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ENVIRONMENTAL ASSESSMENT

Environmental Assessment and Analysis of
Pesticide Use in Commercial Farming Systems Project
(AID Project Number 517-0214)

Prepared for: USAID/Dominican Republic

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INTEGRATED PEST MANAGEMENT
AND
ENVIRONMENTAL PROTECTION
PROJECT

Contract No.
DAN-4142-C-00-5122-00
Project No. 936-4142

LIST OF ACRONYMS AND ABREVIATIONS

AID	Agency for International Development
AID/LAC	AID Bureau for Latin America and the Caribbean
EA	Environmental Assessment
EPA	Enviromental Protection Agency
GODR	Government of the Dominican Republic
IEE	Initial Environmental Evaluation
IPM	Integrated Pest Management
LD_{50}	Lethal dose, expressed in miligrams of pesticide per Kilogram of body weight, required to kill 50% of the test population
LOP	Life of project
SOA	Secretariat of Agriculture
SOH	Secretariat of Health
PID	Project Identification Paper
PP	Project Paper
PPM	Parts Per Million
RPAR	Rebuttable Presumption Against Registration
DOSV	Department of Sanidad Vegetal (Plant Protection)
WHO/FAO	World Health Organization/Food and Agricultural Organization
US	United States of America

BACKGROUND AND RATIONALE (From PP 517-0214):

Agriculture employed about 47% of the population of the Dominican Republic in 1981 (Dept. of State 1981) and has historically played a major role in the economy. About 25% of the surface area of 48,464 sq. km. (18,712 sq. mi.) is arable or permanent cropland (Duke et al. 1987). Traditionally, agricultural emphasis has been on the export crops of sugar, coffee, cacao, tobacco, and meats. These crops plus the export of dore (gold/silver mixture), ferronickel, and bauxite accounted for $964.4 million of the 1980 GDP of $6.7 billion (Dept. of State 1981).

Depressed worldwide sugar prices, a generally depressed market for traditional export crops and the 1984 Caribbean Basin Initiative, have resulted in an attempt to diversify into non- traditional crops both for export and to replace imports. These non-traditional export and import substitution crops include winter fruits and vegetables, corn and sorghum, and industrial tomatoes. Many of the products are produced by small or medium- scale farmers who work closely with agribusinesses. Agribusinesses store, package, process, and market the farmers'production and, at times, provide growers with cash and in-kind credit (wideley known as bridge loans), technical advice, and services such as land preparation.

The AID/DR "Commercial Farming Systems Project" Number 517- 0214 is focusing on two of the key constraints to the continued growth of non-traditional crops. These are: 1) Imperfections in the financial markets serving agriculture, including lack of liquidity, lack of access to credit (partly a function of high costs and risks), and inappropriate regulation and policies for the expansion of rural banking; and 2) Insufficient technology development to adapt higher yielding varieties to local conditions and to protect crops against pests. These constraints limit the realization of the sector's foreign exchange earning potential and limit the benefits to producers agribusiness linkages.

Specifically, the project's goal is to contribute to sustained and equitably distributed economic growth in the D.R. by accelerating the movement of the agricultural sector into non-traditional crops, thereby increasing small-scale farmer incomes and rural employment, and foreign exchange.

The project's purpose is to increase production of non-traditional crops through expanded farmer linkages with agribusinesses and by providing credit and improved technology. The purpose will be achieved by:

1. Expanding and stengthening base-level rural financial institutions that can capture savings of farm and non-farm rural clients, on-lend to rural clients, and establish banking relationships with private banks to further increase access to financial services for small rural clients.

2. Expanding linkages beteen small/medium scale producers and agribusinesses by offering additional credit that is tied to increased agribusiness out-grower contracting; and

3. Developing a private sector-led institution to more effectively guide and finance the development, adaptation, and dissemination of agricultural production technology.

This will be achieved through a "Bridge Credit Fund". USAID will make a new loan of US$10 million to the Banco de Reservas ("Depository Bank"). This will increase the liquidity in the banking system that supports commercial farming, meeting a portion of the known credit demand. This fund will be managed cooperatively with the Technical Secretariate of the Presidency (TSP) with funds being disbursed by various participating financial institutions (the "PFIs"). Each of the PFIs, in turn, will make loans available to private Dominican and joint venture agribusiness companies who use small farmer outgrowers to produce non-traditional agricultural, aquacultural or livestock products primarily produced for export or to substitute for imports.

The Agricultural Technology and Support component has the following objectives: 1) in the medium term (up to two years), to improve agricultural production technolgy for producers-exporters of non-traditional crops ("NTCs"); and 2) in the long term (three to four years), to develop a private sector organization that provides direction, training, financial, and technical assistance for certain kinds of agricultural technology development occurring in both the private and public sectors.

This component will be administered through the Agricultural Development Foundation (ADF) which is a non-profit, private sector directed foundation established by Presidential decree in cooperation with the National Council of Businessmen (CNHE). It is currently (since April 17, 1987) eligible to receive financial support for its endowment fund from the GODR, international donors, and the private sector. Interest earnings on the endowment will finance agricultural research and operating expenses. The Foundation will also have the right to publish and the capability to disseminate all research information obtained through its activities.

The ADF will devlop a research program that defines crops and the technical areas of interest that will receive its funding. This program will be executed by financing work under contracts with researchers in the exisiting agricultural research community, which consists of government research centers, university research stations, and agribusinesses. Emphasis will be given to on-farm research involving uses of the technology, i.e., the agribusinesses and their outgrowers. Research proposals will be accepted from unsolicited sources, others will be solicited from qualified sources, and others will be developed in-house by the Foundation staff. In addition, a computer supported technical information center will be formed to make available shelf technology from both national and international sources. A total of almost $3 million dollars is being provided under this phase of the project over the first five years.

Since the "bridge loan" segment will provide loan funds for crop production, pest control will be one of the inputs being financed. Pest control will also be one of the technologies to be investigated in the ADF research program. Pesticides are one of the pest managment strategies

commonly used. To evaluate the potential environmental impact that pesticides used under the Commercial Farming Systems Project may have, an Environmental Assessment (EA) was conducted. What follows is the result of that EA, along with the results and recommendations on related matters requested in the EA team's Scope of Work (PIO/T no. 517- 0000-3-80023 on CICP-AID/DR Contract DAN-4142-C-00-5122-00).

ENVIRONMENTAL ASSESSMENT

To meet its objectives, the Commercial Farming Systems Project will require some pesticides for use in producing the crops financed under the "bridge loan" portion of the project as well as in research plots, farmer demonstrations, and training in the research phase. This project may propose operational pest control programs within which pesticides play a major or minor role. It is AID policy to try and use only pesticides that the US EPA has registered for general use without restriction. In the US, pesticides in the general use category can be purchased and used without special permits. By contrast, "restricted" pesticides present high risks to humans or the environment and can only be used by licensed applicators or persons under their direct supervision.

A. PROJECT LOCATION:

Project Location	:	Dominican Republic
Name of AID Project	:	Commercial Farming Systems Project
Number of AID Project	:	517-0214
Project Implementor	:	USAID/Dominican Republic
Life of Project	:	5 years (FY 1988-93)
Funding	:	$4 million grant, $10 million loan
IEE Prepared by	:	Erhardt Rupprecht, AID/DR
PID Approved by	:	Dwight Steen, Chief Ag. & Rur Dev. Div. USAID/DR

B. ENVIRONMENTAL ASSESSMENT

The IEE (Annex no. 1) made a negative determination on the project indicating that little or no negative environmental effects were expected. This was primarily due to the fact that the Commercial Farming Systems Project proposes to support rural financial service activities which will expand agribusiness/outgrower relationships for the production of non-traditional export and rotation crops. As per Section 216.2(c)(2) categorical exclusions, AID's environmental regulations are generally not required for projects with intermediate credit institutions when AID does not review and approve individual subloans. The experience thus far under the USAID/DR Agribusiness Loan is that agribusinesses exporting to the US are extremely careful to comply with US pesticide use and application requirements because of the potential closure of export markets. In addition, because the project's collateral fund mechanism will involve some of the same institutions involved in the AID/DR Agribusiness Promotion Loan, Banco de Reservas and approved private commercial and development banks, the project will use the same procedure to insure that adverse environmental impacts do not occur. That procedure, which is operating effectively, involves a specific list of subprojects which will not be eligible for financing under the program, unless approved following an environmental review.

With respect to the technology support services and development activites, these would utilize the services of experienced US crop production specialists and technology packages which are acceptable under US environmental regulations. Testing would be under careful supervision. These types of project involving carefully controlled experimentation are also specifically excluded as requiring an Environmental Assessment (217.2(c)(2)(ii). Any project, however, which demonstrates, extends or uses pesticides is not exempt from the requirement.

When it became evident that the borrowers of the bridge loan funds would involve subprojects using pesticides, it was decided to do an EA to identify pesticides and procedures acceptable for use in the bridge loan phase of the project. What follows are the results of this EA.

In the EA, the term "pest" includes any group of organisms- insects, bacteria, viruses, weeds, nematodes, snails, slugs, birds, rodents, or others- that adversely affect the production, preservation, or use of agricultural plants (including seed and planting stock) or harvested products. "Pesticide" is any chemical preparation used to kill, repel, mitigate, destroy, or stop the action of pest populations and includes the following: (1) insecticides (to control insects), (2) acaricides (to control mites), (3) herbicides (to control weeds), (4) fungicides (to control fungi, molds, etc.), (5) nematicides (to control nematodes - small round worms), and (6) rodenticides (to control rodents).

1 EPA Registration Status of the Proposed Pesticides

In the US, pesticides are registered by the Environmental Protection Agency. The EPA registers a pesticide product in one of two categories: "restricted use" or "general use". A restricted use pesticide is available for purchase and use only by pesticide applicators who are certified by law. It potentially presents a very high toxicity and/or environmental hazard. A general use pesticide, by contrast, is available for purchase and use by the general public. It is not AID policy to provide highly toxic pesticides, which are restricted on the basis of human hazard, to small farmers.

Table 1 shows pesticides available and approved for use in the Commercial Farming Systems Project. Table 2 shows pesticides restricted for use in the US and/or the Dominican Republic or those not registered in the US but still available in the Dominican Republic. NONE of the pesticides listed in Table 2 are considered suitable for use in the "bridge loan" component of the Commercial Farming Systems Project.

Table 1. Pesticides Available in the Dominican Republic and Approved for use on the CFS Project. Also Shown are Toxicity Categories of Listed Pesticides.

Common Name and (Brand Name)	Action	Toxicity Category	TOMATO 1	RICE 2	POTATO 3	SWEET POTATO 4	YAMS 5	CABBAGE 6	CASSAVA 7	PIGEON PEAS 8	SNOW PEAS 9	CUCUMBERS 10	RED KIDNEY BEANS 11	CORN 12	SORGHUM 13	ONIONS 14	CARROTS 15	PAPAYA 16	BEANS 17	BEETS 18	MELONS 19	GREEN SQUASH YAUTIA 20	COTTON 21
Acephate (ORTHENE)	Insecticide	III																					
Atrazine	Herbicide	III												X	X				X				X
Bacillus thuringiensis (DIPEL)	Insecticide	III	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Benomyl (BENLATE) 3	Fungicide	III	X	X				X				X					X		X				
Captan (CAPTAN) 2	Fungicide	III		X				X				X							X				
Carbaryl (SEVIN)	Insecticide	III	X	X	X	X	X	X		X	X	X	X	X	X				X	X	X	X	
Carbofuran (FURADAN) 3	Insecticide Acaricide Nematocide	II		X	X							X		X	X		X		X	X	X	X	X
Copper hydroxide (KOCIDE)	Fungicide	III	X		X	X	X	X		X		X				X			X		X	X	
Copper oxychloride (CUPRAVIT)	Fungicide	III	X		X	X	X			X									X		X	X	
2,4-D	Herbicide	III		X																			X
Daconate (MSMA)	Herbicide	III												X	X								
DCMA (BOTRAN)	Fungicide	III	X		X	X	X					X				X	X						X
Diazinon (BASUDIN)	Insecticide	III; II	X		X			X	X	X		X	X	X	X	X	X		X	X	X	X	X
Dicofol (KELTHANE) 4	Acaricide	III; II	X									X											
Dimethoate (ROGAR, CYGON) 5	Insecticide Acaricide	II	X		X			X	X	X				X	X				X	X	X	X	X
Endosulfan (THIODAN)	Insecticide Acaricide	II	X		X	X	X	X				X					X		X		X	X	X
Fluazifop-butyl (FUSILADE)	Herbicide	III																					
Warfarin	Rodenticide	III																					X

1. Aerial Application Prohibited
2. Currently under review by EPA
3. Granular formulations of Carbofuran are not restricted, but all concentrate suspensions and wettable powders 40% and greater are. FURADAN 10% granules are proposed here.
4. KELTHANE has recently been the subject of EPA cancellation actions. Prior to actual use by the project, the current status of this pesticide should be established.
5. Use approved subject to adherance to U.S. labelling provisions.

Table 1. Pesticides Available in the Dominican Republic and Approved for use on the CFS Project. Also Shown are Toxicity Categories of Listed Pesticides. (Continued)

Common Name and (Brand Name)	Action	Toxicity Category	TOMATO 1	RICE 2	POTATO 3	SWEET POTATO 4	YAMS 5	CABBAGE 6	CASSAVA 7	PIGEON PEAS 8	SNOW PEAS 9	CUCUMBERS 10	KIDNEY BEANS 11	CORN 12	SORGHUM 13	ONIONS 14	CARROTS 15	PAPAYA 16	BEANS 17	BEETS 18	MELONS 19	GREEN SQUASH 20	YAUTIA 21	COTTON
Glyphosate (ROUNDUP)	Herbicide	II		X	X			X		X	X		X	X	X	X	X	X	X	X				X
Linuron (AFALON)[1]	Herbicide	III			X									X	X		X							X
Malathion (MALATHION)	Insecticide	III	X	X	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Maneb (MANZATE)	Fungicide	III	X		X							X				X	X	X			X	X	X	X
MCPB (TOPOTOX, THISTROL)[2]	Herbicide	III									X													
Metalaxyl (RIDOMIL)	Fungicide	II	X		X							X	X			X					X	X	X	X
Oxifluorfen (GOAL)	Herbicide	II												X		X								X
Pendimethalin (HERBODOX, PROWL)	Herbicide	II		X	X									X	X				X					X
Phosalone (ZOLONE)	Acaricide Insecticide	II			X																			
Propanil (RISELECT, STAM)	Herbicide	II		X																				
Triadimefon (BAYLETON)	Fungicide	II										X									X	X		
Trichlorfon (DIPTEREX, DANEX)	Insecticide	II	X					X						X						X				X

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3. Granular formulations of Carbofuran are not restricted, but all concentrate suspensions and wettable powders 40% and greater are. FURADAN 10% granules are proposed here.
4. KELTHANE has recently been the subject of EPA cancellation actions. Prior to actual use by the project, the current status of this pesticide should be established.
5. Use approved subject to adherance to U.S. labelling provisions.

Table 2. Restricted and/or U.S. Prohibited Pesticides Currently Used in the Dominican Republic

Aldicarb (TEMIK) ; Insecticide, Nematocide
Carbicron (dicrotophos) ; Insecticide
Carbofuron (Furodon) - All liquid formulations are restricted in the U.S.
Dibromochloropropane (DBCP) ; Soil Fumigant 1/
Dicrotophos (BIDRIN, CARBICRON) ; Insecticide
Dinocap (KARATHANE) ; Fungicide, Acricide 1/
Disulfoton (SOLVIREX) ; Insecticide, Acaricide
Ethoprop (MOCAP) ; Nematocide
Fenamiphos (NEMACUR) ; Nematocide
Methamidophos (TAMARON) ; Insecticide, Acaricide
Methidathion (SUPRACIDE) ; Insecticide
Methomyl (LANNATE) ; Insecticide
Methyl Parathion (Folidol) ; Insecticide
Mevinphos (PHOSDRIN) ; Insecticide
Monocrotophos (AZODRIN) ; Insecticide
Oxamyl (VYDATE) ; Insecticide, Nematocide
Paraquat (GRAMOXONE) ; Herbicide
Phoxim (VOLATON) ; 1/
Prophenofos (TAMBO, SELECRON) ; Insecticide, Acaricide
Vamidothion (KILVEL) ; 1/

1/This product is not permitted for use in U.S.

The SOA/DOSV plant protection group is aware of dimethoate and paraquat hazards. The Commerical Farming Systems Project does not plan to distribute these to farmers.

Metaldehyde can be used with the restriction that the label must bear the words "this pesticide may be fatal to children and dogs or other pets if eaten. Keep children and pets out of treated area". For all cases, protective clothing will be worn.

Paraquat presently is used widely in the DR, and there is no known substitute per se. A partially effective alternative is the herbicide glyphosate (ROUNDUP). Use of glyphosate would greatly reduce the hazards (see Table 3 for comparison in toxicity of paraquat and glyphosate). Research in Cook Island (South Pacific) and other areas has shown that, when mixed with the common fertilizer urea, glyphosate is effective at reduced rates and therfore less costly. This AID Project affords an opportunity to test this approach in the DR and to seek other cost-effective alternatives, both chemical and nonchemical, to paraquat and other pesticides that present high risks. A new, relatively non-toxic herbicide named Basta^{R} will also be evaluated as an alternative to paraquat.

This project will sponsor an effective training component on pesticide safety and will demonstrate appropriate protective equipment and clothing to project staff. In addition, the project will provide considerable technical assistance in pesticide management to seek safe, cost effective pesticide application techniques.

Not all the pesticides in Annex 2 have been registered by EPA for use in the US (noted as "not registered") . However, the FAO and WHO of the United Nations have recommended maximum residue levels (MRLs) for some of these materials. An MRL is the amount (expressed in parts per million) of pesticide that may legally and safely remain in or on any raw farm products at the time these products are sold for consumption by humans or livestock. Another aspect of this project will be to provide assistance in seeking pesticides for use on export crops that meet EPA criteria.

One of the pesticides in Table 1 was issued (or has ingredients that have been issued) a so-called "Rebuttable Presumption Against Registration" (RPAR) by EPA:

*captan (CAPTAN).

The RPAR process is now designed as special "Special Review" to gather information and stimulate public debate about a pesticide being scrutinized because of adverse effects on human health or the environment. If at the end of this process the risks are found to outweigh the benefits, the pesticide may be cancelled (banned) or greatly restricted in the US. Section 5 discusses why a Special Review has been issued for captan (CAPTAN).

2. The Basis for Selection of the Proposed Pesticides

After discussions with USAID/DR David Gardella and Delbert McClusky, Hector Radhames Gonzalez De Leon, Ruben Marten (Agro-medicine), and Victor Baez, Meir Shori, Francisco Ortiz, and Santiago Echavarria (Agro-business Farmer Associations), and Victor J. Torres, Rafael Pena, and Leonardo Marten (Agrochemical Dealers), the lists in Table 1 and Annex 2 were complied. The pesticides are presently registered for use in the Dominican Republic, are locally available, and are presumed to be effective. As indicated in the PP, there is a lack of research data for all crops (except for rice) in the country and, therefore, no published data are available to judge effectiveness.

A list of pesticides currently available for purchase in the DR which are considered to be too toxic for use in the "bridge loan" phase of this project or which have been cancelled/suspended by EPA is in Table 2.

3. Extent to which the Proposed Pesticide Use is Part of Integrated Pest Management Programs

Reliance on pesticides alone is expensive and rarely gives lasting control. Pests often become physiologically or behaviorally resistant to pesticides used extensively. Such resistant pest strains offer serious consequences to both farmers and the general public. Resistance is most likely to occur in the areas where sole reliance is placed on pesticides and the use is heavy. Control failures and suspected resistance problems have been suspected for several insects, especially the white fly in the Constanza area of the DR.

Experience worldwide has shown that the best way to avoid pest resistance and also to increase and sustain agricultural production is to employ a variety of control tactics, including biological (predator, parasite, and pathogenic natural enemies of pests), genetic, physical, and legislative. This multi- tactic, balanced approach is termed integrated pest management (IPM).

Under IPM, crops are regularly monitored (called "scouting") for presence of pests, natural enemies, and other factors which may influence a decision concerning a control measure. Pesticides are applied only when pest populations have exceeded unacceptable density levels and there is reasonable assurance that pesticide use will be profitable and non-disturbing to the environment.

The IPM concept is currently playing a role in Dominican agriculture. Multi-latice approaches can now be found: for example, the cabbage production packages being used by agribusiness in the areas near La Romana and Azua which include the use of Bacillus thuringiensis product for "worm" control. However, much improvement can be made in monitoring programs and use of economic injury levels and thresholds. This AID project may support some research, training, and technical assistance to advance IPM concepts and techniques in the Dominican Republic. However, development and implementation of IPM will be a long term undertaking. During the 5 year

duration of this project, one should seek as a first step movement toward IPM where pesticides are truly only used on an "as needed" basis.

It is AID policy to stress IPM and make every effort to minimize the use of pesticides. Past experience in AID projects show that this can only be accomplished by budgetary "set-asides" so that within the term of the project there is assurance that needed testing and technical assistance will be accomplished. Short term technical assistance from plant protection specialists in the US in a collaborative effort with local plant protection scientists is considered to be a key part of this process. Only in this way can there be assurance of completion of successful field trials and studies in the short term and a trained, experienced team to continue IPM research after the project is terminated.

These pest management activities should focus, at a minimum, on the following:

a) identification of the nature and magnitude of existing pest management problems;

b) assistance in the design and identification of a testing/ evaluation program on appropriate pesticide use and efficiency;

c) design of a system of pesticide field trials and evaluation which will include some form of crop insurance for particpating farmers;

d) identification, training, and use of appropriate personnel to monitor and evaluate field testing programs;

e) training in the safe use, handling, application, and storage of pesticides; and

f) sensitization of farmers as to advantges of an integrated pest management program and demonstrations of IPM components developed from the field testing programs.

These field testing programs should include one or more, as appropriate, studies related to:

a) use of parasites, predators, and biorational pesticides as alternate pest control agents;

b) investigation related to crop loss assessment and establishment of "protocol" treatment threshold recommendations;

c) use of crop varieties which show acceptable levels of resistance to local pests;

d) maximized use of mechanical cultural control based on availability of labor inputs; and/or

e) evaluation of the status of pesticide resistance and alternative control measures.

A minimal budget addressing the above pest management needs is presented below. This budget should be clearly segregated in the overall project paper budget and monies set aside to guarantee its timely implementation.

PROPOSED IPM PROJECT BUDGET

Technical Assistance (from the US)	
3 person months/year over a 5 year period	
$250.00 per day	$112,500
Travel/per diem for above	65,000
Technical Assistance (Dominican Republic)	
To conduct field plot studies	
6 person months/yr for 5 yrs	
@ $12,500/yr	62,500
To conduct training activities	
3 person months/yr for 5 yrs	
@ $12,500/yr	31,500
In Country Travel	10,000
Research Technicians (Dominican Republic)	
2 person/yr for 5 yrs @ $8,000/yr	80,000
Training Technician (Dominican Republic)	
1 person/yr for 5 yrs @ $8,000/yr	40,000
Vehicles (2) one each for research & training	26,000
Transportation Expenses @ $1,000/yr	
Research	5,000
Training	5,000
General Supplies @$5,500 1st yr & $2,500/yr	
Research	15,500
Training	15,500
Computer Hardware and Software	
(inc. backup power supply, etc.)	5,000
Pesticide Application Equipment @ 1,500/yr	7,500
Meteorological Monitoring Equipment	10,000
Test Plot Rental @ 1,500/yr	7,500
Maintainence and Operation	
(of equipment and vehicles) $2,000/yr	10,000
Laboratory Anslyses (pesticide residues and	
other studies) $5,000/yr	25,000
Audiovisual equipment	
(camera, projectors, video, etc)	5,000
Subtotal	$538,500
Institutional overhead	
(est. 30% of US salaries)	33,750
Total	$572,250

4. The Proposed Methods of Application, including Availability of Appropriate Application and Safety Equipment.

If pesticides are used, the project would utilize both gasoline-powered and hydraulic backpack sprayers. Foliar applications would be made primarily with these sprayers. In some cases, however, mist blowers and tractor-mounted, low-volume sprayers would be used. Granular pesticides would be incorporated in the soil and rat baits would be selectively placed in known rat habitats.

The "bridge loan" phase of the project will include funds in the loan for the purchase and use of all appropriate protective devices and clothing if pesticides are included in the loan. Rubber boots and coveralls or long-sleeved shirts and full-length pants were observed by this EA team as being available in the market-place. However, approved face masks and rubber gloves were not found but were reported to be available at some establishments in some areas. If not currently available, these items may need some special consideration.

The research project will provide and enforce the use of all appropriate protective devices and clothing - face masks, gloves, boots, and coveralls - for project personnel who apply pesticides. Agreement must be reached with all project contractees or grantees that the highest safety standards are upheld, and costs for protective devices and clothing must be a part of contract/grant budgets let by this project if pesticide use is proposed. It is the Project Manager's responsibility to see that pesticides are transported, stored, mixed, applied, and disposed of properly as specified on the pesticide's label. Labels should be in Spanish, registered by the Secretariat of Agriculture and should include the names of pests for which the use is intended.

Based on appropriate label statements on the pesticide pack, the project manager will require loan recipients to follow all recommendations, rates and frequency of application, time of application, and the number of days before harvest the pesticide may be applied. Failure to meet label standards will be grounds for the project manager's cancellation of specific grants, contracts or loans let by this project. Partial enforcement of these requirements in the "bridge loans" will be accomplished through periodic, random sampling of harvested crops and conducting residue analyses for the most likely pesticides to have been used. This is described in detail in Sections 11 and 12.

Pesticides should be stored in their original containers in a location specifically designated for that purpose. The facility should be locked with keys assigned only to authorized personnel. A sign in Spanish reading "DANGER: PESTICIDE STORAGE AREA" should be posted. Pesticides should never be stored near food, animal feed, animals or drinking water. The storage place should be in an area protected from tropical storms and fire hazards.

Empty containers should never be reused - there is no practical method for removing all of the toxic residues

Liquid containers should be treated as follows: empty the container's content into the spray tank, drain in a verticle position for 30 seconds. Refill the container 1/4 full, rinse and pour into the tank, drain. Repeat rinsing and draining three times. Use the rinse water in the sprayer. Punch several large holes in the container's bottom. Bury the container in a designated land disposal site on high ground away from water. Empty containers should be buried in pits in the soil about 1/2 meter deep away from shallow ground.

5. Acute and Long Term Chronic Hazards, either Human or Environmental, Associated with the use of Pesticides and Measures Available to Mitigate the Hazards

All pesticides are potentially hazardous to humans and the environment and should be treated with caution regardless of their relative toxicity. The potential health hazard depends on the toxicity and the amounts swallowed, absorbed or inhaled. The relative toxicity of a pesticide can be found by examing its LD50 value which is the amount of the chemical necessary to kill 50% of the test animal population (usually laboratory rats). It is expressed in the weight of pesticide per unit weight of body (mg/kg) when swallowed (oral toxicity), absorbed through the skin (dermal toxicity) or inhaled. The latter value, inhalation toxicity, is usually expressed in parts per million per unit volume of air.

Pesticides with the lowest LD50 value are potentially the most toxic to humans. Ingestion of just a few drops to a teaspoon of a pesticide with an oral LD50 value of less than 50 might be sufficient to kill an adult person. An adult would probably have to consume 16 tablespoons to 1/2 kilogram or more of a pesticide with an oral LD50 of 5,000 before dying. However, the pesticide's formulation, percentage active ingredient, and other factors determine its actual hazard level. Rodenticides (rat poisons), for example, have low oral toxicity values but would be considered only moderately hazardous to humans because their pellet formulations contain only about 2% active ingredients.

Acute oral and dermal LD50 values of the pesticides used in the Dominican Republic are shown in Table 3. Acute toxicity results from a severe case of poisoning due to a single dose of exposure to the pesticide.

Table 3 shows EPA's "signal word" for pesticides currently used in the Dominican Republic. These words have been assigned by levels of toxicity and appear on the labels of EPA registered pesticides. Table 4 gives criteria for signal word designation. Pesticides assigned the signal word "DANGER" are highly toxic compounds and are not recommended by EPA for general use. Materials showing the words "WARNING" or "POISON" also present a high potential hazard to the user. Some of these possible effects on humans are discussed below.

Possible Human Effects

Organophosphates and carbamates (see Table 5) are chloinesterase inhibitors causing symptomology of varying severity from illness to death by paralysis depending on the dose (concentration) exposure. The LD_{50} is an indicator of human sensitivity (extrapolated from animal studies) to a particular pesticide. The mixer/loader/applicator group has the greatest risk of exposure and therefore has the greatest risk of intoxication. Treatment is possible with atropine and 2-PAM, and the effect is reversible if treated in time. No known long term effects are noted with the organophosphates available in the DR, with the exception of: chlorpyrifos and dichlorvos which are lipophilic and can be stored 1) in body fat and; 2) mephosfolan which was shown to cause demyelinization, (removal of mylial nerve sheath) and permanent paralysis in chickens. Leptophos is registered for use, although none was observed to be available. Leptophos is more lipophilic than DDT and is known to cause delayed neurotoxic effects and demyelinization. It should be deregistered as soon as possible.

Carbamate exposure can be treated with atropine (2-PAM is contraindicated). Bisdithiocarbamate metabolites include ethlylene dithio-urea (EDTU) which is a carcinogen. There is very little evidence of EDTU being found under actual field conditions. The entire group of elbylene bio dethcocosbomates are now under special review in the US, but their use, according to label instructions, is still permitted.

Table 3. Toxicity of Pesticides Available in the Dominican Republic.

Common Name and (Brand Name)	Acute LD_{50} Oral	Acute LD_{50} Dermal	EPA Signal Word 1/
Benomyl (BENLATE)	>10,000	>10,000	CAUTION
Bti (DIPEL)	-	-	CAUTION
Captan (CAPTAN)	9,000	-	CAUTION
Carbaryl (SEVIN)	850	-	CAUTION
Captafol (DIFOLATAN)	5,000-6,200	-	WARNING
Carbofuran (FURADAN)	11	10,200	WARNING/DANGER 2/
Copper hydroxide (KOCIDE)	1,000	-	CAUTION
Copper oxychloride (CUPRAVIT)	1,000	-	-
Coumatetralyl (RACUMIN)	-	-	-
Daconate (DCPA)	10,000	>10,000	CAUTION
Deltamethrin (DECIS)	128>5,000	>2,000	-
Demeton Methyl (METASYSTOX)	170-300	260-410	WARNING
Diazinon (BASUDIN)	300-400	3,600	CAUTION
Dibromochloropropane (NE GON)	170-300	260-410	WARNING 3/
Dicofol (KELTHANE)	684-809	2,100	CAUTION 3/
Dimethoate (ROGOR)	215	>1,000	WARNING
Fenthion (FENTHION)	255-298	1,680-2,830	-
Fluazifop-butyl (FUSILAD	1,490-3,328	>2,420	CAUTION/WARNING
Glyphosate (ROUNDUP)	4,300-4,900	-	CAUTION
Malathion (MALATHION)	1,000-1,375	4,100	CAUTION
Maneb (MANZATE)	7,990	-	CAUTION
Metalaxyl (RIDOMIL)	669	>3,100	WARNING
Methomyl (LANNATE)	17-24	5,880	DANGER
Mevinphos (PHOSDRIN)	4.15	57	DANGER
Monocrotophos (AZODRIN)	8-23	354	DANGER
Oxamyl (VYDATE)	37	2,960	DANGER
Metaldehyde (METALDEHYDE)	250-1,000	630	CAUTION/WARNING
Paraquat (GRAMOXONE)	150	-	DANGER
Propineb (ANTRACOL)	5,000	>5,000	-
Spreader-Streker (TRITON)	-	-	WARNING/CAUTION
Thiram (THIRAM)	780	-	CAUTION
Trichlorfon (DIPTEREX)	150-400	>500	WARNING
Warfarin (WARFARIN)	3	-	WARNING/CAUTION
Zineb (ZINEB)	5,200	>2,500	-

1/ See TABLE 3 for explanation. More than one signal word indicates a difference in formulation (dry vs. liquid) or percentage active ingredient.

2/ WARNING = granules
DANGER = liquid (liquid formulations cannot be used in the project)

3/ All uses cancelled by EPA

TABLE 4.

Toxicity Categories of Proposed Pesticides by Hazard Indicator.

Hazard Indicators	I1/	II	III	IV
Oral LD_{50}	50 mg/kg or less	50-500 mg/kg	500-5,000 mg/kg	> 5,000 mg/kg
Inhalation LD_{50}	.2 mg/liter or less	.2-2 mg/liter	2.0-20 mg/liter	> 20 mg/liter
Dermal LD_{50}	200 mg/kg or less	200-2,000 mg/kg	2,000-20,000 mg/kg	> 20,000 mg/kg
Eye Effects	Corrosive; corneal opacity not reversible within 7 days	Corneal opacity reversible within 7 days; irritation persisting for 7 days	No corneal opacity; irritation reversible within 7 days	No irritation
Skin Effects	Corrosive	Severe irritation at 72 hours	Moderate irritation at 72 hours	Mild or slight irritation at 72 hours
EPA Signal Word	"DANGER"	"WARNING"	"CAUTION"	"CAUTION"

1/ The word "POISON" and also a picture of skull and crossbones appear on the labels of EPA registered in Category I.

Table 5.

Pesticides Used in the Dominican Republic
According to Categories

ORGANOPHOSPHATES

Acephate, Chlorpyrifos, Dichlorvos, Dicrotophos, Disulfoton, Diazinon, Ethoprop, Dimethoate, Fenamiphos, Fenitrothion, Fenthion, Glyphosate, Malathion, Mephosfolan, Methamidophos, Methidathion, Methyl Parathion, Monocrotophos, Phosalone, Profenofos, Triazophos, and Vamidothion.

CARBAMATES

Aldicarb, Carbaryl, Carbofuran, Carbendazim, Methomyl, Oxamyl, Benomyl

BISDITHIOCARBAMATES

Maneb, Propineb and Zineb

ORGANOCHLORINES

Captofol, Captan, Endosulfan, Dicofol, Oxyfluorfen, Propanil

TRIAZINES

Atrazine, Metribuzin

PYRETHROIDS

Cyfluthrin, Cypermethrin, Deltamethrin, Permethrin

MISCELLANEOUS

DCNA, Fentin Acetate, Linuron, Oxadiazon, Paraquat, Pendametholin, Phoxim, Trichlorfon

CHLOROPHENOXY ACIDS

2,4-D, MCPB

If labeling instructions are followed for the use of these types of pesticides (those approved in Table 1 only), there should not be any long term effects associated with organophosphate or cabamate residues on food excluding the noted exception. Organochlorinated pesticides are lipophilic and are stored in body fat. Since they are carcinogens, exposure should be minimized. Studies should be conducted to determine the half-life of available pesticides as used on selected crops. Diofol contains DDE, DDD and DDT as impurities. Use of this product will lead to residues of DDT and metabolites.

Pyrethroids have low mammalian toxicity and do not pose an acute poisoning threat to applicators. Residues may build up in human tissue, but little is known of long term effects. Pyrethroids are primary irritants and can cause dermal problems for applicators. Pyrethroids should not be used around aquatic sites.

The proposed pesticides (see Table 1) are generally non-persistant and, if used in accordance with their labels, should present no unusal hazards to the natural environment (see Section 7). The project will share with the Plant Protection and Agromedical Personnel (DOSV) information concerning toxicity of pesticides and procedures for mitigating hazards. Some of the possible environmental hazards ar discussed below.

Possible Environmental Effects

Organophosphates and carbamates are less persistent than the organochlorines and therefore pose less of a danger to the environment than the more persistent organochlorines. The triazines and miscellaneous pesticides generally are the most water soluble. Usually, the higher the water solubility, the lower the soil sorption. The higher the water solubility, the greater the threat to water systems, including the possibility of contaminating groundwater. As the soil sorption coefficient increases, the stronger the chemical is held in the soil, which lessens the chance of contaminating water systems. Table 6 is a list of water solubilities and sorption coefficients.

If labeling instructions are followed for the use of these types of pesticides, there should not be any long term effects associated with organophosphate or cabamate residues on food excluding the noted exception. Organoclorinated pesticides are lipophilic and are stored in body far. Since they are carcinogens, exposure should be minimized. Studies should be conducted to determine the half-life of available pesticides as used on selected crops. Diofol contain DDE, DDD, and DDT as impurties. Use of this product will lead to residues of DDT and metabolites.

Use of the esters of chlorophenoxy acids instead of the salts is more dangerous because of respiratory exposure even though the oral LD50 of both are approximately the same. The salts are systemic, therefore, there is a chance of residues within the food crop. Chlorophenoxy acids and organochlorines are central nervous system stimulators.

Pyrthroids have low mammalian toxicity and do not pose an acute poisoning threat to applicators. Residues may build up in human tissue, but little is known of long term effects. Pyrethroids are primary irritants and can cause dermal problems for applicators.

The proposed pesticides are generally non-persistant and, if used in accordance with their labels, should present no unusal hazards to the natural environment (see Section 7). The project will share with the Plant Protection and Agromedical Personnel (DOSV) information concerning toxicity of pesticides and procedures for mitigating hazards. Some of the possible environmental hazards ar discussed below.

Possible Environmental Effects

Organophosphates and carbamates are less persistant than the organochlorines and therefore pose less of a danger to the environment than the more persistent organochlorines. The triazines and miscellaneous pesticides generally are the most water soluble. Usually, the higher the water solubility, the lower the soil sorption. The higher the water solubility, the greater the threat to water systems. As the soil sorption coefficient increases, the stronger the chemical is held in the soil, which lessens the chance of contaminating water systems. Table 6 is a list of water solubilities and sorption coefficients.

Table 6. Water Solubility and Sorption Coefficient of Pesticides (References 1 and 3).

Pesticide Common Name	Trade Name(s)*	Water Solubility ppm @ °C		Sorption Coefficient K_{oc}**
Oxamyl	Vydate, Vydate L, HA-2214	280,000	@ 25	6
Aldicarb	Temik, Temik 15G, OMS771	9,000	@ 30	10
Dicamba	Banvel D, Banex, Dianat, Weedmaster	4,500	@ 25	11
Picloram	Tordon, Amdon, Grazon	420	@ 25	26
Carbofuran	Furadan, Yaltox, Curaterr	700	@ 25	29
2,4,D	Agrotect, Amidox, Weed-B-Gone, Weedtrol	900	@ 25	32
Terbacil	Sinbar	710	@ 25	46
Fonofos	Dyfonate, N-2790	13	@ 21	68
Bromocil	Hyvar XL, Borocil, Ureabor	815	@ 25	72
Simazine	Aquazine, Princep, Simadex Sim-Trol	3.5	@ 20	158
Atrazine	AAtrex, Griffex, Atranex, Vectal SC	33	@ 25	163
Carbaryl	Sevin, Denapon, Tercyl, Septene	40	@ 25	229
Diuron	Karmex, Urox D, Direx 4L, Diurol	42	@ 25	389
Lindane	Gamma BHC, Isotox, Lintox, Silvanol	7.3	@ 25	1,081
Malathion	Mercaptothion, Calmathion, Carbofos, Cythion	145	@ 25	1,778
Glyphosate***	Roundup	12,000	@ 26	2,640
Methyl Parathion	Metafos, Parathion-Methyl, Devithion, Nitrox 80	55-60	@ 25	7,079
Parathion	Thiophos, Bladan, Orthophos, Panthion	24	@ 25	7,079
Paraquat***	Ortho paraquat CL, Dexuron,	1,000,000	@ 25	15,423
DDT	Tech DDT, Zerdane, Anofex, Gentox	<0.01	@ 25	243,000

* Trade names given for convenience and does not represent endorsement by

** The larger the K_{oc}, the more strongly the pesticide is held in the soil organic matter and the less likely it will leach through soil.

*** Note: These pesticides are ionic and are exception to the inverse solubility to K_{oc} relationship.

One of the other possible non-target effects is the hazard of pesticides to honeybees. The relative danger of selected pesticides is as follows:

HIGHLY TOXIC - CARBARYL, CARBOFURAN, CHLORPYRIFOS, DIAZINON, DIMETHOATE, MALATHION, METHUDATHION, PERMETHRIN
MODERATELY TOXIC - DISULFOTON, METHOMYL
RELATIVELY NON-TOXIC - TRICHLORFON

Beef cattle are raised mainly in the La Romana area where pesticide use is not concentrated. Cotton is grown in this area. If chlorinated pesticides are used on cotton, and cattle are allowed to feed on cotton stalks and on the cotton seed cake left after cottonseed oil extraction, beef cattle will bioaccumulate the organochlorines in their fat. This can lead to residue levels which exceed the tolerances of importing countries and impose an economic burden on the Dominican Republic as well as a health hazard.

Animal feed development is being considered at the Instituto Dominicana de Tecnologia Industrial (INDOTEC) using otherwise discarded material such as cacao shells. Pesticide residue levels should be determined to prevent animal contamination. In Hawaii, an animal feed was developed from pineapple stock without consideration of residues of heptachlor which is used on pineapple. This led to contamination of milk (heptachlor epoxide) from cows fed this material.

As noted in section 1, EPA is making a Special Review of several of the proposed pesticides. Captan has been accused of causing tumors and toxic effects on the liver and kidney. The RPAR process is a continuing activity, and the EPA will not take final action on this pesticide until the process is completed. Ultimately, the only valid source for information concerning legal use of EPA registered pesticides is the pesticide labels. The label should always be followed carefully, as this best assures minimum hazard to users.

In those cases where pesticides will be used on crops for which no U.S. or international tolerances have been established, residue sampling will be undertaken according to established FAO/WHO Codex procedures and arrangements for analysis and submission of data to the FAO Joint Meeting on Pesticide will be made. ST/AGR/AP can provide assistance with sampling protocals, needed steps to obtain FAO/WHO review, and arrange for needed collaboration with pesticide manufacturers. Ultimately, this process should lead to the establishment of Dominican tolerances. Such procedures will be imperative for export crops destined for foreign markets. A regional IR-4 project should also be considered in satisfying these needs. Assistance in collaborating in such a program can be obtained by contacting the Caribbean Aera Environmental Advisor at RDO/C. Currently, the contact point is Andre de Georges.

6. The Effectiveness of the Requested Pesticides for the Proposed Uses

The pesticides listed earlier have been evaluated under a variety of conditions including those of the Caribbean region and found to be effective for some of the pests attacking the crops indicated. However, as previously indicated, little published data are available on the efficacy of these products in the Dominican Republic. No pesticides are registered in the U.S. for use on some of the "Chinese Vegetables" being proposed for production as export crops. Therefore, one of the objectives of the research phase of this and/or the IPM Project (see Section 3) should be to collect the efficacy, residue, dissipation, and cost/benefit data on products needed to control those pests on those crops where registered, non-restricted pesticides are not available. Where residue data are needed, consideration should be given to the use of a Regional IR-4 Project specifically designed for such studies.

7. Effect of the Proposed Pesticides on the Target and Non-Target Ecosystems

The pesticides are generally non-persistent and, if used correctly and according to their labels, should present no unusual hazards to the target or natural ecosystem. Applying higher dosages, shrinking intervals between applications, spraying during windy conditions, storing or disposing carelessly or rinsing equipment and/or containers in rivers would have harmful effects.

Most suggested insecticides are toxic to some natural enemies and bees, especially if applied at high rates. Thus, natural enemies and bees residing in treated fields and experimental, demonstration or control plots would likely decrease. Further, the threat of buildup of genetically resistant strains of insect pests, plant diseases, weeds, nematodes, and rats always exists.

Some of these possible effects were discussed in more detail in previous sections. A list of the endangered species known in the DR in 1980 is included in Annex 2. AID/DR is currently in the process of implementing a project to update these lists. The EA team suggested that accurate distribution data be included in the studies to facilitate the protection and conservation of any threatened or endangered species occurring in the project area, should this be necessary.

Some of these problems are unavoidable when pesticides are used. Minimal adverse effects result only when pesticides are used in combination with other control tactics in an IPM program and when users are educated to the hazards and proper use of the materials. In cases where pest control is necessary, the project will emphasize IPM and pesticide management and, through special training on these subjects, foster a more rational use of the materials.

8. Conditions under which the Pesticides are to be used including climate, flora, fauna, geogropahy, hydrology, and soil

The Dominican Republic occupies the eastern two - thirds of the island of Hispaniola in the Caribbean Sea between Puerto Rico and Cuba; Haiti occupies the other third. It has a total area of 4,873,000 hectares (ha), which is about the size of Vermont and New Hampshire combined. The estimated population of the Dominican Republic is approximately 6 million people. With Cuba, Jamaica, and Puerto Rico, Hispaniola forms a group of islands known as the Greater Antilles.

The country has a maritime tropical climate. Temperatures, which vary little, average between 72° F and 83° F, rarely falling below 60° F or rising above 90° F in the lower elevations. The weather is somewhat cooler in higher elevations. Annual rainfall ranges between 20-95 inches, with the rainy season lasting from May through November in the south and December through April in the north.

Much of the Dominican Republic is mountainous, with the highest point being Pico Duarte (10,206 ft). In the upper central part of the country between the Central and the Septentrional Mountains is the Cibao, the large and fertile valley, often called the Dominican Republic's "bread basket".

Of its total area of 4,873,000 total hectares, the Dominican Republic has 1,230,000 ha of arable or permanent cropland, 1,490,000 ha in permanent pasture, 1,104,000 ha in forest and woodlands, and 1,014,000 ha in other catagories. Nearly 60 % of its economically active population is engaged in agriculture.

Export crops include sugarcane, coffee, and cacao, with recent exports of selected vegetables and fruits; white rice, beans, plantains, and yucca are national staples. The bulk of basic food staples are produced on small or medium farms; nearly 70% of the farms are less than 5 ha, occupying less than 14% of the total farmland. Only 3.4% of the farms exceed 50 ha, but these farms occupy more than half the total farmland.

Of the 37 major soil mapping units identified, 24 soil types covering about 21,000 sq km have moderate to high agricultural potential. Yet 27,000 sq km are already in farms; only in the arid northwest, southwest, and south are there substantial areas of potential agricultural lands, but they require irrigation.

Soil erosion is the most serious problem affecting the natural resource base in the Dominican Republic. Salinity problems exist primarily in the dry southwest and northwest, where appreciable areas of irrigated land have been lost to crop production. Rampant habitat destruction and the deliberate introduction of exotic animal species as the mongoose have depleted most native wildlife populations. Threatened or endangered fauna include 6 turtle species, at least 11 reptiles, 44 bird species, and 9 mammal species. Little is known of endangered fauna, while marine fauna has been completely ignored (see annex 3).

Abundant anecdotal information suggests that increasing abuse of pesticides is causing chronic or acute poisoning, contaminating agricultural products, and stimulating resistant pests. The general problem in pesticide use is thought to be inadequate training. Only 30% of the pesticides are applied by trained personnel.

9. Availability and Effectiveness of other Pesticides or Nonchemical Control Methods

Pesticides proposed for use in this project, as well as others, are available through commercial outlets in the Dominican Republic.

Crop rotation, use of clean (pest free) planting material, destruction of diseased crop plants, crop residue destruction, biological control, and a host of other cultural practices reduce pest severity. This project will develop and encourage use of these kinds of nonchemical control methods in its programs.

For example, if a cabbage project is funded, presence of the diamond-back moth, Plutella xylostella (L) will most likely be a problem. Successes of the Commonwealth Institute of Biological Control (CIBC, Trinidad) with releasing the parasite, Apanteles plutella, against diamond-back moth should be noted. This project should establish a strong relationship with CIBC and attempt to exploit biological control successes. The successful use of Bacillus thuringiensis in the cabbage production area near LaRomana in the DR has previously been cited. This product was also a major component in one case in the Azua area.

Further, demonstration and experimental plots under this project and the proposed IPM Project should be comprised of a variety of alternative, legitimate control tactics aimed at evaluation of cost/benefit of what will emerge as "options" for ultimate farmer user groups. This is a prime methodology for educating farmers to concepts of multiple and alternative tactics.

10. Dominican Republic's Ability to Regulate or Control the Distribution, Storage, Use, and Disposal of Pesticides

The inappropriate use of pesticides is a classic example of the existence of external costs (externalities in economic jargon). External costs are the detrimental effects arising from pest control action, which affect parties other than the pest control decision-maker, but for which no compensation is paid. Pesticide external costs may be monetary or can be expressed in terms of reduced human health, adverse effects on animals, loss of yield potential, or negative environmental spillovers. Since these costs do not directly affect the pesticide user, they go unnoticed and do not enter the pesticide use decision making process, leading to potential overuse. Three comon approaches are used to reduce these losses. They are:

1. Education - training farmers, manufacturers, business persons, and health personnel of the consequences of their actions.

2. Market intervention - increasing pesticide prices through taxes or other forms of governmental action to force the recognition of the external cost by the user and potentially provide a method of compensation to the bearers of the external costs.

3. Governmental regulation - prohibition or control of pesticide use and manufacturing through the legal system.

Since the second approach requires valid estimates of the external costs, which are often difficult to obtain, education and/or regulation are commonly implemented by governments to reduce external costs.

The Dominican Republic is no exception. The Government of the Dominican Republic (GODR) has recognized the existence of pesticide externalities through the establishment of pesticide control regulation and through its desire for increased training for pesticide users. The Dominican Pesticide Control Act of 1968 (Law No. 311), and its amendments, provide for the control of the manufacturing, reformulation, storage, importation, sale, and use of pesticides in the Dominican Republic. Responsibility for its enforcement resides with the Secretary of Agriculture through its Department of Plant Protection (DOSV). The present capacity of DOSV is inadequate, however, to monitor and enforce the law.

This project affords an opportuity to stimulate more active participation of the Secretariat of Agriculture in pesticide use, monitoring, enforcement, and training. Two activities are discussed which can help accomplish this increase participation and are as follows:

1. Initiation of the IPM Project outlined in section 3 above.

2. A pesticide residue surveillance program aimed specifically at the smaller farmers (<10 hectares), who as "satellite" farmers provide crop outputs to the larger agribusiness groups.

11. Ability of A.I.D. to Regulate or Control the Distribution, Storage, Use and Disposal of Pesticides in the Commercial Farming Systems Project

In regular A.I.D. projects careful control can be exerted in the selection, purchase, extension, use and disposal of pesticides. Particular attention is given to assuring that only pesticides which are safe for small farmer use and which have minimal environmental impact are used. Unless special measures are taken, no control can be assured in projects such as the one covered by this assessment since the farmers are provided with funds by intermediary credit institutions and the farmer can purchase whatever they want. All too frequently, highly toxic pesticides are used or pesticides which are bio-accumulative and persistent. Many of the chemicals purchased are either banned or severely restricted for use in the U.S. A number of possible ways of controlling what a farmer purchases have been explored but all but one seem, at first glance, unwieldly and unworkable. One method, however, has merit and a refined version of it will be required for incorporation into the project to bring the activity into compliance with A.I.D. Reg. 16. In essence, the following steps are required:

1. Place a conditions precedent into the A.I.D./ICI loan agreement that the bank will agree to withhold future years' loans to farmers who use pesticides other than "approved pesticides."

2. Publicize the above and provide training in safe use of the approved pesticides along with assurances during the training program that the approved pesticides will indeed be effective.

3. Establish an inspectorship within the Secretariat of Agriculture to sample farm produce, at random, and without prior notice, on farms who are loan recipients. (NOTE: The smaller "satellite" farmers will be monitored more closely since the larger agribusiness concerns can reasonably be expected to act responsibly.)

4. Analyze samples in appropriate laboratory and notify the loan institution of any farmer who is not cooperating, based on the finding of residues of non-approved pesticides. Since no Dominican Republic laboratory is currently capable of performing such analyses, the first two years' monitoring will be conducted in collaborating U.S. laboratories.

5. Publicize the names of farmers who have had their second years' loan rejected and the reason for rejection.

6. All of the above, of course, is based on agreement of the farmer, as a condition of the loan, to have his crops sampled.

12. Requirements for a Monitoring Program to Implement Control over ICI Pesticide Loans to Small Farmers

Number of Samples

Considering the number of farmers involved, small numbers of samples collected - e.g., 10-20 - may be insufficient and 1000 samples would be excessive. One hundred and fifty (150) per year (2 samples from each of 75 randomly selected farmers) would represent a reasonable effort and would be adequate to demonstrate the degree of farmer compliance.

Method of Analysis

Local laboratories' capability for analysis should be developed and this is strongly encouraged. However, for at least the first two years, in the absence of demonstrated in-country capability to perform the monitoring analyses, samples should be shipped to a commercial laboratory in the U.S. whose credentials are recognized by the LAC/DR Bureau Environmental Officer. Multi-residue methodology, as used by FDA Regional surveillance laboratories, should be applied for all samples.

Location of Laboratories

Local Dominican Republic laboratory capabilities for chemical analysis should be developed and this is strongly encouraged. However, for at least the first two years, in the absence of demonstrated in-country capability to perform the monitoring analyses, samples should be shipped to a commercial laboratory in the U.S. whose credentials have been reviewed and approved by the LAC/DR Bureau Environmental Officer.

Illustrative Budget (Exclusive of Setting up Lab in Dominican Republic $)

	$ Year 1	$ Year 2	$ Year 3
Inspectors Salary	-0-	-0-	-0-
Training of Inspector	2,500	-0-	-0-
Transportation for Inspector	-0-	-0-	-0-
Freezer for Sample Storage	500	-0-	-0-
Sample Shipping Containers	1,500	1,500	1,500
Shipping Charges	1,000	1,000	1,000
Chemical Analyses @ $200/sample	30,000	30,000	30,000
	$35,500	$32,500	$32,500

13. The Provisions Made for Training of Users and Applicators of Pesticides

Training in IPM and pesticide management for pesticide users is an appropriate response to the existence of external costs. Since many of the commodities stemming from the bridge credit component of this project are for export or to replace imports, producers must be trained in the appropriate use of pesticides, to establish and maintain commodity markets. To assist in the training process, a special short course on pesticide management will be funded by the AID Mission. Its purpose is to train trainers, who will in turn train agricultural producers. The short course will be held in three of the main agricultural regions of the country: Constanza, Bani-Azua, and Santiago. The cost, duration, and topics to be covered in the course are detailed in the following tables.

Having completed the course, the trainees, many of whom will be the DOSV and the AID funded Irrigation Project personnel, will train farmers using the materials provided and following the format of the AID funded course. They also will serve as a source of technical knowledge for their respective communities. Monetary support for the trainers will be provided in the previous described IPM project proposal.

Pesticide Management Short Course Topics

Three day course given in three locations: Constanza, Bani-Azua, and Santiago.

Topic	Hours
The Pesticide Problem on a World Scale and in the Dominican Republic	0.5
Agroecosystem Concepts	1.0
Integrated Pest Management (IPM) Concepts	1.5
Pesticide Toxicology: Emphasis on Locally Used Pesticides	1.0
Pesticide Formulation	0.5
Elements of Chemical Control	1.0
Pesticide Poisoning and First Aid	1.0
Worker Protection	1.0
Pesticide Labels	1.0
Precautions in Preparing and Spraying Pesticides	1.0
Disposal of Excess Pesticidies and Pesticide Containers	1.0
Pesticide Spill Cleanup	1.0
Pesticide Storage-Emphasis on "Planned Purchases" to Reduce Carry Over of Products	1.0
Pesticide Application Equipment	1.0

Pesticide Training Course Topics (cont'd)

Topic	Hours
Calculation of Pesticide Dosage	0.5
Calibration of Application Equipment; Field Calibration Exercise	8.0
Factors Affecting Foliar Applied Pesticides	1.0
Factors Affecting Soil Applied Pesticides	1.0
Total	24.0

Pesticide Management Training Course, D.R.

Three day course in three locations: Constanza, Bani-Azua, and Sanitago.

Budget:

A. U.S. Dollars

Salary (1 US Trainer/4 weeks)	3,600
Fringe Benefits (30%)	1,080
Per Diem 14 @ $65 and 14 @ $38	1,448
Airfare	1,600
Misc. (taxis, etc.)	200
Materials $ Shipping $20/Trainee @ 90*	1,800
Subtotal	9,728
University Overhead (35.5%)	3,453
Total U.S. $	$13,181

B. Local currency ($DR)

Transportation 28 @ 300	8,400
Local Consultant 10 days @ 250	2,500
Local Arrangements** 90 trainees @ 120	14,400
Local Equipment & Supplies	1,200
Total D.R. $	$26,500

* Thirty students in each of the three courses.

** A small perdiem may be paid to the attendees.

Required local logistical support needed for the Pesticide Management Training Course, D.R.

A. 25-30 attendees, possibly 15 from the project, a few from DSU, several agricultural leaders in the community.

B. Teaching room (air conditioned ?) that includes:

1. Blackboard
2. Electricity
3. Overhead projector
4. Slide projector
5. Water

C. Large concrete or dirt patio for calibration demonstration.

D. 4 or 5 backpack sprayers in good working order; one of which should be motorized.

E. Arrangements should be made for:

1. Noon meal for trainees
2. Lodging, if required
3. Coffee break (morning and afternoon)
4. Transportation, if required (bus) for participants

F. Several labels from locally available pesticides. Preferably at least one herbicide, one fungicide, one insecticide.

14. The Provisions Made for Monitoring the Use and Effectiveness of the Pesticides

As envisioned in this project, "bridge loans" will be made by the Banco de Reservas to producers through PFIs and agribusinesses who employ outgrowers. A problem immediately arises concerning the enforcement of AID's Environmental Regulation 16. A complicated system could be developed to follow the flow of funds and to monitor the use of the bridge loans. Such a system would be expensive to administer. A more efficient approach may be to monitor pesticide residues on the agricultural commodity. A workable scheme is discussed in Section 11 and 12 above and constitutes a mandatory requirement of the Environmental Assessment.

It should be noted that there are no governmental subsidies for pesticides in the Dominican Republic. This is a sharp contrast to many countries in Latin American when typical rates of subsidy run as high as 15-25 percent. (Some imports are subsidized, however; i.e., fertilizer, agricultural machinery). In fact, a selected comparison of US vs Dominican prices for pesticides (see Annex 5) suggests the prices are higher in the Dominican Republic than in the US with the exception of those reformulated in the Dominican Republic (Annex 6) or those that are restricted in the US.

Since the market price is generally higher, there is no economic or governmental incentive for "overuse". Misuse caused by insufficient training and consideration of the "spillovers" may continue. Misuse of this type is can be partially resolved through education and training. Training was treated in Section 13 of this report. Sections 11 and 12 above outline the major method whereby small farmer compliance will be enforced.

The review team was asked to evaluate the availability of small quantities of pesticides in small containers as a control method. Small containers might reduce inappropriate use by simplifying required instructions, or by reducing the possibility of excess product. For example, the container could be the appropriate amount for a designated area or for a specified volume of water. Packaging pesticides in small containers may increase their cost, however, by as much as 20 percent. (This number is supported by a review of existing pesticide price differentials in the Dominican Republic, see appendix 5). However, the availability of small packages for the commonly used pesticides does not appear to be a problem. Herbicides were commonly found on the retail market in sizes of 1 lb and/or 1 liter; while insecticide package sizes of 250 cc were readily available for many insecticides. Thus, there appears to be little reason to pursue smaller packages as a control option. The actual status of availability of adequately sized containers of various pesticides will be evaluated during the mid-term project review as a line item in the S.O.W.

C. Requests for Additional Pesticides and/or Information

If project personnel determine a need for pesticides not in Table 1 or if they need additional information about the pesticides or EA procedures, they should notify USAID. This AID office can contact AID'S Bureau of Science and Technology, Office of Agriculture (Attention: C.W. Collier) for

any needed assistance. Before any actual demonstrations to/with farmers of pesticides not in Table 1, specific labels and compounds must be reviewed by the Bureau Environmental Officer. This, most likely, will involve AID'S American Association for the Advancement of Science (AAAS) Fellows conducting such reviews.

D. Contributors

The EA was prepared by Charles R. Ward, Professor of Entomology, New Mexico State University; J. Bruce Mann, Assistant Research Professor, University of Miami; and Stanley F. Miller, Professor of Agricultural Economics, Oregon State University as Consultants to the Consortium For International Crop Protection, College Park, Maryland. The following persons in the DR were consulted for information used in preparing the EA:

SOA (Plant Protection)

Santo Domingo - San Cristobal:

Rafael Ramirez, Director, Dept. Sanidad Vegetal, Santo Domingo, R.D., Tel. 532-7941.
Hector Radhames Gonzales DeLeon, Ing. Quimico, Sanidad Vegetal, Apartado Postal 737-2, Santo Domingo, DR, Tel. 533-0802.
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Constanza:

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Ruben Marte (Medico), Sanidad Vegetal, Programa de Agro-medicina, Consfanza, R.D.

SOA (Research)

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Oswaldo Vasquez, Proyecto Mamiferos Marinas (Marine Mammals), (CIBIMA). Univ. Autonoma de Santo Domingo, Calle Jonas Salk No. 56. Santo Domingo, D.N.R.D., Tel., Tel. 685-6682.
Abraham Abud, Ing., Director Depto. de Agronomia, Univ. Antonoma de Santo Domingo, Ciudad Universitaria, Santo Domingo., R.D. Tel. 541/5201/565-8291.

Agribusiness Contacts:

BANI Area

Meir Shori, Ing., Director Tecnico, America Agricola, S.A. Moises Garcia No. 40, Santo Domingo, D.N. Tel. 682-8167/69, 688- 0647, 688-2946.
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Azua Area (Three unidentified outgrower farmers also contacted)

Santiago Echararria, Ing. Agron., Gerente Produccion, DOMEX, S.A., Seccion Guayacanal, Azua, R.D., Tel. 521-3626.

Santo Domingo Area

Henry Mousanto, Ing., COFERKA, S.A., Apt. Postal 477-2, Tel. 542- 2969.
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Constanza Area (Several unidentified farmers also contacted)

Victor Ml. Baez N., Ing. Agr., Presidente (Past), Asociacion de Productores Horticolas del Valle de Constanze, Inc., Salomi Urena S/N, Constanza, R.D., Tel. 539-2595, ofic. 539-2341, Santo Domingo 566-3587.

USAID/Dominican Republic

David Gardella, AID Project Officer, Apartado Postal 2220, Tel. 541-2171 ext. 481.
Del McClusky, AID Natural Resources Officer, Apartado Postal 2220, Tel. 541-2171 ext. 481.
Cesar L. Cruz, Ing., AID Irrigation Project Coordinator, Apartado Postal 2220, Tel. 541-2171 ext. 481.

REFERENCES

1. "Managing Insect and Mite Pests of Sorghum; Texas Agricultural Extension Service;" The Texas A & M University System, College Station, Texas.

2. "Texas Guide for Controlling Insects on Commercial Vegetable Crops;" Texas Agricultural Extension Service.

3. "Managing Insect and Mite Pests of Corn;" Texas Agricultural Extension Service.

4. "Management of Cotton Insects;" Texas Agricultural Extension Service.

5. "The Status of Chemicals in the Special Review Program, Registration Standards Program, Data Call-In Program, and Other Registration Activities 1987;" U.S.E.P.A., 401 M Street, S. W., Washington, D. C. 20460.

6. "Pacific North West Weed Control Handbook January 1986;" Extension Services of Oregon State University, Washington-State University, and the University of Idaho.

7. "1988 Farm Chemicals Handbook;" Copyright Clearance Center, 21 Congress Street, Salem, MA 01970.

8. Harlschorn, G. et.al. 1981. The Dominican Republic, Country Environmental Profile, A Field Study. A.I.D. Contract No. AID/SOD/PDC-C00247. J.R.B. Associates, 8400 Westpark Drive, McLean, Virginia 22102, U.S.A. 109p.

9. "Code of Federal Regulations," Vol. 40, Parts 150-189 (1983).

ANNEX 1.

Copy of the Initial
Environmental Evaluation (IEE)

AGENCY FOR INTERNATIONAL DEVELOPMENT
WASHINGTON, D.C 20523

LAC/DR-IEE-87-04

ENVIRONMENTAL THRESHOLD DECISION

Project Location	: Dominican Republic
Project Title and Number	: Commercial Farming Systems : 517-0214
Funding	: $4 million grant : $10 million grant
Life of Project	: 5 years
IEE Prepared by	: Erhardt Rupprecht USAID/Dominican Republic
Recommended Threshold Decision	: Negative determination
Bureau Threshold Decision	: Concur with Recommendation
Comments	: None
Copy to	: Henry Bassford, Director, Director USAID/Dominican Republic
Copy to	: LAC/DR/CAR, Eric Zallman
Copy to	: LAC/DR/CAR, Tony Velasquez
Copy to	: USAID, Port-au-Prince, Jim Talbot
Copy to	: IEE File

James S. Hester Date DEC 19 1986

James S. Hester
Chief Environmental Officer
Bureau for Latin America
and the Caribbean

ANNEX II

COMMERCIAL FARMING SYSTEMS PID

Initial Environmental Examination

Project Location : Dominican Republic

Project Title : Commercial Farming Systems

Funding : $4 million grant
$10 million loan

Life of Project : 5 years

IEE prepared by : Erhardt Rupprecht, USAID/DR
Agricultural and Rural Development Division

Date :

Environmental Action Recommended : Negative Determination

William Smith
Chief Engineer, USAID/DR and
Mission Environmental Officer

Concurrence:

Henry H. Bassford
Director

I. EXAMINATION OF NATURE, SCOPE, AND MAGNITUDE OF ENVIRONMENTAL IMPACTS

Environmental Impacts from this project would be minimal. The Project proposes to support rural financial service activities which will expand agribusiness/outgrower relationships for the production of non-traditional export and rotation crops. As per Section 216.2(c)(2) categorical exclusions, AID's environmental regulations are generally not required for projects with intermediate credit institutions when AID does not review and approve individual subloans. The experience thus far under the Agribusiness Loan is that agribusinesses exporting to the U. S. are extremely careful to comply with U. S. pesticide use and application requirements because of the potential closure of export markets. In addition, because the collateral fund mechanism will involve the same institutions involved in our Agribusiness Promotion Loan, FIDE and approved private commercial and development banks, we will use the same procedure to insure that adverse environmental impacts do not occur. That procedure, which is operating effectively, involves a negative list of subprojects which will not be eligible for financing under the program. Thus, unless USAID otherwise approves in writing and an environmental examination is conducted by qualified personnel, the borrower will covenant that AID loan funds will not be used for sub-projects involving pesticides, severe chemical treatments such as tanneries, or extensive land clearing or road construction in hillside areas. AID loan funds will also not be used for financing of rotation crop inputs through the base-level rural financial institutions.

With respect to the technology support services and development activities, these would utilize the services of experienced U. S. crop production specialists and technology packages which are acceptable under U. S. environmental regulations. The testing and use of chemical inputs would therefore be under careful supervision and in demonstration conditions.

II. RECOMMENDATIONS FOR ENVIRONMENTAL ACTION

Based on the above examination of the project activities and the little or no environmental negative impact expected, in conformance with 22CFR Part 216, AID Environmental Procedures, it is recommended that a NEGATIVE DETERMINATION be approved for this Project.

IMPACT IDENTIFICATION AND EVALUATION FORM

Impact Areas and Sub-areas	Impact Identification and Evaluation 1/
A. LAND USE	
1. Changing the character of the land through:	
a. Increasing the Population	N
b. Extracting Natural Resources	N
c. Land Clearing	N
d. Changing Soil Productive Capacity	N
2. Altering Natural Defenses	N
3. Foreclosing Important Uses	N
4. Jeopardizing Man or His Works	N
B. WATER QUALITY	
1. Physical State of Water	N
2. Chemical and Biological States	N
3. Ecological Balance	N
C. ATMOSPHERIC	
1. Air Additives	N
2. Air Pollution	N
3. Noise Pollution	N
D. NATURAL RESOURCES	
1. Diversion, Altered Use of Water	N
2. Irreversible, Inefficient Commitments	N
E. CULTURAL	
1. Altering Physical Symbols	N
2. Change of Cultural Traditions	N

1/ N - No environmental impact.
L - Little environmental impact.
M - Moderate environmental impact.
H - High environmental impact.
U - Unknown environmental impact.

F. HEALTH

1. Changing a Natural Environment..... N
2. Eliminating an Ecosystem Element..... N

G. GENERAL

1. International Impacts..... N
2. Controversial Impacts..... N
3. Larger Program Impacts..... N

ANNEX 2.

List of Pesticides In Use In The Dominican Republic

Table 1. Pesticides Available in the Dominican Republic and Used in Crops Indicated. Also Shown are Toxicity Categories of Listed Pesticides. (1,2,3,4,5,6,7)

Common Name and (Brand Name)	Action	Toxicity Category	TOMATO 1	RICE 2	POTATO 3	SWEET POTATO 4	YAMS 5	CABBAGE 6	CASSAVA 7	PIGEON PEAS 8	SNOW PEAS 9	CUCUMBERS 10	RED KIDNEY BEANS 11	CORN 12	SORGHUM 13	ONIONS 14	CARROTS 15	PAPAYA 16	BEANS 17	BEETS 18	MELONS 19	GREEN SQUASH YAUTIA 20	COTTON 21
Acephate (ORTHENE)	Insecticide	III																	X				X
Aldicarb (TEMIK)*	Insecticide & Nematocide	I			X	X									X				X				X
Atrazine	Herbicide	III												X	X								
Bacillus thuringiensis (DIPEL)	Insecticide	III	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Benomyl (BENLATE)[7]	Fungicide	III	X	X				X				X					X		X				
Bromopropylate (NEORON ACAROL)[2]	Acaricide	III																					
Captafol (DIFOLATAN)[8]	Fungicide	II	X		X							X		X		X					X		
Captan (CAPTAN)[4]	Fungicide	III		X				X				X		X	X				X	X	X	X	
Carbaryl (SEVIN)	Insecticide	III	X	X	X	X		X				X	X	X	X		X		X	X	X	X	X
Carbofuran (FURADAN)	Insecticide Acaricide Nematocide	II;I		X	X							X		X	X						X	X	X
Carbendazim (BENCARD)[2]	Fungicide	III																					
Chlorpyrifos (LORSBAN)*	Insecticide	II			X	X		X						X	X	X							X
Copper hydroxide (KOCIDE)	Fungicide	III;I	X		X	X	X	X		X		X				X			X		X	X	
Copper oxychloride (CUPRAVIT)	Fungicide	III	X		X	X	X			X									X				
Cyfluthrin (BAYTHROID)*	Insecticide	I	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Cypermethrin (SHARPA, AMMO, CYMBUSH, RIPCORD)*	Insecticide	III																					X
2,4-D	Herbicide	I;III		X										X	X								

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Daconate (MSMA)	Herbicide	III																					X
DCNA (BOTRAN)	Fungicide	III	X		X	X						X				X	X						X
Deltamethrin (DECIS)[2]	Insecticide	?																					X
Diazinon (BASUDIN)	Insecticide	III;II	X		X			X	X	X		X	X	X	X	X	X		X	X	X	X	X
Dicofol (KELTHANE)[6]	Acaricide	III;II	X									X							X		X	X	X
Dichlorvos (VAPONA; DDVP)[4]	Insecticide	I	X																				
Dicrotophos (BIDRIN; CARBICRON)*	Insecticide	I																					X
Dimethoate (ROGAR; CYGON)	Insecticide Acaricide	II	X		X			X						X	X				X	X	X		X
Disulfoton (SOLVIREX: DISYSTON)*	Insecticide Acaricide	I	X		X			X						X	X				X				X
Endosulfan (THIODAN)	Insecticide Acaricide	I	X		X	X		X				X					X		X		X	X	X
Ethoprop (MOCAP)*	Nematocide	II			X	X		X				X		X									
Fenamiphos (NEMACUR)*	Nematocide	I						X															X
Fenitrothion (SUMITHION)	Insecticide	II																					
Fenthion (FENTHION; BAYTEX)	Insecticide	II																					
Fentin Acetate (BRESTAN)[2]	Fungicide	II			X																		
Fluazifop-butyl (FUSILADE)	Herbicide	III																					X
Glyphosate (ROUNDUP)	Herbicide	II		X	X	X		X		X	X		X	X	X	X	X		X	X			X

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Linuron (AFALON)[1]	Herbicide	III			X									X	X		X						X
Malathion (MALATHION)	Insecticide	III	X	X	X	X		X				X	X	X	X	X	X		X	X	X	X	X
Maneb (MANZATE)	Fungicide	III	X		X							X		X		X	X	X			X	X	X
MCPB (TROPOTOX; THISTROL)[4]	Herbicide	III																					
Mephosfolan (CYTROLANE)[2]*	Insecticide	I		X										X	X							X	
Metalaxyl (RIDOMIL)	Fungicide	II	X		X			X				X	X			X					X	X	X
Methamidophos (TAMARON; MANITOR)*	Insecticide Acaricide	I	X		X			X				X								X	X		X
Methidathion (SUPRACIDE)*	Insecticide	I													X								X
Methomyl (LANNATE)*	Insecticide	I	X		X			X				X		X	X	X	X		X	X	X	X	X
Methyl Parathion (FOLIDOL; MITIDOX)*	Insecticide	I	X	X	X	X		X				X		X		X	X		X	X			X
Metribuzin (SENCOR)*	Herbicide	III	X		X									X									
Monocrotophos (KENOPHOS; AZOMYL; AZODRIN)*	Insecticide	I																					X
Oxadiazon (RONSTAR)	Herbicide	II																					
Oxamyl (VYDATE)*	Insecticide Nematocide Acaricide	I	X		X	X	X					X				X					X	X	X
Oxifluorfen (GOAL)	Herbicide	II												X		X							X

Table 1. Pesticides Available in the Dominican Republic and Used in Crops Indicated. Also Shown are Toxicity Categories of Listed Pesticides. (1,2,3,4,5,6,7)

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Paraquat (GRAMESEN; GRAMOXONE; KENOQUAT; PARADOX; GRAMAFIX)*	Herbicide	I	X		X		X	X	X	X		X		X	X	X	X		X		X	X	X
Pendimethalin (HERBODOX; PROWL)	Herbicide	II		X	X									X	X				X				X
Permethrin (AMBUSH; LORNADA)*	Insecticide	III			X			X						X									X
Phosalone (ZOLANE)	Acaricide Insecticide	II			X																		
Phorim (VOLATON; BAYTHION)[2]	Insecticide																						
Propanil (RISELECT; STAM)	Herbicide	II		X																			
Propineb (ANTRACOL)[2]	Fungicide	II																					
Profenofos (TAMBO; SELECRON; CURACRON)*	Insecticide Acaricide	II																					X
Thiram (THIRAM)[2]	Fungicide Animal Repellant	III																					
Triadimefon (BAYLETON)	Fungicide	II										X											
Triazophos (HOSTATHION)[2]	Insecticide Mitricide Nematocide																			X	X		
Trichlorfon (DIPTEREX; DANEX; DYLOX)	Insecticide	II	X											X					X				X

Table 1. Pesticides Available in the Dominican Republic and Used in Crops Indicated. Also Shown are Toxicity Categories of Listed Pesticides. (1,2,3,4,5,6,7)

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Vamidothion (KILVAL)[2]	Miticide Aphicide	I																					
Vinclozolin (RONILAN)	Fungicide	III																					
Warfarin (WARFARIN; POUG-RAX)	Rodenticide	III;II																					
Zineb (ZINEB; MANCOZEB)[9]	Fungicide	III																					

1. Aerial Application Prohibited
2. Not Registered by EPA
* Restricted Use in some if not all formulations.
3. Residue tolerances have not been established by EPA or recommended by FAO/WHO
4. Currently under review by EPA
5. Granular formulations of Carbofuran are not restricted, but all concentrate suspensions and wettable powders 40% and greater are. FURADAN 10% granules are proposed here.
6. KELTHANE has recently been the subject of EPA cancellation actions. Prior to actual use by the project, the current status of this pesticide should be established.
7. Use approved subject to adherance to U.S. labelling provisions.
8. Voluntary cancellation of all products in U.S.
9. Use suspended in the U.S.

List Provided By Sanidad Vegetal (Constanza)

Trade name	(common name)
Antrocol	(Propineb)
Baythroid	(cyflumethrim)
Botran	(DCNA)
Brestan	(fentin acetate + maneb)
Cymbush	(cypermethrin)
Cytrolane	(mephosfolan)
Decis	(decamethrin)
Dipterex	(trichlorfon)
Dithane	(mancozeb, Maneb, Copper, Zineb)
Folidol	(methyl parathion)
Hostathion	(triagophos)
Kenophos	(monocrotohpos)
Lannate	(methomyl)
Lorsban	(chlorpyrifos)
Nemacur	(fenamiphos)
Ridomil	(metaloxyl)
Sherpa	(cypermethrin)
Tamaron	(methamidophes)
Tambo	(profenophos)
Temik	(aldicarb)
Thuricide	(*Bacillus thuringensis*)
Vydate	(oxamyl)

List provided by Assoc. de Agricultores (Constanza)

Afalon	(linuron)
Antracol	(propineb)
Botran	(DCNA)
Captofol	(captofol)
Captan	(captan)
2,4-D	(2,4-D)
Decis	(deltamethrin)
Dipel	(*Bacillus thuringiensis*)
Dual	(metalochlor
Fusillade	(fluazifop - butyl)
Goal	(oxifluorfen)
Gramoxone	(paraquat)
Hierbatex	(atrazine)
Hostathion	(triazophos)
Lannate	(methomyl)
Lopotox	(MCPB)
Lornada	(permethrin)
Lorsban	(chlorpyrifos)
Maneb	(maneb)
Mancozeb	(maneb, copper, zineb)
Manzate	(maneb)
Methyl Parathion	(methyl parathion)
Mocap	(ethoprop)
Nemacur	(fenamiphos)
Orthene	(acephate)
Ridomil	(metalaxyl)
Riselect	(propanil)
Rogar	(dimethoate)
Ronilon	(vinclozolin)
Ronstar	(oxadiazon)
Roundup	(glyphosate)
Sencor	(metribuzin)
Sherpa	(cypermethrin)
Solvirex	(disulfoton)
Tamaron	(methamidophos)
Temik	(aldicarb)
Tornado	(permethrin)
Topitox	(mcpb)
Vydate	(oxamyl)

In Store #1 Selling Pesticides (Constanza)

Afugan	(pyrazofos)
Ambush	(permethrin)
Botran	(DCNA)
Captan	(captan)
Carbicron	(dicrotophos)
Cymbush	(cypermethrin)
Cytrolane	(mephosfolan)
Dacromack	(?)
Danex	(trichlorfon)
Decis	(deltamethrin)
Diazinon	(diazinon)
Dipterax	(trichlorfon)
Dithane	(mancozeb, maneb, copper, zineb)
Extravon	(?)
Folidol	(methyl parathion)
Fusillade	(fluazifop - butyl)
Goal	(oxifluorfen)
Gramoxone	(paraquat)
Herbadex	(pendimethalin)
Hostathion	(triazophos)
Lorox	(Linuron)
Ripcord	(cypermethrin)
Ronstar	(oxadiazon)
Roundup	(glyphosate)
Selecron	(profenofos)
Sumithion	(fenitrithion)
Tamaron	(methamidophos)
Tambo	(profenofos)
Thiodan	(endosulfan)
Triona	(?)
Vydate	(oxamyl)

In Store #2 Selling Pesticides (Constanza)

Azodrin	(monocrotophos)
Azomyl	(monocrotophos + methomyl)
Bayleton	(triadimefon)
Baytroid	(cyfluthrin)
Bencarb	(carbendazim)
Benlate	(benomyl)
Bidrin	(dicrotophos)
Brestan	(fentin acetate + maneb)
Decis	(deltamethrin)
Dipterax	(trichlorfon)
Dual	(metalochlor)
Folidol	(methyl parathion)
Fusillade	(fluazifop - butyl)
Gramafix	(paraquat)
Gramoxone	(paraquat)
Hostathion	(triazophos)
Kenophos	(monocrotophos)
Kenoquat	(paraquat)
Kilval	(vamidothion)
Lorsban	(chlorpyrifos)
Mancozeb	(maneb, copper, zineb)
Manzate	(maneb)
Metidox	(methyl parathion)
Mocap	(ethoprop)
Neoron	(bromopropylate)
Nespor Z	(maneb + zineb)
Orthene	(acephate)
Paradox	(paraquat)
Ridomil	(metalaxyl)
Roundup	(glyphosate)
Sherpa	(cypermethrin)
Supona	(dichlorvos)
Supracid	(methidathion)
Tamaron	(methamidophos)
Thiodan metil	(endosulfan)
Volaton	(phoxim)
Vydate	(oxamyl)
Zolone	(phosalone)

ANNEX 3.

List of Known Endangered Species of Plants and Animals in the DR

The Dominican Republic

Country Environmental Profile

A Field Study

by:

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AID Contract No.
AID/SOD/PDC-C-0247

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Table III-4. Threatened and endangered plant species in the Dominican Republic. Based on a list prepared by CIBIMA by Dr. José de Jesús Jiménez, with a few additions suggested by Alain Liogier. Orchid list prepared by D.D. Dod. *Denotes Endemic Species.

AGAVACEAE
*Agave intermixta Trel.

BIGNONIACEAE
Ekmanianthe longifolia (Griseb.) Urb.
Tynnanthus caryophyllus (Bello) Alain

BOMBACACEAE
Ceiba pentandra (L.) Gaertn.

CACTACEAE
Dendrocereus undulosus (DC) Britton & Rose
Harrisia hurstii Marshall
Neoabbotia paniculata (Lam) Britton & Rose
Opuntia urbaniana Werdem
Pereskia portulacifolia (L) Haw

CAMPANULACEAE
Lobelia salicina Lam. var. *Brachyantha* Urb.

COMPOSITAE
Ageratum domingense Spreng.
Chaptalia eggersii Urb.
Chaptalia vegensis Urb.
Erigeron domingensis Urb.
Erigeron fuertesii Urb.
Erigeron ocoensis Urb.
Erigeron psilocaulis Urb.
Erigeron subalpinus Urb.
Erigeron tuerckheimii Urb.
Erigeron vegensis Urb.
Eupatorium constanzae Urb.
Eupatorium hekros-quonnon Urb.
Gnaphalium rosillense Urb.
Gundlachia domingensis (Spreng.) A. Gray
Gundlachia ocoana Urb. & Ekm.
Heterodonta haitiensis Urb. & Ekm.
Heterodonta mikanioides Urb. & Ekm.
Heterodonta alinii Jimenez
Mikania cymosma Urb. & Ekm.
Mikania platyloba Urb. & Ekm.
Mikania producta Urb. & Ekm.

CUCURBITACEAE
Doyerea cnetocalhartica Gros.
Melothria domingensis Cogn.
Penelopeia subsercolata Cogn.

CUPRESSACEAE
Juniperus gracilior Pilger
Cupressus sempervirens L.

EBENACEAE
Diospyros domingensis (Urb.) Alain
Diospyros revoluta Poir.

EUPHORBIACEAE
Acidoton microphyllus Urb.
Croton belensanus Urb. & Ekm.
Croton fuertesii Urb.
Cubanthus umbelliformis Urb. & Ekm.
Euphorbia defoliata Urb.
Leucocroton leprosus (Willd.) Pax & Hoffm.
Victorinia acrandra (Urb.) Leon

GUTTIFERAE
Mammea americana L.

HERNANDIACEAE
Hernandia sonora L.

LEGUMINOSAE (MIMOSACEAE)
Acacia barahonensis Urb.
Calliandra nervosa (Urb.) Urb. & Ekm.
Mimosa azuensis Britt
Mimosa farisii Leonard ex Britt
Pithecellobium abbotti Rose & Leonard
Pithecellobium micranthum Benth
Samanea valeriana Britt & Alain

LEGUMINOSAE (CAESALPINIACEAE)
Caesalpinia anacantha Urban.
Caesalpinia barahonensis Urb.
Caesalpinia domingensis Urb.
Cassia angustisiliqua Lam
Cassia emneryana (Britt.) Jimenez
Mora abbottii Rose & Leonard
Mora ekmanii (Urb.) Britt. & Rose
Peltophorum berteroanum Urb.
Stahlia monosperma (Tul.) Urb.

LEGUMINOSAE (FABACEAE or PAPILIONAIDEAE)
Adenanthera peregrina (L.) Sperg.
Aeschynomene pleuronervia DC
Calopogonium domingensis Urb. & Ekm.
Clitoria laurifolia Poir
Piscidia piscipula (L) Sarg.
Sophora oligosperma Urb. & Ekm.

MAGNOLIACEAE
Illicium ekmanii A. C. Smith
Magnolia hamori R. A. Howard
Magnolia pallescens Urb. & Ekm.

MALVACEAE
Hibiscus furcellatus Lam. var. *azuensis* Urb. & Helw.
Malachra radiata (L) L
Phymosia abutiloides (L) Desv.
Ullbrichia beatensis Urb.

MELASTOMATACEAE
Clidemia oligantha Urb.
Conostegia furfuracea Urb. & Ekm.
Graffenrieda barahonensis Urb.
Mecranium ovatum Cogn.
Miconia fuertesii Cogn.
Tetrazygia cordata Urb. & Ekm. ex Alain

MELIACEAE
Cedrela odorata L.
Swietenia mahagoni (L) Jacq.
Trichilia cuneifolia (L) Urb.

MORACEAE
Pseudolmedia spuria (SW) Griseb.

MYRSINACEAE
Ardisia angustata Urb.
Ardisia fuertesii Urb.
Wallenia apiculata Urb.
Wallenia urbaniana Mez

MYRTACEAE
Cryptorhiza haitiensis Urb.
Pimenta ozua (Urb. & Ekm.) Burret
Psidium salutare (H.B.K.) Berg

ORCHIDACEAE (by D. D. Dod)

Orchids Threatened by Habitat Destruction
Barbosella monstrabilis (Ames) Garay
Bletia purpurea (Lam.) D.C.
Bulbophyllum aristatum Hemsl.
Bulbophyllum pachyrrhachis (A. Rich) Griseb.
Campylocentrum monteverdii (Rchb. f.) Rolfe
Campylocentrum porrectum (Rchb. f.) Rolfe
Cranichis diphylla Sw.
Dendrophylax erica-juliae (Ames) Dod
Dichaea swartzii (C. Schweinf.) Garay & Sweet.
Dilomilis scirpoidea (Schltr.) Summerh.
Domingoa nodosa (Cogn.) Schltr.
Encyclia domingense (Cogn.) Dod
Epidendrum acroporpex Ames
Epidendrum paranaense Barb.-Rodr.
Epidendrum strobiliferum Rchf. f.
Erythrodes hirtella (Sw.) Fawc. & Rendle.
Eulophia alta (L.) Fawc. & Rendle.
Ionopsis satyoides (Sw.) Lindl.
Lepanthopsis melanantha (Rchb. f.) Ames
Lepanthopsis serrulata (Cogn) Hespenheide & Garay
Malaxis umbelliflora Sw.
Malaxis unifolia Michx.
Maxillaria adendrobium (Rchb. f.) Dressler
Maxillaria crassifolia (Lindl.) Rchb. f.
Neocogniauxia hexaptera (Griseb.) Schltr.
Oncidium osmenii Withner
Oncidium quadrilobum C. Schweinf.
Pleurothallis appendiculata Cogn.
Pleurothallis aristata Hook.
Pleurothallis erosa Urb.
Pleurothallis foliata Griseb.
Pleurothallis helenae Fawc. & Rendle.
Pleurothallis parvula A. & S.
Pleurothallis quisqueyana Dod
Pleurothallis teshfolia (Sw.) Lindl.
Ponthieva pauciflora (Sw.) F. & R.
Reichenbachanthus emarginatus Garay
Spiranthes cranichoides (Griseb.) Cogn.
Spiranthes domingensis Dod
Stelis domingensis Cogn.
Tropidia polystachya (Sw.) Ames

Orchids in Danger of Extinction
Antillanorchis undlachii (Wright ex Griseb.) Garay
Basiphyllaea angustifolia Schltr.
Basiphyllaea sarcophylla (Rchb. f.) Schltr.
Brachionidium sherringii Rolfe
Campylocentrum constanzense Garay
Campylocentrum macrocarpum Dod
Campylocentrum serpentilingua Dod
Comparettia falcata Poepp. & Engl.
Corallorhiza ekmanii Marsf.
Corymborkis flava (Sw.) Kuntze
Corymborkis forcipigera (Rchb. f.) L. O. Wms.
Cranichis wagenari Rchb. f.
Cryptophoranthus aurantiacus Dod
Cryptophoranthus atropurpureus (Lindl.) Rolfe
Cryptophoranthus erosus Garay
Domingoa x susiana Dod
Encyclia acutifolia Schltr.
Encyclia bipapularis Rchb. f.
Encyclia bletioides Griseb.
Encyclia boothiana (Lindl.) Dressler
Encyclia brachii (Cogn.) Dod
Encyclia cochleata var. *alba* Dod
Encyclia diurna (Jacq.) Schltr.

Table III-4. (continued)

Orchids in Danger of Extinction (continued)

Encyclia ekmanii (Mansf.) Dod
Encyclia fucata (Lindl.) Britt. & Mil.
Encyclia hodgriana (Lindl.) Dod
Encyclia phoenicea (Lindl.) Dod
Encyclia polygonata (Lindl) Dressler
Encyclia vernicosa Dod
Epidendrum rivulare Lindl.
Epidendrum serrulatum Sw.
Epidendrum soratae Rchb. f.
Epidendropsis vicentina (Lindl.) Garay & Dunst.
Eurystyles altícola Dod
Eurystyles amanassacomos (Rchb. f.) Schltr.
Eurystyles domingensis Dod
Fuertesiella pterichoides Schltr.
Galeandra beyrichii Rchb. f.
Geodyera striata Rchb. f.
Habenaria quinqueseta (Michx.) Garay
Habenaria odontopetala Rchb. f.
Lankesterella orthantha (Kransl.) Garay
Leochilus labiatus (Sw.) Kuntze
Lepanthes dussii Urb.
Lepanthes furcatipetala Garay
Lepanthopsis anthocrinium (Rchb. f.) Ames
Lepanthopsis dentifera (L. O. Wms.) Garay
Lepanthopsis dodii Garay
Lepanthopsis domingensis Dod
Lepanthopsis glandulifera Dod
Lepanthopsis hotteana (Mansf.) Garay
Lepanthopsis microlepanthes (Griseb.) Ames
Lepanthopsis moniliformis Dod
Lepanthopsis pygmaea C. Schweinf.
Lepanthopsis stellaris Dod
Liparis neuroglossa Rchb. f.
Liparis viridipurpurea Griseb.
Malaxis hispaniolae (Schltr.) L. O. Wms.
Malaxis leonardii Ames
Malaxis parthonii Morren
Maxillaria inflexa (Lindl.) Griseb.
(*M. crassirubens*)
Oncidium ariza-julianum Withner & Jimenez
Oncidium calochilum Cogn.
Oncidium guianense var. *alborubrum* Moir.
Oncidium henckenii Schomb. ex Lindl.
Oncidium meirax Rchb. f.
Oncidium turckheimii Cogn.
Pleurothallis leochilus (Rchb. f.) Garay & Sweet.
Platystele quercicola (Lindl.) Garay
Pleurothallis alainii Dod
Pleurothallis claudii Rchb. f. ex Dod
Pleurothallis corniculata (Sw.) Lindl.
Pleurothallis dodii Garay
Pleurothallis grobyi Batem. ex Lindl.
Pleurothallis imrayi Lindl.
Pleurothallis lancerola Spreng.
Pleurothallis laxa Lindl.
Pleurothallis longilabris Lindl.
Pleurothallis mazei Urb.
Pleurothallis murex Rchb. f.
Pleurothallis pendens Dod
Pleurothallis simpliciflora Dod
Pleurothallis spilo-porphyrea Dod
Pleurothallis tribuloides (Sw.) Lindl.
Pleurothallis tricostata Cogn.
Ponthieva ekmanii Mansf.
Ponthieva harrisii Cogn.
Ponthieva petiolata Lindl.
Prescottia sp. nov.
Pseudocentrum minus Benth.
Quisqueya ekmanii Dod
Quisqueya fuertesii Dod
Quisqueya holdridgei Dod
Quisqueya karstii Dod
Spiranthes costaricensis Rchb. f.
Spiranthes fauci-sanguinea Dod
Spiranthes monophylla (Griseb.) Dod
Spiranthes polyantha Rchb. f.
Spiranthes speciosa (Bmel.) A. Rich.
Stelis chabreana Mansf.
Stellilabium minutiflora (Krangl.) Garay
Tetramicra bulbosa Mansf.
Tetramicra canaliculata var. *alba*
Tetramicra ekmanii Mansf.
Tetramicra schomina (Rchb. f.) Rolfe
Triphora gentianoides (Sw.) Ames & Schwenfueth
Triphora surinamensis Lindl.
Vanilla mexicana Mill
Vanilla phaeantha Rchb. f.
Wullschlaegelia aphylla (Sw.) Rchb. f.

PALMAE

Acrocomia quisqueyana Bailey
Bactris plumeriana Mart.
Calyptrogyne dulcis (Wright ex Griseb.) Gomez Maza
Calyptrogyne rivalis (O.F. Cook) Leon
Copernicia berteroana Becc
Hatiella ekmanii (Burret) Bailey
Prestoea montana (Grah.) Nichols.
Pseudophoenix sargentii Subsp. *saonae* var. *saonae* (Cook) Red

PODOCARPACEAE

Podocarpus buchii Urb.

RUBIACEAE

Antirhea elliptica Urb. & Ekm.
Antirhea involucrata Urb. & Ekm.
Casasia haitiensis Urb. & Ekm.
Exostema nitens Urb.
Exostema rupicolum Urb.
Exostema subcordatum Krug. & Urb.
Gonzalagunia brachyanthe (A. Rich.) Urb.
Guettarda barahonensis Urb.
Guettarda stenophylla Urb.
Ottoschmidtia haitiensis Urb.
Palicourea micrantha Urb.

RUTACEAE

Zanthoxylum flavum Vahla

SAPOTACEAE

Bumelia integra Cronq.
Dipholis ferruginea
Micropholis chrysophylloides Pierre
Poutteria sapota (Jacq.) H.E. Moore & Stearn.

STERCULIACEAE

Bythneria microphylla Jacq.
Neoregnellia cubensis Urb.
Waltheria calciocola Urb.

THEOPHRASTACEAE

Jacquinia connata Urb.
Jacquinia eggersii Urb.

ZYGOPHYLLACEAE

Guaiacum officinale L.
Guaiacum sanctum L.

Table VII-7. Threatened and endangered species in coastal and marine habitats in the Dominican Republic.

Species	Common Name	Habitat	Known Distribution	Status
Podiceps dominicus	Least Grebe	Lagoons, wetlands, lakes	Guerra, Payaguara, Tres Ojos	Endangered
Dichromanassa rufescens	Reddish Egret	Coast, saline lagoons	Tortuguero, Estero Balsa, Boca del Yaque del Norte	Endangered
Phoenicopterus ruber [1]	Flamingo	Coastal lagoons, lakes, wetlands	Isla Saona, Beata, Azua, Enriquillo	Threatened
Ajaia ajaja [1]	Spoonbill	Coastal lagoons, wetlands, mangroves	Lago Enriquillo, Lago Limón	Rare
Dendrocygna arborea	West Indian Whistling Duck	Lakes, wetlands	Bahia San Lorenzo, Sanchez, Enriquillo, Monte Cristi	Endangered
Porzana flaviventer	Yellow-breasted Crake	Lakes, wetlands	Unknown	Unknown
Haematopus ostralegus	Oyster Catcher	Rocky beach	Playa Azul	Rare
Columba leucocephala [1]	White-crowned Pigeon	Coastal areas, mangroves	Monte Cristi-Higuey, Isla Beata, Saona	Unknown
Eretmochelys imbricata [2]	Hawksbill	Marine, sand beaches	See map	Endangered
Chelonia mydas [2]	Green Turtle	Marine, sand beaches	See map	Endangered
Caretta caretta	Loggerhead	Marine, sand beaches	See map	Endangered
Dermochelys coriacea	Leatherback	Marine, sand beaches	See map	Endangered
Trichechus manatus [1]	Manatee	Marine coastal areas, bays		Endangered
Megaptera novaeangliae	Humpback Whale	Offshore banks, (seasonal)	Bancos de Plata and Navidad	Endangered

[1]Protected by law; [2]Partially protected by law.

fowl threatened with extinction have lost habitat due to draining and clearing of wetlands or harvesting of mangroves for wood and charcoal. Flamingos and spoonbills are hunted for their eggs and feathers, and the white-crowned pigeon is hunted for sport (Ottenwalder 1973). There are an estimated 1,000-1,500 resident flamingos and an additional 2,000 that migrate yearly to the Dominican Republic. Two other migratory birds, both boobies—*Sterna fuscata* and *Anous stolidus*, nest on two cays in the Siete Hermanos off Monte Cristi (Alvarez 1980).

The four species of sea turtles recognized by the International Union for the Conservation of Nature and Natural Resources (IUCN) as in danger of extinction in the Caribbean are reported for the Dominican Republic. Of these four the hawksbill and green are still legally hunted for food (eggs and meat) and the shell for jewelry purposes. Jewelry is made from turtle shell for local sales and use, as well as the tourist trade and export. Though in less demand, the green turtle is also hunted as a substitute for the more highly-prized hawksbill (Ottenwalder 1978). Until recently it was thought the remaining two species, the loggerhead and the leatherback, were relatively scarce. Based on beach surveys, however, Ross and Ottenwalder (1980) calculate that approximately 300 leatherbacks nest per year on the country's beaches. Primary nesting season occurs from mid April through June, favoring beaches with undeveloped hinterland and the absence of an offshore fringing reef. These latter two species are also hunted, though illegally, for food and the shell.

Of the marine mammals, the West Indian manatee is in danger of extinction. Despite government protection in the Dominican Republic, manatees are still widely hunted for meat and bones. Based on aerial surveys, Belitsky and Belitsky (1980) conclude that two separate populations exist with higher concentration around the Monte Cristi area and more dispersed populations in Ocoa and Neiba bays. Abundance appears correlated with presence of grassbeds in an around areas of freshwater discharge.

The northern offshore banks of Plata and Navidad appear to be significant for several species of whales. An estimated 85% of the world's population of the humpback whale, *Megaptera novaeangliae*, concentrate in the area during the winter months for mating and calving purposes (Ottenwalder, pers. comm.). In addition to the humpback whale, other marine mammals observed in Dominican waters include *Stenella coeruleoalba*, *Tursiops truncatus*, *Mesoplodon europaeus*, *Ziphius cavirostris*, *Physeter catodon*, *Orcinus orca*, and *Balaenoptera borealis*. Based on current information critical areas for these groups have been mapped (Fig. VII-1).

The DRP/SEA is responsible for enforcement of existing legislation for marine reptiles and mammals. Responsibility for protection of avifauna lies with the DVS/SEA (Wildlife Department). Based on available information, enforcement is lax and there is little coordination between the two departments.

Existing or Potential Problems and/or Needs: Legislation to protect all endangered and threatened species (that are only partially protected or currently unprotected), with highest priority given the actively hunted turtles; initiate a conservation education campaign to make existing legislation more effective; stimulate enforcement inspectors through workshops; increase the penalties for abuses of endangered species, and request increased assistance from the navy; prohibit export of any product from an endangered or threatened species; require a review process for all proposed national and private projects to assess potential for damage to critical habitat; increase activities calling for parks and preserves, establish qualifing criteria for protection or production, review candidate areas for protection and submit for legislation.

Table VIII-1. Status of selected fauna species in the Dominican Republic. Source data compiled from Bautista 1980, Belitsky and Belitsky 1980, C. Hernandez 1980, Hidalgo 1980, and Ottenwalder 1978. (Explanatory Notes: Population Status: E=endangered; R=rare; T=threatened; I=indeterminate; e=endemic; c=listed in CITES. Information Status: A=adequate; I=incomplete; U=unknown. Legal Status: P=protected; N=not protected. X=contributory factor.

	Population status	Information status	Legal Status	Habitat Destruction	Insecticide Poisoning	Traditions/superstitions	Hunting (meat, eggs)	Commercial Trade	Exotic Competition/Predation	Population Recovering
Turtles										
Caretta caretta	Ec	A	N				X			
Chelonia mydas	Ec	A	N				X	X		
Chrysemis decorata	I	U	N					X		
Chrysemis decussata	I	U	N					X		
Dermochelys coriacea	Ec	A	N				X			
Eretmochelys imbricata	Ec	A	N				X	X		
Reptiles										
Alsophis spp.	E	U	P							
Crocodylus acutus	Ec	A	P							
Cyclura spp.	Eec	I	P	X			X		X	
Darlingtonia hartiana	E	U	P							
Diploglossus spp.	E	U	P							
Epicrates spp.	Ec	I	P							
Mabuya mabouya	E	U	P							
Birds										
Ajaia ajaja	R	I	P	X			X		X	
Amazona ventralis	Ee	A	P	X			X	X		
Anas bahamensis	I	I	P	X	X		X			
Anous stolidus	I	I	N				X			
Aratinga chloroptera	Ee	A	P	X			X	X		
Asio stygius	E	I	P	X		X				
Burhinus bistriatus	I	I	P	X					X	
Buteo jamaicensis	T	U	N							
Buteo ridgwayi	Ee	I	P			X				
Calyptophilus frugivorus	Te	I	P	X						
Caprimulgus cubanensis	R	I	P	X					X	
Columba inornata	I	I	P	X			X			
Columba leucocephala	E	A	P	X			X			
Columba squamosa	E	I	P	X			X			
Corvus leucognaphalus	I	A	N	X			X			
Dendrocygna arborea	Ec	I	P	X	X		X			
Dichromanessa rufescens	E	A	P				X			
Geotrygon caniceps	E	I	P	X					X	
Geotrygon chrysia	R	I	N	X					X	
Geotrygon montana	E	I	P	X					X	X
Haematopus palliatus	R	A	N							
Hylocichla rufigularis	Re	I	P	X		X				
Loxia leucoptera	T	I	P	X						
Myiarchus americana	E	I	P	X			X			
Nycticorax grisseus	E	U	N							
Nycticorax jamaicensis	I	U	P							
Oxyura dominica	T	I	P	X			X			
Oxyura jamaicensis	T	I	P	X	X		X			
Pardirallus maculatus	R	U	N							
Pelecanus occidentalis	I	U	P				X			
Phaeton lepturus	I	U	N				X			
Phalacrocorax auritus	R	I	P				X			
Phoenicopterus ruber	Tc	A	P				X			
Pterodroma hasitata	E	U	P				X			
Podiceps dominicus	E	I	N	X						
Podilimnas flaviventer	R	U	P							
Porzana flaviventer	R	U	N							
Rallus longirostris	R	U	P				X			
Siphonorhis brewsteri	T	I	P	X					X	
Sterna fuscata	I	I	N				X			
Sula leucogaster	T	U	P				X			
Tachybaptus dominicus	E	A	P	X			X			
Temnotrogon roseigaster	Te	I	P	X						
Turdus swalesi	Re	I	P	X						
Mammals										
Eptesicus fuscus hispaniolae	I	I	N							
Lasiurus borealis minor	I	I	N							
Natalus major	I	I	N							
Nectilio leoporinus	I	I	N							
Plagiodontia aedium	E	I	P	X		X			X	
Plagiodontia hylaeum	E	I	P	X		X			X	
Solenodon paradoxus	E	I	P	X		X			X	
Stenoderma haitiensis	I	I	N	X						
Trichechus manatus manatus	Ec	A	P				X			

Plans are being developed to study the possibilities of commercial or semi-captive production of the American crocodile, *Crocodylus acutus*, for hides, oil and other products, and the local iguanas, *Cyclura* spp., for meat. These projects would have the double benefit of reducing pressure on endangered wild populations while at the same time encouraging rationally managed exploitation of a natural resource.

A great deal of interest exists in the Dominican Republic to introduce new species as free-roaming populations or for commercial propagation. Doves, pigeons, wild pigs, white-tail deer, rabbits, pheasants, quail, guinea hens, and some non-game species have been introduced. Aquatic systems are also involved. Tilapia, crayfish, carp, freshwater shrimp, and a host of other game and ornamental species are now found in Dominican streams, rivers and lakes. The introduction of exotic species is a precarious game of chance. The intentional introduction of the mongoose has devastated terrestrial vertebrate populations, particularly ground-nesting birds. Tilapia may have been responsible for the reduction in some native fish species. Particularly in insular situations, the introduction of exotics is unwise due to the high endemism in native flora and fauna.

Beard, J.S. (1944). Provisional list of trees and shrubs of the Lesser Antilles. *Caribbean Forester* 5(2): 48-67. (428 species assigned in a table to individual islands).

Hodge, W.H. (1953). The orchids of Dominica, BWI. *American Orchid Soc. Bull.* 22(12): 891-904.

Stehlé, H. and Stehlé, M. (1947). Liste complémentaire des arbres et arbustes des petites Antilles. *Caribbean Forester* 8: 91-123. (A further 328 species to Beard, 1944, in similar format.)

There are also various papers on the botany of Dominica in *Smithsonian Contributions to Botany*, particularly dealing with Algae, Lichens and Fungi.

Local botanical activity is centered at the facilities of the Dominica National Park Headquarters, who have produced articles on vegetation of the Park.

Field-guides

Honychurch, P.N. (1980). *Caribbean Wild Plants and Their Uses.* Published by the author, Roseau, Dominica. 163 pp. (Conspicuous plants only.)

Information on Threatened Plants Threatened plant conservation is discussed in:

Howard, R.A. (1977). Conservation and endangered species of plants in the Caribbean Islands. In Prance, G.T. and Elias, T.S. (Eds), cited in Appendix 1. Pp. 105-114.

Botanic Gardens

Botanic Gardens, Roseau. (Largely devastated by Hurricane David in 1978, now recuperating.)

Useful Addresses

Dominica National Park Headquarters, Botanic Gardens, Roseau.
Forestry Department. Botanic Gardens, Roseau.

Additional References

Anon. (1970). *Dominica: A chance for a choice.* The Conservation Foundation, Washington, D.C. 48 pp. Some considerations and recommendations on conservation of the island's natural resources.

Hodge, W.H. and Taylor, D. (1957). The ethnobotany of the Island Caribs of Dominica. *Webbia* 12(2): 513-644.

Shillingford, C.A. (1968). Climax Forest in Dominica. M.Sc. Thesis, University of the West Indies, Mona, Jamaica. (Comparative study of 2 examples of lowland rain forest at D'Leau Gommier and Terre Ferme.)

Thorsell, J.W. and Wood, G. (1976). Dominica's Morne Trois Pitons National Park. *Nature Canada* 5(4): 14-16, 33-34.

Weber, B.E. (1973). Dominica National Park. Dept. of Recreation Resources, College of Forestry and Natural Resources, Colorado State University. (Thesis.) (Lists some plants endemic to Dominica in Table 3, p. 57.)

Dominican Republic

A mountainous country consisting of the eastern two-thirds of the island of Hispaniola; west of Puerto Rico and east of Cuba.

Area 48,442 sq. km

Population 6,101,000

Floristics No figures for Dominican Republic; Hispaniola has an estimated 5000 species: 7 gymnosperms, 1087 monocotyledons and 3900 dicotyledons; with 1800 endemic species (Liogier, 1984).

Vegetation In the centre of the island, along the east-west mountain ranges moist forest, low moist forest and high mountain hardwood forest; *Pinus occidentalis* dominant along the central ridge; extensive dry forest along the northern and southern lowlands, arid in parts, with savannah type vegetation; stands of tree cacti and palms in places due to heavy logging of hardwoods. Mangrove swamps best developed along the north-east coast at Samana Bay where the low moist forest comes down to sea level. 22.7% forested (FAO, 1974, cited in Appendix 1); estimated rate of deforestation for closed broadleaved forest 25 sq. km/annum, out of a total of 4440 sq. km (FAO/UNEP, 1981); according to Myers (1980) (cited in Appendix 1), c. 11,000 sq. km of tropical moist forest, most disrupted or degraded.

Checklists and Floras Covered by the family and generic monographs of *Flora Neotropica* (cited in Appendix 1).

Liogier, A.H. (1981). Flora of Hispaniola. Part 1. *Phytologia Memoirs* 3: 1-218. (In Spanish, illus.)

Liogier, A.H. (1982, 1984). *La Flora de la Española*, 2 vols published, the third in press. San Pedro de Macorís. 317 pp., 420 pp., illus.

Moscoso, R.M. (1943). *Catalogus Florae Domingensis*. New York. 732 pp. (In Spanish; checklist of gymnosperms and flowering plants.)

The following provide additional information:

Alvarez, V. (1983). *Manglares de República Dominicana*. Contribuciones 53. CIBIMA/UASD - see Useful Addresses, below. (Describes mangroves.)

Dod, D.D. (1978-). Orquídeas Dominicanas Nuevas I-III. *Moscosoa* 1(1): 50-54; 1(2): 39-54; 1(3): 49-63.

Jiménez, J. de J. (1963-1967). Suplemento no. I al Catalogus Florae Domingensis del Prof. Rafael M. Moscoso. *Archiv. Bot. Biogeogr. Ital.* 39: 81-132; 40: 54-149; 41: 47-87; 42: 46-97 and 107-129; 43: 1-18.

Jiménez, J. de J. (1975). Apuntes para la flora de Santo Domingo (Hispaniola) Novedades III. *Anuario Acad. Ciencias República Dominicana* 1(1): 93-132a.

Liogier, A.H. (1971a). Novitates Antillanae. IV. *Mem. N.Y. Bot. Gard.* 21: 107-157.

Liogier, A.H. (1971b). Novitates Antillanae. V. Miscellaneous new species from the Dominican Republic. *Phytologia* 22(3): 163-174.

Liogier, A.H. (1973). Novitates Antillanae. VI. *Phytologia* 25(5): 265-280.

Liogier, A.H. (1976). Novitates Antillanae. VII. Plantas nuevas de la Española. *Moscosoa* 1(1): 16-49.

The botanical journal *Moscosoa* includes reports of new taxa, of new records and other papers on the flora and vegetation of the Dominican Republic and Haiti. It is published by the Jardín Botánico Nacional 'Dr Rafael M. Moscoso' - see Botanic Gardens, below.

Information on Threatened Plants

Jiménez, J. de J. (1978). Lista tentativa de plantas de la República Dominicana que deben protegerse para evitar su extinción. *Coloquio Internacional sobre la practica de la conservación*, Santo Domingo. CIBIMA/UASD - see Useful Addresses,

below. (In Spanish; lists 133 species of threatened flowering plants, of which 49 are endemic.)

Dr A.H. Liogier has prepared a lengthy list of endangered plants; this is not published.

The IUCN Plant Red Data Book has one data sheet for the Dominican Republic, on *Pseudophoenix ekmanii*. Threatened plant conservation is also discussed in:

Howard, R.A. (1977). Conservation and the endangered species of plants in the Caribbean Islands. In Prance, G.T. and Elias, T.S. (Eds), cited in Appendix 1. Pp. 105-114.

Voluntary Organizations

Sociedad Dominicana de Orquidiología, c/o Jardín Botánico Nacional "Dr Rafael M. Moscoso", Apto 21-9, Santo Domingo.

Sociedad Ecológica del Cibao, Santiago.

Botanic Gardens

Jardín Botánico Nacional 'Dr Rafael M. Moscoso', Apto 21-9, Santo Domingo.

Useful Addresses

Centro de Investigaciones de Biologia Marina, Universidad Autonoma de Santo Domingo, República Dominicana (CIBIMA/UASD), Jonas E. Salk 56, Santo Domingo.

Herbario Dr José de Js. Jiménez Almonte, Universidad Católica Madre y Maestra, Santiago.

Additional References

Hartschorn, G. *et al.* (1981). *The Dominicon Republic, country environmental profile, a field study.* AID Contract No. AID/SOD/PDC-C-0247. JRB Associates, 8400 Westpark Drive, Mclean, Virginia 22102, U.S.A. 109 pp.

Holdridge, L.R., (1945). A brief sketch of the Flora of Hispaniola. In Verdoorn F. (Ed.), cited in Appendix 1. Pp. 76-78.

Jiménez, J. de J. and Liogier, A.H. (1977). Adiciones a los nombros vulgares de las Plantas en la República Dominicana. *Moscosoa* 1(2): 9-21. (See Liogier, 1974.)

Liogier, A.H. (1974). *Diccionario botánico de nombres vulgares de la Española.* Jardín Botánico Dr R. Moscoso, Santo Domingo. 813 pp.

Liogier, A. (1984). La Flora de la Española: sus principales caraterísticas. *2da. Jorandn Científica Academia de Ciencias de la República Dominicana.* Santo Domingo.

Zanoni, T.A., Long, C.R. and Mckiernan, G. (1984). Bibliografía de la flora y de la vegetación de la Isla Española. *Moscosoa* 3: 1-61. (Extensive annotated bibliography of the flora and the vegetation of Hispaniola.)

Easter Island

Easter Island (27°S, 109°30'W) is a triangular volcanic outcrop in the western Pacific Ocean 3700 km west of Chile, of which it is a dependency. It is also known as Rapa-Nui and Isla de Pascua. Area 117 sq. km; population 1400 (1971 estimate). The highest point is Mt Terevaka (601 m), part of the extinct Rano Aroi volcano in the north. Rana Kao (457 m) and Rano Raraku (427 m) form the south-west and south-east parts of the island.

ANNEX 4.

List of Replacement Parts and Supplies Requested by the SOA/DOSV Pesticide Residue Lab

PERKIN-ELMER

Instrument
Sales and Service Division

P.O. Box AJ
UPR Station
Rio Piedras, Puerto Rico 00931-3333
Telephone: (809) 765-4810
Telex: 3450001 (Attn: PERKIN 3450284)

17 de diciembre de 1987

Secretaria de Agricultura
República Dominicana

Piezas y Labor usadas hasta el momento en la reparación de tres Cromatógrafos de Gases en la Secretaria de Agricultura:

Cantidad	Número de catálogo	Descripción	Precio
1	0330-0085	Fid Base	$310.00
1	0330-0118	Fid Jet	64.00
2	0330-1001	Flow Controller	555.00 x 2=1.110.
1	0330-0389	ECD Collector	540.00
1	N625-1026	LCI Paper	17.00
1	0496-3805	056 Paper	19.75
		Total de piezas	$2,060.75
		Total 15 hrs labor	1,725.00 (115.x hora)
		Total hasta ahora	$3,785.75

Piezas que necesitan los Cromatógrafos para finalizar el servicio:

	Cantidad	Número de catálogo	Descripción	Precio
295.00	1	0330-1155	Injector Block (1)	$295.00
41.00	1	0330-0255	Injector Heater (1)	41.00
99.00	1	0330-0915	Injector Sensor (1)	99.00
1,860.00	2	0330-0119	ECD Detector (1)	1,860.00 x 2=$3,720.
2,270.00	2	0330-9524	ECD Amplifier (1)	2,270.00 x 2=$4,540.
	3	N600-1442	Oven Motor	135.00 x 3=$ 405.
	2	0330-1968	Fan Blade	105.00 x 2= 210.
640.00	1	0330-9572	Bead Suppy BD (1)	640.00
220.00	1	0330-0250	Bead Assy (1)	220.00
70.00	2	0330-0106	Oven Limit Switch (1)	70.00 x 2= 140.
2,760.00		24 hrs. x 115 = 2,760	Total de piezas requeridas	$10,310.00
8,255.00		(Aproximado de 35 horas/115.x hora)	Total de labor y viaje	4,000.00
			Gran Total	$14,310.00

Total hasta el momento $ 3,785.75
Total para terminar el servivio $14,310.00
TOTAL SERVICIO COMPLETO $18,095.00

ANNEX 5.

Selected Pesticide Prices in the Dominican Republic

Pesticide Price Differences, U.S. vs, D.R.

Product	U.S.	D.R.
Insecticides	$/lb a.i.	
Ambush 50 EC (lt)	40.00	56.85
Ambush (250 cc)	40.00	39.21
Diazinon AG-500 (lt)	6.00	9.71
Malathion (lt)	2.84	5.70
Methyl Parathion (lt)	8.38	3.67
Sevin 80 (lb)	3.31	5.28
Herbicides		
Arsenal	?	149.36
**Banvel-D	7.63	18.57
Goal (gal)	28.00	51.99
Goal (lt)	28.00	53.19
Gramoxone (5 lt)	16.84	11.47
*,**Paraquat (gal)	17.00	6.32
*,**Paraquat (lt)	17.00	6.35
**Propanil DP (55 gal)	3.88	1.52
Roundup (2.5 gal)	14.90	14.76
Roundup (lt)	18.40	16.29
2-4,D (lt)	1.90	3.99

*restricted use pesticide
**reformulated locally

ANNEX 6.

Pesticides Presently Being Reformulated in the Dominican Republic

COFERIS - Industria Agroquimica, SA- is the single reformulation plant in the DR. It is a company formed through a joint venture between SHELL, FERTINAS (Kettle and Almanzar, SA), and FERQUIPO (Fertilizantes y Quimcas Dominicanas, SA). The product produced and quanties produced per year by company are listed below:

Product	Trade Name	For whom the product was produced
Paraquat (300,000 Lt/yr)	GRAMAFIX PARADOX-Super GROMOXONE-Super	SHELL FERQUIDO FERTIKAS
Propanil (100,000 gl/yr)	POPICIDE 36LV PROPADUX Super PROPANIL	SHELL FERQUIDO FERTIKAS
Banuel D (9,000 gl/yr)	BANVEL D	FERQUIDO