



DFID Natural Resources Systems Programme

IMPACT AND AMELIORATION OF SEDIMENT AND AGRO-CHEMICAL POLLUTION ON CARIBBEAN COASTAL WATERS

(DFID, NRSP-LWI PROJECT R7668)

WORKSHOP PROCEEDINGS

Tuesday, 26th June 2001 - 8:30 am – 4:30 pm

Still Plantation

Soufriere, St Lucia

***Marine Resources Assessment Group Limited (MRAG)
London, UK***

***Ministry of Agriculture Forestry and Fisheries,
Agricultural Extension Services,
Castries, St Lucia***

***and
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Participants at the workshop, Still Plantation, Soufriere, 26 June 2001

EXECUTIVE SUMMARY

- This one day workshop was organised by the Agricultural Extension Services of MAFF St Lucia, CARDI and MRAG as an activity of DFID NRSP LWI project R7668 *Impact and amelioration of sediment and agro-chemical pollution on Caribbean coastal waters*.
- The central MAFF Extension Department and Agricultural Extension Officers from all eight regions of St Lucia were invited to participate at the workshop. A total of 41 participants attended the workshop.
- The workshop was divided into two Technical Sessions with two main objectives. The first Technical Session concentrated on farming practices and soil conservation techniques in St Lucia (and partly divided into working groups to focus on farming practices in Soufriere, Roseau and Praslin/Mamiku watersheds). The second Technical Session introduced the project questionnaire and training of extension officers in standardisation techniques for conducting the questionnaire.
- The questionnaire (use and application of agro-chemicals, livelihoods of farmers, health and safety) was finalised during Technical Session 2 of the workshop and adapted from the Jamaican version for use in St Lucia. The survey will be stratified according to number of farms per water shed and farm size (small, large). There will be a total of 150 interviews conducted: 90 in Roseau, 40 in Soufriere and 30 in Praslin/Mamiku.
- Copies of questionnaire will be finalised in the week following the survey and subsequently distributed by the central MAFF Agricultural Extension Department. Questionnaires will be analysed by CARDI.

ACRONYMS

CARDI	Caribbean Agricultural Research and Development Institute
C-CAM	Caribbean Coastal Area Management Foundation
CEHI	Caribbean Environmental Health Institute
CMS	Centre for Marine Science
DFID	Department for International Development
IICA	Inter-American Institute for Cooperation on Agriculture
IPM	Integrated Pesticide Management
LWI	Land Water Interface
MAFF	Ministry of Agriculture, Forestry and Fisheries
NRSP	Natural Resources Systems Programme
SLREP	St Lucia Rural Enterprise Project
UWI	University of the West Indies

1 OPENING SESSION

1.1 Welcome Remarks

The workshop was officially opened at 9:15am by Felix Chicot Regional Supervisor (Soufriere), Extension Services. He welcomed participants to the workshop and project collaborators, and expressed the hope that the workshop would be of value to MAFF and useful for the work of the Agricultural Extension Services.

Each of the participants introduced themselves. A registration form was also passed around for completion.

1.2 Objectives of the Workshop

Dr Leslie Simpson outlined the collaborative basis for the project with partners in Jamaica, St Lucia and the UK, and highlighted the review to be produced by CARDI to which the current workshop related. He then outlined the objectives of the workshop:

- The primary aim was to finalise the questionnaire for farmer interviews and ensure its relevance to the St Lucia situation; Other aims included:
- Questionnaire implementation and standardisation procedures, and discussion of analysis of the results obtained through the survey instrument;
- Information gathering and sharing of knowledge between all parties;
- To find out more information about the farming practices that exist in the three study watersheds in St Lucia (both large and small holdings) with specific reference to pesticide and fertiliser use;
- To increase the knowledge about study watersheds (Roseau, Soufriere, Praslin/Mamiku);
- To meet all the persons who will be involved in the project, and develop and maintain those linkages.

1.3 Vote of thanks

Dr Chris Mees then thanked the participants for attending the workshop and for their anticipated inputs. He also thanked the Ministry of Agriculture Forestry and Fisheries, particularly the Extension Services (through the efforts of Mr Rufus Leandre) for organising the workshop, and Mr Felix Chicot and the Staff of the Soufriere Region for local arrangements. He thanked CARDI for their input into the workshop, Dr Leslie Simpson from the Jamaica office, and Lennox Daisley of the St Lucia Office. He again referred to the wider collaborative arrangements in both St Lucia and Jamaica and noted that the project was funded through the Land Water Interface component of the

Natural Resources Systems Programme of the UK Department for International Development.

The Chairman, Mr Rufus Leandre expressed the interest of MAFF in participating in this project, and encouraged all staff to participate in the ensuing discussions.

Due to technical delays, the project presentation by Nicole Kenward was delayed until after a short break for refreshments. The technical sessions followed that presentation. A group photograph was taken during the break.

1.4 Project Overview

Miss Nicole Kenward then gave a brief overview of the project *Impact and amelioration of sediment and agro-chemical pollution of Caribbean coastal waters* (Annexe 3). She explained the collaborative nature of the project, with major partners in Jamaica (UWI, CARDI and C-CAM) and St Lucia (Ministry of Agriculture, Forestry and Fisheries and CEHI). She introduced the participants to the various components of the project, covering sediment and agro-chemical research components. The presentation focussed on a background to the project and anticipated outcomes of research on administrative and environmental monitoring of agro-chemicals. Information was presented concerning fieldwork in St Lucia, and case studies of agricultural practices in Jamaica.

The first two project outputs are conducted by the University of York (Soufriere Bay is the study site for sedimentation in St Lucia), and focus on:

1. An Improved understanding of the effects of sedimentation
2. Economic estimates of the value of the reefs and the impact of sedimentation

Other project outputs are:

3. Estimates of agrochemical loadings and the fate of these loadings
4. Review and evaluation of existing agricultural land management

Miss Kenward showed a graph of the increase in imports of pesticides to Jamaica from 1990 to 1999, which showed a major increase in the amount of pesticide imports in Jamaica. This trend was similar in St. Lucia. Miss Kenward also described the necessity for the current workshop activity and planned questionnaire to explore agricultural land practices and soil management in three watersheds in St Lucia.

The final outputs of the project are:

5. Options for pollution management
6. Best Management Practices manual produced

2 TECHNICAL SESSION 1

2.1 Introduction

The first Technical Session was chaired by Dr Chris Mees, who gave a brief overview of the purpose of the two technical sessions. The first Technical Session concerned farming practices, both island-wide and specific to the two watersheds being studied. The purpose of the second Technical Session was to address the details of questionnaire administration. He noted a change to the agenda, and presented apologies for Guy Mathurin who had other commitments relating to quarantine awareness week in St Lucia.

2.2 Outline of existing knowledge of agro-chemical usage and soil conservation techniques in St Lucia

Mr Anthony Philigence, responsible for MAFF's soil and water conservation programme, had been requested to present status of knowledge about agro-chemical usage and soil conservation practices on the island. A review of his presentation follows:

Prior to the intervention of the Extension Services in St Lucia, soil/water management was restricted to the removal of excess water from cultivation. Plant protection was through the use of the Astrological guide and the use of the cutlass and hoe. Soil amelioration was achieved through the use of the hoe and garden fork, to keep plants from excess water and to have the soil amicable enough for roots and tubers. Since the intervention of the Extension Services, farmers have moved towards the use of chemical pesticides and fertilisers, establishment of contour drains and other soil/water conservation practices. Weed control by the 'good-boy' technique (weeds are cutlassed to 4inches high) has changed to the use of Paraquat which kills weeds leaving the dead plants on the soil surface long enough to control erosion before the next re-growth. There will always be re-growth with Paraquat.

The use of pesticides has increased significantly with little regard to personal safety. While Extension has done much to educate farmers in the proper use of pesticides, they still find their way into the rivers. This is largely due to the terrain that farming is practiced on. Surface run-off and infiltration occur rapidly, particularly in the rainy season. The increase in the cultivation of bananas over the years has increased the use of pesticides. Now that bananas are on the decline, pesticide use will also be on the downside.

The same does not apply to erosion of soils into coastal waters. There is the conception that small farmers and farmers in general are responsible for sedimentation in the sea. I [Anthony Philigence] BEG to differ for St Lucia. The soil types of St Lucia do not lend themselves to erosion easily. Some erosion does take place. While the cultivation of bananas did increase significantly years gone by, it is not true that cultivation increased the erosion of soils in St Lucia. The same terrain, mountains and steep slopes which contributed to quick run-off of pesticides prohibit soil amelioration in the cultivation of bananas. Moreover, over flat lands and hillsides, bananas are

planted once in five years minimum. In large-scale cultivations, re-planting does not occur before 12 years.

The agronomic practices for bananas allow the banana leaves to be scattered on the soil surface. The use of Paraquat allows the dead plants to remain on the soil before re-growth, thereby assisting in the control of soil erosion. Raindrops do not always fall on the soil surface, but on the decaying leaves.

The main cause of river and sea siltation from the mainland is ROADWORKS and HOUSING DEVELOPMENTS. Both activities involve the loosing of large volumes of soil, transporting them to river banks. Being loose, the mass of soil is always available for continuous transportation to coastal waters. Moreover, drains of paved and unpaved roads drain onto farm lands causing dead gullies, transporting large volumes of subsoil into the sea. Farming practices are not responsible for the siltation of coastal waters.

The terrain upon which farming is practiced in St Lucia does not allow loosing of the soil by mechanical means (use of tractors, etc), not the use of irrigation. Both situations aid in soil transportation. Where cultivation is practiced in the flat lands, as occurs in the valleys, the banana ratoons do not allow the use of tractors at any time except perhaps once in 25 years. That is the only time a sub-soiler is used.

The small farmer in particular practices a diversified form of farming. In most cases, the cultivation of the small farmer is characterised as AGRO-FORESTRY and does not allow erosion or soil amelioration favourable to soil erosion. The primitive theory of SHIFTING CULTIVATION is not in existence as the small farmers do not have land to shift to. Where contour drains are present, siltation occurs to the extent that it takes up to five years to have the drains cleared on average.

It is not true to say that erosion does not occur on farms. Erosion of the soil surface, land slides and siltation do take place but not at the magnitude that farmers are accused of. Anyone can take the challenge to visit a farm on a rainy day and see that run-offs are clear with little or no soils.

That run-offs do take place where chemicals are applied will cause chemicals to be carried to the sea. Soils reaching the sea are largely those of road works and housing (domestic and commercial) and up to 80% of the total. Soils from farms, if any, constitute 5% of the total.

The greatest contributor to erosion from farms are the demands made by EU consumers who, ignorant of TROPICAL FARMING insist on seeing that fields should be cleared from trash in banana cultivations. Trash from banana leaves serves many important purposes:

1. Trash returns nutrients into the soil
2. Trash, upon decaying, adds organic matter to the soil
3. Trash servers as a mulch against weed growths

4. Trash on a soil conserves moisture through trapping moisture from decaying vegetation as well as preventing evaporation from the soil. Fields are not irrigated.
5. Trash assists tremendously in erosion control by a) cushioning the raindrops when it rains and b) filtering run-offs, allowing water to leave slowly and retaining loose soils.

EU consumers should understand that the production of bananas is not the same as the production of computer chips. Banana trash is essential to economic production.

2.3 Working Groups

The extension officers then divided into three working groups to focus on farmer characterisation, farmer practices and soil management practices in the three study watersheds of Roseau (region 7), Praslin/Mamiku (region 4) and Soufriere (region 6). In particular, working groups were asked to discuss the following:

1. The number and size of farming units in the watershed;
2. The main crop types grown (including position in watershed or slope type);
3. Farming practices (land preparation, planting method, irrigation method, soil water conservation, soil fertility management, pest and disease management, weed management, list of pesticides, harvesting methods, post-harvest operations and marketing); and
4. List of agricultural projects in the watershed

Working Groups were facilitated by Leslie Simpson, Chris Mees and Nicole Kenward and there was lively discussion amongst the groups. The First Technical Session concluded with a plenary presentation of group discussions. The following section summarises the plenary presentations by the Working Groups.

2.3.1 Plenary presentation : Roseau

Group members: Francoise Henry, David Alphonse, Antonia Felix (Rapporteur), Cyril Henry, George Small, Joseph George, Phillip Sidney (Chairman), Christine Glasgow, Vernetta James, Unice Perinneau, Alpernon Pemberton, Anslem Cox

The presentation commenced with a general description of the watershed, followed by information on the number and size of farming units in the watershed (Table 2.1), the main crop types grown, farming practices and list of agricultural projects in the watershed.

Roseau is a watershed with high rainfall (85-100 inches per annum) and is located on the western side of the St Lucia. The watershed is 49.1km² (total acreage of 4500) from the East Forest Reserve to Mont Gimie Central, down the Venus/Anse la Raye ridge to Roseau and the Landelac Sarrot ridge to Marigot.

Table 2.1 Number and size of farming units in the Roseau watershed

Category	Size range (unit)	Upper watershed	Mid watershed	Lower watershed	Total
Large	>25 acres				10
Medium	5-25 acres				35
Small	<5 acres				1200

Table 2.2 Main crop types of the Roseau watershed

LARGE FARMS		MEDIUM FARMS		SMALL FARMS	
Crop	Acreage/ location/ slope	Crop	Acreage/ location/ slope	Crop	Acreage/ location/ slope
Banana	Flat to 15/20°	Banana	15-30°	Banana	Some flat Many >20°
Tree crops	Flat to 15/20°	Tree crops	15-30°	Tree crops	Some flat Many >20°
		Food crops	15-30°	Food crops	Some flat Many >20°
		Root crops	15-30°	Root crops	Some flat Many >20°

The general farming practices were described for the Roseau valley, and summarised in Table 2.3. It was noted that there is a lot of aquatic life in the rivers, particularly crayfish.

Table 2.3 General farming practices in the Roseau watershed

Land preparation:	Manual
Planting methods:	Manual
Irrigation methods:	Rainfed – about 95% of farmers do not irrigate their crops.
Soil and water conservation:	Manual, including contour and graded drains, mulching (some farmers practice this to maintain moisture) and contour planting and spot tillage. In the interior, dense rainforest around the Roseau dam and high precipitation cause

	soil moisture to last well into the dry season. There is wide variation of soil type, therefore water retention levels vary (6" to bedrock in Roseau).
Soil fertility management:	Fertiliser and chemical application
Pest and disease management:	Major pests and diseases are leafspot (in bananas), diamond-back moth, white flies, rodents and man (praedial larceny). Pests/diseases are managed through chemical control (aerial spraying and manual application with knapsack sprayers).
Weed management:	major weeds are water grass, paragrass, wildslip/tendance and creepers/vines. These are controlled using manually-applied chemicals and cutlassing in some crops, e.g., dasheen.
List of pesticides:	WEEDICIDES: Talent, Replane, Gramoxil, Gramoxone, Round Up, Touch Down INSECTICIDES: Benlate, Cupravit, Banrot, Captan
Harvesting methods:	manual
Post-harvest operations	Chemicals used are Ridomyl, Fungaflor and Allum
Marketing	Crops sold through local and central markets, through the Marketing Board, TQ, Charles and export markets to the US (non-traditional crops).

There are two completed agricultural projects in Roseau watershed and one current project. Details of the projects are given in Table 2.4.

Table 2.4 Agricultural projects in Roseau watershed

NRMU	This project is about to start in Jacmel. It aims to provide funding and technical support for land resource management in Jacmel area for soil and water conservation in 28 acres (including 18 farmers)
Roseau Dam	Major project undertaken to construct a dam in the upper valley and re-locate farmers from this area further

	valley and re-locate farmers from this area further downstream.
EU project	This project aided irrigation in Roseau, and now lacks funds to provide irrigation. This project has enabled high production yields in the past, but yields are now substantially lower, particularly during dry season.

2.3.2 Plenary presentation : Praslin/Mamiku

Group members: Maximus Innocent, Bernard Jn Baptiste, Bernadine Evans, Ruth Hunte, Mary Louis, Paul Francis, Robertina St Juste, Blaise Charlery, Francis Blanchard, Adelen Eudovic (Rapporteur), Anthony Philigence

The presentation commenced with a general description of the watershed, followed by information on the number and size of farming units in the watershed (Table 2.5), the main crop types grown, farming practices and list of agricultural projects in the watershed. Praslin/Mamiku watershed includes the rivers of Praslin/Riviere Galet des Trois Islet (11.0km²) and Mamiku/Patience (16.0km²) which is bordered by forested ridges either side of Mamiku valley. Main towns/villages are Mamiku, Mon Repos, Patience, La Pointe and Praslin.

Table 2.5 Number and size of farming units in the Praslin/Mamiku watershed

Category	Size range (unit)	Upper watershed	Mid watershed	Lower watershed	Total
Large	>10 acres	5	5	0	10
Medium	5-10 acres	10	20	17	47
Small	<5 acres	30	30	20	80

Table 2.6 Main crop types of the Praslin/Mamiku watershed

LARGE FARMS		MEDIUM FARMS		SMALL FARMS	
Crop	Acreage/ location/ slope	Crop	Acreage/ location/ slope	Crop	Acreage/ location/ slope
Bananas	55 acres U,M	Bananas	80 acres U, M, L	Bananas	60 acres U, M, L
Coconuts	20 acres U, M	Coconuts	30 acres U, M, L	Coconuts	4 acres U, M, L
Citrus	5 acres U, M	Food/root crop	15 acres U, M, L	Vegetables	1 acre L
Cashew	2 acres U, M	Vegetables	1 acre M, L	Cashew	2.5 acres M, L
		Cashew	2.5 acres M, L	Food/root crop	3 acres M, L

LARGE FARMS		MEDIUM FARMS		SMALL FARMS	
Crop	Acreage/ location/ slope	Crop	Acreage/ location/ slope	Crop	Acreage/ location/ slope
		Breadfruit	1 acre M, L	Breadfruit	1.5 acre M, L
		Hot pepper	2 acres M, L	Hot pepper	2 acres U
		Corn	?	Passion fruit	2 acres L
				Corn	?

The general farming practices were described for the Praslin valley, and summarised in Table 2.7.

Table 2.7 General farming practices in the Praslin watershed

Land preparation:	Clearing (manual and use of cutlass) Tillage (manual and use of garden fork)
Planting methods:	Manual
Irrigation methods:	Rainfed except for 4 farmers (1 upper watershed, 3 lower watershed using gravity, pump and buckets)
Soil and water conservation:	Graded and contoured drains, mulch, tree planting (contoured), trash barriers
Soil fertility management:	Pen manure (in vegetables): NPK fertiliser (16:8:24 + 2MgO and urea 46%N)
Pest and disease management:	Leaf spot control – chemical and manual Nematodes and stem borer control of chemicals Thrips – chemical Mosaic virus – burn (manual)
Weed management:	Foul Foot milk weed, Tet-Meg, watergrass, Vines, Ti Coco, Nut grass – manual cutlass and hoe
List of pesticides in use:	Talent, Gramoxone, Touch Down, Gramocil, Reglone
Harvesting methods:	Manual

Post-harvest operations	Manual
Marketing	Local and export

Currently, there are two agricultural projects in Praslin watershed. Details of the projects are given in Table 2.8.

Table 2.8 Agricultural projects in Praslin watershed

SLREP	St Lucia Rural Enterprise Project The project's main emphasis is to assist resource poor households, particularly women headed households to develop viable economic activities/projects.
Irrigation Project	This involves 10 farmers using a communal irrigation system in Praslin.

2.3.3 Plenary presentation : Soufriere

Group members: Methodius Faucher, Elvis Herelle, Felix Chicot (Rapporteur/Chairman), Kemuel Jn Baptiste, Francis Khodra, Phils Louis, Cornelius Sydney, Jocelyn Elie

A general description of the extent of the Soufriere watershed was presented to the group. The catchment is surrounded by ridges either side and encompasses the villages of Zenon, Cressland, Diamond, Esperance, Fond St Jacques, Toraille, Belvedere, Migny, Soufriere, Mini and St Phillip. There are four estates: Ruby, Diamond, Soufriere and La Perle, as noted in Table 2.9. In addition to impacts on sedimentation by volcanic action, it was pointed out that there is mining for pumice in the upper catchment (Fond St Jacques).

Table 2.9 Number and size of farming units in the Soufriere watershed

Category	Size range (unit)	Upper watershed	Mid watershed	Lower watershed	Total
Large	50-200km ²	-	1	3	4
Medium	10-50km ²	-	5	-	5
Small	<10km ²	150	>50	Few	>200

Table 2.10 Main crop types of the Soufriere watershed

LARGE FARMS		MEDIUM FARMS		SMALL FARMS	
Crop	Acreage	Crop	Acreage	Crop	Acreage
Coconuts	150acres	Coconuts	40acres	Dasheen	100acres
Breadfruit	20acres	Avocado	10acres	Yams	5acres

Cocoa	200acres	Mango	5acres	Vegetables	10acres
Avocado	10acres	Cocoa	25acres		
Mango	5acres	Citrus	10acres		

The general farming practices were described for the Soufriere valley, and summarised in Table 2.11. It was noted that there is a lot of aquatic life in the rivers, particularly crayfish.

Table 2.11 General farming practices in the Soufriere watershed

	Large estates	Medium	Small
Land preparation:	Nil	Minimum	Manual/minimum tillage
Planting methods:		Transplanting	Transplanting
Irrigation methods:	None/rainfed	None/rainfed	None/rainfed
Soil and water conservation:	Drainage, stone barriers	Minimum	Minimum (trash barriers)
Soil fertility management:	Very little	Inorganic	Inorganic/organic
Pest and disease management:	Limited to rat poisoning	Minimum (roadens, cocoa)	Chemical control in vegetables
Weed management:	Under cocoa	Gramoxone	Manual, Gramoxone, Touchdown
List of pesticides in use:	Pesticides: Tambo, Xantari, No Moul, Lanate, Dipel, Agree and Admire Weedicides: Gramoxone, Touchdown, Talent Fungicides: Cipravit Blue, Kocide, Benlate, Banrot Fertilisers: NPK (16:8:24 + 4 MgO; 12:12:17)		
Harvesting methods:	Manual	Manual	Manual
Post-harvest operations	Cocoa (polishing)	Cocoa (polishing)	Nil
Marketing	Local, export	Local	Local

There is one current agricultural project in Soufriere watershed. Details of the project are given in Table 2.12.

Table 2.12 Agricultural projects in Soufriere watershed

SLREP	St Lucia Rural Enterprise Project The project's main emphasis is to assist resource poor households, particularly women headed households to develop viable economic activities/projects.
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A general discussion followed the three presentations about the watersheds and there were several points of note:

- Farmers often apply cocktails of pesticides, e.g. a systemic pesticide, a contact pesticide and fertiliser. Some insecticides and fungicides can be combined with success, however the majority cannot.
- There is minimal application of pesticides to tree crops. Cocoa production requires large volumes of fertiliser. Bananas and vegetable crops (principally dasheen, yams, tamia, sweet potatoes, plantain) require greatest volumes of pesticides.
- Soil conservation practices are mainly grading, contour and trash barriers. There is a wide variation in soil type and water retention level varies. In Roseau and Soufriere, soil has a deep profile (6 feet to bedrock) and filtration rate is thus slower than Praslin (6 inches to bedrock). Crops in Praslin are therefore more subject to drought conditions.
- Some farmers follow recommended dosage concentrations and application timings on pesticides. A lot do not follow recommendations and dilute pesticides beyond effective concentrations.

3 TECHNICAL SESSION 2

The second session was chaired by Miss Nicole Kenward, who welcomed participants back from lunch and then outlined that the purpose of the afternoon's proceedings was twofold: a presentation and feedback on the questionnaire prepared by CARDI and MRAG in Jamaica to ensure that it was compatible with the situation in St Lucia; and a training session on standardisation of questionnaire techniques.

3.1 Presentation of the Survey Instrument

Dr Simpson gave a presentation on the survey instrument with an overview on the purpose of each section in the questionnaire. He then went through each question in detail and invited comments and feedback. Each question was reviewed in turn, and clarifications or modifications were made where necessary.

This process was detailed and all changes were noted. The questionnaire is substantially the same as that in Jamaica, but has incorporated certain changes relevant to St Lucia, for example, to accommodate the fact that there is higher rainfall in St Lucia.

The questionnaire is designed as follows:

- The questions to be asked of the farmer are given in UPPER case.
- Instructions to enumerators are given in lower case italics.
- For 'multiple choice' questions the alternatives are in lower case

There was some debate over the need to include agro-chemical usage for livestock in the study, but in the end the consensus was to omit this aspect.

3.2 Implementation of the survey instrument

Dr Leslie Simpson presented this session dealing with the execution of the survey in the three watersheds.

Farmer Selection

The three study watersheds are of different sizes. Roseau is the largest and Soufriere and Praslin are of similar size. Funds exist to enable 150 interviews, of which it is anticipated that 90 will occur in Roseau and 30 in each of the other watersheds. Stratification of the farming units will be agreed jointly between MRAG/CARDI and MAFF and will be based on data from the agricultural census (at a meeting with Mr Ricardo George, Network Administrator, MAFF held subsequent to the workshop it was agreed that census data would be sent to MRAG during the week of 2 July). As the number of large farms is small, it was anticipated that most of them would be surveyed (except those with tree crops where application of agro-chemicals is

minimal), and that stratification by crop type will occur. A sub sample of the smaller farms will be surveyed. Most are mixed crops so no sub stratification is anticipated. From the census the farmers to be interviewed will be indicated. To ensure that there is no bias in the selection every (e.g.) 10th farmer on the list would be selected. It was indicated that if, for some reason, that farmer is not available, the 9th or 11th farmer is to be chosen.

How to ask the questions / Standardisation

Dr Simpson indicated that the survey instrument is not a form to be filled out by the farmers but is a questionnaire. Enumerators must go through every question with the farmer and solicit a response. The enumerators were asked to note the following points:

- Use pencil – responses to subsequent questions may shed more light on earlier responses.
- All questions are to be answered. If the information is not available write in N/A or Not Known
- You must ensure that the farmer understands the question. In some cases the enumerator may be required to re-phrase the question using the vernacular of the farmer.
- Use your judgement where appropriate.
- Don't answer for the farmer (no prompting) particularly in questions where the opinion of the farmer is being sought e.g. Questions 33 and 34 and the section Impact of agro-chemical use /farming practices on the environment.
- In many of the questions the farmer may chose more than one of the options Record all of these as well as others which may not be listed.
- Question 43 on use of empty pesticide containers is interesting as it lists most of the choices that we hope the farmer uses. In reality, the farmer may be using containers to store kerosene oil and other non-edible products in the household. We must try to solicit this information.
- Question 55 seeks to determine the two most important farming problems and lists a number of options. These options are specific to on farm problems and is attempting to keep the farmer away from some of the known problems such as praedal larceny and marketing. Your skills will be required to ensure these off-farm reasons don't come to the fore.
- Question 56 allows for the total expression of the farmers feelings. It was agreed that this should be the last question. Any earlier and it may be a problem keeping to the task in hand. However at the end, this is the opportunity for the farmer to express his views and the enumerator should take note of important issues that may be dealt with subsequently by MAFF.

3.3 Summary of the Workshop

Dr Chris Mees summarized the day's proceedings and related them to the objectives stated during the first session. He expressed satisfaction with the great effort by all the participants and considered that the objectives of the workshop had been met. He indicated that the intention was to implement the survey soon after the workshop, and wished enumerators well in this task. Referring to the objective of making and maintaining linkages he indicated that a continued correspondence between project collaborators will occur and that the proceedings of the workshop would be made available to participants through MAFF.

3.4 Closure of the Workshop

Mr Rufus Leandre then closed the workshop. He thanked all the major partners such as MRAG and CARDI for organisation of a successful workshop in collaboration with MAFF. He thanked all speakers, and particularly highlighted Mr Philigence who responded at short notice to the request for a presentation. He thanked all the participants for their contributions throughout the day, and briefly outlined the plans for linking with enumerators in order to begin the survey.

He expressed interest in the information that would be gained through the analysis of data produced by the questionnaire, and looked forward to receiving the results for the fulfilment of the projects objectives.

The workshop ended at 4:30 pm

Radio Interview

Following the workshop Dr Chris Mees and Nicole Kenward were interviewed about the project for a subsequent ' Agri-focus' broadcast on Radio St Lucia.

4 ANNEXE 1 – LIST OF WORKSHOP PARTICIPANTS

NAME	ORGANIZATION
Leslie Simpson	CARDI Jamaica – Soil Scientist
Lennox Daisley	CARDI St Lucia – country team leader
Rufus Leandre	Chief Extension Officer
Kensley Promesse	Extension Services – LRMU – Extension Officer
Jocelyn Elie	Extension Services Region 1 - Agricultural Officer II
Elvis Herelle	Extension Services Region 1 – Extension Officer
Vernet James	Extension Services Region 1 – Extension Officer
George Small	Extension Services Region 1 – Food and Root Crop Coordinator
Christine Glasgow	Extension Services Region 2 – Agricultural Officer
Mary Louis	Extension Services Region 2 – Agricultural Officer
Algernon Pemberton	Extension Services Region 2 – Extension Officer
Ruth Hunte	Extension Services Region 2 – Extension Officer
Blaise Charlery	Extension Services Region 3 – Agricultural Officer
Adeline N Eudovic	Extension Services Region 3 – Extension Officer
Maximus Innocent	Extension Services Region 3 – Extension Officer
Robertina St Juste	Extension Services Region 4 – Agricultural Officer
Bernard Jn Baptiste	Extension Services Region 4 – Extension Officer
Bernadine Evans	Extension Services Region 4 – Extension Officer
Francis Blanchard	Extension Services Region 4 – Extension Officer
Kemuel Jn Baptiste	Extension Services Region 4 – Extension Officer
Paul Francis	Extension Services Region 4 – SLREP Technical Officer
Francis Khodra	Extension Services Region 5 – Extension Officer
Phils Louis	Extension Services Region 5 – Extension Officer
Cornelius Sydney	Extension Services Region 6 – Extension Officer
Felix Chicot	Extension Services Region 6 – Regional Head
Phillip Sydney	Extension Services Region 7 – Agricultural Officer
Anselm Cox	Extension Services Region 7 – Extension Officer
Antonia Felix	Extension Services Region 7 – Extension Officer
Francois Henry	Extension Services Region 7 – Extension Officer
Methodius Faucher	Extension Services Region 7 – Extension Officer
Joseph Eluye	Extension Services Region 8 – Agricultural Officer II
Cyril Henry	Extension Services Region 8 – Agricultural Officer IV
Unice Perineau	Extension Services Region 8 – Agricultural Officer IV
Joseph George	Extension Services Region 8 – Extension Officer
Unice Perineau	Extension Services Region 8 – Extension Officer
Anthony Philigence	MAFF – Land and Water Conservation Unit
David Alphonse	MAFF – Land use
Chris Mees	MRAG Ltd, UK
Nicole Kenward	MRAG Ltd, UK

5 ANNEXE 2 – REVISED QUESTIONNAIRE

FINAL VERSION

FARM ID NO:_____

Impact and amelioration of sediment and agro-chemical pollution on Caribbean coastal waters

Baseline Survey
MRAG/CARDI/MAFF June 2001

WATERSHED: ROSEAU [] PRASLIN [] SOUFRIERE []

SIZE OF FARM: LARGE [] SMALL []

MAIN CROP IS:

BANANA [] MIXED VEGETABLES [] ROOT CROPS []

FARM: _____

Introductory Statement

This questionnaire forms part of an activity for a 3-year project to research the *Impact and amelioration of sediment and agro-chemical pollution on Caribbean coastal waters*. The project is funded by the United Kingdom Department for International Development and is managed by the University of York (UK) and the Marine Resources Assessment Group (UK), in collaboration with the St Lucian Ministry of Agriculture Forestry and Fisheries and CARDI (Jamaica).

This specific activity relates to a review of agricultural practices and soil management in three watersheds (Soufriere, Praslin and Roseau). The survey findings will be linked with environmental monitoring in the 3 watersheds, and then used to identify effective agro-chemical and soil management practices.

IDENTIFICATION

1. FARMER ID # _____
2. NAME _____
3. REGION _____
 LOCATION (VILLAGE) _____
- 4.a HOW LONG HAVE YOU BEEN FARMING? _____
- 4.b HOW LONG HAVE YOU BEEN FARMING AT THIS LOCATION _____
5. AGE RANGE (Years) (*Put X in relevant box*)
 <20 41-50 >70
 20-30 51-60
 31-40 61-70
6. WHAT IS YOUR LEVEL OF EDUCATION (*Put X in relevant box*)
 Primary Secondary Tertiary
 Other (please specify) _____
7. SEX (*Put X in relevant box*) M F

BACKGROUND INFORMATION ON FARM

8. SIZE OF FARM (acres) _____
9. WHAT CROPS DO YOU GROW?

For different parcels list: location, size, type of tenure, main crop with area occupied by each and mixed crops

PARCEL	LOCATION (VILLAGE)	SIZE (acres)	TYPE OF TENURE*	MAIN CROP	SIZE (acres)	LIST MIXED CROPS
1						
2						
3						
4						
5						

* *Indicate whether tenure is rented, owned, leased or rent free*

10. LIST YOUR MAIN CROPS IN ORDER OF IMPORTANCE. FOR EACH CROP GIVE THE NUMBER OF CROPS PER YEAR, AVERAGE YIELD AND REASONS FOR GROWING EACH CROP.

CROP	NUMBER OF CROPS /YR	AVERAGE YIELD/YR (lbs)	PERCENTAGE			
			HOUSEHOLD USE	LOCAL MARKET	EXPORT MARKET	OTHER (SPECIFY)

CROP, SOIL AND FERTILITY MANAGEMENT

11. WHAT OPERATIONS DO YOU CARRY OUT IN PREPARING YOUR LAND FOR PLANTING? (*Put X in boxes that apply*)

Cutting of trees/shrubs Weeding with cutlass
 Burning of trash with fire Forking
 Ploughing Ridging
 Other (specify) _____

12. WHAT IS THE MAIN TYPE OF SLOPE ON YOUR FARM? (*Put X in box that applies*)

Gentle (<5°) Moderate (5-15°) Steep (15-30°)
 Very Steep (>30°)

13. WHAT IS THE MAIN TYPE OF SOIL ON YOUR FARM ? (*Enumerator to complete - Put X in box that applies*)

Clay Sand Loam

14. IS RAINFALL ENOUGH FOR FARMING ACTIVITIES? (*Put X in box that applies*)

Too much Most times Sometimes Never

15. IN WHICH MONTHS DO YOU GET THE MOST REGULAR RAINFALL?

16. WHAT ACTION DO YOU TAKE TO COUNTERACT EXCESS RAINFALL DURING THE RAINY SEASON?

17. WHAT SPECIFIC CROPS DO YOU GROW DURING PERIODS OF HIGH RAINFALL?

18. WHAT ARE THE SOURCES OF WATER FOR THE FARM DURING THE DRY SEASON? *(Put X in boxes that apply)*

Piped (domestic supply) Private tank Spring
 None Damming stream Fish ponds
 Other Specify _____

19. HOW DO YOU PROVIDE WATER FOR YOUR CROPS IN THE DRY SEASON? *(Put X in boxes that apply)*

Drip irrigation Sprinkler irrigation Bucket/Watering Can
 None Other specify _____

20. DO YOU USE MULCH ? Yes No

If yes. State mulch type and main crops on which used.

CROPS MULCHED	REASON FOR MULCH	MULCH TYPE		
		GRASS/LEAVES/TRASH	PLASTIC	OTHER (Specify)

If no. State reason _____

21. DO YOU APPLY FERTILIZERS AND/OR MANURE? Yes No

If yes, state main crops, fertilizer used, method of application, time and frequency of application.

CROP	TYPE OF FERTILIZER/ MANURE	METHOD OF APPLICATION		TIME OF APPLICATION (STAGE OF CROP)	APPLICATION FREQUENCY/ CROP
		Surface	Bury		

If no for either fertilizer or manure. State reason? _____

22. HAS A SOIL TEST EVER BEEN DONE ON ANY OF YOUR PARCELS?

Yes No

23. DO YOU KNOW WHETHER THE SOIL ON YOUR FARM IS: (*Put X in box that applies*)?

Alkaline (sweet) Acidic (sour) Don't know

24. DO YOU PUT LIMESTONE ON THE SOIL ?

Yes No

25. WHAT ARE THE MAIN SOIL PROBLEMS THAT YOU ARE EXPERIENCING? (*Put X in boxes that apply*)

Erosion (Soil wash) Too dry Clay (Heavy soil)
 Stones Low fertility Landslips
 Too wet Other (specify) _____

26. DO YOU THINK THAT YOU ARE LOSING SOIL FROM YOUR FARM?

Yes No

If yes, what are some of the things you notice (Put X in boxes that apply)?

Soil is less fertile More stone is visible Land taken over by gullies
 Other (specify) _____

27. WHAT SOIL CONSERVATION METHODS DO YOU EMPLOY (*Put X in boxes that apply*)?

- Terracing Contouring Drains/trenches
 Stone barrier Grass barrier Bamboo/log barrier
 Hedgerows None
 Other (specify) _____

28. WHAT IS THE PERCENTAGE OF TREE COVER ON YOUR FARM (*Put X in box that applies*)?

- 0-10% 10-20% 20-50% 50-100%

29. WOULD YOU BE WILLING TO PLANT MORE TREES ON YOUR FARM ?

- Yes No

DISEASE AND PEST MANAGEMENT

30. HOW DO YOU CONTROL MAJOR PEST PROBLEMS?

CROP	PEST	METHOD OF CONTROL		CHEMICAL CONTROL APPLICATION			
		Chemical	Other	CHEMICAL	METHOD	RATE	FREQUENCY

31. HOW DO YOU CONTROL MAJOR WEED PROBLEMS?

WEED	METHOD OF CONTROL		CHEMICAL CONTROL APPLICATION			
	Manual	Chemical	CHEMICAL	METHOD	RATE	FREQUENCY

32. HOW DO YOU CONTROL MAJOR DISEASE PROBLEMS?

CROP	DISEASE	METHOD OF CONTROL		CHEMICAL CONTROL APPLICATION			
		Manual	Chemical	CHEMICAL	METHOD	RATE	FREQUENCY

USE OF AGROCHEMICALS

33. DO YOU THINK THAT PESTS AFFECT THE AMOUNT OF MONEY YOU MAKE FROM YOUR FARM (*Put X in box that applies*)?

Yes No Don't know

34. WHY DO YOU USE AGRO-CHEMICALS? IS IT: (*Put X in boxes that apply*)

- to increase yield
- to improve the appearance of your produce
- other reason (specify) _____

35a. DO YOU RECOVER THE EXPENSE OF THE AGROCHEMICAL USE (*Put X in box that applies*)?

Yes No Don't know

35b. IF YES, IS THAT FROM (*Put X in all boxes that apply*):

- Increased yield?
- Better price?
- Other reason (Specify) _____

36a. CAN YOU AFFORD TO USE AS MUCH FERTILISER OR PESTICIDES AS YOU WOULD LIKE TO?

Fertilisers Yes No
Pesticides Yes No
Weedicides Yes No

36b. IF NO, IF YOU COULD AFFORD IT, WOULD YOU BUY MORE:

Fertilisers Yes [] No []
Pesticides Yes [] No []
Weedicides Yes [] No []

37. DO YOU THINK THAT THE MORE FERTILISER AND/OR PESTICIDE YOU USE THE BETTER THE RESULTS ARE?

Yes [] No []

If yes, specify _____

If no, is there a level over which it makes no difference?

Yes [] No []

38a. DO YOU USE ANY ALTERNATIVES TO:

i. Fertilisers Yes [] No []

If Yes, what _____

ii. Pesticides Yes [] No []

If Yes, what _____

38b. IF NO, IF THERE WAS AN EFFECTIVE AND AFFORDABLE ALTERNATIVE TO AGRO-CHEMICALS, WOULD YOU USE IT?

Yes [] No []

AGRO-CHEMICALS MANAGEMENT

39. WHERE DO YOU OBTAIN YOUR SUPPLY OF AGRICULTURAL CHEMICALS? (ie fertilizers and pesticides) (*Put X in boxes that apply*)

Commodity Boards [] Farm Store [] Direct import []
MAFF [] Other [] (specify) _____

40. HOW ARE AGRICULTURAL CHEMICALS STORED ON YOUR FARM (*Put X in boxes that apply*)?

Shed [] Locked shed [] In the House [] In the field []
Other [] (Specify) _____

41. WHAT DO YOU DO WITH YOUR EXCESS MIXED CHEMICALS ON THE FARM? (*Put X in boxes that apply*)

Bury [] Wash down streams [] Apply to soil []
Store for further use [] Other [] (specify) _____

42a. HOW OFTEN DO YOU CLEAN YOUR CHEMICAL APPLICATOR (*Put X in box that applies*)

Every use Between different chemical applications
Once per month Never

42b. WHAT DO YOU DO WITH THE WASHINGS FROM THE SPRAY APPLICATOR? (*Put X in boxes that apply*)

Bury Wash down streams Apply to soil
Other (specify)_____

43. WHAT DO YOU DO WITH EMPTY PESTICIDE CONTAINERS (*Put X in boxes that apply*)?

Bury Burn Put with household garbage
Throw in stream Other (specify)_____

INFORMATION

44. WHERE DO YOU ACQUIRE INFORMATION ON FERTILISERS?

a. Type of fertiliser _____
b. Use of fertiliser _____

45. WHERE DO YOU ACQUIRE INFORMATION ON:

a. Type of pesticide _____
b. Use of pesticide _____

46. WHERE DO YOU ACQUIRE INFORMATION ON WEED CONTROL?

a. Type of herbicide _____
b. Use of herbicide _____

47a. HAVE THE INFORMATION POSTERS AND TV/RADIO BROADCASTS ON THE USE OF PESTICIDES HELPED YOU?

Yes No

47b. IF SO, WHAT ASPECTS IN PARTICULAR HAVE YOU FOLLOWED ON YOUR FARM?

HEALTH AND SAFETY

48. WHAT DO YOU WEAR WHEN YOU SPRAY? (*Put X in boxes that apply*)

Regular clothes Protective suit Goggle Hat

Gloves Water Boots Respirator

Other (specify) _____

49a. HOW LONG AFTER SPRAYING PESTICIDE DO YOU WAIT BEFORE HARVESTING YOUR CROPS (*Put X in box that applies*)?

Less than one day 1 day – 1 week 1 week – 2 weeks

Other (specify) _____

49b. WHAT PESTICIDE DOES YOUR ANSWER REFER TO: _____

50. DO YOU APPLY PESTICIDES TO CROPS THAT YOU USE FOR HOME CONSUMPTION?

Yes No

51a. HAVE YOU OR ANY OF YOUR FAMILY SUFFERED ANY ILLNESS WHICH YOU THINK AROSE FROM THE USE OF PESTICIDES (*Put X in box that applies*)?

Yes No Don't know

51b. IF YES, WHAT ARE THE DETAILS (chemical/illness)? _____

51c. IF NO, DO YOU KNOW OF ANYONE WHO HAS?

Yes No

What are the details (Chemical/illness)? _____

IMPACTS OF AGRO-CHEMICAL USE / FARMING PRACTICES

52. DO YOU THINK THAT THE USE OF AGRO-CHEMICALS HAS ANY EFFECT ON THE ENVIRONMENT, AND, IF SO, IN WHAT WAY?

Fertilisers Yes No Don't know

If Yes, how: _____

Pesticides Yes No Don't know

If Yes, how: _____

53. DO YOU THINK THAT FARMING PRACTICES HAVE ANY IMPACT ON THE MARINE ENVIRONMENT / THE SEA?

Yes No Don't know
If yes, how (e.g. by soil erosion/run-off) _____

54. DO YOU THINK THAT AGRO-CHEMICALS HAVE ANY IMPACT ON THE MARINE ENVIRONMENT / THE SEA?

Yes No Don't know
If yes, how: _____

GENERAL

55. FROM THE FOLLOWING LIST, WHICH DO YOU CONSIDER TO BE YOUR TWO MOST IMPORTANT PROBLEMS IN FARMING (Put X in two boxes)?

Soil fertility	<input type="checkbox"/>	Soil erosion	<input type="checkbox"/>	Water supply	<input type="checkbox"/>
Lack of irrigation	<input type="checkbox"/>	Flooding	<input type="checkbox"/>	Pest infestation	<input type="checkbox"/>
Disease	<input type="checkbox"/>	Weeds	<input type="checkbox"/>	Cost of pesticides	<input type="checkbox"/>
Cost of fertilizers	<input type="checkbox"/>	Agrochemical access	<input type="checkbox"/>		
Other <input type="checkbox"/>	(specify) _____				


56. DO YOU WISH TO MAKE ANY OTHER COMMENTS ON YOUR FARM OPERATIONS? (Please state below)

Thank you for your kind assistance

6 ANNEXE 3 – PROJECT PRESENTATION BY NICOLE KENWARD

Slide 1

Impact and amelioration of sediment and agro-chemical pollution on Caribbean Coastal Waters



- MRAG Ltd, UK
- University of York, UK

MRAG Ltd - R7668

June 2001

Title: Impact and amelioration of sediment and agro-chemical pollution on Caribbean Coastal Waters. Funded by DFID – NRSP – LWI for period of 3 years. Contracted to University of York (sedimentation) and MRAG Ltd, UK (agro-chemicals). Agro-chemical part of project has case studies: St Lucia (SIDS) & Jamaica (large island state). Sedimentation side of project – St Lucia only.

Slide 2

Collaborators

- UWI, Jamaica
- CARDI, Jamaica
- C-CAM, Jamaica

- MAFF – Dept of Agriculture, St Lucia
- CEHI, St Lucia

MRAG Ltd - R7668

June 2001

A number of collaborators with different technical inputs for the agro-chemical elements of the project.

In Jamaica: UWI (CMS, DoLS, DoC), CARDI and C-CAM, based in Portland Bight, headed by Peter Espeut.

In St Lucia: MAFF, Dept of Agriculture, CEHI, collaborating for environmental monitoring of agro-chemicals.

Slide 3

**Project Outputs
(sedimentation elements)**

1. Improved understanding of the effects of sedimentation
2. Economic estimates of the value of reefs and the costs of sediment pollution

MRAG Ltd - R7668

June 2001


Outputs (sedimentation elements)

Improved understanding of the effects of sedimentation (on coral reefs, on efficacy of current management measures, on reef recovery from natural disturbances)

Economic estimates of (a) the value of reefs to the St Lucian economy, and (b) the costs of sediment pollution.

Slide 4

Sedimentation in Soufriere, St Lucia



MRAG Ltd - R7668

June 2001

This photo illustrates the impact of sediment that results from soil loss from farmed hillsides in the Soufriere watershed

Slide 5

Project Outputs
(agro-chemical elements)

3. Estimates of agro-chemical loadings and fate of loadings
4. Review and evaluation of existing agricultural land management

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Output 3:

Achieved through quantification of imports over the past few years.

We are carrying out a review of agro-chemical toxicity and recommended management

Environmental monitoring will trace the fate of agro-chemicals along a transect from plantation to reef. For reasons of high analytical costs, environmental monitoring is only being carried out in St Lucia.

Output 4:

We are studying the administrative procedures for agro-chemical imports and production.

CARDI is conducting a review of soil management and the use of agro-chemicals in agriculture (this activity started with a characterisation of farming units, selection of 2 study watersheds in the Rio Cobre and Wag Water, and has now lead to the organisation of this workshop and development of questionnaires)

We also aim to identify critical control points for management and dissemination of information.

Slide 6

Imports of Pesticides

- Imports of total pesticide products to Jamaica, 1990-1999
- Quantity shown in kg
- Graph indicates a three fold increase in imports during the past decade

Year	Imports (kg)
1990	~130,000
1994	~140,000
1999	~300,000

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This data is taken from the 1999 Annual Report produced by the PCA.

It shows the imports of total pesticide products to Jamaica, 1990-1999 and quantity shown in kg.

The graph indicates a three fold increase in imports during the past decade and illustrates that there must be a growing impact of pesticides in Jamaica

Slide 7

Project Outputs
(sedimentation and agro-chemical elements)

5. Options for pollution monitoring
6. BMP manual produced

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Output 5:

Looking at alternative options for environmental monitoring to detect changes in concentration of agro-chemicals and sediment loads in the coastal zone

Output 6:

One of the final activities will be to identify management options (including advice on education, training and awareness needs, and appropriate legislative and policy measures) to improve management of agricultural non-point sources of pollution and thereby we hope to reduce agro-chemicals / sediment in the marine environment. Management options will be discussed at a workshop during the final year of the project.

The final project output will be production of a Best Management Practices Manual concerning usage of agro-chemicals and reduction of agro-chemicals and sediment in the marine environment. Findings and conclusions from the workshop I have just mentioned will be incorporated into the BMP Manual.