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FORESTRY IN DEVELOPMENT ASSISTANCE

Background Paper for AID Policy and Programs

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Comments and criticisms are invited.

PREFACE

This paper was to have provided to AID the basis for program guidance on forestry interventions that could be sent to field missions. A review of old and ongoing AID projects, projects of other agencies, and recent writing on forestry in development discovered so many complex issues and constraints, such a wide range of possible interventions and strategies, and so many questions that are yet unanswered that the formulation of a clear, concise message became unrealistic. Instead, this paper attempts to explore the diversity of forestry interventions and related issues, with the aspiration that in doing so it will serve to inform and orient ongoing policy and program formulation.

While this paper was being prepared, two parallel efforts were being undertaken. Dan Deely of DSB/ST was reviewing agency mandates and institutional capacities related to forestry assistance. Second, two summer interns, Beth Cypser (PPC/DS) and Liz Athos (DSB/ST) undertook a laborious review and summation of AID projects concerned with forestry during the period 1974-1982. The present paper does not include the results of these efforts.

In AID and other development assistance organizations, thinking about forestry and deforestation is rapidly evolving, and so far in a relatively uncoordinated manner. The amount and dynamism of policy studies and project work in AID and other agencies is truly impressive. Over the past 12 to 15 months, there has been rapid expansion of thinking and work. During the preparation of this paper (July and August, 1979), the Interagency Task Force

on Tropical Deforestation was completing its first draft on this topic. Its perspective embraces the entire federal government, and AID's role will be defined in this context, when recommendations for programs are developed.

Other important antecedent work can be listed:

-- The convening in May, 1978, of a Conference on Improved Utilization of Tropical Forests, under AID and USDA sponsorship.

-- The June, 1978, Africa Bureau (AID) Firewood Conference and David French's background paper, "Firewood in Africa."

-- The State Department/AID sponsored conference on Tropical Deforestation, also held in June, 1978.

-- Publication in 1978 by the World Bank and the Asian Development Bank of forestry sector policy papers.

-- Publication in 1979 by Worldwatch Institute of Eckholm's Planting for the Future, Forestry for Human Needs.

-- The convening of the 8th World Forestry Congress in Jakarta, Indonesia, in 1978.

-- Preparation by the Non-governmental Tropical Forest Working Group of a report for submission to the Interagency Task Force on Tropical Deforestation, June 1979.

-- The commissioning by AID's Bureau of Policy and Program Coordination of a research paper on the world firewood crisis (by Bill Knowland).

-- The expansion of the Peace Corps forestry program, through planning efforts undertaken in the summer of 1979.

These events and works show that forestry is now a dynamic and rapidly evolving aspect of development assistance. The profession and practice of forestry in LDC's is also in a state of flux, especially with the current focus on the new and largely untested (in development assistance) community forestry and agroforestry. There are many unknowns, but work is proceeding. Communication and interchange of information as basic and applied research yield results, and as project designs are tested against reality, will be crucial.

I am very appreciative of the information and insights which many persons shared with me, especially Sam Kunkle, Carol Ulinski, Tom Greathouse, Fred Weber, Todd Crawford, Robert Goodland, Jacob Scherr, Francis Gulick, Elroy Carlson, Steve Lintner, Robert Otto, Paul Fritz, William Rhoades, and Mike Benge. Working with the staff of the Development Support Bureau and the Bureau of Policy and Program Coordination was a stimulating and enjoyable challenge throughout.

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A. INTRODUCTION

1. Purpose and Scope

The purpose of this review is to set forth technical and related socio-economic elements that ought to be considered in the formulation of agency programs and project guidance concerned with the problem of deforestation and forestry. Other dimensions of program and project formulation such as authorizations, funding, implementation, and a review of on-going or planned agency work in forestry are being developed independently of this paper.

This work does not for the most part try to explore new ground of a technical or conceptual nature. The present paper has attempted to summarize and interpret the substance of recent thinking on deforestation and forestry, and to relate this to AID's program and mandates. Antecedent work that was reviewed included the World Bank's Forestry Sector Policy Paper, FAO's Forestry for Local Community Development, the Asian Development Bank's Sector Paper on Forestry and Forest Industries, papers presented at the 8th World Forestry Congress held in Jakarta in 1978, and several IDRC publications, especially Trees, Food and People: Land Management in the Tropics. The recently completed first draft of The World's Tropical Forests: A U.S. Policy, Strategy and Program by the U.S Interagency Task Force, was not available except in incomplete provisional draft sections. The available portions were taken into account, but could not be cited, of course.

While there is wide recognition and agreement in these documents on the problem of deforestation and subsequent land degradation, different development assistance organizations or banks approach the solutions to deforestation and strategies for interventions from different points of view. This paper seeks to develop guidance suited to AID's role, mandates and operational mode.

Apart from its focus on forestry, this paper can be viewed as a background document for the broader mandate contained in Section 118 of the Foreign Assistance Act, to assist LDC's in conserving and improving their environments and natural resources. It is perhaps one of AID's most ambitious and complex mandates, as experience with the increasing number of projects falling in the category of special environmental concerns is demonstrating.

2. Definitions

As used here, forests embrace all woody vegetation from high tropical evergreen broadleaf forests to low desert shrubs, and the various in-between forest types. To orient the discussion and to capture some of the diversity of problems, three major types of forests are identified.

1. Low woody shrubs of semi-arid regions, from the desert's edge to low trees of open savannah, e.g. the Sahel.
2. Deciduous forests of sub-humid zones with marked dry seasons, e.g. upland forests of Southeast Asia.
3. Evergreen broadleafed forests of humid to wet zones, including transitions to evergreen mixed with deciduous species, e.g. Amazon basin.

Tropical montane forests are not mentioned as a major category. For the most part they have been cleared. Patches of various kinds of montane forests in remote, inaccessible, or extremely steep, or effectively protected sites can still be found, but in general tropical mountains have long since been cleared and converted to farms or grazing lands. Almost typically eucalyptus, Cupressus, or Casuarina are the principle large trees now to be seen in the montane landscapes. The pan-tropical occurrence of these species belies, however, the great ecological diversity of tropical mountains, which is best represented in Holdridge's Life Zone system of ecological classification, widely used in Latin America (Holdridge,1947).

The uses and values of these forest types are tabulated next.

Climate	Type	Uses and Values	
		of trees or woody species	of forested or vegetated areas
Semi-arid long dry season short > one month rainy season erratic rains	Desert scrub to savannah	browse gum, wax, fiber fuel construction wood implements fruit, medicine soil enrichment on farms wind breaks	livestock raising millet and sorghum production, with vegetation fallow wildlife habitat soil stabilization and erosion control in steep areas wind breaks/dune stabilization
Sub-humid	Deciduous	timber, fuel nuts, fruits, fiber special woods (teak, rosewood) soil enrichment wind breaks shade (plantations) browse	soil conservation watershed protection wildlife habitat gene pool of flora & fauna fallow for shifting agriculture
Humid to wet (or perhumid)	Evergreen	Same as above plus living fence posts	maintenance of soil (site) productivity soil & watershed protection gene pool wildlife & human habitat fallow for shifting agriculture

Forestry assistance may take many forms. Also, a forestry intervention may be the principal project activity, a major project component or a relatively minor complement to a larger rural development effort. This paper first presents descriptions of six major categories of assistance or interventions, and secondly a discussion of the development situations or contexts in which the interventions would be considered. This discussion of development contexts serves as background for recommendations concerning project strategies or areas in which AID could profitably focus its resources.

The categories of forestry interventions and their likely employment in various development contexts are portrayed in Figure 1.

Figure 1

Forestry Interventions and Contexts

Categories of Forestry Interventions	Rural Development: Low-lands	Rural Development: Up lands	Critical Catch-ments	Undeveloped Forest	Deserti-fied or Degraded Zone
• Forestation					
large areas	x	x	x	x	x
small scale	x	x			x
• Agro-forestry	x	x	x		x
• Semi-arid zone vegetation management	x	x	x	x	x
• Forest resource management			x	x	
• Park & preserve management			x	x	
• Institution building	x	x	x	x	x

The categories of interventions and development contexts are a pragmatic rather than a taxonomically perfect classification. They are based upon discussions with the COED forestry policy working group and reviews of documents. (A cataloguing of on-going AID projects undertaken by the Bureau of Policy and Program Coordination employed the same categories.)

The brief definition of different kinds of forestry interventions given next are elaborated upon in later sections.

1. Forestation.

   The planting of trees; the establishment of tree plantations or groups of trees. Includes reforestation, or the planting of trees on cut-over or degraded forest land, and afforestation or the planting of trees on land not previously forested. Large-scale plantings are typically those undertaken by governments or the wood industry on large tracts. Large-scale plantings are usually on public (state) lands, small-scale or community (tribal), or private lands.

2. Agro-forestry. (synonymous with Agrisilviculture)

   The sequential or simultaneous growing of trees with crops or pastures; may include special product trees as well as forest trees valued mainly for wood.

3. Semi-arid zone vegetation management.

   Refers to open woodlands or savannahs and more arid vegetation types, and to the exploitation and management of woody brush and trees as well as annuals in semi-arid zones.

(The isolation of trees for separate management in semi-arid zones has not proven realistic because the total vegetative resource is exploited for fuel, food and forage.)

4. Forest resource management.

   Refers to closed forests, with large trees and substantial growth potential. Management would entail activities such as surveys, inventories of standing timber, determination of harvesting plans and supervision of exploitation and regeneration or reforestation.

5. Park and preserve management.

   The management in protected areas of research, educational work and tourism.

6. Institution building.

   Takes the form of education; special training; technical assistance in planning, programming, monitoring research; perhaps project administration; research support, support for vehicles, equipment, physical facilities. In practice, most interventions involve or require an element of institutional strengthening, because of the general weakness of LDC institutions that deal with forests.

3. The General Problem

Deforestation, degradation of vegetation and desertification are symptoms of a growing human and environmental crisis in the rural regions of lesser developed countries. There are many causes, however, the principal ones are:

- Steady and increasing international demand for tropical hardwoods, and growing demands in LDC's for both softwoods and hardwoods.
- Rapid increases in the number of people and ruminant livestock in the last 25 years.
- Insufficient land, vegetation, and water resources (or access to these) under traditional systems of use relative to the needs of people and domestic animals.
- Insufficient development (underdevelopment).

People and animal pressures to some extent have been absorbed by remnants of forests and other natural vegetation in settled areas--typically in very steep or inaccessible sites--but these are disappearing. Roads built into distant forests and/or the provision of water in semi-arid zones have given access to additional forest and fodder resources, and have absorbed some of the people and animals from over-populated (or degraded) zones. But usually such areas have hitherto been too wet, too dry or too infertile to permit sustainable development. They do not hold up well under continuous exploitation and permanent or relatively permanent degradation of soils and vegetation has often been the result. This is particularly true of cattle raising in the semi-arid and the very humid tropics (e.g. the Sahel and the Amazon basin).

Economic development in rural areas has in general failed to keep pace with the demand for employment and the demand for food and other agricultural products, and development efforts touch the lives of only a fraction of the LDCs' rural populace. Thus,

not only are most people failing to benefit from economic development efforts, as measured by greater income, but they are losing their ability to subsist as local environments degrade from over-exploitation.

It is obvious that (1) the fraction of people and animals in excess of the carrying capacity of the resource base must be removed; (2) more land, water and vegetative resources must be supplied or made accessible to people; (3) development efforts of various kinds must be undertaken to make natural resources more productive and people must be able to obtain what they need on a sustained basis from available natural resources, whether it be through subsistence or commercially-oriented enterprises.

Forestry interventions can help to accomplish some of these measures.

4. Orienting Considerations

A number of facts and principles should be kept in mind in order to maintain a realistic view of assistance in forestry and forest-related problems. Many could be called constraints. It is remarkable that the growth, protection, management and use of trees in LDC's is beset by perhaps more limitations than any other form of rural development assistance. The following facts may explain why.

Land distribution and land tenure. In most LDC's, six and as many as eight households out of ten are landless or have insufficient land to satisfy their subsistence needs.

Figure 2

Landlessness or Near-Landlessness in Certain LDC's

(% of total rural households)

Bangladesh	75	Bolivia	85
India	53	Brazil	70
Java	85	Colombia	66
Philippines	78	Costa Rica	55
Sri Lanka	77	Dominican Republic	68
		Ecuador	75
		Guatemala	85
		Mexico	60
		Peru	75
		El Salvador	80

Source: Esman, 1978.

The situation reflects extreme densities of people on arable land as well as unequal distribution of rural land, especially in the case of Latin America. In South Asia and Southeast Asia, the ratio of people to arable land is now from three to five persons per hectare on average, and by 2000 will be from five to ten persons per hectare. In Latin America, each arable hectare now supports approximately two persons on average and by 2000 will support 2 1/2 to three persons. (Arable land/population ratios are taken from technical supplement of the Global 2000 Study, to be published in late 1979.)

In Africa the traditional form of land tenure is communal or tribal, both in the pastoral or nomadic societies and the sedentary farming societies. Land use rights as well as areas for communities or tribes are known and until recently, respected. Encroachment of farming onto grazing corridors has become a source of conflict, however.

Now Africa's traditional tenure of land is in crisis since, according to researchers at the University of Wisconsin's Land Tenure Center, "it lacks the capacity to expand opportunities (even of traditional quality) to all members of the group, or absorb investment to expand the capacity of the land to provide" (Riddell et al, 1978).

The irresistable and virtually uncontrollable pressures on forests and other natural vegetation owned communally or by the nation state are understood largely in terms of these population/land relationships. Many regions or even nations may never achieve self sufficiency in forest products because of the primacy of food production.

Expanding populations in marginal environments. Human populations are moving increasingly to marginal environments--often in the wake of roads--or are increasing in number in these environments owing to better health. Marginal environments are ones with severe limitations to resource use, especially excessive humidity or aridity, and excessive slope. Experience has shown that the vegetation in these environments is easily damaged or degraded.

Six hundred and twenty-eight million people dwell in semi-arid zones having varying degrees of risk of desertification, according to the United Nations Environment Program.* Almost twenty years ago it was estimated that 200 million people in the tropics practiced shifting cultivation (Nye and Greenland, 1960). Rates of deforestation suggest that their numbers have increased generally in proportion to population growth in the tropical countries, and

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*Figure cited in IUCN Bulletin, Vol. 8, No. 8/9, Aug./Sept., 1977.

there could well be as many as 400 million shifting cultivators in 1979.

Desertification and expansion of cropland into the very margins of the desert in Africa or into grazing lands are evidence of the growing numbers of people as well as animals in semi-arid regions. In both these climatic extremes--semi-arid and wet--population increases have been subsidized by natural forest and other vegetation. The protection, management and better utilization of forests or arid zone vegetation in these frontier zones confronts poor basic knowledge, lack of resource incentives, and an almost irresistable tide of humanity in search of food, fuel, land, and a place to dwell.

In tropical mountains and uplands such as the South American Andes, the volcanic ranges of Central America and Mexico, the Himalayas, the Hindu Kush, and the mountains of the Indonesia and the Pacific Islands, there dwell approximately 10 percent of the world's population. Remaining forests are rapidly disappearing on the steepest portions. The hydrological impacts are immediately felt in adjacent lowlands which harbor an estimated 40 percent of the world's population (Thiesenhusen, 1976).

The deforestation and occupation of critical catchment zones by land-hungry farmers is one of the most serious aspects of world deforestation.

Forestry interventions for the rural poor--relatively new and untested. Village fuel and timber plantations (or woodlots) and agro-forestry applied to shifting cultivation in the humid

tropics are the focus of forest activities aimed at the rural poor. Also, plantations are proposed to relieve pressures on natural forests for fuel and to restore land productivity.

Worldwide, only two examples of successful village woodlot programs can be cited: South Korea's and the program in the state of Gujarat, India. Both were indigenous programs, although the World Bank now supports South Korea's program. No example is known of an agro-forestry project which has diminished forest destruction or land degradation being caused by shifting cultivators. Specific techniques in agro-forestry are known and being researched, however, their acceptance and use by shifting cultivators has not yet been documented in ways that show how agro-forestry can slow forest destruction. Much applied research, now underway, will soon yield results that should advance this ecologically sensible concept.

Colonial forestry legacy. Notions of forestry introduced by colonial administrations have persisted until recently in Africa, India, and other former colonies. More often than not, foresters charged with protecting state forest reserves end up as enemies of the rural poor. This unfortunate legacy takes time and demonstrably beneficial actions to dissipate, as experience in India has shown.

Temperate zone forestry: inappropriate for the tropics. This almost self-evident statement needs saying particularly because U.S. expertise in tropical forestry is so slim, being limited largely to work in Latin America, and focusing mainly on

industrial forestry.* A number of LDC's, on the other hand, have developed a solid capability in tropical forestry and, it can be assumed, the capability to plan projects that AID might wish to support. A review of the merits of such projects must be based on principles of tropical zone forestry, and AID will have to develop the corresponding review capability.

5. Lessons from the Past

AID's assistance in forestry has never had the benefit of an overall evaluation. As background for the present document, a number of indepth reviews of AID forestry projects were made, on the basis of project documentation** and to the extent possible, interviews with persons involved in design and implementation. The projects reviewed were:

Philippines	Agro-forestation No. 492-0306	1976 Project Review Paper, interview with Michael Benge, AID agro-forestry advisor.
Costa Rica	Natural Resources Conservation No. 515-0145	1979 Project Paper.
Niger	Forestry and Land Use Planning No. 683-0230	1979 Project Paper. Interview with Fred Weber, consultant.
Upper Volta	Upper Volta Forestry Education and Development No. 686-0235	1979 Project Paper. Interview with Todd Crawford, Africa Bureau, DR.

* This problem is analyzed in The World's Tropical Forests: A U.S. Policy, Strategy and Program, prepared by the U.S. Interagency Task Force on Tropical Deforestation (first draft, distributed August 21, 1979).

**Documentation for past projects is not uniformly available. Records of the FORPRIDECOM project in the Philippines, (assistance in industrial forestry) are not available in Washington. Documentation for projects older than ten years has been moved physically to storage in St. Louis, although there are exceptions.

Jamaica	Forestry Development (1973-1977)	Project leader quarterly reports and end-of-tour report.
Jamaica	Integrated Rural Development No. AID-DLC/D-2256	1977 Project Paper.
Haiti	Integrated Agricultural Development. No. AID-DLC/D-2195.	1976 Project Paper. Consultant reports. Interview with William Rhoades, LAC/DR.
Gambia	Gambia Forestry Project No. 635-0205	1979 Project Paper. Interview with Tom Greathouse, AFR/SDP forester.
Tunisia	Watershed Planning and Management (1963-1967)	Progress reports, end-of-tour reports, mission evaluation report.
Iraq, Morocco, Sudan	Range management advisory assistance	Reports and end-of-tour reports by advisors.
Chad	Agro-forestation with Acacia albida, OPG to CARE (1976-1979)	Mid-project evaluation report (Weber & Dulsaney)

Papers presented at the 8th World Forestry Congress last year in Djakarta, on the theme of community forestry include sometime biased, not altogether complete, but nevertheless informative accounts of projects or experiences in India (Argal, 1978; Shah, 1978), Korea (Bong Won Ahn, 1978); Brazil (Muthoo , 1978); Ethiopia (Ohlsson, 1978; Sandahl, 1978); and Upper Volta (Ernst, 1978). FAO's Forestry for Local Community Development derives lessons from seventeen case studies, including ones just mentioned:

China	Integrated village forestry
Colombia	Forestry for local community development
Ecuador	Legislation and organization of the social afforestation system

India	Forestry for community development (village forestry)
Indonesia	Upland forest and fodder system on private lands. Community development program in the State Forest of East and Central Java
Kenya	The Shamba system (note - similar to Taungya)
Rep. of Korea	Village fuelwood plantation system
Nepal	Fodder tree system in an integrated rural development project
Nigeria	Farm forestry
Philippines	Smallholder tree farming
Sahel	Forest/cattle system
Sudan	*Acacia senegal* fallow system
Tanzania	Village afforestation - Dodoma district
Thailand	Forest village system. An approach to integrated watershed management - Mae Sa

From this highly diverse background, FAO developed guidelines and recommendations for policies, programs, institutions and project design.

The FAO document on community forestry appears to retain the traditional approach, at least in the recommended planning procedures. Forestry experts would determine through research and surveys what needs to be done and what are the technical options. Thereafter, communities would be consulted or sensitized by means of educational campaigns. This is a telling affirmation of the need, stated elsewhere in the document, to radically reorient the thinking of foresters and the way forestry institutions operate.

In the case study descriptions, there is little mention of the process whereby communities become involved in the projects, although in one of the cases--Indonesia's upland forest and fodder system study--the community helped design the activity. The issues contributing to successes or failures are not adequately recounted in the studies.

There is little mention of the possibilities of integrating the forestry component into an agricultural development program framework, e.g. using agricultural extension agents to promote community forestry. The document's strength is in its treatment of a wide array of technical factors and its definition of most of the problems and issues which appear salient to community forestry. The World Bank's Forestry Sector Policy Paper is in general agreement with FAO's recommendations on community forestry.

The World Bank has recently reviewed its experience in forestry projects, of which fifteen are entirely forestry and 28 are agricultural/rural development projects that include a forestry component. Little or no supervision by foresters has been performed on projects having forestry as a minor component, but a number of lessons have been learned from the supervised, all-forestry projects (World Bank, 1979):

- Securing and retaining skilled staff is the most commonly occurring problem, caused by inadequate, early on-the-job training and the loss of skilled operators to better paying jobs in the private sector.

- Lack of secure land tenure has held back credit requests by smallholders for individually owned pulpwood plantations of Albizzia falcata in the Philippines, which were supposed to supply an existing pulpwood mill in Mindanao. The success of a first phase of this effort (PICOP) was due in part to the provision of agricultural inputs (seeds, fertilizers, breeding stock for domestic animals), and an agro-forestry approach.
- Management of community-owned woodlots may be difficult to achieve. Attempts to establish community woodlots in the Niger Maradi Project were abandoned after three years for lack of protection on a continued basis. Tree planting on individuals' land will be promoted instead.
- Local support for rural forestry programs is most likely to be secured in situations where forestry is integral to rural development, which also provides alternative fodder for livestock, higher production of crops, soil conservation and improved rural infrastructure (e.g. South Korea's Samaeul program, Philippines agro-forestry PICOP I).
- The main constraints to expanded rural afforestation are institutional and social problems, and no alternatives for those who graze or cultivate in forested areas.

There are nine forestry projects being financed by the World Bank in 1979:

India (Uttar Pradesh)	Village forestry
Burundi	Pilot village forestry and farm level forestry
Mali	(no data yet)
Liberia	Institution building for forest management and exploitation of 2 million has. of tropical high forest
Jamaica	9,000 has. of plantations; technical assistance for studies of forests and energy, pulp and paper mill
Nigeria	Reforestation of 22,000 has. with Gmelina and 1,600 has. with pine, using Taungya system. Intensification of management of 260,000 has. of reserve forests
Greece	Increase exploitation of existing forests by road building and improvement, and study alternative management systems
Ivory Coast	Plant 20,000 has. of quality tropical hardwood and strengthen the government forest service
Guyana	Set up 40,000 m^3 capacity sawmill to exploit 150,000 has. of virgin greenheart forest

Two others illustrate projects in which forestry is a component:

Thailand (Northern Agricultural Development Project)	4,000 has. of village woodlots and agro-forestry aimed at stabilizing land use to protect 138,000 has. of catchment forests
India (Khandi Catchment Project)	Small-scale plantations and research

There are almost no case studies that document the full range of factors involved in village forestry efforts. Eckholm's accounts of South Korean and Indian (Gujarat State) village woodlots or plantation establishment (Eckholm, 1979) are the most informative and the most readable as well.

It is striking that except for Eckholm, no U.S. researcher seems to have done field work or case studies on village forestry. An exception is the evaluation by Fred Weber and Maryanne Dulansey of CARE's Acacia albida planting project in Chad. However, this was a project that appealed to individual farmers, not villages, and is more accurately an agro-forestry project.

The considerable experience represented by Peace Corps and Private Voluntary Organizations in community or farm-level tree planting in Africa and Latin America has not been evaluated. Project documents available at VITA (Volunteers in Technical Assistance, Mt. Ranier, Maryland) contain a wealth of information on problems and solutions, and they should be reviewed.

The intractability of the wet tropical forest to temperate zone forest management concepts and techniques spurred AID to commission a series of studies in 1972 and 1973 on the more complete utilization of tropical woods, through better harvesting, marketing, processing, and forest management (Freas et al, 1973; Chudnoff, 1973a and 1973b; Office of Science and Technology, 1972, 1973a and 1973b). These studies were carried out by the U.S. Forest Service.

The review of management experience and problems in this forest type noted the general failure to achieve effective silvicultural systems.

In 1977-78, AID sponsored a review (USDA, 1978) of technological advances in the utilization of tropical forests which are now making possible greater use of the numerous species. A major unknown was raised, however· our ignorance of the nature and value of second growth following clear cutting, or more complete exploitation (Ewel and Conde, 1978).

B. FORESTRY INTERVENTIONS

Short descriptions are given of different categories of interventions in the following order:

1. Forestation
2. Forest resource management
3. Agro-forestry
4. Semi-arid zone vegetation management
5. Parks and wildlands management
6. Institutional development

Illustrations of AID and other donors' support for these kinds of work are set forth [illegible] each category.

1. Forestation

The planting of trees is subdivided here into large-scale plantations or industrial plantations on government-owned land and small-scale plantings on private or community lands. Afforestation is tree planting on lands not previously forested, while reforestation is tree planting on cut over or degraded forests. The distinction is not of major import to the following discussion, however.

Large-Scale Plantations. Large-scale plantations would be established over extensive surfaces on government-owned lands, and would be financed and administered by forest service personnel. This is not invariably the pattern; in Brazil, over 1.0 million hectares of eucalyptus have been planted on private lands with the stimulus of government subsidies.

There is a considerable body of information and experience in plantation silviculture in the LDC's, although it has accumulated mostly for climates with monsoonal rainfall regimes or a marked

dry season (India, Burma, Subsaharan Africa). The economics of plantation tree farming are easily adapted to conventional project analysis, although environmental benefits may not be readily computed. Still, there are fewer unknowns in large-scale forestation than any other type of intervention considered in this paper.

Large plantations in LDC's are presently viewed as the only way to meet future (beyond 2000) wood needs on a predictable and sustainable basis, even in regions that now have relatively abundant forests. This view derives from the high productivity of plantations. Fast-growing species are planted and all the trees are utilized so that plantations are up to forty times more productive than natural forests. The Asian Development Bank, for example, estimates that reforestation in Asian LDC's must be expanded to a rate of 10 million hectares per year at an annual cost of $400 million to $800 million, in order to satisfy future needs, and avoid a wood deficit in 1990 of 170 million m^3 (ADB, 1978). In the Sahel, where there is already a critical wood deficit, plantations must be established at the rate of 300,000 hectares per year to meet future needs (Club du Sahel/CILSS, 1978). The World Bank has recently projected plantation establishment needs to the year 2000, as shown in Table 1.

AID experience in large-scale forestation. AID has supported only one large plantation in the past--in Jamaica. The experience in Jamaica is illustrative of this kind of project. Six thousand acres of the fast-growing Caribbean pine (*P. caribea*) were planted during 1974-1977 on government land, as a major part of a $4.4

Table 1

Comparison of Current Annual Rural Afforestation Programs in Selected Developing Countries with the Approximate Size of Program Needed to Meet Domestic Fuelwood Requirements to the Year 2000

Country	Current Annual Afforestation Program	Approximate Annual Program needed to meet domestic fuelwood requirements to the year 2000	Total Planting Target needed by the year 2000 to meet domestic requirements	Factor indicating by how much the present annual rate of planting would have to be increased to meet domestic requirements to the year 2000
	(000's of ha)	(000's of ha)1/	(million ha)	
Rwanda	1.5	13.0	0.26	8.6
Burundi	1.5	5.4	0.11	3.6
Malawi	2.5	13.0	0.26	5.2
Tanzania	2.5	20.0	0.40	8.0
Sierra Leone	0.5	2.5	0.05	5.0
Niger	0.5	3.5	0.07	7.0
Mali	0.5	4.0	0.08	8.0
Nigeria	10.0	100.0	2.00	10.0
Ethiopia	1.0	50.0	1.00	50.0
Nepal	5.0	50.0	1.00	10.0
Thailand	10.0	75.0	1.50	7.5
India	20.0	250.0	5.00	12.5
Afghanistan	1.0	50.0	1.00	50.0
Peru	5.0	20.0	0.40	4.0
Ecuador	2.0	13.0	0.26	6.5
Totals	63.5	669.4	13.39	

1/ Based on the assumption that between one third and one half of total rural energy requirements could be met by other forms of energy than wood, such as biogass plants or solar cookers and by introducing greater end use efficiency.

Source: World Bank unpublished 1978 estimates.

million Forestry Development Loan. Its purposes were to strengthen the forestry institutions through six scholarships, expansion of physical plants, provision of communication equipment and technical assistance, plant 8,000 acres of pine, and increase the use of Caribbean pine, in part through promoting private plantings.

The project had been preceded by seven years of forestry assistance from Canada and the U.K and a UNDP/FAO project titled Forestry Development and Watershed Management in the Upland Regions. The last yielded 38 studies that helped to justify the project and identify the critical areas for forestation. This background, together with a high level commitment from the government, made in 1970 talks between Jamaica's prime minister and President Nixon, and the relative ease with which P. caribea is grown resulted in a successful project. However, the project leader's quarterly reports revealed that the effort was not totally free of problems: late arrival of the project leader (a U.S. Forest Service man); heavy equipment that arrived damaged and pilfered; lack of senior staff to "receive" technical assistance; poor maintenance and repair of equipment; weak budget and accounting control; and no government commitment to extension forestry.

A recently designed $1.6 million grant project for the Gambia will establish 1,300 hectares of Gmelina trees on government land at a cost of $350/hectare . The selection of Gmelina was backed by 30 years of trials begun by British foresters with various species, including teak, eucalyptus and Khaya spp. The plantation will supply urban fuelwood needs, and was projected to average 15 to 20 m^3/ha/year wood production. The social soundness analysis raised the possible

disadvantage that the main beneficiaries would be the relatively well-off urban dwellers. Other project components were training scholarships, village woodlots (a total of 50 hectares) and a feasibility study of mangrove exploitation.

Barring innovative solutions of collective management, the social benefits of large plantation projects are likely to be limited to: employment in the plantation, a general increased availability of wood for urban markers, and decreased cutting pressures on natural forests. The arguable social appropriateness of large-scale plantations must, however, be weighted against the tremendous deficits in wood that are likely in the coming years in many regions. The bulk--or low value per volume/weight--of fuelwood militates against trade beyond distances of several hundred kilometers. (Conversion to charcoal doubles or triples the value per weight, but entails the extra cost of fuelwood for charcoal conversion.)

Small-scale forestation. Trees planted and grown as a crop in small plantations of a few hectares, or in smaller groups or lines, by communities or by individuals would constitute small-scale forestation. In general, there are no inherent or insurmountable technical obstacles to small-scale forestation. Knowledge of tree cultivation in climatic and ecological zones where most rural people live is well developed. Social and economic constraints are numerous, however.

In the case of plantings on individual farms, there must be sufficient land to spare, and most rural poor have barely enough

for food production, or prefer to plant cash crops on extra land. The choice of trees is therefore important, and fruit or nut trees may be the only ones to excite interest. Village plantations raise questions of organization, ownership, and allocation of work and products. These complex issues are made more so by the diversity of rural societies and cultures.

AID experience in small scale forestation. AID has practically no experience in small scale forestation. However, a number of new projects will support it. In the now-completed Jamaica Forestry Loan, a component that was to induce private landowners to grow Caribbean pines was not achieved, even when it had been a special condition to the loan. The problem was described as institutional: the government was unable to recruit an "extension forester".

Several new projects will attempt to establish community plantations. The Gambia Forestry Project will seek to establish ten five-hectare village fuelwood plantations of *Gmelina* and *Azadirachta*; cashews, mango and citrus trees would also be offered. Motivation of villages to establish the plantations was somewhat in doubt, because the expressed priority need was agricultural improvement. But only interested villages would be chosen. The major foreign assistance input would be barbed wire and plastic sacks for seedlings. The possibility of using P.L. 480 Food for Peace was raised since communal work is traditionally paid with meals, but was rejected since only small amounts of food would be

needed given the project's scale - one day of labor per adult per season, so as to plant about one hectare of trees per season per village. More labor was not projected because the period of crop planting and tree planting coincides.

At an average production of 10 m^3 per ha/year and a consumption rate of 1 m^3/person/year, the five-hectare lots would supply fifty people. Selection of participating villages would be based upon:

- interest in participation (ready to devote land and labor);
- organized method of allocating labor and the harvested wood;
- access to nurseries and to forestry personnel (e.g. not remote).

Size of village was not listed as a criterion. The social soundness analysis of the project emphasized the importance of the process used to elicit the interest and involvement of villages and recommended a four-step procedure:

1) project personnel provides initial information to village leaders;
2) leaders decide whether or not they are interested;
3) additional, detailed information on woodlots is provided by the project personnel; and
4) village makes second decision--whether to institute or reject the proposed woodlot.

Other experience. Small-scale, village or community plantations have been successfully carried out as national (or state) programs in only three developing countries, it seems: People's

Republic of China, South Korea and India (Gujarat State).* None were carried out within the context of foreign assistance programs.

The Chinese and Korean examples lose some demonstration value except for nations with strong, if not totalitarian, governments. However, Eckholm points out that in both instances the village level commitment was strong and the benefits were immediately enjoyed by the community. The Gujarat State case holds perhaps more lessons, nevertheless.

The Gujarat experience, in brief, is as follows. The idea of village woodlots as a national goal was conceived in 1952 shortly after India's independence. However, action was hampered by the guardian mentality of foresters and the lack of cooperation of people.

In Gujarat, repeated failures to protect forests and get plantations going lead in 1969 to the idea of extension forestry, and a group was started in the State forestry department. First, trees were planted on state lands along roads and irrigation canals. Villagers were allowed to cut grass between the trees in return for caring for them. This fostered a new relationship with the villagers. Next, free seedlings and advice were given to individuals. Bigger landowners responded well, but not smaller farmers. Now subsidies are being considered to foster plantings on eroded marginal portions of small farms. Third, village plantations were promoted, through dialogues between state forestry

*All three cases are described by Eckholm in Worldwatch Paper No. 26, Planting for the Future. (Washington, D.C.: Worldwatch Institute, 1979.)

representatives and the elected village councils, panchayats. The elements were:

- four hectares of land set aside for planting by the village;
- seedlings supplied by the state, and wages also, for labor (poorer people were selected);
- in return for the privilege of harvesting grass and fruits from the plantations, the villagers had to protect them from pilfering and grazing;
- on harvesting, the trees were divided equally between the state and the village panchayat. Price controls were applied to the products, keeping them well below the marketplace and more accessible to the poor.

A new element of the state's program is a scheme to involve the landless poor in forest management. A landless person would be put in charge of 2.5 hectares of forest reserve, which he must plant or protect, in return for wages and 20 percent of the proceeds.

Eckholm points out that in this semi-arid region of India, there is no hope for self-sufficiency in forest products, but at least the trend to deforestation has been arrested. And perhaps most importantly of all a new and hopeful attitude exists among the foresters, who are now working with, not against, the people and who see trees growing, not disappearing.

FAO has reviewed experiences in community or village forestry and has identified some of the elements that are requisite to success (FAO, 1978):

- Sustained technical support system;
- Full range of development services, especially if part of a watershed management effort;
- Obvious and tangible benefits for the participating community;
- Appropriate community organization for planning, work and benefits allocation, conflict resolution;
- Strong commitment at the higher governmental level as well as the community level;
- Perhaps profound changes in community attitudes and behavior regarding trees and forests;
- Perhaps profound changes in the attitudes of foresters, regarding people, and a radical reorientation of forest institutions, from policy to technical foundations.

2. Forest Resource Management

In practice, the management of natural forests in LDC's has consisted of, first, attempts to achieve a more homogenous regrowth with a greater volume of valuable species than occurs in the natural forest, and second, the development of technologies and markets to achieve a more complete utilization of the wide variety of species. The second goal is being achieved, but the first has met only limited success. In fact, there is presently a technological impasse in the sustained yield management of the humid tropical forest, notwithstanding more than a century of efforts, particularly in Asia and Africa. It is largely for this reason that development assistance in LDC forestry has emphasized plantations of fast-growing species. There has been little incentive

for long-term management after removal of commercial timber (with the exception of teak forests in Burma).

Aside from technical and economic problems, the practices of slash and burn farmers and indigenous forest dwellers were generally seen as inimical to forest management and conservation. Arrangements to enlist their labor in tree planting in return for the use of land for food crops (the Taungya system of Burma) were the beginnings of present-day agro-forestry, described later.

Thus, forest resource "management" has consisted of the preparation of maps and surveys of forested areas to locate timber resources (and potential agricultural areas), the preparation of exploitation plans, the construction of roads, the management of concessions, and the improvement of extraction and processing. In most instances, there has been little or no management following cutting which in general is the initiation of land clearing and conversion to farming or ranching.

AID experience in forest management. Past AID work has focused on improved and greater utilization of tropical forests, both in the form of special reviews* as well as project work, in the Philippines in particular. Documentation of the Philippines

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*Five reviews were commissioned in 1973 by TAB/OST through a PASA with the U.S. Forest Service: Technological Opportunities for Tropical Forestry Development; Factors Influencing the Utilization of Tropical Wood Species; Physical, Mechanical, and Other Properties of Selected Secondary Species; Utilization of Tropical Forests (A Review of Forestry Literature in the Agency for International Development Reference Center); and Deveveloped of the Tropical Wood Resource. All were published in November, 1973, and are available in the Office of Science and Technology, Development Support Bureau.

experience which supported the forests products utilization research effort (FORPRIDECOM) was not available for the present paper, but results of this project and other AID forestry work in Asia will soon be summarized in a guidance statement being prepared by the Asia Regional Bureau.

In the Asian region the utilization of natural forests could be increased as much as three-fold through the removal of a greater number of species and more efficient processing. In principle, this increase could potentially slow the rate of forest destruction resulting from the occupation of logged areas by shifting cultivators, since concessions could be smaller and the rate of construction of roads into new areas slowed.

In the American tropics, where the percent of recoverable species is less than Asia or Africa, prospects for silvicultural manipulation of natural forests are even less encouraging. At the same time, most soils are too poor to sustain farming or even grazing uses. There is, nevertheless, considerable U.S. scientific interest in the American Tropics, and a long history of plant and animal collections and studies which could be channeled into applied research on forest management, through ISTC.

In the drier regions of the tropics, forest management presents fewer technical problems, although growth is slower. But if resources are limited, management efforts are justified.

In Sahelian Africa and adjacent dry regions to the south, it has been recently recognized that natural "forests" (Acacia bush to open woodland) can produce more firewood and other products if managed, and that yields of from 1 m^3 to 3 m^3 of wood per hectare can be expected in rainfall regimes of 400 mm to 1100 mm per

year average.* (The true Sahel is bounded by the 500 mm rainfall isohyet.)

AID is supporting experiments in improved management of natural forests in Upper Volta, aimed principally at satisfying local fuelwood and other forest product needs. In the Upper Volta Forestry Education and Development Project ($5.9 million grant for 1979-1982), trials of management alternatives will be instituted on 4,500 hectares of natural forests growing on shallow lateritic soils in the Dinderesso Forest (1180 mm average annual rainfall). The work would provide a training opportunity for lower level forestry agents, not only in forest management techniques but in the interaction with herders and farmers in the environs, who, the project paper proposes, could be allowed to exploit the forest under supervision.

This project notes that below 800 mm average annual rainfall growth is too slow--even of exotics such as eucalyptus--to justify the cost of large plantation establishment.

3. Agro-forestry

The simultaneous or sequential growing of trees with agricultural crops is called agro-forestry (or agrisilviculture). The technique was developed through the attempts of foresters in Asia

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*Personal communication with Fred Weber, Forestry consultant, International Resources Development and Conservation Services. Production figures are for the total wood grown. Production figures for humid tropical forests normally refer to only extractable wood--perhaps only 1/10 or less of the total wood. This results in incongruities in production estimates. Thus, while the production of natural regrowth of Asian forests is on the average 1.1 m^3/ha/year, that of the Sahel could be 3.0 m^3/ha/year. The distinction between total wood biomass and harvested wood only explains the difference.

to grow greater concentrations of commercial species--especially teak--than occurred in the natural forest. Cut-over or depleted natural forests were cleared and seedlings of teak or other valuable dipterocarp species were planted. Labor was supplied by local shifting cultivators, who were allowed to farm the land until the canopy closed--two or three years--in return for planting and caring for the seedlings. This was the "Taungya" system, as termed in Burma where it originated. It has been tried in East Africa (as "shamba") and Indonesia (as "Tumpangsari"), India, Thailand, Sri Lanka, and Trinidad. The system was devised to reconcile the interests of foresters and shifting cultivators.

More recently, the emphasis in agro-forestry has shifted from the production of valuable hardwood species in combination with shifting cultivation to the intensification and stabilization of agricultural land use under shifting cultivation by enriching the forest fallow through the use of such species as Leucaena. With this shift in emphasis to the agricultural phase of land use, and a concern for the subsistence needs of the rural poor, the definition of agro-forestry has widened to include many new types of trees, additional values of trees, and permanent combinations of trees and food crops, as well as the original sequential pattern characterizing shifting agriculture. In particular, the old distinction between timber trees and plantation or estate crops, such as tea, rubber, coconut, and coffee, is no longer useful in a subsistence context, given the multiple uses and values of trees for the rural poor.*

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*Forestry in the tropics is a changing concept, and as a consequence there is considerable room for confusion or misunderstanding in the use of the word, according to the knowledge or experience of the user.

Another development influencing the concept and practice of agro-forestry is the increasing recognition among development assistance agencies of the multiple values of tropical legumes. In part, this has been the fruit of AID support for surveys conducted by the National Academy of Sciences, Board on Science and Technology in International Development. Two publications are of particular value: Leucaena: Promising Forage and Tree Crop for the Tropics (NAS, 1977); and Tropical Legumes: Resources for the Future (NAS, 1979).

AID experience in agro-forestry. In addition to the above-mentioned support for NAS work, AID attempted in 1976 to launch an agroforestry project in the Philippines (Agro-forestation Project No. 492-0306). Although the project has not advanced beyond a 1976 Project Review Ppaer, it illustrates an agroforestry approach to the stabilization and improvement of shifting cultivation.

The project would have supported on-going government efforts to carry out agro-forestation (termed Kaingin Management by the government) on 750,000 hectares in a five-year period, on depleted forest lands. Ten- to 25-year leases on the 7-hectare plots would be extended to shifting cultivators (kaingeros), who would plant Leucaena along with food crops. Fruit trees and tea were also to be provided and in places bench terraces constructed. The estimated costs per hectare totaled $160, of which an AID loan/grant would pay about one-half.

The importance of this kind of effort rests in the fact that of the total 17 million hectares of "public"* forest in the Philippines, 5.0 million have been denuded or degraded, including 1.4 million hectares located near or within critical watersheds. An estimated 3.5 million hectares are occupied by shifting cultivators. These fall into two distinct groups: (1) the upland ethnic minorities; and (2) the lowland ethnic philippine kaingero, who is encroaching into hilly forested areas to grcw food crops, and who is more destructive of the forest than the ethnic minorities.

The Philippines Agro-forestation Project is reported to have been delayed and complicated by lack of government support or commitment to its share of the project.

4. Semi-Arid Zone Vegetation Management

The relatively low biomass and paucity of timber species in the vegetation of the semi-arid zones, together with the rather complete and increasingly intensive exploitation of the vegetative resources in this climatic zone, particularly in Africa, compel an integrated management approach. Here a somewhat arbitrary distinction is drawn at the 800 mm rainfall isohyet, which marks the minimum rainfall for profitable plantation establishment.** Thus, the semi-arid zone as referred to here is bounded by the 250 mm isoyhet (minimum for rainfed millet) and 800 mm isohyet.

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*Most forested land in the tropics considered by modern nation states to be public is also by tradition the home of ethnic minorities--hunters and gatherers, or shifting cultivators, or both.

**This criterion needs validation from areas other than the Sahel, and should be considered tentative.

In Sub-saharan Africa, where the empirical bounds for this definition of semi-arid have been observed, this zone is typified by acacia brush or "bush"; the baobob tree is also typical. The zone has been seriously degraded by a combination of drought, over-grazing, over-cultivation, burning and firewood exploitation. Nomadic values, tenure and grazing patterns have undercut the technical and political feasibility of range management, livestock management, and "forest" management. But an awareness that grazing and cropping intensities must be reduced is slowly building towards a commitment to total vegetation management, the only possible solution for ecologically feasible use of this fragile zone. It will require a major commitment of central governments and a major cultural change, especially for the free-ranging nomadic herders, but also for sedentary farmers who, with the exception of gum arabic trees, have not viewed trees or bushes as a crop.

AID experience in semi-arid zone vegetation management. In the 1950's and 1960's AID provided technical advisors in range management to several countries in North Africa and the Near East, including Sudan (1958-59), Morocco (1966 and before), and Iraq (1952-59). Their reports (Anderson, 1959; Carter, 1966; Wixom, 1959) noted the extreme degraded state of most range and the tendency to desertification, the receding perimeter of trees and vegetation around towns, soil erosion (a "national emergency" in Morocco), the encroachment of farming onto traditional grazing lands, the intractible problems of nomadism and collective or

tribal tenure in traditional grazing areas, and the destruction of forests by people and animals. The range management advisor to Sudan doubted the transferability of U.S. range management technology because of the following factors (Wixom, 1959):

- communal land tenure;
- low income and non-monetary nature of nomadism;
- aversion to cultivation;
- lack of education which "limits understanding";
- lack of incentives to practice range management due to mobility.

The advisor in Morocco (Carter, 1966) concluded that recommended stocking rates of 1/3 the actual rate would not pay for the roads, wells and re-seeding that would be entailed in an improved range management project. It would be cheaper to forego the expense and merely reduce grazing pressures. But the herder would have no incentive to do so--a typical "tragedy of the commons" circumstance, in which the individual user of a commons has no incentive to limit his use when others do not.

A more comprehensive approach was attempted in Tunisia, in the Watershed Planning and Management-Marginal Lands project (No. 664-11-120-018) carried out between 1959 and 1967, by means of a PASA with the Soil Conservation Service of the USDA. Twenty-nine man-years of technical assistance were provided between 1963-67, for carrying out soils and range surveys, and conservation planning on the 157,000 hectare Oued Marguellil watershed, in central Tunisia. Previous work by the French had been limited

to bench terraces, or "tabias". It was not considered feasible to extend these to the rest of the watershed to control erosion caused by over-grazing. The main achievement of the project appears to have been a series of soils maps and a watershed management plan. The problem of over-grazing was not solved, however. The government made no attempt to reduce over-grazing, and did not seem to have made the commitment to do so. Also problematical was the inability of the U.S. technicians to speak French, the lack of counterparts, and the extreme poverty and eroded condition of the region, which provoked the U.S. technicians to comment that it was not a good project area. The mission's program evaluation noted, however, that the conditions of the watershed were typical (AID, 1968).

More recent, AID activities in semi-arid zone vegetation management are being designed within the context of rehabilitation and development of the Sudan-Sahelian zone following the drought of the early 1970's. The Niger Forestry and Land-Use Planning Project (No. 683-0230) will seek a broad plan for an entire nation's natural resources, as well as the resources of 2/3 of its 200,000-plus hectares of forest reserves (occurring in 63 different pieces). Among the project's outputs are a natural resources inventory and a 20-year plan for the rehabilitation and protection of the nation's soils, water, vegetation and wildlife.

5. Parks and Wildlands Management

The apparent incongruities between assistance in parks and wildland management and assistance to the poorest of the poor, are resolved to some extent in Section 118 and Section 103 of the FAA. There are solid technical reasons for this kind of assistance as well. Ignorance of the tropical humid forest ecosystem will be dissipated only by continued research and basic studies of undisturbed forests. Parks and wildlands can provide the subject matter. Parks and other wildlands are also needed as living genetic banks of the tropical forest ecosystem. Park and wildland management can potentially provide employment for some rural families.

Concern over genetic losses (flora or fauna) and the imperative to protect representative areas of humid tropical forests is great among world scientists as well as sovereign stewards such as Brazil, Indonesia, Papua New Guinea. The rate of deforestation predicted in the next 20 years (18 to 20 million hectares per year, mostly of humid tropical forests), raises wildland preservation to the status of an international issue, deserving of U.S. assistance in bilateral aid as well as other avenues. The principal justification rests on the increasingly real concern for survival of the biosphere's biological capital.

In this category, AID could provide assistance in two ways: (1) through the environmental examination or assessment process (Regulation 16), by taking pains to review the impacts on wildlands

of planned development; (2) through direct support to governments or non-governmental groups working to conserve wildlands and manage parks. Also, AID could review the newly drafted World Conservation Strategy, being refined by the IUCN, where opportunities for bilateral assistance may be found.

U.S. experience in park and wildland management. A considerable range of practical and scientific work in parks and wildlands in LDC's has accumulated over the years, both within and outside of the government. AID has not been a channel for this work, however, present AID support to the U.S. Man and the Biosphere Secretariat may provide such an opportunity.

Within the government, the U.S. Park Service's Office of International Activities has been the focus for overseas technical assistance as well as for the very successful yearly travelling seminar on park management. The Park Service has extended technical assistance on a reimbursable basis to a number of middle income countries which are not recipients of bilateral aid, especially petroleum exporters such as Saudi Arabia, Iran, and Venezuela. Also through special treaties coordinated through the Department of State, the Park Service has on-going activities in Spain and Brazil, concerned with park and wildlife management.

Through the Smithsonian-Peace Corps program that lasted from 1972-1978, volunteers were fielded to work on park and wildlife management, and related research. This program was never evaluated, but the experiences should be reviewed for lessons of interest to potential AID support.

Of the non-governmental organizations, the African Wildlife Leadership Federation has a fairly long and successful history of conservation education and technical assistance to wildlife parks or preserves, mostly in East Africa. The World Wildlife Fund, U.S. Appeal, has suported special surveys and research on animals and their habitat, including assistance to the Brazilian government in the delineation of critical habitats in the Amazon Basin.

AID support for parks and wildlands management could be productively funneled through any one of these well-established channels of research and technical assistance. Support for expanded research and collection work by U.S. museums could also be considered.

6. Institutional Development

All of the foregoing interventions could require some measure of institutional development. Training of professional staff or counterparts, vehicles, maintenance of vehicles or equipment, office space, and secretarial and local/adminstrative staff are virtually standard and indispensable components to various forestry projects. They are usually shared by AID and the host government. This could be viewed as institutional strengthening in order to make an activity possible. There are also more general needs for institutional strengthening, aimed at longer-term and generic needs.

- Research, Data Collection and Related Training. The lack of success in tropical humid forest management and the underlying lack of understanding of forest ecosystem functioning point to an important research need. Linked to it is the requirement for special training oriented towards problems of tropical forest ecology and forest management. Unique and new approaches in agro-forestry also generate special training or educational needs. The orientation of agro-forestry towards satisfaction of subsistence needs brings a new dimension to forestry which in the past has been called ethno-botany or cultural ecology, and has been pursued mainly by research anthropologists or botanists. The approach of these disciplines must be incorporated into the background of foresters and agronomists who will in the future plan and manage agro-forestry projects. Surveys of local plants and plant lore, as well as exotic homologs, will be needed to establish a systematic and objective base of information for the diverse possibilities in agro-forestry. Research on the more complete utilization of tropical species is also needed, including conversion to alcohol as well as traditional uses.

  The establishment or improvement of information systems (technical libraries, user services, etc.) is a related generic need, especially in support of new kinds of surveys, research or projects. Training in librarianship and information systems could be a key need.

- Forest or Vegetation Surveys and Evaluations. Such surveys are especially critical in nations where deforestation or vegetative degradation has been observed to be rapid, but no objective survey has been accomplished to establish the rate and pattern; and in nations who have yet to take stock of their overall vegetative resources using modern mapping methods, such as aerial photo-interpretation or satellite imagery. Also nations who seek to develop a national vegetative or natural resource plan must depart from surveys and assessments.
  In semi-arid zones, inventories and monitoring of range conditions could be an important and useful ingredient in overall range management programs initiated by governments. Such surveys could support more comprehensive approaches to vegetative resource management in dry zones.

- Technical Assistance. Planning and programming capabilities may be weak in LDC forestry institutions, resulting in the slow or inadequate formulation of policy recommendations and related programs. Technical assistance in this area could be most strategic.

- Educational Programs and Institutions. Inadequate numbers and competence of professionals in forestry is a common problem. Lack of career opportunities and demand is likely to have held back indigenous training programs. However, the inevitable strengthening of LDC forestry institutions that will take place in the coming decades

will eventually generate the need for locally trained foresters, especially those at a lower level. Local programs could more effectively integrate new concepts of agro-forestry and community forestry, moreover, given the importance of social and cultural determinants.

- Private Initiatives. The activity of private groups, such as religious organizations or local groups concerned with forest or wildland conservation has been of great importance in the spread of conservation practices as well as specific innovations, such as community fuelwood plantations. Whether indigenous or international, private groups (or PVO's) may be performing important supplementary work to governmental institutions.

A number of PVO's are supporting reforestation.* Africare and CARE are active in the Sahel. The Church World Service is assisting to plant 31,000 hectares in Peru in collaboration with its local counterpart, the Servicio Evangelico Peruano de Accion Social (SEPAS). AID has supported these and other PVO's with Operational Program Grants.

To the extent that such private groups effect change which becomes integrated into community or personal behavior and practices, e.g. planting trees as crops, diffusion of new species, their contribution is of great significance.

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*A recent report compiled in Nairobi provides a detailed survey of the work of non-governmental organizations around the world: The Environmental Liaison Centre, Report on Non-Governmental Organization Activities on Environmental Issues Related on UNEP Programmes (Nairobi: The Environment Liaison Centre, 1979), 83 p. Forestry is not a major heading for the listing, however.

AID support of institutions. An example of institutional support in order to make possible project activites is the Integrated Rural Development Project of Haiti (No. 521-0078). The purpose of the project is to develop and test an institutional system and capacity to deliver resources and services to small farmers, inhabiting four critical watersheds. This $12 million project began in 1977 but is being redesigned and is scheduled for review in late 1979. Paradoxically, it assumed a greater institutional capacity than exists to absorb the project, and is being scaled down.

The forestry component of the project was minor: 50 small nurseries from which fruit trees and selected forest tree seedlings would be distributed for planting at the foot of bench terrace walls.

The Niger Forestry and Land Use Planning Project (No. 683-0230) illustrates support for planning and managerial capability in the National Forest and Water Service. The project's outputs include the creation of a central technical planning unit, the conduct of a natural resources inventory and yearly vegetation monitoring program, an educational campaign on deforestation and forest conservation (for government and the public alike) and the preparation of a 20-year plan for rehabilitating the nation's natural resources.

Educational support for the development of a national cadre of foresters is illustrated by the Upper Volta Forestry Education and Development Project (No. 686-0235), which will seek to train 40 students per class in a two-year lower level forestry agent training center (at Dinderesso).

A recently initiated project in Costa Rica will undertake institutional strengthening aimed at some of the longer term problems mentioned earlier as well as immediate needs. The purpose of the Natural Resources Conservation project in Costa Rica (No. 515-0145) is to strengthen the institutional mechanisms through which Costa Rica manages renewable natural resources. The outputs, or components of this $9.8 million loan project, will be:

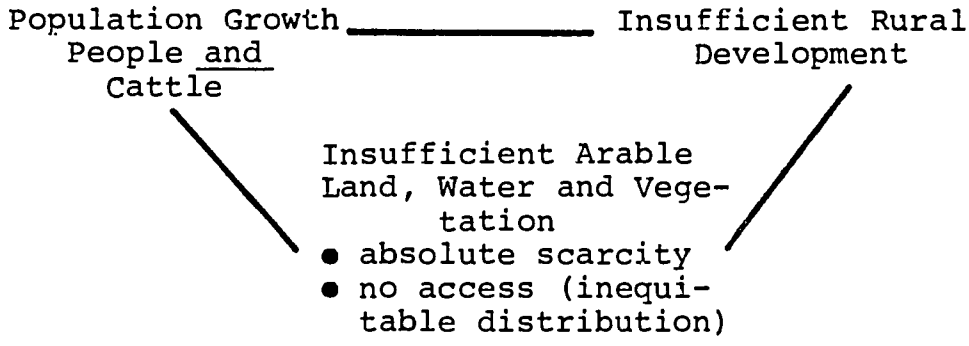
- policy analysis and research;
- pilot micro-watershed management project;
- reforestation and cattle management improvement pilot project;
- forestry production pilot scheme;
- resource management plans for five priority regions;
- development of conservation education in a national park.

The project is an interesting mixture of field work in the form of pilot projects with planning and program development or analysis. It is supported by strong public commitment of the Costa Rican government to the conservation of natural resources and the environment.

C. DEVELOPMENT CONTEXTS AND STRATEGIES

The incorporation of the various interventions mentioned in the previous section into AID project activities must, like all other design problems, seek to resolve local development needs and meet priorities of beneficiary governments or populations, in addition to being appropriate to local ecological conditions. A number of contexts for forestry interventions are presented, as a basis for different strategies and mixes of interventions.

At the outset it is useful, however, to remember the constellation of factors which is generating problems of deforestation and environmental degradation, especially population growth, rural underdevelopment and the limited supply of land, water, and vegetative resources.



This dynamic has at least three outcomes:

1) migration to cities

2) migration to forested areas or desert margins

3) over-exploitation of local natural resources:

   soils
   natural vegetation
   wildlife
   rivers or lakes

It can be appreciated that forests or natural vegetation absorb to some extent the pressures caused by this constellation of factors, but not unendingly. Deforestation and degradation are the ultimate result.

1. Rural Development Context

Forestry in the context of rural development is forestry for people and for the satisfaction of their basic needs.* This is a considerable departure from traditional or "empire" forestry, which sought to grow timber such as teak or mahogany for export, and which was antagonistic to the needs of rural people for food, land or forest products for local needs. This colonial legacy plagued the Indian forest service until recently. Throughout the world, forest guards are generally alienated from the rural populace. Forestry integrated with rural development in LDC's aims to exploit the special characteristics of tropical trees such as fast growth fruits, nuts, resins, nitrogen-fixing properties, or shade, in benefit of the welfare of rural people. People would not be forced to vacate land or be resettled en masse. (Relocation would, however, be a possibility in the context of critical areas such as important catchments, or very fragile areas--both discussed later as special cases.)

Forestry activities or landuses would therefore not be in competition with resources needed by rural people to survive and gain a livelihood. Thus, the more densely populated a region,

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*Industrial forestry, or the large scale commercial extraction and processing of woods contributes in some measure to rural development but usually the benefits have been ephemeral and the profits have been "exported", much the same as the case of mineral exploitation. Perhaps the most lasting impact is the construction of roads, by which people gain access to wilderness forests.

the more useful trees must be to people, since they compete with food crops. Trees with many values such as legumes that provide fruits, dry season browse, and enrich the soil (e.g. Acacias) would be preferred over trees with only fast growth to recommend them, e.g. the Caribbean pine or eucalyptus. (The conversion of all lands to tree crops would amount to the introduction of small holder plantation agriculture, e.g. tea, coffee, cacao, oil palm, which is not in the purview of this policy paper.) The total conversion of small farms to fast-growing timber or fuel wood species would be an extreme measure, probably justifiable only within the context of restoration of tree cover to a critical watershed, mentioned in the next section. More realistically, in the absence of critical environmental problems, new or additional trees would be planted in such a way as to improve the environment, production or food, and in general the living level of the rural dweller. As trees are a relatively permanent or long-term improvement, land tenure is an immediate issue, but equally important is the possibility of the tree generating more costs than benefits for the rural dweller. In regions of very small properties, or fields, large-crowned trees with dense shade, such as mangos or eucalyptus are likely to compete with food crops for space, sunlight and nutrients, and result in disadvantages to the rural dweller.

It is to be expected that more densely populated regions are likely to have fairly fertile soils and rainfall that is not in excess, e.g. Bali, Java, El Salvador. Soil erosion, not

fertility depletion, may be a more critical constraint on land use. Erosion control structures (bench terraces, contour planting, check dams) or special crops that protect the soil (e.g. pigeon pea) may be preferable to trees where arable land is scarce and erosion must be checked. In such circumstances, tree planting would be one of several techniques integrated into a rural development effort that would seek to both conserve or rehabilitate soil productivity while also increasing agricultural production.

In more humid regions, especially in the lowlands of the tropical world, population build-up is prevented by rapid nutrient depletion of the inherently poor clays that develop in this environment. It is in such regions that the shortened forest fallows of shifting cultivators are steadily degrading the natural vegetative and soil resources to the point of domination by noxious or virtually inerradicable weeds such as cogon grass (Imperata cylindrica) with the resulting loss of both agricultural and forestry potentials. Here agro-forestry may be the only way to stabilize and reverse this trend, while permitting a certain level of agricultural production. In this context the forest fallow re-growth would be enriched with species that grow fast and store nutrients rapidly (e.g. legumes such as Leucaena). This is the essence of the proposed agro-forestry project in the Philippines and more recent proposals made to the government of Sri Lanka, in connection with the Mahaveli River Basin development.*

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*Personal communication with Hugh Bollinger.

In the drier Sahel of Africa, the Acacia albida epitomizes a tree that contributes in many ways to rural welfare and development: soil enrichment, dry season browse and pods for cattle, and dry season shade but leafless in the growing season, due to its deciduous nature during rainy months. Thus, it is an ideal tree for millet and sorghum fields, and much esteemed by local farmers, who know its value. Not surprisingly, a CARE-sponsored Acacia albida tree planting project in Chad has been very successful.

Hilly uplands or steep but not critical portions of watershed occupied by ethnic minorities or culturally unique groups (e.g. different Indian groups in Mexico, ethnic groups in the Philippines, hill tribes of Southeast Asia) are possibly the most complex settings for undertaking rural development. Ethnic minorities are likely to be on the margins of monetary society, or completely subsistence-oriented. While a national government may desire to change their land uses so as to better conserve soils and run-off, or limit their scope of movement, what is the government offering in return?

An approach to the problem of incentives is illustrated in the work of two International Voluntary Services ecologists working in Papua New Guinea. During two and one-half years they have painstakingly studied indigenous plants and practices and through a great number of trials (80) are attempting to improve on traditional crops and cropping systems, including an effort to prolong the useful period of the plots of shifting cultivators.

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*Wayne and Betsy Gagne. Their experience is published in the I.V.S. journal Dialogue, Winter/Spring 78/79, "Seeking a Settlement in Shifting Agriculture", pp. 2-5.

2. Critical Areas

Critical areas as used here are of two types:

- Steep catchments with high rainfall and whose run-off is critical to downsteam water supplies.
- Very fragile and therefore easily degraded areas. Examples are areas of soils with very high erosion danger, (Southwestern Brazil), geomorphologically unstable areas subject to landslides or land slips (western slopes of Andean ranges), semi-arid regions with sandy soils (El Obeid, Sudan), very high rainfall areas with inherently infertile soils, and areas underlain with laterite (both occuring commonly in the humid tropical zone).

There is considerable U.S. expertise in the planning and management of critical catchments but hardly any in the management of forests or other vegetation in other critical environments.

Stabilization of these critical areas, i.e. prevention of erosion, vegetative degradation or desertification, is basically achieved by maintenance of forest or other protective vegetation whether entirely natural or in the form of plantations. While some measure of use may be permissible, e.g. collection of tree products, limited removal of logs, browsing/grazing, such uses would have to be carefully determined, alotted, and supervised. Still the relative importance of maintaining critical catchments in good condition or of preventing degradation of fragile areas, argues for a "top down" approach based principally on technical

imperatives, carried out by appropriately authorized institutions, and based upon technical studies and management plans.

Since these critical areas may be used or occupied by the most destitute of the rural poor, or the most alienated (e.g. ethnic minorities), particularly difficult social and human problems are posed by plans that limit or prohibit exploitation. An accompanying compensation or resettlement component may be crucial to the successful achievement of management goals, and being expensive and difficult, will require both policy and financial commitment. In practice this may be most difficult to obtain from governments. It would invite accusations of favoritism from persons in adjoining "uncritical" regions. Also, the expense may rank low in priority compared to more pressing needs, for instance of urban poor, or more profitable investments. Unless the consequences of degradation are socially or economically momentous--urban water supply or hydropower energy sources threatened--the removal of people and animals from critical areas is not likely to be eagerly carried out and enforced by government authorities.

An alternative to the top-down, compulsory removal or limitation of uses would be - hypothetically, at least - a bottom-up, or self-policing, approach, in which the populations who threaten the critical area are turned into stewards and caretakers of the areas. An incentive and appropriate management organization would have to be developed, such as limited access to the critical region

and community allocation of access rights, consistent with the fragility of the region. The government would have to retain the right to break such an agreement in case of abuses. Traditional peoples with prior claims on the lands in question may not agree that this is a valid government option, leaving an agreement with no teeth. Still, if politically and socially feasible, and if technical management goals can be achieved, self-policing could be cheaper financially and politically than compulsory removal and resettlement, or sanctions backed by police power.

In the Jamaica Integrated Rural Development project (AID-PLC/D-2256), 2,000 acres of a 5,000-acre critical catchment are settled, but the government has no legal authority to relocate the occupants. Consequently, it was planned that a subsidy would be paid the farmers to plant Caribbean pine (Pinus caribea). The high total cost of establishing pines on 5,000 acres, estimated to be about $1,100 per hectare, was in part due to the subsidies. (Pines would not be suited to agro-forestry schemes, since their litter produces an acid mulch.)

In the Philippines, where the government has identified 750,000 hectares of critically denuded watershed areas, forest villages would be established, that would:

> "collect and settle shifting cultivators, make the forest village community as the source of labor for reforestation and afforestation, encourage the people to grow agricultural crops in balance with tree plantations, and establish a new community which is easy to administer."*

*Program Summary, Presidential Council for Ecosystem Management. (Appendix No. 5, Agro-forestation Project Review Paper, Nov. 1976, Project No. 492 0306).

The program, which would have been aided by the delayed Philippines Agro-forestation project, emphasizes the planting of fast-growing species, such as Leucaena, by shifting cultivators, who would be able to continue traditional slash-and-burn farming, but on a more controlled basis and with fast-growing forest species. The social acceptability of this scheme for the ethnic minority groups occupying the critical areas was yet to be determined.

3. Degraded Zones

Desertification in the African Sahel epitomizes degradation, but denuded, severely eroded mountainsides (e.g. all topsoil gone), or formerly forested humid tropical soils dominated by cogon grass (Imperata cylindrica) are additional examples.

The salient technical feature of forestry activities in the restoration of degraded zones is the introduction of special trees or woody species (as well as grasses and forbs), which can grow in the degraded site and begin to restore its productivity. Exotics may be needed, but hardy native species may do as well or better, given total protection. Protection from fire, grazing, wind, and perhaps sun (by shading) may result in good spontaneous regeneration of native pioneer species. However, it may be essential to eradicate problem plants such as those which exude growth inhibiting substances or which, because of vigorous growth, exclude natural regeneration of more desirable species.

The planting of trees may be important to the restoration of degraded zones, but a number of complementary interventions are likely to be needed: structures to control wind or water

erosion (and allow vegetation to take root) as well as contain torrents; fences or guards to control grazing or cutting; weed control; special ground cover plants (e.g. Stylosanthes spp.); or special land treatment, such as herring bone berms to channel precious run-off in arid climates to the root zone of trees.

Because severely degraded sites are likely to be interspersed in small areas throughout a larger region in various degrees of degradation or overuse, interventions will have to deal with the people and animals in the environs that are causing or contributing to environmental degradation. The mini-deserts around well points in the Sahel or cultivated landscapes in the South American Andes being destroyed by gully erosion are illustrative.

Long-term alternatives must be considered, furthermore, since the restoration of productivity of degraded sites is likely to require more than five years, and as many as 15 or 20, depending upon ecological conditions and the degree of degradation.

A unique and powerful array of constraints come to play in the design of projects for restoring degraded environments. First and foremost, degraded areas are usually inherently fragile, and not too productive. If areas are degraded to the point of zero productivity (e.g. bare rock, drifting sand or hardened laterite), the technical and economic problems are unusually difficult and there may be no feasible remedy. If only partially degraded and still occupied by farmers or herders, most difficult social and economic constraints come to fore. Alternatives for

these people must be devised in order to ensure adherence to restoration plans, namely total protection of trees and other plants. Some people may have to be relocated. Others might remain, but in order to maintain the necessary level of food production, more production from smaller areas cultivated or grazed would have to be achieved, by means of better seeds, fertilizers and other modern inputs. If the farmed area per family is too small to generate a marketable surplus, there would be no financial return on the inputs. The economic losses to the government in the short-run would have to be justified by the gains in the long-run of an environment restored to former levels of productivity. This benefit would not be realized unless socially and ecologically feasible patterns of resource use were to be developed, something which has eluded the Sahelian nations so far, due to almost insurmountable social and political complications involved in common property resource use.

Similar constraints also occur in degraded environments in the humid lowland tropics and tropical mountains.

Thus, while special planting and conservation techniques are required in order to restore vegetative cover to the harsh conditions of degraded zones, the social feasibility of such efforts rests on the improvements of rural life in the environs, and on the evolution of long-term, sustainable resource use patterns in these zones.

4. Undeveloped Forest Environments

The contemplation of forestry activities in the context of the undeveloped wet tropical forest which occur over large areas in some LDC's presents a most unusual technical and economic paradox. On the one hand, these forests are underutilized--a concern which has resulted in a number of AID-sponsored studies. On the other hand, is the paradoxical fact that no one--neither ecologist or forester, whether in LDC's or developed countries--has yet devised a long-term sustained yield management technique for the wet tropical forest (ADB, 1978). Furthermore, ecologically and economically sustainable forms of land use based upon the continuous cultivation of short cycle food ("field") crops or on the raising of cattle have not yet been devised for the infertile zonal clays (oxisols) of the humid tropics. Farm and ranching failures in the Brazilian Amazon have lead the Brazilian government to rescind tax incentives which had been used to induce large corporations to convert the jungle to cattle ranches.*

In view of this situation, the most appropriate and productive actions that AID can support are those which would:

- Divert or diminish the flow of the rural poor (slash-and-burn cultivators) to intact forests, by providing them with alternatives or improvements in their lives.
- Stabilize the land uses and occupation of already cut forest areas, by developing or introducing ecologically

*Statement by the Brazilian Secretary of the Environment, Dr. Paulo Noguera Neto, at a World Bank seminar in Washington, D.C. on August 24, 1979.

sustainable forms of exploitation. Agro-forestry shows promise, assuming there is sufficient land (viz. Philippines agro-forestation project).

- Undertake long-term research on the ecology of the wet tropical forest ecosystem and its response to disturbance and various kinds of exploitation.
- Undertake research and surveys of indigenous systems of exploitation of humid tropical forests, especially in Asia.

In the drier regions of the tropics where plantation forestry is relatively well developed (especially the cultivation of teak, eucalyptus, Gmelina* and other fast-growing species), there has been less attention to the management of undeveloped or natural forests. But now this is considered to be an important option in the African Sahel, on forested sites with soils too poor to merit the expense of plantation. In lower rainfall zones, better management of woody vegetation may yield higher returns than the rather expensive establishment of eucalyptus plantations, whose growth below the 800 mm isohyet is too slow to be financially feasible.

AID support of management trials and related studies or research on forest ecology could contribute much to the better management of natural forests in the drier tropical life zones.

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*Gmelina and Caribbean pine are being planted in the wet tropics as well, e.g. at Daniel Ludwig's Jari operation in Brazil and in Indonesia.

D. SALIENT ISSUES AFFECTING PROJECTS AND PROGRAMS

A number of issues emerge as being particularly important in the consideration of projects and programs. They are briefly treated here since they have influenced the scenarios presented in the last section.

1. Social Feasibility of Forestry

Social factors are repeatedly cited as one of two principal obstacles to the success of projects. (The second is institutional constraints.) In other words, foresters have had a very hard time getting rural poor people to grow trees and to respect plantations or managed forest areas. The recent emphasis on community forestry* directly confronts the question of social feasibility.

The development of community-owned and managed fuelwood plantations is largely untested and subject to many potential difficulties: no available land; no cultural tradition of growing and harvesting trees as a managed, common property resource; no existing social mechanism to organize the endeavor; no way of achieving or ensuring equitable distribution of benefits; competition with labor, time and space devoted to food crops and more. Also, the great diversity of social and cultural forms in traditional rural communities of the world thwarts the generalization of present limited experiences (see Section B.1b).

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*Community forestry was a major theme of the Eighth World Forestry Congress (Jakarta, 1978) and is the topic of the 1978 FAO publication Forestry for Local Community Development.

However, community motivation and land tenure stand out as important features. The process of eliciting community participation is clearly of critical importance. The tools of rural sociologists and anthropologists must be employed. The general principles of introducing change or innovation--well tested by agricultural extension agents--must be followed, but with the caveat that the innovation (woodlot) is being introduced to entire communities, rather than individuals. Among any group of individuals can be found innovators and the informal leaders who pioneer change, but this principle may not operate in the same way for a number of villages - i.e., one or another being known as "modern" or innovative. Nevertheless, in Senegal, recent experience suggests that villages may emulate the woodlots established in neighboring villages. This has inspired a government strategy of subsidizing a few woodlots, but not publicizing the support, so that other villages will establish woodlots without help.*

There is a very straightforward relationship between secure land tenure and the desire of the landowner (or community) to undertake long-term improvements, such as planting trees or constructing terraces. Secure land tenure is an indispensable prerequisite to forestry done in the context of rural development. Since insecure or inequitable land tenure is a common constraint in rural areas of LDC's, special attention to this feature of project feasibility will be needed. It is a question that must

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*Interview in Washington, D.C. with el Hadji Sene, Director of Water and Forests, Ministry of Agriculture, Senegal. August 31, 1979.

be satisfactorily resolved in the project design phase.

2. Postponement of Benefits

These two issues are inherent to natural resources conservation and management, and must be adequately treated in forestry projects. Special solutions may be needed to provide income during the years needed for maturation of trees, or the regeneration of degraded areas. These years constitute an inescapable postponement of benefits to governments and to rural poor who would exploit these resources. The satisfaction of immediate needs of the rural poor through tree planting will be impossible in most places. Only exceptional trees on exceptional sites, such as the Albizzia plantations in Southeast Asia which grow seven meters in one year (NAS, 1979) will produce benefits of such immediacy that they are adopted without major subsidies, guarantees, or coercion. Measures with longer time delays are almost certain to require either some form of subsidy--especially to cover the opportunity cost of the land removed from subsistence forms of exploitation--or a companion development activity that compensates the time delay.

3. Continuity of Technical and Supervisory Effort

Continuity of administrative and technical effort--in the form of project monitoring and evaluation, and research development--will be essential to efficient and intelligent use of resources for forestry assistance in AID's program. The timeframe for visible results in forestry assistance is not less than five years* and is

*Project planning and the finalization of a loan grant agreement consumes at least one year and often two years.

more likely to be ten years or more. The usual two-year tour of mission and regional bureau personnel conspires against the maintenance of technical continuity. The result is "loss of memory" and loss of opportunities to realize the potential of projects.

One solution would be to exempt persons working in forestry (and related natural resources and environmental conservation activities) from the requirement to transfer to other regions or missions. A second alternative, is to situate the responsibility for long-term technical supervision and continuity of effort within the Development Support Bureau, from which periodic supervisory visits and evaluations of projects would be performed.

4. The Imperative for Comprehensive Management of Vegetation in Semi-Arid Zones

Nomadic grazing and semi-sedentary farming in Africa's semi-arid zones are ecologically sensible adaptations to the patchiness in space of grazing resources as well as the erratic fluctuations from year to year of the region's rainfall. But populations have exceeded the region's carrying capacity. Efforts to commercialize cattle raising and develop a more predictable forage supply together with development of rainfed farming are clashing with the old ways. The nomads who are themselves becoming increasingly entrepreneurial, but who have not relinquinshed their grazing migration patterns, are encountering fences or farms in what were traditional grazing corridors. Armed clashes have resulted. The vegetative resources are more severely exploited

or cut by all--both farmers and nomads. There seems to be no promising solution and no cultural adaptation to this conflict, which is destroying the vegetation of these fragile zones.

A national governmental program is probably the only feasible way to undertake the scale and scope of management activities required to achieve sustainable uses of semi-arid zone vegetation. However, the political will to curtail the movement and the herd sizes of nomads or the cultivation and more localized herding activities of relatively sedentary farmers may be wanting. What can a government offer in return? It must be development or an attractive alternative. Development interventions will be costly and politically difficult relative to the likely contribution to national economic growth. Alternatives such as city jobs or relocation to other, more favorable regions are likely to be equally difficult, and will not solve the original problem. Thus, we can only conclude that systems of sustainable uses of semi-arid zone vegetation must be discovered and adopted since the outcome of not doing so is desertification.

5. The Value of Self-Sufficiency

Like domesticated plants grown for food, woody bushes, trees and palms of many kinds contribute to the subsistence level of life. They supply products that perhaps would not be priority purchases if available in markets, and make it possible for the rural poor to achieve a measure of self sufficiency and quality of life that would not be attainable without increases in

cash income--a possibility that will elude most rural poor in LDC's in the coming decades.

A basic question is raised, whose importance is highlighted by the predicted divergence of growing rural populations (and basic needs) and the rate of development. That question is: What is the value to society (or governments) of self sufficiency of rural people living at the subsistence level? Or conversely, what is the cost of loss of self sufficiency? It may be calculated in terms of resource degradation, overwhelming number of migrants to towns and cities, or uncontrollable occupation and exploitation of fragile or critical areas that have remained unsettled--desert margins, very steep lands with forests or lands incapable of supporting large numbers of people or sustained production under existing technologies (e.g. humid tropical forests). The yearly $400 million cost of combatting and reversing desertification estimated by UNEP is indicative.

Self sufficiency cannot, of course, be achieved only by planting trees, nor are trees the panacea for land degradation, but trees are important--perhaps critical--for both. If land is too scarce and/or resources in rural areas too poor to justify agricultural modernization (cash crop farming with the increasing of incomes), then the achievement of a greater degree of self sufficiency through the better use of trees and tree products would be unquestionably preferable to attempting to control the movement of dislocated rural poor into catchments or forested areas too fragile (or ecologically valuable) to sustain food crop production.

The economics of self sufficiency will be a major question to review in any agro-forestry project. There is no conceptual difficulty, in fact. It is essentially contained in the question: What is the cost to society of doing nothing for the rural poor, the subsistence slash-and-burn farmers entering the lowland forest and the forested catchments and other vegetated zones? Deforestation and destruction of site productivity has a cost to society, but it may be very difficult to derive. Consequently, there will be the tendency to seek some more immediate financial or economic benefit within the context of agro-forestry activity, such as a marketable product (fuel, fruit, nuts, etc.). This may not be the best kind of production for the subsistence farmer, however, and his interest may be lost. Subsistence level slash-and-burn cultivators may have to alter their cropping pattern, but not necessarily to produce cash crops from forest or other tree species. The primary goal must be to increase his welfare, by making him more self-sufficient, whether it be through cash crop or subsistence crop production.

6. Agro-forestry--The Challenge of Diversity

Agro-forestry is a major conceptual advance in coming to terms with the great complexity and diversity of tropical ecosystems. In development thinking, agro-forestry constitutes a major breakthrough as well, since it is an accomodation with subsistence peoples, the poorest, the least-affected by the monetary economy, and the ethnic minorities--who in fact practice "agro-forestry" in their slash-and-burn cultivation and their use of trees.

Thus, ecological soundness and appropriateness to the needs of rural poor are operative principles in agro-forestry. Given the cultural variety and the wide range of ecological conditions in the developing countries, diversity will be the hallmark of agro-forestry. The improvement of unique traditional patterns of local crop and tree cultivation--possibly representing the most efficient and ecologically sound use of local resources--will require site-specific trials with exotics as well as local species. The likelihood of a replicable panacea--such as a combination of trees and crops--is low given the specificity of site conditions through a great range of environments. It is probably neither realistic or useful to aspire to one or two combinations or to harbor expectations of the kinds of universal innovations achieved in the development of high yield varieties of corn, wheat, and rice.

Centralized research will not suffice; many site-specific trials, perhaps following a general methodology, will be required. This is a major challenge to applied research in the agricultural and silvicultural fields, which until recently have emphasized the manipulation of genetic material or environmental factors in order to overcome the respective limitations of crops or the environment.

Since agro-forestry merges the disciplines of ecology, agronomy and forestry with sociology, anthropology and development administration in unique ways, and because its advance will require

investments in small-scale field experimentation in many site conditions, unique problems are posed for development assistance work.

- What are the priorities?
- How can small-scale research be designed and administered?
- How can research involving an enormous number of variables be cost-effective if it is small-scale and perhaps not replicable?
- How can human resources best be marshalled to develop agro-forestry?
- How can the effort be justified?

These and many other questions must be answered. The prospect is sufficiently complex to justify a formal effort at developing the process that could be followed to advance agro-forestry and the outlines of an AID effort in this important new area.

AID should consider the following minimum steps:

1) Sponsorship of a technical seminar on agro-forestry in cooperation with the International Council on Agro-foresty Research.
2) Commission a comprehensive study on agro-forestry with recommendations for AID's program.
3) Undertake a special in-house training effort on agro-forestry for AID personnel.

E. RECOMMENDATIONS

1. Overall Program Goals

Support the development of:

- Rural self sufficiency in wood fuel. Significant geographic units for self sufficiency would vary according to transportation costs, but in principle the ideal would be for every farm or every village to be self sufficient in wood.
- Wood fuel plantations for urban consumption in countries or regions with critical shortages of fuelwood.
- National level (or large area) vegetation resource management plans and strategies for the Sahel, and other large, semi-arid regions which are similarly degraded or fragile. Priorities could be derived from the desertification maps prepared for the U.N. Conference on Desertification in Nairobi, 1977.
- Agro-forestry, throughout the developing world. A special program design effort will be needed to orient AID efforts in this area. (See Section D.6.)
- The better utilization of the humid tropical forest (or high tropical forest), through more efficient extraction and processing, with certain conditions. The conditions would be:

  (1) the demonstration of or the development of an effective plan for preserving unique or fragile forest ecosystems.

  (2) The existence of a research effort for the determination of the effects of cutting on the forest ecosystem

in representative sites. Companion assistance projects could be provided in these areas, if needed.

- Research on the ecology of tropical ecosystems. Detailed recommendations on tropical ecosystem research are presented by the Inter-Agency Task Force on Tropical Deforestation.

2. Guidelines for Project Identification

First, in existing settled areas, efforts must be exerted to:

1) re-establish trees (and other permanent cover) in ecologically appropriate sites, as well as derive fuller benefits from them so as to achieve the greatest degree possible of self sufficiency in fuel, construction wood, food and other products provided by trees (or other permanent vegetation);
2) more fully employ trees for such ecological benefits as soil stabilization and enrichment, nutrient concentration and cycling, and modification of micro-climate;
3) better manage remaining forests or other natural vegetation so as to balance use intensities with growth potentials or carrying capacity.
4) restore trees or other appropriate permanent vegetative cover to hydrologically critical catchment areas.

Second, in agricultural frontiers, newly opened up by roads, efforts must be made to:

1) reduce or prevent destruction of forests on fragile sites.
2) preserve areas with unique or unusually rich genetic resources.

3) develop ecologically sustainable systems of farming and forestry.

4) record and learn the scientific bases for indigenous resource exploitation practices, and knowledge of plants, animals and local ecology.

Third, in undeveloped forests (wildlands) not yet made accessible by roads, research surveys and planning must be undertaken to:

1) determine if there are areas suited to human settlement, i.e. capable of sustained agricultural land use.

2) identify areas which should be preserved because of unique values and develop the associated plans and strategies for preservation.

3) determine ecologically feasible and economically sustainable forms of exploitation.

4) determine the ecological response to cutting and burning, and related disturbances that would be produced by forest exploitation and farming or grazing activites.

5) devise socially feasible management plans and strategies for appropriate uses.

6) record and learn the scientific bases for indigenous resource exploitation practices, and knowledge of plants, animals and local ecology.

Fourth, in areas or nations which are semi-arid or otherwise easily degraded, AID can assist in the preparation for overall vegetation management through support for:

1) Surveys and monitoring of vegetation resources.
2) research on the response of and vegetation to different intensities and/or patterns of use.
3) research and surveys of plant ecology (trees, bushes, forbs, grasses), including adaptations or changes due to fire, drought, over-exploitation.
4) studies of growth rates of different woody species alone and in typical associations.
5) trials with exotics.
6) preparation of overall goals and management strategies for vegetation resources and their utilization.

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APPENDIX

Private Voluntary Organizations Working in Forestry

Information compiled June, 1979, by the
Technical Assistance Information Clearing House (TAICH)

SELECTED LIST OF AGENCIES INVOLVED IN REFORESTATION
1978

The following agencies indicate in their program description for the 1978 TAICH Directory, U.S. Non-Profit Organizations in Development Assistance Abroad, that reforestation is included in their programs in at least some of the countries in which they work.

AFRICARE
1601 Connecticut Avenue, N.W.
Washington, DC 20009
(202) 462-3614

AMERICAN MIZRACHI WOMEN
817 Broadway
New York, NY 10003
(212) 477-4720

AUROVILLE ASSOCIATION
212 Farley Drive
Aptos, CA 95003
(408) 688-4173

BAPTIST WORLD RELIEF
1628 Sixteenth Street, N.W.
Washington, DC 20009
(202) 265-5027

CATHOLIC RELIEF SERVICES
1011 First Avenue
New York, NY 10022
(212) 838-4700

CHRISTIAN REFORMED WORLD RELIEF COMMITTEE
2850 Kalamazoo Avenue, S.E.
Grand Rapids, MI 49508
(616) 241-1691

CHURCH WORLD SERVICE
475 Riverside Drive
New York, NY 10027
(212) 870-2257

CLARETIAN FATHERS
Province of the East
221 West Madison Street
Chicago, IL 60606
(312) 484-2076

HADASSAH
50 West 58th Street
New York, NY 10019
(212) 355-7900

HESPERIAN FOUNDATION
Box 1692
Palo Alto, CA 94302
(415) 327-4576

IRI RESEARCH INSTITUTE
One Rockefeller Plaza, Room 1401
New York, NY 10020
(212) 581-1942

LUTHERAN WORLD RELIEF
360 Park Avenue South
New York, NY 10010
(212) 532-6350

MENNONITE CENTRAL COMMITTEE
21 South 12th Street
Akron, PA 17501
(717) 859-1151

PARTNERS OF THE AMERICAS
2001 S Street, N.W.
Washington, DC 20009
(202) 332-7332

SALESIANS OF ST. JOHN BOSCO (S.D.B.)
Province of St. Philip the Apostle
148 Main Street
New Rochelle, NY 10802
(914) 633-8344

SEVENTH-DAY ADVENTIST WORLD SERVICE
6840 Eastern Avenue, N.W.
Washington, DC 20012
(202) 723-0800

WORLD CONCERN
19303 Fremont Avenue North
Seattle, WA 98133
(206) 546-7201

WORLD NEIGHBORS
5116 North Portland Abenue
Oklahoma City, OK 73112
(405) 946-3333

WORLD RELIEF COMMISSION, INC. OF THE
NATIONAL ASSOCIATION OF EVANGELICALS
P.O. Box WRC
Wheaton, IL 60187
(312) 665-0235

The following agencies have not specified reforestation in their general program description but have mentioned related activities which suggest that forestry might also be a part of their work.

CANONS REGULAR OF THE ORDER OF THE HOLY CORSS (C.S.C.) P.O. Box 789 Hastings, NE 68901 (402) 463-3188	lumber coop
CAPUCHIN FRIARS (O.F.M.CAP.) Province of St. Augustine 220 37th Street Pittsburgh, PA 15201 (412) 682-6430	sawmills
THE CHOL-CHOL FOUNDATION FOR HUMAN DEVELOPMENT Friendship Station Washington, DC 10016 (no telephone number)	soil conservation
CHURCH OF THE BRETHREN GENERAL BOARD World Ministries Commission 1451 Dundee Avenue Elgin, IL 60120 (312) 291-1920	land and water conservation
SOCIETY OF ST. COLUMBAN (S.S.C.) St. Columbans, NE 68056 (402) 291-1920	land reclamation
FUTURES FOR CHILDREN 4401 Montgomery Boulevard, N.E., Suite 194 Albuquerque, NM 87109 (505) 881-6616	land reclamation
VOLUNTEERS IN ASIA Box 4543 Stanford, CA 94305 (415) 497-3228	alternative sources of energy
VOLUNTEERS IN TECHNICAL ASSISTANCE 3706 Rhode Island Avenue Mt. Rainier, MD 20822 (301) 277-7000	renewable energy sources

TAICH staff suggest that the following agencies might have some experience with the development of village wood-lots. Such experience, however, is not mentioned in their program descriptions.

ACCION INTERNATIONAL/AITEC
10-C Mount Auburn Street
Cambridge, MA 12138
(617) 492-4930

AGRICULTURAL MISSIONS FOUNDATION, LTD.
P.O. Box 1045
Yazoo City, MS 39194
(601) 842-4615

THE AMERICAN COMMITTEE FOR CAPE VERDE
14 Beacon Street, Room 506
Boston, MA 02108
(617) 227-2070

AMERICAN FARM SCHOOL
380 Madison Avenue, 22nd Floor
New York, NY 10017
(212) 490-8745

AMERICAN FRIENDS SERVICE COMMITTEE
1501 Cherry Street
Philadelphia, PA 19102
(215) 241-7000

COORDINATION IN DEVELOPMENT (CODEL)
79 Madison Avenue
New York, NY 10016
(212) 685-2030

FARMS
123 West 57th Street
New York, NY 10019
(212) 246-9692

THE FORD FOUNDATION
320 East 43rd Street
New York, NY 10017
(212) 573-5000

INSTITUTE FOR COMMUNITY ECONOMICS
639 Massachusetts Avenue
Cambridge, MA 02139
(617) 661-4661

INTERNATIONAL HUMAN ASSISTANCE PROGRAM
345 East 46th Street
New York, NY 10017
(212) 697-1960

INTERNATIONAL VOLUNTARY SERVICES
1717 Massachusetts Avenue, N.W.
Suite 605
Washington, DC 20036
(202) 387-5533

SAVE THE CHILDREN FEDERATION
48 Wilton Road
Westport, CT 06880
(203) 226-7271