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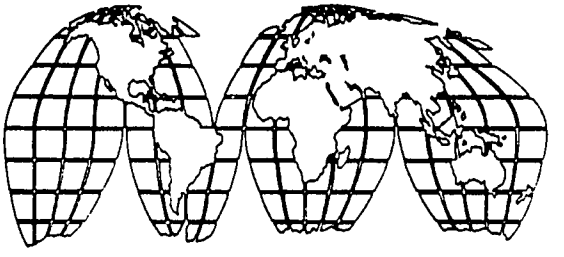

Protecting Biological Diversity: *Sri Lanka Case Study*

March 1994

U.S. AGENCY FOR INTERNATIONAL DEVELOPMENT

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This Working Paper is one of a number of case studies prepared for CDIE's assessment of USAID Protecting Biological Diversity programs. As an interim report, it provides the data from which the assessment synthesis is drawn. Working Papers are not formally published and distributed, but interested readers can obtain a copy from the DISC.

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FOREWORD

"Not even a little water that comes from rain must flow into the ocean without being useful to man".

King Parakrama Baku
(circa 1150 AD)

This saying, inscribed on the walls of Sri Lanka's ancient capital city of Polonnaruwa, has been a guiding principle in Sri Lankan history and culture for centuries. The early Sri Lankan king, true to his word, developed an extensive reservoir and irrigation system in the Sri Lankan uplands long before European civilizations mastered such practices. The most contemporary manifestation of this belief in Sri Lanka is the massive Accelerated Mahaweli Program which has sought to harness the country's largest river for hydro-electric power and irrigation water. Today, fully one third of the Sri Lanka's irrigated crop lands and about one half of its electric power supplies come from the Mahaweli River system today.

Capturing the benefits of the Mahaweli River system has had its environmental costs. Extensive forest areas have been cleared for irrigated crop -- mainly rice -- cultivation. Other forest habitats have been submerged under the seven major reservoirs and several minor water storage tanks that now feed the irrigation systems and electric power facilities. Human settlements, roads and earthworks are distributed throughout the Mahaweli system area. As a result, today within the Accelerated Mahaweli Program (AMP) that oversees the system's development, there remain only scattered forest areas to serve as habitats for a range of plant and animal wildlife, many endemic to Sri Lanka, several on international lists of endangered species.

While the engineers had their day during the early decades of AMP development, the environmentalists are now becoming more and more involved in charting a course for maintaining what remains of the area's forest habitats. The concern is not just one of protecting remaining forests as habitats for endemic or endangered species. The very sustainability of the AMP is threatened by any further destruction of these habitats that also serve as watersheds for the supply of water that feeds the irrigation system and generates the hydroelectric power. The capacity of some Mahaweli reservoirs and irrigation systems has already been reduced by siltation from soil run-off where forest cover has been removed for farming and urban/industrial development.

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There now exists in Sri Lanka heightened government and public awareness about the critical importance of the environment to sustainable development and growth with the AMP. Needed now are strategies for harnessing the range of resources and talents available to preserve forest habitats within the Mahaweli system.

USAID through its Mahaweli Environmental Project (MEP) helped launch a more systematic approach to forest habitat protection within the AMP. These efforts have come none too soon, since human-induced pressures continue to threaten the existence of the remaining forest habitats within the AMP as well as the sustainability of the AMP's development contribution.

The writers of this report believe that the new human and physical capacity put in place by the MEP could be used to seize a number of opportunities that would propel forest habitat protection to sustainable level compatible with the long-run development of the Mahaweli system. The authors hope that this report will help mobilize that new capacity in time to meet the threats to forest habitat protection that continue to grow.

GLOSSARY

USAID	U.S. Agency for International Development
AMDP	Accelerated Mahaweli Development Program
CDIE	Center for Development Information and Evaluation
DWLC	Department of Wildlife Conservation
FAO	Food and Agriculture Organization of the United Nations
GEF	Global Environmental Facility of the IBRD, UNDP & UNEP
GOSL	Government of Sri Lanka
IUCN	International Union for the Conservation of Nature
MARD	Mahaweli Agricultural and Rural Development Project
MASL	Mahaweli Authority of Sri Lanka
MEP	Mahaweli Environmental Project
MEPA	Ministry of Environment and Parliamentary Affairs
MEU	Mahaweli Environment Unit
MFIMD	Ministry of Forestry, Irrigation and Mahaweli Development
NAREPP	Natural Resources and Environmental Policy Project
NGO	Non-Governmental Organization
SALT	Sloping Agricultural Land Technology
TREE	Training, Research, Education, and Extension [Center]
UNDP	United Nations Development Programme
UNEP	United Nation Environment Programme
USFWS	United States Fish and Wildlife Service
USNPS	United States National Park Service
UWMP	Upper Watershed-Management Project

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1. INTRODUCTION

The island nation of Sri Lanka is a rich reservoir of plant and animal species, several found nowhere else in the world, many yet to be classified and inventoried. Sri Lanka has greater biological diversity per unit area than any other country in Asia. In 1980, the National Academy of Sciences Committee on Research Priorities in Tropical Biology identified Sri Lanka as one of eleven countries world wide requiring special attention because of its high levels of biological diversity, number of native (endemic) species, and increasing vulnerability to habitat destruction.

This report examines the U.S. Agency for International Development (USAID) assistance approach used in Sri Lanka to protect its valuable forest habitat and biological diversity resources. Review of USAID's Mahaweli Environment Project (MEP) provided an opportunity for the Agency's Center for Development Information Evaluation (CDIE) to assess the impact and performance of strategies used to mitigate the potential degradation of natural forest habitats in the Mahaweli River catchments.

The purpose of MEP was to minimize the environmental damage resulting from the irrigated agricultural developments being constructed in the Mahaweli watershed and from human settlements in the AMDP. The MEP achieved this by providing alternative protected habitats for displaced wildlife in an ecologically sound and socially acceptable manner. The project proposed reconciling the potentially conflicting objectives of economic development and wildlife conservation through a combination of developing parks and strengthening the institutional capabilities of the Government of Sri Lanka's Department of Wildlife Conservation (DWLC). Under the provisions of the Fauna and Flora Protection Ordinance, the DWLC, created in 1949, is responsible for wildlife conservation and protected areas management (IUCN 1992).

The Sri Lankan case study of park infrastructure development and institution strengthening -- as an approach to forest habitat protection -- is part of a worldwide examination of such programs. Other country field assessments on forest habitat protection include Thailand, Nepal, Madagascar, Costa Rica and Jamaica.

Section 2 of this report discusses problems threatening forest and wildlife habitat in Sri Lanka and USAID's solution This section also describes the data collection methods used. Section 3 describes the evaluation findings on program implementation, impact, effectiveness, sustainability, and replicability of forest habitat protection in Sri Lanka. Section 4 summarizes the major lessons learned, and Section 5 summarizes outstanding issues and challenges ahead.

2. BACKGROUND

The Problem

Between 1965 and 1968 the Government of Sri Lanka, with assistance from the United Nations developed a master plan for the utilization of the island's largest river system, the Mahaweli Ganga (Figure 1). The Accelerated Mahaweli Development Program (AMDP) is a 30-year multi-phased, area development effort to construct twenty large reservoirs, sufficient to provide water and electric power to nearly half a million hectares of newly irrigated agricultural land and to meet the needs of a rural population of nearly 2.0 million people (USAID 1993).

Changes in land use and human settlement were also expected to create pressures to utilize remaining natural forest resources more intensively and natural landscapes. At the time of its creation the AMDP encompassed a land area that included -- in addition to agricultural land and water reservoirs -- approximately 82,000 hectares in five wildlife reserves and 421,000 hectares in five forest reserves in addition to extensive open public forested areas. (USAID 1993).

By the mid 1980s the AMDP had brought an estimated 127,000 hectares of land under cultivation and resettled more than 400,000 people (Tolisano et al. 1993). However, economic and social benefits created by the Mahaweli river basin development scheme have had environmental costs. Extensive natural forest areas have been cleared for irrigated crop cultivation. Other forest habitats have been submerged reservoirs that now feed irrigation system and hydro-electric facilities. New settlements, roads and earthworks are distributed throughout the Mahaweli system area leaving only scattered remnants of natural old growth forests, grassland savannas and wetlands within the Mahaweli system to serve as habitats for the area's plant and animal wildlife (Dissanayake 1993).

Since the late 1800s Sri Lanka's natural forests have declined from over 80 to about 20 percent of the nation's territory (Figure 2). The AMDP has contributed to this steady decline. While the engineers had their day during early decades of Mahaweli irrigation system development, environmentalists are now involved in AMDP management to preserve what remains of the area's forest habitats.

The remaining tropical forests within the Mahaweli system are now the only habitats for a range of plants and animals

FIGURE 1

SRI LANKA AND THE MAHAWELI BASIN

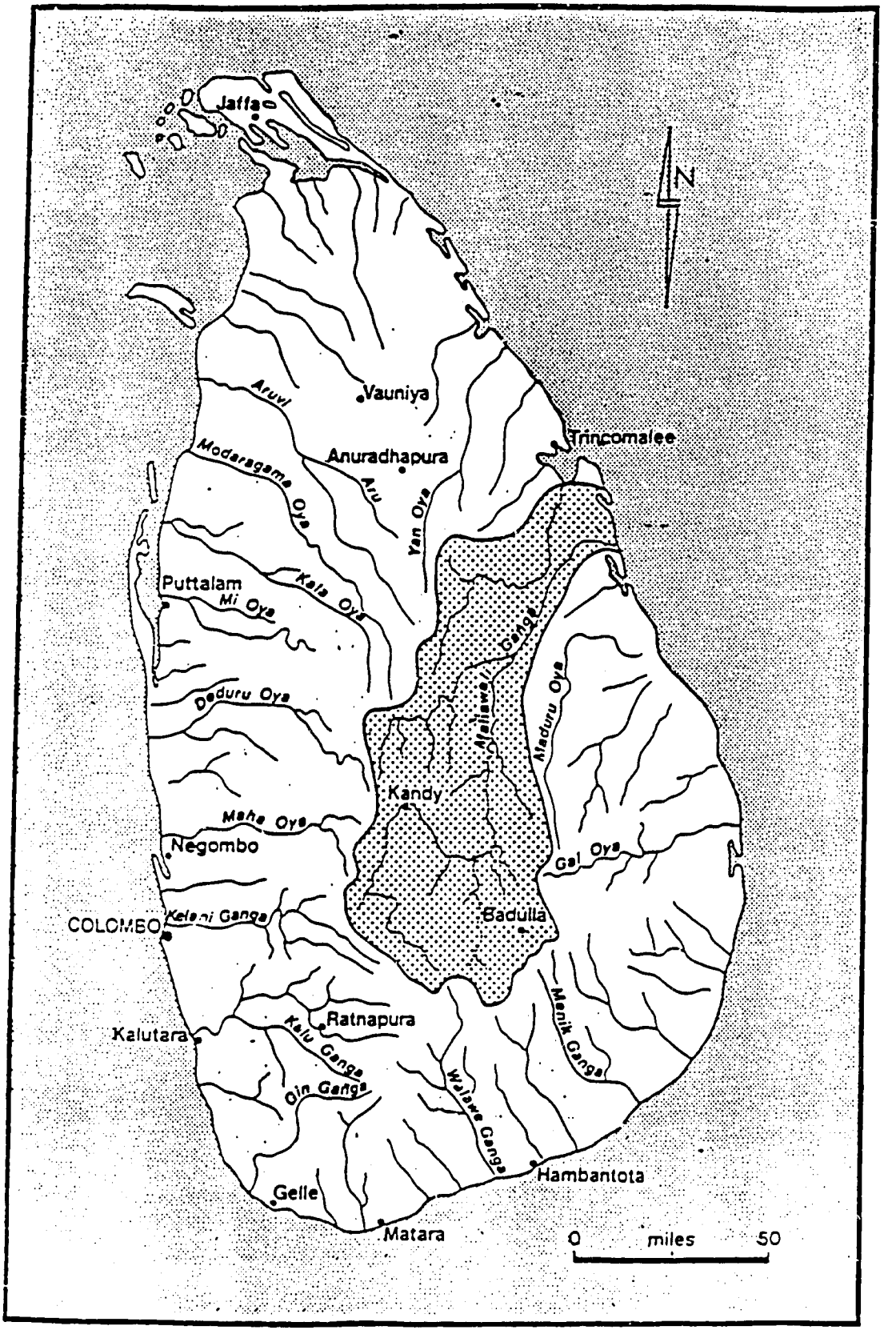

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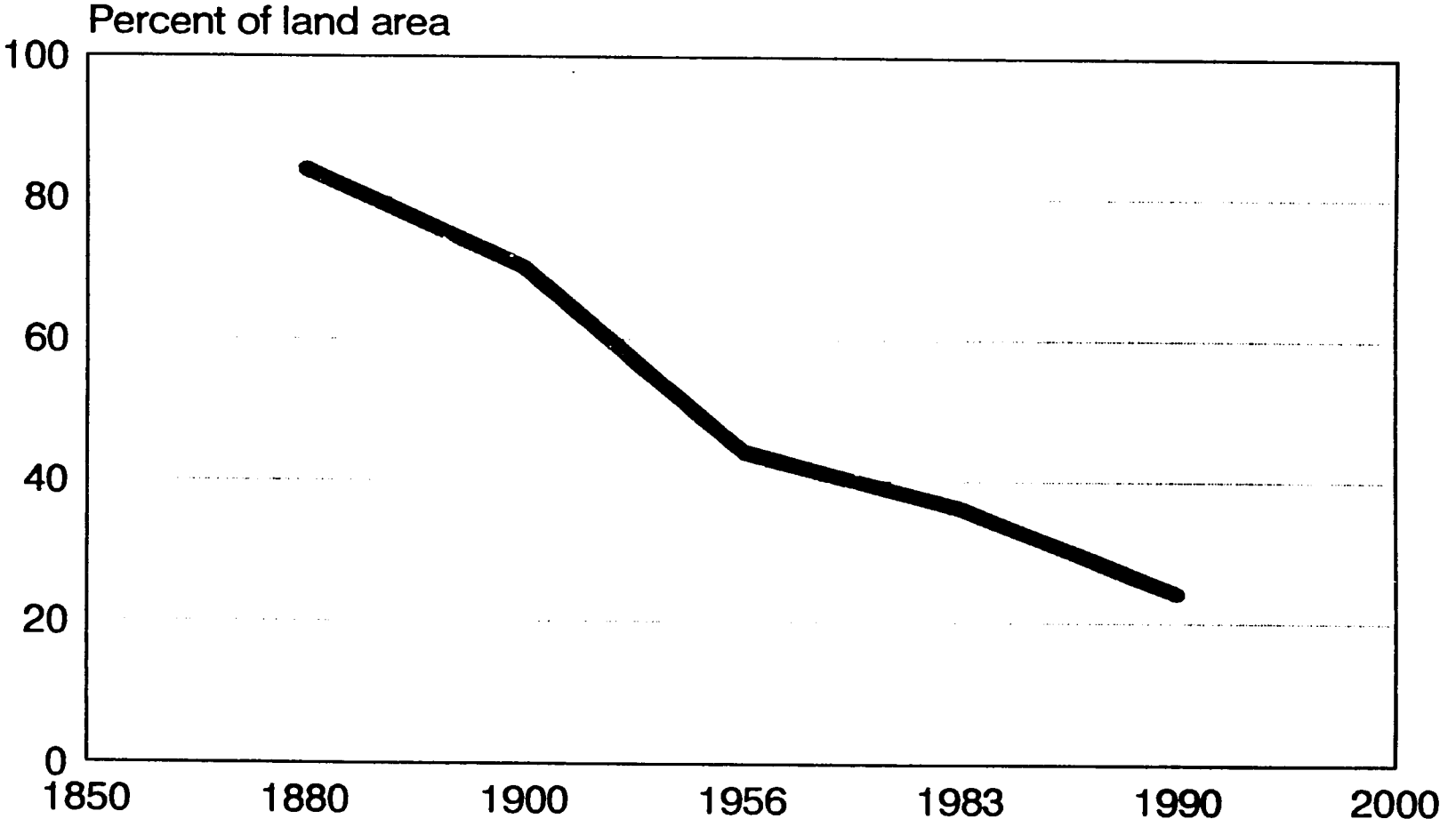
Figure 2
Forest Cover in Sri Lanka



Source: Abeywickrama, et al., Natural Resources and Trends in Sri Lanka, 1991.

including several endangered species endemic to Sri Lanka. (See Figure 3 and Appendix B: "Forest Habitat Protection In Sri Lanka.) In 1980, forest and grassland areas of the Mahaweli basin included most of the 251 resident bird species reported in Sri Lanka, an additional 75 migratory species, more than 86 mammal species, more than 176 reptile and amphibian species, and a wide variety of invertebrates. Biological surveys in the early 1980s identified 42 vertebrates and 70 plants now on international lists of endangered species threatened with extinction (TAMS 1980).

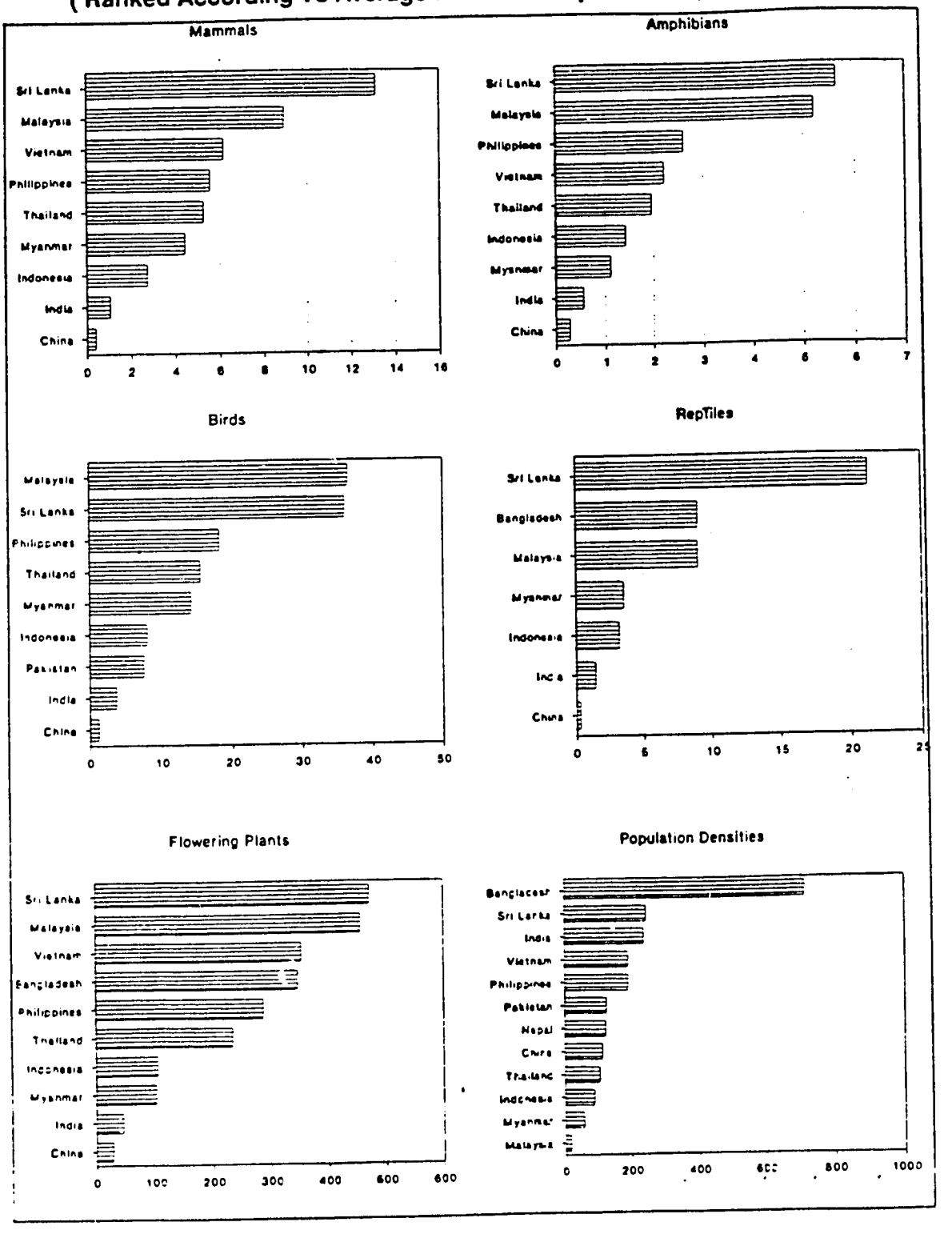
Adding to the threat of plant and animal species loss from the destruction and degradation of forest habitats is the fragmentation of these forests into "biological islands" surrounded by agriculture and human settlements (Figure 4). Sri Lanka has currently registered 67 protected areas covering an estimated 12 percent of its land area (See Appendix B: "Forest Habitat Protection in Sri Lanka"). However, as a frequency distribution of these protected areas by size in Figure 5 reveals, most of these are fragmented into sizes too small to sustain some animal populations at levels that conservation biologists feel necessary to assure the genetic diversity required for species survival (Zola 1993). Extinction of many of Sri Lanka's prized wildlife -- notably the Asian wild elephant, predator cats, migratory ruminants and some predatory birds -- is increasingly likely.

The challenge is not just one of protecting remaining forests as habitats for endangered species. The sustainable economic development of the Mahaweli system is also threatened by any further destruction of habitats that serve as watersheds for the supply of water essential for the irrigation system and generation of hydroelectric power. The capacity of some Mahaweli reservoirs and irrigation systems has already been reduced by as much as 60 percent due to siltation from soil run-off where forest cover has been removed for farming and urban development.

Mahaweli system development highlights the challenge to reconciling agriculture development with habitat and wildlife conservation. The Government of Sri Lanka has tried to meet this challenge through setting aside tracts of natural forest, savanna and wetlands to mitigate habitat loss in and wildlife displacement from the new AMDP irrigation and reservoir areas. The Mahaweli experience is an example of a win-win outcome for the environment and for development. USAID has assisted the government of Sri Lanka in this process of new forest habitat creation and management in a fashion consistent with the areas social and economic development.

FIGURE 3

Biological Diversity Of Asian Countries
(Ranked According To Average Number Of Species / 10,000 Sq Kms)



Source: Abeywickrama, et al., Natural Resources and Trends of Sri Lanka: Conditions and Trends, 1991.

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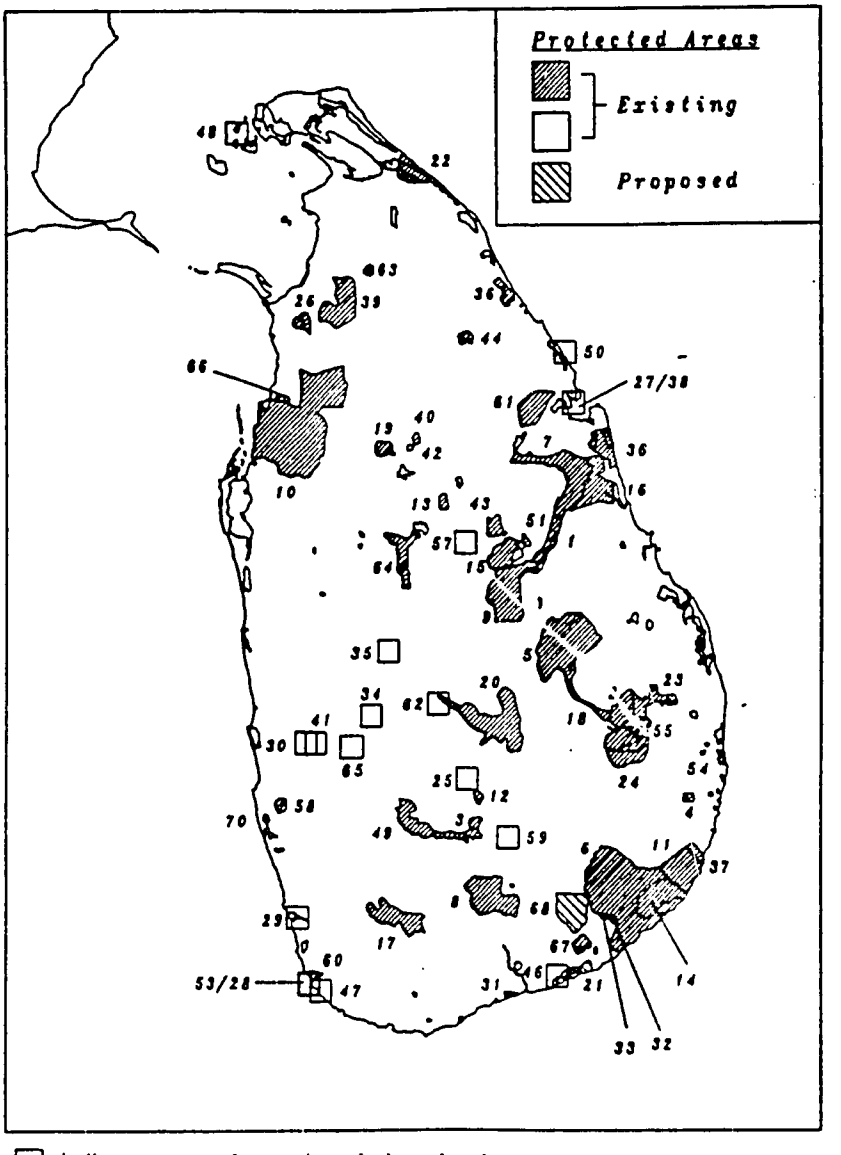
FIGURE 4
Protected Areas of Sri Lanka *

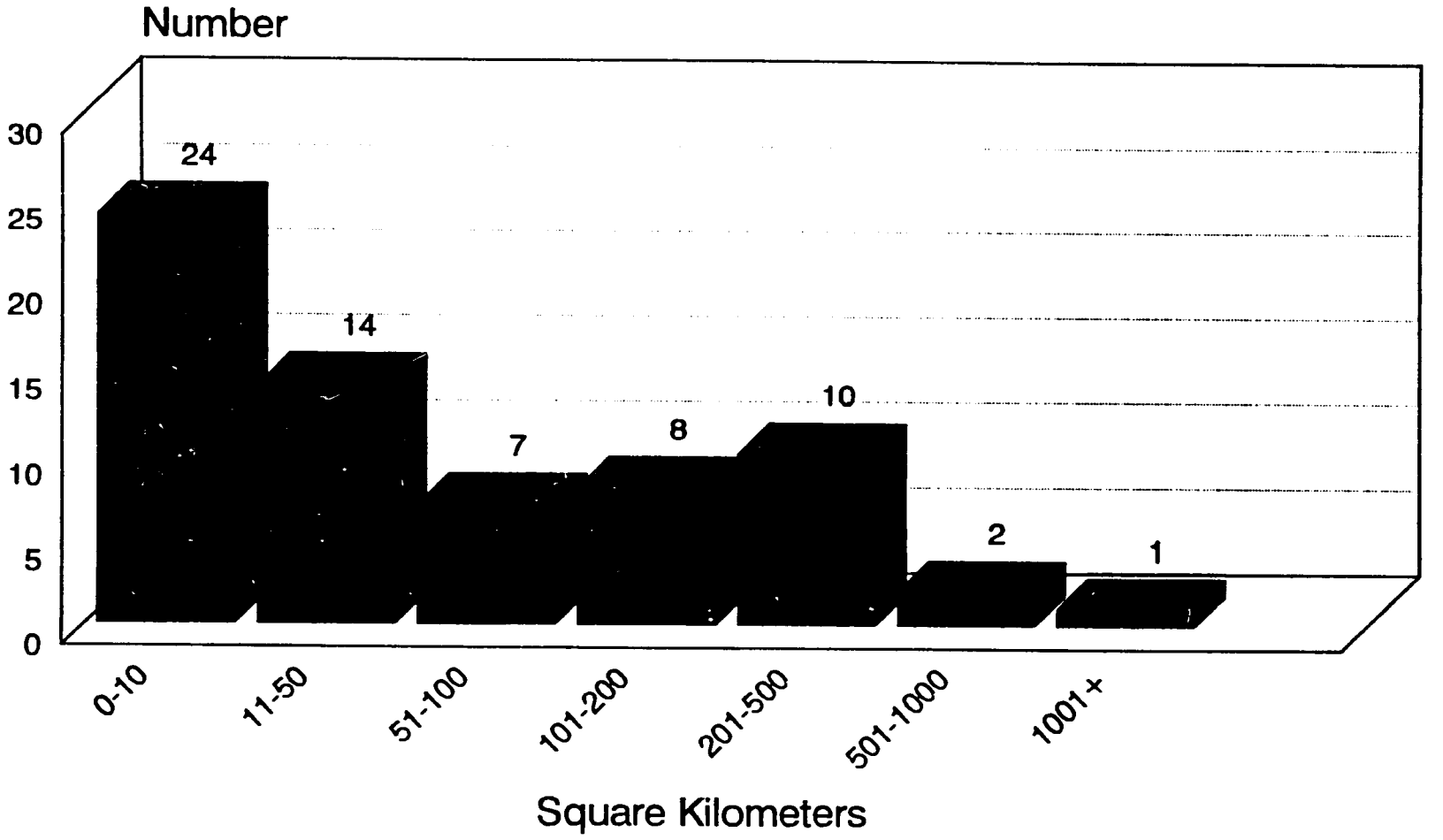


indicates protected area where the boundary is not shown

* Numbers correspond to those listed in summary Table B-1

Source: IUCN 1990

Figure 5
Distribution of Protected Areas by Size



Source: IUCN, Caring for the Earth: A Strategy for Sustainable Living, 1992.

The USAID Assistance Approach

USAID was among first foreign donors to help Sri Lanka address the environmental impacts of the Mahaweli development. In the late 1970's the Sri Lankan government requested an environmental assessment of the AMDP in response to donor community concerns regarding the potential significant negative environmental impacts. In 1979-1980, USAID sponsored the Tibbetts-Abbett-McCarthy-Stratton Environmental Assessment (TAMS Environmental Assessment), and helped the GOSL develop an environmental action plan in 1981. USAID also provided $400,000 to the GOSL through its Mahaweli Basin I Loan, for carrying out AMDP activities to monitor and control the movements of elephants displaced by agricultural development (McNeely et al. 1987).

Completed in 1980, the $1 million TAMS environmental assessment represents one of the most extensive assessments to date in the field of international development. The TAMS assessment recommended feasible mitigation measures to conserve wildlife habitat and reduce vulnerability of agriculture and settlements to wildlife conflict.

USAID's nine-year Mahaweli Environmental Project (MEP), which began in 1982 and terminated in 1991, was in direct response to the wildlife impacts identified by TAMS. The MEP proposed reconciling development and wildlife conservation interests through a combination of parks development and strengthening the institutional capabilities of the GOSL Department of Wildlife Conservation. This was to be achieved by managing the Mahaweli protected areas beyond the life of the project. The total budget was $6.9 million, of which $5 million was a grant by MEP consisted of the following components:

- demarcating national park boundaries and improving park infrastructure
- strengthening Sri Lanka's Department of Wildlife Conservation (DWLC) planning and management system
- developing DWLC's research and training capabilities
- establishing a wildlife trust to independently fund special biological diversity protection initiatives

Between 1982 and 1986, the Sri Lankan Ministry of State implemented the project through a special unit set up within the Ministry . During this time period the MEP made little progress primarily because of the lack of clear authority to the implementation agency, and poor coordination among the DWLC, the MEP unit of the Ministry of State and the Mahaweli Authority of Sri Lanka (MASL). On recommendations made in the project's

December 1985 mid-term evaluation, the GOSL gave sole implementation of the MEP to the DWLC, which came under the Ministry of Forestry, Irrigation and Mahaweli Development (MFIMD), and the project assistance completion date was extended to September 30, 1989.

The change in authority showed immediate improvements in project implementation. Still, due to initial start-up delays and to a difficult security situation that prevailed during the early project years, USAID in June 1989 amended the MEP to extend the project assistance completion date by an additional two years to September 1991 to achieve one of its primary objectives, that of strengthening the institutional capacity of the DWLC.

While the MEP terminated in 1991, USAID has continued to support protection of biological diversity through several subsequent project initiatives. USAID's new $12 million "core" investment in natural resources, the Natural Resources and Environmental Policy Project (NAREPP), focuses on inter-ministerial environmental units, environmental impact assessments, wildlife and coastal protection, including related pilots and non-governmental institution strengthening. One of NAREPP's objectives is to improve DWLC management and that of other GOSL agencies concerned with environmental issues, such as the Central Environmental Authority and the Ministry of Environment and Parliamentary Affairs (MEPA). In May 1993, NAREPP sponsored a 2-day workshop on organizational development and performance improvement planning with the DWLC Director and senior department staff, as well as representatives of the Wildlife Trust and the Giritale Training Center. Most recently a draft report (Dissanayake et al. 1993), prepared under NAREPP, analyzes the DWLC's current institutional capacity.

USAID designed two other projects that support earlier MEP initiatives. These projects specifically address the "second generation" problems associated with resettled households in the Mahaweli watershed and discussed in Section 3 of this report. The Mahaweli Agriculture and Rural Development Project (MARD) promotes crop diversification. A recent MARD Project Report indicates that per unit of land, families can increase incomes by 158 percent through crop diversification although such production techniques required 267 percent more labor per hectare than did rice (Gleason et al. 1993). The Mahaweli Enterprise Development Project promotes private enterprise development in the Mahaweli basin with a goal of generating 11,000 new jobs by its completion in March 1995.

Evaluation Data Collection Methods

CDIE employed a variety of primary and secondary sources of data and information to construct the chain of events linking MEP

activities to observed program impacts and issues and to identify lessons learned (See Appendix A: "Evaluation Methodology").

In preparation for the field work, CDIE collected and analyzed relevant secondary information available in Washington, D.C. and in the host country from a range of sources including project papers, reports, special studies, and mid-term evaluation documents. In Sri Lanka, the assessment team reviewed USAID project document files and reports prepared by host-government agencies, private voluntary organizations, USAID contractors, and international donor institutions. The CDIE evaluation team also employed both minisurvey and key informant interview data collection techniques to access primary data.

CDIE selected Maduru Oya Park for intensive examination because it combines several conditions that highlight the agriculture development and wildlife habitat conservation nexus in Sri Lanka (See Appendix C: "Profile of the Maduru Oya National Park"). Madura Oya National Park is a site of previous human settlement now removed to nearby MASL irrigation scheme areas. The park continues to have households settled in areas immediately adjacent to its perimeter. The Park has also been the subject of major upgrading with staff facilities and roads now under DWLC management. These interventions provide the opportunity to examine the impact of efforts by the GOSL under the MEP to establish a biologically and institutionally sustainable system for the protection of the country's biological diversity.

The CDIE field team conducted extensive key informant interviews to obtain data, ideas, insights, interpretation of events and actions, suggestions for unresolved issues, etc., from a range of project beneficiary participants and knowledgeable people. Key informant interviews permit the free exchange of ideas between the interviewer and the respondent (Kumar 1993). Questions were based on an interview guide developed prior to the site visit. Respondents included government officials and technicians, resettled households border zone cultivators, and representatives of international agencies, local NGOs and universities (See Appendix F: "Persons Contacted").

3. EVALUATION FINDINGS: PROGRAM IMPLEMENTATION

This evaluation examines the following strategies as determinants of the performance of biodiversity conservation programs receiving USAID support:

- **Institution building** -- creation and strengthening of local and national level public agencies and non-governmental organizations to carry out programs aimed at biodiversity conservation;

- **Education and awareness** -- increase in local and national knowledge and understanding of the value of biological diversity;

- **Technological change** -- introduction of new practices and techniques for biodiversity conservation;

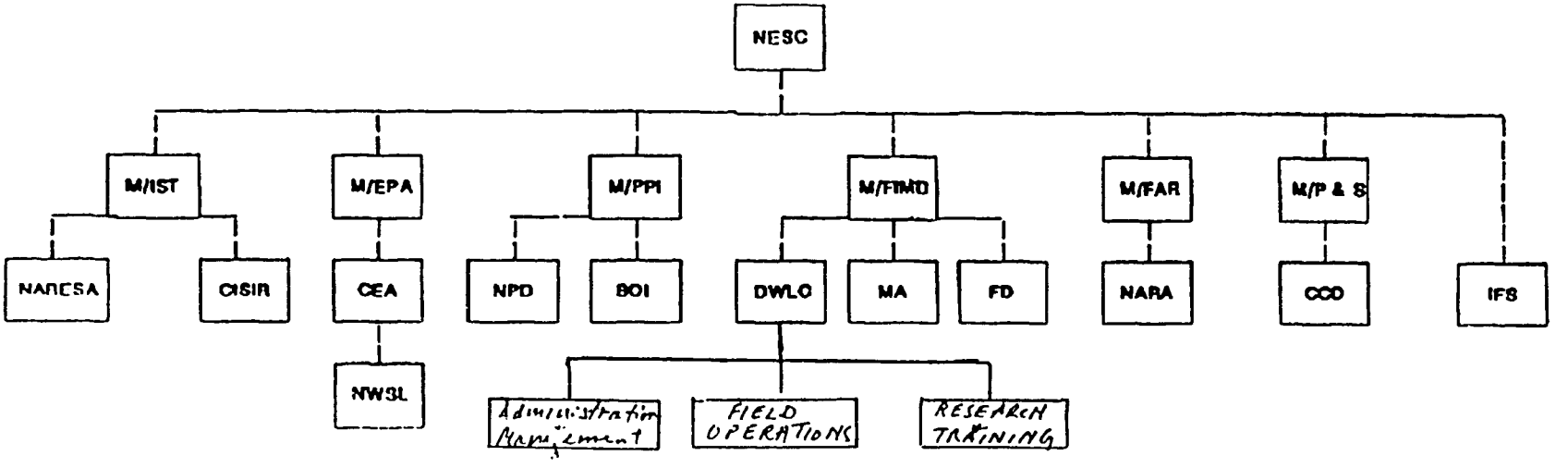
- **Policy reform** -- change in national biodiversity conservation policy for sustainable use of biological resources.

The evaluation assesses the ways in which the USAID Mahaweli Environment Program in Sri Lanka used (or did not use) these strategies to foster biodiversity conservation through the protection of wildlife and their habitats. This section examines the strategies and the conditions created through their implementation.

At the time of the evaluation there were six Ministries with jurisdiction over some aspect of environment and natural resources management in Sri Lanka. (See Figure 6). A National Environmental Steering Committee coordinates the activities of these Ministries. The Ministry of Parliamentary Affairs (MEPA) and the Ministry of Forestry, Irrigation and Mahaweli Development (MFIMD) play the dominant role in biodiversity and forest habitat protection. MEPA focuses on policy formulation, development and coordination, while MFIMD focuses on operational issues and implementation. Within MFIMD, the Department of Wildlife Conservation (DWLC), the Forestry Department, and the Mahaweli Authority of Sri Lanka (MASL) have operational responsibilities. DWLC is the lead agency for biodiversity protection within the Ministry.

FIGURE 6

GOSL ORGANIZATION



GOSL	Government of Sri Lanka
NESC	National Environment Steering Committee
M/IST	Ministry of Industries Science and Technology
M/EPA	Ministry of Environment and Parliamentary Affairs
M/PPI	Ministry of Planning and Policy Implementation
M/FIMD	Ministry of Forestry, Irrigation and Mahaweli Development
M/FAR	Ministry of Fisheries and Aquatic Resources
M/P & S	Ministry of Ports and Shipping
NARESA	Natural Resources, Energy and Science Authority
CISIR	Ceylon Institute for Scientific and Industrial Research
CEA	Central Environmental Authority
NPD	National Planning Department
BOI	Board of Investment
DWLC	Department of Wildlife Conservation
MA	Mahaweli Authority
FD	Forest Department
NARA	National Aquatic Resources Agency
CCD	Coast Conservation Department
IFS	Institute of Fundamental Studies
NWSC	National Wetlands Steering committee

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The DWLC is organized into three separate units: Field Operations, Research and Training, and Administration and Management. The majority of the DWLC staff (rangers and ranger assistants) are in the Operations Unit which is spread over five geographic regions. Field staff, including the Maduru Oya Park Warden, report via the Regional Administrator to the Deputy Director of Field Operations and then to the DWLC Director.

Institution Building

Institutional capacity is defined in this study as the ability to:

- enforce and patrol park boundaries to prevent illegal or restricted activities;
- maintain park infrastructure--roads, shelters, bungalows, and other facilities;
- develop a comprehensive protected areas system plan;
- conduct biological resource inventories, applied research, and monitoring activities;
- provide staff training and educational programs including community outreach and nature-interpretive services.

MEP has heightened awareness and expanded institutional capacity, but the GOSL has yet to organize, equip and train itself to manage a viable forest habitat protection system.

The DWLC, with the support and coordination of other GOSL agencies and environmental NGOs, has the potential to play a pivotal capacity-building role so that future generations of Sri Lankans can benefit from the abundance, diversity, and richness of their protected area habitats. Effective forest habitat protection will take more than simply establishing park boundaries and constructing facilities.

A number of scenarios are possible. For example, effective management of forested protected areas could benefit greatly from a leadership-oriented role by the DWLC, more active support from environmental NGOs, increased private sector and community-based resource management initiatives, and greater participation with the forest and wildlife management scientific community. DWLC could benefit from filling existing staff vacancies and re-examining the allocation of vacancies among guards, ranger assistants and rangers within DWLC is an initial first step.

However, the DWLC has no scientifically-based plan for

protected area management of forest habitats. Leadership has not demonstrated its capacity to involve the public, existing academic and research institutions, national and indigenous NGOs, or other environmentally knowledgeable agencies (e.g., MASL).

Within some government entities, such as the Mahaweli Authority of Sri Lanka (MASL), the team found evidence of institutional capacity in terms of inter-agency coordination between GOSL agencies/authorities and active land management practices (e.g., land planning, resettlement schemes, irrigation and farming). This capacity supports a number of developmental goals (increased paddy cultivation, power generation, reservoir/canal construction, etc.) of the Accelerated Mahaweli Program (AMDP). In contrast, there was only modest evidence of such inter-agency coordination capability within the Department of Wildlife Conservation (DWLC)--the principal Sri Lankan agency charged with national wildlife management and habitat protection.

The mission of the DWLC, within the reorganized Ministry of Forests, Irrigation and Mahaweli Development (MFIMD), is to carry out the Fauna and Flora Protection Ordinance as amended in 1992. The recent amendments to the original 1937 Ordinance generally broaden its scope, provide for a tourist hotel-free buffer zone around natural reserves, better define species, enhances punishment for illegal activities, and expand the power of the Director of the Department of Wildlife Conservation. In broad terms, the Ordinance "...provides for the protection, conservation, and preservation of the fauna and flora of Sri Lanka; for the prevention of the commercial exploitation of such fauna and flora" (GOSL 1938).

Park Demarcation and Management

MEP has helped the GOSL establish seven well demarcated protected areas with publicly recognized borders.

This represents a significant contribution towards conservation of Sri Lanka's biological diversity, with the seven protected areas making up an estimated 30 percent of the existing protected areas in the country and nearly 45 percent of the Mahaweli Basin:

Flood Plains National Park	17,350 ha
Maduru Oya National Park	58,850 ha
Somawathiya Chaitiya National Park	37,762 ha
Wasgomuwa National Park	37,063 ha
Tirikonamadu Nature Reserve	25,019 ha
Minneriya Giritale Nature Reserve	7,529 ha
Victoria Randenigala Rantambe Sanctuary	42,087 ha
Total	**225,660 ha**

The team conducted a four-day visit to the 58,850 hectare Maduru Oya National Park in central Sri Lanka. Based on the site visit, the team observed that the DWLC was actively carrying out park boundary enforcement, but is doing little in the other critical areas of forest habitat protection.

Along with the other three parks and three reserves, the Maduru Oya National Park has been gazetted and demarcated and staff has been hired and trained--either on site or at the Giritale Regional Training Center. As a result, clearly labelled signboards in Sinhalese and English exist on all access roads approaching the park and visitor permits are issued at the northern boundary checkpoint. Interviews with villagers, traditional slash-and-burn "chena" cultivators, and tribal group members along the southern boundary of the park revealed local awareness of the park's borders and curtailment of destructive practices within the park boundaries. However, there appears to be no proactive management of the resource base or monitoring, prerequisite to assure that these protected areas are more than "paper parks", with more than posted signs and decrees upon which to depend.

There is little coordination among GOSL institutions that are addressing environmental concerns.

Examples of other GOSL institutions examining environmental issues related to the protection of forest habitats is the Upper Mahaweli Environment Unit (MEU). The MEU is part of the larger Mahaweli Authority of Sri Lanka (MASL). Although both the DWLC and MASL are within the same Ministry of Forestry Irrigation and Mahaweli Development (MFIMD), evidence of coordinated planning or implementation in the Mahaweli basin area. The Upper Mahaweli Environment Unit is responsible for mitigating the environmental impacts associated with MASL engineering projects (dams, reservoirs, hydroelectric power, and irrigation canals). The Unit also has an active community mobilization, awareness, and training component for farmers, NGOs, and other GOSL line agencies.

Interviews with MASL staff revealed that conservation efforts by the MEU -- located at the Polgolla Dam -- are critical since the upper catchment areas of the Mahaweli River are crucial for many downstream irrigation and hydro-electric operations. Primary issues include changed sediment loading and water flow. MASL staff use data from monitoring sites at various sub-catchment areas to assess the hydrologic flow regime.

Two foreign funded projects--the Sri Lankan-German Upper Mahaweli Watershed Management Projects (Germany) funded by GTZ and the Sri Lankan-British Forest and Land Use Mapping Project funded through ODA--are also active in this area. On site interviews with MASL and donor project staff revealed a broad

range of ongoing activities including tree planting, forest fire prevention, on-farm soils conservation techniques such as SALT (Sloping Agricultural Land Technology), land use planning, and cartograpny. In addition to active community mobilization, awareness, and training for farmers, NGOs, and other GOSL line agencies, the unit is actively courting private sector (Tea Research Institute) involvement in its program.

Infrastructure Development and Maintenance

Maduru Oya Park is relatively well equipped with new physical facilities for park rangers and guards. Field reconnaissance of the Maduru Oya National Park and associated infrastructure revealed an imbalanced emphasis on physical infrastructure development to the near exclusion of human resource development.

The MEP program strategy for habitat protection in Sri Lanka focused on park facility construction and training park rangers and guards in regulation enforcement. With USAID support, the GOSL built more than 50 structures (90,000 square feet) in the four national parks and related wildlife areas (e.g., natural reserves) under the nine year MEP (USAID 1993). These structures, currently managed by the DWLC, consisted of park administrative buildings, residential quarters for park staff, garages and sheds, a social center, tourist bungalows, hostels and lodges. Approximately 36 of these facilities are in the Maduru Oya National Park. The regional Giritale Training Center--which alone consists of some 15 buildings for administration, research, training and staff/visitor housing. The staff facilities exhibited moderate use by park staff. Conversely, those buildings intended for tourism showed low usage levels.

In Maduru Oya Park and vicinity, facility maintenance and tourist accommodations are minimally adequate to support existing park staff. The most serious problem the team encountered was facility access to a reliable source of water. More than one-third of buildings in Maduru Oya Park are without water, the dug well is almost dry, park staff must bring in water from the outside (Chitrasena 1993).

Prior to the CDIE evaluation team site visit, USAID conducted a "building by building" assessment of MEP structures and associated infrastructure (water and electricity) built in the Maduru Oya Park and environs (USAID 1993). In October 1993, the Mission also prepared a report on facility upkeep. Both reports confirm our evaluation team observations of water availability problems at two sites Enderuettamulla and Giritale (See Section 3: Evaluation Findings). At the time of the evaluation site visit, USAID was holding discussions with the GOSL about the need to develop and implement a plan for facility

upkeep and improved water availability at these sites. One recommendation of the NAREPP sponsored DWLC analysis, consistent with this dialogue, is that a maintenance unit be headed up by a civil engineer who would serve in a senior level DWLC position (Dissanayake et al. 1993).

Maduru Oya does not yet possess visitor facilities and services of sufficient quality to attract tourists. However, it should be noted that the park only opened to the public in August 1993, and that civil strife continues to present security problems nearby -- both of which might constrain tourism. Making tourism-related facilities operational currently appears to be less of a priority for the DWLC than enforcement of regulations concerning park land encroachment (e.g., poaching, fuelwood collecting, etc.).

At Maduru Oya's park headquarters, in Enderetta, the team noted the absence of binoculars, radio-telemetry devices, park vehicles for guards and rangers to cover their assigned areas, and a rudimentary communication system between and among park ranger units and park management. Buildings used by guards and rangers within the park headquarters appeared to be in acceptable condition, while those slated for training, research, or tourists were barely operational. Post-construction facility upkeep, repair and routine maintenance, regardless of building type or function, does not appear to be a priority for the DWLC.

Existing park roads are adequate for modest visitor use. The Maduru Oya National Park has one major unpaved road running approximately 40 kilometers between the north-south entrances. Numerous "arteries" which end within about 25-50 meters extend off the main road. Longer arteries-- most from 100-200 meters--but a few as long as 2-3 kilometers--lead to former schools and temples now abandoned as a result of forced resettlement.

The roads in the northern portion of the park appeared newer and more utilized than those in the southern park area which are passable by jeep or four-wheel drive. It remains unclear whether the DWLC or other GOSL agencies have the capacity to maintain existing park roads let alone build the more extensive road network argued necessary for tourism development by several interviewees. If park management were to expand the existing road system to attract and accommodate increased visitors as in Sri Lanka's Yala National Park, the DWLC will need additional planning and management capabilities for these tasks.

Planning Capacity

Only a modest capacity exists within the DWLC to develop and implement a comprehensive national park system plan.

In October 1985, consultants prepared a draft management plan for the Maduru Oya National Park (MEP/DWLC 1985). Subsequent revisions during a series of planning and development workshops culminated in a final plan in June 1987 (MEP/DWLC 1987). Plan objectives extend beyond maintaining biological diversity and protecting the immediate catchments of five reservoirs developed under the AMDP, to habitat enrichment, reforestation, developing water holes in dry areas, and reducing exotic fauna and flora, particularly teak and *Salvinia*. Socio-economic objectives include developing visitor facilities, expanding conservation education programs within the local communities and providing local communities with benefits.

However, the management plan has yet to be implemented. The implementation problem appears to be primarily due to the lack of public participation, including that of national and regional DWLC decision-makers, in the planning process. Because of the lack of involvement of the public and private "stakeholders" in the development of the plan, there is little impetus to implement the plan (Vattala 1993). Park management appears to consist largely of a policing effort by rangers and guards to reduce encroachment from outside.

Interviews with GOSL staff also revealed that during an earlier administration, the park planning unit consisted of fourteen staff. These staff initially received training in resource mapping and park planning under MEP, but only two of those trained are currently engaged in park planning activities. The Assistant Director for Park Planning and his one staff person also have competing demands on their time - situation which further exacerbates effective park planning and management. Because of the staff shortage, regional planning teams are being established under the regional assistant directors in the field. This approach may allow for increased local involvement in the planning process and increase the probability of effective field implementation.

Part of the capacity problems results from a high number of budgeted park staff position vacancies. In Maduru Oya National Park approximately two-thirds of the assistant ranger positions and half of the game guard positions are still vacant. It is unclear why so many funded positions remain vacant, since until these vacancies are filled, active protected area management of forest habitat will not occur. These unfilled park staff vacancies over such a sustained period suggest that additional institutional strengthening within the DWLC is necessary to train, recruit, and retain staff.

Research and Monitoring

The DWLC has plans to develop a research capacity to guide

decision-making on park and reserve planning and management but has not yet implemented this plan. Even with the provision of research supplies and building, there is little on-going research.

At Randenigala, the DWLC established a Training, Research, Education, and Extension (TREE) Center. In 1992, the TREE Center received a Certificate of Registration by GOSL as an educational unit qualified to conduct courses in nature conservation, outdoor nature appreciation, etc. However, the evaluation team observed a very low level of activity at the Center during the site visit, with only one research study on post-fire vegetational succession underway. The Center's herbarium contained an estimated seventy-five plant specimens and there was a small office with various bird nests and a few dried faunal specimens. The DWLC reassigned the Center's only research vehicle elsewhere.

The DWLC also established a Wildlife Research Unit at the Giritale training center. This facility consisted of three rooms (administrative office, computer office, and map room). But as with the TREE Center, there appeared to be little evidence of any basic or applied research taking place. In fact, according to the staff interviewed, the research supplies at Giritale were locked up in a storeroom within the building for "good-keeping".

Data needed for effective protected area planning and management is insufficient.

Although previous efforts to collect data on forest habitats and species have been constrained by civil disturbances, both basic and applied research on keystone linkages in the ecosystem can now be conducted in essentially all representative habitat types throughout the AMDP area. Data is insufficient in the following areas; forest vegetative type and associated wildlife habitat requirements, population dynamics, migration and dispersal patterns, and external threats.

Despite new physical facilities, training, and added staff levels which have increased DWLC capacity to regulate activities within park/reserve areas, the evaluation found no evidence of efforts to accompany regulatory functions with scientifically based information. This would require correlating known information about the feeding, reproductive, and movement patterns of keystone species to ensure that appropriate forest habitats of sufficient size are protected to maintain minimum viable wildlife populations. It is also not apparent that this type of data has been used in the delineation of the AMDP park/reserve system (Eisenberg et al. 1990). The regular monitoring of this information is essential to the viability of protected area management efforts.

Training and Education

The training facility at Giritale is operational, giving DWLC the potential to improve staff skill levels.

Completion of the Giritale Training Center occurred in September 1991, and the first training course began in November 1992 at the Center's official opening. Between November 1992 and September 1993, selected DWLC staff attended the twelve one-week short courses. The average class size consisted of 20-22 participants. The curricula covered a variety of administrative, enforcement, flora identification, and wildlife management topics. Based on our interviews, the team concluded that the training center would benefit from:

- a more comprehensive series of forestry, range, and wildlife courses,
- a library with texts and scientific journals on conservation biology, ecology, forestry, range, and wildlife management techniques, and,
- additional "outside" qualified trainers.

The curriculum is currently under revision by an independent consultant. Trainer recruitment is currently underway, as is review of trainer salary levels.

Long-term operation of the Giritale Training Center presents some cause for concern since the program is largely funded by outside sources (USAID and the World Bank), and future funding is temporarily on hold. Another issue is the development of a more comprehensive and progressive wildlife and forest habitat curriculum without incorporation of the needs of the "target audience" into the curriculum design.

Technological Change

The MEP strategy did not focus on introducing appropriate technology for forest habitat and wildlife protection. However, there are a number of technological contributions that have been made by USAID and other donors to address some of the indirect or external threats.

Within the newly demarcated park and sanctuary areas, the evaluation team found little evidence of habitat management techniques. At Maduru Oya Park there is no evidence of efforts to either regenerate natural habitat, or to monitor wildlife habitat requirements and population levels, human encroachment or recreational tourism (wildlife observing).

USAID-funded construction of electric fencing along a forty mile perimeter of the Mahaweli irrigation Systems B and C is an attempt at animal-human conflict damage control. It is to keep elephants, wild boar, etc., out of agricultural areas. Other donors and the GOSL are coordinating with USAID in this effort. USAID has also sponsored one training course in techniques for wild elephant capture in situations where elephant removal from settled areas to parks is necessary.

Several promising technological changes are being attempted as part of a national strategy for forest habitat protection. These include:

- alternative conservation farming practices as alternatives to slash-and-burn chena cultivation on hilly areas bordering the parks (See Box #1);
- integrated pest management in irrigated paddy rice as a means of reducing toxic chemical build-up in wetland habitat and feeding areas near the parks;
- introduction of fast-growing tree varieties as sources of fuelwood.

========== Box # 1 ==========

SALT in Sri Lanka

The Sloping Agricultural Lands Technology (SALT), that Sri Lankan government agencies have been promoting among farmers, is an import from abroad. SALT was first popularized as a conservation farming technique in the Philippines by the Mindanao Baptist Rural Life Center (MBRLC) which began working with farmers in the early 1970's to devise techniques for the sustainable cultivation of the country's hilly areas.

The objective of the MBRLC was to find a farm system that supports a rural Baptist minister and his family adequately on about one hectare of land and still leave sufficient time to tend to his pastoral duties. The solution was a system of cultivation that called for the inter-planting of food and cash crops on terraces between hedgerows of leguminous trees. The hedgerows of leguminous trees acted to halt erosion, stabilize the soil on benches and to provide green matter to build up soil nutrients. The same hedgerows also proved useful as sources of roughage for livestock and as a supply of construction materials for fences and small dwellings.

A number of local NGOs, several with USAID support, began to test and adapt SALT in hillside farming systems in a number of

locations in the Philippines during the 1980's. The Philippine government has remained skeptical about promoting hillside cultivation as a rural development activity in general and about SALT as a viable farming practice. The fact that farmers who have picked up many of the SALT practices and continue to use them has still failed to win official Philippine government endorsement.

Other countries like Sri Lanka and Nepal have been less reticent. The introduction of SALT to farmers cultivating in the Mahaweli watershed area is perhaps one of the more dramatic applications of SALT cultivation. The MASL seems to have mastered a number of the subtle feature of spreading SALT by addressing such critical features as provision of planting materials and defraying establishment costs.

The emphasis that the MASL gives to the income generating aspects of SALT -- including its variations of food crops, cash crops, livestock grazing and tree farming -- bodes well for the staying power of the practice. With few other options and a lot to loose if current hillside erosion is not halted in the Mahaweli watershed, the MASL has undertaken a pioneering step in conservation farming in Sri Lanka.

========== End ==========

Education and Awareness

The MEP's strategy of creating a private environmental trust to support public education and awareness shows promise but has turned in only a mixed performance to date.

The MEP funded the creation of a Colombo-based Wildlife Trust in 1991 with US $500,000 MEP funds. In 1993 the Trust had a staff of three professionals, three support staff, and one vehicle. The Wildlife Trust facility consists of a lecture hall, a conference room and two general-administrative offices. The Wildlife Trust 1992/1993 Annual Report indicates that the Trust supports a number of activities including the Randenigala TREE Center, school awareness programs (e.g., Kandy, Yala, Bundala), Colombo-based environmental lecture series, and facility renovations at both Randenigala and Colombo. The Trust is registered as a charitable institution and receives private contributions.

The Wildlife Trust has the institutional potential to carry out its functions to support and maintain the TREE Center at Randenigala and financially assist conservation awareness programs. However, the evaluation team noted a number of administrative and operational problems that seemed to impede conservation awareness efforts. For example, the strategic plan,

annual work plans, and budgets prepared by the Trust staff have yet to be formally approved by its Board of Directors. Furthermore, documentation issued on behalf of the Trust by the DWLC in September 1993 reallocated Trust equipment and supplies from the TREE Center at Randenigala to DWLC headquarters and to the Giritale Training Center.

The team's overall conclusion based on extensive document review and interviews at the Randenigala TREE Center, Trust headquarters, and the DWLC is that the institutional capacity of the Wildlife Trust appears to be severely limited in its capacity to support forest habitat conservation activities. Interviews with former DWLC headquarter staff indicated that the TREE Center was a more active training site between 1990 and 1992, focussing as much on public environmental awareness as on staff training. The DWLC is currently scaling back TREE Center training efforts.

As configured, the Trust falls short of its goals, in part due to the manner in which it was chartered with very strong government involvement. Because its charter allows the Board of Directors to be chaired by the head of the DWLC, a political appointee, the Sri Lankan Government controls the Trust as if it were a government agency. As a result the Trust lacks the independence and flexibility envisioned at its inception. (See Box # 2 "Potential and Pitfalls of Wildlife Trusts").

========== Box # 2 ==========

THE POTENTIAL AND PITFALLS OF WILDLIFE TRUSTS

In 1990 CDIE reviewed USAID support for trusts and endowments as vehicles for institutionalizing sustainable, broad based, public involvement in social, economic and environmental issues of development. ("Terms of Endowment: A New USAID Approach to Institutional Development," *Innovative Development Approaches*, No. 4, Washington, D.C.: USAID, Center for Development Information and Evaluation. December 1990). The study highlights the role of trusts and endowments in providing sustainable financial backing for government and non-government organizations in developing countries. The study also underscores several areas of vulnerability that must be addressed if trusts are to be managed soundly without political interference.

Experience with Sri Lankan Wildlife Trust suggests that to avoid or mitigate potential problems, several issues must be addressed during trust formation:

- The trust must retain the flexibility intended at its inception. It must be able to explore and test innovative environmental approaches and strategies

without government intervention. It should not fund budget shortfalls of government agencies.

- Roles of the governing board members and trust administrators must be clearly defined. For example, the board should reserve its authority to resolve policy issues while trust administrators should have responsibility for managing operations (e.g., procurement and staffing).

- Governing board members' qualifications should be germane to the trust's environmental goals and operating needs (e.g., technical expertise, fund raising skills, NGO management).

- Candidates for governing board membership should have full knowledge of the demands of trust management on their time and be willing to commit that time.

- Leadership of the governing body should rotate periodically among members to avoid concentration of power.

========== End Box ==========

Several NGOs now exist with the capacity to assist in coordinated government education efforts to enhance public awareness about sustaining Sri Lanka's forest habitat systems within the AMDP,

There are presently a number of non-governmental organizations (NGOs) with the capacity to play an active role in mobilizing public opinion on matters of national environmental concern and to assist in coordinated government efforts to enhance the sustainability of Sri Lanka's forest habitat systems (See Appendix E: "Environmental NGOs"). The NGO community in the early 1980's did not have the capacity to play an active role in mobilizing public opinion on matters of national environmental concern and to assist in coordinated government efforts to enhance the sustainability of Sri Lanka's forest habitat systems. Furthermore, the GOSL administrations during the 1980s were ideologically opposed to environmental NGOs, private organizations or trusts playing any role in environmental decision-making. Under the volatile political and security conditions that prevailed during the period of the MEP implementation, the options were slim, other than to work with the government.

During the mid 1980's, the MEP did work with the Nation's Builders Association and focussed on community awareness, tree planting, etc. However, throughout the MEP program, USAID's

strategy was not one of aggressively involving and strengthening appropriate NGOs. There was little progress in actively promoting effective community relations, public participation in the park planning and management process, or improving cooperation between GOSL agencies - ostensibly pivotal roles for environmental NGOs. Interviews with GOSL representatives by the evaluation team revealed that in the past environmental NGOs were viewed more in confrontational roles than in cooperative roles.

Policy Reform

Policy reform can be a useful tool to meet USAID's environmental strategic objectives in host countries. A number of alternatives in environmental policy reform are possible. For example, some USAID strategies have attempted to reform price and taxation systems to foster forest management or to provide other government incentives for seedling production and distribution. A combination of both policy disincentives (e.g., taxes, tariffs, water use surcharges) and policy incentives (import duties, quotas) have been used to reduce environmental damage caused by urban and industrial pollution. Other policy reforms have been geared to expand tax and investments credits toward promoting "ecotourism".

There was not a strong push in any of these policy reform areas during the 1980s. The MEP, through strengthening the institutional capacity of the DWLC, has encouraged the GOSL to take the essential first steps in promoting environmental policy development, but not policy reform, by helping articulate a national forest and wildlife management policy.

The GOSL has not developed a scientifically-based national land use policy to guide forest habitat protection and wildlife conservation.

The challenge for forest habitat protection and wildlife conservation policy reform is designing and implementing a multi-disciplinary approach to land use and conservation that integrates development and sustainable utilization of natural forest habitats. Such an approach would, at a minimum, need to include:

- promotion of increased biological research, including resource surveys and inventories, critical habitat assessments, species distribution analyses, ecosystem dynamics, succession patterns, etc.;

- adequate financial and manpower resources towards the effective monitoring, management and regulation of forest habitats;

- strengthening formal environmental education programs at all levels of the education system, and expanding informal conservation awareness programs for politicians, decision-makers, government officials, NGOs, and the general public to improve local community participation in forest habitat conservation initiatives;

- coordination between public and private sector interests for integrated forest habitat protected area planning and management;

- review and reform of legislation to incorporate the principles of conservation and forest habitat management.

The statutes that have a direct impact on conservation and management of biological diversity and natural forests are the Forest Ordinance, the Fauna and Flora Protection Ordinance, and the new National Wilderness Act.

The Forest Ordinance has provision for the establishment of forest reserves and for the regulation and preservation of forests. However, unlike the Fauna and Flora Protection Ordinance, where different categories of reserves can be established, each being afforded different degrees of protection, in the Forest Ordinance, only a single reserve category is recognized, namely the Forest reserve. These Forest Reserves can be released for controlled timber exploitation by the order of the Conservator of Forests. There is, therefore, no legal mechanism to ensure the continued and complete preservation of plant species under the Forest Ordinance.

To overcome this shortcoming, the National Wilderness Act was passed in 1987. This new Act has the provision for the declaration of forests as National Wilderness Areas, where no human disturbance, except entry for scientific purposes would be permitted. Under the Act, forests in steep watersheds, those having endemic plant and animal species such as the mountain and lowland rain forests, and those of historical and cultural value could be declared as National Wilderness Areas. The Forest Ordinance and National Wilderness Act are both administered by the Forest Department.

The Fauna and Flora Protection Ordinance provides for the absolute protection of all fauna and flora within the National Reserves and Sanctuaries declared under the Act. This Act also provides for the protection of prescribed plants and animals outside reserves and lays out controls for the export of wild animals, birds, reptiles and wild products such as ivory. This Act has been amended (1992) to provide for: 1) the creation of new categories of reserves such as buffer zones and refuges; 2)

the protection of certain rare species of fresh water fishes; and, 3) the overall enhancement of fines and other punitive measures for offenses committed under the Act.

The Sri Lankan Cabinet approved a new National Policy for Wildlife Conservation in June 1990. The five policy items relating specifically to protected areas are:

- the formulation of a manifesto of varied objectives specific to each gazetted protected area;
- a reassessment of mechanisms enabling existing and proposed protected areas to meet their objectives;
- identification and control of sustainable resource use within protected areas that are compatible with their objectives;
- multiple resource use within specified "use zones" within protected areas;
- effective management of protected areas to maintain the biological resource potential at natural levels.

The DWLC proposed this policy be incorporated into a Conservation Act with sufficient flexibility to permit a variety of conservation practices, but with strong punitive measures against the destruction of the national habitat and wildlife resources for personal greed or commercial gain. The Conservation Act proposed by the DWLC has yet to be formally developed and enacted.

4. EVALUATION FINDINGS: PROGRAM IMPACT

The MEP midterm and final evaluations documented a number of changes traceable to project activities (McNeely et al. 1987, USAID 1993). Tolisano et al. (1993) corroborated these findings in an independent environmental evaluation of the AMDP. This evaluation specifically addressed the lessons learned of the MEP -- which was originally designed to answer those environmental issues raised in the TAMS 1980 Assessment of the AMDP.

The CDIE evaluation team conducted additional field observations and surveys to further verify the MEP-related changes in forest habitat protection since the initiation of MEP, looking at changes in practices as well as biophysical and socio-economic changes.

Impact on Practices

The most visible impact of USAID support for Sri Lanka's habitat protection efforts is the halt in human settlement activity and agricultural cultivation within the new areas designated with protected area status within the AMDP system.

If the Maduru Oya National Park is typical of the other protected areas, demarcated in the AMDP system, the site visit revealed that former settlements had been abandoned and that former cultivated fields are in various successional stages toward natural vegetation. The resettlement of park dwellers to areas outside the park has essentially halted chena cultivation and hunting within the park. During the site visit, the evaluation team observed some residual evidence (see biophysical impacts below) of lands cleared for agriculture and cattle grazing.

It is really too soon to say what, if any, practices of park visitors have changed within the park boundaries, since the Maduru Oya Park opened to the public in August 1993, and tourists are few. Descriptions from the Visitor Logbook in the guest bungalow indicate use of the park road by jeep primarily during the early morning and evening hours when wildlife is active. At present, and in the foreseeable future, private-sector or park concession businesses (lodging, food, fuel) and recreational services (guides, equipment rental, etc.) do not appear.

Cultivators in border areas also indicated a recognition of the risks associated with encroachment on the park. The visible presence of signs, buildings and staff at all road entrances to the

park appear to be effective at discouraging encroachment. Illegal practices within the park, such as slash and burn chena cultivation, hunting and poaching, and domestic cattle grazing are becoming less frequent according to park guards interviewed.

Based on the available evidence, the team concluded that the major impact on practices within the park are a cessation of chena farming, cattle grazing, and hunting with no obvious change in practices among inhabitants of the park's border zones. Sri Lankan army activities in and near the park, while necessary for national security, tend to deter park use and diminish quality wildlife observing by recreationists.

Biophysical Impacts

The establishment of national parks and protected areas to provide habitat for displaced wildlife species has been accompanied by the fragmentation of remaining forests into "island habitats" surrounded by commercial agriculture and rural population settlements.

Landscape fragmentation results when new human settlement, such as the irrigated agriculture of the Mahaweli systems, begins to break up and surround sections of a formerly continuous forest community or ecosystem. As human modification of Sri Lanka's forested landscape progressed with the massive development of irrigated agriculture systems, the landscape became increasingly different from its ancestral state. As humans extracted their biological resource base from a wildland area, the degree of human domination of the landscape increased, and the potential of the remaining natural areas to support species sensitive to human impacts tended to decrease. Because fragmentation is typically a consequence of human disturbance, remnant habitats are generally in close proximity to areas of human disturbance, such as forest clear-cuts and agriculture, and may thereby be subjected to stress from external invaders such as fire, pesticides, and weed species (Janzen 1986; Lovejoy et al. 1986).

Protecting Sri Lanka's remaining forest habitat by establishing a series of parks and reserves further exacerbates the habitat fragmentation problem by isolating small wildland areas and by destroying necessary landscape linkages (i.e. corridors) essential to the regional existence of many wildlife species. Without landscape corridors to interconnect large tracts of land with nearby protected areas and provide a full spectrum of habitat types from villus to arid uplands, habitat requirements of many wildlife species will not be met, and Sri Lanka's biological diversity will not be maintained.

Forest habitat fragmentation is not necessarily bad. Species populations that are distributed among isolated habitats but with

occasional migration may be less susceptible to extinction from localized natural disasters, or "chance events" that affect reproduction or survival. However, fragmentation becomes a problem when normal species dispersal and migration patterns are increasingly diminished, and the habitat quality too poor or the area too small to sustain viable populations (See Appendix D: "Biological Diversity and Management Constraints").

However, most Mahaweli area forest habitats are located in the upland dry zones where many animal species face seasonal shortages of water and vegetation in often degraded settings inferior to their habitats before Mahaweli scheme development. As a result wildlife populations have begun to fall far below levels conservation biologists estimate are necessary to assure genetic diversity required for species viability. (See Box #3 "Forest Fragmentation and Species Survival).

========== Box # 3 ==========

FOREST FRAGMENTATION AND SPECIES SURVIVAL

There are three dimensions to biological diversity:

- Diversity of habitats -- tropical and temperate forests, savanna grasslands, wetlands, marine ecosystems, etc. -- across the spectrum of climatic and geographic settings;
- Diversity of animal and plant species within each habitat; and
- Diversity in genetic make-up within each species.

The first two are the most easily understood and most widely supported aspects of biological diversity. "Save our Tropical Forests!" and "Save our endangered wildlife!" are popular rallying cries for environmentalist groups in most Asian countries today. In response, governments have focused on adding to the inventory of land area set aside for habitat protection.

Sri Lanka's national protected areas system consists of 67 forest and marine parks, reserves, and sanctuaries totalling 7,980 square kilometers. This represents a respectable 12 percent of total national land area, more than twice that of the global average of 5 percent and exceeding developed countries like the United States at 10 percent.

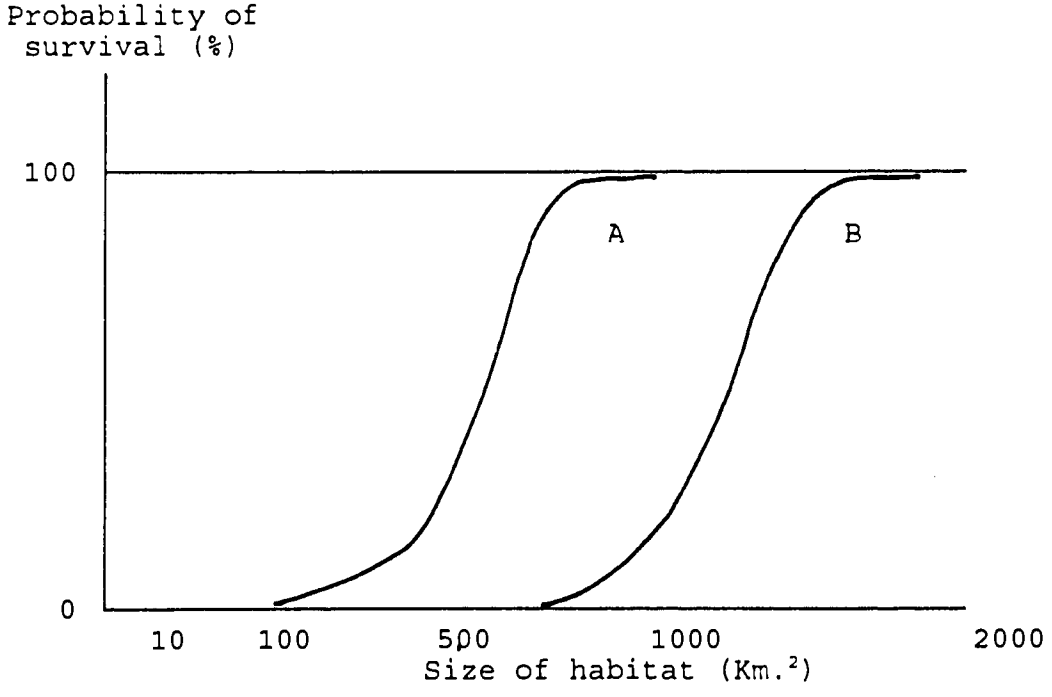
However, many protected areas are degraded, isolated and too small to support some populations in sufficient numbers to assure their long term survival. Moreover, most of the country's 67 protected areas are fragmented into "biological islands" surrounded by commercial agriculture and rural settlements with no corridors

for wildlife to move between them.

One theoretical relationship between species survival and habitat size is illustrated by the "S" shaped curves in Figure 4. Each species also has its own relative habitat size for any given level of acceptable survival probability. For any given animal species, the larger the habitat the greater the chances of survival, though as the "S" shapes of the curves demonstrate, seldom in linear relationship.

The evolutionary process of natural selection and species mutation dictates also that the "S" curves never touch the 100 percent line of absolute and indefinite species survival. Salamanders and small invertebrates, for example, have smaller habitat needs, roughly represented by curve "A", than do large mammals like elephants or leopards, represented by curve "B".

FIGURE 6. SPECIES SURVIVAL AND HABITAT SIZE



Curves "A" and "B" can also be interpreted as separate habitat size requirements for the same animal species for habitats of different qualities or when the habitat conditions change. When animals are forced to retreat to inferior mountainous habitats

where food is more scarce, or where habitats have been degraded by human settlements or tourism, the "S" curve shifts to the right (from "A" to "B") to reflect the larger area of inferior habitat needed for the same chance of species survival.

Animal populations maintain themselves at or near the carrying capacity of their habitats through natural processes such as emigration, immigration, mortality and natality. Fragmentation becomes a problem when it diminishes normal species dispersal and migration patterns between habitats or when habitat quality is too poor or a protected area too small to sustain viable populations.

If barriers against immigration and emigration are created, the populations in an "isolated island" habitat are susceptible to decline. Species with low fecundity, hierarchical breeding practices, and low mobility are particularly susceptible to extinction if their habitat fragments are too small and displaced. In Sri Lanka, animals that are innately solitary such as the leopard (*Panthera pardus fusca*), jackal (*Canis areus*), mouse deer (*Tragulus minima*), those regularly hunted like the sambar deer (*Cervus unicolor*), spotted deer (*Axis axis*), and species almost totally dependent on particular tree and forest like the purple-faced langur (*Presbytis senex*), giant squirrel (*Ratufa macroura*) and the toque monkey (*Macaca sinica*) are most seriously affected by barriers to immigration and emigration. Disruption of emigration and immigration will affect gene flow and increase the probability of inbreeding. Consequently, the viability of wildlife populations, and eventually species diversity, of natural habitats will be reduced.

Overall, small islands of forest habitat support fewer species than do larger areas of similar habitats, and isolated reserves support fewer species than those close to other forest blocks. Creation of protected forest habitats such as the Maduru Oya National Park will increase the probability, but not guarantee the preservation, of biologically diverse natural forest habitats and associated wildlife.

========== End Box ==========

Elephants, for example, are a migratory species requiring great expanses of contiguous forest habitat. With non-availability of sufficient food in their protected area fortresses and with their traditional migration routes fragmented by irrigated agricultural development, it is not surprising to find an estimated 70 percent of the country's elephant population free-ranging in village areas outside protected areas and an increase in elephant-human conflict (See Box #4).

To address this problem, the Flood Plains area was declared a National Park to facilitate the movement of elephants from the

Somawathiya - Thrikonasadu area to the Wasgomuwa National Park and vice-versa. Another corridor was proposed with the initial Mahaweli Plan to join up the Wasgomuwa National Park and the Maduru Oya National Park (See Figure 2). However, because irrigation channels and roadways would have to go through this corridor, pl ns to leave the jungle uncleared were abandoned and the jungles cleared for settlement. The proposed Nilgala Corridor which would have joined the Maduru Oya National Park and the Gal Oya National Park has also been abandoned (See Figure 2).

Habitat conditions within Maduru Oya Park are in various stages of natural regeneration following degradation by earlier human settlements.

Initial observations by the evaluation team suggest that habitat conditions are not yet optimal for a number of wildlife climax species, such as elephants, langurs, macaques, etc. Interviews with the DWLC Director of Research and other scientists corroborated this finding. Less than optimal habitat encourages wildlife to use the park primarily for cover and not for food supply. Elephants, wild boar, sambar and other grazing or rooting ungulates tend to invade cultivated fields in border areas, and conflicts between farmers and wildlife are almost a daily occurrence according to settlers in areas bordering the parks. (See Box #4: "Human-Elephant Conflicts".)

========== Box 4 ==========

HUMAN - ELEPHANT CONFLICTS

" Elephants on the Rampage - lay waste to cultivations and damage cottages of colonists", "Irate Farmers Shoot Marauding Wild Elephants", "Cultivator Trampled to Death by Wild Elephant", "Injured Elephant Limps to Death"..... Such press headlines are a common feature in Sri Lanka's newspapers and reflect the intensity and frequency of elephant-human confrontations that prevail in the dry zone districts of the island nation. These interactions are a direct manifestation of elephant habitat fragmented by expanded systems of irrigated agricultural development. Such development has resulted in isolation of wildland areas inhabited by elephants and destroyed natural elephant corridors (i.e. landscape linkages) that have existed for centuries.

With the clearing of forest areas in the recent past, more National Parks and protected areas have been established to provide habitat for displaced elephants and other wildlife species. However, the main protected areas set aside for such wildlife are small fragmented forest blocks scattered throughout cultivated agricultural settlements, and has led to "pocketed herds", whereby elephants become trapped in the small forest patches which are almost entirely surrounded by croplands. This phenomenon restricts

the movements of elephants, fragments the population into isolated herds and undermines the genetic exchange and long term viability of the species (Rudran et al. 1993). Limited research to date suggests that the minimum critical size required to conserve elephants is at least 100,000 hectares of contiguous forest (Abeywickrama et al. 1990). Only two protected areas in Sri Lanka meet this requirement: Wilpattu National Park (131,693 ha) and Yala National Park (97,878 ha).

Since elephants are a migratory species requiring great expanses of contiguous forest habitat it is not surprising to find an estimated 70 percent of the country's elephant population are free-ranging in village areas outside protected areas resulting in destruction of crops and property by elephants and the retaliatory shooting of elephants by humans (Fernando 1990). These conflicts have contributed to approximately 70 percent of the known mortality of elephants. The number of human fatalities due to human-elephant conflicts in Systems B and C alone, rose from 2 in 1980 to 4-5 in 1985 and then more than doubled to 12 in 1990 (from the records of the Mobile Elephant Control Unit). From an estimated 12,000 elephants which were distributed in all climatic zones of Sri Lanka at the turn of the century, the population has been reduced to a few thousand animals, restricted to the country's dry zone (Rudran et al. 1993), which, in turn is a patchwork of forest fragments with food less palatable than the surrounding farmlands -- and so the cycle continues.

========== End ==========

Maduru Oya Park's main unpaved north-south road is perhaps the most visible negative impact on the park's natural habitat. The road is necessary for movement around the park to enforce park regulations and guard against fires. The park access road system, nevertheless, has resulted in scarred landscapes, particularly along the Maha Oya-Aralaganwila highway. Steep-sided irrigation channels are also a hazard to both wild and domestic animals which occasionally fall into them and are trapped (Chitrasena 1993).

The side roads or arteries off the main north-south road left behind by former settlements, appear have a greater number of game trails than the main park road. The evaluation team used game trail counts as a proxy indicator of forest habitat utilization by wildlife. No game trails were observed off the main north-south road. However, there was an average of 3-4 trails per km of the five side roads inspected. Areas of discontinuous scrub and areas of forest with scrub indicated greater animal activity than pure stands of forest or dense scrub. As the evaluation team travelled to the southern entrance on a relatively unused dirt road, the number of game trails decreased as the vegetation became dense stands of natural forest. The most common species observed during the park site visit were small herds (5-6) of the spotted deer

(Cervus axis), the sambar deer *(C. unicolor)*, and the endemic Sri Lankan jungle fowl *(Gallus lafayetti)*. The team sighted one group of common langur *(Presbytis entellus)* and wild boar *(Sus scrofa)* in the southern portion of the park. The team did not observe any wild elephants sloth bears, leopards, toque macaques, or Indian muntjacs. Appendix C: "Profile of the Maduru Oya National Park" describes the vegetative types observed during the park site visit and common wildlife under optimal habitat conditions.

A major portion of forest habitat within the park appeared to have been exploited for shifting chena cultivation prior to gazetting to park status. This resulted in areas observed by the evaluation team of secondary vegetation and vast stretches of open grasslands/savannas dominated by illuk *(Imperata cylindrica)*, a grass of low nutritional value and largely palatable only in early stages of growth. Illuk is consumed by herbivores, including elephants, wild buffalo, and deer, although these animals would select a more palatable species if available. Other grasses observed included the guinea grass *(Panicum maximum)* and *Pennisetum* species. These grasslands are exploited by domestic cattle as well as wildlife (Chitrasena 1993). Particularly where there had been forest clearing for chena cultivation, or border zone cattle grazing, the weed *Xanthium strumerium*, which bears spiny fruits, appeared from initial observations to be outcompeting the natural grass species. Natural grasslands within the park appeared to be mainly restricted to those surrounding villus.

The evaluation team also observed that the grassland areas within the park appeared to have created an extensive network of "edges" in the park. Edges are boundaries between dense scrub or forest vegetation and the more open grasslands savannas. A high degree of edge generally supports more diverse and abundant wildlife populations, and, elephant populations are reported to be attracted to areas of plentiful edge (Eisenberg et al. 1990). However, according to Janzen (1986), too much edge eliminates important habitat needs. Furthermore, edges can also represent pathways for invader plant species to infiltrate an ecosystem. The Illuk grasses are an example of this kind of invasion.

Habitat enrichment and restoration measures are inadequate to support existing wildlife within and on the park perimeters.

Food availability and palatability for many wildlife species in the Maduru Oya Park and environs appears to be of inferior quality to planted crops in border zone areas. Wildlife predation on agricultural crops has increased over the years and wildlife farmer interactions continue to be a problem (Fernando 1993). Elephants, wild boar, sambar, buffalo and ungulate species tend to invade the periphery of settled areas with damage largely limited to fields and paddies adjacent to forests. No DWLC activity is underway to assist natural habitat restoration or enrichment with

palatable forage in the immediate perimeter of protected areas. Furthermore, according to Dissayanake (1993), no conclusive studies of habitat conditions within or adjacent to protected areas in the Mahaweli basin have been conducted.

There are no available data on important indicators of habitat improvement resulting from park demarcation (e.g., reductions in deforestation of critical wildlife habitat types, baseline information on the percent of park surface area covered by critical wildlife habitat, changes in forest habitat utilization as a result of "fragmentation", etc.). Indirect evidence of negative biophysical changes include the reported increase in wildlife-farmer conflicts and the lack of wildlife landscape linkages or corridors essential to the regional existence of such migratory species as elephants.

Socio-Economic Impacts

The evaluation examined the socio-economic impact of USAID support for forest habitat protection, under the MEP and other initiatives, on three target groups:

- Resettled households displaced from their former homes and lands within the park boundaries;
- Dwellers in "buffer zones" around the perimeters of the park; and,
- Tourists and park visitors using protected forest areas for recreational or research purposes.

Positive, negative and neutral impacts of MEP forest habitat protection measures on these groups are described below.

Resettled Park Dwellers

The immediate socio-economic impact of resettlement of park dwellers to areas outside the park is positive. However, land allocation schemes are providing too small a land base to support more than one generation through agricultural production, resulting in increased potential from future population growth for illegal land use and encroachment on protected forest areas.

The evaluation found that the most immediate socio-economic impact of USAID-supported forest habitat protection efforts was on households resettled from areas designated as national park lands. Over 1,500 families were living inside the Maduru Oya Park boundaries at the time of official demarcation of the parkland. There were numerous small villages with roads, schools, temples and

permanent housing. Chena cultivation and livestock raising were the prevalent forms of livelihood.

Relocation of these families to areas outside the park began in 1982 and ended in 1989. Park dwellers, along with the larger population of households displaced by the AMDP were given preference for free lands within the irrigation development system. Each resettled household, including married children over 18 years of age, received one hectare of paddy land to cultivate and 0.2 hectares to build a home. During the first year, resettled households received a food ration, seed for planting, and technical assistance for paddy cultivation among other support services provided by GOSL. The Government also allocated tribal families new lands in upland areas bordering the park similar to those on which they had been living within the park boundaries.

Many Maduru Oya Park families settled in System C of the Mahaweli irrigation scheme. The evaluation team visited System C offices and located some of the former Maduru Oya families in the Uttalapura Unit of the Sandunpura block of System C. Heads of households interviewed ranged from young to old cultivators. All had resettled with their families in 1982 or 1983 on standard homesteads and paddy land allocations in System C. All had taken advantage of free government support services, food rations and technical assistance offered along with their new lands.

From household interviews conducted by the team, it appears that the social and economic impact of resettlement on these households is positive. One respondent indicated that his household's income increased about four fold -- from 3,000 to 12,000 rupees a year -- after switching from chena cultivation in the park to paddy cultivation in the irrigation scheme. All respondents indicated satisfaction with their greater access to health and educational services. The daughters of one household were aspiring to go to college, an event less likely in their former remote park locale. The daughter of another family was earning additional family income in a nearby garment factory.

When interviewed about the negative impacts of leaving former parkland dwellings and chena cultivation practices, only one older farmer complained that his new living conditions were less favorable because irrigated paddy rice cultivation is more labor intensive than chena agriculture, the cost of living is higher than in his former location, and the forest offered him free game and other resources for the taking. According to Vimaladharama (1993), who conducted a systematic survey of resettled communities in System B, most families have more disposable income than before resettlement, but are also vulnerable to increased input costs for seed, fertilizer, fuel, etc. Published research on real disposable income for resettled communities indicate cash flow problems in the early 1980's. Scudder and Vimaladharma (1984) conclude that "while production goals were met in terms of paddy yield, for many

settlers the income received was insufficient or barely sufficient to cover the costs of production".

Another older resettler yearned for the forest life he knew as a boy and revealed the burgeoning resettlement problem known as the second generation issue. Based on additional interviews and on published literature (Scudder 1993), there is a growing concern that as children of resettled households mature, they are increasingly unable to make a livelihood from paddy cultivation, from local-off farm employment, or from some combination of the two. As a result, illegal subdivision of government-issued paddy land is beginning to occur. This phenomenon, resulting in income loss of settler offspring, is referred to as the second generation issue. In turn, this problem has potentially negative implications for forest habitat protection, namely, the encroachment of resettled households on nearby parkland areas.

This "second generation" problem is becoming a serious issue in the irrigation schemes and surrounding areas. Resettler offspring returning to the park areas could lead to increased chena cultivation and hunting if left unchecked. This second generation issue provides considerable opportunity for coordinated actions among GOSL agencies providing social and health services, land reform, population planning, and off-farm employment, especially in park-related jobs, to alleviate the problem.

Park Border Dwellers

The impact of park demarcation and habitat fragementation on households bordering the park is slightly negative.

Most households bordering the park continue to cultivate their lands using traditional slash and burn chena farming practices. Households interviewed at the southern boundary of the Maduru Oya Park indicated little or no access to social services or private transport. Walking 4 kilometers on a dirt road to the nearest highway to pick up transport to the nearest schools and health centers was not an uncommon occurrence. On the positive side, the team interviewed a young man who had managed to go to college and return to his border zone village to organize neighboring farmers into social action groups to pressure for greater public services and for additional farmlands onto which they could resettle within the AMDP irrigation system.

An important negative aspect of border zone living is elephant damage to crops and dwellings. Nearly every household in the southern park border area had a tree perch on which a family member sat each night for safety, or to drive away marauding elephants. To fall asleep on the job for only half an hour reported one respondent could mean the loss of a vegetable garden and several weeks of planting and cultivating efforts. Unwilling to harm the

elephants for fear of reprisals from park guards, border zone households simply endure this animal damage problem resulting from elephant habitat fragmentation into parkland areas.

The Veddhas displaced from the park appeared to fare no worse than the Veddhas originally living outside the park. The primitive tribal people of Sri Lanka are called Veddhas and some estimate that there are less than several thousand Veddhas today living in remote, forested areas of the island. Only a small portion of these people are hunter-gatherers relying exclusively on forest products. Veddhas are rapidly being absorbed into mainstream Sri Lankan culture. Veddhas resettled outside the park no longer live by hunting with their traditional bows and arrows but instead continue traditional cultivation practices, farm using slash and burn chena cultivation, or adopt paddy cultivation.

The evaluation team found little evidence of improved livelihood for relocated tribal groups encountered during the filed visits. The Veddhas interviewed reported that their wildlife hunting activities are limited to areas bordering the park and their only income seems to be from picture posing for tourists. The evaluation found no evidence of government-sponsored social programs in the newly established tribal areas visited.

Interviews with university staff at Kandy researching Veddhas confirmed our field observations that Veddhas displaced from the park are increasingly becoming chena cultivators and only occasionally supplement themselves with animal kills and wild honey collection. One researcher pointed out that the adjustment period from that of hunter-gatherer to farmer was heavily influenced by the extent to which the Veddhas had practiced chena cultivation prior to resettlement. Those Veddhas exposed to even limited forms of chena cultivation in the park (Domina Village) adjusted more rapidly than those who relied mainly on hunting (Henannegala village).

Recreational Tourism

There is no apparent socio-economic impact of forest habitat protection efforts on tourism in the Maduru Oya Park.

The evaluation team found no evidence of any socio-economic impact of forest habitat protection efforts on tourism. The Maduru Oya Park only opened to tourists in August 1993 and tourists are few in number. Conditions for tourists -- from roads to lodging and interpretive facilities -- are poor. Added investments appear necessary to make the Maduru Oya Park more suitable for tourism. Furthermore, Maduru Oya Park and its wildlife have yet to be discovered by the tourism industry.

No private tourist facilities are yet operating in the vicinity of the park; no excursion agencies that cater to international tourism are yet interested in the park as a location to include on Sri Lankan tourist itineraries. Little change in this picture seems likely until there is improvement in tourist facilities, rehabilitation of forest habitat, and restoration of wildlife populations to levels approaching those that existed before human settlements and crop cultivation.

5. EVALUATION FINDINGS: PROGRAM PERFORMANCE

Program Effectiveness

Among households formerly residing within the newly defined park areas, those resettled into the new irrigation schemes of the Mahaweli system appear to have greater socio-economic benefits than cultivators displaced to areas bordering parks and wildlife sanctuaries.

There are greater socio-economic opportunities (e.g., employment, off-farm employment, access to education, etc.) for former park dwellers resettled within the AMDP irrigation scheme and taking advantage of the government-allocated land for rice paddy cultivation and government-subsidized social programs than there are for resettled border zone households or Veddha tribal families. The households bordering the parks no longer have the option of extracting resources from protected habitat areas and must contend with damage to their crops by wildlife intruding from the park areas. There appears to be minimal attention given to the special needs of culturally disadvantaged Veddha tribal families displaced from their traditional homes within the park system.

Program Sustainability

While USAID certainly helped launch a greatly expanded forest and wildlife habitat protection program in Sri Lanka, the program does not yet appear to be sustainable.

The survival of many wildlife species in the Mahaweli system is unlikely without assisting regeneration of degraded forest habitats and consolidating and linking these habitats into biologically viable units.

The small size, degraded conditions and isolation of Sri Lanka's current protected areas implies that many endangered animal populations will fall to levels below what conservation biologists feel are necessary to assure genetic diversity sufficient for species survival. The extinction of many of Sri Lanka's prized wildlife species -- the Asian wild elephant, predator cats, migratory ruminants, some predatory birds -- is increasingly likely. Frequent occurrences of animal-human conflicts in areas bordering Sri Lanka's forest parks will only hasten the process.

Habitat sustainability in protected areas is questionable

until regulatory and enforcement functions are balanced with a greater technical capacity for active conservation planning and management.

The evaluation team identified five major constraints to the biological sustainability of the forest habitat protection program in Sri Lanka:

- inadequate national land use policy;
- inadequate protected area management planning;
- lack of local participation in the protected area management planning process;
- inadequate habitat restoration and enrichment measures;
- poor interagency coordination.

One of the most visible manifestations of these constraints is the pattern of forest fragmentation that has emerged out of the GOSL's efforts to reconcile development and conservation issues. Habitat elimination and fragmentation precipitates a series of escalating problems and threatens the welfare of wildlife as well as humans (See Appendix D).

The national land use policy is inadequate to address the long-term needs of irrigated agriculture development and forest habitat conservation.

MASL irrigated land allocation schemes provide too small a land base to support more than one generation through agricultural production, resulting in increased potential from future population growth for illegal land uses and encroachment on protected forest areas.

Under the AMDP, each resettled household received one hectare of paddy land to cultivate and 0.2 hectares to build a home. There is a growing concern that as children of resettled households mature, they are increasingly unable to make a livelihood from paddy cultivation, from local off-farm employment, or from some combination of the two. There are increasing reports of illegal subdivision of government-issued paddy land which is resulting in income loss to settler offspring. This problem has potentially negative implications for forest habitat protection, namely, encroachment of resettled households on nearby parkland areas. The "second generation" issue provides considerable opportunity for coordinated actions among GOSL agencies providing social and health services, land reform, population planning, and off-farm employment (especially in park-related jobs) to alleviate the problem.

There is no scientifically-based national protected area

management plan developed to guide natural forest habitat protection and resource use.

The challenge is in designing and implementing a multi-disciplinary approach to land use and conservation that integrates development and sustainable utilization of natural forest habitats. Such an approach needs, at a minimum, to include:

- promotion of increased biological research, including resource surveys and inventories, critical habitat assessments, species distribution analyses, ecosystem dynamics, succession patterns, etc.;
- adequate financial and manpower resources toward effective monitoring, management and regulation of forest habitats;
- strengthening formal environmental education programs at all levels of the education system, and expanding informal conservation awareness programs for politicians, decision-makers, government officials, NGOs, and the general public;
- coordination between public and private sector interests for integrated forest habitat protected area planning and management;
- review and reform of legislation to incorporate the principles of conservation and forest habitat management.

Local participation in the protected area planning and management is insufficient to assuring on-going support for conservation schemes.

At present, most environment and natural resources management decision-making occurs at levels far above local farmers and residents, and without inclusion of any local participation in the process. Such an approach limits the commitment that farmers and local residents are willing to make to support and maintain infrastructure to sustain the natural resource base in the long run. The challenge is policy development and reform toward enhancing the participatory process in forest habitat protected area planning and management, if progress is to be made in the conservation of biological diversity and protected area management.

External threats to forest habitats are not being systematically addressed and interagency coordination is lacking -- the gap between stated environmental policies and their implementation continues to widen.

Because many of the threats to forest habitat protection lie outside the areas for which the DWLC is responsible, coordination

with other agencies is critical. The overlap of DWLC with MASL responsibilities in the AMDP is neither clear nor operational. There is little evidence of coordination in addressing problems of animal-human conflict or the increasing pressures of fuelwood demand and supply. Sri Lanka has in place strong environmental policies. However, these are not consistently translated into environmentally sound natural resource management planning, implementation, monitoring, evaluation, and enforcement practices. There is considerable opportunity to improve coordination among agencies as well as to carry out resource management policy planning and implementation at the regional level with full recognition of the integrated nature of the ecological systems within the Mahaweli watershed in all institutional or "grass roots" responses.

The institutional sustainability of forest habitat protection in Sri Lanka is weakened because protected area management remains vulnerable to political influence.

DWLC direction is still subject to political control. Over the last 10 years there have been three directors with varying levels of competency in wildlife management and varying political agendas. The Wildlife Trust is not insulated from the same political influence that governs the DWLC. The Director of the DWLC is the chairperson of the Wildlife Trust with the capacity to influence how Trust funds are used. While there appears to be no misuse of funds, this detracts from the Trust's ability to independently complement DWLC activities in forest habitat protection or take on new initiatives. Even with an effective director, the political patronage system of the DWLC staff appears to have obstructed DWLC implementation of its mandate.

To address these constraints to sustainability, USAID has placed emphasis on NGOs and their role in creating public awareness of environmental issues.

USAID currently views this strategy as important to public participation in and contribution to favorable environmental policy. This is reflected with the environmental NGO component of the Natural Resources and Environmental Policy Project (NAREPP) which commenced in 1990. Under NAREPP, the Asia Foundation is administering the environmental NGO component of NAREPP. NGO institution-building component is aimed at expanding environmental and natural resource management programs, promoting formulation of initiatives to address critical environmental issues through collaborative efforts with private and public sectors, and emphasizing community participation in resource management programs and in environmental policy formulation are the primary objectives of the NAREPP environmental NGO component. NGOs are selected for environmental NGO component funding through an open application process, and grants to participating NGOs are made at core, discretionary, and seed grant levels.

The Cooperative Agreement between The Asia Foundation and USAID for implementing the environmental NGO component was amended in April 1993 to include special projects on community based resource management programs. The Wayamba Govi Sanwardhana Padanama, the Organization for Resource Development and Environment, the Wayamba Environment Science Explorers, and March for Conservation have agreed to develop these programs in a cluster of about 24 villages in Galagamuwa, Giribawa and Polpitigama Divisional Secretariat areas in Kurunegala District. All of the villages are located in the border of the Kahalla Pallekele Sanctuary. Several programs are anticipated to address critical biological diversity and wildlife management issues by communities in collaboration with relevant private and public sector organizations. The communities which are an integral part of given biological diversity issues will be strengthened under the proposed programs to manage their resource base effectively.

These NGOs have developed a Community Based Resource Management Program and have divided its activities among themselves according to their capacities and expertise. To coordinate the activities of the program, the four NGOs have formed an organization called 'Wana-Jana Mithuro Sanvidanaya'. Wayamba Govi Sanwardhana Padanama and the Organization for Resource Development and Environment will conduct socio-economic surveys, and organize and strengthen community groups. They will conduct about 72 training programs (1-4 day programs) for community groups on environment, NGO administration and project planning and management. Wayamba Environment Science Explorers will develop a core group of 48 villagers (2 per each village) to lead other villagers in managing human-elephant conflict and will also prepare a booklet on proposed solutions to human-elephant conflict. The March for Conservation will engage in research on the demography and behavior of elephants in the area.

Program Replicability

MEP experiences and lessons from protected area creation management have not been replicated elsewhere in the country or by other public or private agencies.

Discussions with the GOSL and NGOs did not reveal any clear examples of program replicability. Program replicability is defined as the spread of MEP impacts beyond the target projects sites. While the Forum For Community and Environment Development, an NGO located near Kandy, was familiar with MEP, its activities in school and community outreach are unrelated to anything involving the habitat and wildlife conservation issues associated with the Mahaweli development scheme.

In discussions with the Asia Foundation (TAF) there was no mention of any MEP-related activities (park gazetting, boundary

demarcation, support for park tourist facilities) being actively promoted by the TAF-administered group of NGOs under the NAREPP Environmental NGO component. There is recognition of the MEP project among the international donor community but no one appears to be pursuing the main components of MEP and introducing follow-on activities elsewhere in Sri Lanka. After the termination of MEP, the DWLC did establish the new 1,600 hectare Bundala Park and also conducted some limited wildlife management training, but there appears to be no other program replication.

6. LESSONS LEARNED

According to Sri Lankan historians, preservation of native wildlife on this island nation began in the third century B.C. when King Devanampiyatissa established the first animal sanctuary. There is also historical evidence that a second ruler, King Kirti-Nissanka-Malla, formally prohibited the killing of wild animals within a defined radius of his capital at Anuradhapura in the twelfth century A.D. (Abeywickrama et al. 1991). Thus in perspective, conservation activities have been going on in Sri Lanka for many generations.

A.I.D.'s involvement in environmental issues is a relatively recent effort. However, after more than ten years of supporting biological diversity protection in Sri Lanka, some lessons are emerging from that experience which can be applied elsewhere in the developing world. Among the lessons identified in this evaluation are the following.

Broad public participation and sound ecological principles are necessary for development, adoption and implementation of effective protected area management plans.

At present, most environment and natural resource management decision-making in Sri Lanka occurs without involving local residents or non-governmental environmental organizations. Such an approach limits the commitment farmers and local residents are willing to make to maintain natural resources in the long run. In order to increase local villagers' dedication to natural resource management, it is critical to actively incorporate them in planning, implementing, managing, and evaluating environmental programs.

Evidence exists in other Asian countries that interactive village planning in watershed management has produced more effective conservation and natural resource management than the top-down approaches as followed in the AMDP. Incorporating local perspectives and continuing participation in the identification of problems, and planning and implementation of solutions promises to be more effective.

Protecting Sri Lanka's biological diversity requires interagency coordination to address both internal and external forces at play.

Because many of the threats to forest habitat protection lie outside areas for which DWLC is responsible, coordination with

other agencies is critical. The overlap of DWLC with MASL responsibilities in the AMDP is neither clear nor operational. Sri Lanka has in place strong environmental policies and legislation establishing a Central Environmental Authority, numerous national parks and wildlife sanctuaries, soil and forest conservation, land use, and assessment of environmental impacts for new development proposals. However, such policies are not consistently translated into sound natural resource management practices.

Policy implementation is assigned across several government agencies, without well-defined roles and responsibilities. The evaluation found scope for improved coordination among agencies to carry out resource use planning and management in a fashion that recognizes the integrated nature of the ecological systems within the Mahaweli watershed.

Spreading USAID forest habitat protection investments among several organizations and institutions may be preferable to fully subscribing to any one entity.

Since the early 1980s, USAID has pinned much of its Sri Lankan environmental strategy in forest habitat protection on building the institutional capacity of the DWLC. In situations where the organizational viability of an implementing government agency is unclear or vulnerable to political influence at top management levels, diversifying USAID 's environmental investments (national and local governments, NGOs, trusts, foundations) may be a more appropriate strategy for weathering a changing political and bureaucratic climate.

Care must be exercised to insulate environmental trusts or foundations from political manipulation and mismanagement.

Environmental trusts represent a promising alternative to traditional government control and regulation of environment issues. However, experience in Sri Lanka suggests that trust creation is not enough. Control and direction must also be arranged to avoid the dangers of influences or of paralysis due to the lack of sound decision-making. Only by being free of government financial support and bureaucratic control can a trust exercise independence in shaping its strategies and carrying out its programs.

APPENDIX A

EVALUATION METHODOLOGY

The Agency's Center for Development Information and Evaluation (CDIE) is undertaking an assessment of A.I.D. investments in environment and natural resources management (E/NRM) programs as part of the Agency's Evaluation Studies Agenda. During the 1993-95 period, CDIE is evaluating programs in the forestry, agriculture and energy sectors. The forestry sector evaluation includes examination of a spectrum of forestry programs from private tree farming, to community (social) forestry, to public forests, to natural forest habitat protection (biological diversity conservation programs based in forest habitats, e.g., forest parks and reserves).

The E/NRM assessment responds to the growing importance of the environment and natural resources management both as a development challenge and as a distinct focus area for the Agency's development assistance activities. Since the early 1980's, A.I.D. has significantly increased its funding for the design and implementation of projects and programs aimed at environmental and natural resources management problems in developing countries. The Agency's Environmental Strategy encourages developing countries to manage their environments and natural resource base in a manner that conserves the biological and physical resource base for sustainable long-term growth.

The purpose of the assessment of A.I.D. environmental programs is to:

- o provide an objective reading on the programs to date in meeting the Agency's environmental objectives, and
- o derive lessons toward more effective design and implementation of ongoing and future programs and projects.

The Sri Lankan field work is one of the series of assessments being conducted on forest habitat protection. Other country field assessments on forest habitat protection include: Thailand, Nepal, Madagascar, Uganda, Coast Rica and Jamaica. In Sri Lanka, the assessment examines the A.I.D. assistance approach to protecting forest habitats and biological diversity within the Mahaweli development scheme under the Mahaweli Environment Project (MEP). Two important MEP objectives were the preservation of wildlife displaced by the Accelerated Mahaweli Development Program (AMDP) and the preservation of remaining natural habitats within the project area. This assessment

examines how A.I.D. employed the following strategies to achieve these objectives:

- **Strengthening environmental institutions** -- What changes have taken place in public institutions charged with forest habitat protection and management. How effectively have concerned institutions coordinated their activities? What measures have proven effective at fostering NGO involvement in environmental concerns? What support roles has networking and international organization played?

- **Fostering environmental education and awareness** -- What roles have awareness and education activities played in forest habitat protected area management activities? How effective have they been? What environmental awareness and education approaches worked best?

- **Introducing technological change** -- What improved forest habitat practices have taken place during and following MEP implementation? How effectively have these new practices been adopted and used?

- **Adopting environmentally sound economic policies** -- What has been A.I.D. experience with introducing environmentally sound management practices among forest habitat users?

The assessment of the Mahaweli Environment Program also examines the above development assistance strategies from the following performance standards:

- **Impact** -- What differences at the levels of policies and practices, biological and physical conditions, and social and economic welfare have resulted from A.I.D. environmental program investments?

- **Effectiveness** -- What implementation approaches have worked best in reaching all concerned socio-economic groups -- small cultivators, park buffer zone dwellers, resource users, eco-tourism businesses, women?

- **Sustainability** -- How well have forest habitat protection activities continued once assistance and A.I.D. support terminated? Did A.I.D. support lead to self-perpetuating bio-physical processes with the targeted forest habitat areas?

- **Replicability** -- Have A.I.D. supported forest habitat protection initiatives spread beyond original project areas?

The overall approach to this CDIE assessment involves examining the relationships between environmental impact and program investment using a five-level framework (Figure A-1). Working from the bottom of the framework, Level I registers actions undertaken by A.I.D. and the Government of Sri Lanka in implementing their mutual environmental program commitments:

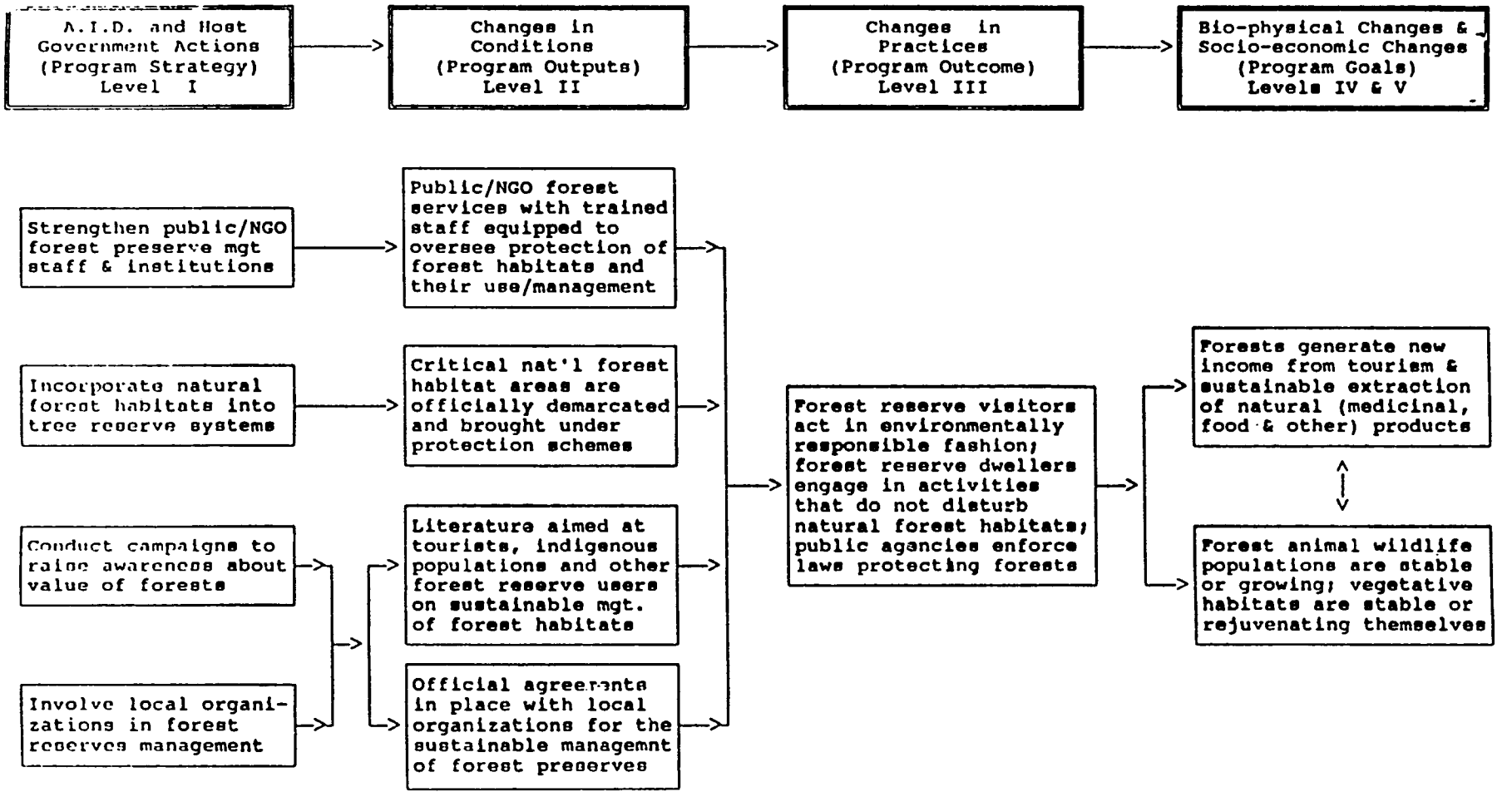
- national park infrastructure development,
- strengthening Sri Lanka's Department of Wildlife Conservation planning and management system, and
- developing DWLC's research and training capabilities.

This includes strengthening public/NGO forest reserve management staff and institutions, incorporating natural forest habitats into park and reserve systems, conducting campaigns to raise awareness about the value of forest habitat protection, and involving local organizations in forest habitat protected area management.

At Level II, conditions that result from these project outputs include the formation of new institutions, changed policies toward forest habitat protection, gazetting of park/reserve boundaries, development of forest and wildlife management plans for officially protected areas, public/NGO organizations with trained staff to manage protected areas, official agreements in place with local organizations for the effective management of natural forest habitat, and literature/interpretative materials aimed at tourists, village buffer zone dwellers and other forest user groups on the protected area status and management of the parklands/reserves. All these strategies contribute, then, toward enhancing changes in practices among resource users (Level III).

Level III practices are the expected and desired outcomes of Level II conditions. Indicators include, for example, forest reserve visitors acting in an environmentally-sound manner, village buffer zone dwellers engaging in activities that do not disturb forest habitat protected areas and associated wildlife, public agencies enforcing laws protecting forests and actively managing protected areas for forest habitat and wildlife enhancement. Level III indicators identify development outcomes that mark performance in achieving sustainable environmental change and development impact. As proxy measures, these indicators can mark the highest level directly attributed to A.I.D.-supported intervention.

FIGURE A-1: CONCEPTUAL FRAMEWORK FOR FOREST HABITAT PROTECTION



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Level IV constitutes the biophysical/ecological and socio-economic changes sufficient to attain the sustainable impacts at Level V. Level IV changes track the specific environmental or socio-economic objective being assessed (e.g., increased forest vegetative cover toward climax species, stable or growing wildlife populations, generation of income from tourism, etc.). Level IV indicators measure environmental conditions and biophysical changes that contribute to producing the strategic objective of ensuring the stability of irrigated agricultural development and human settlements in the Mahaweli basin by providing alternative protected habitats for displaced wildlife in an ecologically sound and socially acceptable manner.

Level V, the highest level, represents the development goal and is generally associated with increased opportunities for equitable economic development and food production. While access to sustainable/equitable income and concomitant quality of life data is difficult, the continued involvement of beneficiaries in the program can be used as a proxy that income conditions and the quality of life have improved. This assessment did not measure any Level V impacts because of the time lag between the MEP practices that might have been altered and the resulting biophysical changes with regard to the Level V variables cited above.

APPENDIX B

FOREST HABITAT PROTECTION IN SRI LANKA

Biological Resources

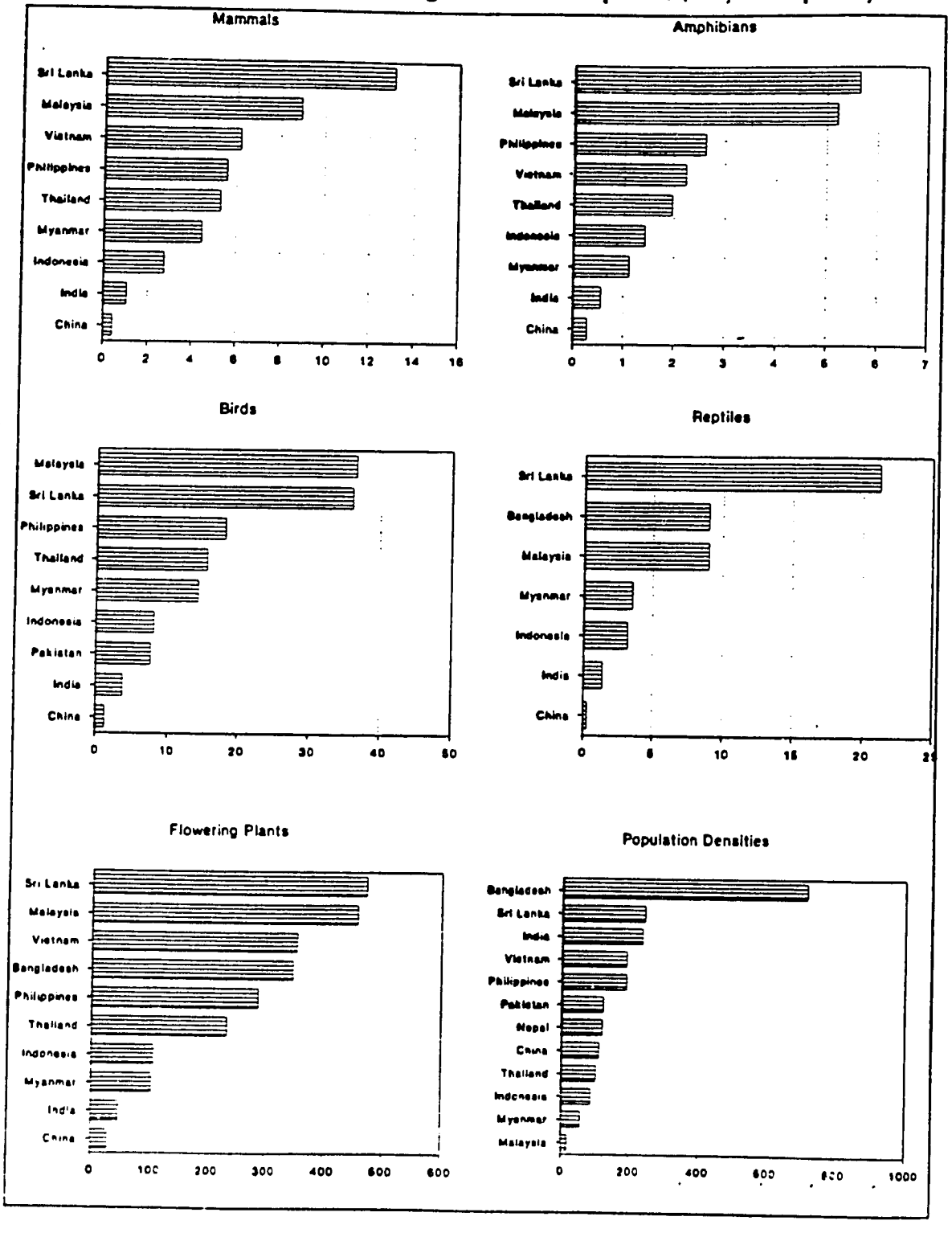
Sri Lanka has the greatest biological diversity per unit area than any other country in Asia (See Figure B-1). Biological diversity, or biodiversity, encompasses the variety, variability, and abundance of plants, animals, and microorganisms as well as the ecosystems and ecological processes to which they belong. Biodiversity is usually considered at three levels: genetic, species, and ecosystem diversity. Genetic diversity is the total genetic information contained in the genes of individual organisms. Species diversity refers the variety of living organisms. Ecosystem diversity relates to the diversity of habitats and biotic communities, as well as to the variety of ecological processes and functions within ecosystems (McNeely et al. 1990).

The Committee on Research Priorities in Tropical Biology identified the country in need of special attention because of its high levels of biological diversity, endemism and its vulnerability to habitat destruction (Abeywickrama et al. 1991). Sri Lanka is second only to Bangladesh in population density - the most critical threat to the conservation of biological diversity on that island nation (See Figure B-1).

The country's forests are divided into four basic types: low country wet zone forests below 1,000 meters, which are tropical wet evergreen forests; montane zone forests above 1,000 m, which are tropical lower and upper montane forests; intermediate zone forests, or tropical moist/wet semi evergreen forests; dry zone forests, or tropical dry mixed evergreen forests. These habitats are home to more 3300 types of flowering plants. Twenty-five are endemic, 65 percent resemble Indian flora and 5 percent have Malaysian, African or Australian affinities. Among the lower plant forms, liverworts and mosses include 190 and 575 species respectively, Pteridophytes 324 species and only a single indigenous species of Gymnosperms. Ninety-two percent of these species inhabit the low-country wet zone and montane zone forests while 8 percent are confined to the intermediate and dry zone forests of the island (Jansen and Loken 1988). It thus appears that the island's most biologically diverse forests are those of the low-country wet and montane zones of the country.

FIGURE B-1

Biological Diversity Of Asian Countries
(Ranked According To Average Number Of Species / 10,000 Sq Kms)



Source: Abeywickrama et al. 1991

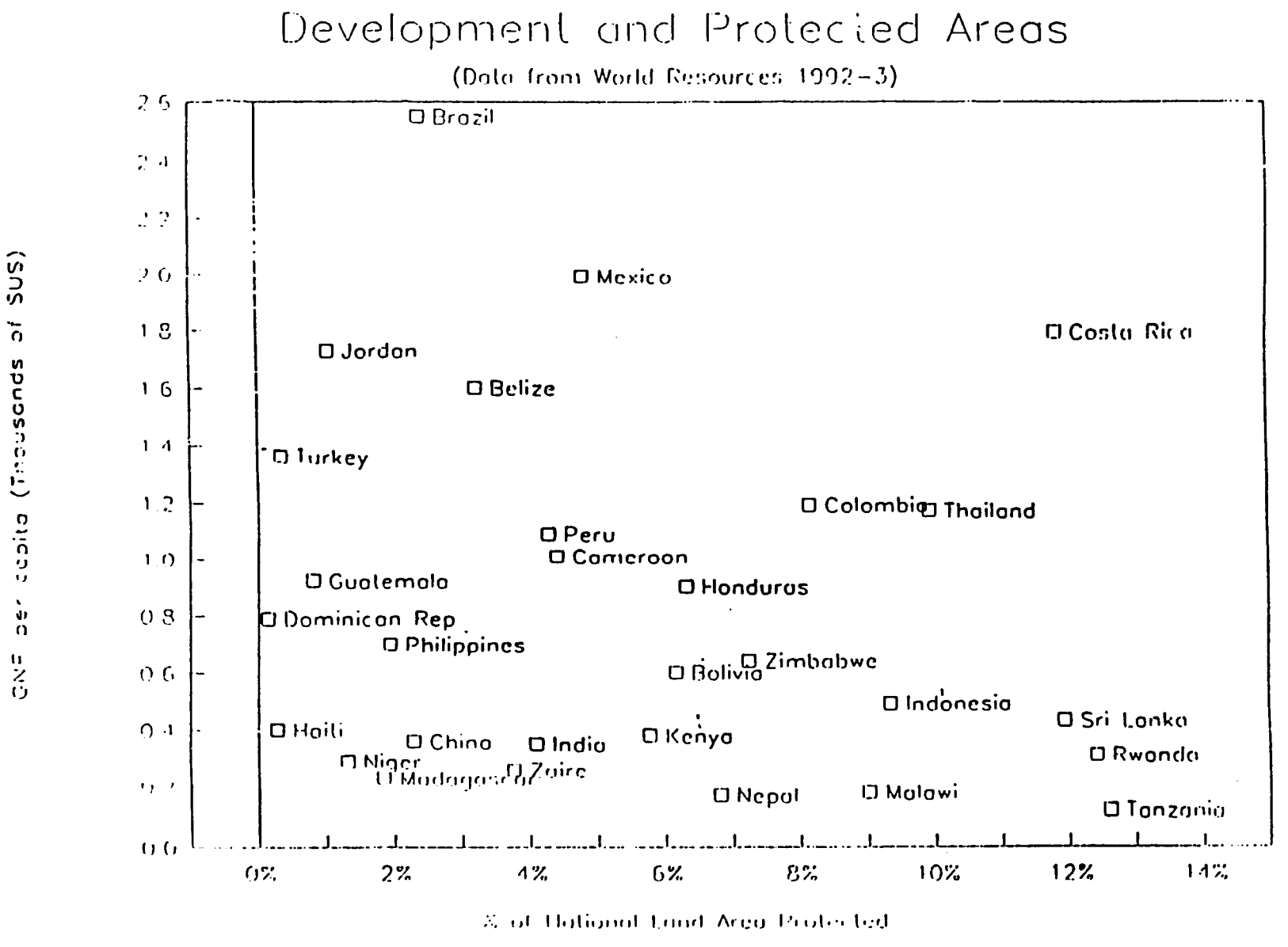
In addition to forests, the island has a great variety of other natural vegetation types including grasslands and wetlands, the including freshwater and coastal wetlands. Natural grasslands vary according to edaphic and hydrological conditions and include montane, savannah, talawa, damana and villu grassland communities (Abeywickrama et al. 1991).

While Sri Lanka possess a great wealth and abundance of wildlife, to date, no comprehensive systematic study has been completed on the number and status of the various species, their respective geographical distributions throughout the country, their basic ecological habitat requirements, or population dynamics. According to the current best available estimates, the Sri Lankan fauna includes some 763 species of terrestrial vertebrates. This figure includes some 86 species of mammals, 427 species of birds (including 175 species of migrants), 158 species of reptiles, 38 species of amphibians and 54 species of fish. Some 18 percent of these species are endemic to Sri Lanka. As for large mammals, few remain, including the elephant, sloth bear, spotted deer, sambar, wild buffalo, wild boar and the aquatic dugong. Few statistics are available on the number and types of invertebrates in the country (Jansen and Loken 1988).

The Status of Protected Areas in Sri Lanka

Sri Lanka ranks among countries with the highest amount of land under protected status (Figure B-2). About 12 percent of the total land area in Sri Lanka is protected, however, only 1 percent is located in the wet lowland and mountain regions -- the areas of highest biological diversity. Since the first national parks were established in 1938, an some 67 protected areas have been set aside exclusively for conservation, covering approximately 798,000 hectares. Table B-1 summarizes the IUCN data on all protected areas -- parks, reserves, sanctuaries -- established in Sri Lanka through 1990. Numbers and size of the protected areas have steadily increased, particularly in the last two decades (Figure B-3). Of the 67 protected areas in the country, about one third are less than 1,000 hectares -- nearly all are fragmented into "biological islands" within agricultural development schemes (Figure B-4).

FIGURE B-2



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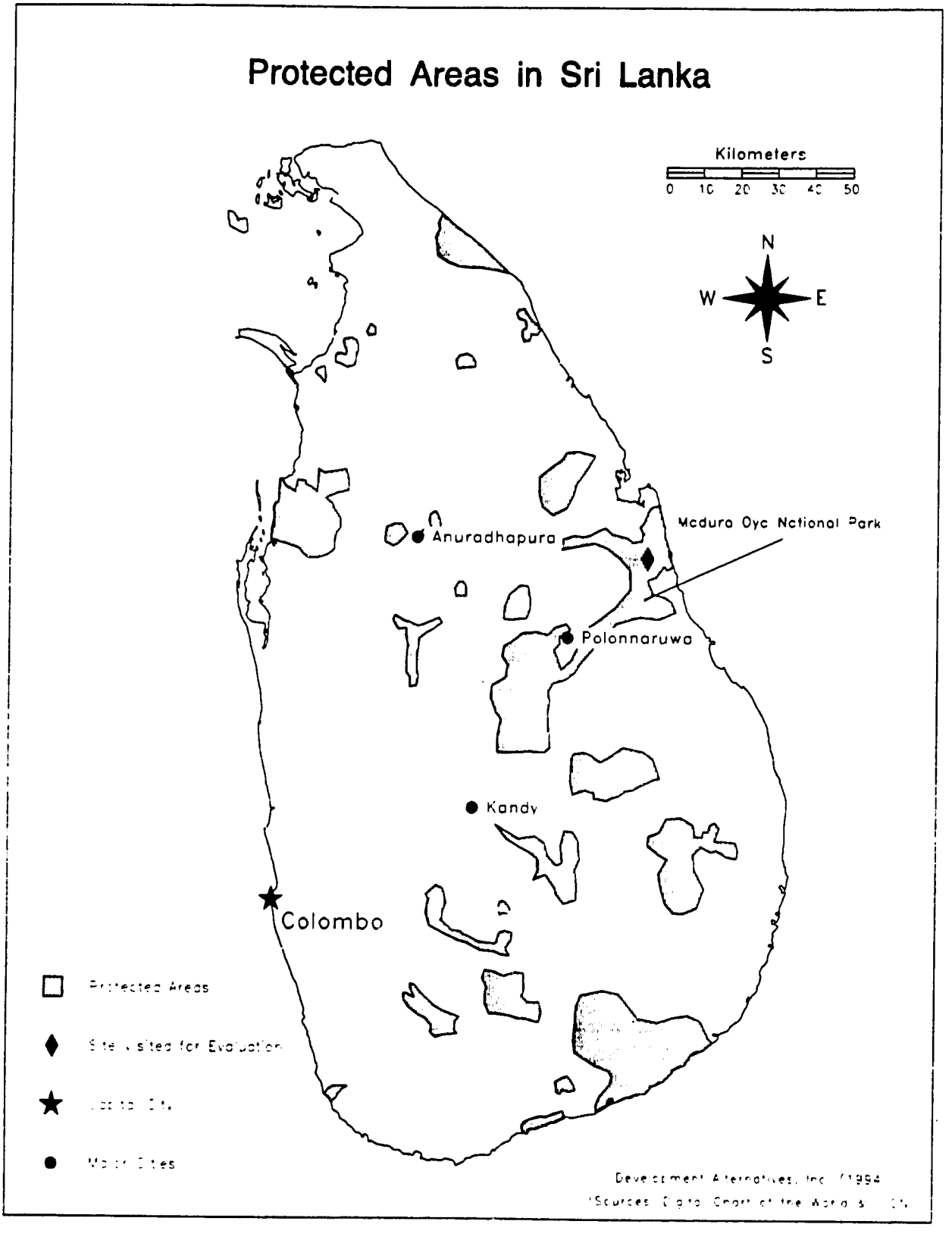

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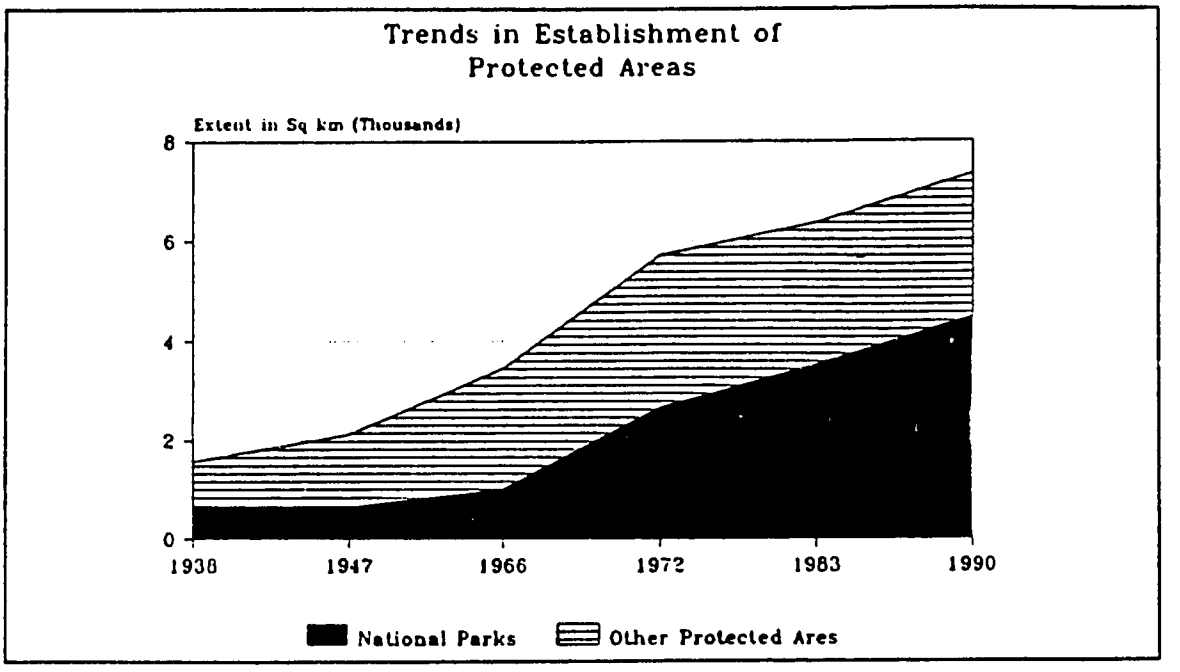
TABLE B-1
SUMMARY OF PROTECTED AREAS IN SRI LANKA

	Ha	Yr. Estab.
National Parks		
1 Flood Plains	17,350	1984
2 Gal Oya	25,900	1954
3 Horton Plains	3,160	1988
4 Lahugala Kitulana	1,554	1980
5 Maduru Oya	58,850	1983
6 Ruhuna (Yala)	97,878	1938
7 Somawathiya Chaitiya	37,762	1986
8 Uda Walawe	30,821	1972
9 Wasgomuwa	37,063	1980
10 Wilpattu	131,693	1938
11 Yala East	18,143	1969
Subtotal (% total land area)	460,180	7.00%
Strict Natural Reserves		
12 Hakgala	1,142	1938
13 Ritigala	1,528	1941
14 Yala	28,904	1938
Subtotal (% total land area)	31,574	0.50%
Nature Reserves		
15 Minneriya-Giritale	7,529	1988
16 Tirikonamadu	25,019	1986
Subtotal (% total land area)	32,548	0.50%
National Heritage Wilderness Areas		
17 Sinharaja	7,648	1988
Subtotal (% total land area)	7,648	0.10%
Jungle Corridors		
18 Nilgala	10,360	1970
Subtotal (% total land area)	13,360	0.20%
Sanctuaries		
19 Anuradhapura	3,501	1938
20 Buddhangala	1,841	1974
21 Bundala	6,216	1969
22 Chundikulam	11,150	1938
23 Gal Oya Valley North-East	12,432	1954
24 Gal Oya Valley South-West	15,281	1954
25 Galway's Lands	57	1938
26 Giant's Tank	3,941	1954
27 Great Sober Island	65	1963
28 Hikkaduwas Marine	45	1979
29 Honduwa Island	8	1973
30 Horagolla	13	1973
31 Kalametiya Kalapuwa	712	1984
32 Katagamuwa	1,004	1938

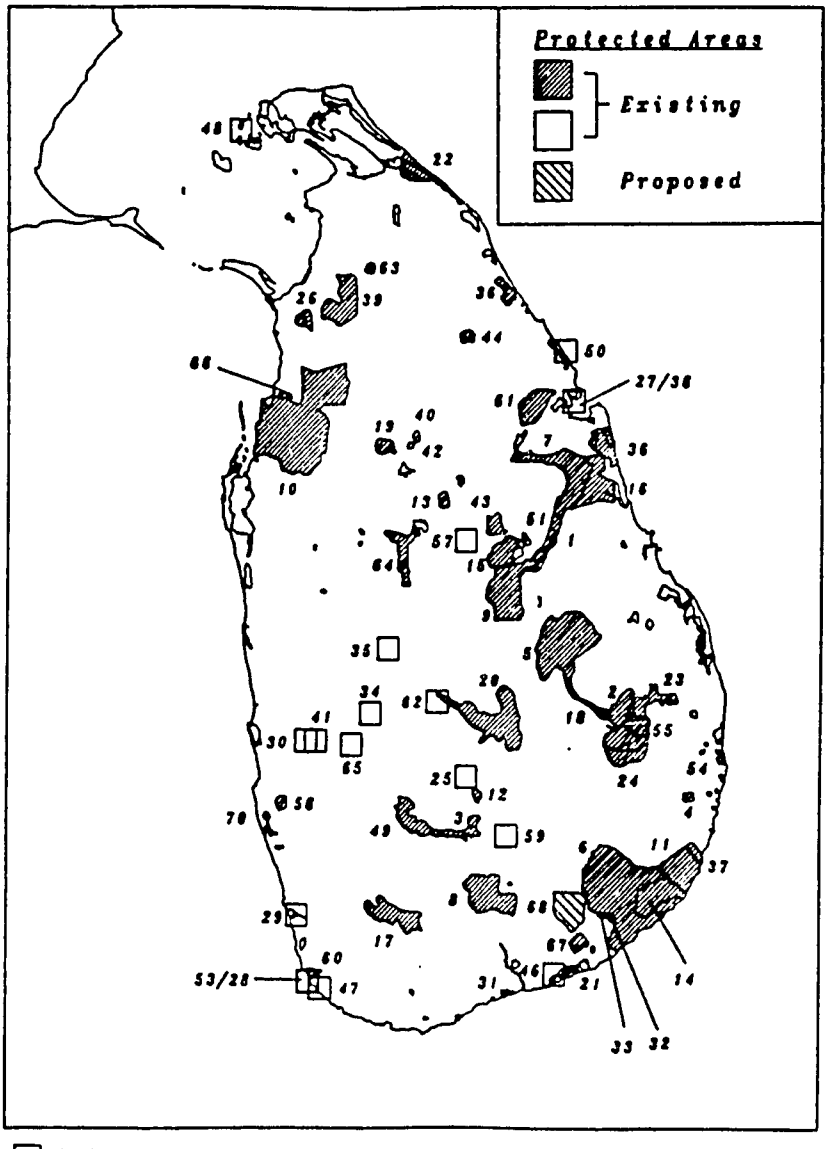
33 Kataragama	838	1938
34 Kegalle	113	1941
35 Kimbulwanoya	492	1963
36 Kokilai	2,995	1951
37 Kudumbigala	4,403	1973
38 Little Sober Island	6	1963
39 Madhu Road	26,677	1968
40 Mahakandarawewa		1966
41 Maimbulkanda-Nittambuwa	23	1972
42 Mihintale	1,000	1938
43 Minneriya-Giritale	6,693	1938
44 Padaviya Tank	6,475	1963
45 Pallekele-Kahalla-Balaluwewa	21,690	1989
46 Pallemalala	14	1942
47 Parapuduwa Nuns Island	190	1988
48 Parititivu Island	5	1974
49 Peak Wilderness	22,380	1940
50 Pigeon Island	5	1974
51 Polonnaruwa	1,523	1938
52 Ravana Ella	1,932	1979
53 Rocky Islets (Ambalangoda)	1	1940
54 Sagamam	616	1963
55 Senanayake Samudra	9,324	1954
56 Seruwila-Allai	15,540	1970
57 Sigiriya	5,099	1990
58 Sri Jayewardenepura	449	1985
59 Tangamalai (Adhisham)	132	1938
60 Telwatte	1,424	1938
61 Trincomalee Naval Headworks	18,130	1963
62 Udawattekele	111	1938
63 Vavunikulam	4,856	1963
64 Victoria-Randenigala-Rantambe	42,087	1987
65 Welhella-Katagille	134	1949
66 Wilpattu North	624	1947
67 Wirawila-Tissa	4,164	1938
Subtotal (% total land area)	256,424	3.90%
Proposed		
21 Bundala	6,216	
68 Lunugamvihira	21,500	
69 Riverine	921	
70 Bellanwila-Attidiya Marshes	60	
71 Dutch Bay (+ Portugal Bay)		
TOTALS		
Existing areas (% total land area)	798,734	12.20%
Proposed areas (% total land area)	28,697	0.40%

FIGURE B-3



Source: Abeywickrama et al. 1991

FIGURE B-4
Protected Areas of Sri Lanka *



☐ indicates protected area where the boundary is not shown

* Numbers correspond to those listed in summary Table B-1

Source: IUCN 1990

Although representing a significant contribution to the conservation of biological diversity with over 10 percent of its land allocated for strict conservation, can Sri Lanka's protected area system, based on areal extent alone, maintain the island's biological diversity? Limited research to date suggests that in the tropics, the minimum viable breeding population of 500 trees of low density species require between 6 and 1,000 hectares for their conservation (Whitmore 1984). The minimum critical size required to conserve elephants is at least 100,000 hectares of contiguous forest (Abeywickrama et al. 1990). Only two protected areas in Sri Lanka meet this requirement: Wilpattu National Park (131,693 ha) and Yala National Park (97,878 ha).

Most protected areas are located in the Dry Zone rather than in the biologically rich wet zone where only 2.6 percent of the land area (400 square kilometers) is under complete protection. Of the 18 reserves in this zone, only five are over 1,000 hectares, and only one is over 10,000 hectares. Furthermore, almost all forest reserves in the floristically rich lowland wet zone are subject to selective logging. Approximately 20 percent of the forest reserves have either disappeared completely or have been reduced to small isolated patches (Abeywickrama et al. 1991). In addition, other existing protected areas are mostly paper parks. Anecdotal evidence indicates that illegal and unmanaged logging, hunting, gathering, farming and livestock grazing continue to occur in most of the protected areas.

Many barriers hinder appropriate protected area management in Sri Lanka. The Department of Wildlife Conservation and the Forest Department have too little funding and too few technically qualified staff members to effectively manage existing protected areas. Neither basic ecological information on e.g., vegetative successional stages, wildlife habitat requirements, population dynamics, etc., nor information on habitat and wildlife management techniques exist for most of the protected areas. Law enforcement is stymied by poorly marked protected area boundaries. Local people are often apathetic toward protected areas, not recognizing the linkage between their biological resource base and their socio-economic well-being. Local and national politics often interfere with management decisions and practices (IUCN 1992). These problems not withstanding, the increasing intensity of cultivation and other demands on the island's natural resources and the resulting loss of forest and biological diversity ultimately stem from the rapidly growing population.

In the last 25 years, Sri Lanka lost 1.3 million hectares, or about half, of its forests. Forest clearing for settled and shifting agriculture, urban expansion, selective logging, reservoir and hydropower construction, and mining for semi-precious stones has resulted in deforestation of approximately three quarters of the island. An estimated 52,000 ha continue to

be deforested each year and numerous coastal swamps are being reclaimed. The introduction of exotic species has also taken a toll. In the wet zone the forest now covers only 9% of the land, yet they are the most interesting in terms of species diversity. Even this has not been left undisturbed. Logging operations in them although selective, have severely affected sensitive species, epiphytes and associated plants. Only a small area - perhaps around 25,000 ha is still relatively undisturbed. These are last refuges of many of the island's endangered plants, especially the endemics (Jansen and Loken 1988).

The loss of habitat from agriculture, mining, weak institutions, inadequate staffing, and lack of conservation awareness and education all have had a devastating impact on the country's wildlife. While few reliable estimates are available, the number of threatened Sri Lankan animal is alarming. It includes the Asian elephant, leopard, dugong, and several species each of crocodiles, turtles and birds which are all of international importance and concern. The fact that many of these threatened species are also endemic to the island nation makes it all the more important to stem the loss (Jansen and Loken 1988).

Functions and Benefits of Protected Area Systems (IUCN, UNEP & WWF 1992)

Protected area systems provide safeguards for:

- natural and modified ecosystems essential to maintenance of life-support systems, conservation of wild species and areas of high species diversity, and supporting scientific research;
- culturally important landscapes, historic monuments, and other heritage sites in developed areas;
- sustainable use of wild resources in modified ecosystems;
- traditional, sustainable uses of ecosystems in sacred places or traditional sites of harvesting by indigenous peoples; and,
- recreational and educational uses of natural, modified, and cultivated ecosystems.

Protected areas are intrinsically beneficial to development when they:

- conserve water and soil in highly erodible zones such as steep slopes of upper catchments and river banks;

- regulate and purify water, notably by protecting wetlands and watersheds;
- ameliorate natural disasters, such as floods and storm surges, by protecting watershed forests, riverine wetlands, coral reefs, mangroves, and coastal wetlands;
- maintain natural vegetation on soils of inherently low productivity that would, if transformed, yield little of value to human communities;
- maintain wild genetic resources critical to medicine;
- protect species and populations that are highly sensitive to human disturbance;
- provide habitat that is critical to harvested, migratory, or threatened species for breeding, feeding, or resting; and,
- provide income and employment, especially from tourism.

Approaches to Conservation Biological Diversity in Sri Lanka (IUCN 1992)

The National Environment Act, 1980, provides a legal and institutional framework for coordinating environmental agencies and policies under the Central Environmental Authority. According to the International Union for the Conservation of Nature a serious drawback of the Act, however, is the lack of legally binding provisions to ensure compliance with environmental requirements.

Game sanctuaries were abolished with the passing of the Fauna and Flora Protection Ordinance (No.2) in 1937. This Ordinance, last amended in 1970, makes provision for national reserves (embodying only crown land) and sanctuaries (comprising both crown and private land), and their administration by the Department of Wildlife Conservation (DWLC). In June 1990, the new National Policy for Wildlife Conservation was approved.

The Forest Ordinance No. 16, 1907, as amended by Act No. 13 of 1966, makes provision for the establishment of reserved forests and village forests, and for the protection of forests and their products, although its primary function has always been to provide for the controlled exploitation of timber.

To overcome the inherent weaknesses in the Forest Ordinance, the National Heritage Wilderness Areas Act, No. 3 was passed in 1988. Any piece of state land having unique ecosystems, genetic resources or outstanding natural features, (including the habitat of threatened species) may be declared a national heritage

wilderness area by the minister, subject to the approval of the president and endorsement by parliament.

A permit is required before entering a national heritage wilderness area. Such visits are restricted to looking at the plants and animals or conducting scientific research. Both the Forest Ordinance and National Heritage Wilderness areas Act are administered by the Forest Department.

The largest and oldest conservation non-governmental organization is the Wildlife and Nature Protection Society. Originally established in 1894 to cater to sport-hunting interests, and later incorporated by Act of Parliament in 1968, the Society has become increasingly concerned with the conservation of the island's biological resources through negotiation and cooperation with the state.

Background Status of Forest Protected Habitats -

Forest habitats gazetted as wildlife reserves are given one of six legal statuses and afforded different degrees of protection. These include:

- Strict Natural Reserves provide the greatest degree of protection to wildlife and associated habitat. In this type of reserve, neither fauna nor flora can be disturbed in any manner, and, entry is prohibited except on a permit obtained specifically for the purpose of conducting scientific research.

- National Parks provide full protection to fauna and flora and contain no permanent human settlements. However, people may enter the Park upon payment of a fee to observe wildlife.

- Nature Reserves afford the same protection to wildlife and associated habitat as a National Park. However, nature reserves are not developed for wildlife observations such as that in national parks.

- Jungle Corridors mainly provide animals with safe paths of movement according to their inherent biological behavioral migratory patterns; and, like a nature reserve afford full protection to fauna and flora, and accommodate existing land rights.

- Intermediate Zones in the past accommodated licensed hunting but have now lost their effectiveness.

- Wildlife Sanctuaries are wildlife reserves where animals cannot be disturbed in any way, but where other human activities, including habitat elimination on

privately owned lands are allowed.

All wildlife reserves are under the jurisdiction of the DWLC. Forest habitats that lie outside wildlife reserves fall into three different categories, of which the first two come under the jurisdiction of the Forest Department (Jansen 1993; TAMS 1980).

- Forest Reserves in which logging is generally permitted. Occasionally a portion of the total area of a forest reserve overlaps with a wildlife reserve of low status.

- Man and the Biosphere (MAB) Reserves include wild and domesticated habitats placed under protection for the purpose of conserving and safeguarding the diversity and integrity of biotic communities.

- Government of Sri Lanka (GOSL) Forests are administered at the district level and released for development schemes whenever necessary.

APPENDIX C

MADURU OYA NATIONAL PARK

History, Location, and Area

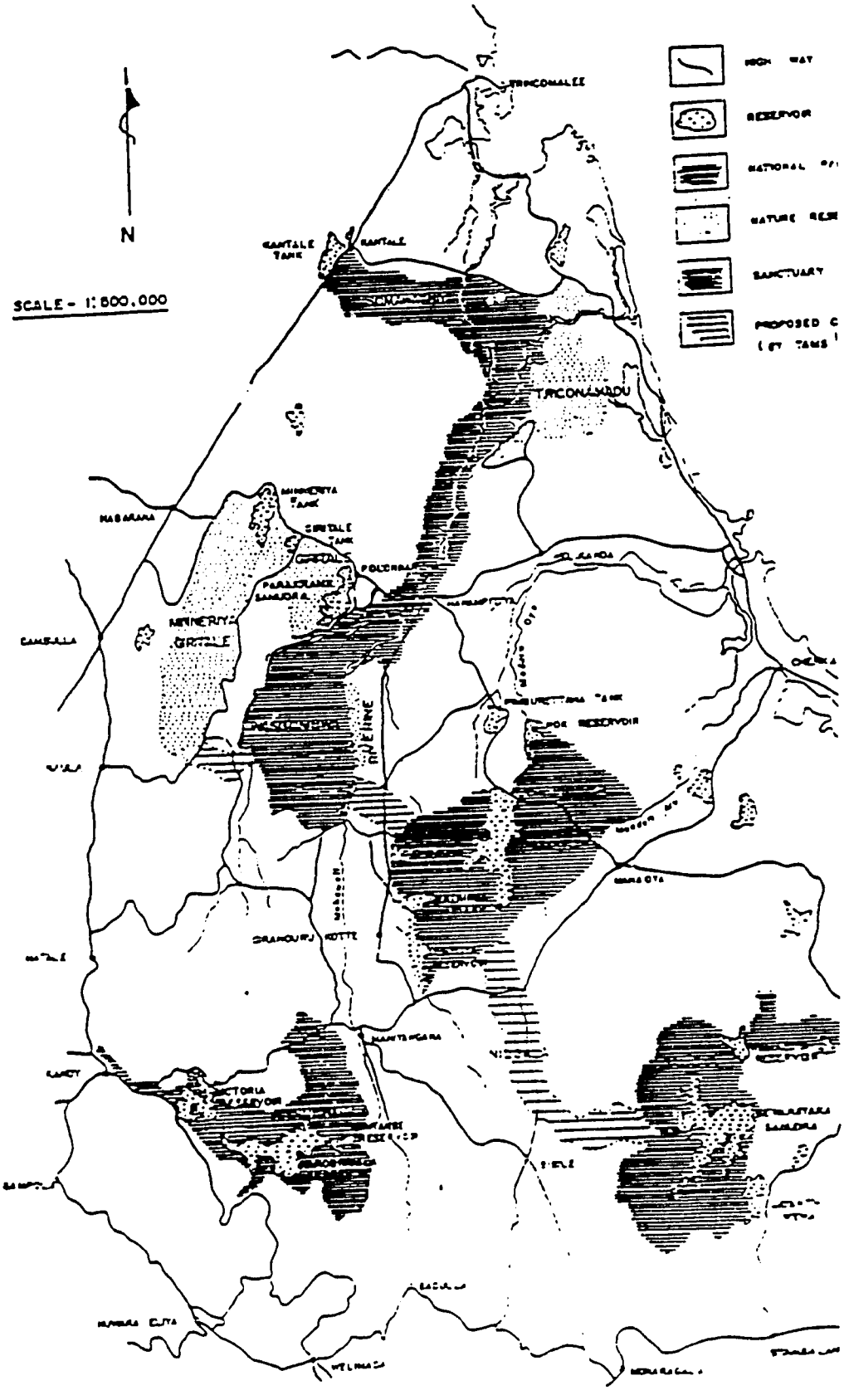
The Maduru Oya National Park was gazetted on 9 November 1983 (Gazette No. 270/9) under the Fauna and Flora Protection Ordinance, having been acquired from crown lands pursuant to the Mahaweli Authority Act, 1979 (IUCN 1990). The park lies between the Polonnaruwa-Batticaloa road and Mahiyangana-Padiyatalawa road in the districts of Ampara, Badulla and Polonnaruwa and spans the border between the Eastern and Uva provinces (See Figure C-1). The park is surrounded on the west and north by Mahaweli development areas, and on the south and east by teak plantations and jungle which is subjected to repeated slash-and-burn (chena) practices. The main access is from the north, approximately 25km by road from Mannampitiya, located on the Polonnaruwa-Batticola highway (IUCN 1990).

The original park area of 51,468 hectares was extended in the east for a total inclusive area of 58,850 hectares on September 16 1985 (Gazette No. 367/3) in order to provide additional habitat for wildlife and to ensure protection of the immediate catchments of five reservoirs developed under the Accelerated Mahaweli Program (AMP). An "extension" has been proposed to link the park with the Gal Oya National Park (25,900 hectares) in the south via the Nilgala Jungle Corridor (10,360 hectares). However, the corrridor has not yet been officially declared because of political pressure against such an action. Most of the park lies between 30m and 150m. Maximum altitude is approximately 700m (Chitrasena 1993).

Vegetation

The park is located entirely within Sri Lanka's "dry zone", although its southern edge appears to border an "intermediate" more "wet zone". The numerous combinations of physical, climatic and floral characteristics of the "dry zone" forests satisfy the ecological niche requirements of a wide range of wildlife species. The climax community of the area is tropical dry mixed evergreen forest, characterized by weera *Drypetes sepiaria*, buruta (satin) *Chloroxylon sweitenia*, palu *Manilkara hexandra*, veleng *Pterospermum canescens*, divul (wood apple) *Feronia limonia*, ehela *Cassia fistula*, and weliwenna *Dimorphocalyx glabellus*. *Drypetes sepiaria* with its gnarled and fluted trunk appears to dominate other tree species. The widespread dominance of this species suggests that its presence may play an important role in maintaining the viability of forest ecosystems of the dry

FIGURE C-1
PROTECTED AREAS IN THE MAHAWELI DEVELOPMENT AREA



Source: Tolisano et al., An Environmental Evaluation of the Accelerated Mahaweli Development Project: Lessons Learned and Donor Opportunities for Improved Assistance, 1993.

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zone. This species offers food to a wide range of wildlife including frugivorous birds, deer, monkeys, wild boar, and elephant. The fruits of M. hexandra, which are produced during the dry season, are favorite food items of monkeys and deer, while its leaves, and the bark and foliage of Crewia polygama, a common tree species in the dry zone Park, are eaten by elephants (Chitrasena 1993).

A major part of the forest within the park appeared to have been exploited for shifting "chena" cultivation prior to gazetting to "park status". This has resulted in areas observed by the evaluation team of secondary vegetation and vast stretches of open plains/"savannas" dominated by grasses such as illuk Imperata cylindrica (a grass of low nutritional value and largely palatable only in early stages of growth). Illuk is consumed by herbivores, including elephants, wild buffalo, and deer, although these animals would select a more palatable species if available. Other grasses observed included the guinea grass Panicum maximum and Pennisetum species. These grasslands are exploited by domestic cattle as well as wildlife (Chritsena 1993). Particularly where there had been forest clearing for chena cultivation, or "buffer zone" cattle grazing, Xanthium strumerium which bears spiny fruits appears to be outcompeting the natural grass species. Natural grasslands within the park appear to be mainly restricted to those which surround villus.

The evaluation team also observed that the grassland areas within the park appear to have created an extensive network of "edges". These edges represent boundaries between dense scrub or forest vegetation and the more open grassland savannas. A high degree of edge generally supports more diverse and abundant wildlife populations, and, elephant populations are reported to be attracted to areas of plentiful adge (Eisenberg et al. 1990). However, according to Janzen (1986), too much edge eliminates important habitat needs. Furhermore, "edges" can also represent pathways for invader plant species to infiltrate an ecosystem. The Illuk grasses are an example of this kind of invasion.

The herbaceous stage is succeeded by shrubs such as Lantana camara, Ziziphus species and Cassia auriculata. The scrub thicket stage is characterized by Trema rientalis. Among the first trees to appear in this succession is Pterospermum canescens, followed by Drypetes sepiaria and Manilkara hexandra. The Maduru Oya Dam is surrounded by parkland, maintained by periodic "managed" fires.

A rare and endemic tree, Vatica obscura, the only "dipterocarp" to occur in the dry zone, is found in restricted locations on the banks of the Maduru Oya and Gallodai Aru. A large plantation of teak, Tectona grandis, an exotic, is included in the north-eastern part of the park (Chritsena 1993).

Wildlife

The park is important for its rich wildlife which includes a variety of endemic species. Threatened species of mammals include the endangered elephant *Elephas maximus*, of which there were 150-250 prior to the park's establishment, the sloth bear *Melursus ursinus*, the leopard *Panthera pardus*, and the water buffalo *Bubalus bubalus*. Other mammals include the slender loris *Loris tardigradus*, the toque macaque *Macaca sinica* (a Sri Lankan endemic), the common langur *Presbytis entellus*, the jackal *Canus aureus*, the fishing cat *Felis viverrina*, the wild boar *Sus scrofa*, the Indian muntjac *Muntiacus muntjak*, the spotted deer *Cervus axis*, and the sambar *C. unicolor*.

Small mammals include the porcupine *Hystrix indica*, the black-naped hare *Lepus nigricollis*, the Indian pangolin *Manis crassicaudata*, squirrels, rats and mice.

Aquatic avifauna include the painted stork *Mycteria leucocephala*, the white-bellied sea eagle *Haliaeetus leucogaster*, the grey pelican *Pelecanus philippensis*, the great cormorant *Phalacrocorax carbo*, and the little cormorant *P. niger*.

Forest species include the endemic Sri Lanka junglefowl *Gallus lafayettei*, the rare broad-billed roller *Eurystomus orientalis* (possibly the only location in the dry zone), the common tailor-bird *Orthotomus sutorius*, the shama *Copsychus malabaricus*, the black-headed oriole *Oriolus xanthornus*, and the woodpecker *Dendrocopos nanus*. The red-faced malkoha *Phaenicophaeus pyrrhocephalus*, endemic to Sri Lanka is also present (Chitrasena 1993).

Reptiles include the tortoise *Geochelone elegans*, the common monitor *Varanus bengalensis*, the water monitor *V. salvator*, the phython *Phython molurus*, the krait *Bungarus* spp., the common cobra *Naja naja*, the mugger *Crocodylus palustris*, and the endangered estuarine crocodile *C. porosus*.

Conservation Management

A draft management plan for the Maduru Oya National Park was prepared in October 1985 by a group of consultants (MEP/DWLC 1985) and subsequently revised during a series of planning and development workshops, culminating in a final plan in June 1987 (MEP/DWLC 1987). Objectives of the plan extend beyond maintaining biological diversity and protecting the immediate catchments of five reservoirs developed under the Accelerated Mahaweli Program, to habitat enrichment, reforestation, developing waterholes in dry areas, and reducing exotic fauna and flora, particularly teak and *Salvinia*. Socio-economic objectives include developing visitor facilities, expanding conservation education programs within the local communities and providing local communities with

benefits from the park.

However, the management plan has yet to be actively implemented in terms of wildlife and habitat management. The problem in implementation of the park management plan appears to be primarily due to the lack of public participation, including that of decision-makers, in the park management planning process. Because of the lack of involvement of the public and private "stakeholders" in the development of the plan, there has been little impetus to implement the plan (Vattala 1993). Park management appears to consist solely of a policing effort by rangers and guards to reduce encroachment from outside.

The park consists of a complex of ecosystems, both natural and man-modified, and has been zoned in the management plan into natural, cultural resource and development areas, with a surrounding "buffer zone" to separate the parklands from the "village buffer zone" and facilitate habitat management. Again, nothing has occurred towards actually implementing the zoning process for the reasons stated above (Vattala 1993). It should be noted, however, that at the time the park management plan was developed there was no legal provision for such "buffer zones". It has only been with the recent 1992 amendment to the Flora and Fauna Protection Ordinance that such a provision has been made. The administrative infrastructure is essentially based on the park's division into three Range units, the Ulhitiya, Bogama, and the Maduru Oya Ranges. The latter is administered from park headquarters, established just south of a complex outside of the park built to service the construction of the Maduru Oya River reservoir dam, and the Bogama Range has been shifted to the Mahaoya Range (Vatalla 1993).

APPENDIX D

BIOLOGICAL DIVERSITY AND MANAGEMENT CONSTRAINTS

Biological diversity, or biodiversity, encompasses the variety, variability, and abundance of plants, animals, and microorganisms as well as the ecosystems and ecological processes to which they belong. Biodiversity is usually considered at three levels: genetic, species, and ecosystem diversity. Genetic diversity is the total genetic information contained in the genes of individual organisms. Species diversity refers the variety of living organisms. Ecosystem diversity relates to the diversity of habitats and biotic communities, as well as to the variety of ecological processes and functions within ecosystems (McNeely et al. 1990).

A key factor in maintaining biological diversity, and a way to measure its vulnerability, is the size of the protected area. About 12 percent of the total land area in Sri Lanka is protected, however, only 1 percent is located in the wet zone -- the area of highest diversity. Since the first national parks were established in 1938, a some 67 protected areas have been set aside exclusively for conservation, covering approximately 798,000 hectares. The number and size of the protected areas has steadily increased, particularly in the last two decades (See Appendix B: "Forest Habitat Protection in Sri Lanka", Figure B-3). Of the 67 protected areas in the country, about 40 percent are less than 1,000 hectares -- nearly all are fragmented into "biological islands" within agricultural development schemes (See Appendix B: "Forest Habitat Protection in Sri Lanka", Figure B-4).

Landscape fragmentation results when new areas of human-altered habitat are produced between sections of a formerly continuous forest community or ecosystem. As human modification of Sri Lanka's forested landscape progressed with the massive development of irrigated agriculture systems, the landscape became increasingly different from its ancestral state. As humans extracted their biological resource base from a wildland area, the degree of human domination of the landscape increased, and the potential of the remaining natural areas to support species sensitive to human impacts tended to decrease. Because fragmentation is typically a consequence of human disturbance, remnant habitats are generally in close proximity to areas of

human disturbance, such as forest clear-cuts and agriculture, and may thereby be subjected to stress from external invaders such as fire, pesticides, and weed species (Janzen 1986; Lovejoy et al. 1986).

Forest habitat fragmentation per se is not necessarily bad. Species populations that are distributed among isolated habitats but with occasional migration may be less susceptible to extinction from localized natural disasters or "chance events" that affect reproduction or survival of individuals. However, fragmentation becomes a problem when normal species dispersal and migration patterns are increasingly diminished, and the habitat quality too poor or the area too small to sustain viable populations.

Animal populations maintain themselves at or near the carrying capacity of their habitat through natural processes such as emigration, immigration, mortality and natality. Populations reproduce in numbers far in excess of carrying capacity. Emigration and natural mortality of young age classes are important to reduce population pressure in any given area and immigration is necessary for the influx of new genotypes and the prevention of inbreeding. If barriers against immigration and emigration are created, such as "protected" forest fortresses within a landscape of agricultural development, the populations in the isolated habitat become susceptible to decline.

This is amply demonstrated by faunal studies of islands where water acts as a barrier (MacArthur and Wilson 1967). For example, since the time Sri Lanka became isolated as an island, it has lost two species of rhino and a species of hippo, lion, red dog and gaur from its large mammal fauna (Deraniyagala 1958). Creation of protected forest habitats such as the Maduru Oya National Park will increase the probability of, but not guarantee the preservation of biologically diverse natural forest habitats and associated wildlife.

The theory of island biogeography states that the number of species on an island (or habitat fragment) is an equilibrium between immigration and extinctions. The former (immigration) is determined by the size and isolation of the island or the fragment, and some characteristics of the species - i.e. relative dispersal abilities (finches but no rhinos in the Galapagos). However, it is important to examine the process and meaning of the extinction "term" of the equation since the theory of island biogeography fails to say how species interact in communities of plants and animals. The theories associated with community ecology deal with how species react under such stresses as harvest and invaders from adjacent modified systems. Thus, in addition to protection, it is important to craft appropriate land uses near protected areas, as well as devise restoration strategies.

Overall, according to island biogeographic theory, small islands of habitat reserves support less species than do larger areas of similar habitats, and isolated reserves support fewer species than those close to other remaining blocks of forest. According to Zola (1993), a tenfold increase in reserve size results in a doubling of species that can be supported at equilibrium. The smaller the reserve, the greater the need for manipulative management to retain species. In some cases, however, a system of smaller parks and reserves may support as many or more species as one large reserve, especially if the first system covers a wide range of habitat types and the conservation areas are linked by corridors of natural habitats. Protected areas linked through larger forest complexes can form effective conservation units.

Can Sri Lanka's protected habitat system, based on area alone, maintain the island's biological diversity? Limited research to date suggests that in the tropics, the minimum viable breeding population of 500 trees of low density species require between 6 and 1,000 hectares for their conservation (Whitmore 1984). Two-thirds of Sri Lanka's existing protected areas are less than 10,000 hectares (see Table B-1: "Summary of Protected Areas in Sri Lanka"). These areas are small by international standards and are unlikely to conserve their present flora and fauna in the long term, especially when surrounding lands are cleared of forest and there are no opportunities for species migration. These areas are also too small and fragmented to survive as representable natural habitats without active ecological management. Fifty thousand hectares is usually considered a minimum size for maintaining viable populations of rain forest species and populations of rare and wide ranging species such as larger mammals and birds (Zola 1993). Limited research to date suggests that the minimum critical size required to conserve elephants is at least 100,000 hectares of contiguous forest (Abeywickrama et al. 1990). Only two protected areas in Sri Lanka meet this requirement: Wilpattu National Park (131,693 ha) and Yala National Park (97,878 ha).

Among the questions of importance to managers of natural systems are:

- how much available habitat must be set aside?
- in what distribution of sizes?
- should they be spread or clustered?
- what is their optimum shape?
- what happens to the natural communities under the types of stresses anticipated?

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- what kinds of species losses can be anticipated with different community structures and stresses?
- are some communities more, or less susceptible to various stresses?
- which species are likely to invade?
- how do invaders affect changes in communities?
- are there "keystone" species, and will a species loss cascade?
- if species are lost, will they recover if original conditions are restored, or selective reclamation is affected?

Population Viability Standards

Standards by which to assess the viability of isolated populations in forest fragments should document and monitor the long-term genetic and demographic viability of selected populations representative of each major guild (e.g., cavity-nesting birds, large browsing ungulates, solitary large predators, etc.). An acceptable coefficient of inbreeding based upon the breeding system and population numbers should be established and the carrying capacity calculated for that number. The foraging behavioral requirements necessary should yield an estimate of the necessary area of contiguous habitat required for population maintenance. The area likely to be lost due to chance events should be added (e.g. fire). Where populations are determined to be too small to be viable in the long run, a mitigation plan (e.g., acquisition of natural habitat corridors to connect small populations, accommodate migratory species habitat requirements, etc.) should be devised.

The calculated minimum maintenance size and the scored and ranked viability of each current population is the calculated area of habitat required and available for each population. A habitat mitigation plan with timetables and milestones and a standard monitoring and evaluation plan should be provided within a year and be upgraded regularly thereafter. The habitat mitigation plan should be based upon research. Therefore, the standards for measuring viability of biodiversity maintenance include:

- criteria development and establishment of guild requirements;
- estimated habitat carrying capacity, size requirements per guild, and status;

- a mitigation plan for fragmented populations too small to be viable;
- a monitoring and evaluation plan; and,
- a supporting research plan for poorly known species.

The AMP, Forest Fragmentation, and Maintenance of Biodiversity

Within the Accelerated Mahaweli Program area, forest habitat elimination and fragmentation has created barriers (i.e. agricultural areas and non-contiguous protected areas critical to total ecosystem function and process) and isolated wildlife habitats. Such "fragmentation" disrupts the emigration and immigration patterns of many species. Animals that are innately shy (e.g., leopard, jackal, mouse deer), those which are hunted (e.g. sambar, spotted deer, muntjac), and species which are almost totally dependent on trees and forests (e.g., purple-faced langur, porcupine, giant squirrel, flying squirrel) are the most seriously affected by the agricultural and protected area barriers to their immigration and emigration. Some species, especially nocturnal forms tend to move across these barriers (e.g., mongooses, civets, wild boar, some rodents), but if the barriers are too wide, the movement of these species will also be affected. Widespread disruption of emigration and immigration will affect gene flow and increase the probability of inbreeding. Consequently, the viability of wildlife populations and the species diversity of natural habitats will be reduced.

The reduction of species diversity through habitat elimination and modification impacts biological food chains. Food chains transfer energy from plants to animals through a stepwise process of eating and being eaten, and stabilize the population levels of predator and prey within a biological community. For example, the reduction of leopards leads to an increase of its prey species. Similarly, the decline of insectivorous animals (amphibians, reptiles, birds, mammals, and predatory insects) results in the proliferation of insect disease vectors and agricultural pests. This increase then, necessitates the use of pesticides and insecticides which further disrupts biological food chains. The chemicals are carried along the links of the food chain and most seriously affect the top predators of aquatic and terrestrial communities within the "isolated" components (irrigated agricultural resettlement lands and protected areas) of the regional Accelerated Mahaweli Development Program. This includes, crocodiles, monitor lizards, storks, eagles, hawks, leopards and humans. Thus, habitat elimination and fragmentation precipitates a series of escalating problems and threatens the welfare of wildlife as well as humans.

In addition to agricultural expansion, human needs for fuelwood also have an extremely serious impact on wildlife

habitats and animal populations. Extensive tree felling affects endangered and endemic plants and species valuable for medicinal purposes. Encroachment also brings human activity in close proximity to wildlife and increase pressure for hunting food and commercial products. The star tortoise, crocodile, bengal monitor, peacock, jungle fowl, deer, sambar, muntjac, mouse deer, hare, wild boar and leopard are affected to different degrees due to hunting pressure.

One of the most serious constraints to developing effective management measures for protecting forest habitat and associated wildlife species is the inadequacy of data on the basic ecological requirements, status and distribution of wildlife species. The Maduru Oya National Park along with most of the forest and wildlife reserves in the country do not appear to have been established on the basis of ecological requirements and conservation principles.

A case in point is the Yala and WilPattu National Parks which were established because forests existed in those areas on land largely not suitable for agriculture. This park planning approach is manifested by the fact that most of the remaining forests and protected areas are located in the "dry zone" which is comparatively far less valuable for either biological diversity or watershed reasons than the wet lowland and montane forests. This stems from the trade-off made between forest lands and irrigated agriculture development, and is exacerbated by the fact that there has been no scientifically based national land use policy developed to guide natural resource use and conservation (Vattala 1993).

Integrating Scientific Methods with Habitat Conservation Planning

While a number of studies have brought substantial quantitative information to conservation planning processes (Gilpin 1989, Givnich et al. 1989, Soule 1989, Menges 1990, Murphy et al. 1990), none has offered a step-by-step application of biological data to the development of a protected area design. Habitat conservation planning cannot be approached from a recipe; rather, each plan is a unique combination of an understanding of the target species and its habitats.

The very demand for conservation planning acknowledges conflicting interests and diverse values. The products of conservation planning, be they park/reserve designs or management plans, are prescriptions resulting from, or adjuncts to, activities that place species at risk of extinction. At the outset of the planning process, competing interests or constraints need be addressed. Non biological considerations that bear on the availability of habitat for protected area status (e.g., lands owned or managed by different jurisdictions) must be integrated into the planning process before ecological

data are used to produce the initial park/reserve design.

Toward the design of a protected area system adequate to the goal of species persistence, conservation planning must address two sources of threat to a target species:

- Systematic pressures associated with human activities that act to threaten target species including habitat destruction, overharvest of individuals, and toxic pollution.

- Natural stochastic phenomena -- expected normal, random perturbations to populations and their habitats -- also affect population persistence.

The ultimate measure of a conservation strategy or habitat conservation plan is the long-term viability of populations in natural habitats. Murphy and Noon (1992) provide an outline of a scientifically-based conservation planning process involving map overlays.

The initial ingredient of the process requires spatially explicit information about:

- the species' ecology - particularly the distributions of populations or the species "range", and,

- the current and historic distributions of suitable habitats, including disturbed areas with potential to recover to suitable habitat.

The intersection of the mapped species range with mapped currently and potentially suitable habitat provides an initial outline of habitat conservation areas that are candidates for inclusion in the protected area network.

Available survey or census information to identify known population centers from the species range coupled with quantifiable environmental correlates of habitat quality may then be mapped as a third layer (population density). The association of survey data with specific habitat types allows projections of species occurrences from unsurveyed areas of similar habitat type. A fourth layer depicts land use patterns, including areas currently set aside for the species during the planning process and areas in permanent protected status. Lands available for conservation planning must be carefully distinguished from lands not available for planning, since subsequent changes in land availability would likely force a repeat of the entire planning process.

The combined intersection of the four map layers:

- the geographic range of the target species,
- the distribution of suitable and potentially suitable habitat,
- population density information, and
- land use patterns

yields a first iteration of a park or reserve design represented as a map. Areas formed by the intersection of map data from each of the four map layers represent potential habitat conservation areas.

APPENDIX E

ENVIRONMENTAL NGOS

There are presently a number of non-governmental organizations (NGOs) with the capacity to play an active role in mobilizing public opinion on matters of national environmental concern and to assist in coordinated government efforts to enhance the sustainability of Sri Lanka's forest habitat systems.

To a limited extent, Sri Lanka's NGOs have been able to directly support efforts related to creating conservation awareness and tree planting. Most of these voluntary conservation-oriented NGOs are registered with the Central Environmental Authority. Some of the more important voluntary organizations have now obtained representation on various National committees such as the Fauna and Flora Advisory Committee, the Environmental Council of the Central Environmental Authority, and on a number of technical panels.

These voluntary organizations have canvassed much public opinion against state sponsored projects that have environmental concerns. In the 1980's, these groups successfully mobilized public opinion against the destruction of the Sinharaja Rainforest - Sri Lanka's only extensive remnant of tropical rainforest. NGOs have mobilized public opinion against the proposed strip-mining project at Elahera, the saltern project at Hambantota, the coal-fired project at Trincomalee, and the National Forestry Master Plan because of unresolved environmental issues.

The Wildlife and Nature Protection Society is Sri Lanka's oldest conservation-oriented voluntary organization. The Society was established in 1894 by individuals interested in hunting as a sport. The Society evolved a new image and became a major force in mobilizing public concern on matters of national interest pertaining to the conservation and protection of the island's biological resources. The present objectives of the Society are to ensure the perpetuity of wildlife and to preserve the island's natural conditions through negotiation and cooperation with GOSL agencies, and by promoting research and public awareness programs. The Society sponsors lecture and study programs, undertakes conservation projects and produces a biannual wildlife journal, LORIS. The Society receives its financial resources from membership fees and sale of publications. The Society has a membership of about 4,000.

March for Conservation is an NGO established in 1980 with the aim to focus attention on the rapid degradation of the

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island's natural resources through conservation education and training and research. This organization draws its strength from the fact that it is university-based. Its membership of about 300 includes university teachers, researchers, undergraduates, students and nature enthusiasts. The March for Conservation is the only NGO that has a strong research capability. Members of this organization are active in research in the lowland Sinharaja rainforest, in national parks and coastal zones, as well as in the Mahaweli River Basin Development area. The organization has published literature and scientific papers on natural resource issues. The March for Conservation has also been instrumental in forming rural-based conservation societies, particularly around the Sinharaja rainforest.

The Sri Lanka Association for the Advancement of Science is a forum for scientists of all disciplines such as medicine, agriculture and forestry, natural sciences, engineering and social sciences. The objectives of this organization include the promotion and advancement of science, dissemination of scientific knowledge, and promotion of coordination in the scientific community.

A rural-based organization involved in forestry activities is the Nation Builders Association, which is active mainly in the Kandy District, is largely composed of village youth. NBA has a strong leadership training component in its program of work.

The Sri Lanka Environmental Federation provides the legal teeth to the NGO movement. This organization is comprised of a group of lawyers whose mandate is to preserve and protect the country's natural resources from activities that damage it through legal action. The Sri Lanka Environmental Federation is renowned for taking environmental issues to law courts.

Additional relevant voluntary NGOs include:

Ceylon Bird Club
Environmental Brigade
Environmental Foundation Limited
Organization for Resource Development and Environment
Parisarikayo
Sevanatha
Soil Conservation Society
The Asia Foundation
Tree Protection Society
Young Zoologists' Association
Wayamba Environment Science Explorers
Wayamba Govi Sanwardhana Padanama

In 1985, a number of these voluntary groups joined together under the umbrella of the Sri Lanka Environment Congress (SLEC) with the intention of providing more force to the environment

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movement. The individual conservation organizations are largely composed of voluntary members, most of whom are constrained by the lack of time to devote to the conservation effort. This, coupled with the limited financial resources of these organizations, has been a serious constraint to their efforts. However, The dedication and commitment by these groups have been impressive and are reflected in the recent success in influencing environmental decisions in the country, such as the 1985 creation of the Environmental Congress.

APPENDIX F

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