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**TERMS OF REFERENCE FOR
AN ENVIRONMENTAL ASSESSMENT
OF
POTENTIAL PINEAPPLE INDUSTRY DEVELOPMENTS IN SRI LANKA**

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BACKGROUND

Agricultural Cooperative Development International (ACDI) has proposed to construct a pineapple nursery near Bibile, Sri Lanka to increase the available planting material for possible commercial production of smooth Cayenne pineapples. One outcome of this activity could thus be the establishment of large scale, commercial pineapple farming operations on lands adjacent to or in the vicinity of the proposed nursery.

The minimum area recommended for such a nucleus farm is 2,000 hectares. The GSL has indicated to ACDI that a block of land of this size could be made available to the east of the Dahamal Oya and west of the Gal Oya National Park and Sananayake Samudra Sanctuary. Development of such a nucleus farm in this location would encompass most of the land base in between the protected areas and the Dahamal Oya to a border approximately one-half kilometer south of the proposed nursery site.

The development of such a nucleus farm would be outside of the scope of work to be done by ACDI on the pineapple nursery, and would likely be undertaken by an independent private sector firm. USAID has not indicated that any financial assistance would be provided to promote or facilitate the development of such a nucleus farm. As a result, any environmental analyses of such a development would become the responsibility of the Central Environmental Authority (CEA) within the GSL.

However, because some connection does exist between the proposed ACDI nursery and future commercial pineapple developments in this region (e.g., the nursery could motivate and facilitate such developments by providing the necessary plant materials to the developer), several requests have been made for USAID to identify, in general terms, the nature of problems which should be anticipated, and the terms of study which should be addressed in preparing for such a larger project development.

Probable Environmental Impacts: In general, the significant environmental consequences from large scale agricultural developments in this area would be experienced in terms of soil and water management, deforestation, changes in wildlife habitat conditions, and changes in the socio-economic structure of the area. The size of the proposed nucleus farm, and the proximity to a large protected area and wildlife sanctuary, will increase the magnitude of some of these impacts. In particular, the more significant adverse consequences which could result from the development of a large nucleus farm would include:

- o Elimination of wildlife habitat through land clearing

operations. This could lead to a decline in the population levels of many wildlife species, including eight recognized TES species, and increased conflicts between wildlife and human populations.

- o Removal of the forest cover could lead to changes in runoff patterns and microclimatic conditions. Even a densely planted pineapple farm will not provide the soil cover that is found in a mature secondary forest, especially considering the area of land in roads or walkways that will not include any vegetative cover. More rapid runoff combined with increased soil loss could be a consequence of the agricultural development. These changes could alter soil and water balances in the Gal Oya drainage and Sananayake Samudra reservoir. These hydrologic changes could also result in a loss of some wetlands, and elimination of springs. Microclimatic changes could also be anticipated in terms of significantly altered soil microbiology and evapotranspiration conditions.
- o Land clearing could also contribute to a loss of some timber and non-timber forest products. These forest products provide a small, but recognized basis of revenue for some local residents, and represent an important source of genetic diversity.
- o Clearing of large tracts of continuous forest and grassland areas could encourage local residents to move into other undisturbed forest areas in order to practice chena cultivation, collect firewood, timber, and non-timber forest products, and hunt, if they could find some way to access these lands. This suggests that the actual forest loss could be greater than simply the area cleared for commercial pineapple production.
- o Commercial pineapple production on a larger scale could encourage more extensive use of agrochemicals for weed, fungi, and insect controls. However, it is likely that any large scale commercial agricultural operations would come equipped with the technical and financial capacity to ensure safe agrochemical use, given defined standards and operating procedures.
- o Large scale commercial pineapple production could encourage significant population increases in the area as people come looking for work. This will increase demands for sanitation and waste management, and could stress existing economic and administrative infrastructure.

Some of the beneficial consequences which could result from the development of a large nucleus farm would include:

- o A highly significant increase in the employment opportunities for local residents, including both skilled and unskilled jobs. The employment provided directly by the nucleus farm would likely be matched, or possibly exceeded by an increase in local service industries and commercial markets catering to employees and increased revenues in the area.
- o Improved social and economic infrastructure in the area, as new schools, health facilities, water and waste disposal systems, and other public services accompany population and economic growth.
- o Improved agricultural extension programs to guide outgrowers in commercial pineapple production, and safe use of agrochemicals and other measures for pest control.

As always, these potential long term economic benefits must be weighed against long term environmental costs in order to determine if the project is socially, economically, or ecologically sustainable. A first step in evaluating these concerns will be an analysis of potential environmental impacts from the development, and determination of measures which can be carried out to mitigate or avoid any significant environmental degradation in the area.

Data Requirements: The preparation of such an analysis will require the collection of some data which do not now exist, and some qualitative interpretations based on limited information. At a minimum, such an environmental analysis of any proposed large scale commercial development of lands adjacent to or in the vicinity of the proposed ACIDI pineapple nursery would need to address the following concerns:

- A. There are no reliable data available to describe the population characteristics, movement patterns, and herd sizes for key vertebrate or invertebrate indicator species in the area. This prevents any accurate prediction of probable impacts to wildlife or wildlife habitats. Indicator species will need to be identified for upper food chain mammals, aquatic macroinvertebrates, restricted endemic species, and baseline data gathered.
- B. In association with baseline data about indicator species, delineation of habitat types in the area, and field inventories of habitat conditions will be needed. These data can be correlated with species data to indicate the present suitability of the area for wildlife populations.
- C. Water quality sampling to establish pre-project baseline conditions, and guide qualitative interpretations of existing habitat and watershed conditions.

- D. Water balance (quantity) studies to indicate baseline hydrologic conditions, and predicted changes that would occur under different land use scenarios.
- E. Forest inventories should be conducted to classify vegetation types, and identify possible TES plant species, or other unique or endemic plant species which occur in the area. The genetic resources of this area are poorly known, at present. These inventories should also identify any important timber and non-timber products found in the area.
- F. Inventory the location and area extent of natural wetland communities found in the area. The analyses should also describe the hydrologic and ecological parameters necessary to sustain these communities, and indicate conservation measures necessary to minimize disruption of these aquatic systems.
- G. Socio-economic surveys to delineate present land use patterns and indicate consequences of current land uses; the present and projected economic status of the population based on formal and informal earning practices; public health conditions and implications from increased earning and infrastructure opportunities; waste management capabilities; settlement patterns and potential problems; and social stratification and gender concerns.

USAID fully expects that any major commercial developments which might emerge as a result of the establishment of a pineapple nursery farm, such as a large nucleus pineapple farm, processing facility, or other such land or resource intensive activities, will be subject to a detailed environmental analysis. The terms of reference (TOR) for such a detailed Environmental Assessment, whether conducted by USAID, the GSL, or other entities are described below.

TASKS REQUIRED TO COMPLETE EA

The GSL or other responsible agency will conduct an Environmental Assessment (EA) of all activities to be conducted to develop a pineapple industry in Sri Lanka. The EA team will identify and describe potential environmental impacts from project-funded field activities based upon an analysis of specific field conditions. The EA team will then describe actions and measures which can be applied to minimize any adverse environmental impacts, enhance beneficial impacts, and ensure that any pineapple nursery development activities are carried out in a manner that promotes environmentally sound practices. Ultimately, the EA will be used as a planning document to ensure that any proposed activities are to be carried out in a manner that sustains and enhances all aspects of the physical, biological and social environment, and which guides long-term

natural resource management policy developments in Sri Lanka, particularly those affecting natural forests and biological diversity.

Specifically, the EA team will accomplish the following tasks:

1. Conduct environmental scoping sessions with responsible or concerned Government of Sri Lanka (GSL) agency, non-governmental organization, or other donor representatives, and with groups living and working within the environments affected by the proposed project activities.
2. Conduct field and research environmental analyses, including NGO representatives as part of the field teams.
3. Identify and describe project implementation options, alternatives, and necessary mitigation measures.
4. Prepare and present workshop(s) that will strengthen the ability of GSL, appropriate NGOs, private sector staff, and community leaders to review and apply the information in environmental assessments, with particular reference to natural forest management and biodiversity management procedures.
5. Prepare a draft report, to include a presentation of findings to the GSL, NGO, or other appropriate groups, and
6. Incorporate comments from reviews of draft reports and formal or informal presentations of findings into a final EA report. The final EA report will follow the guidelines contained in the GSL Environmental Regulations.

The final EA will be prepared for use as both a planning and implementation document. As such, it will include sufficient detail concerning existing conditions, recommended alternatives or mitigative measures, and predicted impacts to enable a Project Manager, or members of the project implementation team to readily apply the recommended measures. The EA will also be prepared to serve as a model for future EAs.

A summary of the activities which could be performed under each of these tasks would include the following:

1. Conduct Scoping Sessions

The EA team will initiate project activities by (a) reviewing available background documentation on the physical, biological, social, economic, and institutional characteristics of the project area and the ecosystems in which it operates; (b) reviewing any design or implementation documents, and other relevant documentation pertaining to specific field management

plans; (c) developing a preliminary task list and product delivery schedule for the EA activity, including task lists for individual team members; and (d) establishing working administrative procedures to support EA efforts. This background research will enable the team to clearly define the problems that should be addressed in the EA, and begin to formulate a plan of action for collecting the information necessary to analyze probable environmental impacts.

The EA team will also initiate a scoping process soon after arrival. This scoping process will involve both formal and informal meetings with people who may be affected by the proposed project either directly or indirectly, or who may have special knowledge of the project area and its environs. This can include government officials, local farmers, merchants, teachers, physicians, religious leaders, or representatives from non-governmental entities, among other people. The purpose of the scoping process is to:

- o provide host country institutions and affected people with an opportunity to assess the proposed project, and identify the potential environmental issues and alternative strategies that they feel are important;
- o refine the Scope of Work for the EA team, and help set realistic and measurable goals and objectives for the EA;
- o identify existing sources of data; key individual contacts; and important areas of field study for the EA team;
- o increase local, regional, or national awareness of the project and its environmental concerns;
- o accelerate the pace of EA investigations, and facilitate rapid data collection and analysis; and
- o ensure on-going dialogue between the EA team and host country institutions and affected people, particularly to provide a basis for evaluating and guiding any proposed follow-on activities.

The EA team will hold a sufficient number of Scoping Sessions to allow all interested parties to provide input into the EA process. These participants should advise the EA team on issues to be investigated, sources of information, and any special concerns which they recognize.

The scoping sessions will provide the framework for an overall scoping process that will be conducted by the EA team. This scoping process is intended to provide meaning and an essential human element to the mass of data that surrounds most development projects. A successful scoping process can also usually accelerate the entire EA effort, and allow the EA to be completed much more rapidly than might otherwise be possible. Successful scoping enables the EA team to grasp the key issues and concerns prompted by a project much more rapidly than might be possible by simply reading documents.

In the process of defining the key environmental issues and overall content of the EA, all participants will become familiar with the environmental policies within which the GSL must operate. This information will enable participants to recognize the role of the EA in the final design and implementation of the proposed project.

The formal meetings will be announced in advance, and will include translators, if necessary, to facilitate communication. Where possible, the formal scoping meetings may be documented through video, audio, or still photographs to be used as training materials by USAID, GSL, NGO, or other interested groups. Graphic or other visual aid materials used by team members during their presentations will be prepared so as to serve as possible future training materials for use by these groups.

Informal scoping meetings will occur throughout the initial research and field work conducted by individual or collective team members. Informal scoping sessions will include meetings with affected communities in the three activity sites. The information obtained through these formal and informal means will be summarized and recorded in the Scoping Summary analysis included as an appendix to the EA.

At the completion of the scoping process the significant environmental issues which should be analyzed should be evident to the EA team, and an outline of the EA document will be prepared. The Scoping Summary analysis and revised EA Scope of Work (SOW) that emerges from the scoping process will be delivered to the GSL for their review and comments.

2. Conduct Environmental Analyses

Initial reviews of available background information, combined with information generated in the scoping process, should enable team members to define specific topics in which they need to conduct more detailed field analyses. A refined and more detailed SOW will be produced by the team to provide this specificity. This detailed SOW will form the outline of the final EA to be produced.

Team members will then carry out data collection and field work to enable them to interpret existing physical, biological, and socio-economic conditions in the three specific project site areas. At a minimum, the information on existing conditions will address the following topic areas:

- A. Geography, Ecology and Social Conditions in the Project Area(s)
- B. Biophysical Resources
 - 1. Watersheds, Hydrology and Geology
 - 2. Climate

3. Soils
 4. Biological Diversity
 - (a) Structure and Function in Natural Forest Communities
 - (b) Wetlands and Fresh Water Communities
 - (c) Grasslands
 - (d) Anthropogenic Communities
 - (e) Known Threatened, Endangered, Unique, or Sensitive (TES) Species Occurring in the Area
 - * Critical Habitat Requirements for TES Species
- C. Land Use and Socio-Economic Conditions
1. Forest Use Systems
 - (a) Commercial Practices
 - (b) Traditional Practices
 2. Farming Systems
 - (a) Agrochemical Uses and Management
 3. Transport Infrastructure
 4. Population Characteristics
 5. Principal Economic Activities
 6. Infrastructure and Decision-Making Processes
 7. Health and Nutrition
 8. Cultural Resources

In conducting field and other analyses, the EA Team will specifically emphasize potential impacts of proposed management activities on the conservation of tropical forest communities and biological diversity. Specific technical concerns which will be addressed will include: (a) potentials for habitat fragmentation and insularization; (b) data limitations, needs, and opportunities; (c) impacts of local economies on ecosystem dynamics; (d) research and policy concerns. Where data limitations are incomplete, the EA team will identify and describe data collection activities required to produce information that can minimize any adverse environmental impacts from the proposed pineapple industry development.

Collectively, the team will use this and all other available background data and information, in combination with any on-the-ground field work which can be conducted, to determine the potential direct or indirect environmental impacts from the proposed project activities on:

Biophysical Systems:

- (1) Hydrology and Water Resource Management (including areas both above and below the proposed areas to be affected)
- (2) Soil and Water Conservation
- (3) Conservation of Natural Forests, Wildlands, and Biodiversity

Agricultural Systems

- (5) Commercial Agricultural Production, including

- Commercial Forestry
- (6) Homestead Agriculture and Forestry
- (7) Non-Traditional Agricultural Practices
- (8) Non-Timber Forest Products
- (9) Agro-chemical Uses

Socio-Economic Systems

- (10) Increased Public Awareness of Environmental Conditions and Management Needs
- (11) Changes in Human Population Conditions and Settlement Patterns
- (12) Economic Conditions and Income-Generating Capacities
- (13) Health and Nutrition Characteristics
- (14) Needs for Improved Technical Capacity and Opportunities for Skills Development
- (15) Needs for Improved Capacity for Dialogue in Planning and Decision-Making
- (16) Strengthened Role of Environmental Management in Planning, Decision-Making and Implementation

3. Identify and Describe Environmental Measures

The information obtained through these environmental analyses will be used to identify and describe alternative actions which could be taken project to accomplish the defined goal and objectives of the project in the most environmentally sound manner possible. At a minimum, the alternative scenarios which will be described and evaluated will include:

1. The existing project without modifications
2. The existing project with the addition of one or more new environmental management components
3. Alternative management plans
4. A No Action scenario, whereby further financing would be discontinued.

The probable environmental consequences of each alternative will be described qualitatively and quantitatively, wherever possible. A weighted average ranking system which establishes a numeric value for anticipated environmental improvements will be developed and applied to select the preferred alternative.

A description of actions and methodologies which can be applied by the project implementation entity, GSL agencies, NGOs, or community groups to carry out the recommendations in the preferred alternative will be included in the EA. This information will ensure that the information in the EA can be

used to guide future project planning and implementation efforts. In compiling this information, the EA team will work with the project implementation entity to emphasize strategies or opportunities which will further the activities or plans which the implementation team has already put in motion or has plans to carry out in the near future. The expertise of the EA team will also be directed to assemble background information in the EA that will be particularly valuable for the project implementation entity as it carries out its management plans and field activities.

If necessary, the EA team will identify and describe specific mitigative measures which can be immediately carried out to minimize or avoid outright any potential or existing environmental problems. Mitigative measures will be written in the form of a preliminary Environmental Action Plan, describing the purpose and objective of the measure; necessary physical or biological resources to carry out the task(s); necessary social or institutional resources and collaboration to carry out the task(s); agencies or entities responsible for implementing and monitoring proposed measures; anticipated timeframe and finances needed; and outputs which can be monitored to measure results.

4. Debriefing on EA Procedures Followed and Findings Identified

The EA team will prepare and present one or more debriefings for USAID, GSL, NGO, PVO, private sector, other donor, or community representatives to present and discuss findings and recommendations. Input from these debriefing(s) will be incorporated into the final analysis and document. These debriefing(s) will be structured to enable participants to fully understand the methodologies and processes applied by the EA team in carrying out the EA of the project. A primary goal of the debriefing(s) will be to increase participants understanding of the processes and methodologies applied by the EA team in completing its collection and analysis of the project, and the relationship between this EA activity and the GSL environmental impact assessment procedures. Facilitators for the debriefing will encourage participants to determine:

- o the suitability of the data base for the analysis,
- o the role and outcomes from the Scoping Process,
- o methodologies applied to develop and evaluate alternative scenarios,
- o format and content of recommended mitigative or other environmental management measures,
- o opportunities to apply the information in the EA as an on-going planning and implementation guide.

In addition to providing the EA team with valuable comments on the immediate information produced for the EA, these

debriefing(s) will result in a valuable training opportunity for participants in EA methodology and uses. Debriefing participants should leave with increased abilities to critically review the EA process and results, and to identify opportunities to use EAs as a working tool in their future project efforts.

These debriefing(s) will also be designed to ensure that the analyses and recommendations from the EA reach as wide an audience as possible, and will not constrain outside input due to limited time, access, or capacity to work with the written EA document.

As with the formal scoping meetings, where possible, these debriefings may be documented through video, audio, or still photographs to be used as training materials by GSL, NGO, or other interested groups. Graphic or other visual aid materials used by team members during their presentations will be prepared so as to serve as possible future training materials for use by these groups.

5. Prepare a Draft Report

The EA Team Leader will use the technical information assembled by team members to prepare a document that covers the following:

- 1.0 Executive Summary
- 2.0 Description of Purpose and Content of the Environmental Assessment
- 3.0 Description of the Affected Environment
- 4.0 Alternative Strategies for Sustainable Environmental Management in Project Areas
- 5.0 Environmental Consequences of Each Alternative (including selection of preferred alternative)
- 6.0 Mitigative Measures for the Preferred Alternative
 - Annotated Bibliography
 - Appendices

The main document will be concise and limited to significant issues and pertinent recommendations. The main text will focus on findings, conclusions and recommended actions, supported by summaries of the data collected and citations for any references used in interpreting these data. Technical information will be presented in graphic form wherever practical and appropriate.

6. Prepare a Final Report

The EA Team Leader will use verbal or written comments received on the initial draft and presentation of findings to modify the text, as needed, and strengthen the EA materials. A final report, which incorporates and develops these comments, will be delivered to the GSL after receipt of all comments on the draft report.

The final document will include one or more Appendices that will, at a minimum, provide:

- I Descriptions of follow-on activities that can be developed to further any recommended mitigative measures, including a detailed plan to monitor the implementation of recommended measures; an estimate of capital and operating costs, and a description of other inputs (such as training and institutional strengthening) that may be required to carry out the recommendations.
- II Identification and description of ecological parameters and methodologies which can be used to document impacts and results from any pineapple industry development activities. Where practical, the final document will include available data pertaining to these parameters to support the project evaluations. Otherwise the document will identify data that are needed and collection means required to support future monitoring and evaluation efforts.
- III Description of actions that will assist in coordinating the recommendations within the various government agencies; and ensure that the views of NGOs, PVOs, and private sector groups will be recognized.
- IV Records and summaries of Scoping Meetings and other relevant public or private sector meetings.

RECOMMENDED SCHEDULE

A team of six specialists will be required for a total period of between eight and ten weeks, depending upon work progress, and unanticipated delays.

In order to strengthen NGO capacities to participate in the environmental impact assessment process, selected members of the Sri Lankan NGO community will participate in the field work conducted by the EA team. NGO participants will act as translators and liaisons with local communities in the sites to be visited, and will monitor and evaluate the overall EA process. The GSL will assist in identifying candidates from the NGO community to join the EA team, and will facilitate their participation in the field activities of one or more of the teams.

Team members working in the field will investigate proposed or active sites of pineapple industry field actions; existing or proposed natural resource development areas; buffer zone areas and activities; protected areas; and will meet with representatives from local communities and settlements to

interview people within the affected environment and interpret field conditions.

Logistics for implementation of the formal scoping meetings, field activities, and debriefing workshops will be arranged by the EA Team Leader with support from the Project Manager for pineapple industry development activities.

The team will include the following personnel:

- Team Leader/Tropical Ecologist
- Forest Ecologist
- Agricultural Development Specialist
- Biodiversity/Nature Conservation Specialist
- Social Scientist
- Watershed Management Specialist

A recommended schedule for the proposed activities is as follows:

- Week 1 - Team Leader begins work in Colombo and initiates background data collection, preparation for initial meetings. Local consultants begin work with the Team Leader immediately. Any contracted expatriate consultants arrive the end of Week 1.
- Week 2 - Team prepares for Scoping Sessions in Colombo and proposed project work area.
- Week 3 - Beginning of Week 3 team presents a one-day Scoping Session in Colombo. Team continues scoping process in Colombo before moving to sites of proposed management activities.
- Weeks 4 and 5 -Field activities and documentation in project area
- Week 6 - 1 day workshop on EA findings and applications for EA information presented to GSL, NGOs, and other groups; Team working on first draft of comprehensive EA.
- Week 7 - Delivery of first draft of EA to USAID Project Officer at beginning of week.
- Week 8 - Draft EA reviewed and comments delivered to EA Team Leader.

Final Report delivered within 10 days after receipt of all written and verbal comments on initial draft.

PERSONNEL REQUIREMENTS

The EA team will function as a cohesive unit in evaluating each proposed management area. However, each team member will have

specific tasks and areas of responsibility which will correspond to their areas of specialization. Wherever possible, specialists will attempt to quantify analyses, or, at a minimum, indicate data requirements and opportunities for data collection to support qualitative interpretations. The following task lists are intended to reflect the technical or policy issues which should be reflected in the analyses and write-up prepared by each team member.

1. **TEAM LEADER/TROPICAL ECOLOGIST** - the Team Leader will manage the implementation of the team's overall tasks and outputs, as well as the preparation and presentation of draft and final reports. He/she will initiate work on the EA prior to the entire team in order to begin arrangements for formal scoping sessions, collection of background information, and other logistical requirements. The Team Leader will be responsible for ensuring that (a) each team member has the logistical, administrative and technical support necessary to fulfill their assignment; (b) individual team analyses are completed promptly and thoroughly; (c) formal and informal Scoping sessions are conducted in Colombo and in the affected project areas; (d) EA debriefing meetings are conducted in Colombo and other designated locations; (e) a complete draft EA is written and delivered to the GSL in a timely manner; and (f) revisions based on verbal or written comments are incorporated into a final EA delivered to the GSL in a timely manner. The Team Leader will also provide technical support in the environmental analyses by assisting in the identification of data and research requirements. He/she must have a demonstrated expertise in managing a diverse team of consultants. He/she must also have training and demonstrated experience in natural resource management, ecology, or environmental science, and in assessing comprehensive environmental impacts of natural resource management projects affecting tropical forest management, including some demonstrated experience reviewing projects that affect protected areas.

2. **FOREST ECOLOGIST** - The Forest Ecologist will assess ecological impacts of project-funded activities that may affect natural forest areas and protected forests. He/she will recommend design changes or mitigation measures as necessary to the proposed management plans, including applied silvicultural or ecological research, opportunities to minimize impacts on existing biotic communities, accelerated natural regeneration or ecosystem restoration techniques, and sustainable opportunities for harvest of non-timber forest products. Specifically, the Forest Ecologist will address the following concerns:

- * Description of existing research to demonstrate regeneration opportunities for cleared forests in the affected areas.
- * Identification and description of indigenous agroforestry or perennial farming systems which exist in or around the project area.

- * Identification and description of non-timber forest products, and marketing opportunities for these products.
- * Impact of disturbed soil systems or nutrient cycles on biotic communities in the project area.
- * Description of influence of proposed natural forest development or management plans on microclimatic conditions, and subsequent habitat suitability for keystone species.
- * Delineation of protection measures needed to ensure conservation or restoration of streamside forests.

Where existing baseline data is incomplete or inadequate to guide planning and policy decisions, the specialist will identify and describe specific data collection needs that will enhance the objectives of the EA. The specialist will identify and describe specific parameters to be studied; the practical uses of this information and application to project objectives; recommended methodologies for obtaining the information; responsible agencies for maintaining the data; and estimated costs for efforts required.

He/she must have a strong technical understanding of forest ecology, and demonstrated expertise in assessing the implementation of forest development activities in the lowland humid tropics.

3. AGRICULTURAL DEVELOPMENT SPECIALIST - The Agricultural Development Specialist will identify any impacts to on-farm soil and water management, pest management, crop productivity, and agricultural ecology. Specifically, the specialist will address the following concerns:

- * Potential impacts from large-scale pineapple industry developments on traditional agricultural practices in the region, including any potential loss of crop genetic material, or changes in soil and water management practices.
- * Toxicity ratings and potential hazards to human and wildlife health from any proposed agrochemical applications planned during the life of the project. The EA will produce a table listing trade and technical names for all proposed agrochemicals, GSL or other international toxicity ratings, and management recommendations.
- * Potential impacts from large-scale cultivation on native plant diversity, and invasion of undesirable plant species in natural communities.

Where existing baseline data is incomplete or inadequate to guide planning and policy decisions, the specialist will identify and describe specific data collection needs that will enhance the objectives of the EA. The specialist will identify and describe specific parameters to be studied; the practical uses of this information and application to project objectives; recommended methodologies for obtaining the information; responsible agencies

for maintaining the data; and estimated costs for efforts required.

The Agricultural Development Specialist should have experience conducting analyses of tropical agricultural development projects, soil and water management in small and medium scale agriculture, pest management and agrochemical uses, and agricultural ecology.

4. BIODIVERSITY/NATURE CONSERVATION SPECIALIST - The Nature Conservation Specialist will assess the potential environmental impacts of project-funded activities aimed at developing viable approaches for improving the management of protected areas, and will recommend design changes or mitigation measures, as necessary. Recommendations could include applied research to minimize loss of critical habitat or genetic diversity, delineation of core zones, buffer zones, and connecting corridors to minimize ecosystem fragmentation and insularization, inventories of species richness and area requirements, and identification of income-generating and management opportunities for local residents in and around the protected areas. Specifically, the Biodiversity/Nature Conservation Specialist will address the following concerns:

- * Ensure that recently established parks are being incorporated into regional resource management schemes, if any exist, or develop recommendations for resource management schemes that address land use management needs that will support the protected area status of existing or proposed protected areas.
- * Ensure that land use practices in areas surrounding the protected areas will sustain the objectives of the parks and protected areas.
- * Identification and description of probable project impacts on any threatened, endangered, or sensitive (TES) species occurring in the project area.
- * Identification and description of data requirements and data collection methods which can improve information about keystone species (abundance, minimum viable populations, habitat requirements); species-area relationships; and size, shape, and suitable land use practices in buffer zones.
- * Delineation of major biotic communities in the project areas, and description of how project activities will enhance protection or restoration of these biotic communities.
- * Description of the present level of public awareness of environmental conditions and management needs. Description of opportunities to expand this level of awareness, or needs for increased environmental education. Identification and discussion of attitudes or strategies that exist among local groups in regards to the designated protected areas, and description of roles that these groups can fulfill in

- regards to these areas.
- * Description of benefits which can be derived by human communities in lands adjacent to designated parks and protected areas, and which will encourage and enhance protection of these lands.
 - * Measures and strategies which must be implemented to minimize human/wildlife conflicts in the proposed work areas, particularly to minimize conflicts with elephants, leopards, bear, and other identified TES species.

Where existing baseline data is incomplete or inadequate to guide planning and policy decisions, the specialist will identify and describe specific data collection needs that will enhance the objectives of the EA. The specialist will identify and describe specific parameters to be studied; the practical uses of this information and application to project objectives; recommended methodologies for obtaining the information; responsible agencies for maintaining the data; and estimated costs for efforts required.

He/she must have demonstrated expertise in designing and implementing management plans for forest conservation in the humid tropics, and a strong understanding of the approaches for encouraging the participation of local communities in conservation strategies.

5. SOCIAL SCIENTIST/ANTHROPOLOGIST - The Social Scientist/Anthropologist will specifically address potential impacts to the social and cultural environments within the project areas. Specifically, the Social Science Specialist will address the following concerns:

- * Impact of the proposed management plans on (a) changes in human populations and settlement patterns in the project area; (b) economic conditions and income-generating capacities; (c) health and nutrition characteristics.
- * Impact of proposed infrastructure improvements (road development, research station expansion, etc.) on social and economic conditions in the affected area, and impact of these social and economic changes on biophysical conditions.
- * Description of the present level of public awareness of environmental conditions and management needs. Description of opportunities to expand this level of awareness, or needs for increased environmental education. Identification and discussion of attitudes or strategies that exist among local groups in regards to the designated protected areas, and description of roles that these groups can fulfill in regards to these areas.
- * Identification of individuals or groups already in place to further environmental education or management endeavors. Description of the capacity or institutional needs of such individuals or groups.

- * Discussion of ways in which the present or proposed decision-making and management structure for the protected areas and surrounding natural areas can be strengthened to ensure local participation and support.

Where existing baseline data is incomplete or inadequate to guide planning and policy decisions, the specialist will identify and describe specific data collection needs that will enhance the objectives of the EA. The specialist will identify and describe specific parameters to be studied; the practical uses of this information and application to project objectives; recommended methodologies for obtaining the information; responsible agencies for maintaining the data; and estimated costs for efforts required.

He/she will have demonstrated expertise in applying social science/anthropology skills in the design and evaluation of natural resource management projects, with particular experience working with people living in and around designated protected areas.

6. WATERSHED MANAGEMENT SPECIALIST - The Watershed Management Specialist will identify any potential impacts to the volume, timing and quality of water or soil delivered downstream from any proposed pineapple project work areas. Specifically, this specialist will assess:

- * Impact of proposed management plans on the timing, quantity, and quality of water resources in the general vicinity or downstream from the affected area. Description of how these hydrologic changes will influence the structure or function of biotic communities and environmental values in the affected areas.
- * Impact of proposed management plans on soil loss, sediment loads, and nutrient cycles in the affected environment.
- * Management strategies or mitigative measures that can be employed to minimize disruption of soil and water balances, and microclimates, or to restore previously disrupted areas.
- * Description of procedures required to inventory and protect wetlands within any proposed work areas.
- * Description of procedures, parameters, training required, and appropriate agencies to carry out regular monitoring of water quality and quantity, both upstream and downstream from proposed work areas.

Where existing baseline data is incomplete or inadequate to guide planning and policy decisions, the specialist will identify and describe specific data collection needs that will enhance the objectives of the EA. The specialist will identify and describe specific parameters to be studied; the practical uses of this information and application to project objectives; recommended methodologies for obtaining the information; responsible agencies

for maintaining the data; and estimated costs for efforts required.

The Watershed Management Specialist should have experience working with water resource and watershed management issues in tropical ecosystems, including experience with the development and management of large agricultural development projects, groundwater development, soil conservation, water quality, irrigation, and management of catchment areas.