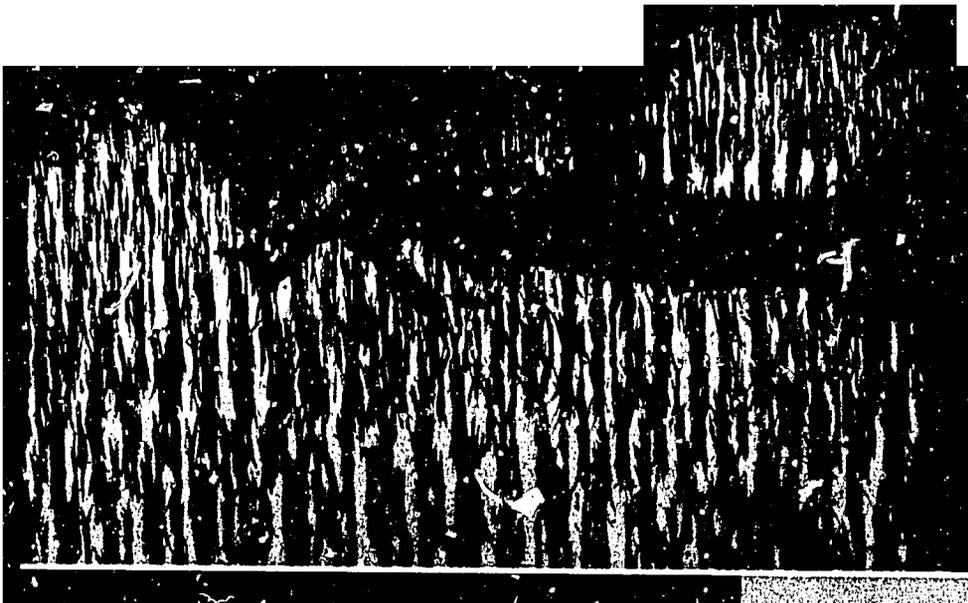
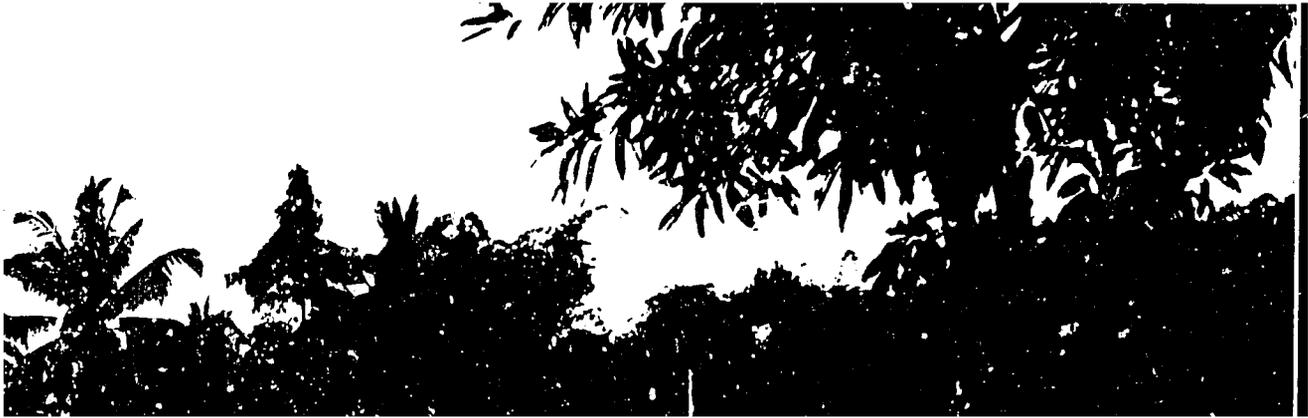


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*This booklet is dedicated to the memory of Dr. Sathit Wacharakitti,
whose life exemplified the ideals and goals of the Multipurpose Tree
Species Research Network.*

Networks are becoming almost indispensable in today's increasingly interdependent world as nations struggle to solve mutually shared problems. A scientific network can range from simple information exchange to germplasm exchange or scientific consultations to more complex, collaborative research. The latter type, which encompasses and integrates the other three, characterizes the Multipurpose Tree Species Research Network.

Network History

The Multipurpose Tree Species Research Network was established under the Forestry/Fuelwood Research and Development (F/FRED) Project. F/FRED is a 10-year effort begun in 1985 by the U.S. Agency for International Development (USAID), Winrock International Institute for Agricultural Development implements the Project under a Cooperative Agreement with USAID. When the second phase of F/FRED ends in May 1995, USAID will have invested over US\$ 21 million in helping establish the Network and supporting related research and training.

In deciding to finance the F/FRED Project, USAID recognized that, although research on multiple-use trees had been underway in parts of Asia for decades, little systematic research had been done to meet the needs of small farmers. The Agency and its Asian colleagues concluded that systematic research to improve neglected multipurpose tree species (MPTS) could yield significant benefits for small farmers.

Increasing Productivity of Multipurpose Tree Species, a 1984 workshop held in Kandy, Sri Lanka and supported by the International Union of Forestry Research Organizations (IUFRO), resulted in a

Blueprint for Action. Its objective was to develop and disseminate, within 10 years, technology to increase the productivity and usefulness of MPTS in sustainable land-use systems to improve the quality of life of the rural poor. The activities of the F/FRED Project have largely been guided by the recommendations of this workshop.

Priority MPTS were identified at the IUFRO workshop for research in three climatic zones. Following consultations with Asian forestry researchers and administrators, the F/FRED team recommended that the Project focus initially on priority species within two of these three zones.

Multilocation Experiments

Research cooperators began multilocation Network trials in the humid and subhumid and arid and semi-arid zones of South and Southeast Asia through formal agreements between their institutions and Winrock International. Since their initiation in 1987, these experiments have not only provided a focus for Network development but have also helped improve and standardize methods used in priority MPTS research. They have enhanced researchers' knowledge of site requirements, growth rates, management treatments, and yield of priority MPTS.

Humid and Subhumid Zone

The 1987 humid and subhumid zone trials were established at sites in Indonesia, Malaysia, Philippines, Taiwan (Republic of China), and Thailand. The trials were designed by Asian cooperators at a 1986 planning meeting in Kuala Lumpur, Malaysia. A randomized complete block design with four replications compared two genotypes each of three species: *Acacia auriculiformis*, *A. mangium*, and *Leucaena diversifolia*. Three management practices were also tested.

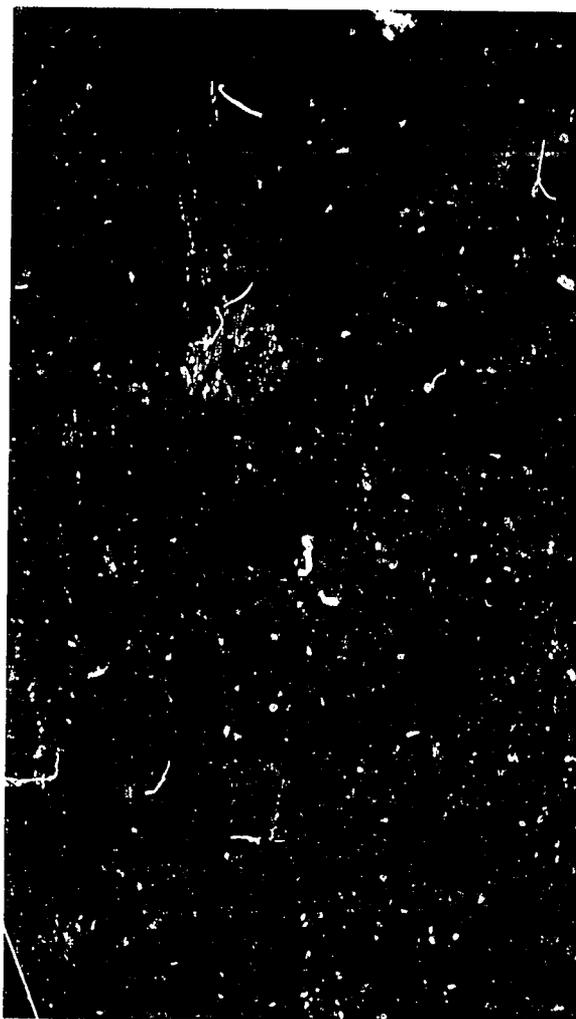
Achievement Highlights

- ▲ Establishing a dynamic network of Asian scientists who exchange research plans, methods, and results to benefit small farmers. *Example:* Active participation of Asian scientists from some 10 countries in multilocal field trials of fast-growing, multipurpose tree species
- ▲ Facilitating MPTS field research. *Example:* Development of Multipurpose Tree Research System 3 (MPTSys3), an integrated microcomputer information and decision support system
- ▲ Supporting MPTS research to benefit small farmers. *Example:* Awarding small research grants annually to enable national scientists to devote time to priority research topics
- ▲ Improving availability of genetic resources. *Example:* Establishing and maintaining seed orchards of psyllid-resistant *Leucaena* in five Asian countries
- ▲ Harnessing the expertise of biological and social scientists to the common objective of improving MPTS for resource-poor farmers. *Example:* Using results of socioeconomic studies on how farmers manage trees to help design multilocal field trials
- ▲ Using interdisciplinary research as a tool for community-based tree improvement. *Example:* Development of jackfruit (*Artocarpus heterophyllus*) sub-network and related pilot project
- ▲ Synthesizing results of regional MPTS field work to meet global research needs. *Example:* Cooperation of scientists representing six world regions to develop a standard methods manual for conducting and managing MPTS field research
- ▲ Incorporating gender analysis as an integral part of MPTS research activities to better understand the needs and preferences of producer and user groups. *Example:* Developing women's focus groups within community-based tree improvement activities of the jackfruit network
- ▲ Meeting needs of participating countries by linking with and strengthening national networks. *Example:* Responding to the expressed needs of the Sri Lankan national network to help it establish an MPTS secretariat and develop an agroforestry curriculum for the University of Peradeniya
- ▲ Strengthening cooperating institutions by linking their scientists who share research interests. *Example:* Twinning of the Universiti Pertanian Malaysia, Kasetsart University, and the University of the Philippines at Los Banos to conduct joint research on common timber species
- ▲ Ensuring a future of trained professionals equipped to advance MPTS research. *Example:* Educating biological and social scientists through Ph.D. training abroad, master's level course work in Asia, regional training, roving short courses in-country, and correspondence training at home
- ▲ Encouraging information dissemination and exchange of viewpoints. *Example:* Distributing *Farm Forestry News*, the Network's quarterly newsletter, which is received by MPTS researchers worldwide

A second set of three-year trials in the humid and subhumid zone was designed at a planning meeting held in Cha-am, Thailand in late 1990. Cooperators agreed to evaluate environmental factors by treatment interactions; estimate the economic yield of fuelwood, fodder, and small timber of MPTS under farmer-oriented management practices; and formulate recommendations to improve farming practices.

Field Trial Features

- ▲ *Common design and standardized methodology,*
- ▲ *Common minimum data set,*
- ▲ *Common germplasm,*
- ▲ *Same experiment on multiple sites,*
- ▲ *Classification of soils and documentation of climate patterns at each site,*
- ▲ *Data exchange and professional interaction between participants, and*
- ▲ *Combined analysis of multiple-site data.*

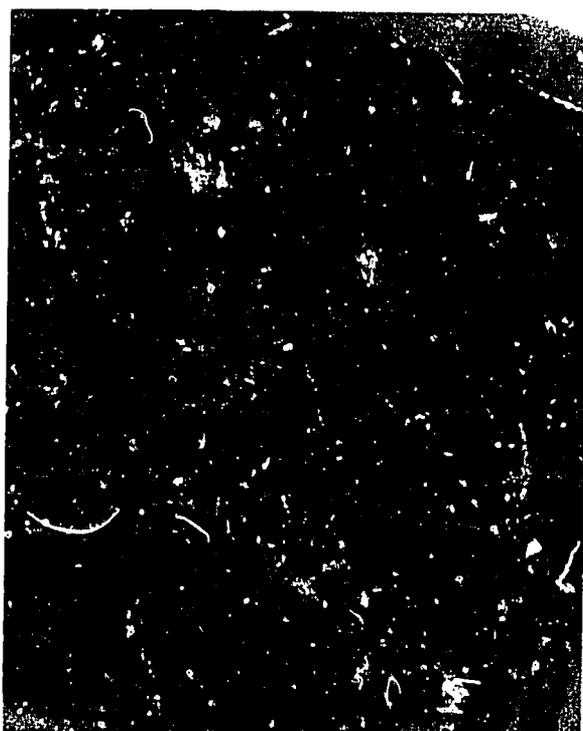


Soil sampling of 1991 Network trial site in Thailand

Field Trial Objectives

- ▲ *Evaluate promising species and subspecies through assessment, management, and improvement studies;*
- ▲ *Strengthen tree improvement through seed collection, interdisciplinary study, and collaboration with complementary organizations;*
- ▲ *Improve and standardize research methods on MPTS for fuelwood, fodder, and other agroforestry uses; and*
- ▲ *Investigate management problems of fuelwood, fodder, intercropping, and optimum silvicultural practices for small farmers to use.*

Seed collected for multilocation experiments is sent to each cooperator.



Like the 1987 trials, this multilocation experiment design is a randomized complete block with four replications. The factorial treatment design includes two genotypes each of two species: *Acacia auriculiformis* and a *Leucaena* hybrid. The three cutting regimes are pruning at 12 and 24 months, thinning at 24 months, and a control treatment of no cutting. Unlike the 1987 trials, however, the scope of the 1991 trials is broader, including two sites in Cos-

ta Rica as well as regional sites in Indonesia, Malaysia, Philippines, Sri Lanka, Taiwan, and Thailand.

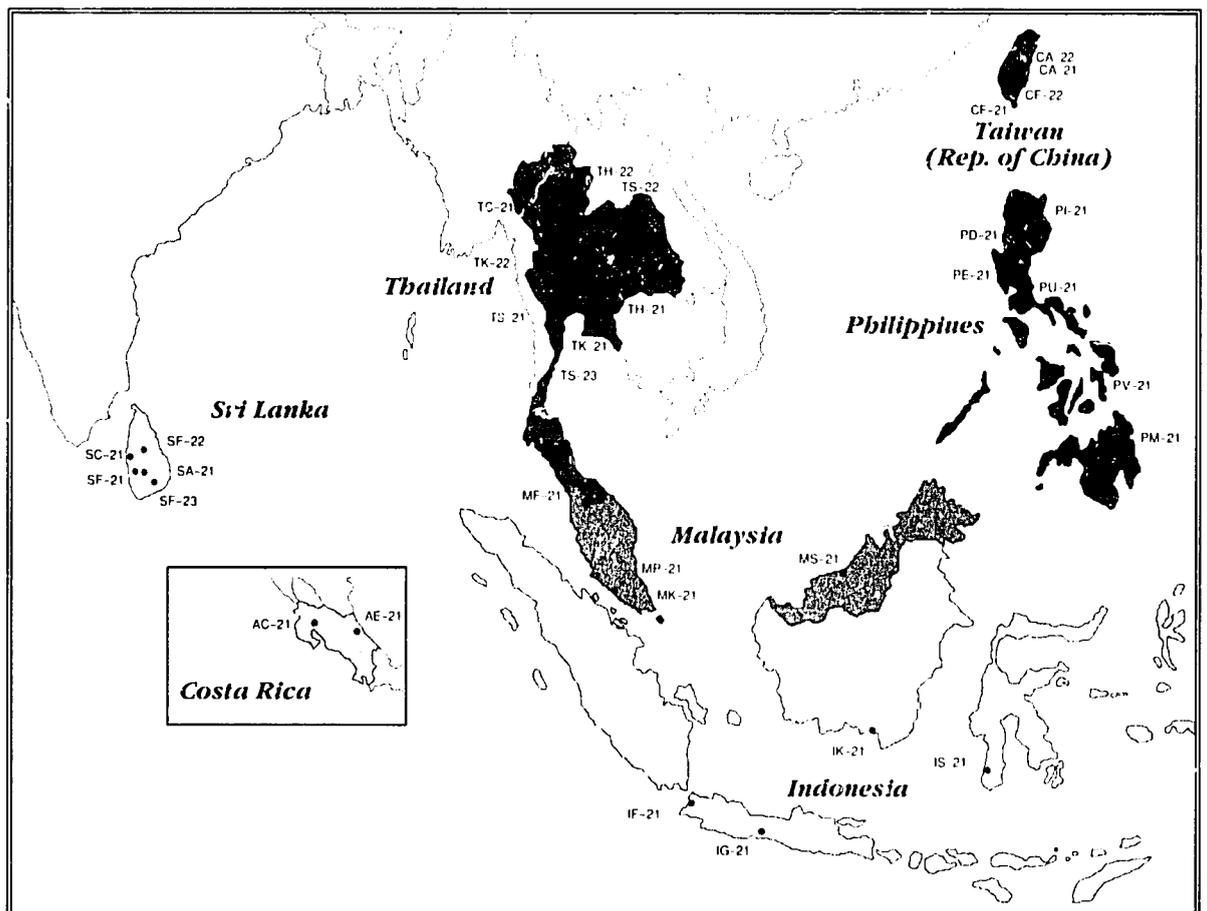
Cutplanted *Acacia auriculiformis* at 1991 trial site in Chachoengsao, Thailand



Nursery seedlings of *Leucaena* hybrid (left) and *Acacia auriculiformis* (right) at 1991 trial site in Costa Rica



F/FRED 1991 humid-subhumid trial sites



Arid and Semi-Arid Zone

The 1989 arid and semi-arid zone trials, designed by cooperators at a planning meeting in Kathmandu, Nepal, were to be established on sites in India, Nepal, Pakistan, and Sri Lanka. The trials were a randomized complete block using a factorial of four species and two pruning regimes. *Dalbergia sissoo* and *Eucalyptus camaldulensis* were selected for the semi-arid zone sites, *Prosopis pallida* and *P. cineraria* were chosen for the arid-zone sites, and *Acacia nilotica* was selected for both zones. Each cooperator was asked to choose an additional species. As a result of poor seed germination and the need for closer monitoring of these trials, cooperators extended most experiments until 1995 to yield more meaningful data.

Provenance Trials

F/FRED is also supporting international *Acacia auriculiformis* provenance trials in Malaysia, Philippines, Taiwan, and Thailand. These trials began in 1989 using seed collected with the Australian Centre for International Research (ACIAR). This important collection now serves as the basis for provenance evaluation of *A. auriculiformis* in the humid tropics. Results from sites in Thailand show clear differences among provenances in growth and form, with provenances from Queensland and the Northern Territory performing as well as those from Papua New Guinea on some sites.

ACIAR and F/FRED staff are working together on follow-up activities, including data compilation for intersite analyses, obtaining a standard assessment of tree form from trial cooperators, exploring other uses for the species, and management strategies needed for given products. An annotated bibliography on *A. auriculiformis*, commissioned by F/FRED and the Commonwealth Scientific Industrial Re-

search Organization (CSIRO), was completed in 1990.

To help define future directions of Network efforts on *Acacia* species, the Consultative Group on Research and Development of *Acacia* (COGREDA) was formed in 1991. In mid-1992, Kamis Awang, the MPTS Network Specialist, will chair a meeting of COGREDA to review existing research, assess urgent research needs, and develop strategies for promoting research and development.

Other Trials

F/FRED supported collections of *Dalbergia sissoo* seed from the species' natural range in Nepal and Pakistan in 1989. The following year, seeds from 13 provenances were sent to participating scientists in India, Nepal, and Pakistan. In 1991, an annotated bibliography was published. A regional research plan on *D. sissoo* was developed to help coordinate research between India, Nepal, and Pakistan—countries in which the species is indigenous.

Plantek International, a private corporation in Singapore, has managed a series of international field trials comparing growth of tissue culture plantlets with seedlings from the same parent stock. Protocols have been established and work on the trials has begun in India, Malaysia, Nepal, Philippines, and Thailand. Species tested include *Acacia mangium*, *A. auriculiformis*, *Leucaena leucocephala*, *Eucalyptus camaldulensis*, and *Dalbergia sissoo*.

Research Support

Multi-country field tours are coordinated by the Network Secretariat, which is located in Bangkok, Thailand, in conjunction with Network experiments. These tours facilitate review and refining of standard methodologies, as well as firsthand exchange of ideas and information. Bian-

nual site visits by the MPTS Network Specialist provide technical assistance to cooperators and ensure close monitoring of trials.

Manuals and training videos describe the methods used in the multilocation trials. A standardized methods manual, which was jointly supported by the F/FRED Project and the International Centre for Research in Agroforestry (ICRAF), contains general guidelines on methods for MPTS field research.

Network Flexibility Pest and Disease Control

A network's ability to respond to urgent, widespread problems helps determine its success. Solutions are often found sooner through collaborative research than by individuals or institutions working in isolation. The regional plan developed to control the *Leucaena* psyllid (*Heteropsylla cubana*), for example, shows how the MPTS Research Network successfully coordinated research on a critical topic.

The psyllid had seriously infested *Leucaena leucocephala* throughout Asia and the Pacific by the mid-1980s. The need for scientists to cooperate, share information, and integrate research efforts was essential to quickly overcome this serious problem.

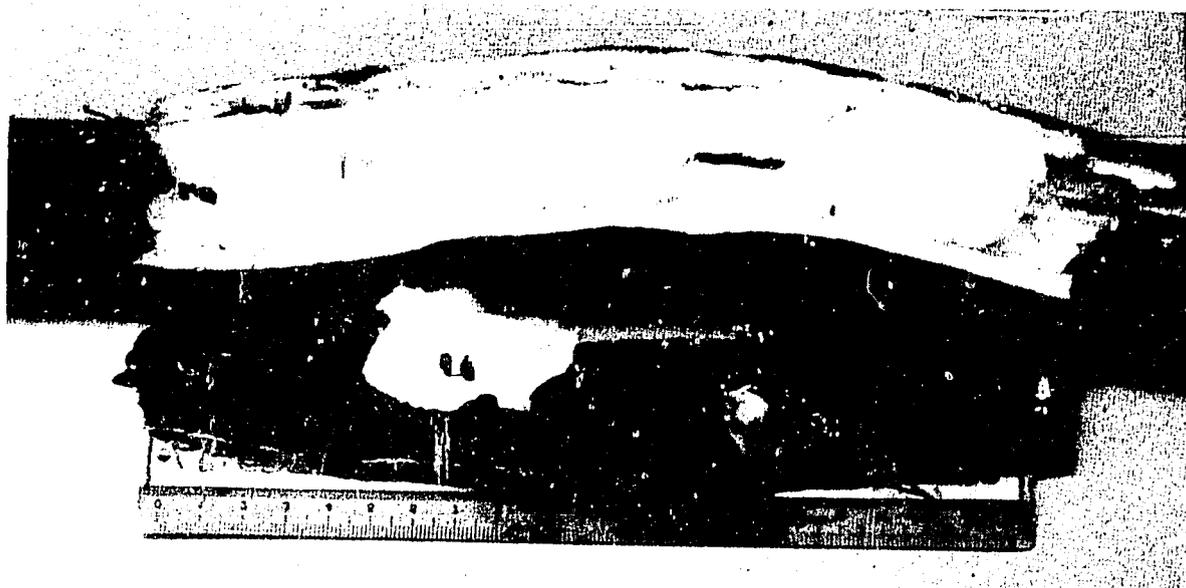
The F/FRED Network Secretariat, working with a psyllid advisory team, sponsored a series of national and regional meetings. This series culminated in a regional research plan that summarized national programs and recommended research support. This was an important step in identifying gaps in the range of urgent topics. F/FRED, USAID, and the International Development Research Centre (IDRC) used the plan as a basis to fund psyllid research.

Malaysia, Philippines, Taiwan, and Thailand have conducted psyllid studies under the regional program. Grouped according

to national research priorities, these studies have included psyllid ecology and life history, biological control agents, economic thresholds of infestation, socioeconomic effects, and development of integrated pest-management programs. Results of these studies have been published in international scientific journals, workshop proceedings, and as graduate dissertations. By late 1991, a simplified sampling method for monitoring psyllid populations had been tested. Psyllid predators had been identified, distributed, and established in the field in several countries. Also, potential biological control agents had been identified.

The psyllid problem has forced tree breeders to discover or develop species varieties and hybrids resistant to or tolerant of the pest. To this end, F/FRED supported seed collections in Indonesia. The Project contracted the Nitrogen Fixing Tree Association (NFTA) in Hawaii to work with Asian organizations to establish and maintain seed orchards of promising species and species hybrids. Scientists in India, Indonesia, Philippines, Taiwan, and Thailand have established seed orchards of psyllid-resistant *Leucaena* under the *Leucaena* Seed Production Program managed by NFTA. Under this program, improved genetic resources are adapted to conditions in each country. Seed produced by these orchards are provided to other Network cooperators through a distribution arrangement with NFTA and the Network Secretariat. The Network also plans to make improved seed available to non-governmental organizations (NGOs) and other such groups that work directly with farmers in tree-growing programs.

More recently, wilt disease of neem (*Azadirachta indica*) has become a problem in West Africa. Working through a formal agreement with the Centre Technique Forestier Tropical (CTFT) of France, the Network Secretariat is developing inter-



Inga edulis, an important multi-purpose food species, produces a sweet fruit with edible pulp; seed germination without storage is nearly 100% after one week.

regional collaboration between Asia and Africa on the species. Network cooperators in India, Pakistan, and Thailand will collect and process seed, which will then be shipped to countries in West Africa for testing. Both regions will participate in coordinated provenance trials and germination studies.

Recalcitrant Seed

Adoption of many useful MPTS is limited because their seed is short-lived or germination is recalcitrant. For example, *Inga edulis*, an important species from Central America, failed in Network trials because of poor seed germination. Other important food species in Asia like *Artocarpus heterophyllus* (jackfruit) could not be included in trials for the same reason. This problem has challenged researchers to begin examining ways to handle and transport the short-lived and recalcitrant seed of some MPTS. Initial efforts will focus on *A. heterophyllus* for the humid and subhumid zone and *Azadirachta indica* (neem) for the arid and semi-arid zone.

Twinning Programs

Scientists working on common research problems benefit from the Net-

work's ability to pair or "twin" scientists from various institutions at national, regional, and global levels. Such linking has strengthened the regional Network by sustaining dialogue and cooperative action to meet common needs. Areas of work include curriculum development in the social sciences, joint supervision of graduate-degree programs, and coordinated research on species and soil conditions common to participants' countries. Most recently, the Universiti Pertanian Malaysia (UPM), University of the Philippines at Los Banos (UPLB), and Kasetsart University Faculty of Forestry (KUFF), through an F/FRED twinning agreement, are conducting joint research on common timber species, writing a field text on social forestry, and organizing a 1993 symposium centered on MPTS and quality of life.

Neglected Research Needs

Farmers plant trees not only to meet household needs but also to earn income. To date, little research has focused on MPTS utilization. At a 1991 Project-sponsored workshop in Taiwan, cooperators developed a framework for a regionally coordinated research program on non-wood products from MPTS. Scientists from five Southeast



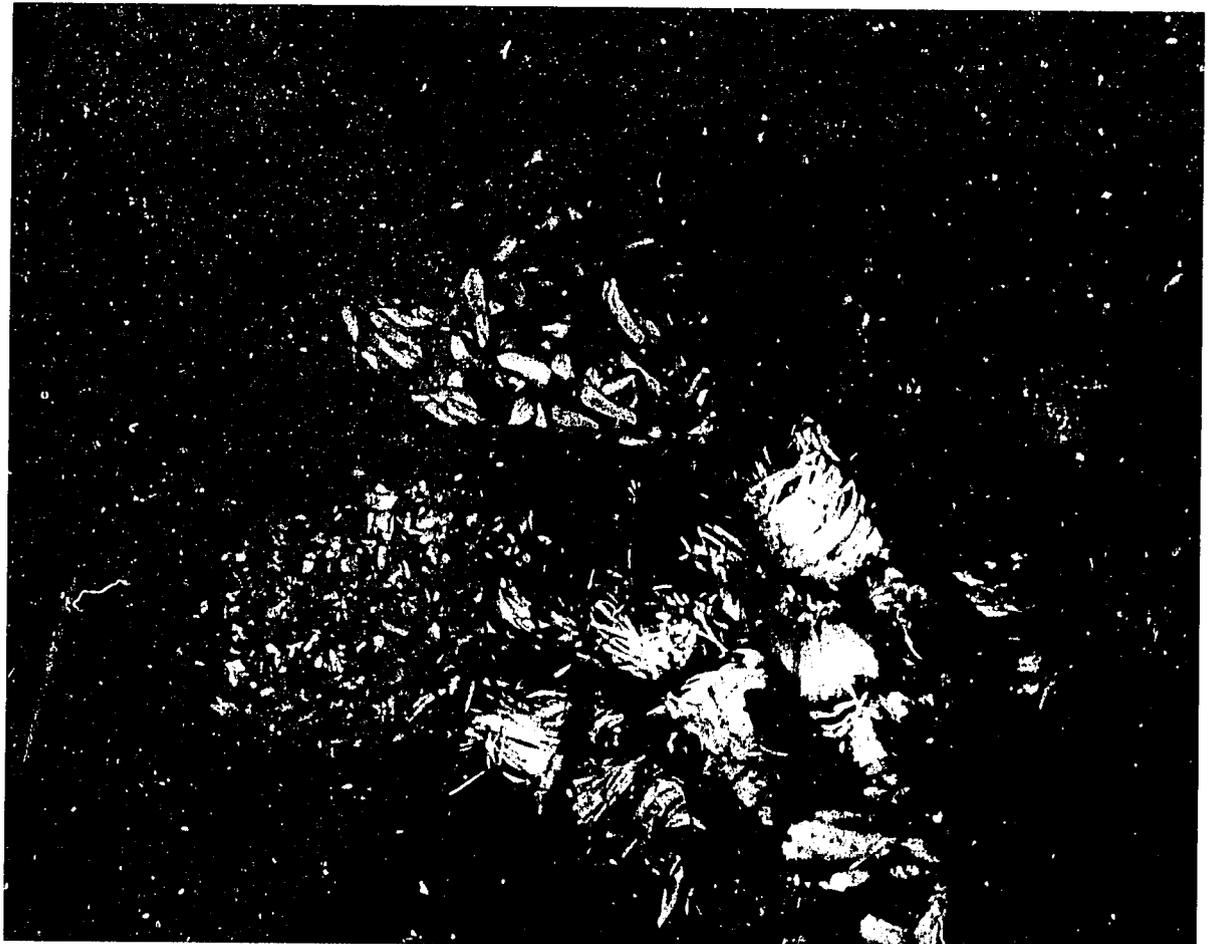
Tree parts are sold for medicinal uses in Chiang Mai, Thailand.



Asian countries are participating in this program, known as the MPTS Utilization for Small-Farm Development (MUSFAD). Criteria for national research studies are relevance to small-farm use, economic significance, and support for sustainable land use.

The gender dimension of MPTS production and use has been little understood by many MPTS researchers. Although the F/FRED Project has fostered social-science activities out of which an awareness of relevant gender issues has grown, the Network Secretariat wanted to translate this awareness into action. In early 1992, the Secretariat submitted a proposal to the Women in Development (WID) Office of AID. The proposal's goal is to strengthen, expand, and link ongoing efforts in gender analysis; add a gender analysis component to selected research activities that lack a gender focus; and, where appropriate, introduce WID orientation into Network action-research initiatives. By strengthening gender analysis, scientists are more likely to understand the needs of MPTS producer and user groups.

Important non-wood products of jackfruit (*Artocarpus heterophyllus*) (left to right): cleaned seeds for boiling, finely cut flakes for cooking, fresh fruit flakes, husks for goat and cattle feed, and seeds for planting



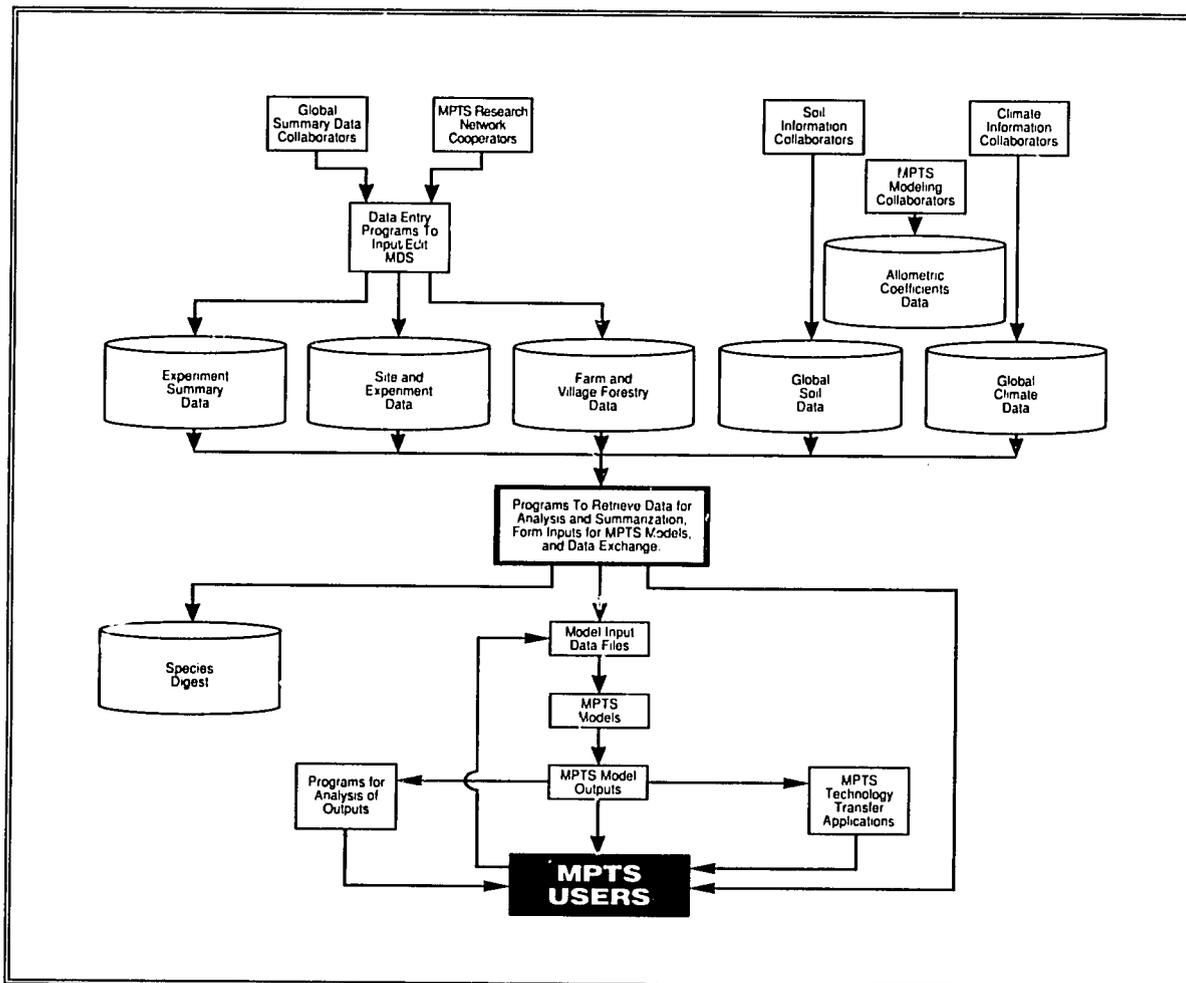
System Support

The Multipurpose Tree Research System, version 3, (MPTSys3), is an integrated microcomputer information and decision support system designed to support the MPTS Research Network as well as global research. Developed by the F/FRED Project's Global Research Systems Staff, MPTSys3 grew out of the earlier Information and Decision Support System (IADSS) developed by the Staff in the first five-year phase of F/FRED.

By being both user-friendly and decentralized in nature, MPTSys3 can help scientists organize their data for better research analysis and publication of results, as well as assist in decision-making about MPTS. The experiment database, the flagship program of the system, has supported the Net-

work's multilocational trials since 1987. Known as MPTData, the experiment database not only allows easy data exchange of Network experiments among researchers but can also be customized to include data from non-Network trials to meet independent research needs.

For example, a graduate student involved in an F/FRED-supported Network trial can store and analyze data of his or her own thesis experiment within MPTSys. The student can then relate such thesis measurements as leaf area to leaf biomass measurements of the Network experiment. MPTSys can estimate parameters of equations for predicting leaf area and then evaluate these predictions by accessing similar Network trials stored within the system.



Schematic of MPTSys component relationships

MPTSys Components

Research Databases

- MPT DATA** Experiment Database
Stores experiment/trial data at the stem, tree, and/or plot levels. Also stores site characteristics. Creates analysis data sets for MPTModel and MPTStat.
- MPT INFO** Summary Database
Stores experiment/trial data at the treatment summary level. Creates analysis data sets for MPTModel and MPTStat.
- MPT SOIL** Soil Database
Stores chemical and physical characterization data of tropical soils at the horizon level. Creates input files for MPTGro and MPTModel.
- MPT CLIM** Climate Database
Stores long-term climate data as monthly means. Creates input files for MPTGro and MPTModel.
- MPT WTHR** Weather Database
Stores daily weather values. Creates input files for MPTGro.
- MPT FARM** Farm and Village Forestry Database
Stores socioeconomic data at household, village, district, and national levels.

Decision Support Programs

- MPTStat** Data Analysis and Modeling
Provides statistical procedures for data summarization, inference, and graphics. Accepts inputs from the experiment and summary databases.
- MPTGro** Growth Simulation
Provides tree growth simulation with or without water stress. Accepts input from the soil, climate, and weather databases.
- MPTModel** Species* Environment Modeling
Provides environment by species performance prediction analysis. Accepts inputs from the experiment, summary, soil, and climate databases.

Reference Databases

- MPT PROS** Specialist Database
Stores information about MPT professionals.
- MPT DOCS** Abstract Database
Stores citations and abstracts.
- MPT SPP** Species Digest
Stores species characteristics and environmental requirements.

Recent efforts in software development have honed the performance and usefulness of MPTSys by improving the databases and strengthening ties between applications. The system now contains integrated, stand-alone database/decision support subsystems as well as stand-alone databases. Stand-alone subsystems, initially defined through discussions with Network scientists, link system components for specific user groups: individual experimenters, growth modelers, technology transfer agents, and international researchers. Data links allow the transfer of information between components and control links allow execution of one program within another.

Subsystems

The experiment subsystem consists of the experiment database (MPTData), the summary database (MPTInfo), and data analysis and modeling (MPTStat). MPTData and MPTInfo provide data sets as input to MPTStat, which gives statistical procedures for data summarization, inference, and graphics. The data summaries are then transferred to MPTInfo.

MPTModel, an interactive decision support package, examines environment by genotype interactions and provides performance prediction analyses. As a subsystem within MPTSys, it accepts inputs from the experiment, summary, soil, and climate databases. Tailored to the design of Network multilocational trials, MPTModel allows a series of experiments with standardized treatment design to be combined and analyzed in an intersite analysis for evaluating the consistency of species and management performance across environments. Both MPTStat and MPTModel help Network cooperators eliminate the time-consuming steps of forming and entering a data set into a decision support package, providing them easy-to-use yet sufficiently flexible inter-

active analysis packages to handle a wide range of research design situations.

For example, researchers participating in the *Acacia auriculiformis* provenance trials can use the decision support system MPTModel to delimit data to sites within particular moisture environments; they can also note the interaction of sites with provenances. Using the data MPTSys provides on seed origin and site weather, cooperators can improve provenance recommendations for different moisture environments.

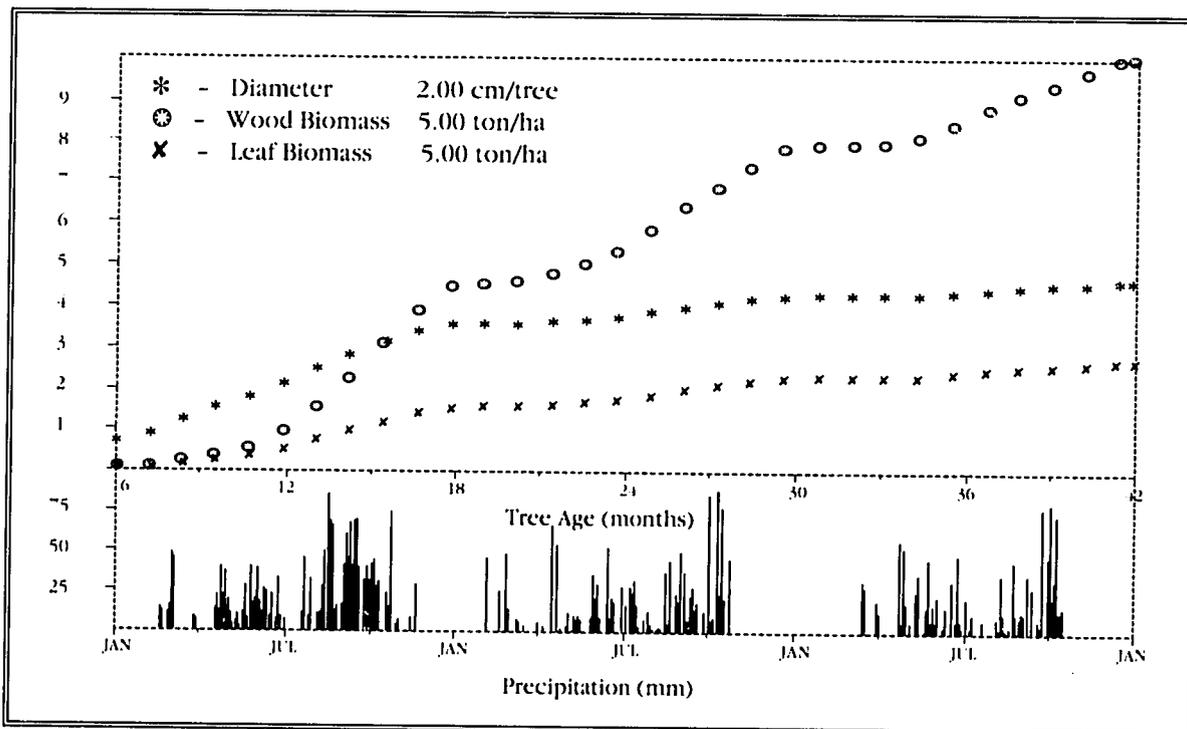
MPTGro is a computer model designed to simulate multipurpose tree growth under a variety of management and environmental conditions. For example, users can quantify trade-offs between species and planting density in terms of wood and foliage biomass production. As a subsystem within MPTSys, MPTGro accepts data inputs from the system's soil, climate, and weather databases to help decision makers match appropriate MPTS with environments.

Allometry, the relationship between the growth rates of different parts of an organism, and light interception are the main conceptual components used to simulate growth in MPTGro. The interaction of allometry and light interception determines growth over time. Using MPTGro, researchers and teachers can compare field observations to a formally defined representation of concepts that may otherwise be vague. One can see when rates are changing and how water stress influences growth rate over time.

MPTFarm, the farm and village forestry database, stores socioeconomic data at the household, village, district, and national levels. It can be used to improve regional and global understanding of the biophysical and socioeconomic conditions under which small farmers grow multipurpose trees. A biological scientist, for example, could determine which species Sri Lankan farmers prefer for fodder and which they actually use. Or a social scientist could find out who is responsible for collecting household fuelwood and how often they do it.



Simulated tree growth of *Acacia auriculiformis* (5000 trees/ha)



Global Links

MPTSys is recognized by organizations in the international forestry community as a promising vehicle for global management and exchange of MPTS information. Collaboration with other research organizations has focused on issues of global entry, exchange, and use of summarized MPTS research data. A global subsystem prototype will be distributed to international organizations. Future versions of MPTSys may include complementary decision support packages developed by such organizations as the Centro Agronomico Tropical de Investigacion y Ensenanza (CATIE), Commonwealth Scientific and Industrial Research Organization (CSIRO), International Centre for Research in Agroforestry (ICRAF), Nitrogen Fixing Tree Association (NFTA), and Oxford Forestry Institute (OFI).

John Raintree, Network Social Scientist, and Anoja Wickramasinghe, Lecturer in Geography at the University of Peradeniya and Network cooperators, confer on possible extension study in Sri Lanka.



Integrating Disciplines

Effective networking pulls together widely scattered researchers from diverse disciplines so that they may learn from each other. A unique dimension of the MPTS Research Network has been its ability to harness both biological and social-science resources to the common objective of improving MPTS for resource-poor farmers.

The Regional Farm and Village Forestry Study was initiated in 1989. This was an important first step in the systematic, comparative analysis needed to help predict possible patterns of tree and forest-use practices in areas of South and Southeast Asia under similar social and economic conditions.

The preliminary analysis was conducted by 13 scientists in 26 villages of Bangladesh, Indonesia, Nepal, Philippines, Sri Lanka, and Thailand. It revealed several general trends in the ways farmers in those countries use trees. Farm households preferred trees that also produce food, mainly fruit. All but three of the 10 top-ranking MPTS were reported as having at least locally important food uses by farmers in the study. This result suggested that food and fruit trees should be studied for their other uses, such as fuelwood, timber, and many other products. Conversely, study data revealed that no less than 150 of some 400 MPTS mentioned by the farmers have important food uses.

One of the most surprising findings of the study was the range of perceptions about tree uses. Farmers in Sri Lanka and Bangladesh, for example, valued jackfruit more for fodder than human food. In Bangladesh, mango was mentioned more often as a fodder than as a fruit tree. Although farmers in Bangladesh regard jackfruit as almost a staple food, they more highly value its timber than its fruit. In Indonesia, villagers reported coconut as

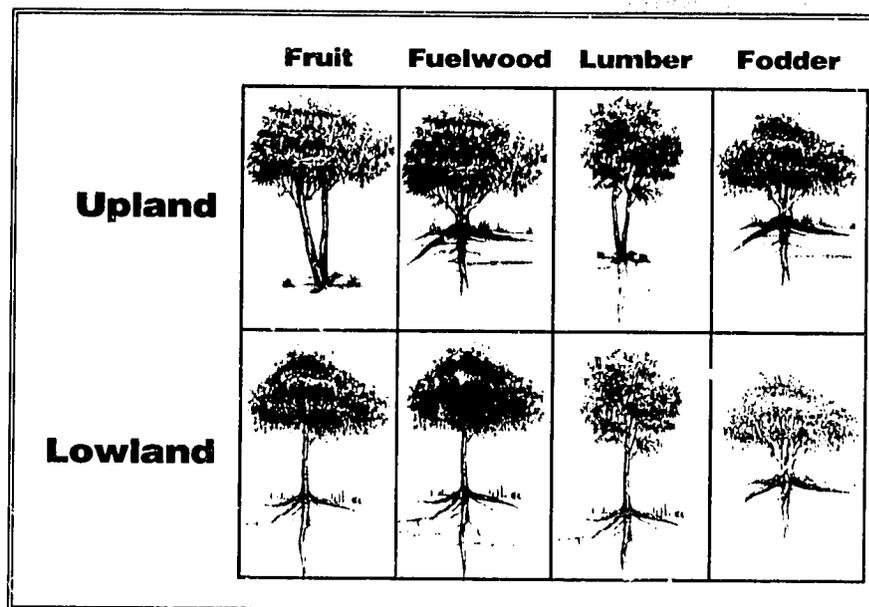
more important as a source of fuel than as human food.

Applied Social-Science Studies

A 1991 workshop led by the Network Social Scientist consolidated and refined the methods for the farm and village forestry survey. Existing survey data are being consolidated and interpreted through national and regional comparative analyses. A geographic information management system (MPTGIS) is being used to store, retrieve, analyze, interpret, and present this information in combination with other relevant biophysical and socioeconomic data from the region. MPTGIS is also being used as an analytical tool to help identify significant knowledge gaps within the emerging knowledge base in order to commission research to fill those gaps. Regional comparative studies on land tenure and forest/land use systems are under way, as are related MPTS studies on women's roles in tree growing, indigenous management, and product marketing.

The Network Secretariat is refining methods to collect economics data from trial plots. This information can be incorporated into growth models for predicting financial yields from MPTS and their products. The data may be used separately in economic and financial analyses. Results from this study can help guide farmers and policymakers in MPTS adoption and production decisions.

The Regional Farm and Village Forestry Study showed that villagers were willing to buy tree products for nearly all uses if those products were not readily available in their communities or if it were more economical to purchase rather than make them. This result suggested the need to develop marketing studies under the second five-year phase of the F/FRED Project. With adequate markets, villagers in areas most conducive to tree farming might be en-



couraged to grow trees for products needed by rural and urban residents elsewhere.

Through relevant national case studies and regional analyses, Network studies now under way will help improve regional understanding of factors that affect marketing of MPTS products.

Field-trial cooperators, in consultation with the Network Forest Economist, are developing bioeconomic methodology to assess returns to scarce production factors and to help optimize designs for agroforestry cropping systems. It is expected that, by using these methods, biological researchers will have an immediate bioeconomic interpretation of their experimental data. Other goals are to establish a consensus among Network members on the utility of such methods and to train them in their use.

Network scientists, many of whom participated in the Regional Farm and Village Forestry Study, also investigated small farmers' tree-breeding objectives during the Project's first five-year phase. They found that ideal MPTS characteristics or *ideotypes* as described by small farmers differed significantly from those used by tree breeders in most traditional tree im-



Jackfruit can be managed without diminished fruit yields because the tree produces fruits along the main trunk.



provement programs. For fruit and food species, researchers found that more emphasis is needed on such traits as stem form and branching to enhance the quantity and value of timber. By understanding what farmers want, scientists can select appropriate provenances for further research and species and varieties that most closely match farmer needs.

Interdisciplinary Studies

Review and consolidation of the results of the tree-breeding objectives study are contributing to interdisciplinary studies in Extension Research and Development (ER&D). Under the F/FRED Project, ER&D is conceived as a generic name for a class of methodologies. Together with elements of classical extension, this group combines elements of participatory, community-based action research and development approaches with a "farmer first" model of on-farm research. This paradigm is believed to offer the greatest potential for genuine collaboration between professional researchers, extensionists, and farmer researchers.

Community Based Tree Improvement (CBTI) is a subset of ER&D activities and is particularly central to the activities of the MPTS Research Network. The concept of "barefoot tree breeders" originated during Phase I of F/FRED. Interest in this approach stemmed from the observation that most forest tree breeders are too busy with industrial plantation species to breed MPTS for small-farmer conditions. Farmers themselves have been engaged for aeons in the successful domestication and improvement of agricultural crops and trees.

The next logical step in recent trends toward participatory research methods in forestry involves developing methods to assist farmers and rural paraprofessionals to undertake more systematic tree-breeding efforts in cooperation with professional tree breeders. A necessary element in this enterprise is to understand and document the ways in which rural communities and individuals acquire, evaluate, and select germplasm in traditional tree-improvement processes.

Pilot Project

A pilot project is under way in the Philippines with the goal of producing genetic improvements in one or more MPTS for farmer-defined purposes. In the future, studies will be commissioned to explore the indigenous technical knowledge base that underlies traditional tree-breeding and tree-management practices. This work will serve to expand regional understanding of local-level institutions and processes on which these activities are based.

The jackfruit (*Artocarpus heterophyllus*) is a popular food-producing multipurpose tree among the rural poor. However, the species has been largely neglected by research. To meet a growing demand for recognition, an interdisciplinary team of scientists is conducting a jackfruit pilot pro-



ject on the island of Cebu in the Central Visayas. Much of the research is being carried out by scientists at the Visayas State College of Agriculture (ViSCA), with technical support from the Network Secretariat.

On the island of Cebu, a vigorous and diverse commercial trade of jackfruit includes a range of production, processing, and marketing. Fruit is marketed fresh and is processed for ice cream on a large scale. The wood is used to make guitars.

The first phase of the pilot study included an initial literature review, field survey of producer and user groups, and a marketing survey to define the baseline situation of germplasm production, utilization, and marketing potential.

Phase-two activities aim at a more quantitative inventory of the jackfruit baseline population, assessment of marketing potential, and definition of tree-improvement objectives. This work is a precondition for later phases of germplasm exploration and collection and tree-improvement work with farmers.

Both genetic and non-genetic improvements are addressed through management techniques like grafting, budding, pruning, arching, and fusion.

The pilot project is nested within a potentially larger network of jackfruit research. The development of the methodology for this form of participatory, community-based research and development is another component of F/FRED's activities in ER&D.



Jackfruit is prized for guitar-making because of the wood's resonance and beauty.



Immature Jackfruits marketed in Cebu City, Philippines are eaten as vegetables.



National Networks

The continuing generation of new ideas by strong national networks forms the foundation for sustaining the vitality and relevance of a regional network. Interdisciplinary, national MPTS research networks in each participating country hold annual meetings that:

- ▲ *bring together scientists working with MPTS and farm forestry to review research and progress,*
- ▲ *refine country priorities for future MPTS and agroforestry research,*
- ▲ *select country representatives to the Network's Research Committee, and*
- ▲ *communicate plans for Network activities.*

Narayan Hegde (on left), head of the BAIF Development Research Foundation in India, explains *Leucaena* uses to NGO workshop participants.



The Network Secretariat encourages the establishment of national-level network secretariats and formal links with other networks. In Indonesia, for example, a national program on MPTS research and development has recently been created to address critical tree improvement and socio-economic needs. Similar programs have been established in Malaysia, Nepal, Philippines, and Sri Lanka. In Thailand, MPTS activities have been institutionalized under a national research council. That country's consciousness-raising efforts use both broadcast and print media, including a forthcoming newsletter, to stress critical needs. *MPTS-Malaysia Newsletter* informs scientists about activities and plans of the Malaysian MPTS Research Network. Such information exchange helps young scientists become aware of the importance of their work and encourages them in their research endeavors.

National-level meetings in Taiwan have helped nurture research interest in MPTS, including tissue culture, utilization, and mushroom cultivation on fast-growing indigenous species. India, Pakistan, and Papua New Guinea have become increasingly active in multipurpose tree research. Their national committees act as forums in which scientists discuss achievements and priorities in research, training, and extension. At such meetings, model projects like those initiated by the BAIF Development Research Foundation, a cooperating NGO in India, can demonstrate the motivation that results when small farmers' needs are taken into account.

Regional Network programs act as catalysts for scientists from various countries to communicate regularly about common concerns and gain ideas to help develop their own national research priorities. National institutions participate in Network training programs, regional theme work-

shops, and exchange visits to international institutions. National institutions are also assisted in curriculum development in agroforestry, as well as library purchases and literature searches.

Training

Realizing that enhancing scientists' knowledge is critical to ensuring the future of Asian forestry leadership, the MPTS Research Network supports both long- and short-term training. In 1988, six fellows—three social scientists and three biological scientists—were selected to pursue doctoral studies at Michigan State University in the U.S. Having completed their coursework, the students are now in their home countries conducting research and completing their dissertations. Through a flexible twinning arrangement of three cooperating institutions—University of the Philippines at Los Banos (UPLB), Universiti Pertanian Malaysia (UPM), and Kasetsart University Faculty of Forestry (KUFF)—graduate fellows at the master's level are being trained. This unique coordination functions as part of a consortium through which students can receive credit for courses taken at universities not offered by their home institutions.

Short-term courses developed by F/FRED staff have helped train over 600 young scientists in Asia. For those termed *roving courses*, the trainers move from country to country, adapting the same course to the special needs of participants throughout the region. Roving courses have focused on data analysis and interpretation, multivariate methods for MPTS research, research problem identification and proposal preparation, strategies for marketing tree products from small farms, and technical writing and presentation. Regional courses have included design and analysis of MPTS experiments and microcomputer applications in forestry research.



Ruiz Tabora (left), Systems Analyst, leads micro-computer training in Indonesia.

To meet the growing interest in course participation and special needs of researchers, Celso Lantican, the Network Training Specialist, has developed correspondence courses. Among the various course topics are participatory research and designing effective research proposals. Training materials are being completed for roving courses; an inventory of existing training materials on research techniques in the social sciences is being prepared; and computer-based presentations on trials design, rapid rural appraisal, agroecosystems analysis, and tree improvement are also being developed.

Participants at theme workshop in Indonesia toured agroforestry systems and industries in Sukabumi District of West Java; nursery workers are bagging soil for raising seedlings of *Aleurites moluccana* (tung oil).



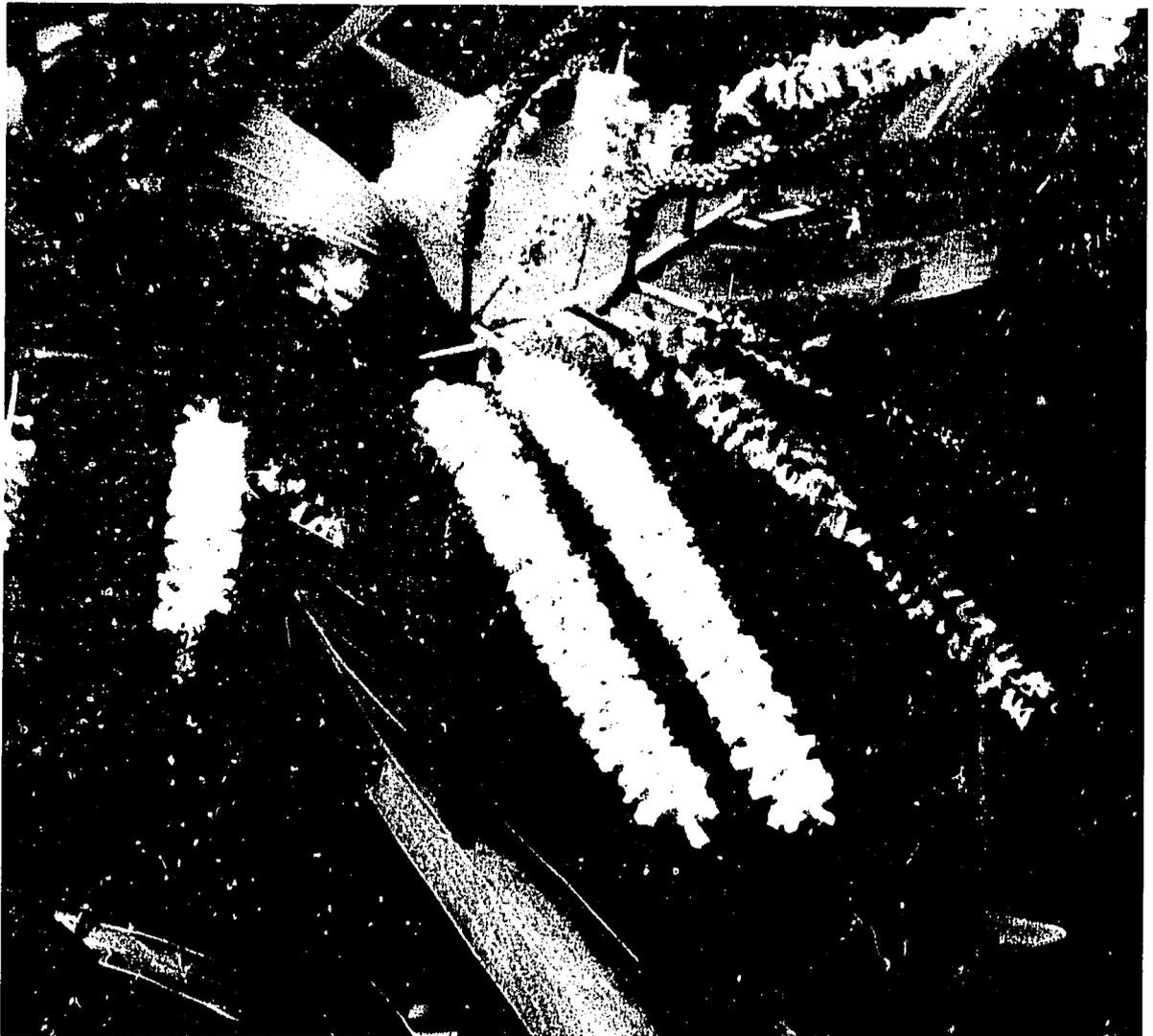
Research Grants

Small grants supported under the F/FRED Project have encouraged MPTS researchers to expand their knowledge frontier through independent work. Such awards have afforded promising scientists the opportunity to strengthen their professional ability by reflecting on particular research problems they have been unable to explore. Proposals have been screened on the basis of their relevance to small-farmer needs, economic significance, and support for sustainable land use. Further screening has been based on applicants' training and research experience, research objectives, relevance to the F/FRED Project's priorities, scien-

tific value, and potential applicability of results. Publication of results, which have appeared in national and international professional journals, is strongly encouraged.

By selecting scientists to work on complementary aspects of particular problems, synthesis of state-of-the-art research is encouraged. For example, to learn more about *Acacia mangium* (one of the Network's priority species), integrated research is being conducted on its silviculture, tree improvement, propagation, and utilization properties. The Network plays a vital role by synthesizing the plethora of data on such species and publishing it in a readily accessible form.

The tree improvement aspect of integrated research on *Acacia mangium* includes study on this promising hybrid with *A. auriculiformis*.



Publications

In addition to the knowledge exchange encouraged by experiment site visits and field tours, pilot projects, theme workshops, and twinning, the F/FRED Project has developed a comprehensive set of publications. The information dissemination program is directed to global audiences interested in multipurpose tree species. The publications program is centrally directed from the F/FRED Project's Management Office in Arlington, Virginia but includes an ever-growing body of publications produced by the Project's Network Secretariat in Bangkok.

Farm Forestry News, F/FRED's quarterly newsletter, is distributed to researchers, development workers, and policymakers in over 90 countries worldwide. It includes summaries of project research in the biological and social sciences, such as data analysis of multilocational experiments, results of marketing studies, and case studies on the trees preferred by small farmers. The

newsletter also provides a forum for scientists to express their views on problems related to MPTS research. Other public information materials have included slide presentations, posters, brochures, and Project profiles.

Working papers, reports, monographs, manuals, handbooks, compendiums, species bibliographies, and research bulletins comprise the Network's MPTS research series. These publications are directed at a more select group of biological and social scientists in the MPTS Research Network. A technical series, which focuses on state-of-the-art volumes in tree improvement and modeling, appeals to scientists with specialized interest in these areas. Theme workshop proceedings cover a wide range of topics from problems and management associated with the *Leucaena* psyllid to the social sciences in Asian forestry curricula. These books extend to scientists throughout the world and are occasionally used as supplemental reading materials in university courses in both developing and developed countries.



The publications program covers a wide range of print media, including a newsletter, research and proceedings series, and technical volumes.

An ever-widening group of readers is being reached through translation of selected publications into languages other than English. To accommodate the needs of Latin American scientists conducting experiments in environmental zones similar to those in the MPTS Research Network, a field trials manual was translated into Spanish. More recently, a manual on standard research methods for multipurpose trees and shrubs, produced originally in English, is now being considered for translation into Spanish and French to reach scientists in Latin America and Francophone Africa. When funds for translation are unavailable, the F/FRED Project encourages co-publication, whereby arrangements are made for a second publisher to issue an inexpensive translation of the original work. This practice is especially useful for publications designed for local use in extension and training.

Information dissemination also means making available key forestry books and journals produced outside the MPTS Research Network. These are provided free to participating institutions in Asia through a system developed in cooperation with Winrock International's Agri-bookstore. Through this simple mecha-

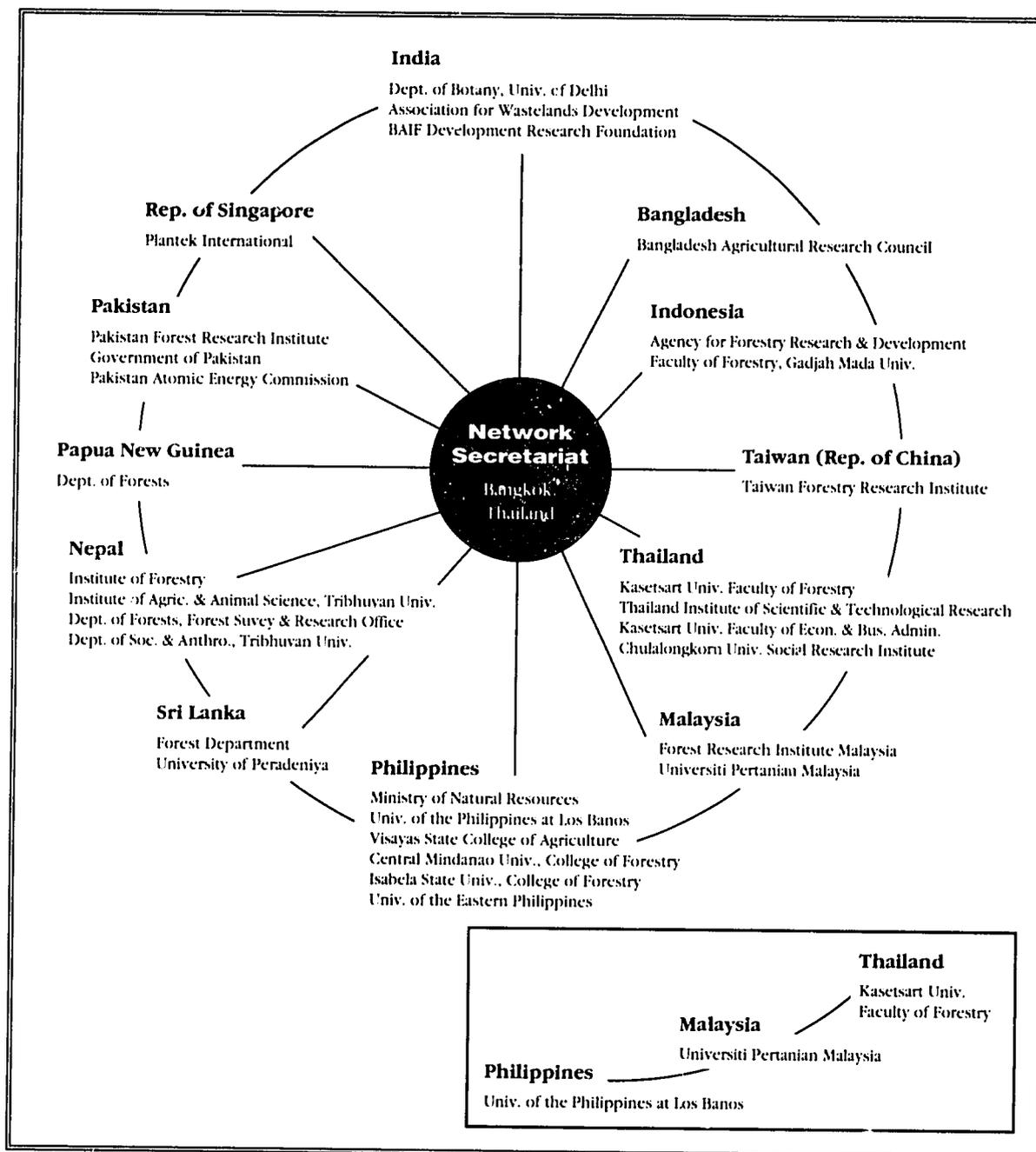
nism, Network libraries are given vouchers with which they may purchase needed professional publications from a single source without the delays involved in foreign currency exchange.

Steering and Research Committees

The governing body of the MPTS Research Network is the Steering Committee composed of senior-ranking Asian scientists and Network specialists who hold permanent positions, as well as USAID monitors for the countries in which its meetings are held. The Steering Committee guides the Network by establishing policies and strategies and promoting programs and activities. Research Committee representatives to the Steering Committee hold one-year terms. The Research Committee, comprised of social and biological scientists selected at national meetings of each participating country, meets annually to discuss issues critical to both national and regional progress. Since 1986, discussions have centered on such topics as guidelines for collaborative research, field trial design, protocol for data use, on-farm research, and strengthening standard methodologies.

1990 members of MPTS Research Committee at site of Doi Weng Pha Highland Development Project in northern Thailand





Project Organization

The Network Secretariat, located on the campus of the Faculty of Forestry at Kasetsart University in Bangkok, Thailand, is the hub of Network activities. From here, F/FRED Project staff, composed of scientists from various disciplinary traditions within the biological and social sciences, pool research talent from Asian forestry institutions. The Secretariat supports such Network activities as defining

MPTS research priorities, planning experiments, developing training courses and theme workshops, providing logistics for Network meetings and participant travel, and developing opportunities for small-research grants. The Global Research Systems Staff, currently housed with the F/FRED Project Management Office in Arlington, Virginia, will move its computer operations to the Network Secretariat in mid-1992.

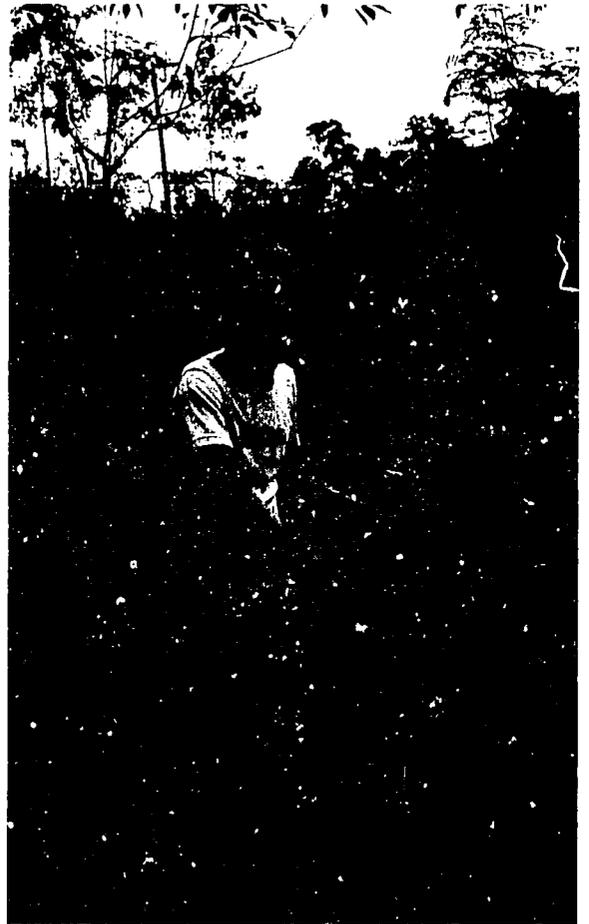
Farmer living in mountain forest north of Chiang Mai, Thailand

Looking Ahead

"The ultimate success of a network rests largely on the quality of the individuals involved."* Many gifted researchers from key Asian institutions joined to form the vibrant fabric that is called the Multi-purpose Tree Species Research Network. The Network's influence, which now extends from national MPTS program development to global decision-making, has resulted largely from its members' willingness and ability to work together effectively to advance MPTS research. Participating scientists have evolved an appreciation of each other's respective disciplines and the range of national priorities and perceptions related to MPTS production and use. The Network is now weaving this combined knowledge in ways that are relevant to the real-life needs of small farmers.

Whatever form the MPTS Research Network may take in the future—whether supported by a future international center, an existing institution, or independent donors—the momentum generated under the F/FRED Project will continue in the years ahead. Field-trial cooperation, inte-

Small farmer of Central Java, Indonesia



grated research programs, twinning, and training are combining with a deeper understanding of the indigenous practices and socioeconomic realities of the women and men who must plant and use trees to meet survival and income needs. Now a dynamic force, the MPTS Research Network is well on its way to achieving its ultimate goal of benefiting small farmers—*Norma Adams, F/FRED Publications Manager.*



* Donald L. Plucknett, Nigel J.H. Smith, and Selcuk Ozgediz. *Networking in International Agricultural Research* (Ithaca, New York: Cornell University Press, 1990) 156.

Network Leadership

F/FRED Project Manager (1985-present)—Thomas C. Niblock, Winrock International, Arlington, Virginia

AID Project Officer (1985-present)—Ian Morison, Bureau for Research and Development, USAID, Arlington, Virginia

Steering Committee Chairman (1986-present)—Salleh Mohd. Nor, Forest Research Institute Malaysia, Kepong, Kuala Lumpur

Research Committee Chairman (1986-present)—Suree Bhumibhamon, Kasetsart University, Bangkok, Thailand

Field Team Leader (1986-1990)—Kenneth G. MacDicken, Network Secretariat, Bangkok, Thailand

Field Team Leader (1991-present)—Rick Van Den Beldt, Network Secretariat, Bangkok, Thailand

Research and Development Director (1986-present)—Foster B. Cady, University of Hawaii, Maui (1986-1990) and Winrock International, Arlington, Virginia (1990-present)

Land and Forest Management Specialist (1986-1990)—Charles B. Mehl, Network Secretariat, Bangkok, Thailand

Network Social Scientist (1990-present)—John B. Raintree, Network Secretariat, Bangkok, Thailand

Additional Readings

Plucknett, Donald L., Nigel J.H. Smith, and Selcuk Ozgediz. 1990. *Networking in International Agricultural Research*. Ithaca, New York: Cornell University Press.

Faris, D.G. 1991. *Agricultural Research Networks as Development Tools: Views of a Network Coordinator*.

Ottawa, Canada: International Development Research Centre; and Patancheru, A.P. 502 324, India: International Crops Research Institute for the Semi-Arid Tropics.

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Inside back-cover photo: Temple carving at Borobudur, Indonesia

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The **Forestry/Fuelwood Research and Development Project (F/FRED)** is designed to help scientists address the needs of small-scale farmers in the developing world for fuelwood and other tree products. It provides a network through which scientists exchange research plans, methods, and results on the production and use of trees that meet the household needs of small farms. These trees, in project terms, are multipurpose tree species (MPTS).

F/FRED is being carried out by the Winrock International Institute for Agricultural Development. Winrock was established in 1985 through the merging of the Agricultural Development Council (A/D/C), the International Agricultural Development Service (IADS), and the Winrock International Livestock Research and Training Center. Winrock's mission is to improve agriculture for the benefit of people--to help increase the productivity, improve the nutrition, and advance the well-being of people throughout the world. Winrock's main areas of emphasis are human resources, renewable resources, food policy, animal agriculture and farming systems, and agricultural research and extension.

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