Environmental and Social Management Framework for the Integrated Transboundary Ridge-to-Reef Management of the Mesoamerican Reef System project

Contents

Terms and Acronyms Used in this Report iii
Introduction 1
Institutional Framework 2
  Budgetary Arrangements 3
The Meso-American Reef Ecoregion 4
Legal Frameworks 6
Classification of Projects 7
Scoping 8
Priority Watersheds 10
Site Selection 10
General Features of the Mesoamerican Landscape 11
Descriptions of Priority Watersheds 12
  Belize River 12
  Río Hondo 14
  Río Motagua 16
  Yucatan Peninsula 19
  Río Chamelecón 20
  Río Ulúa 22
Natural Vegetation in Mesoamerica 23
Fauna of Mesoamerica 25
Protected Areas in Mesoamerica 26
Agriculture and livestock in Mesoamerica. 28
Indigenous People in Mesoamerica 31
Possible Interventions in the Mesoamerican Reef Ecoregion 32
Pest Management 37
Social Impacts 38
  Resettlement 38
  Indigenous People 40
  Grievance Procedures 43
Negative List 43
Summary and Conclusions 45

Annex 1 – Laws, regulations and international agreements 47
Annex 2 – Decision Tool for Screening 48
Annex 3: Northern Mesoamerica's Globally Critically Endangered Species 49

Terms and Acronyms Used in this Report

ASC	Aquaculture Stewardship Council
BOD	Biological Oxygen Demand
CBS	Community Baboon Sanctuary, Belize
CCAD	Comisión Centroamericana de Ambiente y Desarrollo (CCAD) [Central American Commission for Environment and Development]
CCAW	Conservation of Central American Watersheds (USAID)
CIAT	International Center for Tropical Agriculture - Centro Internacional para Agricultura Tropical
CITES	Convention on International Trade in Endangered Species
CNPLH	National Center for Clean Production (Honduras) Centro Nacional para la Producción Limpia de Honduras
COAPALMA	Rural Agroindustrial Company for Agrarian Reform for Oil Palm (Honduras) Empresa Campesina Agroindustrial de la Reforma Agraria de la Palma de Aceite
COD	Chemical Oxygen Demand
CONAP	National Council on Protected Areas (Guatemala)
DUMAC	Ducks Unlimited of Mexico
Equator Principles	A risk management framework, adopted by financial institutions, for . . . managing environmental and social risks in projects . . . intended to. . . support investment decision-making.
ESIA	Environmental and Social Impact Assessment
ESMF	Environmental and Social Management Framework
ESMP	Environmental and Social Management Plan
FAO	Food and Agriculture Organization of the United Nations
FCG	Foundation for the Conservation of Natural Resources and Environment in Guatemala. Fundación para la Conservación de los Recursos Naturales y Ambiente en Guatemala .
FENAPALMAH	Federation of Oil Palm Producers of Honduras
FPIC	Free, Prior and Informed Consent
GEF	Global Environmental Facility
GMO	Genetically modified organism
HONDUPALMA	Oil Palms of Honduras - Palmas Aceiteras de Honduras
IARNA	Instituto de Investigación y Proyección sobre Ambiente Natural y Sociedad, Universidad Rafael Landívar, Guatemala
IADB	InterAmerican Development Bank
IFC	International Finance Corporation (World Bank Group)
Indigenous People	People who fulfill the criteria for indigenous groups as stated in WWF Policies and Procedures
INEGI	National Statistics and Geography Institute (Mexico) Instituto Nacional de Estadística y Geografía
Intervention	Concrete activity aimed at achieving project goals
IPM	Integrated Pest Management
IUCN	International Union for the Conservation of Nature (= UICN en Español)

KPI	Key Performance Indicator
M&E	Monitoring and Evaluation
MAR2R	Ridge-to-Reef Management
Masl	Meters above sea level
MBR	Maya Biosphere Reserve (Guatemala)
Mitigating Measures	Measures aimed at reducing adverse impacts that may be caused by project interventions.
PAH	Polycyclic aromatic hydrocarbon
PCB	Polychlorinated biphenyl
PCDD-F	Polychlorobenzodioxins (dioxins)
PMP	Pest Management Plan
POME	Palm Oil Mill Effluent
PPE	Personal Protective Equipment
Precautionary Principle	The introduction of a new product or process whose ultimate effects are disputed or unknown should be resisted. It has mainly been used to prohibit the importation of genetically modified organisms and food.
PRODOC	Project Document
PRONAGRO	National Program for Agro-Alimentary Development (Honduras) Programa Nacional de Desarrollo Agroalimentario
PRONATURA	Pro-Nature Program - Programa para la Naturaleza
RAP	Resettlement and Land Acquisition Action Plan
RBCMA	Río Bravo Conservation and Management Area (RBCMA Belize)
Red List	A list maintained by IUCN that provides taxonomic, conservation status, and distribution information on taxa that are facing a risk of global extinction
REDD	Reduction of Deforestation and Degradation, a Program adopted by the Conference of the Parties of the United Nations Framework Convention on Climate Change
RPBR	Río Platano Biosphere Reserve (Honduras)
RSPO	Roundtable for Sustainable Palm Oil
SAG	Secretaría de Agricultura y Ganadería (Honduras)
Scoping	A preliminary step aimed at identifying key issues for ESIA
SERNA	Secretaria de Medio Ambiente y Recursos Naturais (Honduras)
SIATL	Flow Simulator in Hydraulic Basins (INEGI) Simulador de Flujos de Agua de Cuencas Hidrográficas
Stakeholders	Persons and groups that have some stake or interest in the project including potential beneficiaries, others affected by the project, government officials, civil society organizations, scientists and other experts with relevant knowledge and experience.
STD	Sexually Transmitted Disease
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNESCO	United Nations Educational, Scientific and Cultural Organization
USAID	United States Agency for International Development
WHO	World Health Organization
WWF	World Wildlife Fund

Introduction

The objective of an Environmental and Social Management Framework (ESMF) is to establish the parameters for an Environmental and Social analysis of a project when the exact nature and location of the project activities are unknown. The following is an ESMF for the Integrated Ridge–to-Reef Management of the Mesoamerican Reef (MAR2R) implemented by the Central American Commission on Environment and Development (CCAD) under a grant from the Global Environmental Facility (GEF) administered by the World Wildlife Fund (WWF).

The objective of the MAR2R as stated in the project document (PRODOC) is

> "The project goal is to contribute to the conservation and sustainable use of shared freshwater, coastal and marine resources of the transboundary MAR Eco region by implementing the ridge-to-reef approach and hence securing sustainable economic benefits and livelihoods for the countries and their communities."
>
> The project will achieve this by 1) strengthening regional capacity and collaboration between the four MAR countries through CCAD and create a favorable political and regulatory harmonized framework, including regional demonstration programs of collaboration and the necessary tools and instruments for monitoring and evaluation (M&E) for decision making; 2) building regional, national, and local capacity for a scaled-up ridge-to-reef integrated management in the MAR; and 3) engage multiple stakeholders from the governments, communities, and the private sector in implementing sustainable management practices to reduce threats to the MAR.

The objective of the ESMF is to set out guidelines for the implementation of project activities that have a potential for a direct or indirect environmental or social impacts and to ensure that such impacts are properly identified, classified and that plans to mitigate any potential adverse impacts have been made. The basic approach of the ESMF follows WWF policy in "WWF Environmental and Social Safeguards Policies and Procedures." It is also informed by internationally recognized ESMF procedures required by such agencies as the World Bank, IFC, IADB, ADB and adherents to the Equator Principles.

It is important to emphasize the difference between an ESMF and an Environmental and Social Impact Assessment (ESIA). An ESIA is a procedure that begins with a screening exercise leading to assignment of environmental category (typically "A," "B" or "C") reflecting the magnitude of potential impact and the sensitivity of the environment. The ESIA is based on a detailed study that examines the proposed intervention in its geographical and social context, ascertains the type and magnitude of probable impacts and proposes measures *in the project* design to mitigate or eliminate adverse impacts. The ESIA also presents evidence that the proposed interventions have been disclosed to human populations or "stakeholders" in or near the targeted areas and these populations have had the opportunity to discuss the proposed project in culturally appropriate ways and to contribute to project design. In cases where indigenous peoples are likely to be affected, additional procedures are required by WWF including the *Free, Prior and Informed Consent* (FPIC) to the project by the affected group.

The ESIA also contains **Environmental and Social *Management Plans*** (**ESMPs**) that present (a) the specific mitigating actions to be taken, (b) the agencies or organizations responsible for such actions, (c) a timetable of actions, (d) a budget and (e) provision for monitoring and evaluation

(M&E) procedures to be followed. An ESIA is required for any intervention or activity classified as "A" or "B" (see below). The costs of implementing ESMPs should be included in the overall project budget.

An ESMF is done when the project design calls for unspecified interventions in areas not yet identified. An ESMF describes, in general terms, what is known about the proposed project, the area where interventions will occur and possible impacts of the interventions. The ESMF lays out the ***procedures*** for scoping, classifying, analyzing project activities, the mitigating measures and the design of management plans. The ESMF is tailored, to the extent possible, to the geographical and social context of the proposed project. In short, the ESMF provides the design for ESIA and ESMP. ***While an ESMF may be used to obtain project approval by the funding agency, it is not a substitute or alternative for ESIA which is required for each specific intervention planned and supported under the project.*** Accordingly, it is necessary to carry out an ESIA for each sub-project supported under the overall project classified as "A" or "B".

Institutional Framework

The lead agency coordinating the Project "Integrated Transboundary Ridge-to-Reef Management of the Mesoamerican Reef System" is the Central American Commission on Environment and Development (CCAD) an international body created at the Central American Summit held in Costa Rica, in December 1989 by the presidents of Costa Rica, El Salvador, Guatemala, Honduras and Nicaragua, who signed the Constitutive Agreement of the Central American Commission for Environment and Development (CCAD) under the umbrella of the Central American Integration System (SICA) headed by the Secretary General. The highest authority of CCAD is the Council of Ministers of Environment of the respective members. CCAD has a staff led by an Executive Secretary. Its scope of action concerns strengthening of the national authorities and regulations focusing particularly on:

-Harmonization of policies and legislations
-Distribution of information
-Determination of priority action areas
-Promotion of a participatory, democratic and decentralized environmental management.

Each of the four countries bordering the Mesoamerican reef has proposed one or more priority watersheds (see below) for the development of demonstration subprojects aimed at contributing to the health and sustainability of the Mesoamerican reef and its associated terrestrial and coastal ecosystems. There will be subprojects in several of the priority areas managed by "partner NGOs."

CCAD will be responsible for assuring that relevant safeguard issues are identified and the necessary steps taken. CCAD will push down the responsibility to the partner NGOs. The actual implementers of the subprojects (the NGO partners) are responsible for ensuring that relevant safeguard policies are identified and complied with. They would also be responsible for collecting relevant information (monitoring) and sending it to CCAD for review. It is essential that the NGO partners be properly trained regarding the safeguard policies that apply to their subprojects.

CCAD will actually propose the specific subprojects and will manage (coordinate) and monitor them from a central position; CCAD will not implement directly the activities in the field. Each partner NGO will need to have a focal point or responsible position within each subproject that liaises with CCAD collects information and reports to CCAD. All NGO partners will have a team that will be engaged in the specific sub-project under their responsibility and will be responsible to monitor each project in the field frequently. This is essential for the continuous monitoring of performance of agreed safeguard measures. CCAD will rely on the NGO partners for information while CCAD will make occasional visits to the field to supervise each subproject.

It will also be incumbent on CCAD/PMU to ensure that partner NGOs for each subproject are staffed by competent professionals who understand the policy framework and are able to implement the project under the overall policy framework established by the donor. Prior to implementation of any subproject, CCAD/PMU will assess the capacity of staff proposed in each NGO for each subproject and ensure that minimum standards are met. Where deficiencies are noted, CCAD/PMU would be responsible for organizing training to fill gaps in staff capacity. CCAD may also wish to contract with one or more qualified consultants experienced in safeguard issues to oversee safeguard preparations (ESMPs) and implementation.

Budgetary Arrangements

In a project of this scale, it is unlikely that full-time staff can be recruited for safeguard monitoring and compliance. However, the NGO focal points (mentioned above) and CCAD/PMU staff responsible for safeguard compliance and monitoring have an adequate amount of their time allocated to safeguard issues. The following table provides an outline for CCAD's budget. A similar format can be used for each participating NGO.

Table 1: Budget Outline for Safeguards

Staff	UNIT	Unit Cost (currency)	No. Units	Year 1	Year 2	Year 3	Total
Safeguards Specialist	Annual Salary	XXX	20%				
Consultant	Honorarium	YYYY	100				
Training							
Training Materials	Package	ZZZ		ZZZZ	ZZZZ	ZZZZ	
Venue & Food	Unit	AAA		AAA	AAA	AAA	
Participant Costs	Unit	BBB		BBB	BBB	BBB	
Travel							
Trainee Travel	Round trip	CCC	4	CCC	CCC	CCC	
Supervision Travel	Round trip	DDD	5	DDD	DDD	DDD	
Per diems	Unit	EEE	15	EEE	EEE	EEE	
						TOTAL	

The Meso-American Reef Ecoregion

The Mesoamerican Reef Eco region (or MAR) encompasses the second largest barrier reef in the world and more than 400 watersheds. The Mesoamerican Reef extends along the coastline over 1,000 km from the northeastern tip of the Yucatan peninsula southward to the seacoast of Belize, Guatemala and Honduras (Map 1). Part of the reef system on the coast of Belize is inscribed as a UNESCO World Heritage Site[1]. The reef is the repository of some of the world's most treasured marine life including coral reefs, myriad fish species, and invertebrate fauna. It is also a major tourist attraction because of the beautiful beaches that line the shore and the opportunities for snorkeling and scuba diving. The watersheds beginning at the ridgeline on terra firme and extending to the coast, are part of the MAR Eco region. These watersheds comprise a rich mosaic of natural and altered habitats ranging virtually untouched areas to entirely man-made habitats such as urban environments. There are also rich cultural resources along the coast including the ruins of Mayan Civilization and its forerunners.

Unfortunately, the health and ultimately the survival of the reef are at risk due to a broad range of threats, most of them man-made. Some of them are direct impacts on the reefs caused by fishing (especially bottom trawling), dive tourism and the introduction of invasive species (e.g. the lion fish). Many – perhaps most – of the threats to the MAR are land-based (Table 1), a fact that is increasingly recognized by conservation organizations and governments, hence the adoption of an integrated ridge-to-reef approach. The term "Ridge-to-reef" or R2R has come into use to reflect the understanding that land-based as well as maritime conditions comprise an integrated system the operation of which is only partly understood by science.

Table 1 illustrates the range of threats to coral reef stability and health from man-made activities. Only some of these risks are addressed by the MAR2R project but all are listed to illustrate the full range of threats to the Mesoamerican reef and associated ecosystems (mangroves, wetlands, rivers, etc.).

Table 2 – Threats to Coral Reef Health and Stability

Threat	Land/ Sea-Based	Mechanism of Reef Degradation Affecting Reef
Climate Change	L	Rising sea temperatures cause the death of corals and bleaching of reef.
Urban Waste (L)	L	Cities and towns along the coast and inland may dispose of wastes through outfalls into rivers or directly into the ocean. Phosphates and other nutrients lead to hyper nutrition causing algae blooms that attack corals. Other compounds contained in urban wastes (PAHs, PCBs, PCDD-Fs) may be toxic to corals and other living organisms.
Agricultural Runoff (L)	L	Sediments from plowed fields Fertilizers (particularly phosphates) and

[1] Belize Barrier Reef Reserve System (BBRRS), inscribed as a UNESCO World Heritage Site in 1996, is comprised of seven protected areas; Bacalar Chico National Park and Marine Reserve, Blue Hole Natural Monument, Half Moon Caye Natural Monument, South Water Caye Marine Reserve, Glover's Reef Marine Reserve, Laughing Bird Caye National Park and Sapodilla Cayes Marine Reserve. The largest reef complex in the Atlantic-Caribbean region it represents the second largest reef system in the world. The seven protected areas that constitute the BBRRS comprise 12% of the entire [Mesoamerican] Reef Complex. (http://whc.unesco.org/en/list/764)

Threat	Land/ Sea-Based	Mechanism of Reef Degradation Affecting Reef
		other agrochemicals improperly applied drain into streams and rivers flowing into the oceans affecting reefs.
Aquaculture	L	Organic waste, chemicals and antibiotics from shrimp farms can pollute groundwater or coastal estuaries. Salt from the ponds can also seep into the groundwater and onto agricultural land.
Oil Palm Plantations and Processing Mills	L	Oil palm has displaced forest and taken land traditionally used by smallholders and indigenous groups. Waste from palm-fruit processing is often allowed to flow into rivers. Palm Oil Mill Effluent (POME) is a thick, brownish, acidic liquid containing high amounts of total solids, oil and grease, COD and BOD. It is estimated to be 100 times as polluting as domestic sewage.[2]
Dive Tourism	S	Divers congregate around favorite dive sites sometimes collecting pieces of coral, discarding wastes. Dive boats cause damage by dropping anchor onto fragile reefs.
Mining	L	Mining of minerals sand and landfill causes erosion and runoff of sediments.
Oil Spills	L & S	Shipping, drilling platforms and shore-based facilities may leak oil into coastal waters. Even small amounts of oil can kill corals; impede their reproduction and growth.
Erosion and Sedimentation	L	Sediment run-off and deposition on coral reefs can significantly impact coral health by blocking light and inhibiting photosynthesis, directly smothering and abrading coral, and triggering increases in macro algae. (http://coralreefs.wr.usgs.gov/sediment.html)
Industrial Effluents	L	Toxic chemical effluents from industrial and agro-industrial facilities can kill or impede development of corals.
Overfishing	L & S	Excessive fishing pressure and certain fishing technologies such as dragnets can have adverse impacts on coral reefs.
Tourism Development	L	Extensive tourism development such as beachfront hotels can result in untreated sewage effluents, dive tourism,
Invasive Species	S	Species introduced from other regions such as the lionfish may predate on or crowd out local species.
Deforestation	L	Removal of the vegetative cover increases erosion and sedimentation of reefs.
Infrastructure	L	Construction of roads, bridges, pipelines, buildings, etc. Causes sediment runoff especially when adequate drainage is not installed.
Plastic Debris	L	Plastic debris can smother corals, may be ingested by fish and can alter the water chemistry.
Ocean acidification	L & S	Release of CO2 into the atmosphere increases acidity of seawater damaging coral reefs.

The approach of the MAR2R project is to foster effective regional collaboration favoring a coherent political and regulatory framework across the MAR region. Component 1 will strengthen CCAD's leadership capacity and development of harmonized protocols, standards, tools, and instruments — where necessary Components 2 and 3 will also promote integrated management of ridge-to-reef of water resources in priority watersheds and coastal and marine habitats (Fig. 1). MAR2R project will demonstrate the direct environmental benefits achievable by integrated regional ridge-to-reef management. Component 4 involves a communication strategy that will be developed to disseminate lessons learned, encourage replication and scaling up in the MAR Eco region and

[2] AN Ma, ASH Ong - Journal of the American Oil Chemists' Society985 - Springer

beyond. The primary focus of the project will be to reduce threats to freshwater, coastal and marine ecosystems, and in turn reduce land-based threats to mangroves, coral reefs and fisheries. The project will also work to develop the capacity of local communities in sustainable management of land, water, and coastal and marine resources. This enhanced capacity development will prioritize gender and social inclusion as an integral component of the overall initiative to ensure that both women and men receive equitable social and economic benefits.

Component 1 is devoted to the development of strategies and instruments and thus will not have direct social or environmental impacts. Components 2 and 3 consists of demonstration projects in, respectively, freshwater river basins and marine and coastal habitats. Component 2 will support mainstreaming of the ridge-to-reef approach to reduce degradation of freshwater ecosystems and reduce the sediment and contaminant-rich effluents flowing into the MAR rivers and estuaries (from the agriculture and tourism sectors). Demonstration projects will be carried out in priority watersheds.

Fig. 1 – Hydraulic Basins Affecting the Mesoamerican Reef[3]

Legal Frameworks

Each of the four countries encompassed by the project (Belize, Guatemala, Honduras, Mexico) have environmental codes and regulations as well as protected areas. These codes are summarized in Annex 1. They include general rules and guidelines concerning environmental protection, specific rules governing forests, coastal areas and marine areas, as well as official protected areas where restrictions apply. The participating countries WWF guidelines require

[3] Note: The Río Chamelecón is included in the Río Ulúa watershed.

that local environmental legislation be respected. In some cases, there are specific regulations that explain and operationalize the laws. Where possible, these regulations are included but it was not possible to locate them in every case.

Once specific plans for project interventions are ready, it is necessary to assure compliance with all local environmental legislation. In some cases, it may be required to file environmental impact assessments or plans. It may also be necessary to apply for a license or permit depending on the proposed activity. In some cases, there is an overlap between local environmental legislation and WWF policies. In such cases, it is not necessary to duplicate the effort for, say, an EIA. Rather, a single analysis can be done and an appropriate report can be filed in the required format.

It is recommended to contact local environmental authorities early in the planning process to be aware of the up-to-date environmental laws and regulations. WWF requires that projects it supports using GEF funds be fully compliant with local regulations. Such regulations may be different from WWF and GEF guidelines but, generally speaking, the legal requirements in each of the MAR countries are congruent with WWF Environmental Guidelines.

Classification of Projects

WWF's policy requires that every project supported by WWF be subject to environmental and social screening. Projects are categorized as follows:[4]

- Projects are classified as Category A if they are likely to have significant adverse social or environmental impacts that are sensitive, diverse, or unprecedented. Category A projects require additional approval by WWF-US's Ventures Committee before the ESIA procedures can continue beyond this step.
- Projects are classified as Category B if they are likely to have potential adverse social and/or environmental impacts, but these impacts are less significant than category A and can be properly addressed and/or mitigated in the project.
- Projects are classified as Category C if they are likely to have minimal to no social and environmental impacts.
- Categorization of the project based on the screening will be publicly and appropriately disclosed.

Given the nature of the subprojects likely to be developed in the MAR2R, it is improbable that any intervention would be categorized as Category A. However, if an intervention involves impacts on indigenous people or involuntary resettlement, Category A may be warranted. Another intervention that could possibly trigger category A is a project activity that effectively deprives a given population of access to a resource necessary to their subsistence and survival. Interventions that have potential adverse impacts that can be mitigated by action taken in the project are categorized as "B." A given project may have various components some of which would be categorized as "A" while others might be categorized as "B" or "C." In such cases, the overall category into which a project falls is that corresponding to the highest risk category. Thus, a project that involves a single category "B" component with others that would be classified as "C" is classified as a "B" project.

[4] WWF Policies and Procedures

Annex 2 provides a tool designed to assist in the categorization of project impacts. It is important to emphasize that the category may depend both on the *magnitude* of the impact and the *sensitivity* of the environment. For example, a project causing displacement of a small number of families from the dwellings or farms may be considered Category B, while the displacement of a large number of families (more than 200 individuals) may be considered Category A.[5] Adverse impacts on extremely sensitive or fragile habitats such as wetlands, mangroves or coral reefs may need to be considered Category A, while other habitats such as savannah woodlands may be considered less sensitive to adverse shocks. Evaluation of sensitivity should also consider the "*tipping point "(punto de inflexion)* of a habitat. If a project activity has the potential to push a stressed ecosystem "over the edge" such as the diversion of sewerage into a wetland at risk of eutrophication, it may be considered to be Category A. In any case, it may be necessary to call in specialists to determine the appropriate classification of a project. It may be difficult to assess the potential of an indirect impact. For example, a new road, passing near but not through an area occupied by indigenous people may have a significant, although indirect, impact.

Finally, in assessing the magnitude of an impact, the analyst must also consider the potential impact of the mitigating measures. For example, in cases where fishing in certain areas is restricted, traditional fishers may be adversely affected. The mitigating measure proposed might be to support aquaculture to offset the loss of fishing rights in the diet. However, aquaculture itself can have adverse environmental impacts that must be considered. Similarly, if people are resettled to a new location, the impact of the new settlement must also be considered. New settlements need to be provided with adequate water and sewerage to avoid potential adverse impacts on health and environmental quality. Another risk arises when new activities are encouraged involving only men, leaving women excluded from productive activities.

Scoping

Scoping precedes or accompanies the categorization process. This term refers to preliminary consultations with stakeholders and assessment of the locale. Stakeholders may be beneficiaries of the project, others affected by the project activities including those who expect to be adversely affected, civil society organizations concerned with the project topic, government officials, scientists and other experts who possess relevant knowledge. Table 2 is an indicative list of stakeholders in the MAR2R project. Even though the MAR2R project is oriented to land-based issues, scoping should include stakeholders concerned with the coastal and marine aspects of the Mesoamerican Reef as well as land-based stakeholders.

[5] In either case, a resettlement plan is required.

Table 3 –Stakeholders in the MAR2R project (partial listing)

- Community leaders in the project vicinity
- NGOs concerned with social and environmental issues
- Local officials
- Fishers
- Dive boat operators and tourism enterprises
- Tourists, especially SCUBA divers and snorkelers;
- Farmers and livestock breeders in river basins flowing into the Caribbean
- Urban authorities, particularly those concerned with water supply, sewerage and solid wastes;
- Journalists and opinion leaders;
- Businesses and industries with effluents flowing into Caribbean;
- Local and national government officials;
- Marine scientists
- Conservationists and Conservation Biologists
- International Conservation advocates

Scoping is not a formal activity and need not be highly structured. Scoping can take place in focus groups, neighborhood meetings, one-on-one interviews, and through written communications. The goal of scoping is to collect facts, opinions and concerns regarding the project *before* the project design has been completed. Issues raised by stakeholders will inform the studies to be done for the ESIA, when required. A scoping session usually begins with a general description of the goals of the project interventions and the methods to be employed. Participants in a scoping session may be asked open-ended questions about the project topic and also asked to rank different issues in order of importance. For example, a group of farmers may be asked to rank the importance of a set of issues in relation to the health of reefs, such as fertilizer use, tillage alternatives, pesticide and herbicides use, double- and triple-cropping, fallowing practices, drainage, management of livestock wastes, water use, etc. To the extent possible, scoping should use terms familiar to the persons whose opinions are sought. Scoping is not intended to change or dispel incorrect opinions but rather to understand what people think about coral reefs and activities that affect them. There are no right or wrong answers in a scoping exercise. A thorough scoping exercise will reveal topics that require further investigation, issues that require better communication and publicity, scientific questions and perceptions of what affects coral reefs. Sometimes scoping reveals popular misconceptions such as a belief that suppressing riparian vegetation has no effect on reefs. Scoping may also raise questions that require scientific assessment such as the application of phosphates to crops.

In addition to revealing topics requiring investigation, scoping can be the beginning of a participatory approach to the planned interventions. Persons who are consulted early in the life of a project are likely to feel that they have some control over project interventions as opposed to interventions imposed by outsiders. Scoping can also inform communication, outreach and extension activities. For example, if studies show that phosphates are leaching out of cultivated fields into rivers, a campaign to educate farmers about optimal use of fertilizers may be needed.

Scoping is the first step in designing the Environmental and Social Impact Assessment (ESIA). Scoping is *required* for all Category-A projects under WWF guidelines but is recommended for Category B projects as well. Scoping usually requires several weeks to be completed. Not every topic can be investigated in equal depth due to limitations of time and resources. Scoping can help to set priorities based on real concerns and beliefs. The scoping exercise will inform the terms of reference for the ESIA. Scoping is not voting; sometimes a scientific issue may outweigh a popular concern but it is important to lay *all* the issues on the table before setting priorities. A scoping report detailing the conclusions and listing the persons and groups consulted should be sent to WWF for review and comment before embarking on the ESIA.

Priority Watersheds

MAR2R is focused on specific river basins in the four countries bordering the MAR. The basins singled out for priority attention are (See Fig 1):

Priority 1

- Río Hondo (Belize, Guatemala and México)
- Río Motagua (Guatemala and Honduras)
- Río Chamelecón (Honduras)

Priority 2

- Yucatán Península, North Zone from Tulúm to Cancún (México)
- Belize River (Belize and Guatemala)
- Río Ulúa (Honduras)

Priority 3

- New River (Belize)
- Monkey River (Belize)

Site Selection

Specific subprojects and their location have not yet been determined. It is necessary for each participating NGO to design and implement subprojects in collaboration with CCAD. Site requirements will vary according to the nature of the subproject design. For example, an agroforestry project will likely not prosper in an area where livestock grazing is the predominant land use. Similarly, a project aimed at composting crop wastes will not do well when labor and machines are not available for transporting and managing crop wastes.

The following list is intended as guidance for selecting specific sites for subprojects. The list takes into account the relatively small scale and budget available for financing subprojects.

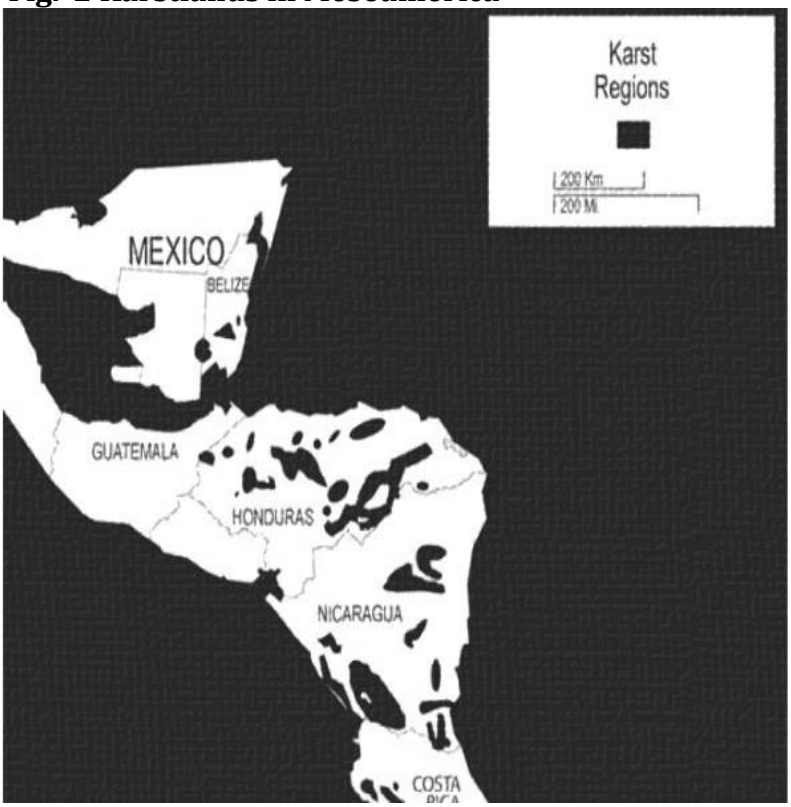
- Areas with steep slopes are not generally suitable for annual crops;
- Areas riven by endemic conflict may not be suitable for innovative subprojects;
- It is best to avoid areas where there is active trade in illegal crops;

- Subprojects must not infringe on protected areas, critical habitats or their buffer zones except where they are designed to enhance the benefits of the protected areas;
- Subprojects that may affect indigenous people should be undertaken only by the NGO partners that have the capacity to work effectively with indigenous communities and where is receptivity by the group;
- It is generally best to avoid subproject designs that require displacement of people from their homes and farms;
- The introduction of new crops should be considered only when the required inputs and marketing facilities are available.

General Features of the Mesoamerican Landscape

Much of the Mesomerican isthmus from the Yucatan Peninsula south to Honduras consists of karst, a geological formation consisting of limestone or dolstone (see Fig. 2). The Mesoamerican reef itself is underlain by submerged karsts. Karsts are highly permeable and water-soluble so little rainwater accumulates on the surface. Instead water percolates down to lower geologic strata where it may form aquifers, underground rivers and lakes. Due to the permeability and solubility of karsts, caverns and deep sinkholes (*cenotes*) form. Karsts support vegetation adapted to the lack of surface water and soil chemistry and agriculture in karstic zones must take account of these characteristics even where soil fertility is high.

Fig. 2 Karstlands in Mesoamerica



In addition to caverns and *cenotes*, Karsts may have surface formations of great natural beauty. Karsts may also be significant floral and faunal refuges harboring rare and endangered species. The permeability of karsts makes them susceptible to pollution. Wastes thrown into cenotes, for example, may contaminate aquifers and may surface elsewhere in the region due to underground flows. For these reasons, many karsts have been established as protected areas, particularly in Belize. Any subproject contemplated for the karstic regions of Mesoamerica will need to take the special characteristics of this formation into consideration.

A continuous mountain chain passes through Central America from Mexico through Panama.[6] These mountains of **volcanic** origin are the source of the soils of the region and the headwaters of many of the rivers flowing into the Caribbean form on their eastern slopes. Damming or diversion of the waters of these rivers can present special problems. For example dams may reduce flows at critical times, threatening aquatic and riparian life downstream. Dams built to regulate flooding may also deprive farmers downstream of the alluvial deposits on which their cultivation depends. East of the *sierra*, a porous limestone shelf leads down to the Caribbean.

Rainfall varies seasonally and geographically in Mesoamerica. Average monthly rainfall in Cancun (northern Quintana Roo), for example, varies from 29mm in April to 282 mm in October, while in Chetumal (Southern Quintana Roo) average rainfall varies from 23mm in March to 185 in September. Average monthly rainfall in San Pedro Sula in Honduras varies from about 20mm in March to about 150mm in September. Rainfall also varies with distance from the coasts and altitude.

Descriptions of Priority Watersheds

Belize River

Largest basin in Belize with a significant upstream part in Guatemala. The Belize River runs 290 Km through the center of Belize, meandering through more than one-quarter of the country as it runs along the northern edge of the Maya Mountains to the sea just north of Belize City. A summary of the general information of the basin shown in the following table:

Basin	Belize River
Watershed	Atlantic Ocean
Elevation Range	0 - 1,000 masl
Coverage area	5,000 Sq. Km
Length	290 Km
Population	342,565 habitants

Source: USAID, 1995

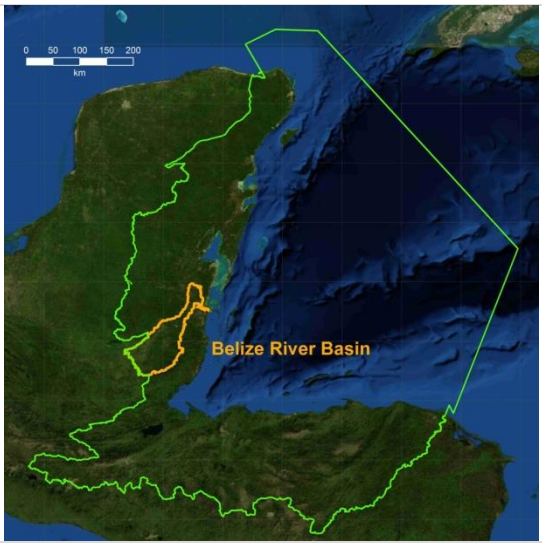


Fig. 3. Belize River basin

[6] Of the four countries bordering the MAR, only Belize lacks mountains of significant altitude.

Mixed topography broadly divided between a lower, long coastal plain section below 100 m with slopes less than 1 degree, and upper, highly dissected mountain basins and plateaus with slopes over 25-30 degrees and elevations to 1,000m.

The geology is broad mix of limestone, igneous and metamorphic rocks with associated soil variations from thin, leached and stony to deeper sedimentary varieties. Varying geochemistry with both acid and basic zones and areas of leachable salts and metal ions.

Land-use reflects a geological and topographic variation, from forestry to agriculture (*milpa*, fruit and vegetables) and cattle ranching. Forest predominates, followed by agricultural and urban land-uses of Belize City, San Ignacio and Belmopan.

In the upper basin there are two hydropower dams, in the middle part there are agricultural areas (basic grains, vegetables and sugar cane, among others) and in the lower part the urban areas are located. Average annual rainfall in the basin varies from 2,500 mm in the highlands to 1000 mm in the northwest and 1500 mm along the coast.

The river is significantly ramified. Headwater stage increases of up to 15m in a day can occur at sub-basin confluences. Date from the Benque Viejo station show that the major Guatemalan tributary produces average daily discharges varying from 1 m^3/s to 275 m^3/s with an annual daily mean between 20 and 40. Peaks are attenuated on the coastal plain due to the staggered floodwater through the drainage network and shallowing of the channel. Average daily discharge to the ocean is thought to be in the range of 155 m3/s. Water chemistry depends on flood stage and timing but generally alkalinity and intensity of base flows are high. Both will decline in concentration with higher flows.

Pesticide use, forest degradation, overgrazing, agriculture and mechanization threaten ecological stability in the basin and ecosystems of the coastal zone. These factors lead to increased sediment loads, nutrients and pollutants flowing in the river. Unsustainable agriculture, livestock production, and unplanned urban growth, excessive fishing and hunting, cause severe impacts on terrestrial, aquatic and marine ecosystems. Many farmers traditionally use practices including slash-and-burn, contributing to the degradation of basin (Kasper and Boles, 2003). Additionally, there is pollution from industrial and domestic waste from San Ignacio and the Mirador Español.

As part of the leading stakeholders in the basin conservation, we can mention the Community Baboon Sanctuary (CBS) who have a pioneering voluntary conservation project, because they are outside the system of government support and private institutions. CBS helps educate the local community and visitors about the importance of biodiversity and sustainability. The biggest threat to the monkeys is habitat disturbance due to agriculture, logging and hunting. CBS works for sustainable tourism as an attractive alternative to the destructive practices of soil management. In the following pictures the Belize River seen from some of the villages included in the CBS.

Fig. 4 - St. Paul's village

Fig. 5 - Flowers Bank village

Río Hondo

The Río Hondo is formed by the confluence of the Blue River in Belize, known as "Blue Creek", that flows from Guatemalan mountains and Rio Bravo (Belize). The confluence occurs in the vicinity of the towns of the Union (Mexico) and Blue Creek (Belize). The Río Hondo is considered one of the major permanent surface flows in the Yucatan Peninsula. A summary of the general information of the basin shown in the following table:

Basin	Río Hondo
Watershed	Atlantic Ocean
Elevation Range	0 - 250 masl
Coverage area	13,500 Sq. Km
Length	250 Km
Average precipitation	1000-1500 mm/per year.
Population	560,393 habitants

Source: USAID, 1995[7].

Fig. 6 -Río Hondo Basin

The topography is largely lowland with a broad meandering valley with tributaries flowing from limestone scarps and hilly lands of Mexico and Guatemala. Elevations range between 0 and 250 m with majority below 100 m with slopes less than 5 degrees. Pollution sources are largely from non-point sources across the drainage network, primarily agricultural runoff from sugar cane and livestock, discharge of domestic wastewater from small river towns, and natural mineral leaching.

[7] USAID. 1995. Environmental Water Quality Monitoring Program. Government of Belize. Project NARMAP.

The river has a great diversity of aquatic life, including 40 fish species grouped in 33 genera, 18 families and 11 orders; of these, the best family represented is Cichlidae, including *Oreochromis niloticus*[8] (an exotic species) known locally as *tilapia*.

Land use is mixed ranging from forest land through subsistence agriculture (*milpa)* at higher elevations through mechanized sugar cane plantations at lower elevations. Agricultural land in the basin totals 57,076 ha.

One example of the agricultural industries in the Hondo River basin is Circle R Products, one of several grain production cooperatives cultivating mainly rice, located in Blue Creek. Within its farming operations members are implementing good agricultural practices such as water conservation and targeted pesticide use aimed at environmental sustainability in the production processes, ensuring quality and reliability of their grain production. The good practices implemented in addition to reducing operating costs have a positive impact on the environment. However, there are no constraints in place to prevent additional forest conversion to crops. Additional forest conversion will invariably lead to greater stress on the riverine and marine ecosystems.

Fig. 7 – Water Circulation Circle R. Products Cooperative

Rio Bravo is a tributary of the Río Hondo.

Aquaculture in Belize formally began in 1982 with the development of ten acres (4 ha) of experimental ponds by a private company, in southern Belize. Since that time, the industry has developed rapidly and has become firmly established as a significant contributor to the Belizean economy in terms of foreign exchange earnings, income generation, employment, nutrition, and food security[9].

Aquaculture (primarily marine shrimp farming) has increased tremendously over the past decade and requires high nutrient input that may contribute to eutrophication of the marine environment. Currently there are more than 3,000 ha of shrimp ponds in Belize. Sixty percent of marine shrimp farming occurs in the southern portion of the Stann Creek District near the coast, while 38 % occurs in the Belize District. Shrimp farms draw water directly from the sea and most of the water released during harvest time drains directly back to the sea passing through mangrove forests. However, during extreme rainfall, water may be released to avoid product loss

[8] 2014. JM López-Vila, ME Valdéz-Moreno, JJ Schmitter-Soto. Composición y estructura de la ictiofauna del río Hondo, México-Belice, con base en el uso de arpón - Revista mexicana de biodiversidad.
[9] http://www.fao.org/fishery/countrysector/naso_belize/en#tcN7018B

through pond overflow. These farms are point sources of nutrient pollution with great potential to impact Belize's marine environment (DOE, 2008[10]).

Shrimp producers in Belize have demonstrated an ongoing commitment to improving water quality by adapting responsible management practices. The eleven Belize shrimp producers work with WWF to reduce and control the quality of effluent released into the waters of the Mesoamerican Reef. Effluent quality control is based on the data provided by water monitoring stations established for this purpose. In addition to best practices in production and effluent control, WWF and its partners are preserving and replanting mangrove areas near shrimp farms[11].

Another crop that has an impact on the basin is sugar cane, which is concentrated in the northern districts of Corozal and Orange Walk, also known as "sugar belt" with approximately 65,000 planted acres. One of the goals of the Sugar Industry Control Board is to increase intensity and decrease the spread of cultivation by the technical qualification of the personnel involved, in order to increase production in already intervened and avoid using areas that still have vegetative cover. In addition, one of the programs to be implemented is management of post harvest production waste, avoiding the second burning in the process. Both actions will have a positive impact on the basin, reducing adverse effects on the Mesoamerican reef.

Río Motagua

The Río Motagua is a binational basin shared between Guatemala and Honduras. The Río Motagua is the main water course of the basin, which extends from the highlands in the department of Quiche, downstream until it reaches the ocean, in Puerto Barrios in the department of Izabal. A summary of the general information of the basin is shown in the following table:

Basin	**Río Motagua**
Watershed	**Atlantic**
Elevation	**0 - 3,217 masl**
Area	**12,670 Km²**
River extension	**483.6 Km**
Population	**2,742,286**

Source: IARNA, consulted in March 2016.

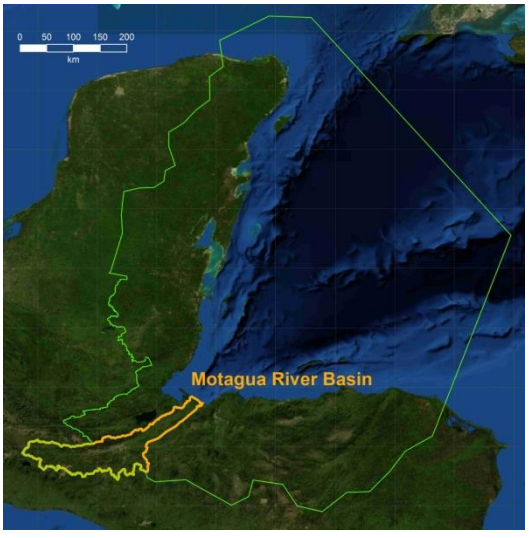


Fig. 8 - Río Motagua basin

According to De Leon[12], regarding the agricultural capacity of the basin, surface soils have a depth of 25 cm, with slopes ranging from 32-45%, which promotes high susceptibility to erosion, especially when planted to annual crops. Soil structure consists

[10] Department of Environment Ministry of Natural Resources and the Environment. 2008. National Plan of Action for the Control of Land-Based Sources of Marine Pollution in Belize (DRAFT).

[11] http://www.wwfca.org/nuestro_trabajo/agricultura_ambiente/camaron/

[12] De León, R. 2003. Análisis de contaminación de peces en el Río Motagua (Contaminación de peces y lesiones gastrointestinales y dermatológicas) 74 p.

of sub-angular blocks; the dominant soil texture is loam and clay-loam, with a consistency from soft to friable in dry conditions and friable to slightly hard in humid conditions. The surface drainage is high, due to the slope, its internal drainage is considered normal, and the erosion is moderate to high with great susceptibility. Land is not suitable for annual crops, but usable for permanent cultures; due to limitations in the soil vocation, its use is appropriate through intensive conservation practices.

According to the FCG[13], four biomes are present: (i) Tropical rain forest (including swamps, flooded forests, wetlands, estuaries, Caribbean marine coast, jungles, palm savannas and grasslands) (ii) Montane forest (most of the highlands with abundant conifers (pine), oak and others, and in the highest parts, Subalpine steppe. There are marked temperature differences between cold and warm season) (iii) Warm temperate thorn scrub (forests of cacti and thorn scrub with characteristics xerophytic species). (iv) Montane rain forest of the Verepaz (Chamá, Chuacús and western Minas mountain ranges). A complex floristic structure is present, with plenty of habitats, abundant water and humidity, mixed forests with plenty of mosses and ferns, considered a high endemism area.

At least 55 protected areas are located in the Motagua basin, as of 2012, with a combined area of 188.502 ha[14]. Twenty-seven fauna species and 11 species of flora are considered endangered by CONAP and the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), including Jaguar (*Panthera onca*), puma (*Panthera concolor*), bearded lizard (*Heloderma horridum*), horned guan (Oreophasis derbianus) giant anteater(*Myrmecophaga tridactyla*), howler monkey (*Alouatta palliata*); many orchids, Mahogany (*Swietenia macrophylla*), Tree ferns (*Alsophilla* spp.), columnar cacti (*Pilosocereus maxonii*), among others (FCG , 2012).

Several industrial and agricultural activities are reported in this basin. Eight main groups of livelihoods are described for this basin in the life means analysis (September 2005)[15]:

- Zone 4: Agroindustry for export and cattle
- Zone 5: Subsistence agriculture
- Zone 7: Agroindustry, Forest industry, Mining and coffee
- Zone 8: Basic grains, border zone between Honduras and El Salvador
- Zone 9: Basic grains and labor
- Zone 10: Agroindustry and textiles
- Zone 16: Vegetables and fruits
- Zone 19: Artisanal fisheries

Some river water is used for irrigation. However, the Motagua receives wastewater from communities and cities along its course, including Guatemala city, being relevant for the transport of pollutants to downstream communities and to fish (De Leon, 2003) and the marine environment.

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[13] Fundación para la Conservación de los Recursos Naturales y Ambiente en Guatemala (FCG). 2012. Diagnóstico preliminar de Situación de la Cuenca del Río Motagua. FCG. Guatemala. 78 p.

[14] CONAP 2011

[15] Documento disponible en: http://coin.fao.org/coin-static/cms/media/3/12603988723200/modos_de_vida_mfews.pdf

Threats to the ecological stability in the basin include deforestation, forest fires, reduced flow or desiccation, erosion, pollution by solid and liquid wastes, drought, storms and hurricanes, and agrochemical waste. (FCG).

One of the most important threats mentioned by the FCG in 2012, is deforestation. This should be given special care when working on watershed management, due to the impact it has on the quantity and quality of water along the basin, and above all, as the threat that apparently stands throughout the area. In addition, deforestation will contribute to other threats such as erosion and landslides, among others.

As part of stakeholders involved in conservation activities of the basin are Fundación Defensores de la Naturaleza (FDN) that is responsible for one of the largest protected areas in the basin, the Biosphere Reserve Sierra de las Minas (RBSM). The activities they develop include: distribution of fuel efficient woodstoves; promoting reforestation activities with government programs for forestry and agroforestry species; education, control and prevention of forest fires; contribute to increase the income of the population with productive activities; among other. These activities aim to preserve natural resources at the RBSM and have a positive impact on the Río Motagua basin.

Fig. 9 – Fire Break Motagua Basin

Fig. 10 - Fuel efficient stove

Yucatan Peninsula

The Yucatan Peninsula is a northern portion that divides the Gulf of Mexico and the Caribbean Sea, between the southern tip of North America and the northern part of Central America, is made up of several sub-basins, of which, the one that influences the reef, is the Yucatan east basin (see adjacent image) . Topographic features of the region are composed mostly of plains, however, elevations up to 150 masl are present. The presence of water bodies is represented mainly by wetlands, coastal lagoons and small islands[16,17].

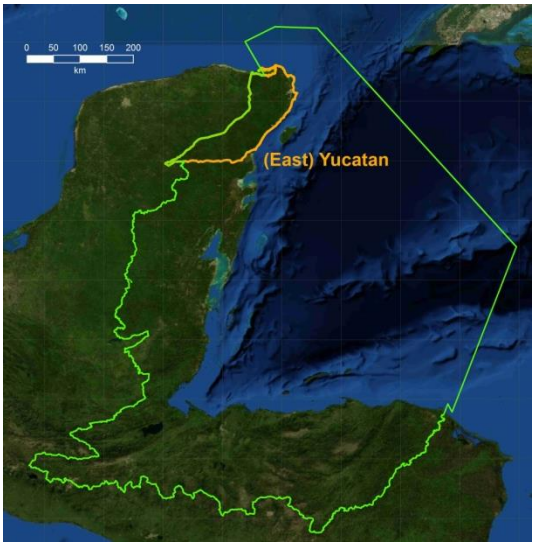

Fig. 11 - Yucatan Peninsula

Basin	Yucatán east
Slope	Atlántico
Elevation	0 - 150 masl
Area	14,372 km^2
Population	1,881,181

Source: INEGI/SIATL.[18]

The vegetation in the region is mainly composed of grassland, tropical rain forest, and macrophytes, tropical deciduous forest and mountain cloud forest, the latter to a lesser extent. Karstic subsoil is highly carbonated and permeable; therefore groundwater is a very important water resource for the region. This resource is mainly affected by urban development, since tourism has increased greatly in recent decades. The development of the region has led to increased deforestation, and threatens species such as spider monkeys, jaguars, ocelots, parrots, ocellated turkey, raptors, anteaters, tapirs and several species of orchids[19].

Slash and burn farming systems are common in the peninsula where henequen (*Agave sisalana*) is grown; this activity requires nitrogen sources that are important for fertilization, however, it reduces the ability of ecosystems to provide benefits. This lacks an efficient system for water treatment, so the groundwater is exposed to pollution by nitrates. Consequently, the complex hydraulic connectivity of the region causes direct flow pollution of the Caribbean Sea, and threatens the conservation of coral reefs[20].

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[16] González-Herrera, R., Sánchez-y-Pinto, I., & Gamboa-Vargas, J. (2002). Groundwater-flow modeling in the Yucatan karstic aquifer, Mexico. Hydrogeology Journal, 10 (5), 539-552.

[17] Euán-Ávila, J., García, A., & Liceaga-Correa, M. A. (2007). Programa de Ordenamiento Ecológico del Territorio Costero del Estado de Yucatán CINVESTAV, CICY, ITC, ITM, UADY.

[18] Available at: http://antares.inegi.org.mx/analisis/red_hidro/SIATL/#

[19] Bauer-Gottwein, P., Gondwe, B. R., Charvet, G., Marín, L. E., Rebolledo-Vieyra, M., & Merediz-Alonso, G. (2011). Review: The Yucatán Peninsula karst aquifer, Mexico. *Hydrogeology Journal*, *19* (3), 507-524.

[20] Smardon, R. C., & Faust, B. B. (2006). Introduction: international policy in the biosphere reserves of Mexico's Yucatan peninsula. Landscape and Urban Planning, 74(3), 160-192.

In addition, other sources of pollution are present, including dissolved solids, pathogens, pesticides, nitrates, flow and groundwater recharge. Factors influencing pollution are: domestic animals/livestock (organic waste, nitrates, pathogens); water extraction (saltwater intrusion); urban growth (nitrates, pathogens and organic waste); agriculture (nitrates, pesticides, fertilizers, organic waste); agrochemicals (hazardous, organic, fertilizers)[21].

Dissolved solids contamination is mainly due to the increased salinity, and higher concentrations occur on sites with water overexploitation or presence of wells near the coast. Another source are industrial chemicals, particularly chlorinated solvents. Pathogen pollution comes mainly from domestic animals, and caused by inadequate management of waste from these farms. Pesticide contamination occurs in horticultural areas on where the use organophosphates, carbamates and organochlorine insecticides is common. Nitrate pollution is mainly due to the hog industry and liabilities left by the production of henequen (Agave).

There are several regional conservation programs for the Yucatan Peninsula. The first conservation efforts were carried out in 1962 by Mexican conservationist Enrique Beltran, in the First World Conference on National Parks. UNESCO subsequently declared the Sian Ka'an, Rio Lagartos, Celestún and Calakmul parks as a Biosphere reserve, and others including Tulum and Los Petenes by the Commission of Natural Protected Areas (CONANP). Other conservation efforts have also joined as civil organizations Ducks Unlimited of Mexico (DUMAC) and Programa para la Naturaleza (PRONATURA), who receive foreign and local funds for their conservation activities[22].

Río Chamelecón

Basin	Río Chamelecón
Watershed	Atlantic Ocean
Elevation Range	0 – 1,200 masl
Coverage area	4,427 Sq. Km
Length	256 Km
Annual incoming	3,264 million m^3/year
Average precipitation	1526 mm/year
Population	1,200,000 habitants

Source: GWP-FAO 2013, Country Profile, Aquastat update

Fig. 13 - Río Chamelecón Basin

The Río Chamelecón Basin, arises in the mountains of Copán Department in western Honduras and runs 256 km north, to the Gulf of Honduras. The Río Chamelecón covers the departments of Santa Bárbara

[21] Durand, J. et al. (1999) Contaminación del agua subterránea en la Península de Yucatán, México. Universidad Autónoma de México. México. 41-50 p.

[22] Aranda Cirerol, N., Comín, F., & Herrera-Silveira, J. (2011). Nitrogen and phosphorus budgets for the Yucatán littoral: An approach for groundwater management. Environmental monitoring and assessment, 172(1-4), 493-505.

and Cortes, also the Sula Valley. At least, 3 Holdridge life zones are widely represented: Very humid subtropical forest (**BMHsT**) and humid tropical (**BHT**) to sub-tropical.

The rocks that forms the basin are predominantly metamorphic, followed by mixed sedimentary and siliciclastic rocks. The soils, under the Simmons´ Classification System, are predominantly Tomala (Tipo IV y VII), Jacaleapa (Tipo VII) and "Suelos de los Valles", with an average depth of between 10 and 20 cm.

The upper part of the river basin has conifer and broadleaf forests while lower areas have patches of primary forest. It is home of a wide range of species of flora and fauna, such as the manatee, crocodile, sea turtles and terrestrial birds (resident and migratory). The Río Chamelecón Basin covers only 4% of Honduras, but it includes 15% of the population resulting in very high population density. 71% of it are in rural areas. One of the most important cities of Honduras, San Pedro Sula, is located it this Basin.

According to CIAT data[23], the basin potential for mechanization is 36% but also has an important potential for coffee production in high slope plots. 29% of the basin has forest coverage that is lower than the 54% of coverage recommended. This percentage added to the high sloped terrain contribute to the soil erosion, especially when is associated to annual crops. There is a high grain production (corn, sorghum, beans and rice); fruits such as cantaloupe, watermelon, avocado, mango, pineapple, lemon; vegetables such as tomato, yucca and onions. Most farmers practice subsistence farming in the basin and the poverty rate is high. Also there are extensive plantation crops such as oil African palm, sugarcane and pastures for livestock.

Regarding oil palm farming, National Program for the Agro-alimentary development (PRONAGRO) of the Secretariat of Agriculture and Livestock of Honduras (SAG), estimates that in 2013, 150,000 ha were cultivated with Oil Palm, where 21,375 ha are located in Cortes, and have a direct influence over river basin. Oil palm plantations are subject to erosion and there is runoff containing fertilizers and pesticides.

The Coca Cola Company and WWF have a broad and global Alliance to protect water resources. [24]This partnership includes the promotion of the efficient use of the water in productive processes and protect the natural resources associated with water. With the financial support of the USAID Conservation of Central American Watersheds Program (USAID/CCAW) an initiative for the establishment of a scheme of payments for environmental services named Business Model for Improving Competitiveness and Performance in the Chamelecon Basin. ("*Modelo de negocios para el mejoramiento de la competitividad y desempeño Ambiental del sector industrial y el manejo integrado de la cuenca del Chamelecón*".) In 2009, the Honduran brewer SAB-MILLER signed an agreement with WWF to be part of this initiative to develop a business model of payments for hydrological services for sustainable management of the basin. This scheme sought the active involvement of people in the communities in the watershed management by implementing activities favorable to water quality and using cleaner production practices. These actions will

[23] CIAT, 2000. Diagnóstico y Priorización de las Cuencas Hidrográficas para el Programa de Desarrollo Rural Sostenible en Cuencas Hidrográficas Prioritarias (H0-0179). Informe final de la Consultoría BID CIAT.
[24] Global Water Partnership 2015

simultaneously lead to water conservation in the highest industrial region of the country and a significant percentage of the general population of Honduras is located, as well as reduction of pollution affecting the Mesoamerican Reef System. These schemes consider the hydrological cycle from a broad perspective, i.e. not only the consumption phase but also with regard to precipitation in the basin.

Río Ulúa

The Ulúa river basin arises in the Intibucá mountain range, near the city of La Paz and runs 358 km (222 mi.) in a north-westerly direction heading for the Gulf of Honduras. The Ulúa river is one of the most important rivers in Honduras collecting flows from the Humaya, Blanco, Otoro, Sulaco y Jicatuyo rivers. The Ulúa basin covers 11 of the 18 departments of Honduras. At least, 3 Holdridge life zones are represented: Very humid subtropical forest (BMHsT), humid tropical (BHT) to sub-tropical and humid montane forest (BHM).

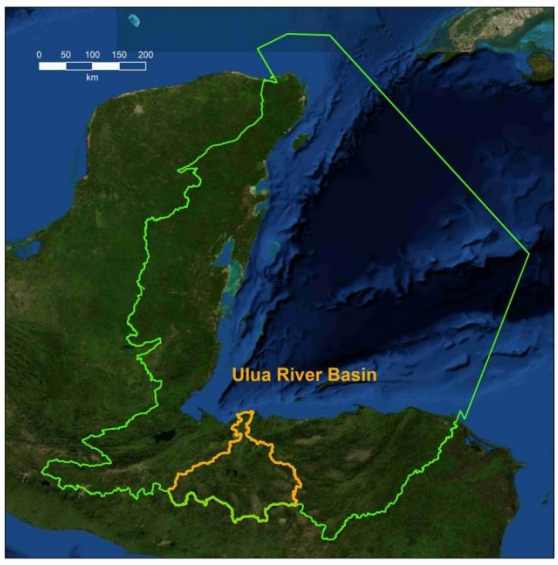


Fig. 14 - Río Ulúa Basin

Basin	Río Ulúa
Elevation Range	0 – 1,500 masl
Coverage area	22,817 Sq. Km
Length	358 Km
Annual flow	16,959 million m^3/year
Average precipitation	1477 mm/year
Population	4,400,000

Source: GWP-FAO 2013, Country Profile, Aquastat update.

The rocks that forms the basin are predominantly pyroclastic tuff, followed by mixed sedimentary and siliciclastic rocks. The soils, under the Simmons´ Classification System, are predominantly valley soils type and Sulaco (IV and VII) and Cocona (VII), with an average depth of between 10 and 20 cm.

The upper part of the river basin has conifer and broadleaf forests while lower areas have primary forest patches. It is home of a wide range of species of flora and fauna, such as the manatee, crocodile, sea turtles and terrestrial birds (both resident and migratory). Many natural and artificial reservoirs are located in this basin. The biggest natural water reservoir of Honduras, Yojoa Lake, is 17 km long, 5 km wide and a maximum depth 27.5 meters; the basin also contains the artificial lake of the El Cajón Dam.

Economically, the Ulúa River Basin is the most important of Honduras; it has the highest industrial production that consists mainly of manufacturing processes. CIAT[25], describes this river basin as containing a small area of montane rainforest (about 2%). In the upper part of the basin, deforestation occurs mainly in pine forests while in the lower part it occurs in broadleaf forest. The basin has the highest agricultural production based on the banana production in the Sula Valley and coffee production in the highlands. Additionally there are high grain production (corn, sorghum, beans and rice); fruits such as cantaloupe, watermelon, avocado, mango, pineapple, lemon; and vegetables such as tomato, yucca and onions. There are also extensive plantation crops such oil palm, sugarcane and grasslands for livestock grazing. The population living in poverty is high and subsistence farming is widely practiced.

The National Program for the Agro-alimentary development (PRONAGRO) of the Ministry of Environment indicates that oil palm plantation production began in the 1930´s, but the first commercially cultivated plantations were established by United Brands in San Alejo, Tela, Atlántida, in the 1940s. Since 1971 oil palm was strongly driven as part of agrarian reform process organized by the farmer cooperatives in Bajo Aguan, Department of Colon and later in the Guaymas Region, Department of Yoro, the ones that later formed COAPALMA Y HONDUPALMA. In the early 90´s the industrial development of oil palm began, with the rise of vertically integrated companies such as Grupo Jaremar, Grupo Dinant, Aceydesa, Palcasa, Palmasa y Coinsu, for a total of twelve oil processing mills.

The emergence of Independent Producers Organizations such as: Aprova, Apripa, Arpa, Anapropalma, Apropyco, Parguay, Apalco and Anapih, where together with other companies as Salama, Hondupalma and Coapalma, comprise the National Federation of Palm Producers of Honduras (FENAPALMAH). In 2013, an estimated 150,000 ha were planted to Oil Palm, of which 48,375 ha are located in Yoro and Cortes, and have a direct influence over Ulúa river basin.

Natural Vegetation in Mesoamerica

The natural vegetation of Mesoamerica is highly diverse (see Fig. 3, Tables 4, 5). Its characteristics vary largely in accordance with rainfall, altitude and the geological substrate (see section on Karsts above). The entire region from Southern Mexico to Panama is considered to be a biodiversity hotspot. The major ecosystems in the hotspot are a mosaic of dry forests, lowland moist forest, and montane forests. Tropical dry forests are found at higher altitudes in rain shadows in Guatemala and Honduras while humid tropical forest abounds at lower altitudes in Belize, the Guatemalan Petén and coastal Honduras. Coniferous forests combined with broadleaf species are found at the higher altitudes. The highland areas of the cordillera central are generally lower in diversity.

> "Mesoamerica has a total of about 17,000 species of vascular plants, nearly 3,000 of which are endemic (17 percent). In addition, 65 of 2,523 genera are endemic, 50 of which are represented by a single species."[Encyclopedia of Earth[26]]

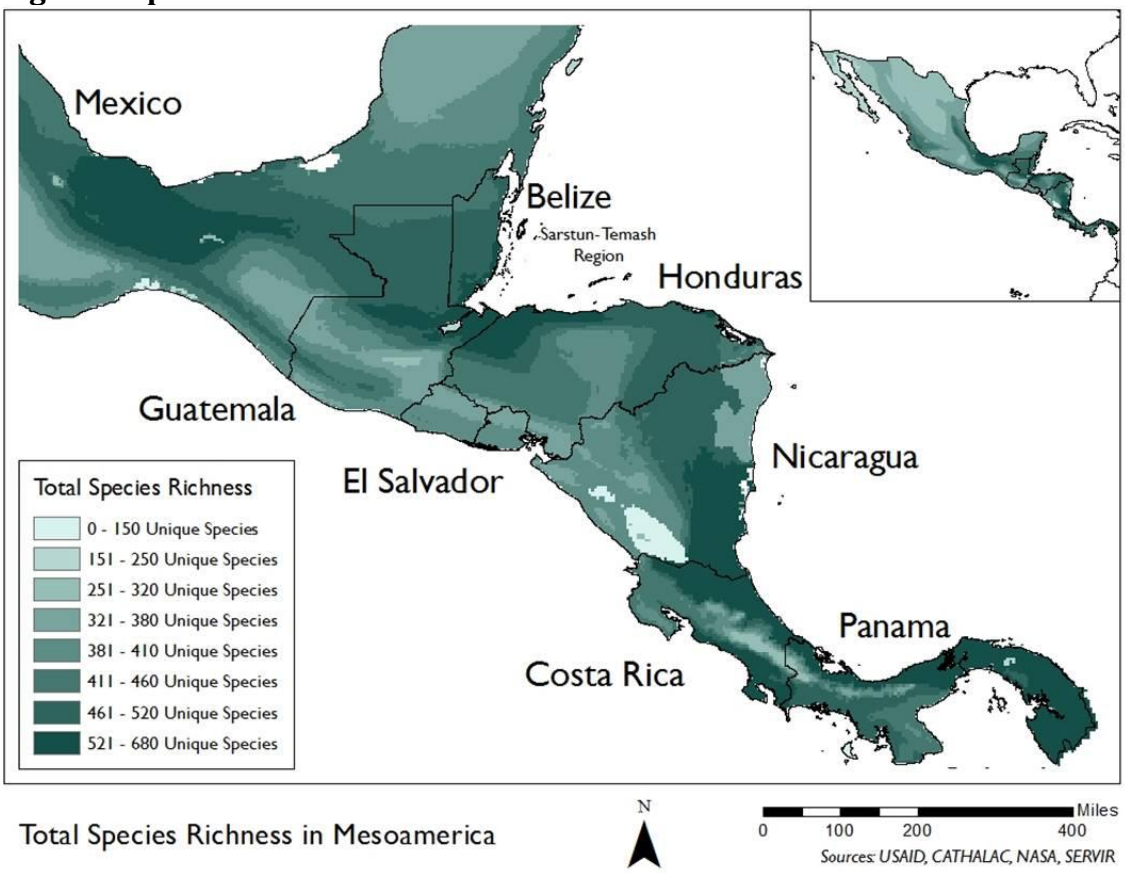
[25] CIAT, 2000. Diagnóstico y Priorización de las Cuencas Hidrográficas para el Programa de Desarrollo Rural Sostenible en Cuencas Hidrográficas Prioritarias (H0-0179). Informe final de la Consultoría BID CIAT.

[26] http://www.eoearth.org/view/article/150625/

More than half the 300 cactus species in the region are endemic. The region harbors valuable hardwood species such as mahogany, spanish cedar and rosewood. Other species such as pine and oak are sought after for construction timber, charcoal and pulpwood. The commercial value of these species have driven a considerable amount of logging and deforestation in recent years. A great deal of deforestation has occurred as well to make way for agriculture and grazing as well as for firewood and charcoal production. Among the field crops are sugar cane, maize, beans, soybeans, melons, sorghum and rice (both dryland and irrigated). Over the past 20 years, cultivation of African oil palm has expanded in Guatemala and Honduras. Agroforestry is also practiced in pockets throughout the region including coffee, fruit trees, and cacao (native to the Americas).

There are many protected areas in the region providing refuges for many plant and animal species some of which are threatened with extinction.

Fig. 15 - Species Richness in Mesoamerica

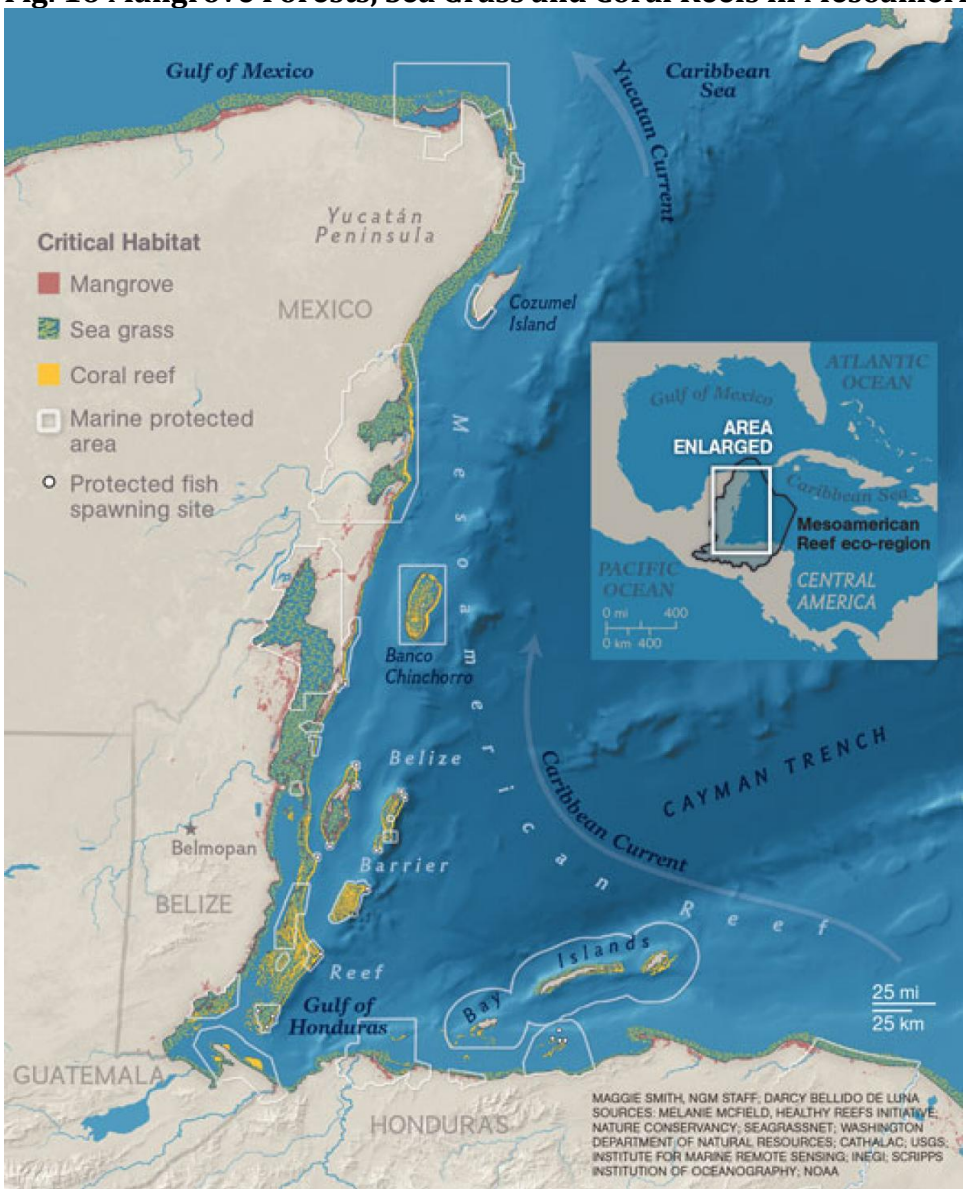


Total Species Richness in Mesoamerica

Mangrove Forests and coastal wetlands are particularly important features of the coastal landscape in Mesoamerica (Fig. 16). Coastal mangrove forests and wetlands are critically important to the survival of coral reefs because of their functions to stabilize shorelines, remove pollutants, improve water quality and serve as nurseries for fisheries. They also have important economic functions as a source of food and building materials for coastal dwellers. Mayan

civilization was apparently heavily dependent on the cultivation of wetlands, a pattern that disappeared even before the arrival of the Spanish conquistadores. Development in Mesoamerica has degraded mangrove and wetland habitats by clear cutting of mangrove species to make way for tourism facilities, shrimp farms and urban sprawl. Wetlands have been drained and landfilled for some of the same purposes.

Fig. 16 Mangrove Forests, Sea Grass and Coral Reefs in Mesoamerica



Fauna of Mesoamerica

Similar to the biological diversity of plants, there is a wide range of animal life in Mesoamerica (see Table 4). The regions is especially rich in mammals, birds and reptiles. There are many endemic species that do not occur in other regions. Many of these species face local or even global

extinction due to deforestation, interruption of migratory movements or other disturbance of ecological balance. Annex 3 presents a list of animal species at risk of global extinction. [27]

Table. 4 Number of species in Northern Mesoamerica [28]

Country	Mammals	Birds	Reptiles	Amphibians	Plants
Belize	163	571	121	42	3,409
Guatemala	251	738	231	112	8,681
Mexico - Quintana Roo	90	340	ND	ND	2,180

Sources: IUCN 2002; CONABIO 1998; CCAD 1999b; CONAMA 1999; NBC 1998; DGB 2001; Obando 2002; OdD-UCR and UNEP 2001; Mendieta and Vinocur 2001

Protected Areas in Mesoamerica

Table 4 and Figs. 17 and 17a show that all four countries along the MAR coastline have dedicated substantial portions of their territory to protected areas. Establishing a protected area, however, does not assure that the area is well protected against predatory logging, deforestation, conversion to grazing land or agriculture, or pollution from industrial or other sources. In fact, news is circulating that the southern flank of the MBR in Guatemala and the Southwestern Border of the Río Platano Biosphere Reserve in Honduras are subject to unregulated logging, deforestation and expansion of cattle ranching. The lawlessness and destruction reflect the relatively weak enforcement capacity of the governments involved as well as the relatively low priority attributed to conservation. Even Belize, that derives much of its income from offshore nature-based tourism (especially dive tourism) there is virtually unregulated expansion of mechanized farming on the border with Mexico in the Río Hondo watershed practiced by Mennonite farmers who have migrated into the region in recent decades.

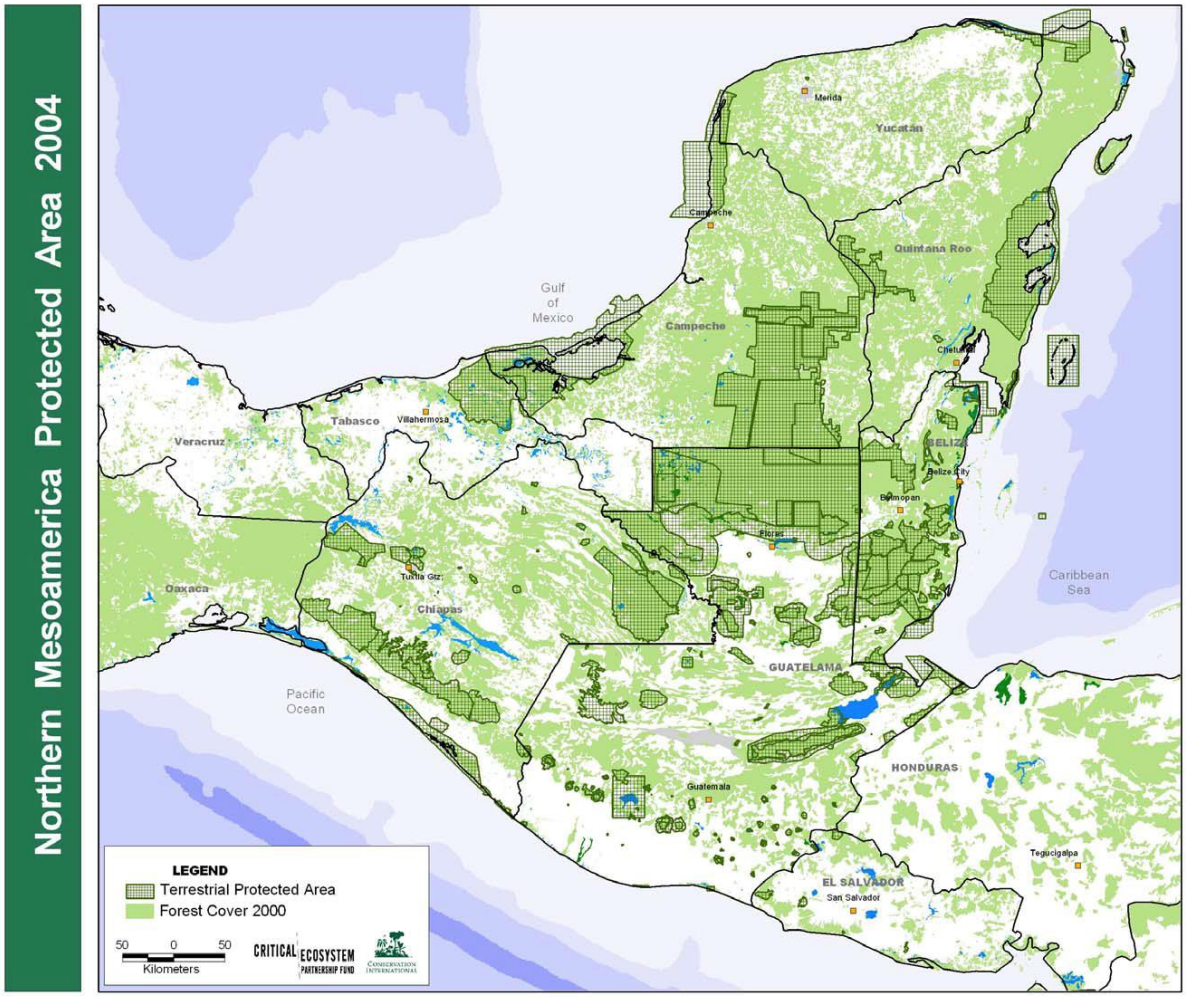
[27] Source; Critical Ecosystem Partnership Fund: Mesoamerica Hotspot: Northern Mesoamerica Briefing Book. 2004

[28] http://www.cepf.net/Documents/final.Mesoamerica.northernMesoamerica.briefingbook.pdf

Table 5 - Protected Areas in Mesoamerica, 2000

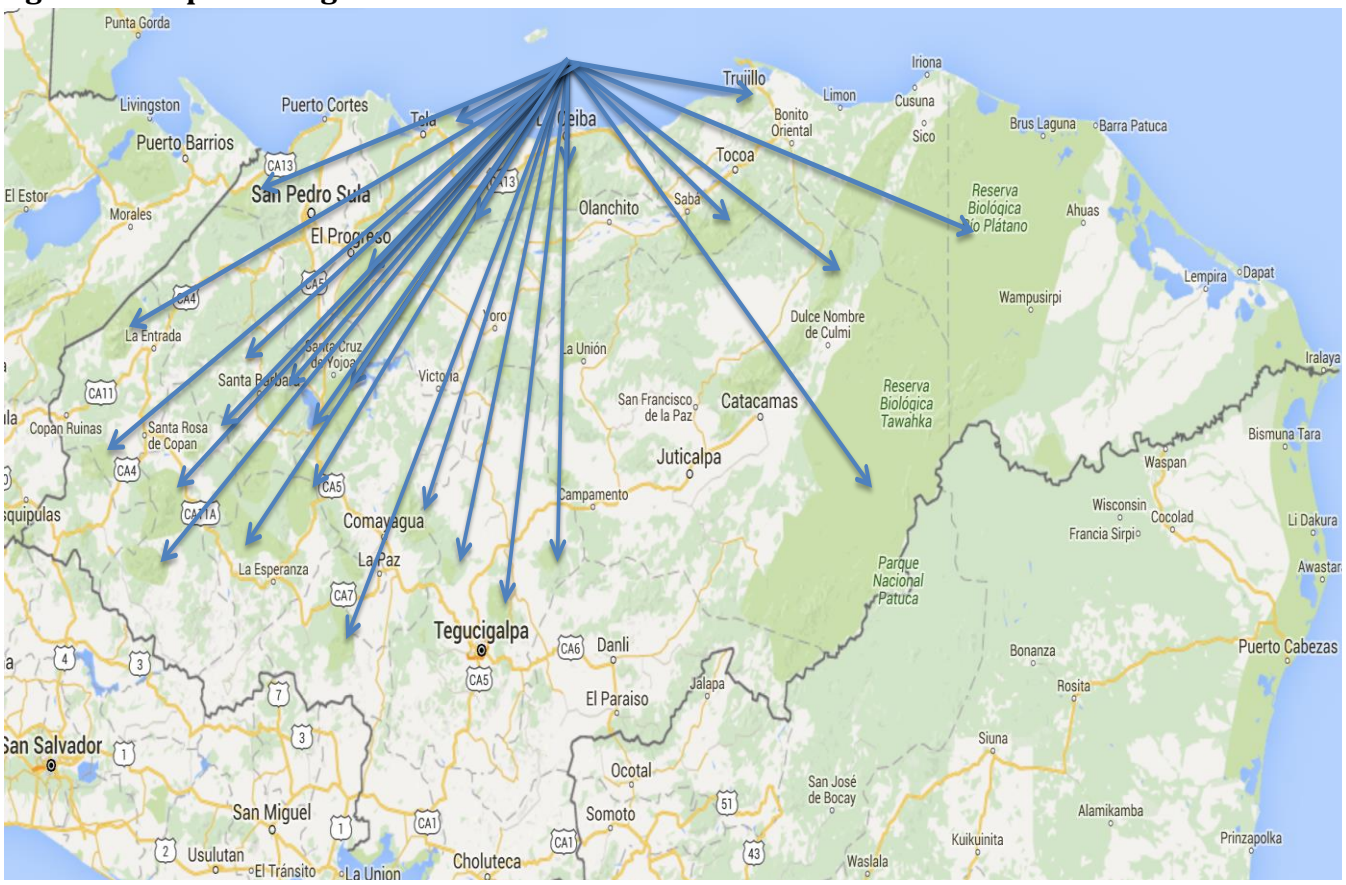
Country	Number of Protected Areas	Area (ha)	Percent of Territory Protected	Percent of Total Area Protected in Mesoamerica
Belize	59	1,029,110	44.82	6.04
Guatemala	104	2,865,830	26.32	16.83
Mexico - Quintana Roo	9	998,000	25.46	5.86
Honduras	35*	2,360,900**	21.1	n.a.
* National Parks Only **All protected areas (2012)			Source: CCAD, UNDP, GEF, 2002	

Fig. 17 - Protected Areas in Northern Mesoamerica



Source: CEPF - Northern Mesoamerica Briefing Book

Fig. 17a – Map Showing Location of Protected areas in Honduras



Agriculture and livestock in Mesoamerica

Mesoamerica is a producer of a wide variety of crops. Subsistence crops planted by small farmers include maize, beans, chilies, rice, melons, cassava and others. Small farmers also produce coffee, cacao, fruits and vegetables for local markets and export. Commercial farms produce coffee, cacao, rice (rainfall and irrigated), bananas, sugar cane, melons, edible beans, sorghum and cotton. Nontraditional agricultural exports have greatly increased in recent years; including such products as: lychee, rambutan, cut flowers melon, pineapple, broccoli, okra, snow peas, celery, cauliflower, asparagus, garlic, spices and nuts, and ornamental plants. Tree crops are increasing in the region including oil palm, citrus, mango and papaya. Sugar cane and oil palm require substantial investments in processing mills and therefore attract relatively well capitalized investors. Large, well capitalized commercial farms and their associated industrial facilities often occupy the prime productive areas, such as river valleys (see Fig. 18). The environmental impacts of commercial agriculture are significant. Many of the crops mentioned above employ large amounts of pesticides and herbicides, sometimes sprayed by aircraft. The Pan-American Health Organization reports that Central America uses more pesticides per capita than any other world region. Many authors have warned of the health impacts of pesticides but relatively few studies have focused on the environmental impacts, particularly on marine life offshore affected by agricultural runoff. Perhaps the most effective constraint on the selection and use of pesticides is

testing conducted by importers of agricultural products. [29]

Livestock production is significant in parts of Mesoamerica and is expanding in certain regions, particularly Honduras where the conversion of forest to pasture is significant. Livestock wastes create a problem for water bodies wherever cattle or poultry are concentrated such as in feedlots, corrals, slaughterhouses, poultry barns, etc. These wastes can flow as runoff into rivers where they are responsible for algae blooms, infestations of aquatic plants (e.g. hydrilla) with implications for marine life as well.

Fig. 18 – Río Motagua Valley in Guatemala showing predominance of commercial farms on the alluvial plain.

Aquaculture is also a growing area of production in Mesoamerica. Organic waste, chemicals and antibiotics from shrimp and fish farms can pollute groundwater or coastal estuaries. Infections of shrimp or fish may be transmitted to wild populations by aquatic birds. Salt from the ponds can seep into groundwater and onto agricultural land with lasting effects, changing the hydrology that provides the foundation of wetland ecosystems. Another major impact of aquaculture is destruction or conversion of wetlands and mangroves and the consequent loss of environmental services (Fig. 18). Most of the aquaculture practiced in on the Caribbean coast of Central America is in Belize that began in 1982. By 2014 the industry occupied more than 3,000 ha and produced more than 21 million pounds of shrimp of which 90% was ASC certified. Belize also produces Tilapia on farms and in small scale ponds. The environmental risk of Tilapia appears to be lower than shrimp because antibiotics are not used. However, there are risks from contamination of

[29] Purchasers of pesticides in Belize are required to show a card indicating they have received training in pesticide use but farmers freely admitted that they often relied on card holders to purchase pesticides for them.

fresh-water by Tilapia wastes and also the risk of escaped fish that expand rapidly in fresh water. Honduras also produces shrimp and Tilapia but it appears that most (or all) of the ponds are located on the Pacific Coast and do not affect the Mesoamerican reef.

Fig. 18 – Shrimp Ponds in Belize

Table 6 – Livestock in Central America

Species	Population size (1 000)
Cattle	51,693
Goat	12,297
Sheep	9,983
Pig	19,690
Chicken	614,409

Source: FAO 2007[30]

[30] FAO – 2007 Sub regional Report on Animal Genetic Resources: Central America

Indigenous People in Mesoamerica

There is a large number of indigenous peoples in the four countries under discussion here. They include the descendants of the ancient Maya who occupied much of what are today Yucatan, Campeche, Quintana Roo, Tabasco and Chiapas in Mexico, Guatemala, Belize and Honduras. Millions of Mesoamericans speak Mayan languages while most of them are bilinguals, who speak Spanish as well. [31]

WWF adopts the broadest possible definition of Indigenous People,that contained in the International Labor Organization Convention 169.

> (a) tribal peoples in independent countries whose social, cultural and economic conditions distinguish them from other sections of the national community, and whose status is regulated wholly or partially by their own customs or traditions or by special laws or regulations;
> (b) peoples in independent countries who are regarded as indigenous on account of their descent from the populations which inhabited the country, or a geographical region to which the country belongs, at the time of conquest or colonization or the establishment of present state boundaries and who, irrespective of their legal status, retain some or all of their own social, economic, cultural and political institutions.

About half the population of Guatemala speak Mayan languages and millions more in Mexico, Honduras and Belize also speak indigenous languages. This raises the question of whether to consider this population as an indigenous population. It can be argued that Maya speakers of the region are highly integrated into their national populations and, while many communities can be considered vulnerable on economic and social grounds, they may be no more vulnerable than many other people in the region. The question may be reduced to that of ethnic identity or self-identification as indigenous (as opposed to a citizen of Guatemala, Mexico, etc.). Studies have shown that many people in Mesoamerica have "dual identities" and that the same person may, at times, consider him or herself to be indigenous while, at other times, to be national citizens. The question may also be reduced to whether or not people as individuals or entire communities suffer adverse discrimination *because* they are indigenous. Again the answer may be ambiguous because while people may suffer from discrimination because their location, speech or dress style are used by others as markers of inferior status, these differences can also be attributed to socio-economic *class*. The issue may also considered through the lens of conflict. The civil war fought in Guatemala until the peace accords of 1996 was articulated in ethnic and religious[32] terms. Similar conflicts occurred in Mexico, primarily in Chiapas.

In view of the complexity of the issue, we suggest that the decision to apply or not WWF's Indigenous Peoples Policy should be made on a basis of whether or not it would be beneficial to the people involved. We suggest that applying the policy in Mexico, Belize or Guatemala would, generally speaking, not yield positive benefits, while to do so in Honduras may be necessary in view of the active conflicts involving ethnic minorities in priority watersheds. Several ethnic groups in Honduras (namely Chorti, Garifuna, Lenca and Tolupanes; see Fig. 19) are in conflict with the government and private investors, primarily over issues of land tenure and technology.

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[31] There are more than 20 languages derived from the Mayan language stock.

[32] The Guatemalan government was led for a time by evangelical protestants who fought predominantly Roman Catholic villagers in a kind of "holy war." Conversion to Protestantism became a token of submission to the regime.

The Lenca People, for example, have resisted construction of dam on a river they considered sacred. [33] The Garifunas and Chortis (a Mayan speaking group) have opposed the appropriation of their ancestral lands for plantation agriculture. The situation in Honduras between groups structured around ethnic identity is tense, in the Chamelecón and Ulúa watersheds. It is necessary to trigger the Indigenous Peoples Policy if any project activities are contemplated in the vicinity of these groups in order to avoid exacerbating conflict. The policy emphasis on securing indigenous land rights is particularly relevant in this region.

Fig. 19 - Map of Indigenous Peoples in the Chamelecon and Ulua Basins in Honduras.

Possible Interventions in the Mesoamerican Reef Ecoregion

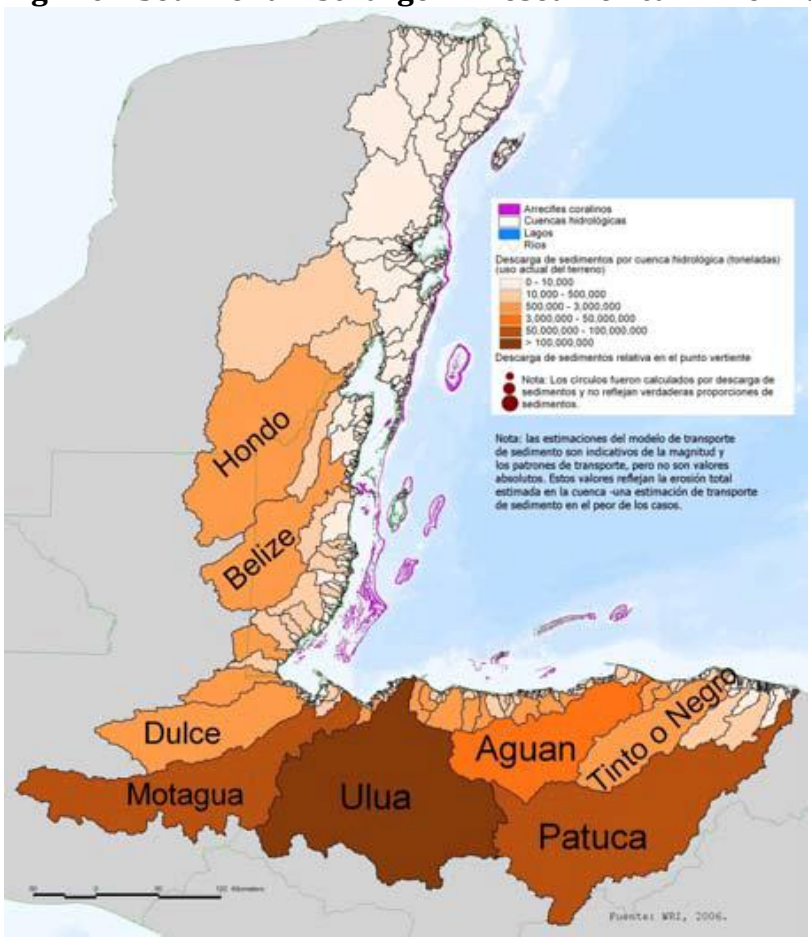
The following section describes possible types of subproject interventions in the four countries bordering the MAR. Since these interventions have not yet been designed, it is possible that additional types of subprojects will be devised. The following types of projects will therefore only exemplify the types of subprojects to be carried out. This list is not prescriptive or predictive. Some of the interventions mentioned below are not covered by the MAR2R project.

a. Watershed management (WM). WM takes various forms. Basically, the aim of watershed management is to regulate water flows within a given microbasin, sub-basin or basin to optimize water availability and minimize water damage. Most of the river basins in the Mesoamerican reef region have been significantly modified by human intervention so WM involves correcting the problems caused by inadequate basin

[33] A Lenca Leader, Berta Caceres, winner of the Goldman Environmental Prize, was assassinated on March 3, 2016, possibly in retaliation for her leadership in the opposition to the construction of the Agua-Zarca dam on the Río Gualcarque that the Lenca consider to be sacred.

management. These problems may consist of excessive flows during peak rainfall, transport of sediments (erosion), siltation, flooding, waterlogging, and destruction of mangroves and wetlands. WM requires planning and the adherence of most or all land users in the target basin. Typical WM measures include building of check dams, berms, overflow basins, drainage and channelization works, and modification of construction and agricultural techniques. Perhaps the greatest WM problems are erosion caused by inadequate drainage during and after construction of infrastructure and inadequate agricultural practices. Some of the remedies are the mandatory use of silt fences at construction sites, the design and construction of adequate drainage facilities such as culverts. In agriculture, cultivation on steep inclines promotes erosion, as does leaving the soil uncovered for long periods, plowing of fields parallel to slopes rather than along contours. Mountainous areas have been terraced in many countries in the Andes and Asia as a form of WM, but it is an extremely labor intensive technique. Use of vegetation to stabilize slopes, increase soil moisture and recharge and to prevent erosion is a common means of WM. Draining or filling wetlands for construction or agriculture causes damage to local ecological cycles, nutrient recycling and flood control. Properly designed and executed, WM can reduce sediment transport, the silting of rivers and the consequent damage to reefs offshore (Fig. 20).

Fig. 20 – Sediment Discharge in Mesoamerican River Basins



Source: Análisis de Cuencas Hidrológicas en el Arrecife Mesoamericano

b. Land-use planning. Land-use planning (LUP) has been practiced in development and conservation work for many years. It consists of analyzing and documenting existing features of designated areas in terms of soils, slope, natural vegetation, fauna, water bodies, geology, geomorphology and other characteristics. It may also take into account current land uses, land tenure, existing and planned infrastructure, migration patterns, etc. In recent decades, LUP has been facilitated by the use of remotely sensed data and GIS technology. Experts generally agree that finer grain planning is more powerful than large-scale plans drawn at the level of 1:50,000 or greater. However, the finer the scale, the greater the cost of collecting and analyzing data. Land-use plans fall into two broad categories: (i) information intended primarily to inform planners and developers in order to optimize human use and minimize environmental damage and losses; (ii) information intended to establish use zones in order to regulate how land is used. Urban zoning is a good example of the latter type of LUP but it has also been used at a larger scale with varying degrees of success. In developing countries, governments often lack the capacity to enforce land-use zoning and changes in land use may occur spontaneously, driven by migration, population growth, investment and markets. LUP may be done "top-down" driven primarily by technical criteria, or it may be done in participatory fashion, taking local uses and preferences into account.

c. Water Reserves: The concept of water reserve, as the term is used in this project, refers to the establishment of governance mechanisms and cooperative action among institutions and civil society designed to mobilize resources, policies and collective action in favor of good management of critical hydric recharge and regulation zones, and wetlands. A water reserve is not necessarily the same as a watershed but may include more than one watershed or only part of a single watershed, wherever organized actions can benefit the maintenance or improvement of water quality and water resources sufficient to maintain overall environmental quality, and to assure their availability for other uses.

d. Agro Forestry: This encompasses the use of perennial tree and shrub species such as cacao and coffee. Agroforestry can be practice under shade or in full sunlight. It is relatively undemanding of agrochemicals and may contribute to stabilizing soils. Coffee can be produced on mountain slopes while cacao thrives mainly in the lowlands. Other tree crops include mango, citrus, nut trees (e.g. Macadamia), and species grown for the wood or fodder. Tree crops may be interplanted with annual crops until they create too much shade. A major benefit of tree crops is that they typically require lower labor inputs and they continue to yield year after year with minimal cultural activities.

e. Terrestrial Habitat Restoration. Restoration of natural habitats can help to restore ecosystem services important to the preservation of coral reefs. In Mesoamerica, there is a wide range of habitat types providing ecosystem services, some of which have been degraded due to human activities such as agriculture, transportation development, urban growth, logging and industry. Among the key habitat types that provide services are montane forest, riparian vegetation, mangrove forests, and wetlands. There are two key approaches to restoring any of these habitats and their associated services. First is to reduce or eliminate the activities causing degradation, allowing natural processes of seed dispersal, regrowth, and ecological succession to occur spontaneously. The second approach involves actively encouraging the regrowth of desired plant and animal

communities. For example, some programs have established nurseries for distribution of native mangrove seedlings for replanting s where mangroves have been degraded or clear cut. In some cases, habitat restoration may involve the introduction of exotic species. Areas with severe erosion following deforestation or overgrazing, may be planted in rows of vetiver grass (*Chrysopogon zizanioides*) perpendicular to the slope.

f. Marine Habitat Restoration. As on land, the prevention and cessation of degradation is the first line of defense to conserve the ecosystem services of reefs. These are currently the most feasible approaches to coral reef restoration, i.e. reducing the insults to coral reefs caused by unregulated dive tourism, toxic effluents or hyper nutrition, damage caused by boat anchors and destructive fishing techniques such as drag nets and trawlers. Imposition of catch limits and careful regulation of commercial fishing may also help. Other factors, not directly attributable to local activities also contribute to reef degradation. Chief among them are ocean acidification and bleaching caused by warm temperatures. These are linked to global impacts such as the burning of fossil fuels. Direct intervention to promote the regrowth of coral reef that has been damaged by one of the one of these factors is still in its infancy. There is some evidence that electrical stimulation can encourage the regrowth of corals.[34] More promising have been experiments using samples of corals that have survived bleaching episodes and employing them to recolonize damaged reefs. With regard to biodiversity, it is also possible to seek natural predators that will attack undesirable or alien species. However, such experiments must be undertaken with extreme caution because the introduction of organisms to new habitats to combat others has resulted in many unfavorable episodes. The same caution applies to genetically modified organisms introduced into a wild habitat.

g. Ecosystem Services: These are normal ecosystem functions that are useful to people. They include scenic beauty, absorption or dilution of human wastes, soil stabilization, protection against erosion, aquifer recharge, water purification, flood prevention, protection from storms and winds, carbon sequestration, nutrient recycling and others. Efforts to maintain or enhance an environmental service can have both positive and adverse impacts. For example, disposing of raw sewage through a river or marine outfall can benefit people by carrying off wastes but can reach a limit where it creates problems such as the contamination of water for downstream users. Economists have developed techniques for estimating the value to society of ecosystem services[35] and, in some cases, a decision is taken to compensate individuals or communities who help to conserve or deliver the service. For example, a government may decide to provide tax incentives to farmers who preserve riparian vegetation to help prevent erosion. It is useful to attempt to quantify how environmental services contribute to human well being and economic development. Policies can be developed based on economic calculations. On a global scale, the United Nations' REDD program is a form of payment for carbon sequestration on a global scale.

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[34] Rinkevich, Baruch 2005 Conservation of Coral Reefs through Active Restoration Measures: Recent Approaches and Last Decade Progress *Environmental Science and Technology.*, V. *39* (12), pp 4333–4342

[35] Siikamäki, Juha, Peter Vail, Rebecca Epanchin-Niell, and Francisco Santiago-Ávila Mapping the Value of Ecosystem Services in Latin America and the Caribbean. Resources for the Future.

h. Resource Optimization: There are various possible approaches to optimizing the use of resources that contribute to the conservation of biological and physical resources in contributing watersheds. Table 7 below summarizes some of these approaches. As in newly introduced technology, there are potential risks in the practices outlined above. The last column in Table 7 highlights some of the risks. Perhaps the greatest risk in the adoption of some resource optimization measures is the possible exacerbation of social cleavages based on differences in access to capital, credit or information. In physical and environmental terms, most of these measures are unlikely to have adverse environmental impacts.

i. Effluent Treatment. Palm Oil processing mills, sugar mills, and livestock operations produce large amounts of waste that pollute water bodies when released untreated. These effluents can be treated through various methods such as biogas production from animal wastes. Treatment facilities add significantly to investment and operating costs which explains why producers resist adopting them. In some cases, some costs can be recovered by producing usable by-products such as methane gas.

j. Protected Areas: Perhaps the most common instruments for environmental protection in Mesoamerica are protected areas. Protected areas provide important ecosystem services such as use restrictions that significantly reduce the likelihood of damage to freshwater ecosystems and the reefs offshore. For example, the Maya Biosphere Reserve in Guatemala (MBR), together with the Río Bravo Conservation and Management Area (RBCMA) in Belize and the Calakmul Biosphere Reserve in Quintana Roo, Mexico all help to protect the Río Hondo Watershed.

Table 7 - Resource Optimization Measures

Measure	Methods	Benefits	Risks
Integrated pest management; optimal use of fungicides and antibiotics.	Selective use of pesticides , use of biological controls, targeting of pesticide use to specific pests, voluntary and mandatory controls on pesticide sales.	Reduction of toxic substances in the ecosystem; lower costs to farmers, preservation of benign or helpful insects, e.g. pollinators.	Potential health risks due to exposure to toxic chemicals, or release into environment due to improper storage and disposal.
Improved Fertilizer Management	Selection of optimal fertilizer composition, optimal timing of application, use of silt fences	Better yields, lower costs, lower fertilizer runoff, greater crop absorption.	Untried amendments may reduce yields.
Treatment of agro-industrial effluents	Aeration ponds, digestors (biogas), anaerobic sludge bioreactor, etc.	Certification by RSPO, ISO 14.000, lower toxicity of effluents.	Resistance by producers due to high capital costs
Fire prevention and suppression	Environmental education, forest fire prevention and suppression, suppression of poaching.	Reduced destruction of forest cover, reduced erosion, biodiversity conservation.	Fire suppression is dangerous and costly.
Reduce clear cutting of forest or mangrove	Establishment of protected areas, voluntary restraint by farmer organizations, better enforcement of logging regulations	Maintenance of forest cover, CO_2 sequestration, maintenance of biodiversity, watershed protection.	Protected areas may reduce access to important resources to some people.
Improved water management	Water Reserves; Water-saving irrigation methods (e.g. drip irrigation vs. sprinkler),	Reduced water consumption, reduced evaporation, lower pumping	New technologies with higher cost may create barriers to entry and

Measure	Methods	Benefits	Risks
	recycling.	costs, augmented flow through watershed.	cause income imbalances.
Organic Agriculture	Composting of organic wastes, mulching, "green manure", crop rotation legumes	Reduced use of chemical fertilizer, lower fertilizer runoff, lower costs to farmers. Rising consumer demand for organic produce.	Production may be reduced
Low- and no-till farming	Direct planting, cover crops, plastic mulch[36].	Lower fuel and labor costs, improved soil quality, reduced sediment runoff, greater retention of organic matter and soil carbon, weed suppression,	Some methods (e.g. plastic mulch) may lead to gullying.
Improved tillage	Contour plowing, terracing, use of berms and silt fences to soil transport, use of ground cover between harvests	Reduced siltation of streams and rivers,	Higher cost in technology, fuel and labor may create entry barriers to poorer farmers.
Restoration of montane forest, riparian vegetation, wetlands and mangrove,	Prevent overgrazing, grazing or agriculture on steep slopes, deforestation, clear cutting of riparian vegetation, destruction of wetlands, etc. Also replanting of desired vegetation types.	Reduced erosion, reduced siltation of streams and rivers, Neutralization of pollutants; absorption of excess nutrients, "filtering effects,"	Restoration of vegetation requires collaboration of landholders, fencing to prevent grazing in replanted areas, Replanting requires investment in nurseries and dissemination of seedlings. Nurseries often use pesticides
Improved Aquaculture Management	Avoid flushing of antibiotics and chemicals into water bodies, Avoid expansion of fish ponds into forest or mangroves. Support entry into ASC.	Reduce contamination of water bodies, reduced abandonment of fish/shrimp ponds.	No matter how it is practiced, large-scale aquaculture displaces native vegetation.

Pest Management

As mentioned above, Mesoamerica is among the world regions that consume the largest amounts of pesticides and other agro-chemicals per capita or per unit area. While the management of agricultural pests and weed control are important to the success of modern agriculture, there has been increasing recognition of the need to use agrochemicals more strategically because of the damage they can do to aquatic and terrestrial ecosystems. Starting with the world-wide ban on the use of DDT, there have been increasing demands for limitations on the use of agrochemicals because of their impact on human health and the ecosystems.

[36] Plastic mulch was observed to be in widespread use on melon farms in the lower and middle Motagua basin in Guatemala.

The World Health Organization maintains a classification of agrochemicals based on the health risk that they pose. The classification is shown in Table 8.[37]

Table 8 - WHO Classification of Agrochemicals

Ia	**Extremely hazardous**
Ib	**Highly hazardous**
II	**Moderately hazardous**
III	**Slightly hazardous**
U	**Unlikely to present acute hazard**

If a proposed intervention involves the cultivation or introduction of crops that require, or are likely to require, pesticide use, WWF prohibits using WWF support for procurement of products listed under lass Ia and Ib and allows use of Class II products only when it is managed and applied by persons properly trained and with protective gear.

Additionally, WWF recommends the following measures be incorporated into project plans.

1. Avoid the use of pesticides and herbicides to the extent possible;
2. Follow the recommendations contained in the FAO International Code of Conduct on the Distribution and Use of Pesticides[38]
3. Provide training and individual protective gear to anyone handling or applying such products;
4. Provide adequate storage and disposal facilities for hazardous products;
5. Apply agrochemicals only when conditions demand applying pesticides only when particular plant pests are identified;
6. Use Integrated Pest Management or organic methods or biological controls in preference to using pesticides or herbicides.
7. Prepare a Pest Management Plan (PMP) for submission along with the ESMP describing the products to be procured and used and the precautions taken to apply them safely.

Social Impacts

The two primary policies concerning social impacts are those concerning involuntary resettlement and Indigenous Peoples.

Resettlement

Resettlement can be considered under two headings: (a) the physical displacement of people from their homes or places of business; (b) the taking of land on which people depend for farming, hunting, fishing, or other activity important to their livelihoods. Resettlement can cause disruption of community life, loss of income, damage to cultural traditions. The description of the MAR2R project does not suggest that activities will be undertaken under the project that are likely

[37] http://www.who.int/ipcs/publications/pesticides_hazard_2009.pdf?ua=1
[38] http://www.fao.org/docrep/005/Y4544E/Y4544E00.HTM

to cause either type of resettlement. Nevertheless it is necessary to consider the possibility of displacement or the taking of land in order to be clear about the proper procedures required to manage such situations. WWF policy requires that resettlement planning be carried out whenever implementation of a project will cause "direct and significant" impact on resettlement or access to land. The key issues that need to be addressed are the number of families and people potentially affected, the impact on their livelihoods and assets, their concerns and desires regarding loss of housing and other assets,

There are a number of guiding principles required by WWF policy and internationally recognized best practice regarding resettlement.

1. Resettlement should only be undertaken when there is no reasonable or viable alternative and must be undertaken in compliance with national law.
2. Affected people should be provided with full information regarding resettlement and offered alternatives;
3. Resettlement plans shall be prepared in a participatory fashion with the opinions and concerns of affected people taken into full consideration;
4. Resettlement planning and implementation shall be carried out by a team that includes qualified social scientists, preferably with experience among the affected people and familiarity with their language;
5. Resettlement plans may involve the collaboration of other institutions such as government agencies, NGOs, health providers, etc.; plans must demonstrate that other agencies are fully committed to playing a specific role and legal agreements between agencies should be prepared and signed prior to approval of the resettlement plans;
6. Resettlement plans require a detailed timetable and budget as well as a financing plan showing the source of all funding needed;
7. A full census of all households affected by the project should be carried out and used to plan resettlement; the census includes data on length of residence, educational level, livelihood activities and income; census data will also be used as a baseline for ex-post evaluation;
8. Affected persons who lose assets should be fully compensated for their losses in a manner that is least disruptive to their life style;
9. When land is taken, the preferred solution is to provide equivalent amounts and quality of land elsewhere;
10. When cash compensation for lost assets is contemplated, the valuation method shall be described in detail in the resettlement plan; assets shall be compensated at their full replacement value without taking depreciation into consideration;
11. When people are moved to a new location, transitory benefits such as moving expenses, meals, compensation for lost harvests, etc. should be provided;
12. When land resettlement is not possible, the project must develop socially acceptable plans for livelihood restoration;
13. When people are denied access to resources previously available to them and important for their subsistence, a process framework ***shall be negotiated with the affected groups***, to compensate for the lost access;
14. Persons who have occupied land without legal title are entitled to resettlement and livelihood assistance even when local laws do not recognize their tenure; occupants who

have rights that can be lawfully secured should receive legal assistance to assure these rights;

15. To avoid abuse and opportunism, a cutoff date should be declared – normally just after the census is completed -- after which new settlers or improvements to assets will not be entitled to compensation;
16. The project activities that cause resettlement should only be implemented after the affected people have been censused and consulted; ***temporary resettlement is generally not acceptable*** except when people have the opportunity return to the place of origin;
17. A grievance mechanism shall be provided for persons who feel they have been treated unfairly or compensated inadequately. Such mechanism shall be widely disseminated and shall include registration and follow-up on each grievance, a time-bound adjudication process as well as an impartial appeals process. Finally, grievances shall be tabulated and categorized at regular intervals with frequent reports to management.
18. Resettlement programs shall be evaluated after a period sufficient to allow the proposed mitigating measures to have achieved their goals. The principal issues to be investigated are restoration of livelihoods and community bonds.

Indigenous People

The first task under the heading of Indigenous People is to determine whether any indigenous group is actually affected by the project. Unlike other safeguard policies, the indigenous peoples policy triggers the policy regardless of whether the expected impact is adverse or beneficial. Thus, even highly beneficial interventions such as educational, health, or productive programs will trigger the policy. Consideration should be given to indirect impacts. For example, if a protected area is planned near an indigenous community, it is necessary to evaluate whether the operation of the project activity will impact the community. If indigenous people have previously used the area for hunting, fishing and gathering, their access may be restricted.

If determined that the intervention will affect one or more indigenous communities, the next step is to engage directly with the indigenous group in a culturally appropriate manner. It is very helpful to include a person familiar with the indigenous community and who speaks their language on the team. Reaching out to an indigenous community often requires significant tact and skill. It is important to determine who in the group is qualified, from the community's perspective, to engage with the project team. It is unwise to arrive in a village, convene a meeting of all the villagers and begin to "sell" the project. Sometimes, community leaders insist that all dealings with the community be channeled through them. Gaining access to all members of a community (youth and elders, men and women, farmers and fishermen) may not take place immediately, but should be achieved over time.

It is sometimes argued that making an early contact with a community is dangerous because it raises expectations that the project will bring a bonanza of benefits to the community in the form of cash, jobs, services, or donated items, leading to disappointment when the expected benefits do not materialize. This may be a consequence of past experiences when benefits were promised to a community to participate in a project, such as a one-off gift or a one-day clinic. This does not prevent the offering of incentives such as paying a guide for a botanist in the forest, or meals for

volunteer laborers for assistance in building a community center as part of the project activities. Every effort should be made to be clear, consistent and coherent in dealings with indigenous people. The team should ***never*** promise more than it can reasonably deliver.

As engagement with indigenous communities deepens and trust builds, the team will expand its circle of contacts to reach and discuss the project with a fair and representative cross-section of the community (or communities) affected by the project. Sometimes, communities unaffected by the project of the same or different ethnic group ask to be included in the discussions and the benefits. The team should be ready for this eventuality but make it clear that its primary obligation is to the community (-ies) affected by the project. However, in cases where feasible, it may be better to extend some project benefits to all members of a given group rather than risk provoking rivalries and complaints.

Once an indigenous group has been engaged, concrete discussions should begin regarding the proposed project and how the indigenous communities involved can be accommodated within the project in culturally appropriate ways. The project team should be attentive to possible rumors and misconceptions and careful to avoid overpromising. Meetings should be carefully structured with an agreed agenda and objectives. Minutes should be taken at meetings and records kept of attendees. Decisions should be carefully worded and recorded. The entire process can extend over months so early engagement and beginning of substantive discussions should begin as early as possible and continue on at regular intervals. The key principle for developing activities affecting indigenous peoples is *Free, Prior and Informed Consent* (FPIC). FPIC is required by ILO Convention 169, by the United Nations Declaration of the Rights of Indigenous Peoples and by WWF policy.

As part of the ESMP or as a stand-alone document, the project designers will prepare an Indigenous Peoples Plan including

> Specific measures to provide culturally and economically appropriate benefits to potentially-affected groups and/or at minimum to avoid, minimize or mitigate adverse effects. Measures should include capacity development and training measures, an implementation schedule, and cost estimate.
>
> All project and program planning to address adverse social or environmental impacts must be developed with the participation of multiple stakeholders, including local NGOs, indigenous peoples and local communities (women and men, and including vulnerable and at-risk groups), and include consultation and consent procedures in keeping with relevant WWF policies. [39]

The IPP identifies the principal stakeholders and proposes a culturally appropriate process of consultation with the indigenous people in each stage of the preparation and implementation of a project. When the principal impacts (adverse and positive) of a project have been identified, the IPP presents an action plan seeking to minimize, mitigate or compensate adverse impacts. Through discussions with the affected communities, the IPP identifies and evaluates the necessary measures to avoid adverse impacts and to ensure that IPs receive culturally appropriate benefits. This includes a proposal that guarantees access to the land and natural resources necessary for

[39] WWF Environmental and Social Safeguards Policies and Procedures

subsistence and continued development. The proposed measures should comply with two criteria (a) economic and environmental sustainability and (b) acceptability to the indigenous community.

An IPP is based on a social assessment. A social assessment is normally prepared by a social scientist (anthropologist or sociologist) familiar with the affected indigenous group. The evaluation is based on the available literature, consultations and direct observation. The analysis should focus on the relative vulnerability of the group and the risks to the communities in the existing social and political context.

The IPP should include the following themes:

i. A description of the affected group(s)
ii. The ethnic affiliation of the group and its language;
iii. The origins and migrations and the areas traditionally occupied or utilized by the group;
iv. The location and territorial limits;
v. The legal status of land tenure;
vi. Literacy and educational level;
vii. Social organization including family and household composition, clans, community organization, gender roles, leadership and governance;
viii. Relations with other social groups including economic relations (trade) and relationships with non-indigenous people, the state, private companies;
ix. Conflicts within communities and between communities or other outside groups and their impact on attitudes and expectations;
x. Natural resources utilized by the group and subsistence means;
xi. Religion and spiritual traditions;
xii. Health status and sanitation;
xiii. Available services: health, education, electric power, water;
xiv. Concerns and desires expressed by the group.

The IPP presents an evaluation of possible negative and positive impacts of the project from various perspectives: economic, social and cultural. The team presents the details of the project to the affected communities including information regarding the type of project, its scope and duration and the expected impacts. Meetings should have a definite structure and should be inclusive of all members of the community. If necessary, separate meetings can be held with women, youth, elders and dissidents. Minutes should be taken of meetings and participants recorded. Project management should be prepared to respond to specific suggestions made by participants.

As a rule, the greater the sense of ownership of the plan the greater the likelihood of acceptance. If significant opposition to the project should arise, the responsible entities should continue the discussions and negotiations until opposition has been overcome. Often, this will involve making changes in the project design or providing benefits to overcome resistance and satisfy the objections. The objective is to obtain broad approval within the community and to instill a sense of co-management of the project. Consultations should be continuous before and during implementation of the project, avoiding long gaps between meetings.

The project may involve not only infrastructure but also training in key areas such as financial management, health care, etc.

The IPP should establish specific goals and include a budget for the activities to be carried out. The IPP should also include a timetable correlated with that of the project itself. Actual implementation of the project should not begin until agreement has been reached with the indigenous community (-ies). The IPP should identify the persons who will be responsible for project implementation and describe their functions including the minimum qualifications. A grievance mechanism should be available (see below) as well as agreed procedures on how to identify and resolve conflicts that may emerge. Finally, the IPP should provide specific M&E procedures.

Grievance Procedures

A project should have established grievance procedures rather than treating complaints ad hoc. A grievance procedure includes the following steps:

1) Dissemination: the availability of the procedure should be announced and discussed, preferably in the indigenous language;
2) Reception and Registration: Grievances may be presented orally or in writing to any member of the management team; they should be registered in a standard format indicating the nature of the complaint and the objectives of the griever;
3) Fact-finding and adjudication: once a grievance has been filed, it should be assigned to a member of management (not the person who is the object of the complaint) who should ascertain the facts of the case. Care must be taken to avoid bias or favoritism;
4) Delivery of results: The normal period for adjudication should be established, normally about 2 – 4 weeks unless prevented by specific circumstances; the results should be delivered in writing to the griever;
5) Appeals: Grievers should have the right of appeal. Typically, this would involve bringing a respected figure from outside the project to assist in the review of the case;
6) Review: There should be a periodic management review of grievances to determine whether policy changes need to be made

Negative List

It is customary in applying safeguard policies to present a negative list. This list itemizes potential project activities that could trigger safeguard policies. This list follows the "Precautionary Principle," that states that processes or projects should *not* be undertaken when there are significant doubts or conflicts regarding the possible outcome. The principle is applied, for example, when considering the introduction of alien or genetically modified organism to a particular habitat. The introduction of rabbits to Australia is a well-known example of a species introduction that had severe unintended consequences. First introduced for hunters, rabbits have caused damage to crops and native vegetation, causing extensive erosion. A more positive example is the introduction of a small wasp (*Trichogramma spp*) to help control sugar cane borers.

These insects have significantly reduce borer infestation in cane fields and they may replace the use of pesticides. The precautionary principle requires that the potential adverse consequences of introducing an alien or GMO species are thoroughly investigated by qualified experts and, if possible, experimental or pilot studies have demonstrated the effectiveness of the technique and the absence of adverse impacts. Another example of unintended impacts resulting from introduction of a plant can be found in the introduction of kudzu (*Pueraria spp*) to prevent erosion on slopes and road cuts. Once planted, however, kudzu can be highly invasive, enveloping trees, houses, power lines, etc.

Table 9 is a suggested negative list to be distributed among CCAD/PMU and partners for sub-projects under the MAR2R project. The list does not create an absolute prohibition for specific interventions. It is intended primarily as a precaution applied to possible project activities. It places a burden on subproject proponents to show that a proposed subproject design has been adequately investigated and that measures to reduce or eliminate potential adverse impacts have been built in to the project design, including the budget, staffing and timetable.

Table 9 – Negative List

Project Activity	Potential Risks	Possible Mitigatory Measures
Use of WHO class Ia or Ib Pesticides (see Table 8)	Severe health impacts on workers and possible consumers of agricultural products	None available Should not be procured or used under any circumstances
Use of WHO class II Pesticides	Adverse health impacts if not properly used, development of resistant pest populations, harm to desirable animal or plant populations, e.g. pollinators.	Pest Management Plan including procurement of PPE, proper training and monitoring.
Subprojects affecting indigenous groups	Disruption of community life, undermining local authority; introduction of practices incompatible with indigenous culture, reduced access to important subsistence resources, violation of cultural norms.	Extensive consultation leading to Indigenous Peoples Plan aimed at maintaining the integrity of the indigenous group and their effective environment.
Introduction of exotic species or GMOs	Specie becomes invasive; cross breeding with native plants or animals, crop damage, damage to infrastructure	Careful investigation by qualified expert and comparison to introductions in similar environments.
Activities that violate local laws or regulations	Risk of legal action	None.
Conversion of natural habitats, (forests, wetlands, mangroves, etc.)	Loss of biodiversity and ecological services	Creation of offsets to compensate for loss.
Subprojects requiring physical displacement of persons from their homes or legal businesses	Disruption of community life, loss of income, loss of subsistence resources.	Resettlement action plan minimizing resettlement, intensive consultation with affected people and full compensation for losses.
Any prohibited activity	Loss of natural or cultural heritage	None

Project Activity	Potential Risks	Possible Mitigatory Measures
inside protected area or buffer zone		
Interruption of an ecological corridor	Loss of mobility and consequently of genetic exchange within plant and animal communities	None
Activity that disturbs or encourages disturbance of a critical natural habitat	Loss of biodiversity, extinction of critically endangered species	None

Summary and Conclusions

Table 10 summarizes the steps to be taken for any intervention that might be considered for support by the MAR2R Project. If the decision is taken not to support a proposed intervention the process may stop at step 5 or 6. If the screening or scoping exercise uncovers a potentially adverse impact, the process should be carried through to the end. If, however, the project is classified category C, steps 6 – 18 can be omitted.

Table 10 - Check List for ESIA

No.	Ítem
1	Identify location and boundaries of proposed intervention.
2	Describe proposed intervention
3	Describe sensitivity of the environmental and social context including potential vulnerabilities
4	Identify potential social and environmental impacts of proposed intervention.
5	Screening. Select category for proposed intervention (A, B or C)
6	Scoping: Consider concerns of stakeholders and experts.
7	Identify need for Pest Management Plan (PMP), Indigenous Peoples Plan (IPP) or Resettlement Action Plan (RAP).
8	Draft terms of reference for ESIA including budget and timetable and send to donor for review if required.
9	Identify KPIs
10	Send scoping report for review by donor
11	Recruit independent consultant to conduct ESIA and other studies
12	Begin ESIA studies including baseline study.
13	Consult with affected stakeholders, carefully documenting meetings.
14	Identify specific mitigating measures to avoid or reduce impacts
15	Draft ESMP, PMP, IPP and RAP with M&E plan, budget and timetable. .
16	Disclose documents to Civil Society
17	Submit ESIA/ESMP to donor for review and clearance.
18	Revise ESIA/ESMP and disclose to Civil Society
19	Project Implementation with M&E.

There is a small risk of over-emphasizing safeguard procedures. Sometimes, the preparation of ESIAs involves the useless compilation of data irrelevant to the issues that arise in a particular project. For example, an intervention designed to promote agroforestry without converting natural forest areas may not pose a significant threat to biodiversity. In such a case, a detailed survey of species diversity in the area of the project is not called for. It is essential, therefore, early in the scoping process, to realistically assess the concrete and significant impacts that an expected intervention can reasonably be expected to cause. This will allow the ESIA process to identify the actual risks posed by the proposed intervention and to target mitigating measures to the expected impacts.

Annex 1 – Laws, regulations and international agreements

Annex 2 – Decision Tool for Screening

Annex 3: Northern Mesoamerica's Globally Critically Endangered Species[40]

Clase	Familia	Nombre Científico	Nombre(s) Comun(s)	Countries of Occurrence in N. Mesoamerica				
				Belice	El Salvador	Guatemala	Honduras	Mexico
ACTINOPTERYGII	CYPRINIDAE	Notropis moralesi	Sardinita de Tepelmene					1
	CYPRINODONTIDAE	Cyprinodon verecundus	Cachorrito de Dorsal Larga					1
	POECILIIDAE	Gambusia eurystoma	Guayacon Bocon					1
		Poecilia sulphuraria	Molly del Teapa					1
AMPHIBIA	Centrolenidae	Hyalinobatrachium crybetes					1	
	Hylidae	Duellmanohyla salvavida					1	
		Hyla dendrophasma				1		
		Hyla insolita					1	
		Hyla perkinsi	Perkins' Treefrog			1		
		Hyla salvaje				1	1	
		Hyla valancifer	Lichenose Fringe-limbed Treefrog	1				1
		Plectrohyla chrysopleura					1	
		Plectrohyla dasypus					1	
		Plectrohyla pycnochila	Thicklip Spikethumb Frog					1
		Plectrohyla tecunumani	Cave Spikethumb Frog			1		
	Leptodactylidae	Eleutherodactylus anciano					1	
		Eleutherodactylus coffeus					1	
		Eleutherodactylus cruzi					1	
		Eleutherodactylus fecundus					1	
		Eleutherodactylus merendonensis					1	
		Eleutherodactylus olanchano					1	
		Eleutherodactylus pozo						1
		Eleutherodactylus saltuarius					1	
	Plethodontidae	Bolitoglossa carri	Cloud Forest Salamander				1	
		Bolitoglossa decora					1	
		Bolitoglossa diaphora					1	
			Jackson's Mushroomton gue Salamander			1		

[40] Source; Critical Ecosystem Partnership Fund: Mesoamerica Hotspot: Northern Mesoamerica Briefing Book. 2004

		Bolitoglossa longissima					1	
		Bolitoglossa synoria			1		1	
		Bradytriton silus	Finca Chiblac Salamander			1		
		Cryptotriton monzoni				1		
		Cryptotriton nasalis	Cortes Salamander				1	
		Dendrotriton	Forest Bromeliad Salamander			1		
		Ixalotriton niger						1
		Ixalotriton parvus						1
		Nototriton lignicola					1	
		Pseudoeurycea exspectata	Jalpa False Brook Salamander			1		
AVES	MIMIDAE	Toxostoma guttatum	Cozumel Thrasher					1
	TROCHILIDAE	Amazilia luciae	Amazilia Hondureña				1	
			Esmeralda Hondurena				1	
			Honduran Emerald				1	
CRUSTACEA	HIPPOLYTIDAE	Somersiella sterreri						1
MAGNOLIOPSIDA	ANNONACEAE	Desmopsis dolichopetala					1	
		Malmea leiophylla					1	
	AQUIFOLIACEAE	Ilex williamsii					1	
	ARALIACEAE	Dendropanax hondurensis					1	1
		Oreopanax lempiranus					1	
	BIGNONIACEAE	Chodanthus montecillensis					1	
	BOMBACACEAE	Quararibea yunckeri					1	
	BORAGINACEAE	Cordia urticacea					1	1
	CACTACEAE	Coryphantha vogtherriana						1
		Echinocactus grusonii						1
		Escobaria aguirreana						1
		Mammillaria berkiana						1
		Mammillaria brachytrichion						1
		Mammillaria guelzowiana						1
		Opuntia chaffeyi						1
		Turbinicarpus booleanus						1
		Turbinicarpus						1
		hoferi						
		Turbinicarpus jauernigii						1

		Turbinicarpus rioverdensis						1
		Turbinicarpus swobodae						1
	CAPRIFOLIACEAE	Viburnum hondurense					1	
		Viburnum molinae					1	
		Viburnum subpubescens					1	
	CELASTRACEAE	Maytenus williamsii					1	
		Tontelea hondurensis				1	1	
	CONNARACEAE	Connarus popenoei					1	
	ELAEOCARPACEAE	Sloanea shankii					1	
	FAGACEAE	Quercus hinckleyi	Hinckley's oak					1
		Quercus hintonii						1
	FLACOURTIACEAE	Casearia williamsiana					1	
	HAMAMELIDACEAE	Molinadendron hondurense					1	
	LAURACEAE	Pleurothyrium roberto-andinoi					1	
	LEGUMINOSAE	Bauhinia paradisi					1	
		Dalbergia intibucana					1	
		Lonchocarpus molinae					1	
		Lonchocarpus phaseolifolius			1	1	1	
		Lonchocarpus sanctuarii					1	
		Lonchocarpus trifolius					1	
		Lonchocarpus yoroensis					1	1
		Platymiscium albertinae					1	
		Terua vallicola					1	
	MONIMIACEAE	Mollinedia butleriana					1	
		Mollinedia ruae					1	
	MYRSINACEAE	Gentlea molinae					1	
	MYRTACEAE	Eugenia coyolensis					1	
		Eugenia lancetillae					1	
	OLEACEAE	Forestiera hondurensis					1	
		Fraxinus hondurensis					1	
	POLYGONACEAE	Coccoloba cholutecensis					1	
		Coccoloba lindaviana					1	
	RHAMNACEAE	Colubrina hondurensis					1	
	RUTACEAE	Decazyx esparzae					1	1
	SAPOTACEAE	Sideroxylon retinerve					1	
	SYMPLOCACEAE	Symplocos molinae					1	

	THEACEAE	Ternstroemia					1	
		landae						
	VIOLACEAE	Gloeospermum boreale					1	
	VOCHYSIACEAE	Vochysia aurifera					1	
MAMMALIA	GEOMYIDAE	Orthogeomys cuniculus						1
	HETEROMYIDAE	Heteromys nelsoni						1
	MURIDAE	Tylomys bullaris						1
		Tylomys tumbalensis						1
	VESPERTILIONIDAE	Myotis cobanensis				1		
REPTILIA	ANGUIDAE	Abronia montecristoi			1			
	DERMOCHELYIDAE	Dermochelys coriacea	Canal		1	1	1	1
			Cardon					
			Leatherback					
			Tinglada					
			Tinglar					
			Tortuga laud					
	CHELONIIDAE	Eretmochelys imbricata	Hawksbill Turtle	1	1	1	1	1
			Tortuga carey					
			Cotorra					
		Lepidochelys kempi	Kemp's Ridley					1
			Tortuga iora					
			Tortuga marina bastarda					