Appendix E

Aid To Developing Countries: The Technology/Ecology Fit

Staff Paper
Food and Renewable Resources Program
Office of Technology Assessment
Congress of the United States

June 1987

OTA PROJECT STAFF

Roger Herdrnan, ***Assistant Director,*** OTA
Health and Life Sciences Division

Walter E. Parham, Food and Renewable Resources ***Program Manager***

Analytical Staff

Alison L. Hess, ***Project Director***

Bruce Ross-Sheriff, ***Contractor***
Patricia Durana, ***Research Analyst***

Administrative Staff

N. Ellis Lewis, ***Administrative Assistant***[1]
Sally Shafroth, ***Administrative Assistant***[2]
Nellie Hammond, ***Secretary***
Carolyn Swarm, ***Secretary***

[1] From May 11,1987.
[2] Until May 1,1987.

Foreword

The U.S. Congress influences development assistance most directly through the U.S. Agency for International Development (AID) and five multilateral development banks (MDBs): the World Bank,[1] the InterAmerican Development Bank the Asian Development Bank the African Development Bank, and the Caribbean Development Bank. Congress also influences development assistance through a number of Federal civilian and military agencies, bilateral programs (e.g., the Peace Corps and the Overseas Private Investment Corporation), and multilateral organizations (e.g., United Nations' agencies).

The Chairmen and Ranking Members of the House Committee on Science and Technology[2] and its Subcommittee on Natural Resources, Agriculture Research and Environment requested the congressional Office of Technology Assessment (OTA) to investigate how aid agencies might improve their capability to match technologies to local environmental conditions of recipient development countries. The request grew out of an earlier study conducted under the auspices of the Environmental and Energy Study Institute (EESI) and ten Members of Congress. The EESI study identified the mismatch of technologies with developing country environments as a common contributing cause of development assistance project failures. One of the EESI report's 13 explicit recommendations for congressional and aid agency action was to conduct a study addressing this aspect of development assistance failure.[3]

The House Science and Technology Committee staff, and staff of several other interested committees, suggested that this OTA paper might serve as a resource for oversight and reauthorization hearings of the Foreign Assistance Act, which provides the framework for U.S. development assistance. To enhance the report's utility, questions are included that committee Members and staff might use in hearings or informal conferences with development assistance personnel.

This paper focuses primarily on AID and to a lesser extent on the World Bank. AID and the World Bank have made the most observable efforts to integrate environmental and development concerns. Other multilateral and bilateral organizations tend to emulate their environmental policies and procedures to various degrees. Today, the World Bank is undergoing major reorganization in part to enhance its environmental capability. It is not clear at this time what the magnitude of these changes will be, although the President of the World Bank Barber Conable, has stated his environmental goals for the Bank's reorganization. Once the reorganization incomplete, the success of this effort in achieving the stated environmental goals could be examined through the congressional hearing process.

This paper is based on information derived from: 1) a series of interviews with personnel of development assistance organizations, certain Executive and congressional agencies, nongovernmental organizations involved in development assistance, and development consultants; 2) an OTA workshop, and 3) study of selected aid organization reports (many of which are not intended for specific citation). By agreement with persons interviewed and workshop participants, observations are not attributed to particular individuals.

OTA greatly appreciates the contributions of the workshop participants, interviewees, and reviewers. As with all studies, the content of the Staff Paper is the sole responsibility of OTA.

JOHN H. GIBBONS
Director

1 The International Bank for Reconstruction and Development, the International Development Agency, and the International Finance Corporation comprise the World Bank.
2 The Committee was renamed the Committee on Science, Space and Technology at the beginning of the I00th Congress.
3 OTA and the World Resources Institute initiated similar studies; this report presents only the results of OTA's study.

Contents

Box

Figures

Appendix E
Aid To Developing Countries: The Technology/Ecology Fit

CONCLUSIONS

Ecological compatibility of ***technologies*** with local site ***conditions is fundemenental to success of development assistance:*** Development assistance organizations know that the specific sociocultural political, economic and ecological conditions of a development site create the framework into which their efforts must be integrated. Each of these will affect the sustainability of the development project. Regardless of the cause of resource degradation or damage, developing countries generally cannot afford even a temporary decline in food or foreign exchange derived from their natural resources, and they lack sufficient economic resources to implement reclamation or restoration activities. Thus, selection of ecologically appropriate technologies becomes imperative.

Why unsustainable technologies may be chosen: Most developing countries are located in tropical latitudes where, at many sites, few if any sustainable technologies exist to satisfy development needs. So technologies that worked elsewhere under different conditions are chosen and some of these prove unsustainable. When technologies developed for temperate areas are transferred without appropriate modification to tropical areas, they tend to disrupt ecosystem functions beyond natural regenerative capabilities, thus reducing the land's current and future productivity. Sustainable technologies, in other cases, do exist and have been demonstrated but are rejected in favor of approaches that are expected to achieve other, overriding goals. Finally, no single individual is likely to have adequate technical knowledge to assess thoroughly whether a proposed technologywill be compatible with the political, cultural economic and ecological conditions of the development site. Experts responsible for informing decision makers sometimes are unable to recognize which technologies will be sustainable. Thus, technologies may be promoted based on "best guesses," which sometimes are wrong.

Need for continued congressional oversight: Selecting technologies expressly to fit ecological conditions is becoming an important component of development assistance strategy at the U.S. Agency for International Development (AID). Similarly, the multilateral development banks (MDBs) have strengthened their capabilities to foresee and mitigate adverse environmental impacts from the projects they sponsor. These changes largely are reactions to pressure from Congress and other concerned organizations. Several initiatives at AID, and the environmental goals recently articulated by the President of the World Bank suggest that the importance of ecological sustainability is becoming an accepted value for development assistance professionals. However, bureaucratic inertia seems to work against substantial improvement in the agencies' abilities in this regard. Therefore, continued pressure from Congress is needed to assure progress towards a goal of ecologically sustainable development.

Congress has a direct and profound influencc on AID. Indeed, changes in AID's authorizing legislation and appropriations have contributed to a proliferation of high priority goals so numerous that they are widely perceived as a serious constraint to the agency's effectiveness. Thus, Congress is faced with a dilemma. "Micromanaging" AID by increasing the specificity of development objectives in the Foreign Assistance Act and earmarking shrinking development assistance appropriations for specific purposes may inhibit the agency's ability to develop and carry out efficient development assistance programs. Without pressure, on the other hand, AID maybe slow to progress in integrating an environmental perspective in agency activities.

An alternate solution maybe modified use of congressional oversight. This could include enhancing the capabilities of committee staff by adding additional personnel experienced in development assistance and technology development, and fostering improved collegial and informal working relationships between committee staff and AID personnel. Congress or AID could undertake a study of how congressional pressures are perceived within AID, and what mechanisms could improve productive interaction.

Attitudes at ***the top:*** Improvements to assure that promoted technologies are ecologically appropriate seem unlikely to occur on the scale needed without high-level management personally committed to this goal. Thus, congressional confirmation hearings-in which a candidate's capabilities and views are assessed-are an important mechanism to influence AID activities. Confirmation hearings provide an important opportunity for Congress to raise issues and to discern the depth of a nominee's knowledge of and concern for matching development projects and technologies to local conditions in developing

countries, and are an appropriate place to reinforce the guidance given in oversight hearings and legislation. Careful attention should be focused on the personal knowledge and attitudes of a proposed AID Administrator, and on his/her criteria for selection of Assistant Administrators. Agency recruitment policies and practices, that ultimately affect the agency's ability to perform its mandate effectively, largely are determined at the Assistant Administrator level.

Congress does not formally influence the choice of officials in multilateral development banks, but it does approve appointments of Treasury Department officials who represent U.S. interests to the banks. Members of Congress probably can have a significant impact on selection of the top bank officials through informal communication with the Administration.

***Having** enough of the right people:* Environmental science is a technical field based on scientific principles, knowledge, and tools that cannot be used effectively by persons without appropriate training and experience. Neither AID nor the World Bank has a sufficient number of environmental officers to assure agency wide guidance. Just as a development agency needs the right set of economists to design a commodity pricing intervention, it needs the right set of specialists to design and execute a successful intervention in the use of natural resources. Further, periodic accounting of natural resource conditions and environmental quality indicators to accompany reports of recipient country economic indicators prepared by development assistance organizations could provide a way to motivate these people to address carefully the match of technologies with ecological conditions.

Organizing technical skills: In addition to having an adequate number of people with needed technical expertise and fostering their collaborative work, it is necessary to ensure that these staff occupy appropriate positions in the organization so that they can provide needed expertise at the right times in the project cycle. Although environmental and natural resource expertise is integral to all stages of project development and implementation particularly important stages are:

- problem/opportunity identification
- contractor identification and selection for project design and
- project monitoring and evaluation.

Thus, interdisciplinary teams might be established in AID to link the U.S. science and technology community with field activities, and to serve as a technical filter assuring that AID would be unlikely to select and transfer unsustainable technologies to developing countries. Each team would be charged to assist with evaluation, redesigning or designing agency activities in one of several ecological zones common to developing countries (e.g., hot wet lands, arid/semiarid lands, and high altitude lands). This would increase the likelihood that technologies chosen would fit the ecological setting of the development site.

Interdisciplinary analysis: The systems in which AID projects intervene are complex and changes are likely to result in cross-sectoral conflicts. Thus, the tasks of preproject analysis and project evaluation usually require the knowledge of several types of specialists such as sociologists, ecologists, and soil scientists as well as the experience and knowledge of local people who represent the sector to be affected. The analytical methods for bringing this information together for presentation to engineers, economists, and decisionmakers is the specialty of environmental analysts. Thus, adequate planning often necessitates use of interdisciplinary teams guided by environmental analysts. However, teams of consultants and staff fielded by development assistance agencies too seldom accomplish this. Project officers generally have neither the correct technical backgrounds nor ready access to sufficient inhouse technical personnel to facilitate adequate interdisciplinary environmental analysis.

Interdisciplinary cooperation seems unlikely to occur without staff incentives and an organization structure explicitly designed to encourage such teamwork. The development assistance organizations might increase their support for development of interdisciplinary planning and analysis expertise, and expand support for development of techniques that might facilitate and streamline interdisciplinary planning.

Improve project planningand increase project flexibility
Assistance projects that intervene in a developing country's natural resource base require careful and perhaps extensive planning. In most cases, the scientific knowledge base is from temperate regions whereas the development site often is tropical. Further, the recipient culture and economy tend to differ substantially from those of the project designers, making it difficult to predict what types of projects are likely to be adopted. Most development projects, then, are at least in part experiments and must be designed to accommodate unidentified changes.

Risks to natural resource systems and development assistance recipients may be reduced where projects include an extended technical planning phase, a gradual phasing in period for adaptation of technology to the site's

ecological and social conditions, and have a length commensurate with achievement of results despite likely midterm project realignment. However, internal organization goals, to keep funds moving and to achieve measurable results quickly, operate against these approaches. Further, short project duration makes it difficult to introduce technologies or implement projects gradually, and presents a serious obstacle to making midterm corrections in response to monitoring and evaluations. Instead of today's common three to five-year AID projects, durations of 10 to perhaps 20 years seem more appropriate.

Improved use of project evaluations: Midterm and final project evaluations are little used to improve AID and World Bank technology decisions. Even when evaluations are broad enough to observe external effects, and are conducted long enough after project completion to determine ecological sustainability, evaluations seldom address faults with the original problem identification and project design. Yet, this is the time when with the benefit of hindsight sharpened by project experience, important lessons can be learned.

Analysis of existing evaluation reports could identify important environmental and cultural interactions that determine whether technology interventions will be maintained after the project is completed. Evaluation procedures could be modified to improve identification of causes of development project success and failure and to assess effectiveness of environmental mitigation proposed during project planning and midterm evaluations. In addition, evaluations could be designed to create a feedback system for project officers and design teams.

INTRODUCTION

The question posed by Congress and addressed by this study may be stated as follows:

***How can** international development assistance agencies improve their ability to choose technologies that are compatible with biological and physical conditions at the sites where tile technologies are to be implemented?*

For the purposes of this study, technologies will be considered compatible with biological and physical conditions if they support and prolong the contributions of local natural resources to the provision of goods and services for human consumption. Such technologies will be called "ecologically sustainable technologies."

Finding an answer, and instituting the solution or solutions, does not imply eliminating or even minimizing the potential for adverse environmental impacts from development assistance projects. These can occur from the failure to transfer the technology to the practitioners, and from failure of the development projects for reasons other than the ecological sustainability of the chosen technology (see figure E-l). Even when choosing a particular technology, further questions are relevant, such as:

- Are the eventual practitioners likely to have cultural aversions to the technology?;
- Is the technology within the means of these practitioners?; and
- Will governmental or other institutions provide the necessary support to ensure continued operation of the technology in a manner appropriate to local conditions?

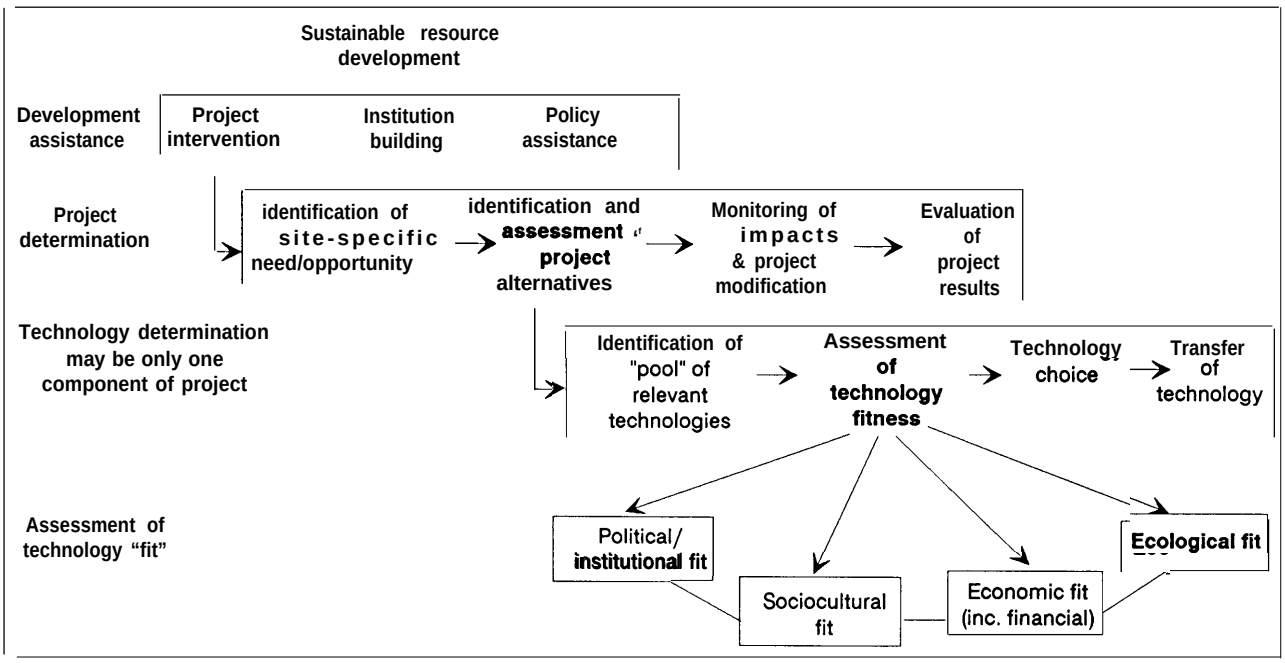
Thus, to minimize the possibility of adverse impacts from development assistance activities in general, one must address a considerably broader arena of issues than just technological/ecological fit. Such a study, however, is beyond the request at hand, and the resources for this Staff Paper.

The **Ecological Underpinnings of Development Assistance**

Development assistance interventions commonly are designed to facilitate development of human and natural resources in recipient countries. Three general modes of intervention are 1) tangible project intervention, 2) local institution building and 3) policy assistance (see figure E-2). In aggregate, these interventions are designed to assist developing countries to establish institutions for orderly improvement of the quality of life, to effect policy changes needed for satisfactory project performance, and to undertake investments that are properly engineered financially feasible, and economically and environmentally sound.

Views of the relative importance of the three types of development assistance are mixed. The Environmental and Energy Study Institute (EESI) study and the Science and Technology Committee's request to OTA indicates that the primary focus of development assistance-projects and programs-can visibly, tangibly affect the quality of life and environment in developing countries. These activities also have important interactions with developing country environments. However, project interventions can beneficially ***or*** adversely affect how renewable resource systems are used the benefits derived from them, and the impacts of their use on other communities or future populations. Thus, while such activities probably should

Figure E-l—The Role of Technology/Ecology "Fit" in Development Assistance



SOURCE: Office of Technology Assessment, 1987,

continue to be a major focus, they should be designed specifically to minimize the potential for adverse impacts.

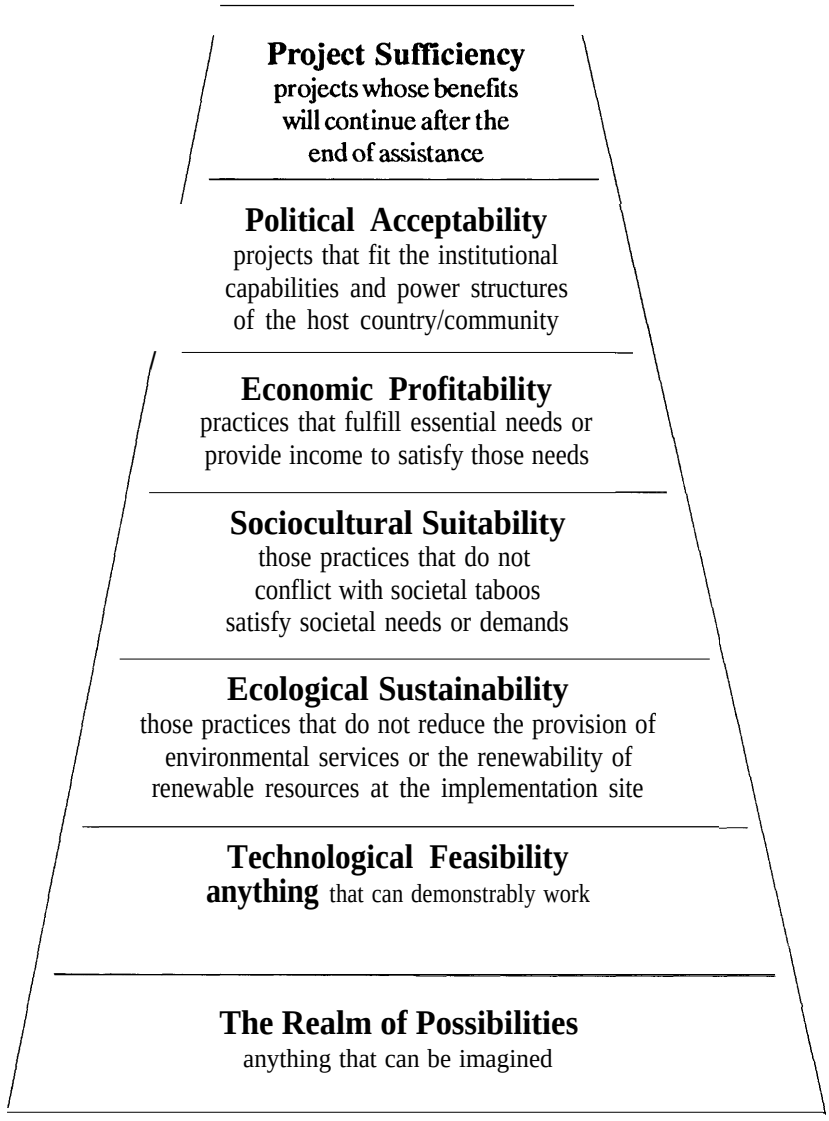
A second view is that development assistance can contribute only marginally to the damage or conservation of natural resource systems, because the scope of resource system abuse generally is so much greater than the scope of development assistance projects and programs. Therefore, to promote resource conserving technologies effectively, assistance agencies must use their influence to encourage governments to design and enact policies that will reward resource conserving development and discourage resource-wasting development. The extent of influence is usually related more to the level of general support funding an agency provides than to the specific development assistance projects it sponsors. Support for the second view is growing at the U.S. Agency for International Development (AID) and the World Bank, where it is thought to have a potential at least equal to that of improving the environmental soundness of sitespecific projects.

The third approach is based on the perception that, while project interventions and support for policy development can have substantial impacts, the only means to ensure that development be widespread and appropriate to the local needs and conditions is for development activities to be defined, planned, and implemented by the assistance recipients themselves. Thus, proponents argue that ensuring local participation in all phases of project assistance and emphasizing local institution building projects is fundamental to longterrn development. Support for this approach is well-based in U.S. nongovernmental organizations, and is growing in development assistance organizations.

In practice, no clear lines can be drawn between the three types of assistance: developing local institutional capabilities may require and be accompanied by policy assistance grants and loans, and projects may have institution-building components. Indeed, institution-building itself can be seen as a project. Thus, the three types are complementary and the balance among them in development assistance can only be determined on a ease-by-ease basis.

The purpose of the tangible project interventions usually is to improve the wellbeing of some target population by causing a prolonged increase in production of goods or services. Thus, many of these projects are related directly to resource use and include activities such as agricultural intensification or expansion, dam-building etc. Such interventions often include introduction of new technologies or improvement and expansion of existing ones.

Figure E-2—Hierarchy of Criteria for Sustainable Development



SOURCE: Office of Technology Assessment, 1990.

Clearly, selection of appropriate development interventions must be based on a number of development site conditions. Development assistance organizations have identified that the specific sociocultural, political, economic and ecological conditions of a development site **create** the framework into which their efforts must be integrated. Regardless of the cause of resource degradation or damage, developing countries generally cannot afford even temporary decline in the food or foreign exchange derived from their natural resources, and lack sufficient economic resources to implement reclamation or restoration activities. Thus, selection of ecologically appropriate technologies becomes imperative.

Successful interventions depend on the existence of the conditions necessary to support the new, improved or expanded technologies. Compatibility of the technology with local ecological conditions is prominent among these. Development interventions sometimes have failed because ecological compatibility has not been assured. Consequences have included irrigation canals filled with silt, rangelands degraded by expanded cattle herds, or settlements abandoned because of declining soil fertility. Thus, ***the problem is to develop technologies that are ecologically sustainable under the political, social and economic conditions*** that ***will prevail when assistance has ended.***

The Agencies' Response

Over the past decade, the U.S. Agency for International Development (AID) and the World Bank have developed procedures designed to incorporate certain environmental considerations in their assistance activities. Despite progress, however, the agencies' abilities to identify ecologically sustainable resource development interventions still are frequently criticized.

A 1975 lawsuit brought against AID by the Environmental Defense Fund, Inc. culminated in Agency compliance with the National Environmental Policy Act (NEPA). As a result, AID established well-defined environmental procedures and a small cadre of environmental officers to screen projects for significant environmental effects and to focus planning attention on likely negative impacts of development projects.

Amendment of the Foreign Assistance Act in 1977 mandated that AID increase investments in projects and programs explicitly intended to conserve as well as develop the productivity of developing countries' renewable natural resources. AID responded with numerous programs designed to enhance client country abilities to manage resource development, and projects addressing some immediate symptoms of resource deterioration. Examples include the AID Country Environmental Profiles program, and the numerous AID projects that sponsor distribution of tree seedlings and technical assistance to farmers on "fragile lands."

The World Bank also developed a process to focus planning attention on projects likely to have significant environmental impacts (e.g., construction of large darns, roads that penetrate forests, and extractive industries). The Bank has had a small environmental office since 1970 to screen proposed projects and alert project officers when detailed scrutiny of environmental impacts seems warranted.

Recently, Bank officers have begun to evaluate the relationships between economic policies and resource use practices in certain countries. If these analyses reveal how national policies could be changed to enhance ecodevelopment, the Bank then may promote such changes in its policy dialogues and offer support through sectoral loans for natural resources. Finally, the Bank's current reorganization is expected to strengthen the bureaucratic status of its environment operations while establishing positions for natural resource professionals in regional offices, thus giving them a more direct role in project identification and design.

WHY ECOLOGICALLY INAPPROPRIATE TECHNOLOGIES MAY BE SELECTED

Introduction

Mismatches between ecological conditions and technologies promoted by assistance organizations is currently receiving the attention of Congress and a number of public interest groups. This concern is expressed in the EESI report and summarized in the Committee's request letter. Therefore, no detailed review of evidence for the problem is included here. In OTA's interviews, no one denied that the problem existed, although opinions differed on its relative importance. The evidence, in fact, is largely anecdotal: few recent cause-effect analyses of development project successes and failures have carefully investigated the issue of matching technologies to environment.

Interviews for this study and the relevant literature indicate that at least three broad factors contribute to the use of ecologically inappropriate technologies. These are:

- Few, if any, sustainable technologies exist to satisfy development needs at many sites. So technologies that worked elsewhere under different conditions are chosen and some of these prove unsustainable.
- Sustainable technologies, in some cases, do exist and have been demonstrated but unsustainable technologies still are implemented.
- Experts responsible for informing decisionmakers sometimes are unable to recognize which technologies will be sustainable.

Where Sustainable Technologies May Not Exist

Most developing countries are located in the tropical latitudes. Here, the common problems of rainfall extremes or irregularities, high temperatures, and lack of seasonal reduction of insects and parasites make natural ecosystems highly susceptible to self-reinforcing cycles of degradation.[1] Such vicious cycles are easily triggered by attempts to develop and use the local natural resources. Most technologies used to get high yields of goods and services from

1 Degradation of ecosystems involves physical, chemical, and biological processes set in motion by activities that foster reduction in the system's inherent productivity. For example, hillside deforestation in the humid tropics commonly leads to accelerating soil erosion, decreasing soil fertility, and disrupted hydrologic cycles. These changes, in turn, can promote further reduction in ecosystem productivity through decreased natural plant regeneration, establishment of weedy plants that displace more desirable plant species, and increased hazards to public health.

soil vegetation, animals and water resources have been developed intemperate regions where natural systems are generally more resilient. However, when transferred without appropriate adaptation to tropical area they tend to disrupt ecosystem functions beyond natural regenerative capabilities thus reducing current and future productivity.

Further, many technologies that could be ecologically sustainable commonly require resources not readily available in developing countries. For example, the Near-East and Pakistan have, although not tropical harsh environments for which ecologically sustainable technologies are few. Although much western U.S. agriculture and water management experience is relevant to development in these areas, U.S. technologies often are not suitable within their political social and economic framework.

Similarly, principles of science and logic often can be used to make marginal improvements in long-sustained traditional technologies or to adapt technologies that have worked elsewhere. If the design is good and appropriately applied such technologies can conserve the natural resource base. However, such adaptations of technology can become unsustainable if cultural or financial factors prevent correct application.

In cases where ecologically sustainable technologies suitable to the sociocultural framework do not yet exist, development assistance options include: 1) support for research to develop ecologically sustainable technologies, 2) definition of development goals that can be met with technologies known to be ecologically sustainable (e.g., reducing risk or improving distribution of goods and services may be more appropriate goals than increasing production), and 3) gradual technology modification with careful monitoring to reduce the risk to affected people and natural resource systems. In practice, however, project time frames and objectives often preclude such gradual development.

Where Unsustainable Technologies Are Chosen

Sustainable technologies, in some cases, are rejected in favor of approaches that are expected to achieve other, overriding goals. Thus, technologies may be chosen for which sustainability is unproven, or those known to be ecologically, culturally, or financially incompatible with local conditions. For example, although many traditional technologies are ecologically sustainable, production gains from these may not seem adequate to resolve the identified development problem.

A variety of other reasons are given for support of projects known to deplete renewable resources rapidly. For example, an emergency condition may seem to necessitate immediate action using technologies which do not fit the local environmental conditions. Similarly, short-term economic or political goals may override ecological goals. Examples include forests cleared for timber and cattle exports to meet short-term foreign exchange requirements and settlements established to curtail nomadism or to secure boundaries.

Choice of technology also can be skewed by economic analyses which value immediate, although perhaps only temporary, benefits more highly than distant costs and benefits.[2] For example, the present value of temporary production gains (e.g., from a reservoir) can be shown to be higher than the worth of an unending stream of modest benefits from current resource uses (e.g., subsistence agriculture). Or, for highly subsidized projects, the rationale is either that the temporary effects will resolve a significant development problem, or perhaps that foreign source subsidies can be continued indefinitely.

Such decisions in favor of unsustainable technology can seem rational. However, great care must be taken to assure that:

- the development problem has been correctly identified;
- the benefits and costs, including cross-sectoral conflicts, are fully accounted;
- the lifetime of the project has been correctlyestimated;
- the project will be subsidized long enough to achieve its intended objectives; and
- the project include a monitoring component to ensure that recipients are protected from adverse impacts.

Where Sustainability Is Not Determined

No single individual is likely to have adequate technical knowledge to assess thoroughly whether a proposed technology will be compatible with the political, cultural, economic, and ecological conditions of the development site. However, development assistance projects often have relied on technology choices made without adequate interaction among all the necessary types of experts.

2The Congressional Research Service recently conducted a workshop reviewing the state of the art in incorporation of environmental considerations into benefit-cost analyses. The draft proceedings are under review.

World Bank and AID consultants now used for planning generally are members of a multidisciplinary group.[3] But whether such groups perform interdisciplinary analysis[4]—identifying the interactions between environment, technology, culture, and financial conditions-is less apparent. Without interactive, interdisciplinary analyses, it is unlikely that predictions of compatibility with local site conditions can be made with assurance. Thus technologies maybe promoted based on "best guesses," which by definition sometimes will be wrong.

CONDITIONS INTERNAL TO DEVELOPMENT ASSISTANCE ORGANIZATIONS THAT PERPETUATE INAPPROPRIATE TECHNOLOGY CHOICE

Introduction

Some causes for inappropriate technology choices are Perpetuated by development assistance agencies themselves. Other, generally more powerful causes for poor technology decisions are problems of values, personnel resources, economic and bureaucratic structures, and economic/financial constraints that exist in developing countries. However, technical, financial, and analytical assistance profoundly influence policies and technology decisions in developing countries. Thus, conditions internal to development assistance agencies can be significant contributing causes of development successor failure.

Although perceptions differ as to appropriate modes of development assistance, a remarkable consensus exists on the major internal factors that constrain an assistance organization's ability to match technologies to development site environmental conditions. A major constraint has been a lack of internal commitment to the concept that renewable resource conservation is a necessary condition for development success. AID, the World Bank and other multilateral development banks (MDBs), and Federal agencies with international activities, have individuals strongly committed to the importance of integrating conservation and development. However, for most development officers this has not been a high priority. Policies and procedures addressing environmental soundness generally have not come from intellectual consensus within the agencies, but rather have been formed in reaction to outside pressure, particularly from Congress. Internal factors inhibiting an aid organization's ability to consider fully environmental conditions in carrying out development assistance are summarized in Box E-1.

Conflicting Goals

Several time-driven goals of development agencies operate strongly against allocating the planning time necessary to determine which technologies are compatible with ecological conditions of the development site. Prominent among these is the need to *keep funds moving.* For AID, pressures to spend money come from the Department of State, Office of Management and Budget, and from the annual budgeting process-where large amounts of money have to be obligated each year or else they are "lost." For the World Bank, pressure comes from client countries and from organizations providing capital for jointly financed projects.

The goals that influence personnel activities the most are those with deadlines for clearly discernible achievements. Thus, the goal to commit and spend money within a given year can be expected to receive greater attention than the goal to develop a project likely to be successful within the complex workings of the natural resource base, the host economy, and the host society.

Another time-driven goal for development organization personnel, and as a result for their contractors, is to ***achieve measurable results quickly.*** For multilateral bank personnel, the pressure arises from the fundamental fact that banks must operate as banks. Even when loan rates are highly concessionary, benefits from investments made with borrowed capital must soon begin to match debt costs. Final evaluations ultimately focus on a project's economic success as measured by the direct economic rate of return.

Even though project officers are strongly aware that their performance on achieving the above-mentioned goals largely will determine their career progress, related goals also are important. In AID, for example, many officers believe that career rewards accrue to those who can design ***and initiate numerous projects each of which outwardly addesses many of the agency's many priorities.*** Part of these motivations are perceived to come from Congress, because AID personnel frequently are requested to enumerate projects with objectives that match

3 Multidisciplinary planning implies (hat specialists of several disciplines contribute (o the completed plan. However, it do not imply that they work together to identify and resolve cross-sectoral conflicts between their separate analyses.

4 Interdisciplinary planning and analysis implies that the specialists of several disciplines interact within the framework of a tested method to assure that the overall analysis is internally consistent and that foreseeable conflicts are identified and resolv Typically such analysis requires a team member trained in interdisciplinary analysis techniques.

Box E-l-General Internal Constraints That Inhibit Full Consideration of Environmental Conditions in Development Assistance

- Agency policies shift often (AID).
- Agency has too many high priorities (AID).
- Few projects last long enough to accomplish significant development goals (AID).
- High staff turnover (AID).
- No career path exists for environment and natural resource professionals (AID).
- Heavy and increasing bureaucratic workloads are compounded by inadequate staff support services (AID).
- Too few in-house staff have knowledge about how technologies interact with ecological and cultural conditions (AID; World Bank).
- Inadequate numbers of staff are professionally trained in environment and natural resources (AID; World Bank).
- Existing in-house expertise in environment and natural resources is underused because of inappropriate assignments and job descriptions (AID).
- Selected contractors often lack strong expertise which facilitates linking technology and environment indeveloping countries (AID; World Bank).
- Agriculture and environment are not clearly linked by agency structures, procedures, and practices; agencies provide little incentive to link them (AID; World Bank).

SOURCE: Interviews.

current congressional and constituency interests. The officer who designs and initiates a project seldom sees it through to completion and is unlikely to be recognized for the ultimate success or failure of the project. Little incentive exists for recognizing mistakes and learning from them.

The time-driven goals can directly preclude sound technology choices. For example, because the ecology of tropical estuary ecosystems is poorly known sustainable interventions for port development usually cannot be designed without preliminary investigations covering an entire yearly cycle of seasons. But the time-driven goals seldom allow such lengthy preliminary studies, so decisions must be made with incomplete information. Commonly, these decisions are based on the personal experience of the engineer or other technical planner in charge. That experience too often is inadequate to assess correctly how the technology, environment, and local society will interact.

Potential Oversight Questions:

- *Increased interdisciplinary planning might result in more successful development projects. But it might also slow obligation of an agency's budget. What do you perceive as the possible beneficial and adverse impacts on your agency if your actions to improve the number of project successes result in funds remaining at the end of the year?*
- *To what extent does your agency use the environmental plans developed under the auspices of the Organization of Amen-can States (or other similar organizations) in your project planning process?*
- *What other mechanisms allow you to carry out adequate* ***planning without hindering timely expenditure*** *of your* ***budget?***

Narrow **Evaluations and Poor Feedback**

Development assistance banks' criteria and procedures for evaluating projects also tend to perpetuate the causes of poor technology choice. The overriding bank criteria for project success are narrowly focused financial and economic measures of project benefits and direct costs. External costs may be noted in evaluation documents, but seldom are they weighed against benefits.

The World Bank has been a leader in development of careful financial and economic post-project evaluations. Project sustainability is assessed in financial terms: will necessary continuing investments be made after the funding period ends? In this regard, the Bank's evaluations seem to be thorough with a significant proportion of projects frankly assessed as either not sustainable or dubious at the time of the final evaluations However, Bank evaluations seldom include thorough consideration of environmental or social impacts. Recently, Bank evaluations have been self-critical in this regard. In addition, project impacts on natural resource sustainability commonly are not recognized in World Bank evaluations. A current review of completed Bank-supported dam/reservoir pro-

5 The economic implications of unsustainable projects for the client country, which remains liable for the debt, usually are not addressed.

jects may bring increased attention to this issue, as many of the reservoirs are reported to be deteriorating rapidly.

AID objectives and criteria for project evaluations are specified early in the planning process and commonly are broadly stated in terms of institution building processes (e.g., number of extension-agent visits number of students educated), or direct measures of accomplishment (tree seedlinga distributed gains in farm income). Thus, evaluations are not narrowly financial and economic. However, the evaluations seldom are broad enough to identify external effects, or conducted long enough after project completion to determine ecological sustainability. Further, final evaluations seldom address faults with the original problem identification and project design. Yet, this is the time when with the benefit of hindsight sharpened by project experience, important lessons can be learned.

In spite of their shortcomings, evaluation procedures are institutionalized and the reports generated contain many potentially valuable lessons which could be applied to improve future projects. Also, end-of-project evaluations could be used in a motivation system that would reward development success and provide accountability for development failure. Even so, aid agencies have not learned to use these evaluations effectively. Indeed, negative evaluations tend to disappear due to political pressures and delay.

At the World Bank, post-project evaluations are conducted regularly by an office separate from the project implementing office. Annual summaries of these evaluations are widely distributed in the Bank and used to train Bank staff and client country trainees. Summaries are available for official use in donor and client countries, but are not widely distributed outside of the Bank. A rationale for strictlylimiting circulation of evaluations is that, written as frankly as they are, they might embarrass clients or donor country individuals. This, in turn could hinder efforts to foster policy improvements in client countries or willingness to participate in development assistance. However, distributing the reports more widely might improve the quality of guidance that nongovernmental organizations offer the Bank, directly and through Congress.

Nevertheless, feedback from the Bank's evaluations to its project design process seems to be inadequate; similar types of project failure sometimes are identified in subsequent years. Livestock project failures in Africa are an example. Contractors and client country nationals who design Bank supported projects may not be encouraged to study reports from past projects or warned of the economic consequences of project failure to the recipient country.

End-of-project AID contractor reports, written by the organization that implemented the project, commonly contain a wealth of technical detail and often include description of social and environmental causes of project success or failure. Commonly these technical end-of-project reports are short on the analysis and synthesis needed to derive lessons for future projects. Report drafts are critiqued by the Agency's project officers and other interested parties and may be revised accordingly. The reports then are filed with other project papers. Technically they are available to host country personnel and outsiders in addition to AID personnel and contractors involved with current projects and preparing for future ones. In practice, they commonly are distributed among technical managers of similar AID projects within the country where they are written but otherwise are an underused resource. Their shelf-life is far shorter than their potential utility because of narrow distribution, unwieldy length, unattractive format, and lack of editing.

AID's Program and Policy Coordination office (AID/PPC) tracks agency projects, the nature of technologies used in various geographic regions, and many other evaluation parameters. It produces syntheses of project evaluations, drawing lessons from multiple experiences. The number of these syntheses now available not only within AID but to the broader government and nongovernment community is increasing steadily. However, these are another underused resource. Contractors and host country counterparts generally have little time to study evaluation reports or the unsynthesized end-of-project technical reports for projects in which they are not personally involved. Thus, the agency continues to reinvent some successes and repeat some mistakes. Finally, AID has no formal program for reevaluating completed projects at a time long enough after completion to learn the real determinants of sustainability.

Potential Oversight Questions:

- *Does your agency conduct post-hoc evaluations of its development assistance projects? If so, for what kind of projects are such evaluations conducted? How long afler project completion does such evaluation occur? What have such evaluations revealed about how to change development assistance to increase the likelihood of interventions being ecologically, culturally, and financially sustained?*
- *How would an analysis of your existing evaluation reports benefit your ageney and Congress 'ability to cooperate in development of foreign assistance policy?*

- ***Does your agency conduct generic program evaluations? On what subjects has it completed these evaluations (e.g., irrigation, rural development)? What changes have been made in subsequent programs as a consequence of lessons learned?***

Inappropriate Staffing

Development assistance agencies' technical staffs were comprised mainly of agronomists and engineers during the 1950s and 1960s. By the mid-1970s, technical specialists decreased in number on agency staffs and especially at the Banks economists began to dominate. More general types of development assistance began to compete with technical project assistance.

Awareness of the potential for environmental conflicts also arose in the early 1970s. Subsequently, the World Bank and AID established small cadres of environmental professionals and retained some technical specialists despite the continuing trend towards hiring generalists for staff positions. While project officers often function as generalists, technical experts are contracted for project design, implementation, and evaluation. The generalists, with some support from the small cadre of resource professionals, are expected to have sufficient knowledge to assure recruitment of appropriate specialists, who in turn will develop the technical and social information and conditions needed for development success.

To enable generalists to carry out this function, detailed guidelines and checklists for environmental evaluation have been developed at the World Bank other MDBs and bilateral aid agencies. In AID, a sign-off procedure to assure scrutiny of potential environmental effects of projects considered likely **to** have negative impacts culminates with approval by an environmental officer. AID and World Bank environmental officers further provide advice to project officers on consultant selection and review contractor reports to identify significant environmental issues. However, neither organization has had a sufficient number of environmental officers to assure agency-wide guidance.

Potential Oversight Questions:

- *In your entire professional staff, what are the percentages of officers with degree-level academic training in each discipline, such as economics, agriculture, ecology, forestry, geography, anthropology, medicine, public health, civil engineering etc. ?*
- *How frequently have your officers been retrained in the advances of their discipline or cross-trained to learn about scientific advances in biological or physical sciences?*
- *What percentage of each of these professional ups are assigned to positions where most of their time is spent applying their speciaJ training?*
- *Can you provide a list of personnel assigned to environment or natural resource functions that brifly indicates each person's responsibilities and technical qualifications for that position ?*

Structural and Procedural Constraints

The primary concept of "environmentalism" during the 1970s was that negative impacts of resource development should be avoided. Thus AID, the World Bank, and other development agencies did not organize their environmental offices **to** identify resource development opportunities. Rather their function was primarily to determine which of the planned interventions were likely to have harmful environmental impacts, and to insist on design changes that would mitigate such impacts. Given the compelling time-driven goals motivating most activity in these organizations, it was probably inevitable that the environmental officers would be widely viewed as adversaries and their involvement would be avoided when possible.

Most project or loan officers generally work within well-established time constraints, and thus, various methods have evolved to avoid the in-house environmental officers. For example, a project officer may not fund time to cooperate in detailed review of a project's environmental aspects. Environmental staff input can be avoided when recipient country officials, desirous of getting a project started signify that there are no environmental implications requiring study. In the World Bank, the environment office has had the responsibility to review all project documents, but that office has operated from the sidelines with a minuscule staff compared to its task. It has often not been in a position to provide constructive input to project design and operation.

Potential Oversight Questions:

- *The heavy workload of your project officers, the deadlines for processing large amounts of money, and the pressures from Congress and others to reach objectives quickly must all discourage full investigation of the likely environmental impacts of projects. Are the kinds of projects likely to need full environmental evaluation avoided to save time?*
- *What steps has your organization taken to encourage officers responsible for project identification, design, and*

implementation to seek paticipation of in-house natural resource specialists and environmental analysts ?

Environmental procedures in AID, being a legal requirement, have had significantly more force than has simple policy at the World Bank. Avoidance of environmental concerns today is difficult in AID. Some years ago a simple statement denying that adverse impacts were likely often could suffice. But the gradual increase in environmental officers with professional expertise has discouraged this practice.[6]

AID officers having environmental charges are located in each geographical bureau and in Missions abroad as well as in the central Bureau for Science and Technology Bureau (AID/S&T). Professional environmental personnel in AID/S&T carry out a number of programs designed to raise environmental awareness among AID personnel and host country decisionmakers, and to encourage officers in AID bureaus and Missions to use environmental analysis early in the formation of development assistance strategies. Country Environmental Profiles sponsored by AID, for example, go beyond the impact assessment level of environmental concern to promote integration of development and resource conservation. Still with the present structure, AID's continuing progress in integration of conservation and development depends on:

- the extent to which staff exhibit a commitment to environmental analysis and programmatic investment in environmental management as a necessary condition for development project success, or
- ID being "micromanaged" by Congress to force it to consider impacts on the environment.

AID activities now seem to focus increasingly on incorporating natural resource considerations into regional and sector strategies, suggesting that AID personnel are adopting the premise that environmental analysis is a necessary element of economic development. The AID/S&T Agriculture Office is leading an effort to develop anew focus for AID agricultural assistance, which explicitly includes maintaining the productivity of the natural resources on which agriculture depends. Another AID/S&T program promotes a cooperative effort among Missions in Latin America to focus development efforts on fragile lands. AID/PPC is revising its guidelines for economic and financial analysis of projects to take environmental impacts into account. Finally, the Africa Bureau is working intensively on a development assistance strategy focused directly on natural resources. While some of this activity may be a reaction to a perceived threat that appropriations will be further earmarked for environment and natural resource purposes, the activities seem largely to be internally motivated.

The causes of poor technology choice are perpetuated not only by structure but also by agency procedures. The weak feedback links between project evaluation and design already have been noted. Other internal constraints on sound technology decisions include:

- too little permanent staff involvement at the development site;
- use of consultants and organizations with inadequate technical expertise; and
- bureaucratic procedures that discourage intterdisciplinary collaboration.

Too Little Permanent Staff Involvement at the Development Site

At AID, the size of the bureaucracy is limited strictly in order to control overhead on development assistance spending and in response to a keen awareness of congressional and public concern regarding "bloated" bureaucracies. Thus, each project officer typically manages several projects. These officers design development assistance strategies, oversee project design, manage cash and paper flows to and from contractors or host country organizations, and assure that evaluations and other procedural steps for each project are on time and complete. These heavy workloads typically prevent their active involvement at the sites of development projects.

Further, AID project officers generally have weak administrative support and restricted travel funds. AID project officers stationed in Washington DC cannot use project funds for project management activities, such as travel or secretarial support. These constraints maybe less severe in AID's Mission.., but the existing bureaucratic requirements of managing several projects can keep an officer at his/her desk most of the time. Thus, the amount of time project officers can spend onsite usually depends more on their ability to capture office resources and

6To avoid environmental regulations, some AID bureaus and missions are reported to have reduced investment in the types of projects that intervene in resource use, such as irrigation development. This results in increased funding for projects such as research and restitution building, that are not required to include detailed consideration of environmental effectSuch reactions to environmental regulations, though difficult to document, could have significant adverse impacts on activities needed to address certain natural resource problems.

personal willingness to go into the field than on the management needs of the project.

Potential Oversight Question:

- ***How would your organization's** efficiency be affected if expenses for staff management of projects, such as direct-hire staff travel to project sites, could be charged against the budgets of the projects?*

Use of Consultants and Organizations With Inadequate Technical Expertise

The procedures and workloads that severely restrict the onsite activities of AID staff increase the likelihood of project failures. Most technology decisions ultimately are made either by contractors or host country personnel. Even where technology decisions rest with host country personnel contractors often have substantial indirect influence through the options they present. Staff officers write terms of reference for contractors, influence the choice of contractors, modify the terms (or decide not to do so) per suggestions from contractors or host country officials, and approve the contractors' activities. However, with inadequate opportunity for field level involvement, the staff are unlikely to be fully competent for these functions.

The World Bank uses many consulting teams for project identification design and evaluation, and Bank officers provide lists of potential contractors to client country officials for project implementation. The World Bank maintains a formal consultant roster which can be searched to develop lists of individuals and organizations who seem to meet various criteria of disciplinary and geographic area expertise and development project experience.[7] AID/S&T has established similar computerized rosters of environment and natural resource specialists appropriate to design or implement projects for developing countries.

In practice, World Bank and AID consultants probably are chosen more often from informal systems based on project and loan officers' experience than from rosters. No mechanical system can be relied upon to judge the all-important personality factors that will determine whether a consultant successfully completes the terms of reference. From the project officer's perspective, the selection of contractors who will complete project design and evaluation jobs on time is critically important to achieving bureaucratic goals. Coupled with the project officer's heavy workload this usually means using consultants whom the officer or his/her close associates have used previously, and ones that are not likcly to cause unexpected delays in moving the project forward.

Officers without appropriate technical backgrounds for selecting technical consultants need to have ready access to in-house technical experts. In AID, this expertise is provided by technically trained AID personnel, in-house contractors and technical experts loaned to AID by other government agencies through Participating Agency Service Agreements (PASAs). Further, officers are required to seek assistance from the agency's environmental officers where off-site environmental impacts are an issue. World Bank officers also have used expert assistance routinely to choose consultants, but have not been required to seek such assistance from the environmental office. The Bank's reorganization is intended to increase the availability of in-house natural resource and environmental specialists.

Often, local institutions can be identified and funded to carry out planning and evaluation tasks. International programs through which developing country nationals with ecological qualifications can be located have been sponsored by the United Nations Education, Science, and Cultural Organization (particularly the Man and the Biosphere Program), by the United Nations Environmental Programme, and by such nongovernmental organizations as the World Wildlife Fund (U.S. and International), International Union for the Conservation of Nature and Natural Resources (IUCN), and the Nature Conservancy. Some of these, such as IUCN's Conservation Data Canters have rosters of experts in developing countries sorted according to skills needed for particular types of development activity. But these mechanisms are now uscd mainly by European (principally Scandinavian) bilateral agencies.

Bureaucratic Procedures That Discourage Interdisciplinary Collaboration

Interdisciplinary planning seems necessary for improved matching of technologies to the natural resource, social and economic conditions at development sites. This depends first on the agency choosing the right group and writing adequate terms of reference, and secondly on the team leader's capabilities. Integration of disciplines often is not achieved because the team leader and project officer have not been trained or lack experience in techniques of

7 World Bank consultant rosters favor individuals and firms in OECD countries. This does not seem to be in keeping with Bank policy developing country role in the development assistance process.

interdisciplinary **team** management and analysis, Wrong consultants are chosen in some cases, and their interaction is not facilitated; for example, the anthropologist, the agronomist and the economist of a multidisciplinary team may each visit the development site separately.

The need to develop interdisciplinary teams applies just as much to development assistance agency staffs as to consultants. Workloads, bureaucratic structures, and procedures all discourage integrated analyses of development problems and projects. Thus, for example, cooperation between agricultural and environmental personnel largely is inadequate.

This is not just a problem of agriculturalists or economists having learned to view environmentalists as adversaries. University training in natural resource and environmental sciences typically produces technical experts who cannot speak the language of economists and who have only superficial knowledge of agriculture and engineering issues. Thus, interdisciplinary cooperation seems unlikely to occur without staff incentives and an organizational structure explicitly designed to encourage such teamwork.

Experience with AID's Country Environmental Profiles, with Organization of American States' (OAS) environmental studies, and with development of national conservation strategies in several countries indicates that interdisciplinary teams often can be recruited in the host country. However, a shortage of persons trained in the techniques of interdisciplinary team management, and in cross-sectoral assessment methods (other than economics) is likely to be a significant constraint as development assistance agencies seek to increase use of interdisciplinary techniques.

Potential Oversight Questions:

- ***OAS, AID, and other** organizations supported by U.S. foreign assistance have developed techniques for interdisciplinary, cross-sectoral analysis of development problems, intervention options, and technology soundness. What part of your oganization's assistance strategies, projects, and programs are designed by using these new interdisciplinary techniques?*
- *What Participating Agency Service Agreements that are intended* to ***enhance AID's** environmental expertise remain in force? How has the usefulness of these PASAs' been evaluated? Is AID investigating creation of similar PASAs with agencies not currently participating with AID? Which might be most beneficial and Why?*

HOW TO CHANGE-PIECEMEAL APPROACHES

Introduction

Congress and aid organizations could make broad institutional changes to foster sound technology decisions. A second alternative would be actions to incrementally eliminate the constraints to sound technology decisions that are internal to the development assistance organizations. Such piecemeal approaches include:[8]

- relieve the overriding pressure to move money,
- improve project planning and ensure project flexibility,
- increase personnel motivation and accountability,
- hire enough of the right people,
- improve use of in-house expertise, and
- improve selection of consultants.

Relieve the Overriding Pressure To Move Money

Congress normally requires AID funds to be spent within one fiscal year. However, other approaches have been tried. For example, Congress has already has acted to make funds "available until expended" for the Sahel Development Program. Reportedly, the experiment has been only somewhat successful. Some agency personnel still believe that, even though unspent funds from the current year will not be "lost;' the next year's funding is likely to be reduced by at least the unspent amount. Legislation has now been introduced to broaden the experiment by keeping other development assistance appropriations for Africa available until expended.

To reduce the force of AID's "spend the money' syndrome, Congress might have to complement such legislation by extending the budget cycle for development assistance. However, evaluation of this topic is beyond the scope of this paper.

Potential Oversight Questions:

- *How has keeping project funds available until expended affected project quality in AID's Sahel Development Program ?*
- *Remembering that MDBs arc banks, and that the first function of a bank is to assure timely return on its capital,*

8The following potential changes in development assistance agencies are not presented in order of priority or as a suggested strategAll seem likely to improve aid agency abilities to match technologies to the ecological conditions of development sites.

how does one manage the tradeoff between cautious decisionmaking and expanding the scaleup of technology interventions to get the flow of benefits started?

Improve Project Planning and Ensure Project Flexibility

Assistance projects that intervene in a developing country's natural resource base require careful and sometimes extensive planning. In most cases, the scientific knowledge base is from temperate regions while the development site often is tropical. For example, U.S. experts in soil and agriculture may be unfamiliar with the behavior of certain developing country soils or with local crops and cultivation practices necessary to ensure their satisfactory growth. Further, the recipient culture and economy tend to differ substantially from those of the project designers, making it difficult to predict what types of projects are likely to be adopted. Most development projects are, in part, experiments.

Projects that rely heavily on the technology/ecology fit, therefore, must be designed to accommodate expected but unidentified changes. Short project duration makes it difficult to introduce technologies or implement projects gradually, and presents a serious obstacle to making mid-term corrections in response to monitoring and evaluation. And, too, measurement of the project's ecological and social soundness may take much longer than AID's typical three- to five-year project allows. Where the research element of a project is particularly prominent, adequate project length is essential.

Risks to natural resource systems and development assistance recipients may be reduced where projects include an extended technical planning phase, a gradual phasing-in period for adaptation of technology to the site's ecological and social conditions, and a length commensurate with achievement of results despite mid-term project realignment. Yet, many constraints work against these approaches. Means to address these needs include:

- lengthened budgetary cycle and legislative language fostering improved project planning
- increased investment in development of resource development planning techniques that can be used by project officers to ensure consideration of technology/ecology fit,
- increased projects with natural resource assessments and resource development plans as their goals, and/or
- longer project periods with gradual technology introduction and increased project monitoring fostering mid-term corrections in objectives and methods as necessary.

A major constraint to increasing investment in planning is the impatience of client country governments the U.S. Congress, and other donor country institutions. Already, many developing country officials perceive development assistance project planning as too lengthy and costly. Such critics probably are not aware that the standards of haste common to industrial countries maybe inappropriate in developing countries. The annual budgeting process further inhibits extended planning: the need to move money commonly requires that project planning be substantially shorter than one fiscal year, while determining ecological compatibility may require an understanding of natural system behavior over at least an entire cycle of seasons.

Similarly, contractors and aid organization staff are keenly aware of the urgency for each project to produce substantial, quantifiable results by the end of its period. Production targets stated at the beginning of three- to five-year projects often necessitate rapid scale-up of technology interventions and therefore, major project realignments may be viewed as counterproductive. Further, managers of short projects cannot easily accommodate major unexpected changes in their projects. Instead of today's common three- to five-year AID projects, durations of 10 to 15 or perhaps 20 years seem more appropriate.

These problems exemplify the drawback of piecemeal approaches. If more projects were designed specifically to produce resource development plans for target areas but the plans do not become the basis for subsequent development assistance projects, nothing has been gained. Similarly, if projects were given longer periods for planning and implementation, but continued to move rapidly into fullscale operation and disallowed mid-term corrections, then damage from ecologically unsustainable technologies still might result.

Potential Overnight Questions:

- *What is the average length of your projects? are projects generalty expected to be selfsustaining after this period? which kinds of projects are appropriate for gradual development and phase-in of technologies and which are appropriate for rapid scale-up of operations?*
- *What is the typical ratio of investment in project planning to investment in project implementation for various kinds of projects (agtcultural industrial, institution building research, etc.)?*

- *What would be the advantages and disadvantages of increasing=*
  - *a) the general lengths of projects?*
  - *b) the ratio of project planning expense to investment in project implementation?*

Increase Personnel Motivation and Accountability

The World Bank and AID have few mechanisms to reward officers responsible for developing successful technology interventions, or to induce improved decisionmaking for those who have made poor technology choices. Project officers commonly move on to new projects or geographic regions prior to the termination of the initial project. This management problem will become more difficult, particularly in AID, as they shift increasingly to policy and economic support interventions where cause and effect may be obscure. In these, technology suitability is even less likely to become apparent before the officer responsible has moved out of range of accountability.

Nevertheless the level of effort invested in developing information for sound technology decisions could be made a prominent feature in periodic personnel evaluations. The World Bank AID, and other development organizations could experiment with methods for assessing quality of development work. Such factors could be given at least equal weight to quantity of tasks accomplished and total funds obligated in personnel evaluations. Determination of adequate criteria for evaluating and attributing development success, however, is problematic.

Individuals generally behave so as to perpetuate their bureaucratic unit. Thus, it should be possible to facilitate good technology decisions by monitoring the technology development success/failure ratio for the various bureaus, departments, and offices, and then by rewarding successful units of the bureaucracy, perhaps with increased funding.

The World Commission on Environment and Development has recommended that periodic accounting of natural resource conditions and environmental quality indicators accompany reports of host country economic indicators prepared by development assistance organizations. This could provide a way to motivate the development assistance community to address the match of technologies with ecological conditions more carefully.

Potential Overnight Questions:

- *How is quality of work weighed against quantity o f tasks accomplished in your personnel evaluation procedres?*
- *How does your project evalutiation procedure give feedbacktoareward/accountability system that gives officers or ofjices credit or blame when projects are or fail to be sustainable?*

Hire Enough of the Right People

Development organizations need to include increased numbers of staff trained and experienced in the development and management of natural resources as well as staff with expertise in the techniques of environmental analysis. This conclusion has been stated repeatedly at Congressional hearings. Gradually, the aid organizations have responded. Most of them now have some foresters and ecologists or environment planners in positions that employ their technical expertise. Still most aid organizations seem to add environmental professionals only in reaction to outside pressures. A substantial part of new personnel could be selected from people having demonstrated expertise in natural resources development or environmental analysis at the direction of high-level AID and MDB management. The continued low numbers of such experts on agency staffs indicate that their importance is not yet appreciated by high-level agency personnel.

Currently, development assistance organizations rely on consultants and contractors for nearly all technical expertise needed to develop sustainable projects. Meanwhile, evidence favors hiring and placement of natural resource and social science experts where they will form development strategy, identify project, program, and policy interventions, and support project implementation and evaluation. Each development organization could analyze its past evaluations and project records to obtain clearer evidence for or against this proposition.

Potential Oversight Questions:

- *Over the past decade, what hasbeen the trend of the ratio of numbers of positions for technically trained staff to numbers of positions for generalists in your organization ?*

- ***What** evidence exists, **or could be developed to indicate whether your organization's current reliance on consultants for technical expertise is sufficient for successful development assistance operations?***
- ***What is your organization's current policy on recruitment** and **hiring of personnel with training and experience in natural resource sciences versus personnel with training in economics?***

Improve Use of In-House Expertise

The World Bank and AID operate in countries having a wide variety of cultures and environments. These organizations regularly rotate personnel among country and regional assignments to foster broad experience and career development. Few officers probably would be satisfied with an entire career tied to one country.

Concurrently, however, the AID rotation system constrains development of in-depth staff expertise on the cultures, languages, and environments of the recipient countries. This is compounded by lack of incentives for staff to investigate local people's knowledge of development opportunities and constraints, by heavy bureaucratic workloads, and by project funding procedures that inhibit staff participation in field activities.

The MDBs and AID have staff who have technical knowledge developed through academic training professional experience, and self-education. Considerable knowledge-particularly regarding ecological conditions-remains relevant long after staff have rotated out of an assignment. Yet these people often are placed in positions which make little use of their expertise.

Without abandoning the rotation system, procedures for assignment of personnel could be adjusted to facilitate improved use of existing in-house technical expertise. For example, computer database techniques similar to those used to manage consultant rosters could be used to match staff technical backgrounds to agency assignment opportunities.

Further, AID and the World Bank could improve project design by developing in-house review boards made up of personnel experienced in the given geographic area. At present, few officers are called on to assist in designing projects that will be implemented at their previous posts. Some of these individuals probably would be interested in tracking proposed new projects and serving as a member of ad hoc review boards. Abstracts of proposed new projects could be sent to the boards for critical evaluation of likely impacts. Their reviews would be used by project officers to confirm or revise their technology choice. Through such a procedure, in-house expertise could be expanded without adding new positions. However, in AID at least, this is unlikely to be feasible without broader changes **to streamline** project design procedures and reduce agency workloads.

Potential Oversight Question:

- *Recognizing the good reasons for rotating staff among country assignments, how do your organization assignment and communication procedures assure best use of the technical and geographic area expertise of your staff?*

Improve Selection of Consultants

Donor agency consultants and personnel of host country organizations probably will continue to provide most of the technical information and technical decisions for project design implementation, and evaluation, even with expanded in-house expertise. AID consultants commonly are recruited in the United States or other industrialized countries. However, U.S. academic and government institutions generally have not encouraged development of expertise relevant to tropical developing countries. Similarly, consultants experienced in managing interdisciplinary teams to analyze development problems and interventions are scarce. Consequently, the combination of developing country experience and interdisciplinary technical expertise is rare; recruiting technically competent consultants for such teams will bc difficult.

Therefore, it seems appropriate for the MDBs and AID to focus a significant part of their in-house training on methods of interdisciplinary analysis. AID has supported programs in U.S. universities and other institutions to develop in-house expertise relevant to its needs. For example, AID/S&T Forestry, Environment, and Natural Resources Office has supported development of interdisciplinary planning methods at the International Institute for Environment and Development and elsewhere, and has held seminars to train in-house staff in their use. Other S&T Offices similarly could increase support for development of interdisciplinary expertise. This might be particularly relevant to the Bureau's Agriculture office as part of its new focus on conservation of agriculture's natural resource base.

A longer-term approach maybe to increase the pool of U.S. technical expertise in the development and management of tropical resource systems. For example, certain Land and Sea Grant institutions are located in tropical U.S. areas and conduct research and development activities

relevant to tropical developing countries. However, these institutions are few and generally have small numbers of personnel and financial resources for such research. Development of a significant tropical component in other such institutions could increase the pool of U.S. experts from which development organizations could choose consultants, and concurrently assist resource development efforts in tropical U.S. areas. Congress could explicitly identify development of tropical resource system curricula in certain Land and Sea Grant institutions as a goal, perhaps in the Foreign Assistance Act. Additional institutions that have developed specialized programs related to temperate resource systems may be induced to follow this example and enhance their own curricula in tropical resource development and management.

HOW TO CHANGE-HOLISTIC APPROACHES

Introduction

Budget cuts, declining technical staff, shifting priorities, and a proliferation of congressional mandates may adversely affect the likelihood of development successes. Thus, without clear expression of Congress' recognition of the importance of matching technologies to local conditions, piecemeal efforts may have only short-term beneficial effects.

Make **Technology/Ecology Fit an Expressed Priority**

Congressional concern about transfer of inappropriate technologies can be expressed in new or modified legislation and at hearing convened for oversight, authorization, appropriation or confirmation. Through these mechanisms, Congress can identify ecological compatibility as a priority, or even a necessity, for U.S. development assistance efforts. To improve the effectiveness of this guidance, it may be necessary to provide some clarification, ranking or consolidation of the other myriad priorities in development assistance expressed by Congress.

Congress often can stimulate improvements in development organizations' handling of issues such as technology selection without creating new legislation. Informal meetings between Members and AID or MDB officials and followup cooperation between congressional and agency staff, reportedly had an important role in the changes in development assistance priorities that occurred during the 1960s and 1970s. This kind of cooperation seems less common today.

A goal of identifying the ecological attributes of a recipient country and basing selection of development **assistance** interventions on those established parameters could be specifically identfied in the Foreign Assistance Act. Such a measure would definitively establish integration of environmental considerations into development assistance efforts as a priority.

Legislation and congressional views strongly expressed at hearings certainly affect priorities'in the development agencies. But these priorities are likely to be internalized only if they are views shared by the heads of the agencies. Actions and decisions of high-level agency officials, particularly AID's Administrator and Assistant Administrators, may bring about changes affecting the entire agency. Many past AID Administrators have not had backgrounds that equipped them to recognize the importance of the links between technologies and developing country ecological settings. Thus, confirmation hearings provide an important opportunity for Congress to raise issues and to discern the depth of a nominee's knowledge of and concern for matching development projects and technologies to local conditions in developing countries.

It is during these confirmation hearings that the candidate is first exposed to congressional concerns that relate to his/her new responsibilities, and also a time when he/she may be looking for new ideas. Thus, confirmation hearings are an appropriate place to reinforce the guidance given in oversight hearings and in legislation. Questions at confirmation hearings can indicate clearly what Congress will expect from him/her later on. Similarly, it is a time when Congress can assess the likelihood of its concerns being addressed, should the official be confirmed.

Encourage Research and Cautious Innovation

Even under optimum conditions, development problems are difficult to solve. To find ways to improve the fit of technologies to local conditions, Congress could encourage the AID Administrator to support related research and to foster innovation and experimentation in cases where sound theory and gradual implementation can protect technology recipients from the consequences of failure. Experiments would of necessity, be small scale activities such as on-farm research and demonstration and would be carefully monitored until their suitability for expansion is clear.

Such small efforts, in aggregate, could have considerable impacts. Today, fewer U.S. foreign assistance dollars are assigned to development assistance activities than in past years. However, international development institutions monitor the activities of similar institutions and

where successes occur, they commonly copy them. Therefore, if U.S. supported development assistance were to take a clear leadership role in assuring that technologies fit developing country ecological settings even these diminished funds could have a far reaching impact on other organizations conducting development assistance activities.

Restructure Technical Resources

A key factor in assuring that development assistance promotes ecologically sustainable technologies is effective use of the technical staff with professional training experience, and interest in applying technology to developing country needs. Although AID and World Bank have such people, they do not seem sufficiently integrated into all aspects of development assistance (e.g., problem definition project design implementation, evaluation and redesign) to assure the highest development project success to failure ratio. This seems particularly true for those projects which involve technology transfer to address developing countries' environment and natural resources problems and opportunities.

Notwithstanding AID may have the technical staff collectively in its Missions and in Washington to increase its overall successes. If AID were to concentrate its knowledge on the various ecological settings in developing countries and on matching technologies to these settings, it seems likely that the physical and biological conditions necessary for sustained development could be maintained. AID could accomplish this by developing in-house, interdisciplinary specialist teams to help screen host country problems and AID-proposed solutions, and to assist field staff in locating technical assistance appropriate to the recipient country's ecological characteristics.

One possible categorization of developing country ecological zones in which AID and the MDBs operate is 1) hot wet lands, 2) arid/semiarid lands, and 3) high altitude lands. Although differences obviously exist between the environments and resource systems within these zones (e.g., the Brazilian rainforest is somewhat different than Zaire's rainforest), they are similar enough that technologies compatible with the environment of a given ecological zone are likely to be sustainable when adapted for the same zone in another area. (Of course, political, cultural and economic factors may vary greatly among between areas, potentially rendering **technologies** incompatible in other ways.)

These ecological **teams** should include, for example, participation of other technical specialists like agronomists, soil scientists, foresters, hydrologist anthropologists, geologists, geographers and ecologists. Grouping AID personnel in this fashion would have the immediate beneficial effect of linking specialists in a close working relationship (e.g., agriculturalists with other environment/natural resource specialists), thus resolving a well-identified communication problem.

A fourth team or office with expertise that overlaps the three ecological zones, such as engineers, economists, health specialists, educators and demographers, would work with the ecological teams on projects. This fourth team would take the lead on technical design and evaluation projects unlikely to have strong interactions with the natural resource base (e.g., projects to improve text books for primary education).[9]

AID could assemble teams from AID/S&T[10] technical staff having appropriate professional training, experience, or interest in the various aspects of natural resources and environment in each ecological zone. So, for example, an agronomist from this Bureau having professional training in dryland agriculture could become part of the team on arid/semiarid lands; a geographer having many years of experience in Guyana and the Philippines could join the hot, wet lands team; and anew staff member with a general background in hydrology but a strong interest in erosion control might move into the high-altitude lands group.

Where certain specialties might be missing AID could draw qualified persons from regional bureaus, or from Mission staff. Such an arrangement might not require additional AID staff if agency personnel were screened carefully for their appropriate professional training experience and interest. However, these offices should not be depleted of technical specialists or environmental analysts. A hiring policy aimed at filling vacancies in each ecological team as well as maintaining basic strength in regional bureaus and Missions could mitigate potential staffing deficiencies.

Ecological teams could serve as environment/natural resource falters for all proposed projects coming in from

9 An additional team, less directly related to issues of ecological compatibility, might specialize in projects relevant to urban problems and opportunities.

10 Some technical specialists view this Bureau as having the largest number of technical staff with the greatest number of years of relevant experience.

the field or arising in AID Washington (figure E-3). Each ecological team could examine mission-identified problems and assist in project response development, or review previously prepared plans for their suitability to the development site conditions. The team also could help Missions identify relevant outside technical expertise and technologies with a strong likelihood of fitting the local environmental conditions and thus of achieving the development goal.

The ecological teams (perhaps within a reorganized Science and Technology Bureau) also would be in direct line between the Missions/regional bureaus and U.S. technical expertise (e.g., universities, private sector, PVOs/NGOS, and executive agencies' technical resources) further assuring that AID would be unlikely to select and transfer unsustainable technologies to developing countries. Although AID and MDBs structures differ, such teams could fulfill a similar function in MDBs, operating as a "technical filter" between bank regional technical departments and outside technical resources.

This restructuring might be strongly resisted by AID management or the Foreign Service Union because it would require a significant reorganization of AID technical staffs. If this reorganization became untenable, the ecological teams could be implemented (perhaps on a simplified level) in each geographic bureau.

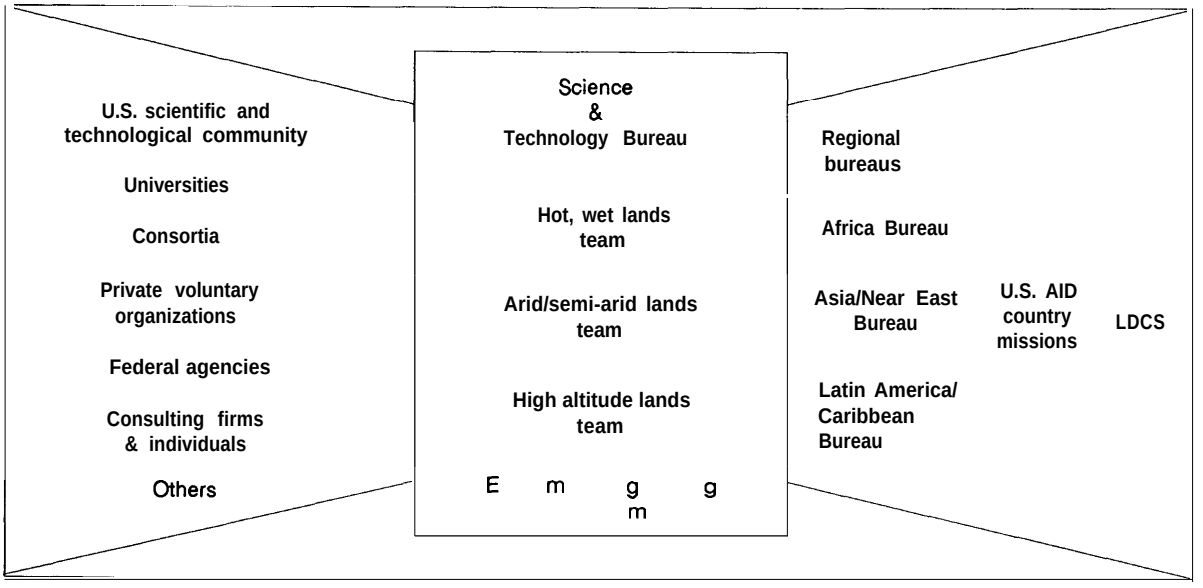
Suggested Oversight Questions:

- ***What do** you see as advantages and disadvantages of oganizing your technical staff into interdisciplinary teams with separate teams for each major ecological **zone?***
- ***Please provide a listing of existing personnel with technical qualiifications for these ecological teams. Please indicate technical areas for which no qualified personnel are currently available.***

Strengthening Technology Selection Expertise

Increasing developing country capabilities to determine which technologies will lit their own particular ecological setting probably will do more to foster sustainable development activities and help to stem degradation of their natural resources than simply having development assistance agencies ensure the ecological compatibility of technologies used in development assistance projects. AID/S&T, eight years ago, began a few special projects to assist Mission and bureau staff as well as developing country planners and natural resource specialists to im-

Figure E-3—Simplified Diagram of Proposed Restructuring of AID Technical Resources



SOURCE: Office of Technology of Assessment, 1987.

prove their understanding of interactions between technology and ecology. These projects led to the creation of Country Environmental Profiles (CEPs).

CEPs describe the status of a country's natural resource base and associated problems and potential opportunities for development of the resources. They are used by specialists from developing and developed countries alike in project and strategic planning.

CEPs involve several stages of writing review and rewriting. Phase-one profiles are desk studies prepared by U.S. experts mostly through library research followed by Phase-two reports that are supported by AID but largely prepared by host-country experts using outside expertise when necessary. Fifty Phase-one versions are complete; one-fifth as many Phase-two profiles exist. The process provides an opportunity to improve the knowledge base of AID staff, contractors, and host-country counterparts, as well as to increase and strengthen the analytical skills and involvement of developing country environmental/natural resource experts.

Additional AID projects produced comprehensive, individual reports on various ecological settings common to many developing countries; several of these have been published in book format. The reports were produced primarily by teams of U.S. environment/natural resource experts and included separate analyses on: the humid tropics, arid/semiarid lands, the coastal zone, environment/natural resource planning methods, and case studies of development technologies drawing directly on the natural resource base. Generally, these reports were intended for use by AID bureau and Mission personnel involved with project design. However, followup training associated with certain topics has been held in developing countries. In addition experimental computer models were investigated that might facilitate natural resource and environmental planning and research definition in developing countries. Such efforts by AID and cooperating agencies are important in the process of improving the fit of development technologies to particular ecological settings.

These efforts, though small in comparison to AID's overall activities address congressional concerns about matching technologies to developing country environments. However, since these are individual projects, they have a defined lifetime. Yet, learning to link the most appropriate technologies to the local ecological conditions of development sites is certainly an ongoing process for U.S. development assistance agencies as well as for developing countries themselves. Expanding strengthening and building such activities into the ongoing development process rather than dealing with them as finite projects may be a promising opportunity to improve technology/environment linkages.

Suggested Oversight Question:

- *What efforts has your agency made to strengthen technology selection expertise? What results have been obtained? What further actions are being planned?*

WORKSHOP PARTICIPANTS AND PERSONS INTERVIEWED[11]

Workshop Participants

David Bathrick
U. S. AID/S&T/AG

Peter Freeman
Consulting Geographer
Alexandria,VA

John Gaudet
Regional Office for Eastern
and Southern Africa
U.S. AID
Nairobi, Kenya

MollyKux
U. S. AID/ST/FNR

Stephen F. Lintner
U. S. AID/ANE/PD/ENV

Christopher Russell
U.S. AID/S&T

Bob J. Walter
Department of Geography
Ohio University
Athens, OH

Persons Interviewed

Steven Berwick
International Institute
for Environment and Development

Robert O. Blake
International Institute for
Environment and Development

Warren Brockleman
Mahidol University
Bangkok, Thailand

Kjell Christophersen
International Resources Group

Jon Clark
Environmental and Energy Study Institute

John Cleave
World Bank

Diana Crowley
World Bank

Paul Lightfoot
Thai Bank for Agriculture and Cooperatives
Bangkok,Thailand

Andrew McGuire
World Resources Institute

Kathleen McNamara
World Bank

Wlliam J. Nagle
World Resources Institute

Raymond Noronha
Consulting Sociologist
Alexandria, VA

J. Kathy Parker
Office of Technology Assessment

Steve Parcells
Natural Resources Defense Council

Sheridan Pluckett
U. S. AID

Mit Pramuanvorachat
U. S. AID

Bert Printz
Neill & Co.

Bruce Rich
Environmental Defense Fund

Jeff Romm
University of California
Berkeley,CA

Richard Saunier
Organization of American States

Stephen Schwartzman
Environmental Defense Fund

Ben Severn
U.S. AID

Chamlong Tohtong
Thai Bank for Agriculture and Cooperatives
Bangkok, Thailand

Jeremy Warford
World Bank

Paul Weatherly
Biomass Users Network

11 Unless otherwise noted, the listed institutions and individuals are located in Washington, DC.

Francis Weber
National Audubon Society

Phyllis Windle
Office of Technology Assessment

David Wirth
Natural Resources Defense Council

Montague Yudelman
World Resources Institute