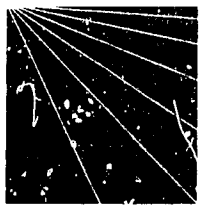

Consortium for International Crop Protection

4321 Hartwick Road, Suite 404, College Park, Maryland 20740 USA
Telephone: (301) 403-4223 ☐ Cable: CONSORTICP
Telex: 5106013963 ☐ FAX: (301) 403-4226

ENVIRONMENTAL ASSESSMENT

Environmental Assessment of Pesticides and Biological Control Agents Proposed for Use in U.S.A.I.D./Honduras Integrated Pest Management Project (A.I.D. Project No. 522-0362)

Prepared for:

U.S. Agency for International Development
Teguicigalpa, Honduras

Prepared by:

Dale G. Bottrell, Professor of Entomology
University of Maryland
College Park, Maryland 20742-5575

and

Pest Management Specialist
Consortium for International Crop Protetion

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INTEGRATED PEST MANAGEMENT
AND
ENVIRONMENTAL PROTECTION
PROJECT

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

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BACKGROUND AND RATIONALE

The Escuela Agrícola Panamericana (EAP) has what is widely regarded as one of the most comprehensive and effective integrated pest management (IPM) programs in Latin America. The Government of Honduras and U.S.A.I.D./ Honduras have supported the IPM activities since 1983. EAP has excellent research, training, and outreach facilities and a well trained staff in IPM.

The purpose of the present U.S.A.I.D. project grant, Integrated Pest Management (Project No. 522-0362), is to permit completion of IPM work carried out since 1983. The proposed activities are concentrated in IPM research, training, communications, and outreach.

In its Initial Environmental Examination (IEE), U.S.A.I.D./Honduras recommended a positive determination. In accordance with A.I.D. Environmental Procedures (Regulation 16, 22 CFR Part 216), an Environmental Assessment (EA) was required. The IEE team recommended that the EA address environmental impact of the following:

* Issue No. 1: Procurement and use of agricultural pesticides regarding compliance with 22 CFR Part 216 guidelines

* Issue No. 2: IPM technology generation and transfer, including pesticide management handling by farmers, training, and safety and access to safety equipment

* Issue No. 3: Use of biological control agents to be liberated against target pest species.

In addition, IAC Chief Environmental Officer James Hester required a summary of specific mitigative measures to be taken (to reduce negative environmental impacts) and their budgeted costs. Further, he required that the EA specifically address Section 119 of the Foreign Assistance Act, Part g(10), concerning introduction of exotic organisms in national parks or similar protected areas.

ISSUE NO. 1: PROCUREMENT AND USE OF PESTICIDES

The project will involve testing and demonstrating pesticides in comprehensive IPM programs. Testing carried out under careful supervision by project personnel is exempt from requirements of 22 CFR Part 216. However, efforts to demonstrate, extend, or any way use pesticides in farmer run programs must comply with EA requirements, 22 CFR Part 216.3(b)(1)(i)a-1, found on page 2D-9 of Handbook 3, App. 2D.

Environmental Procedures (22 CFR Part 216.3(b)(1)(i)a-1

a. The EPA registration status of the requested pesticides

In the United States, the U.S. Environmental Protection Agency (EPA) is responsible for registering pesticides, in one of two categories: "general use" and "restricted use." Pesticides in EPA's restricted use category are

too toxic for general use. In the U.S., they are available for purchase and use only by pesticide applicators who have been certified by law. They have a very high potential for causing harm to humans and/or environment. It is not A.I.D.'s policy to provide such pesticides to small farmers. On the other hand, EPA considers that pesticides in its general use category will cause minimal harm to humans or environment if used as directed on the pesticide containers' labels.

Table 1 shows pesticides recommended for use in the Integrated Pest Management project. All of the pesticides are in EPA's general use category. The table indicates if EPA has established tolerances for the crops for which the pesticides were requested. Under the Miller Pesticide Residue Amendment to the Federal Food, Drug, and Cosmetic Act, a tolerance is the minute trace permitted by the Food and Drug Administration to be present in or on raw agricultural commodities. In A.I.D. projects, treated crops are not to be used for human or livestock animal consumption unless appropriate tolerances have been established and the rates and frequency of application, together with the prescribed harvest intervals, do not result in residues exceeding such tolerances.

Several of the fungicides and herbicides in Table 1 are currently in EPA's Special Review category (formerly Rebuttable Presumption Against Registration or RPAR). The Special Review is a process to establish risk criteria for EPA registered pesticides. If the Review determines that a pesticide exceeds the risk criteria, the pesticide is presumed unsuitable for registration unless presumptions are rebutted. At the end of the review

Table 1. Pesticide Uses Recommended for Use in the U.S.A.I.D./Honduras Integrated Pest Management Project (No. 522-0362)

Pesticide Names[1]	Acute Oral LD_{50} (mg/kg)[2]	Toxicity Category/ EPA Signal Word	Status of FDA Tolerances for Crops for Which Requested:[3] Maize	Beans	Cabbage
Insecticides					
Chlorpyrifos (Counter)	96-270	II-Warning	T		
Bacillus thuringiensis (Dipel)	Non toxic	III-Caution	E		E
Fungicides					
Benomyl (Benlate)[4,5]	>10,000	III-Caution	T	T	
Mancozeb (Dithane M-45)[5]	11,200	III-Caution			
Copper Hydroxide (Kocide)	1000-2000	III-Caution		E	E
Copper Oxychloride (Cupravit)	Ca. 1000	III-Caution		E	E
Bactericides					
Streptomicin (Agri-Mycin)	9,000	III-Caution			NT
Herbicides					
Metolachlor (Dual)	2,534	II-Warning		NT	
Bentazon (Basagran)[5]	2,063	II-Warning		T	
2,4-D (Acme)[5,6]	1,780	III-Caution		NT	
Atrazine (Gesaprim)	375-805	III-Caution		NT	
Pendimethalin (Prowl)	1,250	II-Warning	T	T	
Molluscicides					
Metaldehyde[7]	250-1000	II-Warning		NT	

[1] Approved common name in the Pesticide Chemical News Guide (1988) and, in parenthesis, the trade name. A pesticide may have one or more trade names in addition to the trade name shown.

[2] Based on toxicity to rats.

[3] T=Tolerance established; TP=Tolerance pending; NT=No tolerance; E=Exempt from tolerance. Source: The Pesticide Chemical News Guide (1988).

[4] Approved use subject to adherence to U.S. labelling provisions.

[5] Currently in EPA's Special Review category.

[6] Emulsifiable concentrate.

[7] Used with the restriction that the label must bear the statement "this pesticide may be fatal to children and dogs or other pets if eaten. Keep children and pets out of treated areas."

process, the pesticide may be cancelled (banned) or greatly restricted if the risks are found to outweigh the benefits. The following pesticides are currently under Special Review for the reasons indicated:

* Benomyl:	Reduction in non-target mutagenicity Reproductive effects Teratagenicity
* Mancozeb:	Oncogenicity Teratagenicity Hazard to wildlife
* Bentazon:	Ground water contamination
* 2,4-D:	Oncogenicity (tumor formation).

Escuela Agrícola Panamericana will keep up to date on pesticides in EPA's Special Review Category and will eliminate if cancelled or restricted by EPA.

Use of Benomyl in the project is subject to adherence to U.S. labelling provisions. The use and precautions appearing on the label of EPA approved Benomyl products must be followed closely. Use of Metaldehyde is also subject to adherence to labeling provisions. The label must bear the following statement in Spanish:

"This pesticide may be fatal to children and dogs or other pets if eaten. Keep children and pets out of treated area."

Escuela Agrícola Panamericana requested additional products for use in the U.S.A.I.D./Honduras Integrated Pest Management project, but approval is not recommended for reasons shown in Table 2. EAP will not use any of the pesticides in the table.

Table 2. Pesticides Requested but not Recommended for Use in the U.S.A.I.D./Honduras Integrated Pest Management Project (No. 522-0362)

Pesticide Names[1]	Reason for Failure for Approval
Fluazifop-P-butyl (Fusilade)	In EPA;s restricted use category
Cypermethrin (Arrivo)	In EPA's restricted use category
Methamidophos (MTD)	In EPA's restricted use category
Terbufos (Counter)	In EPA's restricted use category
Alachlor	In EPA's restricted use category
Profenofos+Cypermethrin (Tamnbo)	No record of registration in U.S.
Chlorfluazuron (Jupiter)	No record of registration in U.S.

[1] Approved common name in the Pesticide Chemical News Guide (1988) and, in parenthesis, the trade name. A pesticide may have one or more trade names in addition to the trade name shown.

b. The basis for selection of the requested pesticides

EAP requested the pesticides on the basis of local availability in Honduras, effectiveness, and EAP and farmer experience with their use. All are presently widely used in Honduras for the uses proposed.

c. The extent to which the proposed pesticide use is part of an integrated pest management program

As its name implies, the U.S.A.I.D./Honduras Integrated Pest Management project emphasizes IPM. All uses of pesticides will be in IPM programs. EAP is a primary leader in IPM. Under its IPM programs being emphasized, the crops are regularly scouted for pests and the pests' natural enemies (predators, parasites, and pest disease agents) to determine damage and need for control. Pesticides are applied only when pest populations have exceeded unacceptable density levels and there is reasonable assurance that pesticide use will be profitable and nondisturbing to the environment. This approach often leads to a tremendous reduction in pesticide use.

EAP has developed and is demonstrating model IPM systems in all crops (maize, beans, and cabbage) to be emphasized in the project. The pesticides in Table 1 will be used only in the context of IPM programs for these crops.

d. The proposed method or methods of application, including availability of appropriate application and safety equipment

Most of the pesticides will be dispensed by hand-held application equipment. Small backpack sprayers will be the most common means for application.

Metaldehyde is a molluscicide bait that will be used to control slug pests of beans. The pelleted bait formulation will be applied to the soil surface and not to the bean plants.

The research project will provide and enforce the use of appropriate protective devices and clothing - face masks, gloves, boots, and coveralls - for project personnel who apply pesticides. It is the project manager's responsibility to see that the 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 Government of Honduras, and include the names of pests for which the use is intended.

Pesticides should be stored in their original containers in locations specifically designated for storage. The storage 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 not 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 not be used, since 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 vertical 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.

All farmers participating in the IPM demonstrations that include pesticides will receive special training on pesticide use — including correct application, safety, storage, and disposal.

e. Any acute and long-term toxicological hazards, either human or environmental, associated with the proposed use and measures available to minimize such 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 examining its LD_{50} value which is the amount of the chemical necessary to kill 50% of the test animal population (usually laboratory rats). The LD_{50} 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.

Table 1 shows the acute oral LD_{50} (mg/kg) of pesticides recommended for the project. Acute oral toxicity results from a severe case of poisoning due to a single dose of exposure to the pesticide.

Pesticides with the lowest LD_{50} value are potentially the most toxic to humans. Ingestion of just a few drops to a teaspoon of a pesticide with an oral LD_{50} 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 LD_{50} of 5,000 before dying. However, the pesticide's formulation, percentage active ingredient, and other factors determine its actual hazard level.

Table 1 includes the "toxicity category" and EPA "signal word" for pesticides recommended for the project. The pesticides are in toxicity category III (signal word: Caution) or II (signal word: Warning). Table 3 shows the hazard indicators and toxicity criteria used to establish the toxicity categories.

It is impossible to predict exactly what effects can result from long-term repeated exposures, to even the least hazardous pesticides. The most common — and hazardous — form of exposure results during mixing and applying and when entering or working in treated areas soon after application. If proper protective clothing is worn and safety equipment used, the amount of exposure will be greatly reduced. The pesticides' labels provide safety and emergency guideline and therefore must be followed closely.

Table 3. Criteria Used to Establish Pesticide Toxicity Categories (EPA Signal Words Appear Below Category Numbers)

Hazard Indicators	Category I Danger	Category II Warning	Category III Caution	Category IV Caution
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

The proposed pesticides are generally nonpersistent and, if used in accordance with their labels, are not supposed to cause significant long-term environmental hazards. The pesticides' labels provide environmental guidelines that must be followed closely. (Section g. below provides additional discussion on environmental effects.)

f. The effectiveness of the requested pesticides for the proposed uses

EAP has had considerable experience evaluating all of the requested pesticides and has determined them to be effective for the proposed uses.

g. Compatibility of the proposed pesticides with target and nontarget organisms

Honduras has an exceptionally diverse native flora and fauna that include a mix of temperate and tropical species. In addition, the country is the temporary home of many migrating species, including the white-winged dove and green turtle (Chelonia mydas). Animal species include 112 mammals, over 700 birds, and 196 reptiles and amphibians. Numerous species are considered to be in danger of extinction. Habitat destruction, especially in the rain forest, and overhunting represent the major threat to these species (from Honduras Country Environmental Profile, A Field Study, 1982. Prepared by JRB Associates, McLean, Virginia, A.I.D. Contract No. A.I.D./SOD/PDC-C-0247).

The proposed pesticides are generally non-persistent and, if used correctly and according to their labels, are not supposed to present 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 could have harmful effects. Also, some problems are unavoidable when pesticides are used. Adverse effects are reduced 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.

Most proposed 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 pests always exists.

h. The conditions under which the pesticides are to be used, including climate, flora, fauna, geography, hydrology, and soils

Information presented here was condensed from Honduras Country Environmental Profile, A Field Study, 1982, cited above.

Honduras' landforms can easily be distinguished as the Caribbean lowlands, interior uplands, and Pacific lowlands (Figure 1).

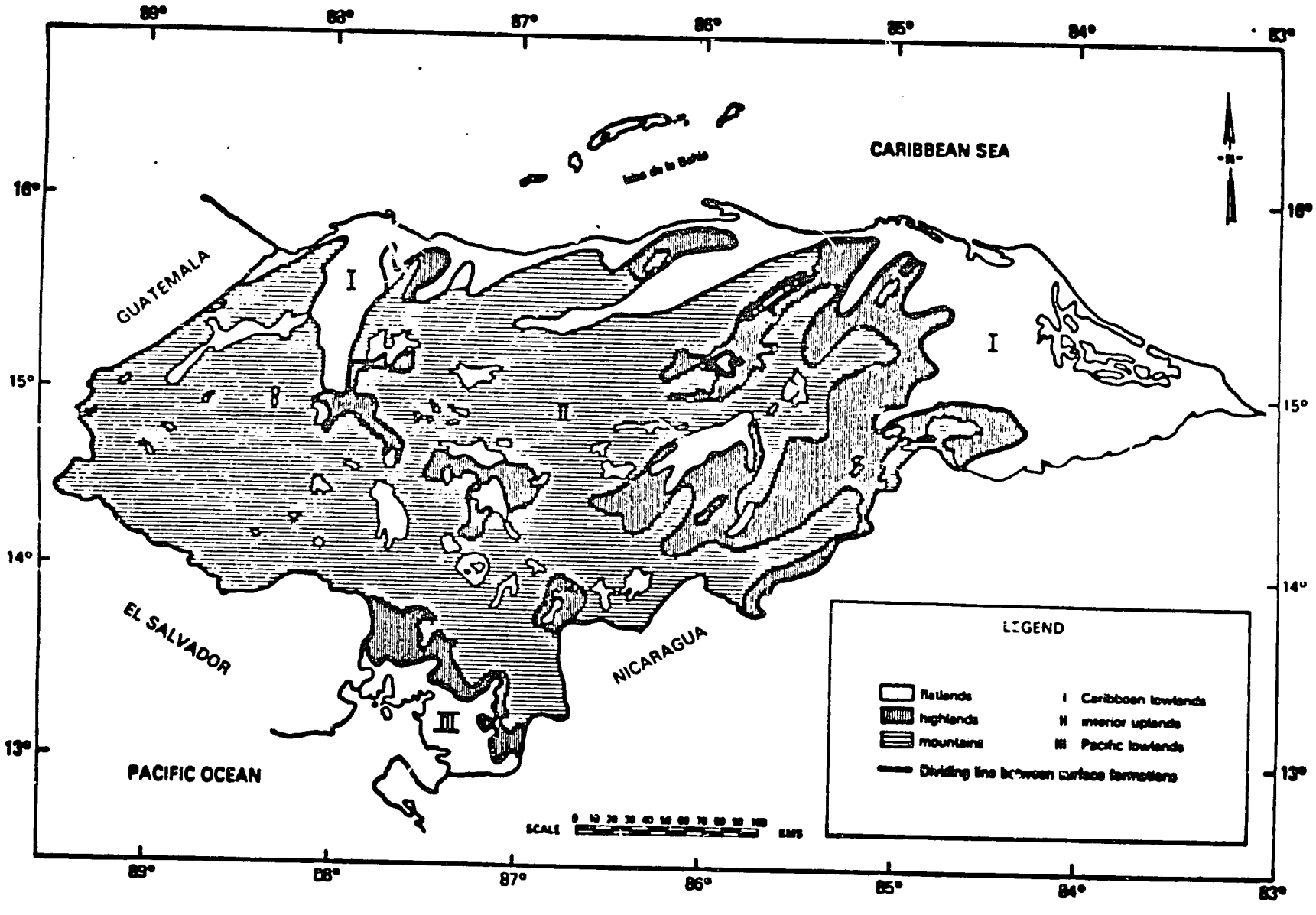

Figure 1. Landforms of Honduras (From Honduras Country Environmental Profile, A Field Study, 1982)

The Caribbean lowlands account for 16.4% of the national territory and along with the 20 major river valleys that connect to the three coastal plains represent the best soils of Honduras.

Highlands of the interior represent 81.7% of Honduran territory. The highlands consist of mountains greater than 600 meters in height (78.9%), hills 150-600 meters (14.9%), and plains at or near sea level (6.2%).

The Pacific lowlands account for only 1.9% of the national territory.

Zamorano valley, where EAP is located, is in the interior uplands. Intensive production of vegetables and other crops are found in the valley.

The Caribbean coast receives more than 2,400 millimeters of rain annually. Precipitation decreases in the interior uplands with less than 1,000 millimeters recorded annually in the interior highlands. The Pacific lowlands, while wetter than the interior uplands, are drier (400-2,200 millimeters/year) than the Caribbean lowlands.

Temperatures are related primarily to elevation. Coastal lowlands below 500 meters have mean annual temperatures of 26-28 degrees Celsius. Mountain basins 500-2,000 meters have mean annual temperatures of 16-24 degrees Celsius. Zones above 2,100 meters have annual means as low as 14-15 degrees Celsius.

Honduras represents an important link in the transition between neoartic and neotropical plants and animals. The lowland tropical rain forests of southern Central America become constricted and discontinuous in northern and eastern Honduras and form the first natural filter to northern expansion of rain forest biotic north of Panama. Tropical plant and animal species are often found in juxtaposition with those of more temperate climates.

Figure 2 shows the country's major habitat zones.

Honduras' natural resources are not being managed effectively. Hardwood and pine forests are rapidly depleting, soil erosion is rampart, dozens of plant and animal species are imminently endangered, and aquatic systems are increasingly polluted. The growing population is putting greater pressure on the environment. The influx of large numbers of refugees from El Salvador and Nicaragua has added to the problem.

The Honduras Country Environmental Profile, A Field Study, 1982 recommended several actions to retard further environmental deterioration brought on by agricultural practices. One recommendation was to promote IPM strategies, such as the U.S.A.I.D./Honduras project is emphasizing.

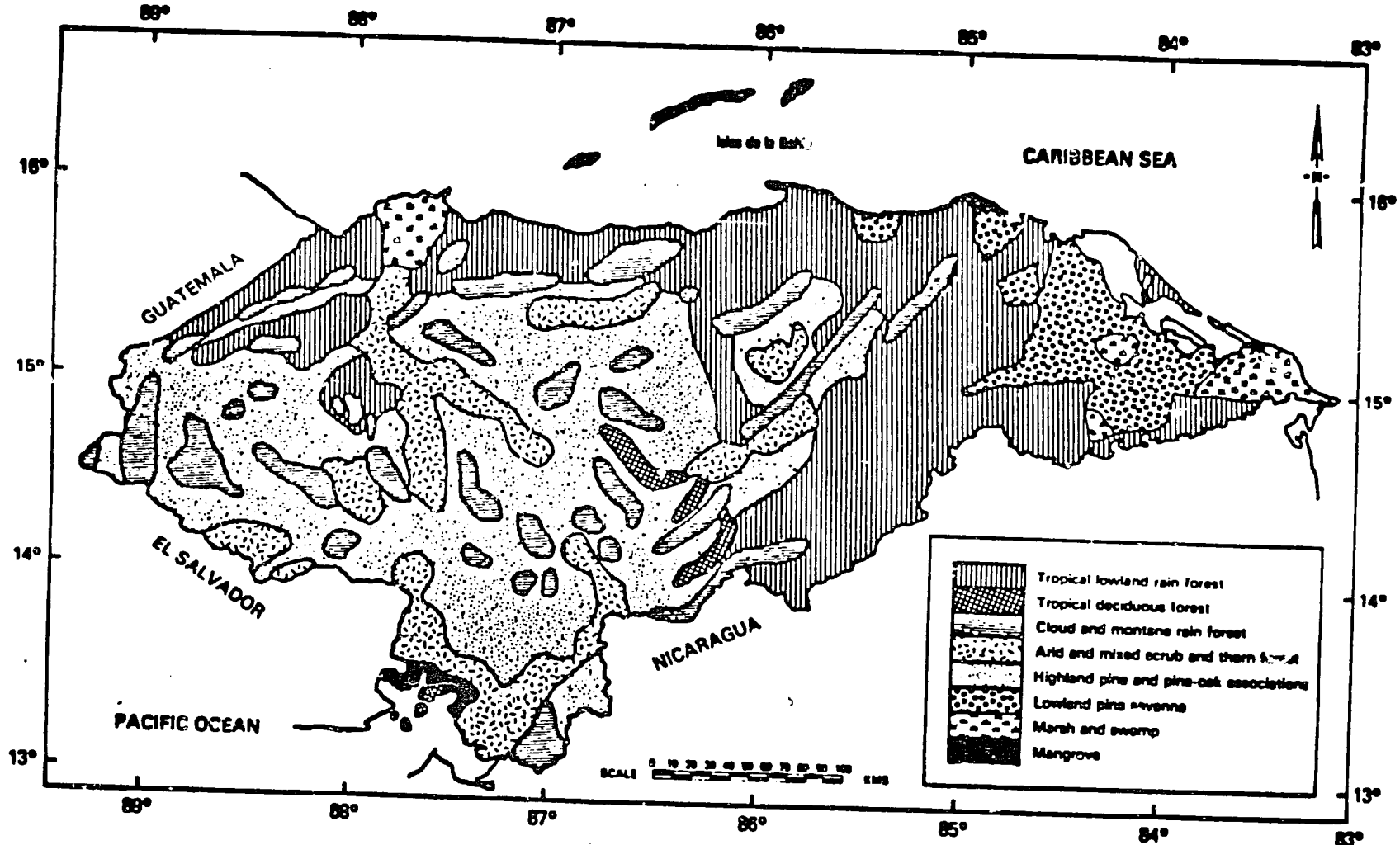

Figure 2. Major Habitats in Honduras (from Honduras Country Environmental Profile, A Field Study, 1982. After B. Monroe, A Distributional Survey of the Birds of Honduras, 1968, Ornithological Monographs No. 7, The American Ornithological Union).

i. The 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 Honduras.

The project is emphasizing a range of nonchemical control methods, used in combination with and without pesticides. As noted below, biological control is receiving major emphasis.

j. The requesting country's ability to regulate or control the distribution, storage, use, and disposal of the requested pesticides.

Honduras' pesticide law ("Reglamento de Registro, Importación, Elaboración, Almacenamiento, Transporte, Venta and Uso de Plaguicidas — Law No. 318, November 3, 1980) was established in 1980. It provides for the control of the registration, importation, manufacture, storage, transportation, sale, and use of pesticides. However, the Government of Honduras is presently not capable of adequately enforcing the law.

EAP, on the other hand, is in an excellent position to enforce requirements of this EA and provisions for pesticide training and monitoring (see below).

k. The provisiors made for training of users and applicators

EAP has an excellent program in IPM training that includes emphasis on correct pesticide use and safety for farmers and others. All of the project personnel at EAP have been - or will be - trained on the correct use and safe handling of pesticides. Further, all of the participating farmers will receive training appropriate to their educational level, cultural background, and experience with pesticide use.

The project manager will be responsible for seeing that all project personnel and participating farmers have been trained properly before being allowed to use any pesticides in the project. EAP will conduct all of the training.

l. The provisions made for monitoring the use and effectiveness of the pesticides

EAP has an excellent new pesticide use and efficacy center. Its objective is to develop reliable data on pesticide use and efficacy for distribution to farmers, farmer organizations, government officials, students, and agribusiness. The center is ideally situated to monitor pesticide use, changes in pesticide efficacy (due to pest resistance or other reasons), and health and environmental impacts, and pesticide residues on treated crops.

The project manager will develop and enforce a plan that includes monitoring of the following:

* Safe use practices of project personnel and participating farmers

* Pesticide efficacy

* Potential environmental impacts resulting from pesticide use. Special attention will be given to changes in populations of natural enemies and honey bees in treated areas.

The project manager will be responsible for immediately correcting any unsafe practices detected by monitoring.

ISSUE NO. 2: IPM TECHNOLOGY GENERATION AND TRANSFER

EAP has had a major impact in transferring improved IPM technology to Honduran farmers. The institution has received wide scale attention for successfully developing, validating, and extending to farmers IPM programs in maize, beans, and cabbage to be emphasized in the present project. The EAP outreach program includes the following components:

* Diagnosis of plant protection problems (pests, incorrect use of pesticides) on farmers' fields

* Pesticide monitoring

* Farming systems research and documentation to test and identify cost-effective and environmentally sound techniques in plant protection

* Developing and validating improved extension procedures for plant protection

* Developing and validating improved plant protection teaching materials for use in agricultural high schools, vocational schools, and universities and training teachers to use the materials.

IPM experts in Central America and many in the U.S. who have observed the EAP outreach program in IPM consider it the best in Latin America and one of the best in developing countries. It is structured to reduce pesticide use, increase use of nonchemical pest control techniques, and strengthen farmers' ability to execute economically sound and environmentally safe plant protection.

As noted, EAP has an excellent on-going program in training that emphasizes correct and safe use of pesticides. Further, it is ideally situated to carry out pesticide monitoring and other pesticide management tasks.

ISSUE NO. 3: USE OF BIOLOGICAL CONTROL AGENTS

EAP Biological Control Center and Plans

Biological control involves the use of predators, parasites, and pathogens for suppressing pest populations. It is a natural phenomenon that, when applied successfully, provides a permanent, harmonious, and economical solution to many pest problems. With the increasing problems caused by misuse of pesticides, biological control is being more closely investigated for combating many pests. There are many examples of spectacularly success programs utilizing natural enemies for control of pests of fruits, vegetables, and agronomic crops.

Classical biological control, which involves the introduction of new natural enemies against pests of foreign origin, has been highly effective. The cottony cushion scale, Icerva purchasi, a formerly severe pest of citrus, has been controlled in over 80 countries through the introduction of the vedalia beetle, Rodolia cardinalis. Populations of the diamondback moth, Plutella xylostella, an important pest of cabbage, have been controlled with a complex of introduced parasitic wasps. In Latin America, importations of Eretmocerus serius reduced infestation levels of the citrus blackfly, Aleurocanthus woglumi, to below economically damaging levels. Parasites of the sugarcane borer, Diatraea saccharalis, released in Brazil, Mexico, and Cuba lowered damage levels to less than 5%, well below the economic threshold. Exemplary classical biological control of weeds

programs include Opuntia cactus in Australia, St. Johnsworth in California, and water hyacinth worldwide.

Private enterprises in Mexico, Colombia, and Venezuela have been established and are successfully rearing large numbers of native parasites and predators such as Trichogramma spp. and Chrysoparla spp. in small insectaries for sale and distribution to farmers.

Sustainable agriculture experts point out correctly that the enhancement of native biological control agents as well as selective importation and establishment of exotic natural enemies of both native and pests of foreign origins are among the best tactics available to provide permanent, environmentally sound, and economical solutions to insect pests and certain weeds without jeopardizing the natural resource base. Biological control, when successful, is cost effective especially considering that whatever costs are involved in its establishment are compensated by selfperpetuating, permanent control agents.

EAP has recently constructed a major new center in biological control which is unique to Central America.

Seven 6.25m^2 (67ft^2) rooms are available for rearing predators and parasites of insects and natural enemies of weeds. The EAP's altitude (820m) and latitude (14°N) make year round rearing very easy. The rearing and quarantine rooms are well equipped with window space for maximum exposure to natural light conditions and for observation by students and

visitors. A centrally located diet-mixing room is used to prepare and mix artificial media for the various host cultures.

Five 6.25m^2 rooms are designated for production of insect and weed disease agents. These facilities are separated from the predator and parasite rearing rooms in order to prevent contamination of the latter. Maintenance in the two sections is performed by separate production staff. As with the predator and parasite rearing rooms, ample window space allows students and visitors to observe all activities carried out in the rooms.

Besides being used for natural enemy colony maintenance, the spacious laboratory in the biological control center will be utilized by EAP staff, EAP students, and graduate students from U.S., European, and Latin American universities for conducting research on biological control. Laboratory experiments and processing of field-collected samples will be conducted in the laboratory. Moreover, the laboratory will be used to conduct exercises for the biocontrol course taught at EAP and for training extensionists, agricultural development workers, and short course participants.

The center may also serve as a research base for foreign scientists in search of potential biological control agents of pest species native to Central America which might be introduced into other regions of the world. These foreign explorers can carry out basic life history studies and evaluate candidates for shipment to other countries. Cooperative programs are already underway with the Commonwealth Agricultural Bureaux International and U.S. Department of Agriculture (USDA). Other

collaborative projects are being negotiated. Close association is also maintained with national ministries of agriculture and international projects working in Central America.

The center is conveniently located near complementary facilities. The agroecological inventory center provides critical information concerning natural enemy guilds, plus distribution, seasonality, host range, and systematics of pests and natural enemies. The pesticide efficacy and use center supplies data on pesticide toxicity to and pesticide resistance of natural enemies.

The center's quarantine room will be used to process exotic natural enemies from other regions of the world for introduction into Honduras. A tentative list of target pests that might be controlled by exotic natural enemies along with the proposed natural enemies appear in Table 4.

Numerous biological control experts were consulted for assistance in developing the list in Table 4. They agreed that the importation and release of the natural enemies promises to provide permanent, inexpensive, and environmentally safe alternatives to chemical control of those pests in the table.

Table 4. Biological Control Candidates and Their Natural Enemies Already Identified for Importation and Release.

	Pest	Crop	Natural Enemy
1.	Diamondback moth	cabbage	Cotesia plutellae Tetrastichus sokolowski
2.	Fall armyworm	maize, rice, sorghum	Telenomus remus
3.	Coffee bean borer	coffee	Prorops nasuta Heterospilus coffeicola Cephalonomia stephanoderes
4.	Stem borers	sugarcane, maize, sorghum	Cotesia flavipes Lixophaga diatraeac
5.	Water hyacinth	(aquatic weed)	Neochetina bruchi Neochetina eichornia
6.	Empoasca spp.	legumes	Gonatocerus spp.
7.	Mexican bean beetle	legumes	Pediobius foveolatus
8.	Rufous scale	citrus	Aphytis roseni
9.	Snow scale	citrus	Aphytis lignanensis Telsemia spp.
10.	Purple scale	citrus	Aphytis lepidosaphes
11.	Florida red scale	citrus	Aphytis holoxanthus
12.	Coconut scale	coconut	Cryptognatha nodiceps
13.	Cotton leaf perforator	cotton	Sympiesis spp.
14.	Fruit flies	citrus, mango, guava	Biosteres sp. Aceratoneuromyia indica
15.	Slugs	legumes	Antichaeta spp.*
16.	Southern green stink bug	legumes	Trissolcus basalis
17.	Banana weevil	bananas, plantains	Plaesius javanus
18.	Palm weevil	palms	Sarcophaga nonata Paratheresia rhynchophreae
19.	Kissing bugs	human disease vectors	Telenomus costalimai Telenomus fariai
20.	Citrus aphids	citrus	*
21.	Itch grass	(weed)	fungus
22.	Purple nutsedge	(weed)	Puccinia canaliculata

* Exploration needed

Potential Hazards

The routine introduction of natural enemies from foreign countries does have potential hazards. Noxious species, such as a foreign pest, may accidentally arrive in the same shipping parcel with the desired natural enemy. In addition, it is possible for the shipments of beneficial parasitic insects to contain certain hyperparasite species (insects which are parasitic in or on another parasitic insect), or species that attack not the pests at which targeted but instead nontarget organisms. The accidental introduction of any of these unwanted species could result in the establishment of a new pest in the target area, or of a hyperparasite that may interfere with the effective biological species already established or the one to be colonized.

Therefore, the U.S. and other countries have strict laws and quarantine procedures to guard against introductions of the unwanted organisms. Introductions of exotic natural enemies are allowed only by permit, and then only to a those very few authorized quarantine facilities. To protect against potential problems, the shipments must go through thorough scrutiny in the authorized facilities and found to be safe before the exotic natural enemies can be liberated.

The following minimal steps are followed in the quarantine facility:

* Rearing organisms in the shipments and separating them by species

* Careful taxonomic studies to determine correct identification of the species and/or strains

* Destruction of any remaining host specimens and plant material

* Culture of recovered beneficial natural enemies on locally derived pests

* Determining culture requirements and life cycle characteristics of the beneficial species

* Host suitability studies to ascertain that the introduced natural enemies will attack only the targeted pests.

Only when all individuals of the species have been identified, transferred to a local host, and reared in pure culture (therefore ensuring against hyperparasites or plant pathogens) are they allowed to be removed from quarantine. The procedures often take several years, but they are essential.

Because of the stringent security required in their operation, quarantine laboratories are restricted to access. Very heavy security is required, and only authorized quarantine experts are allowed entry.

Security Requirements at EAP Quarantine Facility

The EAP biological control facility consists of a tightly secure quarantine room that will be used only to process the exotic natural enemy introductions. The quarantine facility was designed in consultation with leading authorities in biological control at USDA, CAB International's Institute of Biological Control (CIBC), and University of Florida. The facility is made of earthquake-proof material, its windows are fixed and double pane, entry is accessed through double doors (kept locked) with a barrier vestibule between them, and only authorized personnel are allowed entry. It was patterned after U.S. biological control quarantine facilities. However, the facility has not been officially endorsed by USDA or CIBC, which is advisable. Also, EAP has not developed operational procedures endorsed by USDA or CIBC showing what steps will be taken to ensure against accidental or other unwanted releases in the Honduran environment.

Before any exotic natural enemies are imported to the EAP quarantine facility, EAP should receive a written endorsement from USDA or CIBC indicating that the quarantine facility is adequately secure. If found to be inadequate, requirements needed to make it secure should be specified; EAP then should take steps to meet the requirements before importing any exotic natural enemy to the facility. Also, before any exotic natural enemy is imported, EAP should develop a USDA or CIBC approved plan of operational procedures showing what steps will be taken to ensure against accidental or other unwanted introductions into the Honduran environment.

Finally, EAP should ensure that introduction of exotic natural enemies does not conflict with Section 119, Part (g)(10) requirements discussed below.

SUMMARY OF MITIGATIVE MEASURES AND COSTS

The project manager will be responsible for implementing all of the mitigative measures, summarized here:

1. Use Only AID Approved Pesticides

EAP will use only the pesticides recommended in the EA for those uses specified (see Environmental Procedures, a., above). AID must approve any additional uses of these or uses of other pesticides. EAP should regularly monitor EPA registration status of the recommended pesticides. A pesticide use recommended here but later suspended, cancelled, or restricted by EPA must be stopped immediately.

2. Provide Pesticide Training and Safety Devices to Project Personnel and Participating Farmers

EAP will provide pesticide training to all project personnel and participating farmers using pesticides in the project. The training will address correct application, storage, transportation, disposal, worker and applicator protection, and environmental safety (see Environmental Procedures, d. and k. above).

EAP will provide project personnel and participating farmers pesticide safety devices and enforce their use. The safety devices and procedures should comply with recommendations appearing on the pesticide manufacturers' label (see Environmental Procedures, d. and k. above).

3. Comply with Special Requirements for Benomyl and Metaldehyde

The special labeling requirements for Metaldehyde and use requirements for Benomyl should be enforced (see Environmental Procedures, d. above).

4. Monitor Pesticide Use

EAP should regularly monitor project use of pesticides on farmers' fields, demonstration sites, and other locations. Any unsafe practice that would endanger humans, livestock, pets, or the environment should be stopped immediately (see Environmental Procedures, 1. above).

5. Ensure Safe Handling of Biological Control Agents

Before any exotic natural enemies are imported to the EAP quarantine facility, EAP should receive a written endorsement from USDA or CIBC indicating that the quarantine facility is adequately secure. If found to be inadequate, requirements needed to make it secure should be specified; EAP then should take steps to meet the requirements before any introduced natural enemy is imported to the facility. Also, before any exotic natural

enemy is imported, EAP should develop a USDA or CIBC approved plan of operational procedures showing what steps will be taken to ensure against accidental or other unwanted introductions into the Honduran environment (see Issue No. 3: Use of Biological Control Agents, above).

Finally, EAP should ensure that introductions of exotic natural enemies do not conflict with Section 119, Part (g)(10) requirements discussed below.

Cost Requirements

Cost to implement the five mitigative measures are shown in Table 5. According to U.S.A.I.D./Honduras and EAP personnel, these costs were contemplated and included in the original grant budget from U.S.A.I.D./ Honduras.

SECTION 119 REQUIREMENTS

Section 119, Part (g)(10), of the Foreign Assistance Act requires that AID "deny any direct or indirect assistance under this chapter for actions which significantly degrade national parks or similar protected areas or introduce exotic plants or animals into such areas."

The project manager will be responsible for ensuring that provisions of Section 119, Part (g)(10), are met. Before any exotic natural enemies are released in Honduras, he will notify Honduras authorities in charge of the

national parks or similar protected areas of the planned releases. Releases will not be made without permission of the authorities. No releases will be made within or near the parks or similar protected areas.

Table 5. Costs to Implement Mitigative Measures.

1. Monitoring EPA registration status		$ 1,000
2. Training		
Technicians		1,000
Farmers		2,000
3. Labelling		150
4. Monitor farmer use of pesticides		6,000
5. USDA/CIBC written endorsement of EAP Quarantine facility USDA round trip to Honduras		850
	TOTAL	$11,000