Multipurpose Tree Species Network Research Series

Forestry/Fuelwood Research and Development (F/FRED) Project

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This series of publications, produced or supported by the Forestry/Fuelwood Research and Development (F/FRED) Project, was developed to improve the scientific research exchanged on the production and use of multipurpose trees. The series includes research papers, reports, case studies, manuals, and videos. Publications in this series are available for distribution to F/FRED network members and other selected individuals and institutions.

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ARCHIVE OF F/FRED'S MULTILOCATIONAL NETWORK TRIALS' DATA

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MPTSys - Information and Decision Support System

Overview

The Multipurpose Tree Species Information and Decision Support System, Version 3 (MPTSys 3), is an integrated microcomputer program designed to support the MPTS Research Network as well as global research. Developed by the F/FRED Project's Global Research Systems staff, MPTSys 3 grew out of the earlier Information and Decision Support System (IADSS) developed during the first five-year phase of F/FRED.

The database system was developed through 1) joint planning with collaborating Asian scientists in the F/FRED research network, 2) coordination with global efforts of MPTS database program specialists, and 3) study of existing databases from key forestry and agricultural organizations. Several regional and global databases are supported in the system. The system addresses one of F/FRED's core objectives—that of providing better information management to enhance analysis and publication of research results related to multipurpose tree species.

MPTSys is an integrated, user-friendly microcomputer software package designed to help scientists, administrators, and extension workers organize, manage, and share research information on multipurpose tree species. This system is based on a modular approach to system design. The components include database management and application programs. Schematic representation of MPTSys components and their relationship is presented in Figure 2. Stand alone components give the system flexibility and allows users to install selected components to meet their individual needs and resources. The system is decentralized and does not require users to have previous training in computers or database management. Standardized screens, options and menus along with help windows, reduce the time required for learning this application.

The database management program has standard options to add, search, modify, delete, browse and output records. MPTSys can provide improved information management to enhance research analysis and publication of results as well as assist in decision making about multipurpose trees.

Subsystems in MPTSys determine the logical and structural linkages between MPTSys components. By focusing on subsystems, it is not necessary to link each component with every other component. Instead, the components are linked in predefined ways to accomplish predefined tasks. These linkages can be classified as data or control. Control linkages allow users to move from one component to the other; data linkages transfer data between components.

Research databases

MPTSys consists of five research databases—Experiment, Summary, Soil, Climate, and Farm and Village Forestry.

Experiment Database

The experiment database, the flagship of the system, has supported the multilocational trials being carried out by the network since 1987. The experiment database not only allows easy data exchange of network experiments among researchers but also can be customized to include data from non-network trials to meet independent research needs. Researchers can enter information directly into the system. Data can be selectively retrieved, viewed and printed to disk, file or printer.

The experiment database is the prime residence for experiment data sets generated by the F/FRED research network. It is ideally suited for comparative analysis from a series of trials with common treatments, experimental designs and methodologies. The experiment database is, furthermore, linked with a data analysis and graphics package. Database files on experimental design, treatment to plot assignments, and user selected plot measurement data are joined within MPTSys and automatically inputted into MPTStat for an intra-site analysis of the data. Frustrations associated with preparing and analysis of data for input to an external data analysis package are eliminated.

Summary Database

After performing appropriate statistical, economic and other analyses, the summarized information from experiments can be entered into another database that contains highly condensed, key information on MPTS which is suited for practical management decisions. This called the summary database.

Soil Database

The soil database stores chemical and physical characteristics of tropical soils at the horizon level. Two major data files comprise the soil database. One contains information associated with a single soil profile and does not vary according to soil layer. It uses a soil pedon number as a primary key to distinguish among pedons. The other contains information associated with a single layer of a soil profile.

Climate Database

This database contains long-term climate data obtained from the Plant Protection and Production Division of the Food and Agriculture Organization of the United Nations. Primary files contain station information and climate data. Climate variables are mean rainfall, minimum and maximum temperatures, vapor pressure, wind speed, sunshine, radiation, daytime and night time temperatures, etc.

Farm and Village Forestry Database

This database stores and manages socioeconomic information at 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.

Reference databases

MPTSys contains three reference databases—MPTS Specialist Database, Abstract Database and Species Digest

MPTS Specialist Database

This database provides quick access to the names, addresses, phone/fax numbers and expertise of researchers who are active in MPTS research worldwide. About 450 specialists are listed now.

Abstract Database

Literature citations and abstracts relevant to MPTS are contained in this reference database. There are about 500 abstracts available now.

Species Digest

This database stores species characteristics and environmental requirements. About 175 species are included.

Decision support packages

There are three decision support packages available in MPTSys. They are—Data Analysis and Modeling, Growth Simulator, and Genotype x Environment Modeling.

Data Analysis and Modeling

This is a general purpose statistical analysis and graphics package which has been integrated into the F/FRED MPTSys. The primary objective of MPTStat is to offer researchers an easy-to-learn yet flexible data analysis package to handle a range of research design situations.

Growth Simulation

This is a computer model designed to predict yield and biomass of tropical MPTS under various management conditions, soil types, and climate conditions. For example, users can

quantify trade-offs between species and planting density in terms of wood and foliage biomass production. As a sub-system 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 under what conditions growth rates are changing and how water stress influences growth over time.

Species x Environment Modeling

MPTModel, is an interactive decision support package, which examines environment by genotype interactions and provides performance prediction analyses. Tailored to support network multilocational trails, MPTModel allows a series of experiments with standardized treatment designs to be combined and analysed 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 organizing and entering a data set into a decision support package providing them easy-to-use yet sufficiently flexible interactive analysis packages to handle a wide range of research design situations.

INSTRUCTIONS

The data available on the computer has been backedup through MPTSys package. Hence, MPTSys package must be installed before the data is restored. MPTSys software is available on seven high density diskettes. They are described below.

Details of modules with files names and sub-directory names.

Module name	Sub-directory name to be created	File names
Experimental Database	DATA	MPT_DATA.001 MPT_DATA.002
Summary Database	INFO	MPT_INFO.001
Soil Database	SOIL	MPT_SOIL.001 MPT_SOIL.001
Climate Database	CLIM	MPT_CLIM.001
Farm & Village Forestry Database	FARM	MPT_FARM.001
Species Digest	SPP	MPT_SPP.001
Abstract Database	DOCS	MPT_DOCS.001
MPTS Specialist Database	PROS	MPT_PROS.001
Data Analysis and Modeling	STAT	MPTSTAT.001
Growth Similator	MPTG	MPTGRO.001
Genotype X Environment Modeling	MPTM	MPTMODEL.001

The user need to create a sub-directory as mentioned against the module names before the respective file(s) is/are copied.

INTERNATIONAL PROVENANCE TRIALS

OF

ACACIA AURICULIFORMIS

INTRODUCTION

Acacia auriculiformis A. Cunn. ex Benth. occurs naturally in tropical regions of Australia, Papua New Guinea and Indonesia. It grows fast, fixes nitrogen and adapts to a wide range of environmental conditions. It is widely planted in Asia, and to a lesser extent, in Africa and South America. The wood can be used for fuel, plywood, carving, flooring, and furnitur and pulp and paper. The bark has sufficient tannins and natural dye for possible commercial exploitation.

In 1987, the USAID funded Forestry/Fuelwood Research and Development (F/FRED) Project of Winrock International, and the Australian Tree Seed Centre of the Commonwealth Scientific and Industrial Research Organization (CSIRO) jointly organized a range wide seed collection of *A. auriculiformis* provenances in Papua New Guinea and northern Australia . Following this, the F/FRED Project further collaborated with the Australian Centre for International Agricultural Research (ACIAR) to evaluate the provenances by establishing multilocational trials in 1989. The trials were established in Zimbabwe and seven other locations in Asia, they are Thailand (four locations in Thailand), Indonesia, Taiwan, Malaysia.

Experimental Design

A randomized complete block design with six replicates was used. Each replicated plot consisted of 16 trees (4 x 4) spaced at 3 m x 3 m. Two buffer rows were planted surrounding the trial to minimize edge effects. No fertilizer was applied at planting except at Sai Thong, Kanchanaburi and Sakaerat where 50g of complete fertilizer (NPK 12:24:12) was applied to each plant within one month after planting. Fertilizer was dug in. Weeding was done frequently, especially at the initial stages of development.

Details of trial sites of *A. auriculiformis* Provenance Trials.

Trial Site (Code)	Lat. (°N)	Long (°E)	Alt. (m)	Mean Annual Rainfall (mm)	Mean Annual Temp. (°C)			Soil
					Max.	Min.	Av.	
Chou-Fong, Pin-Lin, Taiwan, Republic of China (CF10)	23°47′	121°29′	16	2076	26.7	19.7	23.2	Sand-skeletal, mixed, Lithic Tropopsamments, isohyperthermic and udic; pH 7.4.
Sakaerat, Nakhon Ratchasima, Thailand (TS12)	14°13′	101°55′	420	1300	-	-	25.9	Utisol; isohyperthermic and ustic; pH 5.5.
Lampao-Lamsai, Kanchanaburi, Thailand (TS10)	13°58′	99°18′	45	950	-	-	29.9	Sandy and silty loam; isohyperthermic and ustic; ph 6.5.
Lad Krating Plantation, Chacheongsao, Thailand (TK10)	13°30′	101°12′	150	1244	36.8	20.3	28.6	Fine-loamy, mixed Paleustult, isohyperthermic and ustic; pH 5.2.
Sai Thong, Prachuab Khirikan, Thailand (TS11)	11°25′	99°27′	50	1500	-	-	27.2	Coarse-loamy, silliceous, Typic Kandiustults; isohyperthermic and ustic; pH 4.9.
Universiti Pertanian Malaysia, Serdang, Malaysia (MP10)	3°2′	101°42′	33	2141	32.8	22.0	27.4	Fine-loamy, mixed, Typic Hapludults, isohyperthermic and udic; pH 5.5.
Riam Kiwa Trial Area, Banjar Baru, Indonesia (IK10)	3°9′ S	115°7′	100	2404	26.0	22.5	24.2	Very fine, kaolinitic, Typic Hapludalfs, isohyperthermic and udic; pH 5.5.

Details of the 25 provenances of *Acacia auriculiformis* tested in the experiments.

No.	CSIRO Seedlot No.	Provenances		Lat. (°'S)	Long. (°'E)	Alt. (m)	No. parents
1	15483	Archer River	Qld	12 26	142 57	100	5
2	15697	South Coen	Qld	14 7	143 16	160	10
3	15985	Mt Molloy	Qld	16 41	145 17	380	10
4	16142	Coen River	Qld	13 53	143 3	170	7
5	16145	Wenlock River	Qld	13 6	142 56	130	20
6	16484	Morehead River	Qld	15 3	143 40	50	6
7	16485	Kings Plain	Qld	15 42	145 6	150	7
8	16147	Noogoo Swamp	NT	12 23	131 0	28	5
9	16148	Manton River	NT	12 50	131 7	100	10
10	16149	Douglas River	NT	13 51	131 9	70	10
11	16151	Mary River	NT	13 56	132 8	120	8
12	16152	East Alligator River	NT	12 17	132 55	10	10
13	16153	Cooper Creek	NT	12 6	133 11	40	5
14	16154	Goomadeer River	NT	12 8	133 41	50	9
15	16155	Mann River	NT	12 22	134 8	60	4
16	16156	Yarunga Creek	NT	12 18	134 48	50	6
17	16160	South Alligator River	NT	13 16	132 19	100	10
18	16163	Elizabeth River	NT	12 36	131 4	40	9
19	16187	Melville Island	NT	11 55	130 50	1	7
20	16101	North Bensbach	PNG	8 50	141 15	20	16
21	16103	South Balamuk	PNG	9 0	141 15	10	7
22	16105	Balamuk	PNG	8 5	141 17	20	12
23	16106	North Mibini	PNG	8 49	141 38	40	35
24	16107	Old Tonda Village	PNG	8 55	141 33	40	19
25	16108	Mari Village	PNG	9 11	141 42	5	8

Qld - Queensland ; NT - Northern Territory ; PNG - Papua New Guinea

1987 HUMID AND SUB-HUMD ZONE

NETWORK TRIALS

INTRODUCTION

In 1986, the United States Agency for International Development (USAID) launched the Forestry/Fuelwood Research and Development Project (F/FRED) to address the needs of small-scale farmers for fuelwood and other tree products. The first major research activity initiated in 1987 by the project was the establishment of a set of 15 multilocational trials in five countries evaluating the growth of two genotypes each of three MPTS (Acacia mangium Willd., Acacia auriculiformis A. Cunn ex Benth, and Leucaena diversifolia (Schlecht) Benth.) under three cutting practices; control, pruning and pollarding. A network experiment includes the following critical elements:

- common design and standardized methodology
- common germplasm
- the same experiment on multiple sites
- thoroughly described soils and climate at each site;
- data exchange and professional interaction between participants; and
- intersite combined analysis of data.

The purpose of the 1987 Humid and Sub-Humid Zone Network Trials is three-fold:

- to enhance the knowledge of site requirements, growth rates, and fodder versus wood yield interactions of priority MPTS. Coordinated multiple-site testing of MPTS allows far greater opportunity for making conclusions based on experimental results through the use of statistical modeling.

- to provide a focus for network development.

- to help improve and standardize research methodologies used in forestry research. The design of network experiments provides a forum for discussing research priorities.

This set of trials was designed by network participants in a meeting in Kuala Lumpur. Malaysia in December 1986.

Experimental Design

A randomized complete block design with four replications has been chosen for the first set of experiments. This first set of experiments involves two genotypes of three species of trees and three management treatments. A sample field plan is appended.

Details of Trial Sites of 1987 Humid & Sub-Humid Network Trials

Location Site ID	Cooperator's name and institution	Moisture regime	Mean annual rainfall (mm)	Mean minimum temp.	Mean maximum temp.	Soil family (USDA)
Hengehum,Taiwan, ROC (CF-01)	F.J.Pan, Taiwan Forest Research Institute	Udic	2194	21.8	28.3	Not determined
Jan Fong, Taiwan, ROC (CF-02)	F.J.Pan, Taiwan Forest Research Institute	Udic	2076	19.7	26.7	Not determined
Dramaga, West Java, Indonesia (IF-01)	Forest Research and Development Center, Bogor	Udic	3950	21.3	31.0	Clayey, Kaolinitic, isohyperthermic, Typic Haplorthox
Cikampek, West Java, Indonesia (IF-02)	FRDC, Bogor	Udic	1565	22.8	32.3	Clayey, Kaolinitic, isohyperthermic, Rhodic Hapludult
Mata Air, Perlis, Malaysia (MF-01)	Mohd. Lokmal B. Hj. Ngah, Forest Research Institute of Malaysia, KL	Udic	1717	22.4	34.9	Clayye-skeletal, kaolinitic, isohyperthermic, typic Hapludult
UPM Campus, Serdang, Malaysia (MP-01)	Kamis Awang, Faculty of Forestry, Universiti Pertanian Malaysia	Udic	2141	22.0	32.8	Coarse-loamy over clayey, siliceous, isohyperthermic, Aqualfic Tropofluvent

Lad Krating, Chachoengsao, Thailand (TK-01)	Suree Bhumibhamon, Faculty of Forestry, Kasetsart Univ. Bangkok	Ustic	1211	20.3	36.8	Clayey-skeletal, kaolinitic, isohyperthermic, Oxic Paleustult
Uthai Thani, Thailand (TK-02)	Suree Bhumibhamon, Faculty of Forestry, Kasetsart Univ.	Ustic	1529	21.4	33.5	Coarse-loamy, siliceous, isohyperthermic, Typic Ustifluvent
Ratchaburi, Thailand (TS-01)	Bunyalid Puriakorn, Div. of Silviculture, Royal Forest Department, Bangkok	Ustic	983	23.4	35.0	Loamy-skeletal, siliceous, isohyperthermic, Ultic Haplustalf
Donglarn, Thailand (TS-02)	Div. of Silviculture, Royal Forest Department, Bangkok.	Ustic	1612	20.8	32.3	Clayey, kaolinitic, isohyperthermic Oxic Paleustalf

FACTOR A SPECIES	FACTOR B GENOTYPE		FACTOR C CUTTING MANAGEMENT		
			 C-CONTROL	 PO-POLLARD	 PT-PRUNING
ACACIA MANGIUM	IRON RANGE	(QLD)	1	2	3
	BOITE	(PNG)	4	5	6
ACACIA AURICULIFORMIS	MORE HEAD	(QLD)	7	8	9
	BENSBACH BALAMUK	(PNG)	10	11	12
LEUCAENA DIVERSIFOLIA	K 156		13	14	15
	KX3 (K743)		16	17	18

Table 1.

Species, genotypes and management treatments involved in the trials.

Figure 1.

Sample layout within a block.

TRT 12 Aric PNG Pruning Plot 1	TRT 6 Mang-PNG Pruning Plot 2	TRT 16 Leu K156 Control Plot 3	TRT 18 Leu K156 Pruning Plot 4	TRT 11 Aric-PNG Pollard Plot 5	TRT 3 Mang-QLD Pruning Plot 6
TRT 17 Leu K156 Pollard Plot 7	TRT 9 Aric-QLD Pruning Plot 8	TRT 1 Mang-QLD Control Plot 9	TRT 15 Leu KX3 Pruning Plot 10	TRT 4 Mang-PNG Control Plot 11	TRT 8 Aric-QLD Pollard Plot 12
TRT 10 Aric-PNG Control Plot 13	TRT 14 Leu KX3 Pollard Plot 14	TRT 2 Mang-QLD Pollard Plot 15	TRT 7 Aric-QLD Control Plot 16	TRT 13 Leu KX3 Control Plot 17	TRT 5 Mang-PNG Pollard Plot 18

1991 HUMID AND SUB-HUMD ZONE

NETWORK TRIALS

1. Introduction

A group of Asian scientists representing various disciplines of biological and social sciences met in Cha-am, Thailand, December 9-16, 1990 to plan a second set of multilocation network trials for the Humid Zone of the Asian tropics.

The scientists at the Cha-am meeting first reviewed the lessons learned from the 1987 network trials and assessed the results of the regional Farm and Village Forestry survey[1] to help guide the new set of trials. Consensus was reached on the need for all cooperators conducting the trials to adhere to the following features:

* common design and standardized methodology
* common minimum data set to be collected
* common germplasm
* thoroughly described soils and climate at each site
* data exchange and professional interaction among participants
* intersite combined analysis of data

The trials are designed to serve three broad objectives:

1. To increase knowledge of growth, site requirements, management practices of priority multipurpose tree species (MPTS) to meet the needs of small-scale farmers in Asia for fuelwood, fodder and small timber
2. To provide a focus for network cooperation and expansion
3. To help improve and standardize forestry and agroforestry research methodology

This manual provides guidelines for research collaborators participating in the network trials. It outlines the experiment, standard procedures to follow, minimum data set to be collected, and maintenance practices applicable to the trials.

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[1]See Charles B. Mehl, *Trees and Farms in Asia: An analysis of farm and village forest use practices in South and Southeast Asia*. MPTS Research Series Report No. 16. Bangkok: Winrock International.

2. Experiment Description

2.1. Specific objectives

1. To evaluate environment x treatment interactions.

2. To estimate the economic yield of fodder, fuelwood and small timber at farmgate under different farmer-oriented management practices.

3. To formulate recommendations for improved farming practices.

2.2. Experimental design

The experimental design is a randomized complete block with 4 replications, using a factorial arrangement of 2 species x 2 varieties or provenances x 3 management treatments. The three treatment factors are labelled as Factor A (species), Factor B (varieties/provenances) and Factor C (management treatments). Management treatment on each plot is applied to all live trees, including trees in buffer rows. The total number of treatments = 2 x 2 x 3 = 12 treatment combinations (Table 1).

Table 1. Species, genotypes (provenances/varieties) and management treatments for the 1991 network trials.

Factor A Species and Code	Factor B Genotype	Factor C Management Treatments*		
		C	P	Th
Acacia auriculiformis ACACAU	Wenlock, QLD (Seedlot No. 17941)	1**	2	3
	Bensbach, PNG (Seed lot No. 17583)	4	5	6
Leucaena hybrid LEUCHY	KX3B (K156 Dive x K636 Leuc)	7	8	9
Leucaena leucocephala LEUCLE	K636	10	11	12

*Management Treatments: C = Control, receives no special treatment. P = Pruning, removes all live and dead branches with a pruning saw (first stroke is an undercut) at age 12 months, up to 50% of total height; the same trees are pruned again at 24 months to 50% of the new total height. Th = Thinning, removes half the trees, systematically selected, at age 24 months.
**Treatment numbers (T): 1-12.

2.3. Layout

Treatments are randomly assigned in complete blocks of 12 plots each. A sample block layout is shown in Figure 1.

Tree spacing is 2 x 2 m. Each plot is uniquely numbered serially and consists of 6 rows spaced 2 m apart. Figure 2 shows a standard plot layout. Each row contains 6 trees, also 2 m apart; 6 rows x 6 trees = 36 trees/plot x 48 plots = 1,728 trees/site. With 2 species and 2 varieties of each species, there are 4 species-variety combinations. Number of trees of each variety at each site = 1,728 trees/4 = 432 trees of each variety.

Plot size is 12 x 12 m = 144 m^2 per plot x 48 plots = 6,912 m^2 per site.

In Figure 2, trees are numbered beginning at the northwest corner and proceeding east, from 1 to 6. The first tree in the second and succeeding rows is directly below tree number 1 in the plot layout. The outer rows of each plot are buffer trees, the interior 16 trees (interior 4 x 4 rows) are samples measured every 6 months after planting.

T 3 ACACAU QLD THINNING	T 1 ACACAU QLD CONTROL	T 4 ACACAU PNG CONTRAL	T 8 LEUCHY KX1 PRUNING
T 11 LEUCLE K636 PRUNING	T 6 ACACAU PNG THINNING	T 10 LEUCLE K636 CONTROL	T 2 ACACAU QLD PRUNING
T 9 LEUCHY KX1 THINNING	T 5 ACACAU PNG PRUNING	T 7 LEUCHY KX1 CONTROL	T 12 LEUCLE K636 THINNING

Figure 1. Example of block layout (T = Treatment number).

1991 Humid and Sub-Humid Zone Network Trial

1991 trials have been conducted at 33 locations, but the data is available from 18 locations for 12 months. List of cooperators and site identification codes for the sites data available are given in the table below.

Network cooperators from whom data has been received.

Researcher	Institution	Site Code
Markku Temmes	Nursery and Reforestation Advisor, Mechanized Nursery and Plantation Project in South Kalimantan, Jl, Sei Ulin No. 28B, Banjarbaru, Kal-Sel, Indonesia	IK-21
Eko C. Hardiyanto	Fakultas Kehutanan, Universitas Gadjah Mada, Bulaksumur, Yogyakarta, Indonesia	IG-21
Nor Aini Abd. Shukor	Faculty of Forestry, Universiti Pertanian Malaysia, 43400 Serdang, Selangor, Malaysia	MP-21
Mohd. Zaki Hamzah	Centre of Applied Sciences, Universiti Pertanian Malaysia, Bintulu Campus, P.O.Box 396, 97008 Bintulu, Sarawak, Malaysia	MS-21
Zakri A. Hamid	Faculty of Life Sciences, Universiti Kebangsaan Malaysia, 4300 UKM Bangi, Selangor D.E. Malaysia	MK-21
Amado P. Imper	Research Coordinator, College of Agriculture and Forestry, Don Mariano Marcos Memorial State University, Rosario, La Union, Philippines	PD-21
Justino Quimio	Department of Forestry, Visayas State College of Agriculture, Baybay, Leyte 6521-A, Philippines	PV-21
H.P.M.Gunasena	Dean, Faculty of Agriculture, University of Peradeniya, Peradeniya, Sri Lanka	SA-21
M. de S. Liyanage	Head, Agronomy Division, Coconut Research Institute, Bandirippunra Estate Lunnwila, Sri Lanka	SC-21
Charoon Sukkasem	Project Leader, Dept. of Soil Science and Conservation, Faculty of Agriculture, Chiang Mai University, Chiang Mai 50002, Thailand	TC-21

Suree Bhumibhamon	Department of Silviculture, Faculty of Forestry, Kasetsart University, Bangkhen, Bangkok, Thailand	TK-21 TK-22
Kovith Yantasath	Thailand Institute of Scientific and Technological Research, 196 Phahonyothin Road, Bangkhen, Bangkok, Thailand	TH-21 TH-22
Bunyarit Puriyakorn	Silviculture Division, Royal Forest Department, Phahonyothin Road, Bangkhen, Bangkok, Thailand	TS-21
Verapong Suangtho	Silviculture Division, Royal Forest Department, Phahonyothin Road, Bangkhen, Bangkok, Thailand	TS-22
Bopit Kietvuttinon	Division of Silviculture, Royal Forest Department, Phaholoyothin Road, Bangkok, Thailand	TC-23

The Forestry/Fuelwood Research and Development (F/FRED) Project 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 farmers. 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 Services (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 men, women, and children 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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