	11
<i>5.1 Land Tenure</i>	11
<i>5.2 Land Use Patterns</i>	11
<i>5.2.1 Agricultural Uses</i>	11
<i>5.2.2 Recreational Use</i>	12
<i>5.2.3 Mining and Quarrying Use</i>	12
<i>5.3 Incomes and Employment</i>	12
6 GOVERNANCE AND CAPACITY BUILDING	14
<i>6.1 Settlements in Caura Valley</i>	14
<i>6.2 Settlements in Maracas/St. Joseph</i>	14
<i>6.3 Community of Actors</i>	14
<i>6.4 Institutional Support</i>	15
7 SURVEY OF FARMER EXPECTATIONS	16
<i>7.1 Areas of Concern</i>	16
<i>7.2 Survey Results</i>	16
8 RECOMMENDATIONS	19
8.1 Settlements	19
8.2 Tenure Regularisation	19
8.3 Alternative Farming Techniques	19
8.4 Application Research	19
8.5 Education and Awareness	20
8.6 Potential Income and Employment	20

REFERENCES	22
APPENDICES	
Appendix 1 – List of farmers interviewed	23
TABLES	
Table 1: Farming Population in the Caura Valley	5
Table 2: Farming Population in the Maracas/St. Joseph Valley	5
Table 3: Water Source and Topography Type by Communities in the Caura Valley	8
Table 4: Land Ownership in the Caura Valley	11
Table 5: Tenure Situation in Maracas/ St. Joseph	11
Table 6: Comparative Wages	12
Table 7: Location of Farms of Interviewees	17
Table 8: Choice of Crop Decisions	17
Table 9: Land Tenure Situation	18
Table 10: Percentage of Cash Income from Farming	18
Table 11: Importance of Sources for Cultural Practices	18
ANNEXES	
ANNEX 1: ACTIVITIES OF THE CONSULTANT	24
ANNEX 2: BASIC STATISTICS: CAURA VALLEY	26
<i>Table A: Population by age of the residents of the Caura Valley</i>	26
<i>Table B: Land Use Capability - Caura Valley</i>	26
<i>Table C: Number of farmers by Communities in the Caura Area</i>	26
ANNEX 3: BASIC STATISTICS: MARACAS/ST. JOSEPH VALLEY	27
<i>Table A: Population change in the Maracas Valley watershed area</i>	27
<i>Table B: Community classification by topography</i>	27
ANNEX 4: THE WATERSHEDS OF THE NORTHERN RANGE	28
ANNEX 5: FAUNA AND FLORA DIVERSITY IN THE NORTHERN RANGE	29
<i>Table A - Species Diversity in Trinidad and Tobago and in the Northern Range</i>	29
<i>Table B – Summary of some Key Faunal Species of the Eastern Northern Range</i>	29
<i>Table C - Some Northern Range Floral Species that have some proven Medicinal use</i>	31
ANNEX 6: LONG-TERM TRENDS FOR GROUND-WATER LEVELS FROM 1988 TO 1998	32
ANNEX 7: SUMMARY OF VISITOR NUMBERS TO NORTHERN RANGE SITES FOR 1997 – 2002	33
ANNEX 8: COMMUNITY OF ACTORS	34
ANNEX 9: FARM MODELS	35
<i>Table A: Summary of Farm Model Type 1</i>	35
<i>Table B: Summary of Farm Model Type 3</i>	35
<i>Table C: Summary of Farm Model Type 3</i>	36
ANNEX10: SURVEY INSTRUMENT AND SURVEY RESULTS	38
ANNEX 11: LANDSCAPE (ECOSYSTEM) SERVICES TO HUMANITY	46
ILLUSTRATIONS	
Map – 1: Maracas /St. Joseph	47
Map – 2: Caura /Tacarigua	48

1 INTRODUCTION

1.1 *Objectives of The Project*

The project titled “**Implementation of Sustainable Farming Practices in Trinidad’s Northern Range Communities**” specifically targets the Maracas/St. Joseph watershed area and the Caura/Tacarigua watershed area. The overall objectives of the project are:

- a) To pilot a replicable model for sustaining livelihoods of small scale hillside farmers in the Northern Range while protecting the resources of the ecosystem and alleviating negative downstream impacts;
- b) To support the social and economic development of participating farming communities;
- c) To communicate the approach and learning and assist in the scaling up and replication of this model.

1.2 **Baseline Data Collection**

As the initial component of the project, this data collection exercise was designed to inform a programme of intervention and support to farmers in the two targeted watershed areas. The exercise sought to gather data and information that would profile, among others;

- Farmers, the farming communities and their farming systems including their land use practices and their use of chemical inputs on their farms;
- Changes that may be occurring in their asset base in terms of soil depletion (nutrient and physical status) and water availability;
- Changes that may be occurring in the wider landscape in terms of land clearing, soil erosion, impact on flora and fauna and water quality in the area;
- The presence of community-based organizations, NGO’s and Government Institutions and their potential to bring about changes in the livelihood of farmers.

It is hoped that an intervention model will be designed, based on these findings, to introduce farmers to more sustainable farming practices and to simultaneously improve their livelihood and maintain the integrity of the landscape within which they currently operate.

1.3 **Activities of Consultant**

The activities of the Consultant, between March 12 – June 20 and July 14th – July 24th 2010 included:

- Literature review;
- Meetings with sources of information;
- Discussion with farmers on their farms;
- Sharing of our perspective on landscape-ecosystem services.
- Conducting a farm survey in the two study areas

Annex 1 expresses these activities in full detail.

2.0 DEMOGRAPHIC CHARACTERISTICS

Summary Characteristics

Background	Caura/Tacarigua Watershed	Maracas/St. Joseph Watershed
<i>Population (Census 2000)</i>	776	13,288 (ref 2005)
<i>Watershed Area</i>	4,836 Ha	4,280 Ha
<i>Comparative watershed Size</i>	4 th largest	7 th largest
<i>Number of Farms</i>	88	34
<i>Number of Interviews</i>	12	3

2.1 Caura Tacarigua Valley Demographic Factors

The location of Caura Valley is (Latitude: 10° 41' 60 N, Longitude: 61° 21' 0 W). The valley comprises some 4,836 ha, which represent 4% of the total Northern Range area and is the fourth largest watershed area in the Northern Range.

The population in the Caura Valley according to the 2000 census is 776 persons. (*Annex 2: Table A*). Most settlements and farming activities occur within the lower areas of the valley. In fact the soil has been classified as good in the upper watershed and poor in the lower watershed.

Most of the soils in the higher elevations are classified as Type VII, (*Annex 2: Table B*), unsuitable for agricultural purposes and thus remain in forest cover. The majority of human activities occur on soils that are classified as Types 1 - 3, which are suited for agriculture. This represents approximately 23% of the valley.

2.2 Maracas/St. Joseph Valley Demographic Factors

The location of Maracas St. Joseph Valley in Trinidad and Tobago is Latitude 10.6166667° and Longitude. - 61.4166667°. The valley is approximately 4,280 hectares in Trinidad, which ranks it as the 7th largest watershed area of the Northern Range, and comprises primary and secondary forests. (*Annex 4*)

The population in this valley itself is significantly greater than in the Caura Valley, having grown from 7,030 in 1980 to 13,288 in 2005, approximately 89% over a 25 year period. This is a significant development since the main influx has been from private housing developments and not expanded agricultural activities. (*Annex 3: Table A*)

3.0 LANDSCAPE CHARACTERISTICS

Summary Characteristics: Environmental Vulnerability

Caura Valley	St. Joseph Valley
<ul style="list-style-type: none"> • Unauthorized use of more secluded pools; • Pollution from visitors' refuge 	<ul style="list-style-type: none"> • Quarrying • Pollution of the river from raw sewage and quarry materials ; • New upscale housing developments

3.1 Landscape Features

Both valleys are living examples of “Eco-agriculture Landscapes” represented by a mosaic of natural features (forests, ravines, wildlife habitat) accompanied by human land uses, primarily for agriculture, but also inclusive of mining, timber harvesting etc, and social organization such as communities and villages.

The diversity of flora and fauna in both valleys is common to other watershed areas in the Northern Range and include lappe, agouti, deer, wild hog, ocelot, and capuchin monkeys, various species of snakes and hard wood tree types such as cedar, mahogany, and cypre, pink and yellow Poui. (*Annex 5: Table A*). The area is also known for floral species that have proven medicinal uses, such as Jumbie Bead, Olive bush and Wild Senna (*Annex 5: Table C*).

The Landscape is capable of providing a range of services for sustaining human and biological existence (*Annex 5*). Significant services within the Caura and St. Joseph landscapes are those of **Food Production** including the production of game, fish, crops, nuts, fruits and subsistence farming and **Water Retention** and the regulation of the flow of water on surface and in underground aquifers. Much of the potable water supplied to downstream communities in the Caura/Tacarigua area and the surrounding “developed” areas (*including other near-by watersheds*) comes from the Water and Sewerage Authority (WASA) facilities on the Caura River. The long term trend is declining ground water levels in most watersheds in the Northern Range. This trend has specifically been noted in the Valsayn gravels of Maracas and Tacarigua gravels of Caura/Tacarigua. (*Annex 6*).

3.2 Vulnerability in Caura Valley

In terms of environmental vulnerability, the extreme dry season of 2010 has resulted in a significant number of bush fires in the hillsides of the Northern Range. Both the Fire Services Division and the Forestry Division have expressed the opinion that the bush fires of the 2010 dry season have caused significant damage essentially to non-farm lands, with possible severe consequences for example flooding and soil erosion to farming activities when rain begins. The subsequent advent of the rainy season appears to be confirming their expectations.

Farming practices also create conditions of vulnerability. The current farming practices by the majority of farmers is the use of harmful non organic based pesticides which contribute to pollution of water courses, reduction of bio-diversity and the degradation of soils (both in physical structure and soil fertility).

A few farmers in the Caura valley cultivate on slopes without incorporating hillside soil conservation techniques such as terracing, building wind breaks, check dams etc. This has the potential of leading to erosion and soil loss on the hillsides.

The Caura Valley's Recreational Park is a major area for recreational activity in northern and eastern Trinidad with excess of 60,000 visitors per year. But recreational activities in the Caura

Valley have both beneficial and challenging consequences. Outdoor cooking activities, bon fires and the debris left by visitors are becoming a serious challenge to maintaining the integrity of the riverine area. Visitors are also reported by farmers to steal produce and dump waste on cultivated fields and in some cases directly into the water ways. Another aspect of litter damage in the valley occurs when trucks dump huge amounts of litter on the mountain sides and along the side of the roads.

In addition to the high population traffic in the vicinity of the major water pools in the Caura valley, visitors venture further up the valley in the vicinity of the more secluded pools. The residents of the valley have also expressed concern with the visitors who frequent the rivers and springs in the valley, particularly the ones located in upper regions.¹ A few farmers have observed “dead spots”² in the river further up the valley.

The fertile soils, the water sources, the encouraging micro-climate of the Caura Valley tend to attract new³ residences and new farmers to the valley. Fortunately this migration is not as widespread as to cause concern in the sensitive areas (hillsides, forest reserve). However, in the absence of a public awareness programme on preserving the landscape, this trend may likely have a negative influence on watershed management and sustainable measures of environmental management.

3.3 Vulnerability in Maracas/St. Joseph Valley

The perception of environmental vulnerability in Maracas/St. Joseph is somewhat different. Because of the extensive bush fires in 2010, atmospheric pollution became the major concern. This has been championed by the residents’ association.⁴ However other environmental hazards have been identified and are cause for concern by residents. These include:

- Quarrying
- Pollution of the river from raw sewage and quarry materials
- New upscale housing developments which remove significant vegetative cover from the mountain side and increase runoff
- Slash and burn farming in the rainy season which leaves the hillsides without protective vegetative cover and the current practice does not utilize soil conservation techniques for hillside farming, this leads to loss of top soil in the farmed areas and contributes to flooding in the lower watershed and downstream communities in the rainy season.

¹ These sentiments have been expressed to the Consultant and on a first hand basis in addition consultant has visually confirmed significant pieces of litter strewn inside the river at recreational spots.

² Dead Spots refer to the absence of marine life in the rivers (particularly fish)

³ Farmers in the Caura valley indicated to the Consultant this phenomena is occurring along the forest reserve (Extension along Caura Royal rd), approximately 10 new residents over the last 5 – 6 years

⁴ The Maracas Valley Residents Association

4.0 AGRICULTURAL ACTIVITIES

4.1 Farming Population

Generally the farming population of Trinidad and Tobago is believed to be in decline⁵. This is evident in both valleys. In the Caura Valley, the Extension Services and Information Division of the Ministry of Food Production, Land and Marine Resources (MFPLMR) has recorded a total of 88 farmers with significant concentration in the Tumbasson and Caura Royal Road Area. However, this number could not be verified during the dry season. Indeed a 2003 Report on the participation of farmers in the Farm Schools observed an attendance of 24 participants out of total of 45 active farmers in the Caura Valley.

Table 1: Farming Population in the Caura Valley

Communities	Number of Farmers	% of Total
Tumbasson	28	31.82%
Caura Royal Road	35	39.77%
Concordia	15	17.05%
Cachipal	10	11.36%
TOTAL	88	100.00%

Source: MFPLMR, Extension Officer, (Ms. Averill Charles)

In the Maracas/St. Joseph Valley the reduction in the farming population has been more pronounced. The MFPLMR records suggest the presence of 34 farmers in this valley, which would be a significant reduction from the 1984 record of 103. It is further believed that the reduction in these farmers has occurred in the 1-5 acre farm-size category, which in 1984 constituted about 81% of the farmers.

Table 2: Farming Population in the Maracas/ St. Joseph Valley

Community	Number of farmers	% of Total
La Grind Road	8	23.53%
La Baja	11	32.35%
Acono	12	35.29%
Maracas	3	8.82%
Total	34	100%

Source: MFPLMR, Extension Officer, (Jason Ramsaran)

4.2 Farm Enterprises

Summary Characteristics

Farm Profiles	Caura Valley	St. Joseph Valley
Commercial Farms	Small farms growing commercial crops, averaging about 5 acres	In Caurita and Lango there exist a few estates with citrus, mango and cocoa.
Subsistence farms	Not Significant	Not more than 1.5 acre farms
Direct Hillside Farming	Farmers in Cachipal Rd growing on the hillside.	Two farmers in La Baja, four on Bancal Rd and one in Caurita cultivates on hillside during the rainy season, but during the dry season utilizes grow box technology on smaller plot on flat.
Bee Keeping	3 farmers	1 farmer

⁵ Central Statistical Office of Trinidad and Tobago, Agricultural Census 2003/4

The majority of farm enterprises in the Caura Valley are small farms averaging 5 acres and growing crops for the local wholesale market as well as contract buyers. These farmers cultivate primarily in the rainy season using limited soil conservation technologies such as planting along the contour. .

The majority of agricultural activities in the Maracas/St Joseph watershed comprise crop production with very insignificant backyard rearing of livestock (common fowl, goats, ducks). These farmers cultivate no more than one and a half acres at a time, utilizing shifting cultivation.⁶ During the severe dry season of 2010, a few vacant farms were observed. In the upper regions of the valley, namely Caurita and Lango, there are a few estates with citrus, mango and cocoa. These have remained relatively intact with little replanting and aging tree crops constituting their production acreage. In the lower region of the valley, in communities such as Acono and La Baja, short term cultivation is conducted solely under rain fed conditions.

The main short crops cultivated in the valley were pigeon peas, corn, tomato, eggplant, and string beans. Within each farm model pigeon peas and corn occupied approximately 80% of the area and the **other more high valued crops 20%**. This was probably due to lack of financial resources. These farming models can be described as subsistence type.

There is one farmer in La Baja Road, who produces a range of crops such as patchoi, lettuce, chive, celery and thyme and in some instances cabbage during the dry season using a grow box technology. During the rainy season, this farmer cultivates tomato through shifting cultivation practice. Bee keeping is a notable occurrence in both watersheds and could represent an integral component of an upgraded farming system. There are at least three bee keepers in the Caura Valley and one in Maracas St. Joseph Valley.

4.3 Crop Production

Summary Characteristics

Communities	Crops cultivated	Farming status (fulltime, part time)
Tumbasson	Tree crops, banana, plantain, corn, pumpkin, golden apple	Majority fulltime > 80%
Caura Royal Road	Papaya, egg plant tomato, corn, golden apple, pumpkin	Majority fulltime > 80%
Concordia	Oranges, pumpkin, tree crops, tomato, pumpkin, sweet pepper	Part time
Cachipal	Papaya, agro forestry, tomato, hot pepper, watermelon, egg plant	Majority fulltime > 80%

Source: MFPLMR, Extension Officer, (Averill Charles)

Both valleys cultivate similar short-term crops but their methods and systems are different. The majority of farms observed on the slopes in Maracas Valley ranged in size from 0.5 – 1.5 acres with the modal value at about 0.75 acres. These sizes appear to be consistent with what is manageable under subsistence resources. In addition, the farmers indicated that there exist a sub group of farmers that they titled ‘gardeners’ whom plant on an **average of 0.5 acres and practice a subsistence type farm model on sloping lands**. Besides size the other major difference identified was farming was **done on a part time basis**. Short term crops cultivated in the two study areas included:

⁶ Planting one acre one year, progressing to a different location in year 2 and the pattern continues year after year.

- Corn
- Eggplant
- Hot pepper
- Sweet pepper
- Tomato
- Cucumber
- Pumpkin
- Few herbs (chive, thyme)

More recently Papaya has been introduced as a commercial crop in the Caura Valley. The predominant variety cultivated is “*Tainung*” with fruits averaging 2.5 lbs (1.1 kgs) in weight and geared towards the local fresh fruit market. These papaya farmers do not dedicate their entire farm to this crop, but cultivate an average of 40% of their 5 acre plots (about 2 acres). This is considered a very remunerative option. According to several farmers this crop accounts for over 70% of their farm income, selling at both farm gate and wholesale market. This crop is a medium-term crop as its economic life span is 18 – 20 months.

A new crop has been introduced over the last 2 years. This is the dwarf Golden Apple cultivated on contract from the Trinidad and Tobago Agri-Business Association (TTABA). These contracts compare favourably to those for papaya with the duration for golden apple of 10 years as against one year (bearing) for papaya. Currently TTABA has two production contracts with two farmers from the Caura Valley Farmers Association (CVFA) for golden apple. The opportunities for the production of golden apple and papaya have been extended by TTABA to other farmers in the valley. This program, however, has the important condition that all contracted farmers must have year round water supply on their farms.

4.4 Farming Practices

Summary Characteristics

Farming Practices	Sustainable	Unsustainable
<i>Irrigation System</i>	Drum depositories in field Drip Irrigation	Rain-fed only– (Uneconomical to source water from river, springs or build ponds)
<i>Land Preparation</i>	Contour planting	Slash & Burn
<i>Current Farming Practices</i>	<ul style="list-style-type: none"> • Recycling green material: • Composting 	Use of inorganic commercial inputs
<i>Cultivation Methods on Slopes</i>	<ul style="list-style-type: none"> • Terracing, • Wind breaks and • Check dams 	Direct planting without soil conservation infrastructure
<i>Weeds, Pest and Disease Control</i>	<ul style="list-style-type: none"> • Integrated Pest Management (limited) 	Production utilizing pesticides, mineral fertilizers and un-composted pen manure taking place right up to the river's edge

4.4.1 Land Preparation

Mechanized land preparation is practiced on the flat lands. Tractors are used and the typical activities involve, brush cutting, ploughing, rotovating and constructing drains. Additionally, some farmers add limestone and external sources of manure (mainly chicken cured pen manure) at this time. In some cases cambered beds are used instead of rows on the flat. Land preparation

practices on the slopes, however, are performed using manual labour. Rows are normally constructed for planting short crops while trees are planted either on rows or by digging holes on the contours.

In the Maracas/ St Joseph Valley, where farmers cultivate crops on much steeper slopes, the infrequent use of such methods as contour planting, green manuring, terracing, wind breaks and check dams in their land preparation systems is a matter of concern.

In the Caura Valley, topography and accessible water sources play a significant role in the decision relating to which areas should be cultivated. There is a strong preference for overhead sprinkler systems⁷, much to the chagrin of WASA (Water and Sewerage Authority). In collaboration with MFPLMR, the water utility company (WASA) has been attempting to encourage farmers in the Caura Valley to change their irrigation systems from overhead sprinkler irrigation systems to drip irrigation systems.

Table 3: Water Source and Topography Type by Community in the Caura Valley

Communities	Topography	Water source
Tumbasson	slope < 20 degrees	rain fed, dam
Caura Royal Road	Flat	river & tributaries & springs
Concordia ⁸	slope < 20 degrees	Springs & tributaries
Cachipal	flat, plateau	river & tributaries

Source: MFPLMAR, Extension Officer

The arguments presented to farmers by MFPLMAR and WASA emphasize the following advantages:

- Less water consumption (gravity fed or pump with low horse power requirement)
- Less horse power use (cheaper pump)
- A more cost effective technology using the Chinese⁹ manufactured irrigation lines
- Lower demand for manual labor to irrigate¹⁰
- Lower incidence of pest and disease
- Less soil impact damage (Erosion)

4.4.2 Alternative Farming Methods

The introduction of the Farmer field schools in 2003/4 contributed significantly to farmers' knowledge of agronomic requirements for the major agricultural activities. Twenty percent (20%) of the farmers in Caura Valley attended the farm field schools and were exposed to the use of soil ameliorants such as manure, mulching, companion planting and the application of less broad spectrum pesticides. Some farmers (20%) in the Caura valley continue to exhibit knowledge and willingness to use alternative methods of pest and disease control.

⁷ Overhead sprinkler irrigation systems waste significantly more water than drip irrigation systems

⁸ Some farmers have a serious problem with flooding in the rainy season.

⁹ Proven under local conditions and allow farmers savings of on average 60%

¹⁰ A significant amount of farmers in Trinidad utilizing the sprinkler overhead irrigation system at any point in time may irrigate 20 – 30% of their field. The process involves assembling the system, irrigating the specific area (for example 20%) then disassembling the system moving to another 20% area, reassembling, irrigating the new area and so on and so on until the whole field is fully irrigated. This is a very labor intensive exercise, which is quite expensive.

This basic knowledge is not as prevalent among the farmers in the Maracas/St. Joseph Valley. The line Ministry for agriculture (MFPLMR) operates one or two courses in some aspects of agronomy specific to the farmers in the area.

4.4.3 Cultivation Methods on Slopes

There are two communities in the Caura valley in which cultivation on slopes is an important feature. These are the communities of Concordia and Tumbasson. Farmers in these communities appear to hold to a convention of “*not planting above the thirty five (35) feet contour level*”¹¹, planting only tree crops on the slopes and planting along the contours.

A contrasting situation occurs in the Maracas valley where farmers of the La Baja and Acono communities cultivate lands in the forest above. These farmers practice slash and burn agriculture and shifting cultivation, on a year by year basis, in addition to only planting during the rainy season. Land preparation practices on the slopes were done manually and in the majority of cases none or very limited soil conservation techniques were applied.

This destroys the soil’s physical and chemical characteristics while significantly altering the surrounding landscape.

The challenge to educate the existing farmers on alternative farming techniques while encouraging and supporting new entrants in earning a living from the land is being addressed in a series of short-term courses. In 2008 there was a short training course conducted by the MFPLMR extension officer for the St. Joseph Valley area on “***The use of the “A” frame for farming on slopes***”. The Ministry of Food Production, Land and Marine Resources (MFPLMR) has a demonstration farm in the Caura Valley located on Cachipal Rd. This facility demonstrates the technically sound principles of soil conservation and cultivating on slopes. The choice of crops on the demonstration plots, however, do not represent the more common crops found on the farms.¹² These efforts, while giving testimony to the need to find a balance between agricultural endeavours and sound watershed management are probably too isolated to have a lasting effect.

4.4.4 Crop Management systems

Conventional crop management systems are still very popular among the farming population. A major concern in the Caura Valley is the failure to implement buffer zones. Thus production utilizing pesticides, mineral fertilizers and un-composted pen manure takes place right up to the river’s edge.

Arising out of three field farm schools interventions held in 2003 /4, is a new sense of awareness among farmers of the consequences of their practices and actions on their immediate natural environment. Consequently, they spray only when required with the recommended pesticides, but these products still do damage to the environment. While such Integrated Pest Management (IPM) strategies are to be complimented, they appear to be practiced by only a few farmers.

There is limited but encouraging use of recycled farm inputs on a few farms in the Caura Valley. The farmers in the Concordia community use a wood chipper to manufacture composting material from the waste generated. This is then used as an input into their farming practices. There is also

¹¹ An expression used frequently in discussions with these farmers.

¹² This demonstration farm has no short crops and the long term crops present on this demonstration farm have short bearing seasons (e.g. mango).

evidence of the use of cardboard as mulch but availability of this medium is a problem. It is usually sourced from West Indian Tobacco Company Ltd (WITCO).

Farmers have indicated a willingness to practice input substitution with organic type inputs particularly to substitute the non organic forms of potassium and phosphorus which are in low available quantities in the Northern Range soils. This situation present challenges as these organic substitutes (phosphorus and potassium) identified in the USA are not available in Trinidad.

In Maracas St Joseph Valley the majority of pesticide products used constituted manmade pesticides of inorganic origins with high LD 50's. In addition the more broad based and cheaper pesticide products were the preferred choice. No usage of green teas etc was practiced.

No manure or naturally occurring soil fertility additives such as compost or green manuring were applied. Most farmers utilize mainly inorganic fertilizers on their crops and in most cases not in the recommended amounts due to lack of financial resources.

5.0 LIVELIHOOD FUNCTIONS

5.1 Land Tenure

In communities like those of the Northern Range, land becomes the foundation for viable household strategies to ensure a sustainable livelihood. At the base of all land management decisions about livelihood is usually the household's ownership (tenure) right. In the Caura Valley, few of the farmers have unfettered tenure to the lands they farm. Approximately 61% of lands in the Caura Valley are classified as State Lands and most of the farmers occupy such lands under varying "modes of accommodation"¹³.

Table 4: Land Ownership in the Caura Valley

Land Ownership Caura Valley

Type of Owner	Number of Hectares	% of Total
Private Lands	1,966	38.87%
State Lands	3,092	61.13%
TOTAL	5,058	100.00%

Source: Management & Development Plan for the Caura Recreational Park, April 1983, OAS & Forestry Division MALAMAR

The situation repeats itself in the Maracas/St. Joseph area, where most of the farmers growing short term cash crops are on state lands with no leases.

Table 5: Tenure Situation in Maracas/St. Joseph Valley

Community	Number of farmers	Tenure Status
La Grind Road	8	No lease on state lands
La Baja	11	No lease on state lands
Acono	12	No lease on state lands
Maracas	3	Private lands
Total	34	

Source: MFPLMR, Extension Officer

This single fact that most of the farmers in the target areas lack security of tenure to the lands they cultivate, poses the greatest challenge to changing the decisions that they make with respect to their patterns of land use. In such circumstances, the transition to more ecologically sustainable farming practices would tend to rely more on the provision of technical and financial incentives than on the sharing of economic information and increasing awareness of the benefits of sound practices.

5.2 Land Use Patterns

5.2.1 Agricultural Uses

Most of farming activities in the Caura valley is small scale farming done on relatively flat lands with average farm sizes ranging from 4 - 6 acres. The farmers' source of water ranges from rain-fed systems to different types of irrigation systems (drip and sprinkler). This is important because for the significant percentage that depends on the rain for irrigation, extended dry seasons tend to force them to abandon farming temporarily. During the dry season of 2010, more than 50% of the farms on the Caura Royal Road were temporarily abandoned. Thus the prevalent patterns of agricultural uses in these valleys are neither stable nor do they imply sustainable decisions.

¹³ Most farmers believe that their lands (tenure situation) are in the process of being regularized.

The landscape for Maracas/St. Joseph reflects a similar pattern. With the decline in small-scale farmers from 103 active farmers¹⁴ in 1982 to the current (2010) situation in which the Extension Officer recognizes only 34 farmers, farming now appears to be sporadic and not organized. Limited by water and access roads most farming activities are limited to no more than 2 acres at a time.

5.2.2 Recreational Use

The Northern Range of Trinidad and Tobago is a significant source of recreation for the people of Trinidad and Tobago. The Caura Recreation Park is a significant part of the array of natural recreational sites in Trinidad and Tobago, with an estimated 60,000 to 80,000 visitors per year¹⁵, this site is only surpassed in popularity by the Lopinot Historical Complex. There are inherent legacy values within these local natural systems and they are in need of a proper valuation of the available resources so that any management strategy employed can include this information to make better decisions on the sustainable development of the area.

5.2.3 Mining and Quarrying Use

The Maracas/St. Joseph Valley has seen an increase in private residential developments in the area parallel with significant increases in quarry activity, both of which have lasting impact on the terrain of the Northern Range. The interests driving these two land use patterns frequently find themselves in conflict with each other. The new residents in the Maracas/St. Joseph Valley have formed an association 'The Maracas Valley Residents Association' whose advocacy efforts target the serious consequences of barren hillsides leading to soil slippages and flooding attributed to unregulated quarrying activity and to a lesser extent unauthorized (untenured) agricultural activities.

5.3 Incomes and Employment

The potential to support the social and economic development of selected communities in these valleys is based on making their livelihoods sustainable. Community-Based Environmental Protection and Enhancement Programme (CEPEP), Unemployment and Relief Programme (URP), and on-farm employment are the main opportunities to earn an income in the Maracas/ St Joseph Valley and the Caura Valley. Table 6 indicates that paid agricultural work is more remunerative than construction or CEPEP employment. However, the level of economic performance of existing farms in these valleys does not provide the capital to hire any significant number of such workers. In the Maracas/ St Joseph Valley which appears to have significantly less agricultural activity, opportunities for employment are scarcer.

Table 6: Comparative Wages¹⁶

Type of Worker	Per hour	Daily Wage	Monthly Gross*
Agricultural	\$23.57	\$165.00	\$3,630.00
Unskilled Construction	\$21.43	\$150.00	\$3,300.00
CEPEP Whacker Operator	\$18.07	\$126.50	\$2,783.00.
CEPEP Unskilled worker	\$12.32	\$86.25	\$1,897.50

* Monthly estimate based on 22 work days.

Source: The Trinidad and Tobago Agribusiness Association (TTABA) Guest Labor Study March 2008

¹⁴ Socio Economic profile of the Maracas Valley Watershed, CARDI, July 1984 by R A Carew and V.M Chase

¹⁵ Information supplied by Park Wardens from Forestry Division, 2009.

¹⁶ The Year is 2007

In both situations there, one would have to compose a farming enterprise with the opportunity to return to its operator a net income in excess of \$3,500/monthly for the farming alternative to become attractive. The farming models in this report explore the feasibility of such an alternative. (See Annex 9: Tables A - C)

6.0 GOVERNANCE AND CAPACITY BUILDING

6.1 Settlements in Caura Valley

MFPLMR's classifies the Farming Communities within the valley by roads and the demarcated areas. (See *Map of Area*). There are four major farming communities in the area, namely:

- Tumbasson community;
- Caura Royal Road community;
- Concordia community; and
- Cachipal community.

The population density in the valley is very low, averaging about 6.52 hectares per person or 16 acres per person¹⁷.

6.2 Settlements in Maracas/St. Joseph Valley

The Maracas/ St Joseph watershed area is divided into nine communities. In the lower valley there are the communities of St. Joseph and Riverside; in the Central valley there are La Baja and La Mango; and in the upper valley above 300ft. elevation we find the communities of Juaranta, Acono, Caurita, Maracas and Lango (See *Map of area*).¹⁸

In 1982, the two communities of St Joseph and Riverside were defined by Socio Economic profile of the Maracas Valley Watershed, CARDI, July 1984 by R A Carew and V.M Chase as exclusively residential communities with no agricultural activity. Today most of the other communities with the possible exception of Lango, Maracas and Caurita exhibit similar characteristic.

6.3 Community of Actors

In the Caura Valley, there are approximately 28 farmers from the Tumbasson area who are permanent residents. The majority of other farmers do not reside on their lots. This would indicate that their priority of needs may differ from those who are resident. In The Maracas/ St Joseph Valley we have encountered 5 /7 farmers interviewed who are residents on their farmsteads. The majority are non resident farmers.¹⁹

There are very many empowered actors on an organization basis. The Caura Valley farmers Association (CVFA) and the Caura Valley Village Council are the two official representative organizations. Currently the CVFA appears to be barely functioning. TTABA²⁰ has offered support in fully funding and establishing a secretariat for this organization in addition to providing training. The CVFA with proper support can serve as a focal point to address challenges which affect the livelihood of farmers.

The Maracas Valley Resident Association was established to protect the rights of residents in the Maracas St Joseph Valley. It has emerged into a strong local lobby group that seeks to address common problems and challenges that affect individuals in the respective geographical areas. They actively pursue crime, street lighting, drainage, better roads and such activity as quarrying which contributes to threats to their homes in the form of land slippage and flooding.

¹⁷ Annex 2: Table C expresses the size of the communities within the Caura Valley

¹⁸ Annex 3: Table B expresses the size of communities in Maracas/St. Joseph

¹⁹ Annex 8 reflect the community of actors that may be present in the process of co-management of the landscape

²⁰ Trinidad & Tobago Agribusiness Association

6.4 Institutional Support

There also exist many institutional actors with a history of active participation and support in both valleys. These include:

- The University of the West Indies (**UWI**) which has been a key institution particularly on improving aspects of farmers' skills in the valley.
- The Caribbean Agricultural and Research Development Institute (**CARDI**) has also supported farmers' practices and skills in both valleys with research, information and training intervention.
- The Ministry of Food Production, Marine and Land Resources (**MFPLMR**) is the official face of Government in all aspect of agricultural production in the valley, improving farmers skills and implementing the land regularization process (Leases of State Land).
- The Trinidad and Tobago Agribusiness Association (**TTABA**) intervention has focused on marketing support specifically issuing commodity contracts and technical and agronomic support in managing the components life cycle of the contracted commodities.
- Similarly the National Agricultural Marketing Development Company (**NAMDEVCO**), has also offered farmers training, marketing advice and markets opportunities, locally, regionally and extra regionally, also in addition to technical support via a packing house
- The Commonwealth Agricultural Bureau International (**CABI**) in collaboration with the MFPLMR and UWI have introduced IPM systems in the Caura area through the **farm field schools methodology** in the years 2003 / 4

Other relevant actors with capacity to introduce changes in the pattern of land use in these valleys include:

- The Cropper Foundation
- The Regional Corporations
- The Forestry Division
- The Institute of Marine Affairs

7.0 SURVEY OF FARMER EXPECTATIONS

7.1 Areas of Concern

Perception is the main area that attracted our concern. Individuals act not only on the basis of available information but more so on their perception of what that information may do to change their current status. We are interested in gauging the perceptions of Farmers in the Caura Valley and Maracas/St. Joseph Valley on the following areas

- Criteria for choosing crops
- Usage of on-farm inputs (grass mulch, manure, herbal teas etc)
- Ranking the reasons for the use or non use of certain soil management techniques
- Farm income contribution to their livelihood
- Where Farmers get their information from
- Awareness of the impact of their practices on the environment

The detailed interviews with farmers to ascertain their perceptions presented some challenges. The severe dry season resulted in the absence of a significant amount of farmers who depended on rain fed conditions to cultivate their crops. According to the MFPLMR's Extension Officers, the two study areas at full capacity should have accounted for one hundred twenty (120) farmers. This study was only able to interview fifteen (15) farmers representing twelve percent (12%) of the assumed full capacity; approximately 2 out of 34 in the Maracas St Joseph Valley and 13 out of 88 in the Caura Valley.

The Consultant **re-visited the field (two study areas) from July from July 16th – July 24th 2010**, during this period, (beginning of the rainy season), he interviewed five (5) additional farmers all located in the Maracas / St Joseph Valley area. In the Caura Valley along with the Baseline study consultant accompanied with the intervention Consultant visited all the 13 farms that were interviewed in the dry season and observed an additional eight farms, three that were temporarily abandoned during the dry season and five within the forest reserve. Between the weather and the absence of personnel or leadership / ownership on specific farm sites only 38% of the observed new farms were interviewed.

Some farmers are part time farmers which made it difficult to catch up with them, particularly when no official list with addresses and contact information exist. In the Caura valley where farming activity is organized in close proximity to the main road locating farmer was much easier. The terrain and farming activity at some distance from the main road made access more difficult in Maracas/ St. Joseph Valley. On the other, displacement, accessibility and lack of activity and crime all provide significant challenges that must be taken into consideration in locating farmers in the Maracas/St. Joseph Valley.

7.2 Survey Results

The survey was conducted among 15²¹ farmers, two of whom were from the Maracas/St. Joseph Valley and 13 from the Caura Valley. Farm sizes ranged from 2 acres to 12 acres with the mean size being 5.27 acres. It is a bi-modal distribution with the modes being 1 and 2 acres. Annex 10 (Table A).

²¹ Survey results based on the original fifteen farms that were interviewed during the dry season

Table 7: Location of Farms of Interviewees

LOCATION	NUMBER OF FARMS	Percent
Maracas/St. Joseph	2	13
Caura	13	87
Total	15	100

a) Choice of Crops

The major crops grown are shown in Annex 10: Table B. Eggplant and papaya are the two most frequently grown crops. Respondents were asked to state the importance of each of the five variables in determining the crops chosen to be cultivated. The scale used ranged from “not at all” (assigned a score of 1) to “extremely important” (assigned a score of 5). Mean scores on each attribute are shown below. Experience in growing the crop and the market value are the two top criteria used.

Table 8: Choice of Crop Decisions

ATTRIBUTE Responsible for CROP SELECTION	MEAN SCORE
EXPERIENCE/ PREVIOUS GOOD RESULTS	4.8
MARKET VALUE	4.53
SUITABILITY OF THE SOIL	4.07
LOW CROP MAINTENANCE COSTS	2.67
LOW WATER REQUIREMENT	2.33

There were 5 farmers who reported growing Tomatoes in Caura. Of these 4 (80%) reported getting average yields and 1 reported having high yields. Sweet Pepper was the only crop for which low yields were reported. (*Annex 10: Table F*)

b) Soil Management Techniques

Mean scores were used to determine the main uses of on-farm inputs and techniques. The scores were based on the following scale: 1= High Use 4= No Use. On this basis crop- rotation and manure application were the on-farm inputs practices used most often. (*Annex 10: Table D.*) Most farmers (67%) did not know the Ph levels of their soils.

None of the farmers used terraces, wind breaks or live fences. Three (3) used channeling of water paths and two (2) took measures to reduce erosion. In most cases, respondents had “no opinion” about why they did not use the specified soil management techniques.

c) Tenure, Income and Information

Eighty percent of the farmers interviewed reported occupying state lands waiting regularization.

Table 9: Land Tenure Situation

TYPE OF LAND TENURE	NUMBER OF FARMERS	PERCENT
PRIVATELY OWNED/OPERATED	1	7
LEASEHOLD	2	13
STATE LANDS WAITING REGULARIZATION	12	80
Total	15	100%

For most farmers (67%) farm income provides over 50% of total cash income.

Table 10: Percentage of Cash Income from Farming

PROPORTION OF TOTAL CASH INCOME PROVIDED BY FARMING	NUMBER OF FARMERS	PERCENT
OVER 50%	10	67
26% TO 50%	3	20
10%-25%	2	13
TOTAL	15	100%

In terms of the source of information for farmers, most tend to rely on their own experience (80%) and “sometimes” on the extension officer and input supply store (53%).

Table 11: Importance of Sources for Cultural Practices

	Experience %	Extension Officer %	Input supply store %	Farm field schools %	Internet %
MOSTLY	80	20	7	7	0
SOMETIMES	7	53	53	27	13
HARDLY EVER	0	27	7	13	0

8.0 RECOMMENDATIONS

8.1 Settlements

One of the recommendations arising out of the report “A socio economic profile of the Maracas St Joseph Valley²²” is that no permits for housing or quarrying be allowed over the three hundred (300) feet height marker in the valley. This advice and recommendation has been ignored for the past 26 years.

8.2 Tenure Regularisation

Since a significant portion of the farming residents in both study areas, are awaiting leases, this has implications for the development of the properties that they occupy and provide challenges for sourcing and channeling financial resources towards the improvements and upgrades of their properties. An evaluation of the substantial potential benefits to be gained from the regularization of leases of state lands can provide evidential proof of the wisdom of pursuing this line of remedial action with haste.

8.3 Alternative Farming Techniques

- a. The use of more recycled organic materials should be encouraged as a long term measure in building sustainable fertile stable soils.
- b. Farmers on the slopes should be encouraged to engage in significant multi cropping practices.
- c. There is definitely room for improvement in the land preparation practices that occur both on slopes and on flat lands in the two study areas.
- d. Not enough recycling of green materials occurs in both study areas. When mechanical land preparation occurs on the flat, the green organic residues such as crop residues and unwanted plants or deliberately planted crops high in nitrogen such as legumes can and should be ploughed back into the soil or made into compost materials to be added to the crop production cycle at a latter stage to improve soil fertility naturally.
- e. Terracing can also be introduced along with check dams and wind breaks. However, as the most significant external costs to farmers are fertilizer inputs and for those switching to organic methods, pen manure, and these additional expenses may have to be shared with others (downstream) who would also benefit from such practices.

8.4 Application Research

- a. A strategy needs to be fine tuned to facilitate the change from sprinkler irrigation to drip irrigation. When the two systems are compared, the drip irrigation system can be perceived as being more beneficial.
- b. The challenge of exposing more farmers to alternative farming methods is to present them with information researched from conditions similar to theirs.

²² Source: Socio Economic profile of the Maracas Valley Watershed, CARDI, July 1984 by R A Carew and V.M Chase

- c. Another urgent need is supportive research in identifying and cataloguing natural enemies to pests in the area and what integrated practices would reduce the losses due to the prevalence of these pests.
- d. Crop management is an area of input substitution that provides much scope for collaboration between farmers and research institutions, resulting in innovative strategies and practices that could be incorporated into farming systems and practices
- e. There is inherent legacy value in the recreational services of these ecosystems and they is a need for a proper valuation of this particular resource use so that any management strategy employed can include this information contribute to make better decisions on the sustainable development of the area.

8.5 Education and Awareness

A good investment of time and resources will be required at the outset to help communities to appreciate the significance and benefits of the ecosystem services of the Northern Range and to understand the immediate and long-term consequences of present approaches to hillside agriculture on the functioning of the ecosystems and subsequently on their well-being as well as for the national community.

8.6 Potential Income and Employment

The potential to support the social and economic development of selected communities is based on making their livelihoods sustainable. An examination of the level of income potential based on a mixture of cropping patterns is modeled in the three farm models

- **Model 1; No Commercial Crop Production: \$2,550/mth**

The finding summarized in Annex 9 – Table A represents farmers who do not cultivate a commercial crop in their production plan and rely primarily on short term (wholesale market) crops. These farmers generated an average gross farm income of \$30,600 per annum or roughly \$2,550 per month. Most of the labor utilized in this farm model is family and since this farm generated approximately 81.36 man-days, quantifying this at ($\$200 \times 81.36 = \$16,272$ or \$1,356 additionally per month).

- **Model 2: Golden Apple as a Commercial Crop: \$5,043/mth**

The finding attempts to forecast what may be possible if farmers adopt golden apple as a commercial crop into their farming model. Currently there are two (2) farmers in the Caura Valley whom have production contracts with TTABA for Golden Apple. These farmers are projected to generate an average gross farm income (Year 5)²³ of \$60,516 per annum or roughly \$5,043 per month. These farmers would utilize a combination of family and hired labor. The average amount of labor utilized per

²³ Golden Apple bears fruit from year 1 and the yield increases annually maximizing in year 10. The analysis utilizes year 5 yields. Year 10 yields are double that of year 5.

annum on this farm type is 91.59 man-days or quantifying this equates to \$18,318 per annum. The findings are presented in Annex 9; Table B.

- **Model 2: Papaya as a Commercial Crop: \$8,558/mth.**

The major finding summarized in Annex 9 - Table B, is representative of farmers who have incorporated one commercial crop in their production model, namely Papaya. These farmers generated an average gross farm income of \$102,694 per annum or roughly \$8,558 per month. These farmers would utilize a combination of both family and hired labor. The average amount of labor utilized per annum on this farm type is 102.94 man-days or quantifying this figure is equivalent to \$20,984 per annum.

REFERENCES

- 1) CARDI, (July 1984) by R. A. Carew and V.M Chase, Socio Economic Profile of the Maracas Valley Watershed,
- 2) OAS & Forestry Division MALAMAR, (April 1983), Management & Development Plan for the Caura Recreational Park,
- 3) FAO and UNDP and MFPLMR Planning Division, (October 1984), Evaluation of the Upper Maracas Valley Watershed Management Project
- 4) Trevor Murray, Lenox Andrews, Planning Division MFPLMR and FAO, (September 1985,) Integrated Watershed Management Plan (Maracas Valley), Sub Watershed No #2,
- 5) Regional Office of FAO Latin America and the Caribbean, **(no date)**, Watershed Management in the Caribbean,
- 6) Wikipedia, (2006) On the Flora and fauna of Trinidad and Tobago
- 7) Beard, J. S. (1946) The Natural Vegetation of Trinidad, Oxford University Press, Oxford
- 8) David Dolly, “*Assessing the Benefits of Two Farmer Field Schools recently conducted in Trinidad and Tobago*” Paper presented at an Extension Conference in San Antonio Texas, (2005)
- 9) *Northern Range Assessment 2005. Report of an Assessment of the Northern Range, Trinidad and Tobago: People and the Northern Range. State of the Environment Report 2004. Environmental Management Authority of Trinidad and Tobago.* The Cropper Foundation: Project Proposal (Draft) “Delineation of Project Area”, Summary of some Key Faunal Species of the Eastern Northern Range
- 10) Management & Development Plan for the Caura Recreational Park, April 1983, OAS & Forestry Division MFPLMR
- 11) Socio Economic profile of the Maracas Valley Watershed, CARDI, July 1984 by R A Carew and V.M Chase :

APPENDIX 1 – LIST OF FARMERS INTERVIEWED

List of Farmers interviewed

Number	Farmers Name	Area
1	Terrance Haywood	Caura Valley
2	Clement Tanais	Caura Valley
3	Edmond Parmashwar	Caura Valley
4	Vivian Howard & Andre Patrick	Caura Valley
5	Basdeo Ramcharan	Caura Valley
6	Deonarine Koopsammy	Caura Valley
7	Arnold Baliram	Caura Valley
8	Krishna Heera	Caura Valley
9	Ahmad Ali	Caura Valley
10	Naresh Ramcharan	Caura Valley
11	Harry Persaud-Sonnial	Caura Valley
12	Bhawawan Dial Sookraj	Caura Valley
13	Paraj Sookraj	Caura Valley
14	Chad Williams	La Baja Road
15	Leon Thompson	La Baja Road
16	James Vire	Caurita
17	Felix Noriega	Bancal Road
18	Ramdeo Pitty	Bancal Road
19	Jagdeo Ramoutar	Bancal Road
20	Rajdaire Ramoutar	Bancal Road