



*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**

**Monday, 11<sup>th</sup> June 2001 - 9:30 am – 4:30 pm**

**Biology Lecture Theatre**

**UWI, Mona Campus, Jamaica**

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

*Centre for Marine Sciences (CMS)  
University of the West Indies (UWI)  
Mona Campus, Kingston 7*

*and  
Caribbean Agricultural Research and Development  
Institute (CARDI)  
Mona Campus, Kingston 7*



**Centre for Marine  
Sciences, UWI**



**Caribbean Agricultural  
Research and  
Development Institute**



**Marine Resources  
Assessment Group Ltd**

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## EXECUTIVE SUMMARY

- This one day workshop was organised by the CMS (UWI), 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*
- Jamaican Ministry of Agriculture RADA officials and extension officers from two watersheds (Rio Cobre and Wag Water) were invited to participate at the workshop. A total of 36 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 Jamaica (with focus on crop types in Rio Cobre and Wag Water). 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. The questionnaire will be stratified according to farm size (small, large) and crop type (for large farms only). There will be a total of 150 interviews conducted: 100 in Rio Cobre and 50 in Wag Water watershed.
- Copies of questionnaire will be prepared by the end of June and subsequently distributed to the RADA extension officers together with a copy of the Proceedings of the Workshop.



**Workshop participants at UWI, Mona Campus, 11 June 2001**

## 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
DoC	Department of Chemistry
DoLS	Department of Life Science
ICM	Integrated Crop Management
IICA	Inter-American Institute for Cooperation on Agriculture
IPM	Integrated Pesticide Management
LWI	Land Water Interface
NRSP	Natural Resources Systems Programme
UWI	University of the West Indies

## 1 OPENING SESSION

### 1.1 Chairman's Welcome Remarks

The workshop was officially opened at 9:45am by the Chairman, Dr George Warner, of the Centre for Marine Sciences (CMS). He gave the participants an overview of the project and its relationship to coastal water quality and coral reef health in Jamaica. He highlighted that the core business of the current workshop was to find out what activities are occurring in the upper watersheds. This information is essential since it feeds into implications for management of the coastal zone and the associated exclusive economic zone.

### 1.2 Remarks

Mr. Frank McDonald (Country Leader CARDI Jamaica Unit) gave a few remarks after the chairman's opening. He spoke mainly of the cooperative efforts of several organisations, including CMS, MRAG, CARDI, RADA and The Ministry of Agriculture. He also wished the participants a successful and productive workshop.

### 1.3 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* (summary of presentation is given in Section 5). She explained the collaborative nature of the project, with major partners in Jamaica (UWI, CARDI and C-CAM) and St Lucia (Ministry of Agriculture, Fisheries and Forestry 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 two watersheds in Jamaica.

The final outputs of the project are:

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

#### **1.4 Workshop Objectives**

Dr Dale Webber then welcomed all workshop participants to UWI and outlined the objectives of the workshop. He started by explaining the importance of bringing all the partners together to discuss and exchange ideas.

He then spoke of the main goals of the workshop, which were:

- Information gathering and sharing of knowledge between all parties;
- To meet all the persons who will be involved in the project;
- To find out more information about the farming practices that exist in Jamaica (both large and small holdings) with specific reference to pesticide and fertiliser use;
- To increase the knowledge about the two target watersheds (Rio Cobre and Wagwater);
- Discussion and feedback on the questionnaire developed by CARDI;
- Questionnaire implementation and standardisation procedures;
- Continued communication between all the partners (*de facto*);
- Analysis of the results obtained through the survey instrument.

Dr Webber reminded us that all these questions needed to be answered by the end of the day.

#### **1.5 Vote of thanks**

Dr Leslie Simpson then thanked the participants for attending the workshop. He also thanked the Ministry of Agriculture, especially RADA (through the efforts of Mr Albert Shand), IICA, the Faculty of Agriculture (UWI), CMS and CARDI for their input into the workshop.

After a short break the participants returned to start the technical sessions of the workshop.

## **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.

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

### **2.2 Outline of existing knowledge of farming and soil conservation practices in Jamaica**

Dr Leslie Simpson presented an outline of the existing knowledge of farming practices and soil conservation techniques in Jamaica to stimulate discussion on more detailed agricultural practices island wide (overview of presentation given in Section 6).

#### **2.2.1 Background**

He informed the group that Jamaica has 33 watersheds, mainly consisting of sloping lands (80%), of 5° or more. The watersheds are often drained by a major river, and the land area ranges from hills to coast. Over half the island exists on very steep slopes. There are small portions of gently sloping areas. Land topography has greatest influence on farming systems of island. The highest numbers of farms are located on hillsides.

Dr Simpson then gave an outline of the soil series across the island. There are 8 soil series: 6 soil series found in hilly areas and 2 in coastal areas.

The hillside soil series are derived from the following:

1. Hard Limestone, eg. St Ann clay and Chudleigh clay loam.
2. Soft limestone eg. Carron Hall clay, Killancholly clay.
3. Shale material, Bellfeild clay, Llandewy clay
4. Purple conglomerates
5. Tuffs and other conglomerates (more acidic soils)
6. Granite eg. Flint River sandy loam

In coastal areas there are two main alluvial soil series: the recent Agualta sandy loam and Caymanas clay loam. The older alluvials are Chruch Pen clay and Bodles Clay loam (eg found in Clarendon).

Dr Simpson also spoke about the climate and rainfall of Jamaica. He told the workshop that the temperature variations in Jamaica were minor. More importantly the evapo-transpiration ranges between 77 - 158mm. Evapo-transpiration rates are often higher than rainfall levels (causing drought conditions). Annual rainfall ranges between 140 - 158 mm. Slides were shown of monthly rainfall in 1999. There was a drought early in the year and this showed rainfall levels below the evapo-transpiration rates. Later in the year there was rainfall. Climate and rainfall patterns indicate that crop seasons are quite limited and this suggests the need for water storage and irrigation of crops during other times of the year.

Dr Simpson also presented data on the distribution of agricultural land: 407,434 ha of land available for farming. There are 187,791 holdings or farming units. 38% of the total area are large holdings of 200 ha or above. However, 38% of land area is held by only 11% of the total number of farming units. 42% of the land area is available as small farms which represent 90% of the total number of farming units.

### **2.2.2 Characteristics of farming units**

Agricultural Systems:

There are three types of distinct agricultural systems: the Estate or Plantation system (extensive basis, monoculture, includes cattle for market, occupies some of best lands of the country), Medium scale farming systems (10-200ha, normally engaged in wide range of activities) and Small scale farming systems (<10, crops for domestic or subsistence, variety of enterprises).

Soil Conservation Techniques:

Some of the farming practices currently cause accelerated erosion:

- Land clearing – includes removal of trees, brushes etc
- Cultivating up and down the slope
- Poor plant sand and exposed soil areas
- Overstocking of animals
- Burning of vegetation

Soil conservation techniques fall into two categories:

- Engineering structures (larger Estates and Plantations)
- Cultural practices (smaller farmers) including reduced tillage systems, grass and trash barriers, hedgerows, contour farming, strip cropping, crop rotation, tree crops.

Other practices of importance are:

- Soil fertility management, soil water management, soil fertility and land preparation.
- Disease and pest management
- Integrated Pest Management (IPM) practices
- Overall farm management
- Water sources
- Sanitation and environmental considerations

### **2.2.3 Discussion**

#### **Soil conservation:**

Accelerated erosion is caused by poor farm road construction on hillsides by bulldozers without engineering considerations, causing wash down hillsides (St Thomas). But once done, this does not appear to cause further disturbance and, for this reason, small farmer activities tend to re-disturb seasonally. However, there is often no maintenance on these roads which were poorly constructed. As a result there is continued erosion in areas traditionally farmed by small farmers (downslope of these roads). These impacts are often particularly severe in soils composed primarily of conglomerates.

Some basic soil testing is conducted by RADA along with the assistance of the farmers. Here soil sampling is conducted at different locations on a particular holding. For example soil is collected from a yam field, under a tree and near the main road. The soil quality of each location is compared and this exercise is often useful in raising the awareness of the farmers on issues such as soil management etc.

#### **Use of fertilisers:**

There is an increase in the use of fertilisers. RADA is involved in the training of farmers to identify deterioration of soil, not just adding fertiliser but using organic fertiliser. Most farmers keep adding fertilisers yet there is nothing to trap the fertiliser since organic matter and the soil matrix have been lost. Further to this training programme, many farmers are now able to identify problems such as lack of nutrient, plasticity of soil, etc. Dr Simpson stated that he would like to see more organic fertilisers being used. Farmers are advised to slash and burn less and use composting to stabilise soils.

#### **Use of pesticides:**

The issue of the increase in volume of pesticide use was raised. Some entomologists are suggesting that the use of pesticides is impacting not only on the pests but also beneficial insects (natural control mechanisms).

However, it was reported that there is a reduction of pesticide use per individual farmer, and this was related to existing export regulations. There are often reports of rejected shipments due to high pesticide residues. In addition, reduced incomes of farmers have affected their ability to purchase highly priced chemicals.

It is possible that the increased imports of pesticides can be related to an overall increase in the numbers of farmers (over the past 10 years). However there is a marked increase of weedicides, particularly by small farmers. There is a greater availability and range of pesticides available to farmers, but is use less per farmer? A reason for the increase in pesticide use could be related to increased herbicide use to minimise labour costs.

Integrated Pest Management (IPM) practices are encouraged but this is only working in some areas. It appears that there is a substantial increase in pesticide use by larger Estates.

### **What are the techniques taken up by farmers for soil conservation?**

Dr Mees asked the extension officers about the soil management techniques available, and which are the ones that are readily accepted by the farmers. The comment was made that the least labour intensive, and financially beneficial, methods are accepted. Farmers are however encouraged to plant pineapple barriers (terracing) and to conserve soil by tree planting. There is resistance to accepting tree planting as immediate financial returns are not always forthcoming. Farmers have also been encouraged by handouts (money and goods) as rewards for implementing sustainable practices.

There was a comment that in the past RADA officers were the persons responsible for promoting increased pesticides use to improve crop production. However, the officers are now promoting organic farming. This should have an island-wide focus so as to tap into export markets. Unlike previous agricultural professionals with training in fertilizer application, extension officers need to understand beneficial rates of application of organic fertilizers, so as to properly advise the farmers.

Perhaps application techniques have been addressed so application is more efficient. Farmers have often reached the stage where not just fertilisers are needed, but the soil requires organic matter. A question was asked; "Is it that we are discouraging the use of fertilizers or are we encouraging better management of fertilizer use?". The answer given was, No, the message should be encouraging a more holistic approach to agricultural practices, ie more efficient use of fertilizers while complementing soil nutrition with the use of organic fertilizers.

## **2.3 Main crops of the two watersheds: Rio Cobre and Wag Water - farming practices and soil management**

Raymond Martin led the next segment of the first technical session. The discussion continued on the main crops of the two watersheds Rio Cobre and Wag Water, including farmer practices, soil management practices, etc (overview of presentation given in Section 7).

### **2.3.1 Objectives:**

The main objectives were to:

- Characterise watersheds
- Describe survey sampling method
- Obtain general information on farming practices in the watershed

The participants were shown slides of the watersheds across the entire island, including the two target areas. Categorisation of the watersheds was influenced by the following factors:

- Slope categories
- Cropping systems (large vs small)
- Pollution
- Groundwater vs surface run-off
- Land use categories

The point was raised that the impact of industries in both watersheds (Rio Cobre and Wag Water) must be taken into consideration. In both watersheds there is the release of domestic washing (laundry) and industrial effluent (coffee processing waste) into the rivers. Some possible sources of waste were mentioned including, Nestle (diary products), United Estates (citrus) ALCAN (now owned by Glencore).

## **2.4 Characteristics of the Rio Cobre watershed**

The Rio Cobre is fed by four tributaries which meet in the upper section above Bogwalk:

- Rio Pedro – tributary from the west
- Rio Dora
- Rio Cobre – important pollution from bauxite pollution
- Rio Magno

A note was made that the Rio Cobre is very different from Wag Water as most of the underlying rocks are permeable so there are underlying stream flows. These rivers are often intermittent which is typical of Jamaican rivers. The upper section of the watershed has steeper slopes, while the lower sections (e.g., Bogwalk) have gentler slopes. Soils also change moving through the watershed, from clays in upper valleys to alluvial and loam further downstream.

Mr Martin explained that feedback on general crop systems was required in order to stratify the survey, and identify beneficial/deleterious farming practices, cases of organic farming, different project or pilot farms.

A closer look at the Rio Cobre was then conducted in order to investigate farming practices occurring in the watershed. Larger estates are located in Bogwalk and lower areas of the watershed. These large farms are primarily monocrop systems. Small farmers are mainly engaged in mixed crops in the upper watershed.

Examples of soil conservation programmes were highlighted. A project in the Riversdale involved establishing pineapple barriers. The farmers are more receptive if some financial benefit is offered and pineapple barriers provide income therefore this method is attractive.

Mixed cropping systems are promoted by RADA in the smaller farms. Planting different crops ensures that the farmer has the possibility to earn throughout the year.

Soil conservation programmes on larger farms (i.e., monocrop systems) are typically related to drainage systems, check dams (structures to check flow of water) and irrigation management strategies. Estates often have their own farm managers who basically serve the functions of RADA officers. They also receive assistance from Agricultural Boards (coffee, banana, citrus, etc). RADA is therefore an add-on on these large farms, and therefore most of RADA's activities are focused on smaller farmers.

#### ***2.4.1 What soil conservation systems are present in smaller farms?***

The dominant soil conservation systems practiced are terracing and contour farming. The main crops are; yam, cocoa, assorted vegetables, red peas, sweet potatoes, bananas and pineapples. For those areas with really steep hillsides, tree crops would be first choice. However, the farmer has limited resources (i.e., small piece of land), and therefore has to maximise the yield from his/her plot. They are advised by RADA to use strip cropping, for example planting red pea borders around plots of yam.

#### ***2.4.2 Predominant crop types***

General information and further details on the main crops produced in sections of the Rio Cobre watershed were then provided by the RADA extension officers.

## **Riversdale**

Yam – most dominant in Riversdale and priority Gungo peas

Red peas

Monocropping with sweet potato.

## **Ewarton**

Chiefly vegetables – callaloo (mono), Pak Choi and cassava (mono)

Tree crops (citrus dominant, little coffee, some cocoa)

Main concerns are soil conservation issues as well as pesticide use (for vegetable cultivation).

There is better agricultural management of citrus and coffee with respect to soil conservation. These crops are also grown on the lower slopes so soil erosion is not a major issue. The main concern with tree crops (i.e., citrus and coffee) is the heavy use of herbicides.

## **Guy's Hill**

Main crops are Irish potato, vegetables, plantain, coffee, banana, pumpkin, tomato, hot and sweet peppers and cabbage.

The main issues here are deforestation and heavy pesticide use on vegetable crops. There is a low percentage of forest and tree crops in the Guy's Hill area.

Because of the high permeability of the substrate, the Rio Cobre has the potential for groundwater contamination. Most rivers are recharged with groundwater and this should be a concern for RADA, as there is heavy weedicide use, especially from large plantations.

## **2.5 Characteristics of the Wag Water watershed**

This watershed encompasses St Mary and St Andrew, and runs from upper St Andrew to Annotto Bay. The main tributaries of the watershed are important in that they feed the Hermitage Dam, which provides drinking water for Kingston. This dam is fed by Ginger River and Flint River.

The difference between Wag Water and Rio Cobre is that most of the Wag Water watershed is drained by surface drainage as most rocks are impermeable. This creates a major problem of heavy sediment loading along the reefs of the northern coast. Another concern is the high amount of solid waste from the watershed, which enters directly into the coastal waters. The slopes of the north coast are mostly over 10<sup>0</sup>, and the majority of the area is comprised of steep slopes.

### **2.5.1 *Predominant crop types***

#### **St Andrew: Temple Hall**

Main crops produced in this area of the watershed are coffee, yam and vegetables. The main concern is therefore the impact of pesticides from coffee cultivation. The issue of poor or inadequate soil management practices in the district was noted.

There is a problem of high nitrogen levels on coffee plantations. The extension officers are now encouraging the farmers to change to mixed fertiliser grades (with lower N).

Other considerations in this district are the impacts of logging, e.g., the cutting of young yam trees for yam sticks. There are also several logging operations.

There are many natural springs in the Wag Water area and there are some bottling water operations. Sewage contamination (farm and household) is also an issue.

#### **Salisbury Plain**

The predominant crops grown in this district are yam, vegetables, some coffee and tree crops. Main concerns are associated with vegetable cultivation due to high pesticide use on cabbage, tomato, Pak Choi, callaloo and string bean (mainly cabbage, tomato and Pak Choi). Cucumber is also grown in this locale.

There are however increasing incidents of household and farm waste entering the rivers including drums, plastics and Styrofoam containers. In addition, there are pig farms and some chicken pens adjacent to the Wag Water River, as well as factories and coffee pulperies. The concern raised was that these activities often pollute the river directly (e.g., pens are washed and the waste is shunted directly into the rivers with no pre-treatment).

There was a suggestion to encourage framers to integrate the use of chicken/pig waste into their farming systems. There were reports of some farmers with good systems in this area.

#### **Castleton**

The main crops found here are coffee (major concern), plantain, yam, cocoa and banana. Mixed cropping of plantain and yam is primarily found in Castleton.

Yam is cultivated using contour farming so this does not cause an erosion problem; coffee cultivation is the major culprit of soil erosion here.

Vegetables are also cultivated in Castleton, including Pak Choi and cabbage. Concern was also raised regarding pesticide use for these vegetables. Additionally, many of the vegetable plots are located along the banks of the Wag Water River.

### **Broad Leaf district**

The main concern raised by an extension officer was the illegal dumping of solid waste, farm waste and livestock on the banks of the river (e.g., pigpen wastes).

### **Highgate**

Flint River and Robins Bay area have large plantation farming systems, e.g., Green Castle Estate cultivates papaya, scotch bonnet pepper, banana, coconut and breadfruit.

The main concern at this location is the impact of pesticide used by the large banana estates (also aerial spraying). The area is also prone to landslides.

Drains have been cut through the fields of the St Mary Banana Estates, which discharge directly into the Wag Water.

### **Flint River**

The main crops grown here are cocoa, pineapple (barriers) and ginger. The main concern is soil management. There are steep slopes found in this area.

## **2.5.2 Target crops for each watershed**

Further to lengthy discussion about the predominant crop types in each watershed, target crops were selected for each area as follows:

<b>Wag Water</b>	<b>Rio Cobre</b>
<ul style="list-style-type: none"><li>• Coffee</li><li>• Yams</li><li>• Vegetables</li><li>• Banana and Plantain</li><li>• Hot Peppers</li></ul>	<ul style="list-style-type: none"><li>• Citrus</li><li>• Banana</li><li>• Yams</li><li>• Sugarcane</li><li>• Vegetables</li><li>• Coffee</li></ul>

The larger holdings would be predominated by monocrop systems of sugarcane, citrus, banana, plantain, coffee and hot peppers. Other characteristics of the watersheds are that the coffee plantations are found in the hills on steep slopes while the banana plantations are located in the coastal areas.

### 3 TECHNICAL SESSION 2

The second session was chaired by Miss Nicole Kenward, who thanked CMS for organisation of 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; and a training session on standardisation of questionnaire techniques. An addition to the agenda was a break between the two sessions for refreshments and a photograph session.

#### 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 (summary of presentation given in Section 8). 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.

Some examples of modifications were the inclusion of check boxes with sub-categories to reduce the time per question. Standardization of units such as area was also implemented.

This process was very detailed and all changes were noted. It was concluded that all recommendations would have to be taken into consideration.

A list of supplementary questions was also examined by the participants (namely questions on Health and Safety, Use and Application of agro-chemicals and Livelihoods). Subsequent changes were made where relevant, and these questions were included under appropriate sections in the final survey instrument.

#### 3.2 How to Conduct the Survey

Raymond Martin made a presentation on how to conduct to survey. He explained the stratification process to participants, i.e., farms stratified according to size and then crop type (only in the large farm category). The total number of questionnaires is 150: 100 in the Rio Cobre and 50 in Wag Water. The process is to be a random selection of individuals from a list from the Statistical Institute (STATIN) or from the farmer's register. The point was made that STATIN's list was outdated as it is based on the last agricultural census in 1996.

Mr. Martin also pointed out that all details needed to be added to open ended questions such as names and places of residence. He also advised the RADA officers to ensure the use of "X's" (not ticks) **within** the respective check boxes (not beside).

Further details were explained such as clarification of the difference between ridging and furrowing and time of fertilizer application (related to the age of the plant).

Mr Martin also pointed to the need for a standard introductory statement that introduces the project to the farmer. This introductory statement will be given to extension officers together with the questionnaires. He also strongly requested that the extension officers ensure that all questions were answered even if one had to put Not Applicable (N/A) in empty slots. This would make it easier for the persons entering the data.

### **3.3 Summary of the Workshop**

Dr Warner summarized the day's proceedings. He expressed satisfaction with the great effort by all the participants. He praised them for their dedication to the task of ensuring that the survey instrument was correct. He thought that the day's proceedings were very useful and wished the project all the success it deserves.

### **3.4 Closure of the Workshop**

Dr Chris Mees then closed the workshop. He thanked all the major partners such as CMS and CARDI for organisation of a successful workshop. In particular, he thanked the Ministry of Agriculture and especially its extension arm, RADA for their time and invaluable contributions to the day's proceedings.

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

## **4 ANNEXE 1 – WORKSHOP AGENDA**

**Technical Session 2**  
**Chairman: Nicole Kenward**  
**MRAG Ltd., UK**



1:30 - 2:30 pm	Presentation and Simpson discussion on survey Martin instrument (questionnaire)	Dr Leslie and Raymond CARDI
2:30 – 4:00 pm	Presentation on how to Simpson conduct the survey, how Martin to ask the question, standardization of questionnaire techniques Followed by discussion	Dr Leslie and Raymond CARDI
4:00 – 4:20pm Warner	Summary of Workshop	Dr George CMS
4:20 - 4:30 pm	Closure of workshop	Dr Chris Mees MRAG Ltd

**IMPACT AND AMELIORATION OF SEDIMENT  
AND AGRO-CHEMICAL POLLUTION ON  
CARIBBEAN COASTAL WATERS  
(DFID, NRSP-LWI PROJECT R7668)**

**PROJECT WORKSHOP**

11 June, 2001

at 9:30 am

Biology Lecture Theatre

UWI, Mona Campus

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

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University of the West Indies (UWI)  
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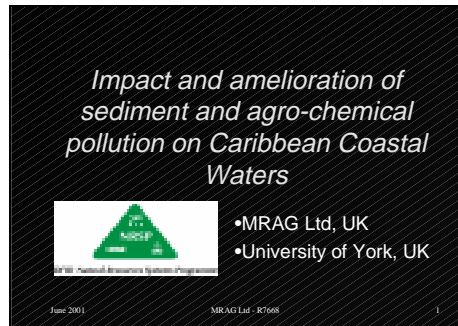
**Opening Session**  
**Chairman: George Warner**  
**Centre of Marine Sciences**  
**University of the West Indies, Mona**

**Technical Session 1**  
**Chairman: Dr Chris Mees**  
**MRAG Ltd., UK**


Chairman's Welcome Remarks		10:30 - 11:30 am	Outline of existing Simpson knowledge of farming practices and soil conservation techniques in Jamaica, leading onto facilitated round-table discussion	Dr Leslie CARDI
Remarks	Frank D. McDonald Country Team Leader CARDI/Jamaica Unit			
Presentation on project	Nicole Kenward, MRAG Ltd., UK			
Workshop objectives	Dr Dale Webber Faculty of Pure & Applied Sciences University of the West Indies	11:30 - 12:30 pm	Discussion continues on Martin main crops of the two water-sheds Rio Cobre and Wag Water - farmer practices, soil management practices, etc	Mr Raymond CARDI
Note of Thanks	Dr Leslie Simpson Head of NRM Section CARDI/Jamaica			
Refreshments		12:30 - 1:30 pm	LUNCH	

## 5 ANNEXE 2 – OPENING SESSION: 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

June 2001 MRAG Ltd - R7668 1

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

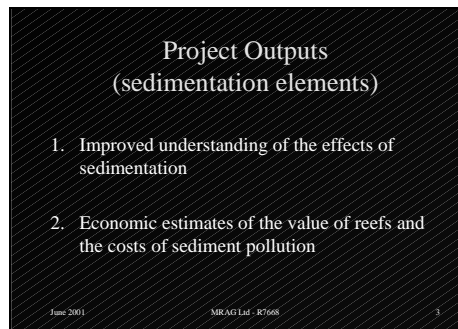
June 2001 MRAG Ltd - R7668 2

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

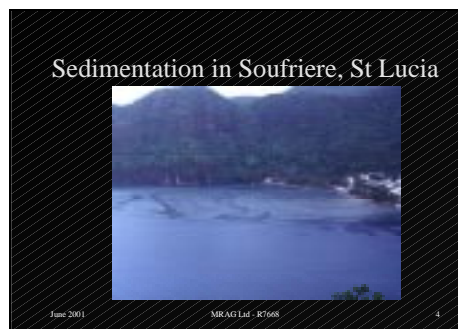
June 2001 MRAG Ltd - R7668 3

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



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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	~1,200,000
1995	~1,500,000
1999	~3,500,000

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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.

## 6 ANNEXE 3 – TECHNICAL SESSION 1: PRESENTATION BY DR LESLIE SIMPSON

Slide 1

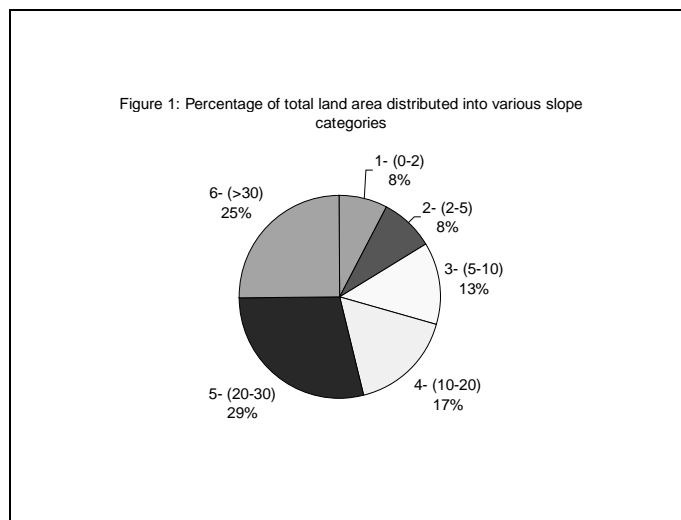
**Outline of existing knowledge  
of farming practices and soil  
conservation techniques in  
Jamaica**

Slide 2

**Land area and topography**

- Total land area is 11,424 km<sup>2</sup>
- Greatest length is 80.8 km
- Greatest width is 35.6 km
- 80 % of land is above 5° slope

Slide 3



Slide 4

### Soil series

- Six soil series are found in the hilly areas as follows:
  - Soils derived from hard limestone eg. St Ann clay and Chudleigh clay loam
  - Soils derived from soft limestone eg Carron Hall clay and Killancholly clay
  - Soils derived from shale material eg Belfield clay and Llandewey clay loam
  - Soils derived from purple conglomerates eg Cuffy gully gravelly sandy loam

Slide 5

### Soil series (Cont.)

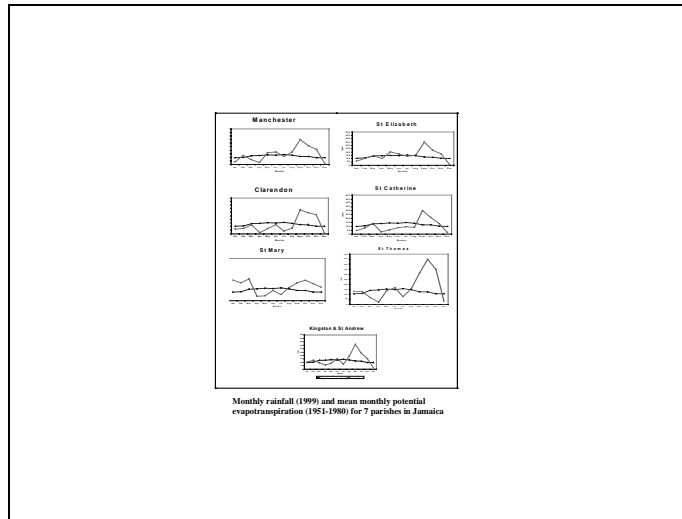
- Soils derived from tuffs and other conglomerates eg Wirefence clay loam and Wait-a-bit clay
- Soils derived from granite eg flint river sandy loam and Valda gravelly sandy loam
  - There are two soil series in the coastal areas
- Recent alluvial soils eg Agulta sandy loam and Caymanas clay loam
- Older alluvial soils eg Churchpen clay and Bodles clay loam

Slide 6

### Climate and rainfall

- Minimum daily temperature vary between 12.4 and 18.8°C
- Maximum daily temperature vary between 31.1 and 31.6°C
- Monthly evapo-transpiration range between 77mm and 158 mm
- Annual range between 1400mm and 2200mm

Slide 7

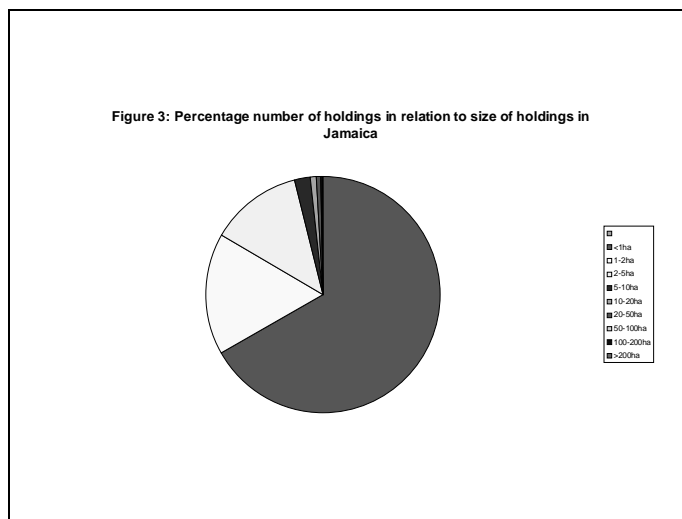


Slide 8

### Characteristics of the farming units

- There are 407,434 ha land available for farming
- There are 187,791 holdings or farming units
- 38% of the land area is in large units over 200ha each
- This 38% accounts for only 205 farming units

Slide 9

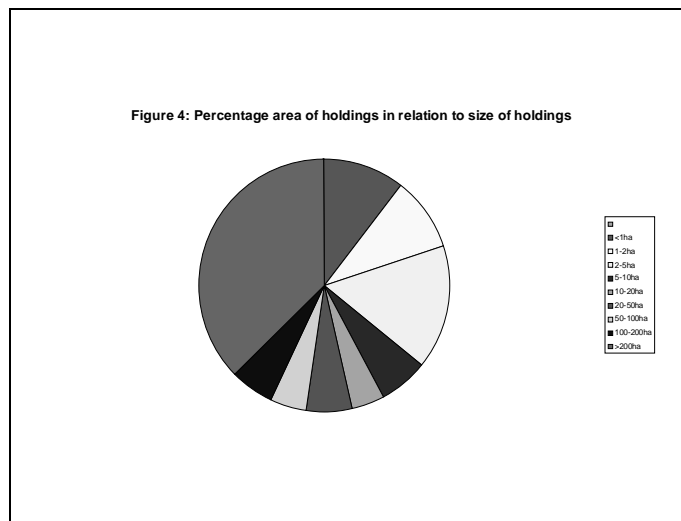


Slide 10

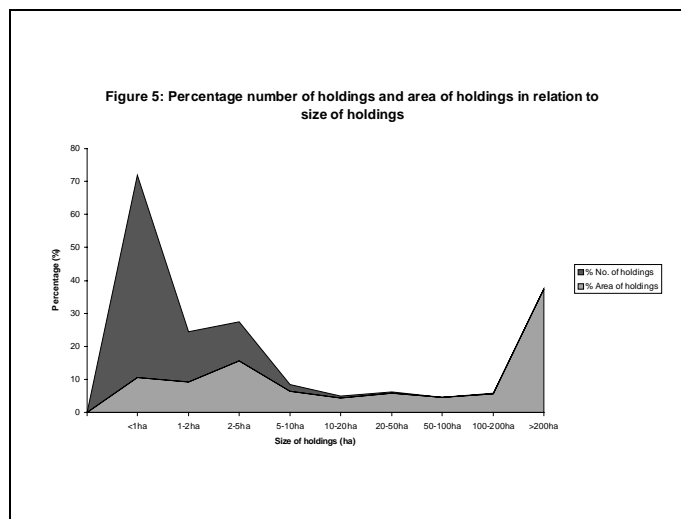
### Characteristics of the farming units (Cont)

- 42% of the land area is in small units <1-10 ha
- This 42% accounts for 170,033 farming units
- 170,033 farming units is 90% of the total farming units

Slide 11



Slide 12



Slide 13

### Agricultural Systems:

- There are three distinct Agricultural systems
  - The Estate or Plantation system
  - Medium Scale farmingsystem
  - Small scale farming system

Slide 14

### Soil Conservation Techniques

- Some of the agricultural practices which accelerate erosion on hillsides are:
  - Land clearing
  - Cultivating up and down the slope
  - Poor plant stand and exposed soil areas
  - Overstocking of animals
  - Burning of vegetation

Slide 15

### Soil Conservation Techniques (Cont.)

- Soil conservation falls into two categories
  - Engineering structures
  - Cultural practices

Slide 16

## Cultural Soil Conservation Practices

- Reduced tillage systems
- Grass and trash barriers
- Hedgerows
- Contour farming
- Strip cropping
- Crop rotation
- Trees

Slide 17

## Conclusion

- Other farming practices of importance:
  - Soil and fertility management
    - Soil water management
    - Soil fertility management
    - Land preparation
  - Disease and Pest management
    - Pest and disease problems
    - Weed problems
    - Major pesticides in use
    - Management of pesticides

Slide 18

## Other farming practices of importance: (Cont.)

- - Overall farm management
  - Water sources
  - Sanitation
  - Environmental considerations

## 7 ANNEXE 4 – TECHNICAL SESSION 1: PRESENTATION BY RAYMOND MARTIN

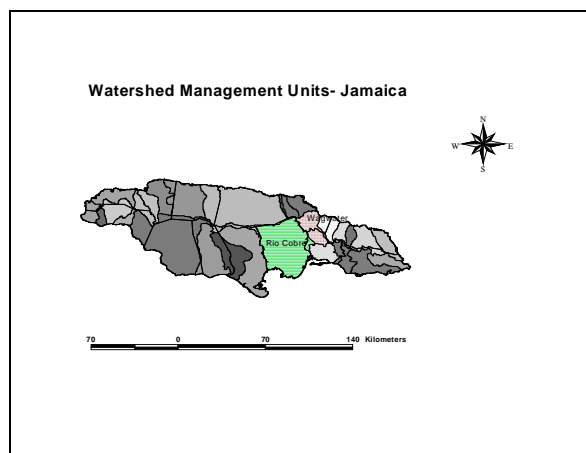
### Slide 1

**Objectives**

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1. Characterise watersheds
2. Describe survey sampling method
3. Obtain general information on farming practices in the watersheds

### Slide 2



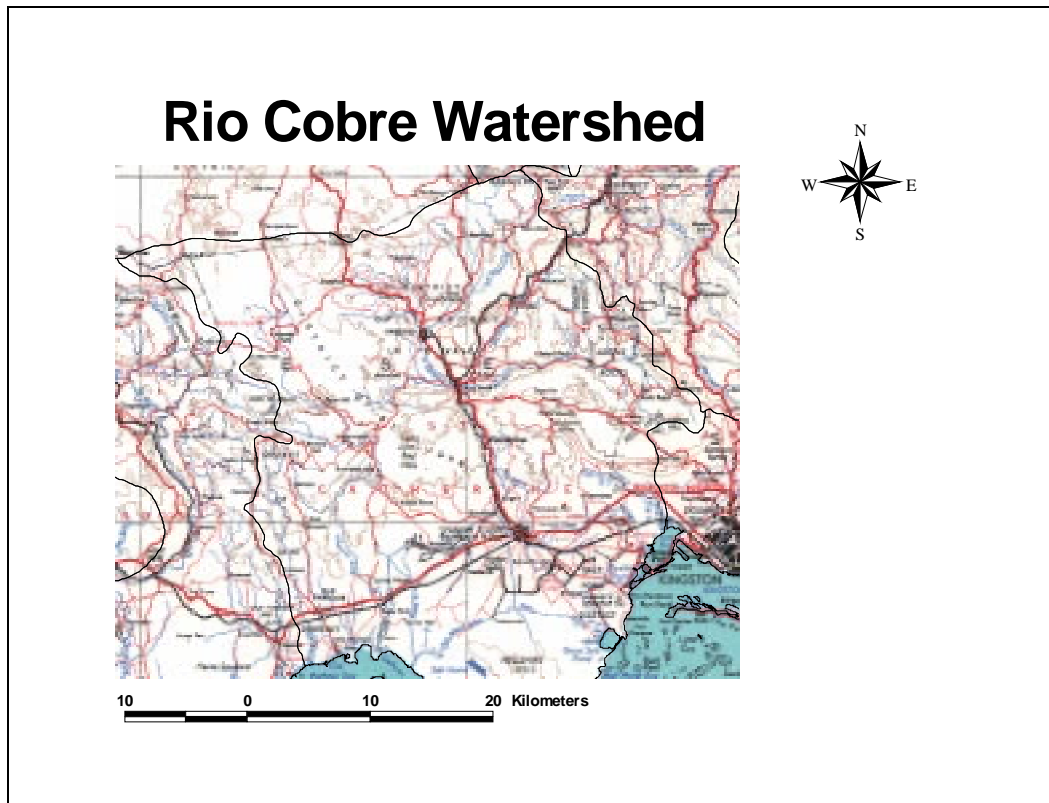
### Slide 3

**Characteristics of watersheds**

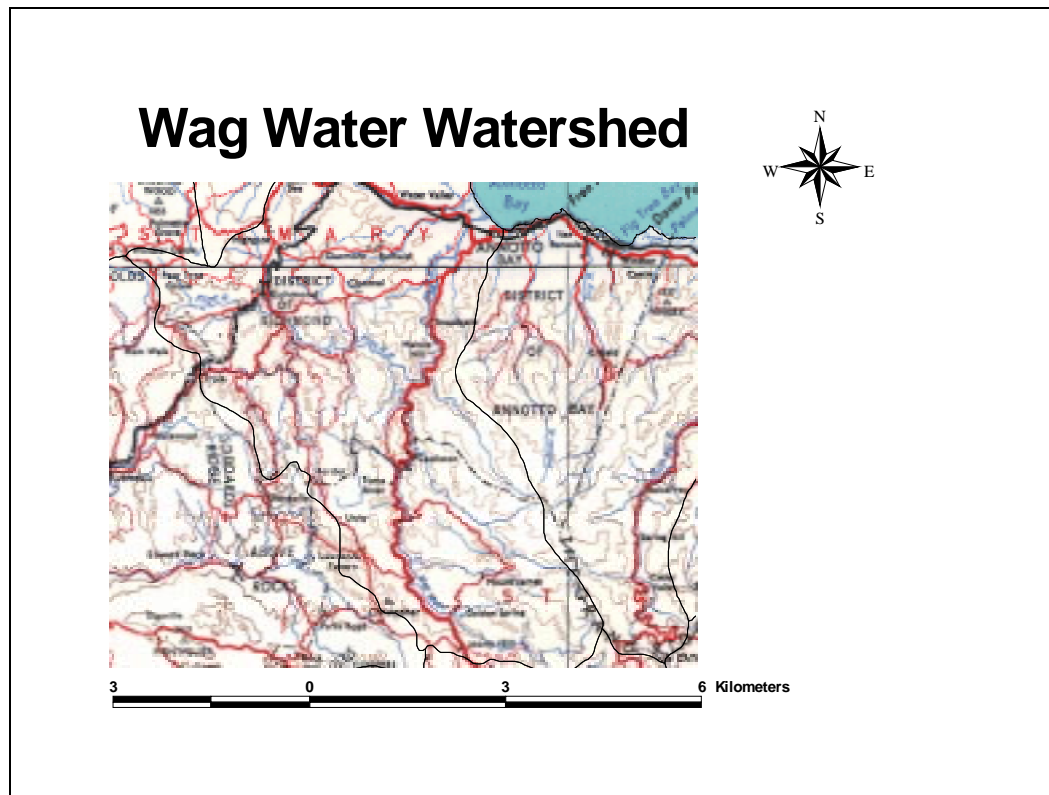
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1. Slope categories
2. Cropping systems
  - Large scale vs small scale
3. Pollution potential
4. Groundwater vs surface drainage
5. Use

Slide 4



Slide 5



## 8 ANNEXE 5 – TECHNICAL SESSION 2: PRESENTATION BY DR LESLIE SIMPSON

### Slide 1

#### The objectives of the survey are:

- 1. To identify farming practices for select crops in the Rio Cobre and Wagwater River watersheds.
- 2. To document important information on fertilizer and pesticide usage of both small and large farmers in the Rio Cobre and Wagwater river watersheds.
- 3. To determine possible areas of fertilizer and pesticide abuse in the two watersheds.

### Slide 2

#### The objectives of the survey (Cont)

- 4. To identify possible areas of intervention to improve the efficiency of fertilizer and pesticide use in the watersheds
- 5. To identify possible alternatives to the use of fertilizers and pesticide in the watersheds
- 6. To determine the health risks related to pesticide use in the watersheds
- 7. To identify probable areas of pollution in the watersheds

## 9 ANNEXE 6 – LIST OF WORKSHOP PARTICIPANTS

<b>NAME</b>	<b>ORGANIZATION</b>
Raymond Martin	CARDI, Jamaica
Dr Leslie Simpson	CARDI, Jamaica
Frank McDonald	CARDI, Jamaica
Joseph Lindsay	Ministry of Agriculture: R&D, Bodles Station.
Dr Chris Mees	MRAG Ltd, UK
Nicole Kenward	MRAG Ltd, UK
Winston D. Simpson	RADA, Head Office
Albert Shand	RADA, Head Office
Thomas Burton	RADA, Head Office
Harold Spaulding	RADA, Head Office
Jerome Clarke	RADA, St Andrew, Wag Water
Dotsy Fuller	RADA, St Andrew, Wag Water
Marlon Harvey	RADA, St Andrew, Wag Water
Andrew Carty	RADA, St Andrew, Wag Water
Egbert G. Blackstock	RADA, St Andrew, Wag Water
Sadie McKenzie	RADA, St Andrew, Wag Water
Anchenry Deans	RADA, St Andrew, Wag Water
Donovan Walker	RADA, St Andrew, Wag Water
Dwight Carty	RADA, St Catherine, Rio Cobre
Sherlock Pinnock	RADA, St Catherine, Rio Cobre
Sheldon McPherson	RADA, St Catherine, Rio Cobre
Joseph Bent	RADA, St Catherine, Rio Cobre
Kerry-Ann Lambie	RADA, St Catherine, Rio Cobre
Lennox Hermans	RADA, St Catherine, Rio Cobre
Leroy Grant	RADA, St Catherine, Rio Cobre
Lenworth Taylor	RADA, St Mary, Wag Water
Marshal Wint	RADA, St Mary, Wag Water
Victor Edwards	RADA, St Mary, Wag Water
Harold Brown	RADA, St Mary, Wag Water
Michael Beecher	RADA, St Mary, Wag Water
Peter Edwards	UWI: Centre for Marine Sciences
Dr George Warner	UWI: Centre for Marine Sciences
Dr Dale Webber	UWI: CMS/Department of Life Sciences
Dahlia Lambert	UWI: College of Agriculture, Science and Education
Malverne Spencer	UWI: Pesticides Research Group, Dept of Chemistry
T. McWhinney	UWI: Sanitation and Grounds

## 10 ANNEXE 6 – REVISED QUESTIONNAIRE

**FINAL**

**FARM ID NO:\_\_\_\_\_**

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

**Baseline Survey  
MRAG/UWI/CARDI May 2001**

**WATERSHED:                      RIO COBRE [ ]                      WAG WATER [ ]**

**SIZE OF FARM:                      LARGE [ ]                      SMALL [ ]**

**IF LARGE FARM, MAIN CROP IS:  
BANANA [ ]                      COFFEE [ ]                      CITRUS [ ]                      SUGAR CANE [ ]**

**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 UWI and CARDI.

This specific activity relates to a review of agricultural practices and soil management in two watersheds (Wag Water and Rio Cobre). The survey findings will be used to identify effective agro-chemical and soil management practices.



**IDENTIFICATION**

1. FARMER ID # \_\_\_\_\_
2. NAME \_\_\_\_\_
3. DISTRICT \_\_\_\_\_  
PARISH \_\_\_\_\_
- 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	<input type="checkbox"/>	41-50	<input type="checkbox"/>	>70	<input type="checkbox"/>
20-30	<input type="checkbox"/>	51-60	<input type="checkbox"/>		
31-40	<input type="checkbox"/>	61-70	<input type="checkbox"/>		
6. SEX (*Put X in relevant box*)    M     F

**BACKGROUND INFORMATION ON FARM**

7. SIZE OF FARM (ha) \_\_\_\_\_
8. WHAT CROPS DO YOU GROW?

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

PARCEL	DISTRICT	SIZE (ha)	TYPE OF TENURE*	MAIN CROP	SIZE (ha)	LIST MIXED CROPS
1						
2						
3						
4						
5						

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

9. 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 (kg)	PERCENTAGE			
			HOUSEHOLD USE	LOCAL MARKET	EXPORT MARKET	OTHER (SPECIFY)

### CROP, SOIL AND FERTILITY MANAGEMENT

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

Cutting of trees/shrubs  Weeding with machete   
 Burning of trash with fire  Forking   
 Ploughing  Ridging   
 Other  (specify) \_\_\_\_\_

11. 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°)

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

Clay  Sand  Loam

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

All the time  Most times  Sometimes  Never

14. IN WHICH MONTHS DO YOU GET THE MOST REGULAR RAINFALL? \_\_\_\_\_

15. 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   
Other  Specify \_\_\_\_\_

16. 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 \_\_\_\_\_

17. 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	PLASTIC	OTHER (Specify)

If no. State reason \_\_\_\_\_

18. 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/ OF CROP
		Surface	Bury		

If no for either fertilizer or manure. State reason? \_\_\_\_\_

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

Yes  No

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

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

21. DO YOU PUT LIMESTONE ON THE SOIL ?

Yes  No

22. WHAT ARE THE MAIN SOIL PROBLEMS THAT YOU ARE EXPERIENCING? (*Put X in box that applies*)

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

23. 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 box that applies)?*

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

24. WHAT SOIL CONSERVATION METHODS DO YOU EMPLOY(*Put X in box that applies*)?

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

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

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

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

Yes  No

## DISEASE AND PEST MANAGEMENT

### 27. HOW DO YOU CONTROL MAJOR PEST PROBLEMS?

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

### 28. HOW DO YOU CONTROL MAJOR WEED PROBLEMS?

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

### 29. HOW DO YOU CONTROL MAJOR DISEASE PROBLEMS?

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

## USE OF AGROCHEMICALS

30. 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 [ ]

31. 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) \_\_\_\_\_

32a. DO YOU RECOVER THE EXPENSE OF THE AGROCHEMICAL USE (*Put X in boxes that apply*)?

Yes [ ]

No [ ]

Don't know [ ]

32b. IF YES, IS THAT FROM (*Put X in all boxes that apply*):

[ ] Increased yield?

[ ] Better price?

[ ] Other reason (Specify) \_\_\_\_\_

33a. CAN YOU AFFORD TO USE AS MUCH FERTILISER OR PESTICIDES AS YOU WOULD LIKE TO?

Yes [ ]

No [ ]

33b. IF NO, IF YOU COULD AFFORD IT, WOULD YOU BUY MORE:

Fertilisers Yes [ ] No [ ]

Pesticides Yes [ ] No [ ]

Weedicides Yes [ ] No [ ]

34. DO YOU THINK THAT THE MORE FERTILISER OR PESTICIDE YOU USE THE BETTER THE RESULTS ARE?

Yes [ ]

No [ ]

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

Yes [ ]

No [ ]

35a. DO YOU USE ANY ALTERNATIVES TO:

i. Fertilisers Yes [ ] No [ ]

If Yes, what \_\_\_\_\_

ii. Pesticides Yes [ ] No [ ]

If Yes, what \_\_\_\_\_

35b. IF NO, IS THERE WAS AN EFFECTIVE AND AFFORDABLE ALTERNATIVE TO AGRO-CHEMICALS, WOULD YOU USE IT?

Yes  No

### AGRO-CHEMICALS MANAGEMENT

36. 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   
Other  (specify) \_\_\_\_\_

37. 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) \_\_\_\_\_

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

Bury  Burn  Wash down streams  Apply to soil   
Store for further use  Other  (specify) \_\_\_\_\_

39a. HOW OFTEN DO YOU CLEAN YOUR CHEMICAL APPLICATOR (*Put X in box that applies*)

Every use  Between different chemical applications   
Once per month  Never

39b. 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) \_\_\_\_\_

40. 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) \_\_\_\_\_



## 11 INFORMATION

### 41. WHERE DO YOU ACQUIRE INFORMATION ON FERTILISERS?

- a. Type \_\_\_\_\_ of  
fertiliser \_\_\_\_\_
- b. Use \_\_\_\_\_ of \_\_\_\_\_ fertiliSer  
\_\_\_\_\_

### 42. WHERE DO YOU ACQUIRE INFORMATION ON:

- a. Type \_\_\_\_\_ of  
pesticide \_\_\_\_\_
- b. Use \_\_\_\_\_ of  
pesticide \_\_\_\_\_

### 43. WHERE DO YOU ACQUIRE INFORMATION ON WEED CONTROL?

- a. \_\_\_\_\_ Type \_\_\_\_\_ of  
pesticide \_\_\_\_\_
- c. Use \_\_\_\_\_ of  
pesticide \_\_\_\_\_

### 44a. HAVE THE INFORMATION POSTERS AND TV/RADIO BROADCASTS PRODUCED BY PCA ON THE USE OF PESTICIDES HELPED YOU?

Yes []      No []

### 44b. IF SO, WHAT ASPECTS IN PARTICULAR HAVE YOU FOLLOWED ON YOUR FARM?

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11.1.1.1

11.1.1.2

11.1.1.3 *Health and safety*

### 45. 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) \_\_\_\_\_

46. HOW LONG AFTER SPRAYING PESTICIDES DO YOU WAIT BEFORE HARVESTING YOUR CROPS (*Put X in boxes that apply*)?

Less than one day  1 day – 1 week  1 week – 2 weeks   
Other  (specify) \_\_\_\_\_

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

Yes  No

48a. HAVE YOU OR ANY OF YOUR FAMILY SUFFERED ANY ILLNESS WHICH YOU THINK AROSE FROM THE USE OF PESTICIDES (*Put X in boxes that apply*)?

Yes  No  Don't know

48b. IF YES, WHAT ARE THE DETAILS (chemical/illness)?

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

48c. IF NO, DO YOU KNOW OF ANYONE WHO HAS?

Yes  No

What are the details  
(Chemical/illness)? \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

#### 11.1.1.4 IMPACTS OF AGRO-CHEMICAL USE / FARMING PRACTICES

50. 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

]



## 12 GENERAL

53. 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 pesticides  | <input type="checkbox"/> | Weeds               | <input type="checkbox"/> | Cost of          | <input type="checkbox"/> |
| Cost of fertilizers | <input type="checkbox"/> | Agrochemical access | <input type="checkbox"/> |                  |                          |
| Other               | <input type="checkbox"/> | (specify) _____     |                          |                  |                          |

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

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**Thank you for your kind assistance**